40p EVERY WEEK · JAN 5 1985 · No 93

PERSONAL Computer NEWS

40p EVERY WEEK

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First-class utility for the Commodore — p 12

BBC PLOT
Quality output from the Model B — p 38

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Complete hi-res screen designer — p 18

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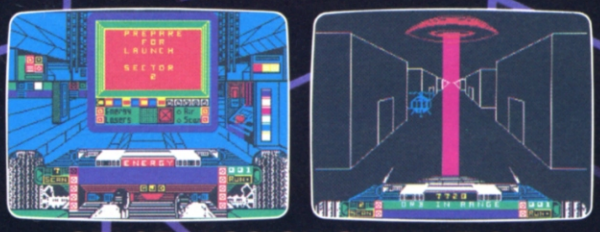
Now you've got it, what can you do with it?

BUGGY BLAST



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MONITOR

Acorn lines up its OPD challenger

ICL may have stolen a march on its competitors with its One Per Desk (issue 88), but it is unlikely to have the field to itself for long.

The first UK threat to ICL will come in the shape of Acorn's promised Communicator.

According to managing director Chris Curry, its offering will undercut the price of the OPD with a price somewhere between £500 and £800. It will be based on a 16-bit processor, probably an 8086.

Unlike other manufacturers, Acorn is doing all the development work in-house, although there is believed to be a heavy British Telecom interest in the product.

Work is well advanced on the Communicator and those who have seen it are enthusiastic about its chances.

Unlike other Acorn products, the Communicator is not based on either the BBC board or the Electron.

From the other side of the Atlantic comes news that both IBM and AT&T are planning products.

The IBM offering is called the Cedar and was originally designed by Rolm, a telecommunications company. IBM was so impressed with the product it bought the company.

AT&T is also buying in a design from outside. Its PC7300 comes from Convergent Technologies, the West Coast company that produces a range of personal computers that invariably appear with other people's labels on.

Since both these American machines combine the power of a personal computer with the communications facilities of an intelligent telephone they will cost considerably more than ICL's OPD.

All these OPD competitors are due to appear in the UK during the course of the year.

Acorn, having leaked the Communicator's existence, has now returned to its traditional reluctance to discuss future products. The best guess of its launch date is sometime during the summer.

Regardless of who makes it first, it would seem that ICL has around a six months lead.

Spectrum users get third disk option

Spectrum Plus and Minus users who want to take a step up from cassette have a new option.

For £219.95 Thurnall Electronics (061-755-7922) has produced a 3in disk drive that can handle up to 500K of storage.

The Thurnall drive comes boxed with all the necessary leads, a manual and a disk with introductory programs to start you off. In terms of compatibility, the disk drive will run a wealth of software already available for the Spectrum and it can be used with Microdrives, Interface 1, a host of printers and joysticks.

The system will be available in late January and if you're not satisfied with its performance when you've bought it the company is offering a money back guarantee.

Birmingham show gets down to business

The Which Computer? Show at Birmingham next week wins the ultimate accolade — Sinclair will be there for the first time.

Since the four day show is primarily a business exhibition Sinclair's main exhibit will be the QL, but you'll be able to see the Spectrum and Spectrum Plus and the company promises that 'any new developments' will also be on view. This could mean that new QL peripherals

A200 — Canon fires IBM broadside.

are expected, either from Sinclair itself or from independent suppliers — Quest's disk attachments are almost ready for release.

Sharp, the Japanese giant that started out with a propelling pencil, will give the first public demonstrations of its MZ800 (issue 91). This machine offers compatibility with the MZ700 home micro but Sharp intends it for serious business applications in the style of the QL or the Commodore Plus/4.

Sharp's business-like approach to the subject will also be evident in two other systems on show. These are for specific users behind bars and in shops. Built around existing hardware, they put Japanese know-how at the disposal of licensed victuallers and point-of-sale shop assistants.

Commodore, which used the show last year to give the latest re-launch to its will o' the wisp 700 system (now you see it, now you don't), will produce an IBM-compatible desktop from up its sleeve this time round (issue 92).

IBM-compatibility will also be the theme of the Canon stand, where the new A200 micro will make its début. A feature of this system is the Q-Link networking system launched at the same time, to give users the ability to communicate with the PC itself and with Apricot micros. Compaq will also be demonstrating its desktop IBM-able, the Deskpro.

For home enthusiasts one of the most tantalising of January's new machines will not be at the show, nor for that matter in the country. Oric intends to launch its Stratos in France, and will only bring it to the UK if it sees any future for it here. Last year Oric launched the Atmos at the Which Computer? Show.

The other UK companies launching new machines fall firmly into the business category. A little known Aldershot systems house threatens to make a splash with a sub-£1,000 IBM-compatible, and LSI will launch an upgraded Octopus alongside a re-released Durango Poppy. Tadpole Technology will give a run to its Titan Unix micro, and Cifer is aiming in the same direction with a machine called the Series 9.

MSX will be there, but Sanyo will probably give more prominence to its new MBC775 than to the MPC100 MSX micro. The MBC775, with 256K and an 8088, is designed says Sanyo to be completely IBM-compatible; the main difference lies in its 9in colour screen which is supplied as part of the basic package.

Olivetti, the quietest of the lap-held micro makers, will be sounding off on the subject of applications for the M21 and M24 and on the integration of personal computers in office environments. Its 744 square metres of floor space will not be so integrated — the company has had to take two separate stands to fit everything in.

Away from the bustle of the show the National Computing Centre is putting on seminars, of which the most interesting for personal computer users looks like its exposition of the Data Protection Act.

The Which Computer? Show takes place at the National Exhibition Centre, Birmingham, from January 15 to 18.

C64 games top new year releases

New year software for Commodore 64 and QL users is on the way from Romik, Pact, and Energy Soft.

Romik's Knightmare and Captain Starlight, both selling at £6.99 for the 64, are described by Romik as 'the best games they've ever released'. You'll be able to judge for yourself at the end of this week, when they go on sale.

Pact (0733-233600) has added a switch and two LEDs to its Commodore software to produce a cassette interface. The Panda 20/64 will let you use a non-Commodore recorder with either the Vic 20 or the 64. It costs £17.99.

The QL gets a graphics designer from Energy Soft (0695-33988) this month. The software provides a range of drawing facilities, lets you mix text and graphics, copes with full colour and offers you single pixel plotting. It costs £12.50.

Octopus — LSI adds tentacles in upgrade.

Sinclair's latest act of faith

The ZX81 has often been described as the Model T Ford of the microcomputer industry, so it's perhaps inevitable that Sinclair's C5 battery-assisted tricycle will be described as the ZX81 of the motor industry.

The C5 is a bare-bones sort of machine — so much so that we at *PCN* can now bring you a personalised Pro-Test of it. You don't need a machine — just follow these instructions.

First, lie down on your back. Now bring your feet up about six inches from the floor, and tilt your head forward. You're now most of the way there, but you need to steer, so put your hands under your knees, and start pedalling with your feet. Just a few more hours practice and you should be a competent C5 driver.

Of course you can also go into full simulator mode by repeating the above instructions in the kitchen, this time with the washing machine on so that you can simulate the C5's adapted washing machine engine. You could also put a blanket round your shoulders to simulate the weather-proofing add-on that will be produced for it.

You can probably deduce from all this that the C5 isn't quite the combination of milk-float and Mini Metro the world has been expecting. It's an open-topped three-wheeler whose motor will take it up to around 15mph, perhaps faster if you pedal hard. You'd better not though, because you don't need to have a licence, insurance, crash helmet or road tax for a vehicle with a maximum speed of 15mph.

Sinclair is aiming for production of 100,000 C5s next year, although currently only around 100 a day are being produced. But with the vehicle selling for less than £400 we should soon see recumbent pioneers gliding past.

It's a moot point whether the vehicle will revolutionise commuting, but it's certain to achieve minor cult status at the very least. And there could be more where it came from, as Sinclair is talking about producing a whole series of electric vehicles.

PCN can exclusively reveal that the first step will be the production of a 500 Lb (legabyte) RAMpack that will help you pedal faster. The machine's successor, the C6, will have a number of added features, including a rubber membrane keyboard to replace the C5's pressure-sensitive handlebars.

MONITOR

Enterprise sneaks in at last minute

The Enterprise micro finally made it into the shops with just a week to spare before Christmas.

True to form, the micro that is 16 months old at birth lined up on the starting grid after last minute hiccups and false starts. Enterprise expected to have 3,000 machines in a selection of shops in secret locations on December 10. But by December 13 the distributor, Prism, still had nothing to distribute; Enterprise was talking about numbers closer to 300 and the shops turned out to be just round the corner from Enterprise's London HQ.

On December 14 the first reported retail sightings of the famous micro started to come in. Two retailers claimed to have a handful of machines each, and encouragingly for Enterprise one of them almost sold out over the weekend.

The next deadline for the company to watch come and go is mid-February, when it is due to hit full production.

We'll have a full Pro-Test of the Enterprise 64 in our next issue. Here by way of a trailer are some of our reviewer's comments on the micro that came in from the cold: 'Sixteen months ago the Enterprise was probably the dream machine of just about every computer owner in the country. However, more than one year later, enthusiasm for the machine has dropped.

'Unfortunately the Enterprise offers the computer public nothing that hasn't been seen before.

'The Basic is extremely long-winded using phrases such as CLEAR SCREEN to erase the screen content. Surely it would have been much shorter to use the more common CLS. Nevertheless, it must be said that the use of these extended phrases does make any program that is written in Enterprise Basic much more readable than on any other machine.'

MSX prices — still tumbling down

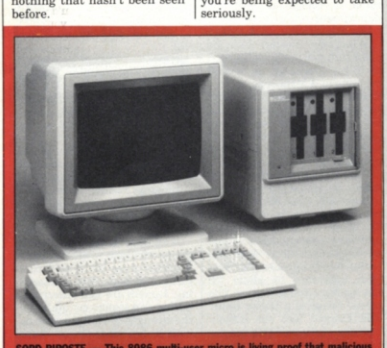
The tumble that MSX prices took before Christmas looks likely to continue in the new year as UK prices come down to approach Japanese levels.

Toshiba led the way (issue 92) and three other companies have responded so far. Goldstar was the first, bringing the lowest priced MSX micro in the country down to £199. Sony and Sanyo are expected to cut theirs by £60 this week.

Goldstar is still the only one below £200 and in Japan MSX costs less than half this (see View from Japan). The magic figure for the UK seems to be £150 — this is the level that MSX machines in general are expected to reach in 1985.

The figure of £150 is roughly half what MSX micros came in at when the first machines arrived in the UK a matter of a couple of months ago.

The MSX manufacturers have offered an assortment of reasons for the early high prices: a shortage of the boards which convert the output signals to match UK television protocols was one proposal you're being expected to take seriously.



SORD RIPOSTE — This 8086 multi-user micro is living proof that malicious rumours of Sord's imminent withdrawal from the UK are grossly exaggerated. The Japanese company is keen to prove that it is alive and well in this country. The micro in the picture has been designed to be the mainstay of its push into the business market and employs a modular approach using a VME bus to allows upgrades to more powerful processors and greater memory. The M343SX will cost around £4,500 and further details can be obtained from Sord 01-631 0787.

VIEW FROM JAPAN

Hara-kiri: MSX claims a new victim

I've been giving some time recently to turning a word processor into a column processor. This is a sample of how future Views from Japan might begin: 'How are the mighty fallen. No sooner said than done. Tis the season to be joyful. A fool and his money are easily parted.'

The theme of this gibberish and the reason for the exercise come from the same cause. It is the last desperate throw of a man who is determined to keep the games tide at bay by finding useful and serious things to do with a micro. Christmas is ultimately responsible. I hate it, forgive me. But I must confess it. . . I was in the market for an MSX machine as a present for my seven-year-old son.

Actually my wife helped me for into the market, but that's no excuse. It was either MSX or a bunch of games for my micro, and have half the kids in the neighbourhood coming in and getting the Japanese equivalent of peanut butter and jelly all over my keyboard. My Christmas spirit doesn't extend quite that far.

As a matter of fact, as I tried to point out to my faithful helpmate, Japan being a Buddhist country we should wait until Buddhamas before becoming a two-computer family. She didn't bite.

Instead, she handed me a brochure delivered right to our door by Daiei, Japan's biggest mass-merchandiser, with pictures and prices of all kinds of MSX systems.

There was one from Pioneer listed at £300, discounted to £279. The Christmas spirit overwhelmed me. 'Let's have three, one for each kid,' I cried. The brochure also listed a Casio at £99, discounted to £89, and in between there were similarly discounted offerings from Yamaha, Sanyo, Toshiba, Sony, Mitsubishi, National and Matsushita.

No fool I, it was clear that if I could get that kind of deal at my door I could do even better in Aki-Habai, Tokyo's electronics discount centre.

A quick run through a few of the major shops told me I was on the right track. The Sony HB-55, listed at £149, was going for about £100. National's CF-200 was similarly priced and discounted, and ROM packs from General with what appeared to be decent games were going for £9.50, down from £16 (the standard games price here).

Products from other makers were less generously discounted. So as far as I was concerned it was a choice between Sony and National, with the latter favourite because of its real keyboard and two cartridge slots. Unfortunately neither could be linked up to an RGB monitor, a grievous fault with all MSX machines.

It was at this point that I realised, as I've said before, that I don't have any overwhelming affection for games and consequently don't know much about them. It was conceivable that my son might feel the same way. Perhaps, I thought, I should test him out first. I bought Donkey Kong III for £2.80 and took it home. That evening I tried it out for a couple of hours — I made it to stage two and scored a few hundred points.

The next morning my son tried it out and made it to stage seven with several thousand points. On his second game he did even better, displaying beyond doubt his attitude towards computers as game playing machines.

So I came to hate the thought of Christmas and probably will come to loathe the days that will follow. The very thought that from now on, whenever I have to lecture him about his youthful transgressions, he'll be staring me in the eye thinking, no, *knowing*, that all he has to do to reassert himself is to challenge me to a game of Donkey Kong.

Even more terrifying is the possibility that my wife, who so far has avoided micros like I avoid dirty dishes, will get hold of some kind of home budget program and start running my bar bills.

But there under the tree was the MSX micro, a witness to my abject failure to bribe Santa Claus, surrender my keyboard to peanut butter and jelly, or convince my family to join some obscure Zen sect that requires them to spend every idle moment meditating on the evils of middle-tech.

Maybe eventually I'll come to terms with it and meet it on its own ground. Maybe by then its ground will have shifted, and I'll only need to use it in a video-recorder or a television.

In any case, the view from Japan is that 1984 was an interesting year. Hope it has been for you, and until next time the season's greetings from Donkey Kong's latest victim.

Serge Powell

Putting commerce back into computers

Acorn is due to launch a series of home control products (issue 90) in a few months time. MSX is intended to be built in to articles like video recorders, televisions, and other electronic goods. Sir Clive Sinclair's electronic car is powered by a washing machine motor.

All through last year the movement behind 'useful' home micros gathered strength. In the form of public statements from such people as Acorn head Chris Curry it hinted vaguely at how micros are likely to develop in 1985. But you'd better be ready for the change, because now the people at the business end — the high street retailers — are looking forward to a revolution in microcomputing.

Their reasons are based on commercial judgements. Dave Gilbert, Dixons' marketing manager, said: 'You can't grow the home computer market on the basis of games because you reach saturation.' Others were less direct, but the overall impression is that the shops near you will be selling micros for useful purposes because that's the way they see the market going.

'People are now going to consider more serious applications,' said Michael Litvin of Computers of Wigmore Street. 'Serious software sales will increase.'

Odd man out among the big chains is Woolworth, which is upholding the honour of the games machine. It told *PCN* categorically: 'We will not be stocking the Acorn home control device.' Instead, in 1985, it will be concentrating on software and add-ons.

But it might be forced to change this position. Its competitors — independents and retail chains alike — agree that the next stage for microcomputers will involve an element of usefulness. 'Computers are not there just for playing games,' said WH Smith, which also spread a wet blanket over the kind of home applications that are available now when it added: 'and budgeting . . .'

None of them is prepared to be very specific about the form that 'usefulness' will take. Acorn's idea is to produce a board-level device that can be built into pieces of domestic electronic equipment so that you will be able to exert computer control over a number of household functions.

'The new style of computing will need a hell of a lot of hard work and will be dependent on the quality of the merchandise and how well the trade can explain the benefits to the consumer,' said Dave Gilbert.

Others see it as a development; WH Smith, for example: 'Anything that makes the computer useful in the home sounds like a good idea. Anything that develops the role of the computer we would see as useful.' John Greengrass of Boots admitted: 'Computers are useful, but no one seems to know what to do with them. Home control devices may be the answer, who knows?'

According to Litvin the stress will be different. Software that applies the logic of programming to the nature of tasks is his idea of usefulness, and he cited an ideas processor as an example. This is a radical distinction and, on the face of it, a more attractive proposition than a device that will close the curtains at nightfall, but it points in the same direction.

Curry: hotting up the micro war.

With the manufacturers and the retailers agreeing, it begins to look as though there's a conspiracy at work to make you throw away your games machines in favour of something less frivolous. But not all the manufacturers are committed — there's always the new Atari Corporation, headed by Jack Tramiel, to carry the banner of the games players. Tramiel has gone on the record as saying that the fun has gone out of computing, and that the manufacturers are taking themselves too seriously. In the same breath he's prone to say things like: 'Business is war,' but if that's the case you can be sure that Atari will have presented it in the form of a computer game before too long.

Meanwhile Sinclair continues to put its weight behind the QL, Acorn prepares to deliver the ABC business machines, and Commodore is about to launch a desktop IBM-compatible machine. Oric's Stratos isn't due to be launched in the UK but its business machine probably will, and Apple will be lost to the hobbyist for ever if the Mac succeeds. Perhaps it is a conspiracy.

'Hardware glamour' is simply not enough

Why can't they get it right? Micro manufacturers and micro specifications, that is. This outburst follows the so-called release of the Enterprise, sixteen months old at birth.

It should be so simple. If Amstrad can cobble together a more than half-decent micro from off-the-shelf parts in under a year, companies with more experience should be able to turn out everyone's favourite micro with one hand tied behind their back.

But the Commodore 64 has lousy Basic and the Spectrum has a strangely mapped screen, as does the Amstrad. Only the Enterprise comes with a joystick built in — without a fire button — and only the Amstrad has a dedicated tape deck and monitor as part of the package. The 64's drives are slow, the disk drive from Oric and Amstrad won't support random access files and the BBC has a severely limited memory. You name it, there's at least one department where my micro beats yours.

What's the answer? Well, it's clear that you don't really need a 16-bit processor, so a Z80 running at 4 MHz or so will do. Certainly the machine must have sprites, and more than the 64's miserly eight. Say 16, and here MSX gets it almost right with 32, except you can have only four on one line at once.

Micro graphics, like sound, need a dedicated processor, and at least 16K video RAM, preferably 32 so we can finally sort out all those attribute problems and have a decent colour range in high-resolution. And the screen handling must offer Boolean operators to allow for fore/background activities. The colour range is a tricky issue. The Dragon lost out largely because of its pathetic resolution and lack of colours, while Atari and Enterprise demonstrate that it's not impossible to offer a wide range of colour tones, without slowing down the cpu or demanding masses of screen RAM.

On a similar note, interrupts should be available from Basic and there should be some attempt at multi-tasking — even if it's restricted to three or so tasks.

One thing I'd really like to see is a built-in toolkit. The BBC may have an assembler, but what's needed is a full Basic toolkit, including such features as find and replace, variable dump, in-line assembling of machine code and so on. And on similar lines, modern machines shouldn't have only a cartridge port but, as with the Beeb, ROM bays too for applications software.

Any micro these days should include some built-in mass-storage device, and Amstrad almost got that right. But the tape deck isn't under micro control (which the microcassette of the Epson PX-8 lap portable is) so you must go through all that press-play-and-any-other-key to get anywhere.

This is surprising given the company's experience in hi-fi. The QL has its Microdrives, but reliability is still a major problem and capacity is low. So what's wrong with a single 3in drive or whatever, like the Macintosh?

Memory is still a thorny issue. Is 48K enough? It doesn't look like it, but 64K seems to be a sticking point. Is it really worth producing a 128K micro if the code for applications software must be so large you're left with only 15K work-space? No, 64K seems quite adequate.

But sound is a different matter. It's here that manufacturers have come closest to the ideal. Three or four voices, tone and volume envelopes, sound synchrony and so on all fit the bill.

Sound commands could, however, be simpler. Surely micros offering hardware defined (but user redefinable) characters could offer an analogous feature for sound at the same time?

Lastly, any modern micro should have a built-in modem — preferably with BT approval.

Expense should be no problem. I don't believe for one minute that what I've proposed need cost you more than £400.

It all boils down to 'hardware glamour'. Once, a micro's specifications were what sold it. I think and hope this is changing. Buyers are more discriminating and select a computer on the strength of what they can do with it, not what the ad blurb promises. Essentially, this means more bundled software and even more thought in design if any new micro is to make a name for itself. Surely someone out there can get it right?

Bryan Skinner

CHARTS

1984's TOP SELLING GAMES

As featured on Radio 1's Saturday morning Chip Shop

	TITLE	PUBLISHER	MACHINE
1	D T's Decathlon	Ocean	SP, C64
2	Jet Set Willy	Software Projects	SP, C64
3	Manic Miner	Software Projects	SP, C64, AC, AM, MSX
4	Hunchback	Ocean	SP, C64, AC, Vic 20
5	Football Manager	Addictive Games	SP, C64, AC
6	Sabre Wulf	Ultimate	SP, AC
7	Beach-Head	US Gold	SP, C64
8	Fighter Pilot	Digital	SP, C64
9	Match Point	Psion	SP, C64
10	Full Throttle	Micromega	SP
11	Flight Path 737	Anirog	SP, C64, EL, AM, Vic 20
12	Tornado Low Level	Vortex	SP, C64
13	Chukkie Egg	A&F	SP, C64, AC, AM, DR
14	Monty Mole	Gremlin Graphics	SP, C64
15	International Soccer	Commodore	C64
16	Elite	Acornsoft	AC
17	Snooker	Visions	SP, C64, AC, Vic 20
18	Twin Kingdom Valley	BugByte	SP, C64, AC
19	Sherlock Holmes	Melbourne House	SP, C64
20	Ghostbusters	Activision	C64
21	Pyjamarama	Mikrogen	SP, C64, AM
22	Chess	Various	SP, C64, AC, AM, MSX
23	Knight Lore	Ultimate	SP
24	Lords of Midnight	Beyond	SP
25	Chequered Flag	Psion	SP
26	Hobbit	Melbourne House	SP, C64, AC, Oric
27	Blagger	Alligata	SP, C64, AC
28	Atic Atac	Ultimate	SP
29	Trashman	New Generation	SP, C64, AC
30	Valhalla	Legend	SP, C64

SPECTRUM

TW	TITLE
1	Jet Set Willy
2	D T's Decathlon
3	Manic Miner
4	Football Manager
5	Chequered Flag

COMMODORE 64

TW	TITLE
1	Beach-Head
2	D T's Decathlon
3	International Soccer
4	Flight 737
5	Manic Miner

BBC B

TW	TITLE
1	Elite
2	Aviator
3	Frak
4	Fortress
5	Micro Olympics

VIC 20

TW	TITLE
1	Wizard & Princess
2	Perils Of Willy
3	Chariot Race
4	Crazy Kong
5	Flight 737

DRAGON

TW	TITLE
1	Cuthbert (Series)
2	Chukkie Egg
3	The King
4	Ring Of Darkness
5	Hunchback

ATARI

TW	TITLE
1	Zaxxon
2	Caverns Of Khafka
3	Pole Position
4	Solo Flight
5	Forbidden Forest

These charts are compiled from both independent and multiple sources across the nation. PCN Charts are compiled exclusively for use by RAM/C, who can be contacted on 01-892 6596.

MONTY IS INNOCENT

If you are one of the thousands of Monty Mole fans who have followed the exploits of our furry friend through the Yorkshire pits and eventually to jail—fear not! Because Monty is innocent and plans are in hand to rescue your superhero.

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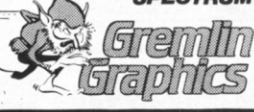

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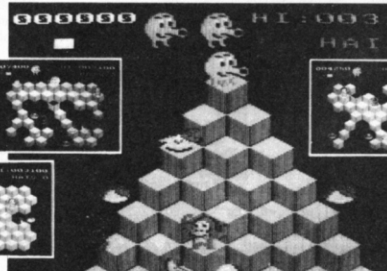

- Avoid his unwelcome guests.
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Sanyo software support extolled

In Routine Enquiries (issue 90) you admitted to J Smith of Islington that 'he could do a lot worse than the Sanyo 555', but qualify this by suggesting that the bundled software is all he will probably ever get for it.

You are certainly right on the first count: the Sanyo is an excellent machine, and must be about the best value for money of its type.

So far as the software is concerned, however, you are far from the mark. Both Molimerx and Icarus market a wide selection, ranging from arcade and adventure games to business and professional applications. In addition there is a magazine — Soft Sector — devoted entirely to the Sanyo, and imported from US by Molimerx. It has proved extremely useful. Caxton's superb Brainstorm runs happily on the Sanyo, as does dBase II.

Like myself, Mr Smith obviously does not have an enormous budget: short of considering a second hand or demo machine (which both carry risks), he could look much further than the Sanyo and do no better: the software is excellent, once one has put in the time to learn it properly, and the machine itself both pleasing to the eye and a delight to use over long periods. The support offered by Molimerx, which frequently updates catalogue and price list, has been invaluable.

Laurence Denholm,
Sleaford.

We've had to own up several times recently on this score, so here's a definitive statement. While modesty is a fine virtue, it makes life very difficult for us — we can't pass on the good news if companies aren't telling us in the first place. We are, as always, happy to publicise a company providing first class support — Ed.

Protection devices hinder amateurs

Unauthorised copying of games and other programs inflicts heavy losses on software firms, we are constantly being told.

Well, yes, but let us also spare a thought for the amateur programmer, who is often less interested in some dazzling effect than the way in which it is produced. But should he try to find out, he will run up against an array of traps that violate the spirit of patent/copyright law.

When I tried to modify a two-part program for the Electron I found: REM lines stuffed with control codes to stop the program being listed; control codes hidden in the filenames; CALL commands which jumped to an RTS and straight back again, designed to wreck the program if it were altered in length; *FX commands to emasculate Escape or Break; and finally the main program was gibberish until it was EOR'ed with a 256-byte decoding section in the title program.

It took me so long to struggle through all this, I forgot what I wanted to do in the first place.

W E Trevelyan,
Epsom Downs, Surrey.

Big Brother to the rescue

Like J Stephenson (issue 90) I too have had problems attaching the Brother M100 printer to my Sinclair QL: however, I found the staff at Brother very helpful.

A phone call to Brother, revealed that dip switches 1 to 8 should be set as OFF, OFF, ON, ON, ON, OFF, OFF, OFF.

The following morning I received from Brother a fact-sheet detailing the settings to be used in the install bas program to allow articles written on Quill to be printed.

A G Bancroft,
Northampton.

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MICROWAVES

Have you any good answers for Amstrad owners or brainwaves for the Beeb? Share them with fellow computer users by sending them to us. Not only will you get £10 for every tip published, but you could find a bonus of £50 comes your way if you are chosen as the Microwave of the month. Send them to *Microwaves, PCN, Evelyn House, 62 Oxford Street, London W1A 2HG.*

Doubling up your BBC characters

Print double height characters in the graphics modes 0,1,2,4, and 5 on the BBC with this routine.

Type in the listing and then call it with: PROCdouble (x-position on screen,y-position on screen, colour, message).

To see it in action type in this short demonstration program:

```
10 MODE 0
20 PROCDOUBLE (23,1,2, "DOUBLE
   HEIGHT IN MODE 0")
30 Q=INKEY (250)
40 MODE 1
50 PROCDOUBLE (8,2,2, "DOUBLE
   HEIGHT IN MODE 1")
60 Q=INKEY (250)
70 MODE 2
80 PROCDOUBLE (3,2,2,"AND IN MODE
   2")
90 END
```

Jonathan Temple
Beeston, Northampton.

```
1000 DEFPROCdouble(X,Y,C,M$)
1010 COLOUR C
1020 AX=8*X:X%=8*0:Y%=8*0
1030 FOR L%=1 TO LEN(M$)
1040 ?&70=ASC(MID$(M$,L%))
1050 CALL &FFF1
1060 VDU 23,254,?&71,?&71,?&72,?&72,?&73, ?&73,?&74,?&74
1070 VDU 23,255,?&75,?&75,?&76,?&76,?&77,?&77,?&78,?&78
1080 VDU 31,X+L%-1,Y,254,10,8,255
1090 NEXT
1100 ENDPROC
```

Adding single key to the Amstrad

When Locomotive Software wrote the Basic interpreter for the Amstrad it provided an entirely soft keyboard *ie* total control over what happens after each key is pressed. Different results are produced depending on whether the control or shift keys are pressed.

The following program provides the Amstrad with a set of 26 keywords using the KEY and KEY DEF commands. These are accessed by pressing the control key in conjunction with the first letter of the required keyword. This method of keyword entry is referred to as 'single key entry' and can speed up programming considerably.

Once run, the program will self destruct so remember to save it to tape first. The 26 keywords are ones I use frequently including BORDER, WINDOW, VAL and PLOT. Of course, these can be replaced by words of your own choosing, but take care not to exceed the maximum total of 120 characters.

Jeffery Birks,
Brixham, Devon.

```
10 ' Single key entry
20 KEY DEF 15,1,48 :KEY DEF 13,1,49 :KEY DEF 14,1,50 :KEY DEF 5,1,51
30 KEY DEF 20,1,52 :KEY DEF 12,1,53 :KEY DEF 4,1,54 :KEY DEF 10,1,55
40 KEY DEF 11,1,56 :KEY DEF 3,1,57 :KEY DEF 6,1,13 :KEY DEF 7,1,46
50 FOR char=128 TO 153
60     READ KEY.NUMBER,EXP.CHAR$
70     KEY DEF KEY.NUMBER,1,char-31,char-63,char
80     KEY char,EXP.CHAR$
90 NEXT char
100 DATA a9,"AUTO",54,"BORDER",62,"CHR$",61,"DRAW",58,"EDIT"
110 DATA 53,"FOR",52,"GOSUB",44,"HIMEM",35,"INPUT",45,"JOI"
120 DATA 37,"KEY",36,"LIST",38,"MOVE",46,"NEXT",34,"ORIGIN"
130 DATA 27,"PLOT",48,"TAB",58,"RETURN",48,"SOUND",51,"TEST"
140 DATA 42,"UPPER$",55,"VAL",59,"WINDOW",63,"XPOS",43,"YPOS"
150 DATA 71,"ZONE"
160 KEY DEF 6,1,13,13,154 :KEY 154,"RUN"+CHR$(34)+CHR$(13)
170 NEW
```

Cracked — the QL Brother connections

With reference to the letters in issue 90 regarding Brother to QL interfacing difficulities, I too had the same problems, but with help from Brother and the technical staff at Boots (my employers) I have finally cracked it. This letter is written with Quill and the Brother M-1009.

First, my Brother is J series. The more recent K series apparently requires a different lead. Check your serial number and if it starts with a K, contact Technical Support, Brother, on 061-330 6531 to ascertain what the correct lead connections are. My RS232C lead is configured (QL end first, Brother end second) 1-7,2-2,3-3,4-20,5-5,6-6.

My dip switch settings are as follows:

1. off,1.2 on,1.3 on,1.4 on,1.5 on,1.6 on
1. 7 off,1.8 off
2. 1 on,2.2 on,2.3 off,2.4 on,2.5 off,2.6 off
2. 7 off,2.8 off

I am told that on some printers the dip switches are only read at switch-on, so it may be good practice to turn off your printer each time you try a new setting.

When printing from Basic, I use the following opening statements:-

```
10 BAUD 9600
20 OPEN #3,ser/shc
```

When printing from Quill, set up the printer install program (see page 2 of the information section of the QL manual) as follows:

PARITY	SPACE
BAUD RATE	9600
END OF LINE CODE	<CR>,<LF>
END OF PAGE CODE	<FF>
PREAMBLE CODE	NONE
POSTAMBLE CODE	NONE
EMPHASIZE ON	<ESC>,E
EMPHASIZE OFF	<ESC>,F
UNDERLINE ON	<ESC>,—, <SOH>
UNDERLINE OFF	<ESC>,—, <NUL>
SUBSCRIPT ON	<ESC>,S, <SOH>
SUBSCRIPT OFF	<ESC>,T
SUPERSCRIPT ON	<ESC>,S, <NUL>
SUPERSCRIPT OFF	<ESC>,T

I am not certain if there should be pre- and post-amble codes, or what they should be. However, the printer works set to NONE both codes.

Allan Postgate,
Droitwich, Worcs.

Curing the hiccups in the MTX screen saver

I was delighted to see the routine for saving the graphics screen on the Memotech MTX (issue 87) but had some trouble in getting it to work. On consulting the VDP Manual, I found some errors.

The VDP requires a minimum of 8 microseconds between the initial address setup and the subsequent data read or write. The program for dumping the VRAM to RAM has only 7.5 microseconds between these two instructions and so requires the insertion of two NO OP instructions.

The cassette save/load routine requires that resister DE is loaded with the number of bytes to be transferred, and not resister BC as was listed.

Finally, as written, the routine would not save the colour information. This can be rectified by also saving the colour table. It is simply necessary to save #3800 bytes instead of #1800 bytes, as indicated in my listing.

P Brewer,
Bury, Lancs.

```
SAVE
     LD A,0
     OUT (2),A
     LD A,0
     OUT (2),A
     NO OP
     NO OP
     LD HL,£B800
LOOP: IN A,(1)
     LD (HL),A
     INC HL
     LD A,H
     CP £FO
     JR NZ,LOOP
     LD HL,£B800
     LD DE,£3800
     LD A,0
     LD (£FD68),A
     CALL £AAE
     RET
```

```
LOAD
     LD HL,£B800
     LD DE,£3800
     LD A,1
     LD (£FD68),A
     CALL £AAE
     LD A,0
     OUT (2),A
     LD A,£40
     OUT (2),A
     LD HL,£B800
LOOP: LD A,(HL)
     OUT (1),A
     INC HL
     LD A,H
     CP,£FO
     JR NZ,LOOP
     RET
```

Yet another 'winning wave'

November's Microwave of the month goes to David R Parker of Hemel Hempstead in Herts, for his useful routine in issue 85 enabling Spectrum users to obtain printouts of any section of their programs. £50 will be winging its way to him soon.

ROUTINE ENQUIRIES

Got your digits in a twist over a problem? Can't decide what micro to buy? Need some sensible advice? Why not try writing to the experts? Remember we cannot reply personally, so no stamped self addressed envelopes, please. Address your questions to *Routine Enquiries, PCN, Evelyn House, 62 Oxford Street, London W1A 2HG.*

A search for a micro that bridges the gap

Could you give me advice for my friend on buying a computer which is capable of playing the following games — backgammon, chess and bridge. I own an Acorn Electron but, unbiased, I suggested the Amstrad. But I think he would prefer a micro which has the software available now.
Richard Rennie,
West Calder, West Lothian.

A The only machine we know that has all three games available now is the Spectrum. Just about any machine will have chess available, several have backgammon but the kicker is bridge.

The most recent Spectrum game we reviewed was way back in January — *Bridge Player*, from CP Software, of Orchard Lane, Prestwood, Great Missenden, Bucks, at £8.95.

There are any number of chess programs available, and several versions of backgammon.

Flexible interface sought for Spectrum

Do you have any information on disk drive interfaces for the Spectrum? I have information on the Datafax interface but would prefer a more flexible one with on-board memory for the running of programs. I would prefer a 5.25in drive with 200K-plus storage capacity.
D Graig,
Tarland, Aberdeenshire.

A There are quite a number of disk interfaces for the Spectrum around, although it's only recently that the larger manufacturers have got involved. It's difficult to know exactly what you mean by 'flexible' as you could either want a highly sophisticated system or one that doesn't interfere too much with your existing programs.

All disk interfaces will interfere with the running of programs to some extent and broadly speaking, the more sophisticated the system, the more it's liable to interfere (cue—wave on wave of letters from interface manufacturers claiming the contrary).

At the not too sophisticated but relatively efficient end of the market there's the Timex drive and interface (issue 89). This is a 3in drive, but we're not too sure why you want 5.25in in the first place.

We've also seen a prototype of the Abbeydale system (available from Watford Electronics, 0923-40588/37774). This is a bit more at the professional end of the market (although Timex intends to put CP/M onto its drives in the future) and will handle just about any drive you want to use. *PCN* should be testing the finished product soon.

You might also like to take a look at the Opus system (01-701 8668) which again will take a variety of different-sized drives. We haven't seen one as yet, but if Opus would care to send one. . .

There are a few other systems that have been out for a while. The Viscount, for example, used to be sold by Spectrum, but its original operating system was quite clumsy, and we haven't seen the revised version.

We suggest you choose between Opus, Abbeydale and Timex, if only because these drives stand the best chance of getting software support.

Amstrad address causes confusion

You published an article which gave the address of the ROM routine SCR HW ROLL as &BC4D. This, it was claimed, is the same as decimal 50395. Please can you explain how on earth you get this? Every time I try PRINT &BC4D, my Amstrad displays –17331. I am sure there must be many other readers who are as confused as I am.
L W Cox,
Gravesend, Kent.

A Oops. That 50395 should have been 48205, but that doesn't answer your question. Bascially, the Amstrad's print function doesn't work properly for numbers greater than 32767.

It deals with 16-bit signed integers and in this system the top bit (bit 15) is used to signify a negative number. Therefore a number over 32767 will be taken as negative because its MSB is set.

There are many ways to get your Amstrad to tell you the correct decimal equivalent of large hex numbers. The simplest is to add negative results to 65536, so 65536 + (–17331) gives 48205.

Shop around for the 64 best buys

I am going to buy a Commodore 64 and tape deck plus a joystick and some games but don't know how to go about it.
Jackie,
Mottingham, SE9.

A To get the best deal you need to do quite a bit of shopping around.

Although the recommended retail price for the Commodore 64 is £230, with some careful hunting you should be able to find one for as little as £199.

The best places to look are the big chain stores, Dixons, W H Smith, Boots, etc. You should also be able to pick up some free leaflets from the stores giving you full information on the machine and its software and peripherals including all the prices.

Compromises when choosing a micro

I am contemplating purchasing either a Commodore 64 or an Amstrad CPC 464.

Since I already know a little 6502 assembly language I think the Commodore may be more suitable. However, I intend to purchase disk drives later on and the ones supplied by Commodore are reputedly very slow. Also, might Commodore neglect the 64 in favour of its two new machines?

On the other hand many magazines are starting to publish articles and games listings for the Amstrad and all say how good the machine is.

I want to use the machine for playing games and for some serious development of machine code programs.
M Sutton,
Swansea.

A When a new machine is launched it takes quite a while for the software industry to learn its ins and outs. This means it can be a while before much software becomes available. This is where the Commodore wins over the Amstrad, as it has reams of extremely good titles available.

The Amstrad has quite a way to go before it catches up so, if you want lots of games available now, the 64 looks like the one to go for. And Commodore's two new machines won't dent the popularity of the 64 enough to stop the company's support for it.

On the other hand, once the Amstrad disk drive is available, it will be able to run existing CP/M software. This means that you'll be able to use business and development programs that are already established favourites on business machines, as well play games on it. Obviously, the Amstrad's Z80 processor means learning a new language but this shouldn't be too difficult. Only you can decide which compromises to make.

DISK MANAGER GOES ON FILE

Get your 64's files under control with these powerful disk utilities. David Jones' package performs simple and difficult tasks.

Here is a collection of powerful disk utilities for the Commodore 64 and 1541 disk drive. The utilities are strung together in one package, very much like the Apple FID program or Atari DOS. Some of the options allow you to perform simple tasks (rename, validate etc), but some perform functions that would otherwise be difficult *eg* restoring deleted files.

There are 11 main options excluding **Q**-uit manager. **A, I** and **J** are self-explanatory, and the following are the more exotic commands:

B — restores previously scratched files. It searches the disk for all scratched files, and if they can be retrieved, you are asked if you want to regenerate each file in turn. If one or more files has been reclaimed, the B option will validate the disk to fix the BAM (Block Availability Map) before exiting.

C — copies one or more files on a single disk system. It uses memory from $1000-$FFF for storing the file before copying it. This means it copies files of 96 blocks or less, although this limit can be altered by adjusting the buffer value in line 100. If *Disk Manager* is asked to copy a file when the file name already exists it asks for a new name, or gives you the option to skip that particular file.

D — scratches files from the disk, but unlike the normal wildcard scratch it asks for permission before scratching each file.

E — is a useful option that displays the start/end addresses for PRG files, or just the exact file length for USR and SEQ files.

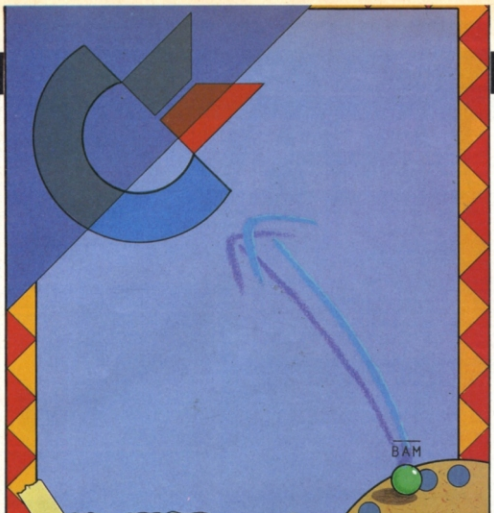
F — has four sub-options, and allows the user to format the whole disk, erase just the sub-directory, and test the disk surface for bad blocks.

G and **H** — are exact opposites, locking and unlocking disk files respectively. This is a little-known feature of the 1541 disk drive, and normally difficult to implement. Locked files are displayed with a '<' next to the file type, *eg* 'PRG<'. When a file has been locked any attempt to scratch it is ignored, although SAVE@ is still effective.

K — is almost a self-contained program. It is a simple block editor that allows the user to edit any disk block in either ASCII or Hex. When executed, the option displays the entire 256-byte block, and using the cursor allows the user to type over bytes. As with the Basic editor, Return must be pressed to fix the changes. To change the disk block the cursor must be positioned over the 'Write Block' phrase, and again Return must be pressed. The Quit option works just the same.

Listing

```
90 REM SET VARS & DEFINE BUFFER
99 REM BUF=(BUFFER ADDRESS)/256
100 BUF=64:POKE55,0:POKE54,BUF:CLR:BUF=P
EEK(56):DIMD$(144),NS%(17):DEV=8:PD%=4
102 GOSUB60000:FORF=0TO17:READNS%(P):NEX
T
105 OPEN15,DEV,15,"UI+"
110 POKE49259,DEV:POKE53280,6:POKE53281,
6:PRINTCHR$(147);CHR$(155)
120 PRINTTAB(5)"**********************
*****"
125 PRINTTAB(5)"*
      *"
130 PRINTTAB(5)"*    C64/1541 DISK MANAGE
R    *"
140 PRINTTAB(5)"* (C) DAVID JONES  07/10
/84 *"
145 PRINTTAB(5)"*
      *"
150 PRINTTAB(5)"**********************
*****DOWN}"
170 PRINTTAB(6)"A. READ & DISPLAY DIREC
TORY"
180 PRINTTAB(6)"B. RESTORE DELETED FILE
S"
190 PRINTTAB(6)"C. COPY FILES (1 DRIVE)
"
200 PRINTTAB(6)"D. DELETE FILES"
210 PRINTTAB(6)"E. DISPLAY FILE INFO"
220 PRINTTAB(6)"F. FORMAT & TEST DISK"
230 PRINTTAB(6)"G. LOCK FILES"
240 PRINTTAB(6)"H. UNLOCK FILES"
250 PRINTTAB(6)"I. RENAME FILE"
260 PRINTTAB(6)"J. VALIDATE DISK"
270 PRINTTAB(6)"K. EDIT BLOCK"
275 PRINTTAB(6)"L. PROCESS DIRECTORY"
277 PRINTTAB(6)"Q. QUIT MANAGER"
280 FORK=0TO14:CLOSEK:NEXT:POKE49261,2
:C$="":INPUT"{DOWN}{RIGHT}WHICH";C$:IFC$
=""THEN110
285 IFASC(C$)!=81THEN9000
290 IFC$<"A"ORC$>"L"THENPRINT"{UP} ???":
GOTO280
295 KK=ASC(C$)-64:PRINT
300 ONKKGOTO1000,1500,2000,2500,3000,350
0,4000,4500,5000,5500,6000,6500
999 REM PRINT DIRECTORY
1000 MF$="*0":GOSUB16000:POKE251,0:POKE2
52,BUF:POKE49261,0:SYS49152
1002 INPUT"OUTPUT TO PRINTER";IK$
1004 IFLEFT$(IK$,1)="Y"THENOPEN4,4:GOTO10
10
1006 OPEN4,3
1010 MM=BUF*256+4:PRINT#4
1020 GOSUB1400:IFPEEK(MM+1)=0ANDPEEK(MM+
2)=0THENPRINT#4:GOTO200
1030 MM=MM+3:GOTO1020
1400 PRINT#4,PEEK(MM)+PEEK(MM+1)*256;MM
=MM+2
1410 IFPEEK(MM)=0THENPRINT#4:RETURN
1420 PRINT#4,CHR$(PEEK(MM));:MM=MM+1:GOT
O1410
1499 REM RECOVER SCRATCHED FILES
1500 PRINT"{DOWN}SCANNING DIRECTORY FOR
SCRATCHED FILES"
1510 RC=81:T=18:S=1:OPEN2,DEV,2,"#"
1520 GOSUB13000
1530 GET#2,A#:NT=ASC(A#+CHR$(0)):GET#2,A
#:NS=ASC(A#+CHR$(0)):E=0
1540 GET#2,T$:GET#2,FT$:GET#2,FS$:F$="":
FORKK=1TO16
1550 GET#2,A#:IFA#=CHR$(160)THEN1570
1560 F$=F$+A#
1570 NEXT
1575 IFF$=""THEN1710
1580 FORKK=1TO9:GET#2,A#:NEXT
1582 GET#2,A#:NB=ASC(A#+CHR$(0)):GET#2,A
#:NB=NB+ASC(A#+CHR$(0))*256
1584 GET#2,A#:GET#2,A#
1590 TY=ASC(T$+CHR$(0)):IFTYAND127<>0THE
N1710
1600 IFFT$<CHR$(1)ORFT$>CHR$(35)ORNB=0TH
ENPRINT"{DOWN}CANNOT RECOVER "F$:GOTO171
0
1610 PRINT"{DOWN}DO YOU WANT TO RECOVER
"F$;:INPUTA$
1620 IFLEFT$(A$,1)<>"Y"THEN1710
1630 INPUT"{DOWN}FILETYPE (SEQ/USR/REL/P
RG) : "LT$
1640 IFT$="SEQ"THENTY=1:GOTO1690
1650 IFT$="PRG"THENTY=2:GOTO1690
1660 IFT$="USR"THENTY=3:GOTO1690
1670 IFT$="REL"THENTY=4:GOTO1690
1680 PRINT"{DOWN}*** INVALID FILE TYPE":
GOTO1630
1690 RC=1:PRINT#15,"B-P:"121E*32+2
1700 PRINT#2,CHR$(TYOR128);:PRINT#15,"B-
P:"21E*32+34
1710 E=E+1:IFE<8THEN1540
1720 GOSUB13500
1730 IFNT<{DRNT>35THENCLOSE2:GOTO1750
1740 S=NS:T=NT:GOTO1520
1750 IFRC=1THEN5500
1760 GOTO200
1999 REM BACKUP FILES
2000 PRINT"{DOWN}COPY WHICH FILES? "::GO
SUB15000:S$="*"+IN$
2010 GOSUB18000
2020 IFNF<2THENPRINT"{DOWN}*** NO FILES
FOUND":GOTO200
2030 FORA=1TONF-1:F$=DI$(A):GOSUB12000
2035 IFT$<>"PRG"ANDT$<>"SEQ"ANDT$<>"USR"
THENPRINT"{DOWN}CANNOT COPY "N$:GOTO2200
2040 PRINT"{DOWN}FOUND: "N$
2042 PRINT"{C}OPY, {S}KIP, {Q}UIT"
2050 GOSUB11000:IFK$="S"THEN2200
2052 IFK$="Q"THENA=NF-1:GOTO2200
2054 IFK$<>"C"THEN2050
2070 MF$=N$:GOSUB16000
2080 POKE251,0:POKE252,BUF
2090 SYS49152
2095 IFPEEK(252)>159THENPRINT"{DOWN}{DOW
N}*** FILE TOO LONG - CANNOT COPY{DOWN}"
:GOTO2200
2100 INPUT#15,ER,ER$,KK,KK:IFER>19THEN20
810
2120 PRINT"{DOWN}INSERT COPY DISK & HIT
A KEY":GOSUB11000
2130 MF$=N$+",*T$+",W":GOSUB16000
2140 POKE253,PEEK(251):POKE254,PEEK(252)
:POKE251,0:POKE252,BUF:SYS49155
2150 INPUT#15,ER,ER$,KK,KK:IFER<20THEN21
90
2160 IFER<>63THEN2800
2165 PRINT"{DOWN}FILE ALREADY EXISTS ON
COPY DISK, ENTER NEW FILENAME ";
2170 PRINT"OR JUST RETURN TO SKIP FILE"
2180 PRINT"{DOWN}{DOWN} .. ";:GOSUB15000
:IFIN$=""THEN2190
2190 N$=IN$:MF$=N$+",*T$+",W":GOSUB1600
0:POKE251,0:POKE252,BUF
2195 SYS49155:GOTO2150
2198 PRINT"{DOWN}INSERT SOURCE DISK & HI
T A KEY":GOSUB11000
```



The B option searches the disk for scratched files.

```
2200 NEXT
2210 PRINT"{DOWN}COMPLETE{DOWN}{DOWN}":G
OTO2200
2499 REM DELETE FILES
2500 PRINT"{DOWN}DELETE WHICH FILES? "I:
GOSUB15000:S$="$"+IN$
2510 GOSUB10000
2520 IFNF(20OTO2020
2530 FORA=1TONF-1:F$=DI$(A):GOSUB12000
2540 PRINT"{DOWN}FOUND: "N$
2542 PRINT"(D)ELETE, (S)KIP, (Q)UIT"
2550 GOSUB11000:IFK$="S"THEN2600
2552 IFK$="Q"THENA=NF-1:GOTO2600
2554 IFK$<>"D"THEN2550
2560 CM$="S0:"+N$:GOSUB14000
2570 PRINT"FILE DELETED"
2600 NEXT:PRINT:GOTO200
2999 REM DISP FILE INFO (START/END/LEN)
3000 PRINT"{DOWN}LIST WHICH FILES? "I:GO
SUB15000:S$="$"+IN$
3002 INPUT"{DOWN}OUTPUT TO PRINTER"IK$
3004 IFLEFT$(K$,1)="Y"THENOPEN4,4:GOTO38
10
3006 OPEN4,3
3010 PRINT#4:GOSUB10000
3020 IFNF(20OTO2020
3030 FORG=1TONF-1:F$=DI$(G):GOSUB12000
3032 IFT%()"PRG"ANDT%()"SEQ"ANDT%()"USR"
THEN3120
3040 MF$=N%:GOSUB14000:IFT%="USR"ORT%="S
EQ"THEN3200
3050 OPEN3,DEV,3,N%:GET#3,A%:GET#3,B%:CL
OSE3
3060 PRINT#4,F$;":X=ASC(B%+CHR%(0)):GOSUB
16500:PRINT#4,SPC(23-LEN(F$))"$"HEX$;
3070 X=ASC(A%+CHR%(0)):GOSUB16500:PRINT#
4,HEX$" - $"I
3080 POKE251,0:POKE252,0:SYS49158
3090 LL=PEEK(251)+PEEK(252)*256-2
3100 EA=ASC(A%+CHR%(0))+ASC(B%+CHR%(0))*
256+LL:HI=INT(EA/256)
3110 LO=INT(EA-HI*256):X=HI:GOSUB16500:P
RINT#4,HEX$:X=LO:GOSUB16500
3115 PRINT#4,HEX$
3120 NEXT:GOTO200
3200 POKE251,0:POKE252,0:SYS49158
3210 LL=PEEK(251)+PEEK(252)*256+1
3220 HI=INT(LL/256):LO=INT(LL-HI*256)
3230 PRINT#4,F$;X=HI:GOSUB16500:PRINT#4
,SPC(23-LEN(F$));"$"HEX$;
3240 X=LO:GOSUB16500:PRINT#4,HEX$;" ("LL
")"
3250 GOTO3120
3499 REM FORMAT/DISK TEST
3500 PRINT"PLEASE WAIT..":PRINT#15,"I0"
3510 INPUT#15,ER,ER$,KK,KK
3520 IFER=26THEN20010
3530 IFER=74OR(ER)19ANDER<20)THEN3570
3540 IFER>19THEN20010
3550 PRINT"{DOWN}{DOWN}";TAB(13);"** WAR
NING! **{DOWN}{DOWN}"
3560 PRINT"THIS DISK SEEMS TO BE ALREADY
 FORMATTED ..."
3565 PRINT"MODES 1-3 WILL DESTROY ALL DI
SK FILES{DOWN}{DOWN}"
3570 PRINT"{DOWN}MODE:  1 - COMPLETE FOR
MAT"
3580 PRINT"            2 - ERASE DIRECTORY TR
ACK"
3590 PRINT"            3 - COMPLETE FORMAT &
 TEST DISK"
3600 PRINT"            4 - TEST DISK (NON-DES
TRUCTIVE)"
3605 PRINT"            5 - LEAVE FORMATTER"
3610 INPUT"{DOWN}{RIGHT}CHOICE"IA
3620 IFA>5THENPRINT:GOTO280
3625 IFA=4THEN3672
3630 PRINT"{DOWN}NEW DISK NAME: "I:GOSUB
15000:N%=IN$
3640 IFA=1ORA=3THENPRINT"{DOWN}DISK ID (
2 CHARS)! "I:GOSUB15000:IFLEN(IN$)<2THE
N3640
3650 CM$="N0:"+N%:IFA=1ORA=3THENCM$=CM$+
","+IN$
3655 PRINT"{DOWN}CONTINUE (Y/N)?"I:GOSUB1
1000
3658 IFK$<>"Y"THEN280
3660 GOSUB14000
3670 IFA<>3THEN280
3672 MF=0:INPUT"{DOWN}DO YOU WANT TO MAR
K BAD BLOCKS"IK$
3674 IFLEFT$(K$,1)="Y"THENMF=1
3679 REM CHECK DISK BLOCKS
3680 PRINT"{DOWN}{DOWN}CHECKING DISK{DOW
N}{DOWN}"
3690 OE=-1:A=0
3700 T=1:OPEN2,DEV,2,"#"
3710 S=0
3715 PRINT"      TRACK :"T"{LEFT} ":PRINT
"{DOWN}     BLOCK :"S"{LEFT} "
3716 PRINT"{DOWN}BAD BLOCKS :"A"{LEFT}
"
3720 PRINT#15,"U1:"12;0;T;S
3730 INPUT#15,ER,ER$,KK,KK:IFER>19THENA=
A+1
3732 IFER>19ANDMF=1THENPRINT#15,"B-A:"10
;T;S
3735 IFER=OETHENPRINT"{DOWN}":GOTO3750
3736 OE=ER
3740 PRINT"{DOWN}{RVSON} DISK STATUS:
                {LEFT}{LEFT}{LEFT}
{LEFT}{LEFT}{LEFT}{LEFT}{LEFT}{LEFT}{LEF
T}{LEFT}{LEFT}{LEFT}{LEFT}{LEFT}{LEFT}{L
EFT}{LEFT}{LEFT}{LEFT}{LEFT}{LEFT}{LEFT}
{LEFT}"ER$
3750 PRINT"{UP}{UP}{UP}{UP}{UP}{UP}{UP}"
;
3790 S=S+1:IFS<(17THEN3715
3792 IFT<10ANDS<21THEN3715
3800 IFT<25ANDS<19THEN3715
3810 IFT<31ANDS<18THEN3715
3820 IFS<17THEN3715
3830 T=T+1:IFT<36THEN3710
3840 PRINT"{DOWN}{DOWN}{DOWN}{DOWN}{DOWN
}{DOWN}{DOWN}{DOWN}":IFA=0THENPRINT"} D
ISK PASSES TEST":PRINT:GOTO3860
3850 PRINT"DISK HAS"A"BAD BLOCKS":PRINT
3860 CLOSE2:GOTO200
3999 REM LOCK FILES
4000 PRINT"{DOWN}LOCK WHICH FILES? "I:GO
SUB15000:S$="$"+IN$
4010 GOSUB10000
4020 IFNF(20OTO2020
4030 FORA=1TONF-1:F$=DI$(A):GOSUB12000:P
RINT"{DOWN}LOCKING   "N$
4040 SF$=N$:LB=64:GOSUB4200
4050 NEXT:GOTO200
4199 REM SET/RESET LOCK BIT
4200 T=18:S=1:OPEN2,DEV,2,"#"
4210 GOSUB13000
4220 GET#2,A%:IFA%=ASC(A$+CHR$(0))THEN42
30
4230 GET#2,A%:IFA%=CHR$(16)THEN4260
4240 GET#2,A%:IFA%=CHR$(160)THEN4260
4250 F$=F$+A$
4260 NEXT
4270 FORKK=1TO13:GET#2,A%:NEXT
4280 IFSF$<>F$THEN4340
4290 TY=ASC(T$+CHR$(0)):IFTY<128THENPRIN
T"{DOWN}CANNOT LOCK "F$:GOTO4340
4295 IFTY<>ANDTY<160THEN4340
4300 IFFT$<>CHR$(1)ORFT$>CHR$(35)THENPRIN
T"{DOWN}CANNOT LOCK "F$:GOTO4340
4310 PRINT#15,"B-P:"12;1;E32+2
4320 PRINT#2,CHR$(TY+ANDLB)(ORLB);1
4330 PRINT#15,"B-P:"12;1;E32+34
4340 E=E+1:IFE<8THEN4230
4345 GOSUB13500
4350 S=NS:T=NT:IFNT<(1ORNT)35THENCLOSE2:R
ETURN
4360 GOTO4210
4499 REM UNLOCK FILES
4500 PRINT"{DOWN}UNLOCK WHICH FILES? "I:
GOSUB15000:S$="$"+IN$
4510 GOSUB10000
4520 IFNF(20OTO2020
4530 FORA=1TONF-1:F$=DI$(A):GOSUB12000:P
RINT"{DOWN}UNLOCKING   "N$
4540 SF$=N$:LB=191:GOSUB4200
4550 NEXT:GOTO200
4999 REM RENAME FILES
5000 PRINT"{DOWN}ORIGINAL FILENAME? "I:G
OSUB15000:N$=IN$
5010 PRINT"{DOWN}NEW FILENAME? "I:GOSUB1
5000:F$=IN$
5020 CM$="R0:"+F$+"="0:"+N$:GOSUB14000
5030 GOTO200
5499 REM COLLECT/VALIDATE DISK
5500 CM$="V0":PRINT"{DOWN}{DOWN}>>> VALI
DATING - PLEASE WAIT! <<<":GOSUB14000
5510 GOTO200
5999 REM "SAP" DISK BLOCK
6000 INPUT"TRACK, BLOCK  : "T,S
6010 IFT<1THEN200
6016 MF=0:INPUT"{DOWN}DO YOU WANT TO WOR
K IN ASCII"IA$
6017 IFLEFT$(A$,1)="Y"THENMF=1
6018 OPEN2,DEV,2,"#":PRINT"{CLEAR}"+TAB(
5);"TRACK"T;:PRINTTAB(20);"BLOCK"S
6020 IFMF<>1THENPRINT"{DOWN}{RIGHT}{RIGH
T}{RIGHT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}{RI
GHT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}
HT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}0
{RIGHT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}{RIGHT}@C{DO
WN}"
6025 IFMF<>0THENPRINT"{DOWN}    (a 0)=C
AN'T DISPLAY (a 1)=ASCII 160{DOWN}"
6030 PRINT#15,"U1:"12;0;T;S
6032 INPUT#15,ER,ER$,KK,KK:IFER>19THEN20
010
6040 FORP=0TO255STEP16
6050 X=P:GOSUB16500:PRINTHEX$" - "I:FORQ
=1TO16
```

OUTPUT: COMMODORE 64

When in Hex mode, inverse text mode is used to show where individual bytes start — apart from this visual aid it has no other function. In ASCII mode solid circles represent characters that cannot be displayed (non-ASCII codes). A hollow circle is used to show CHR$(160), which DOS V2.6 uses to pad out filenames — a useful character to be able to enter/display.

L — does three things: tidies up a disk directory; purges deleted files and sorts the directory alphabetically or by file type. The purge option erases all trace of previously deleted files from the directory — purged/sorted files cannot be recovered with utility B. The sort used is a crude bubblesort — more than adequate for an application like this.

How it works

Disk manager relies on the U1 and U2 disk commands for reading and writing sectors. Options B, G and H modify the file type marker (the first byte of a directory entry). This is set to zero when a file is deleted, and when ORed with 64 causes the file to be locked. The copy command merely treats PRG, SEQ and USR files as sequential files and reads them as just a string of characters.

Any sequential type file can be read by opening the file and using INPUT £ commands *eg* OPEN 2,8,2,"filename, P,R" will open a PRG file for reading.

Note that *Disk Manager* is set up for 1541 drives using device 8. It can send outputs to device 4 (CBM printer), and these values can be altered by editing line 100.

The machine language routines are used by options A and C for reading and writing sequential disk files into the temporary buffer — they are poked into memory at $C000.

In ASCII mode, solid circles represent characters that cannot be displayed (non-ASCII codes).

Listing

```
6052 IFMF=1THENGET#2,A$:GOSUB6300:GOTO60
65
6056 IF(QAND1)=1THENPRINT"{RVSON}"
6058 IF(QAND1)=0THENPRINT"{RVSOFF}";
6060 GET#2,A$:X=ASC(A$+CHR$(0)):GOSUB165
00:PRINTHEX$
6065 NEXT:PRINT:NEXT
6070 PRINT"{DOWN}GUIT EDITOR":PRINT"{DOW
N}WRITE TO DISK";:PRINT"{HOME}{DOWN}{DOW
N}{DOWN}"
6074 REM OPEN SCREEN EDITOR
6075 OPEN5,8,5
6080 INPUT#5,A$:PRINT
6085 IFLEN(A$)<{2}THENA$=A$+RIGHT$("
              ",21-LEN(A$))
6090 IFLEFT$(A$,4)="QUIT"THENCLOSE2:CLOS
E5:GOTO110
6100 IFLEFT$(A$,1)="  "THEN6080
6110 IFLEFT$(A$,5)="WRITE"THENPRINT#15,"
U2:"{2}8;T;S:GOTO6080
6120 HEX=LEFT$(A$,2):GOSUB17000
6130 IFX>255THEN6080
6140 PRINT#15,"B-P:"{2}X:XX=X
6145 IFMF=1THEN6180
6150 FORP=6TO36STEP2
6160 HEX=MID$(A$,P,2):GOSUB17000:PRINT#
2,CHR$(X);
6170 NEXT:GOTO6080
6180 FORP=6TO21
6190 IFMID$(A$,P,1)="{S G}"THENPRINT#15,
"B-P":{2}XX+P-5:GOTO6210
6195 IFMID$(A$,P,1)="{S W}"THENPRINT#2,C
HR$(160);:GOTO6210
6200 PRINT#2,MID$(A$,P,1);
6210 NEXT:GOTO6080
6299 REM DECODE ASCII
6300 IFA$=CHR$(32)THENPRINT"{S G}";:RETU
RN
6310 IFA$=CHR$(160)THENPRINT"{S W}";:RET
URN
6320 IFA$>CHR$(127)THENPRINT"{S G}";:RET
URN
6330 PRINTA$;:RETURN
6500 PRINT"{DOWN}READING FILENAMES...{DO
WN}"
6505 MM=BUF*256:NF=-1:T=18:S=1:OPEN2,DEV
,2,"#"
6510 GOSUB13000
6520 GET#2,
6530 F$="":FORP=1TO32:GET#2,X$:IFX$=""TH
ENX$=CHR$(0)
6532 F$=F$+X$:NEXT
6535 IFE=@THENNT=ASC(F$+CHR$(0)):NS=ASC(
MID$(F$,2)+CHR$(0))
6540 IF(ASC(MID$(F$,3)+CHR$(0))AND12)=@
THEN6590
6550 FORKK=1TO32:POKEMM+KK-1,ASC(MID$(F$
,KK)+CHR$(@)):NEXT:MM=MM+32
6560 N$="":FORKK=6TO21:IFMID$(F$,KK,1)<>
CHR$(160)THENN$=N$+MID$(F$,KK,1)
6570 NEXT
6580 NF=NF+1:DI$(NF)=N$+MID$(F$,3,1)+CHR
$(MF)
6590 E=E+1:IFE<@THEN6530
6600 IFNT=1@THENS=NS:GOTO6510
6610 PRINT"{DOWN}MODE:  1 - PURGE DELETE
D FILES"
6620 PRINT"                2 - SORT ALPHABETICALL
Y"
6630 PRINT"                3 - SORT BY FILETYPE"
6640 PRINT"                4 - QUIT DIR PROCESSOR
"
6650 INPUT"{DOWN}{RIGHT}CHOICE";KK:IFKK<
1ORKK>4THEN6650
6660 IFKK=4THENPRINT:GOTO280
6670 RC=KK
6680 IFRC=1ORNF{1THEN6740
6685 PRINT"{DOWN}SORTING...{DOWN}"
6690 FORA=1TONF
6700 FORB=@TONF-A
6710 IFDI$(B)<DI$(B+1)ANDRC=2THEN6730
6715 IFRIGHT$(DI$(B),2)<RIGHT$(DI$(B+1),
2)ANDRC=3THEN6730
6720 F$=DI$(B):DI$(B)=DI$(B+1):DI$(B+1)=
F$
6730 NEXT:NEXT
6740 PRINT"{DOWN}GENERATING NEW DIRECTOR
Y...":T=18:S=1:N=@:A=@
6750 E=@:PRINT#15,"B-P:"{2}18
6755 FORKK=@TO255:PRINT#2,CHR$(@);:NEXT
6760 F$=DI$(N):KK=ASC(RIGHT$(F$,1)+CHR$(
@))
6762 PRINT#2,CHR$(18)CHR$(NS%(A+1))
6770 FORP=KK*32+2TOKK*32+31:PRINT#2,CHR$
(PEEK(BUF*256+P));:NEXT
6780 E=E+1:N=N+1
6790 IFN)NFTHENPRINT#15,"B-P:"{2}@:PRINT
#2,CHR$(@)CHR$(255):GOTO6850
6800 IFE<8THEN6760
6810 A=A+1:GOSUB13500:S=NS%(A):GOTO6750
6850 GOSUB13500
6870 PRINT:GOTO280
9999 REM BYE!
9000 PRINT"{CLEAR}":CLOSE15:CLOSE2:END
9999 REM READ DISK DIRECTORY
10000 NF=@:CM=-"18":PRINT"{DOWN}SEARCHIN
G...{DOWN}"
10010 GOSUB11000
10040 OPEN2,DEV,@,S$
10050 GET#2,X$:GET#2,X$
10060 GET#2,X$:GET#2,X$:IFX$=""THENCLOSE
2:RETURN
10070 GET#2,X$:GET#2,X$
10080 GET#2,X$
10090 IFX$<>CHR$(34)ANDX$<>""THEN10080
10100 IFX$=""THEN10060
10110 X$=""
10120 GET#2,X$
10130 IFX$<>""ANDX$<>CHR$(34)THENXX$=XX$
:XX$=NT%(@)+X$
10135 IFX$=CHR$(34)THEN10120
10140 DI$(NF)=XX$:NF=NF+1:GOTO10060
10999 REM WAIT FOR A GET KEY
11000 PRINT#15,"U1:"{2}8;T;S
11010 IFPEEK(BUF*256+1)<>@THEN11010
11020 RETURN
11999 REM GET FILENAME OUT OF F$
12000 KK=16
12005 IFMID$(F$,KK,1)=" "THENKK=KK-1:IFK
K>@THEN12005
12010 IFKK=@THENN$="":RETURN
12020 N$=LEFT$(F$,KK):T$=MID$(F$,18,3):R
ETURN
12999 REM GET DISK BLOCK
13000 PRINT#15,"U1:"{2}8;T;S
13010 INPUT#15,ER,ER$,KK,KK:IFE}19THEN20
010
13020 RETURN
13499 REM PUT DISK BLOCK
13500 PRINT#15,"U2:"{2}8;T;S
13510 INPUT#15,ER,ER$,KK,KK:IFE}19THEN20
010
13520 RETURN
13999 REM SEND DISK COMMAND
14000 PRINT#15,CM$:INPUT#15,ER,ER$,KK,KK
:IFER}19THEN20010
14010 RETURN
14999 REM INPUT FILENAME
15000 FORKK=1TO10:GETK$:NEXT:IN$=""
15010 POKE204,@:GETK$:IFK$=""THEN15010
15020 IFK$=CHR$(13)THENPOKE204,1:PRINT"
":CHR$(155):RETURN
15030 IFK$<>CHR$(20)THENPRINTK$;:IN$=IN$
+K$:GOTO15010
15040 IFLEN(IN$)=@THENI5010
15050 PRINTK$;:IFLEN(IN$)=1THENIN$="":GO
TO15010
15060 IN$=LEFT$(IN$,LEN(IN$)-1):GOTO1501
@
15999 REM SET M/C FILENAME
16000 POKE49408,LEN(MF$):FORP=1TOLEN(MF$
):POKE49408+P,ASC(MID$(MF$,P,1));:NEXT
16010 RETURN
16499 REM DEC --> HEX
16500 HEX$="":NH=INT(X/16):GOSUB16600:NN
=XAND15:GOSUB16600:RETURN
16600 IFNN}9THENHEX$=HEX$+CHR$(55+NN)
16610 IFNN<10THENHEX$=HEX$+CHR$(48+NN)
16620 RETURN
16999 REM HEX --> DEC
17000 X=@:KK$=RIGHT$(HEX$,1):IFKK$<":"TH
ENX=X+ASC(KK$)-48:GOTO17020
17010 X=X+ASC(KK$)-55
17020 KK$=LEFT$(HEX$,1):IFKK$<":"THENX=X
+(ASC(KK$)-48)*16:RETURN
17030 X=X+(ASC(KK$)-55)*16:RETURN
17200 KK$=RIGHT$(HEX$,1):IFKK$<":"THENX=
X+(ASC(KK$)-48)*16:RETURN
20000 INPUT#15,ER,ER$,KK,KK
20010 PRINT"{DOWN}***  "ER$:GOTO280
59999 REM LOAD M/C ROUTINES
60000 FORP=1TO135:READA:KK=KK+A*P:POKEP+
49151,A:NEXT
60005 IFKK=13648665THENRETURN
60007 PRINT"{CLEAR}{DOWN}{DOWN}{DOWN}***
 DATA STATEMENTS INCORRECT":END
60010 DATA76,42,192,76,79,192,32,104
60020 DATA192,162,2,32,198,255,32,207
60030 DATA255,32,183,255,208,@,6,32,31
60040 DATA192,76,14,192,76,127,192,238
60050 DATA251,208,2,238,252,165,252,201
60060 DATA198,96,32,104,192,162,2,32
60070 DATA198,255,32,183,255,208,229,32
60080 DATA207,255,162,8,129,251,32,31
60090 DATA192,144,239,176,215,32,104,192
60100 DATA162,2,32,201,255,162,8,161
60110 DATA251,32,210,255,32,183,255,208
60120 DATA192,32,31,192,165,251,197,253
60130 DATA165,252,229,254,144,231,176,10
@
60140 DATA169,2,162,8,168,2,32,186
60150 DATA255,162,1,168,193,173,8,193
60160 DATA32,189,255,32,192,255,96
60170 DATA32,204,255,169,2,76,195,255
60999 REM DIRECTORY SECTORS
61000 DATA1,4,7,10,13,16,2,5,8,11,14,17,
3,6,9,12,15,18
```

ASSEMBLY TUNE

Listen to DJ Miles' advice on machine code sound and your MTX will soon be warbling 'Thanks for the memory . . .'

The Memotech MTX series produces sound using the Texas Instruments SN76489A chip — the integrated circuit used to great effect by BBC Basic. MTX Basic, unfortunately, does not stretch to 14 parameter music envelopes like the Beeb, but it does offer frequency and volume control through the SOUND statement. Continuous music may be played into a sound buffer, but the maximum number of notes per channel allowed is only 256, and this fills more than 12K of RAM.

Machine code, on the other hand, can be used for sound with the advantage of making efficient use of memory. Data must be sent to the chip through output port 6 and strobed in via input port 3. The destination of this data is one of eight registers which control the frequency and volume for the three tone generators and the noise generator (see table 1).

Volume is controlled by passing a nibble to the respective attenuators. A volume level of zero is the loudest, and 14 is the softest. If the bit pattern representing 15 is sent, the sound is switched off. It is not necessary to program the volume of the channel whenever the frequency is changed (as in Basic) but no sound is output if no level has been set.

Frequency is altogether different. The tone channels require ten bits of information to produce a sound. This data is related to the frequency produced by the formula: Frequency = 4,000,000 / (32*Data).

A list of notes, frequencies and their equivalent data numbers is given in table 2. It's useful to remember that doubling these numbers produces the same notes one octave lower, and halving these numbers raises the scale by one octave. *Sound* is a handy subroutine which simplifies the task of transferring bytes to the sound processor. It must be entered with Z80 register C containing the chip's destination register and register pair HL containing the data to send. Program 1 demonstrates how it is used. It emits a simple 'laser-gun' noise by repeatedly changing the frequency of a tone channel.

Program 2 proves how simple it is to play tunes with this subroutine by playing a few bars of a familiar tune. It occupies only 200 bytes of memory, which is about 14 times more efficient than the equivalent Basic program using a sound buffer.

The data for the tune is held after label START in the format note, length, note, etc. Any suitable music could be placed at that address so long as it ends with the number 255) which tells the program to return to Basic. There is, of course, no limit to the length of the music, and the program could easily be adjusted to perform some other task during the delay between notes.

Table 1

Register	Contents
0	Channel 0 Frequency
1	Channel 0 Volume
2	Channel 1 Frequency
3	Channel 1 Volume
4	Channel 2 Frequency
5	Channel 2 Volume
6	Channel 3 Shift Rate
7	Channel 3 Volume

Table 2

Note	Frequency (Hertz)	Data
C	264	475
C#	278	450
D	294	425
Eb	312	400
E	334	375
F	358	350
F#	370	338
G	400	313
G#	416	300
A	454	275
Bb	476	263
B	500	250

Program 1

```
0 CODE
8007            LD HL,0
800A            LD C,1
800C            CALL SOUND
800F            LD C,0
8011 LOOP:      DEC HL
8012            CALL SOUND
8015            JP LOOP
8018 SOUND:     PUSH BC
8019            PUSH HL
801A            LD A,L
801B:           AND 15
801D            RRC C
801F            RRC C
8021            RRC C
8023            RRC C
8025            ADD A,C
8026            SET 7,A
8028            BIT 4,A
802A            OUT (6),A
802C            IN A,(3)
802E            JP NZ,BOT
8031            SRL H
8033            RR L
8035            SRL H
8037            RR L
8039            SRL L
803B            SRL L
803D            LD A,L
803E            OUT (6),A
8040            IN A,(3)
8042 BOT:       POP HL
8043            POP BC
8044            RET
```

Symbols:
SOUND8018BOT8042
LOOP8011

Program 2

```
0 CODE
8007            LD DE,START
800A            LD HL,0
800D            CALL VOLUME
8010 TOP:       LD A,(DE)
8011            CP 255
8013            JP Z,END
8016            LD H,0
8018            LD L,A
8019            INC DE
801A            LD A,(DE)
801B            LD B,A
801C            INC DE
801D            LD C,0
801F            CALL SOUND
8022            INC C
8023            INC C
8024            ADD HL,HL
8025            CALL SOUND
8028            INC C
8029            INC C
802A            ADD HL,HL
802B            CALL SOUND
802E DELAY:     PUSH BC
802F            LD B,0
8031 LP:        PUSH BC
8032            PUSH BC
8033            POP BC
8034            POP BC
8035            DJNZ LP
8037            POP BC
8038            DJNZ DELAY
803A            JP TOP
803D END:       LD HL,15
8040            CALL VOLUME
8043            RET
8044 VOLUME:    LD C,1
8046            CALL SOUND
8049            INC C
804A            INC C
804B            CALL SOUND
804E            INC C
804F            INC C
8050            CALL SOUND
8053            RET
8054 SOUND:     PUSH BC
8055            PUSH HL
8056            LD A,L
8057            AND 15
8059            RRC C
805B            RRC C
805D            RRC C
805F            RRC C
8061            ADD A,C
8062            SET 7,A
8064            BIT 4,A
8066            OUT (6),A
8068            IN A,(3)
806A            JP NZ,BOT
806D            SRL H
806F            RR L
8071            SRL H
8073            RR L
8075            SRL L
8077            SRL L
8079            LD A,L
807A            OUT (6),A
807C            IN A,(3)
807E BOT:       POP HL
807F            POP BC
8080            RET
8081 START:     DB 150,128,125,0,113,128,
100,192,89,64,100,128,113,0,131,128,
169,19 2,150,64,131,128,125,0,150,
128,1,5,150,192,169,64,150?128,131,0?
169,128,200
8088            DB 0,150,128,125,0,113?
128,100,192,89,64,100,128,113,0,131?
128,169,192,150,64,131,128,125,192?
131,64,150,128,156,192,175,64,156?
128,150,0,1,5,150,0
,255
8002            RET
```

Symbols:
START8081VOLUME8044 SOUND8054DELAY802E
TOP8010END803D LP8031BOT807E

APPLE ORCHARD

In *Apple Orchard* you are engaged in a desperate mission to save as many apples as possible before the arrival of a hurricane. So if you didn't know it was Be Kind to Defenceless Fruit Week, you do now . . .

Fortunately, you're mechanised — you have three buggies that you use to tear round your orchard. But the local vandals have scattered tacks around, so you also have to avoid crashing, and fuel is limited, so watch the gauge.

Fill your three applecarts with fruit in William Prew's fast-action game. Instructions are in the program.

Listing

```
WIDTH 40
>L.
   10REM Apple Orchard. ....
   20REM By William Prew. ..
   30REM 1984. November. ...
   40REM ..... PCN .........
   50:
   60P%=&900
   70[OPTO:LDA£229:LDX£1:LDY£0:JSR &FFF4
:RTS:]
   80CALL&900
   90DIM sco(8),entries 150,code 10
  100MODE7:PROCassemble
  110PROCinst
  120MODE2:PROCdefine
  130PROCdisplay
  140:
  150REPEAT
  160PROCvariables
  170MODE2:VDU23;8202;0;0;0;
  180REPEAT
  190PROCinit
  200PROCscreen
  210x%=9:y%=15
  220IF screen=1 PROCjingle
  230PROCgame
  240UNTILdeath
  250PROCfin
  260MODE7
  270PROClist_fame
  280UNTILFALSE
  290:
  300DEFPROCgame
  310REPEAT
  320fuel=fuel-1
  330IF fuel=0 PROCdeath:fuel=200
  340PROCkeys
  350COLOUR7:PRINTTAB(6,29)!score
  360PRINTTAB(4,30)(fuel)"  "
  370pos%=FNscrn(x%,y%)
  380IF pos%=134 OR pos%=136 die=TRUE EL
SE IF pos%=135 PROCcollect
  390UNTILdie=TRUE OR score=40#screen
  400IFdie=TRUE THENPROCdeath ELSE PROCn
ew_screen
  410ENDPROC
  420:
  430DEFPROCwait(T)
  440FORdelay%=0TOT
  450NEXT delay%
  460ENDPROC
  470:
  480DEFPROCkeys
  490VDU17,7,31,x%,y%,226
  500PROCwait(sp#18)
  510IF INKEY(-17) THEN PROCoff
  520IF INKEY(-82) THEN PROCon
  530IF INKEY(-2) PROCfreeze
  540IFINKEY(-67) THEN m%="right"
  550IFINKEY(-98) THEN m%="left"
  560IFINKEY(-73) THEN m%="down"
  570IFINKEY(-105) THEN m%="up"
  580VDU17,0,31,x%,y%,225
  590IF m%="right" THEN x%=x%+1
  600IF m%="left" THEN x%=x%-1
  610IF m%="down" THEN y%=y%-1
  620IF m%="up" THEN y%=y%+1
  630:
  640IF x%<1 x%=1
  650IF x%>18 x%=18
  660IF y%<3 y%=3
  670IF y%>27 y%=27
  680ENDPROC
  690:
  700DEFPROCscreen
  710CLS
  720COLOUR6
  730VDU31,6,1,227,228,229,234,236,228,2
35
  740IF display THEN ENDPROC
  750PROClive_print
  760COLOUR7:PRINTTAB(0,29)"APPLES"!scor
eITAB(10)"BEST"!sco(0)
  770VDU17,135,17,1
  780PRINTTAB(0,2)STRING$(20,CHR$225)
  790PRINTTAB(0,28)STRING$(20,CHR$225)
  800FOR A=3 TO 27
  810PRINTTAB(0,A)CHR$223
  820PRINTTAB(19,A)CHR$223
  830NEXT A
  840VDU17,128,17,7
  850PRINTTAB(0,30)"FUEL":PRINTTAB(10,30
)"ORCHARD"!screen1
  860COLOUR3
  870FOR obst=0 TO screen#2+20
  880PRINTTAB(RND(16)+1,RND(25)+2)!CHR$2
30
  890NEXT obst
  900VDU17,2
  910FOR apple=0 TO 50
  920PRINTTAB(RND(16)+1,RND(25)+2)!CHR$2
31:
  930NEXT apple
  940VDU17,6
  950ENDPROC
  960:
  970DEFPROCvariables
  980li=3
  990score=0
 1000fuel=200
 1010sp=9!screen=1
 1020m$="right"
 1030ENDPROC
 1040:
 1050DEFPROCinit
 1060die=FALSE:death=FALSE:display=FALSE
 1070ENDPROC
 1080:
 1090DEFPROClive_print
 1100COLOUR2
 1110PRINTTAB(2,1)STRING$(11,CHR$233)
 1120ENDPROC
 1130:
 1140DEFPROCdeath
 1150VDU31,x%,y%,224
 1160li=li-1:IFli=0THENdeath=TRUE
 1170IF fuel=0 AND score>10 THEN score=s
core-10
 1180FOR sound=170 TO 15 STEP-2
 1190SOUND&12,3,sound,2
 1200NEXT sound
 1210PROClive_print
 1220PROCwait(5000)
 1230ENDPROC
 1240:
 1250DEFPROCnew_screen
 1260VDU31,x%,y%,226
 1270screen=screen+1:sp=sp-1:IFsp(=0sp=0
 1280PRINTTAB(1,15)"ORCHARD "!screen-1!"
 FINISHED"
 1290fuel=200
 1300FORinc=15TO60
 1310SOUND3,3,inc,1
 1320NEXTinc
 1330PROCwait(10000)
 1340ENDPROC
 1350:
 1360DEFPROCfin
 1370RESTORE1490
 1380FOR dec=50 TO 0 STEP-1
 1390SOUND3,2,dec,1
 1400NEXT dec
 1410PROCwait(2000)
 1420VDU17,8,31,5,15:PRINT' 'SPACE' "
 1430REPEATUNTILGET=ASC" "
 1440ENDPROC
 1450:
 1460DEF FNscrn(x%,y%)
 1470VDU31,x%,y%
 1480CALL code
 1490=?&70
 1500:
 1510DEFPROCdefine
 1520VDU23,223,0,251,251,251,0,239,239,2
39
 1530VDU23,224,0,36,18,64,42,0,72,0
 1540VDU23,225,191,191,0,247,247,0,223,2
23
 1550VDU23,226,189,231,189,36,60,189,255
,153
 1560VDU23,227,254,242,194,194,130,130,1
30,254
 1570VDU23,228,252,242,194,194,252,130,1
```

Program notes

LINES	ACTION
10-40	REM statements
60-80	Assembler to disable the Escape key.
90	DIMension arrays for hall of fame and reserves space for the assembler routine which is at the end of the program.
100	MODE 7. Calls up the Assembler routine.
110-130	Calls instructions and the PROCedure which defines the user definable characters, and the PROCedure which displays them.
150-280	Game's main loop. Sets up screen and initialises the variables.
300-410	PROCedure which handles the buggy and score etc.
430-460	Delay loop embedded in a PROCedure which in turn passes a parameter to the loop.
480-680	Scans keyboard and takes appropriate action when a key is pressed. Checks position of buggy and sets up boundaries for it.
700-950	Sets up screen, plots apples etc.
970-1030	Defines some variables.
1090-1120	Prints how many lives you have left.
1140-1230	PROCedure which handles death.
1250-1340	PROCedure which handles everything when an orchard is cleared, *ie* resetting variables and so on.

1360-1440 PROCedure which is called up when the player has ruined all the buggies.

1460-1490 See 2850-2940.

1510-1690 Defines characters and envelopes for the sound effects.

1710-1750 Filling the arrays with data for the hall of fame.

1770-1860 Displays characters.

1880-2070 Name entry routine. An OSWORD call is made with the accumulator set to zero. This method is also used by Acornsoft etc.

2090-2220 Hall of fame.

2240-2490 Instructions.

2510-2560 Space bar routine.

2580-2640 On/Off sound routines.

2660-2680 Freeze routine.

2700-2730 Updating of number of apples collected.

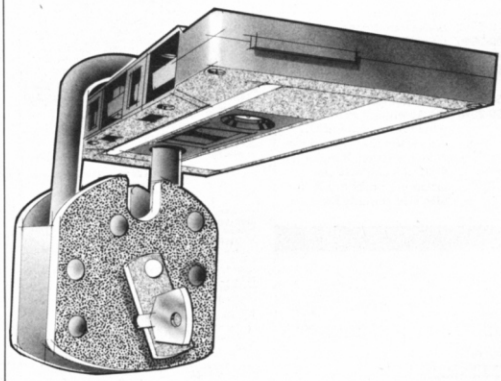
2750-2830 Music routine.

2850-2940 An Assembler routine which returns the ASCII code of the character at the cursor position. It makes an OSBYTE call with the accumulator set to 135. It also uses the only Function.

```
30,130
 1580VDU23,229,124,130,128,192,192,192,2
42,124
 1590VDU23,230,0,0,24,24,24,126,0,0
 1600VDU23,231,24,126,239,239,247,247,12
6,60
 1610VDU23,232,0,0,16,16,8,8,0,0
 1620VDU23,233,0,90,126,60,60,126,90,0
 1630VDU23,234,194,194,194,194,242,254,130,1
30,130
 1640VDU23,235,252,242,194,194,194,130,1
30,252
 1650VDU23,236,124,242,194,194,254,130,1
30,130
 1660ENVELOPE1,128,21,0,-12,4,5,7,77,-17
,0,-11,120,73
 1670ENVELOPE2,1,-8,0,1,5,2,40,61,-1,-1,
-4,126,126
 1680ENVELOPE3,1,0,0,0,1,1,1,126,-4,-1,-
4,126,0
 1690ENVELOPE4,3,0,0,0,0,0,0,126,-1,0,-5
,126,0
 1700:
 1710FOR loop=0 TO 7
 1720%(entries+loop*15)="W.P.Soft. .."
 1730sco(loop)=400-50*loop
 1740NEXT loop
 1750ENDPROC
 1760:
 1770DEFPROCdisplay
 1780display=TRUE
 1790PROCscreen
 1800VDU17,135,17,1,31,5,4,225,225,31,5,
5,223,31,8,5,17,128,17,7:PRINT'Wall."
 1810VDU17,2,31,5,8,231,17,7,31,8,8:PRIN
T"Apple."
 1820VDU17,3,31,5,11,226,17,7,31,8,11:PR
INT"Buggy."
 1830VDU17,7,31,5,14,230,31,8,14:PRINT"T
ack."
 1840VDU17,8,31,1,17:PRINT"PRESS THE SPA
CEBAR"
 1850REPEATUNTILGET=32
 1860ENDPROC
 1870:
 1880DEFPROCammend
 1890IF score(=sco(7) ENDPROC
 1900FOR I=7 TO 0 STEP-1
 1910IF score)sco(I) THEN sco(I+1)=sco(I
):%(entries+(I+1)*15)=%(entries+I*15):fi
x=I
 1920NEXT I
 1930sco(fix)=score
 1940PRINTTAB(8,2)CHR$134"WELL DONE !"
 1950PRINTTAB(8,3)CHR$132"==========="
 1960PRINTTAB(2,5)CHR$129"YOU PICKED ENO
UGH APPLES"
 1970PRINTTAB(0,7)CHR$131"TO QUALIFY FOR
 THE HALL OF FAME !"
 1980PRINTTAB(5,10)"PLEASE ENTER YOUR NA
ME."
 1990VDU31,5,12,131,157,132,31,26,12,156
,31,9,12
 2000#FX15 0
 2010!&900=entries+fix*15
 2020?&902=14
 2030?&903=32
 2040?&904=127
 2050%0:?%=&9?A%=0
 2060CALL&FFF1
 2070ENDPROC
 2080:
 2090DEFPROClist_fame
 2100PROCammend
 2110CLS
 2120PRINTCHR$134 CHR$141 TAB(12)"APPLE
ORCHARD."
 2130PRINTCHR$134 CHR$141 TAB(12)"APPLE
ORCHARD."
 2140PRINTCHR$131 CHR$141 TAB(12)"HALL O
F FAME.."
 2150PRINTCHR$131 CHR$141 TAB(12)"HALL O
F FAME.."
 2160PRINTCHR$133 TAB(12)"1984 W.P.Soft.
.."
 2170FOR I=0 TO 7
 2180VDU32,32,I+49,46:PRINTTAB(6)!sco(I)
;TAB(12)"... "!%(entries+I*15)"
 2190NEXT I
 2200PRINTTAB(1,23)CHR$134"Press the SPA
CE BAR to replay.."
 2210REPEATUNTILGET=ASC" "
 2220ENDPROC
 2230:
 2240DEFPROCinst
 2250VDU31,0,1,147
 2260PRINT'6'1 7'1 6'% 5 j 6'1 7'1 7'4"
 2270VDU31,0,2,147
 2280PRINT"5 j up! 5   upz upz up! 5 j"
 2290VDU31,0,3,147
 2300PRINT"ep! 5 j ep% 5 j 5 j 5 j up%"
 2310VDU31,5,5,134,73,79,83,84,82,85,67,
84,73,79,78,83,31,5,6,131
 2320PRINT"============"
 2330PRINT"GREAT BRITAIN has just been i
nformed by a weather station in America
that a      hurricane is heading this way
. It is     due to reach the south of Eng
land in     roughly five hours.""
 2340PRINT"YOU ARE the owner of an apple
 orchard.  You must drive your buggy aro
und the     orchards collecting as many a
pples as    possible before you crash 3 b
uggies.""
 2350PRINT"This is fairly easy to do as
tyre -      piercing tacks have been spre
ad every - where by the local vandals.""
 2360PROCspace
 2370PRINT"YOU'RE fuel is limited also.
If you      run out of fuel then you will
 lose a     buggy and drop 10 apples.""
 2380PRINT"WHEN YOU have collected 40 ap
ples you    have cleared an orchard and y
ou will     progress onto the neighbourin
g one,      but the hurricane is nearing
and you     could well lose the rest of y
our         orchards. So work hard !""
 2390PRINT"IF YOU have collected enough
apples      then you will be asked to ent
er your     name in the hall of fame."
 2400PROCspace
 2410PRINT"THE NUMBER of buggies you hav
e left is   displayed in the top left han
d corner    of the screen."
 2420PRINT'TAB(11)CHR$129"CONTROLS:-"
 2430PRINTTAB(10)CHR$132"============"
 2440PRINT'TAB(8)CHR$129"Z - Left. X - R
ight."
 2450PRINTTAB(8)CHR$129"* - Up.   ? - Do
wn."
 2460PRINTTAB(3)CHR$129"Q - Sound off. S
 - Sound on."
 2470PRINTTAB(2)CHR$129"CTRL - Freeze.
SHIFT - Unfreeze."
 2480PROCspace
 2490ENDPROC
 2500:
 2510DEFPROCspace
 2520PRINTTAB(1,23)CHR$134"Press the SPA
CE BAR to continue."
 2530REPEATUNTILGET=32
 2540CLS
 2550PRINT'
 2560ENDPROC
 2570:
 2580DEFPROCoff
 2590*FX210 1
 2600ENDPROC
 2610:
 2620DEFPROCon
 2630*FX210 0
 2640ENDPROC
 2650:
 2660DEFPROCfreeze
 2670REPEAT UNTIL INKEY(-1)
 2680ENDPROC
 2690:
 2700DEFPROCcollect
 2710score=score+1
 2720SOUND3,2,55,1
 2730ENDPROC
 2740:
 2750DEFPROCjingle
 2760RESTORE 2830
 2770FOR jingle=1 TO 8
 2780READ pitch,duration
 2790SOUND3,4,pitch,duration
 2800NEXT jingle
 2810PROCwait(5000)
 2820ENDPROC
 2830DATA 95,8,83,3,75,6,83,6,63,6,55,5,
63,2,47,9
 2840:
 2850DEFPROCassemble
 2860osbyte=&FFF4
 2870P%=code
 2880[OPT 0
 2890LDA#135
 2900JSR osbyte
 2910STX &70
 2920RTS
 2930]
 2940ENDPROC
```

BREAKING AND ENTERING

The last thing you want to happen with your commercial software is for someone else to break into the listing and copy it. Using Stuart Nicholls' routine will ensure that your Spectrum listings are safe.



Programmers wishing to write commercial software in Basic often find that there is no real protection against anyone breaking into the program, examining the listings and copying any special routines that they may have produced.

Many methods have been put forward to protect Basic programs. The most successful involve some routine to disable the break keys, but they all have the fault of causing a crash if break is used, which can be annoying if the keys are hit accidentally.

To overcome this I developed a routine that makes Basic programs unbreakable, unmergeable and thus unlistable and, what is more, requires no knowledge of machine language although it does use a five-byte machine code routine. It also ignores many error reports, continuing with the program if they are found.

Error handling

To explain how this is achieved, we must first examine the Spectrum ROM to find just how and where the break keys are read during the running of a Basic program. This happens after the correct interpretation of a statement has been made at address 1B76h and takes the form:

```
1B76H   CALL 1F54H
        JR C,1B7DH (cont)
        RST 8
        DEFB 14H
1B7DH (cont)
```

The CALL 1F54H instruction checks the break keys and, if there is no carry, calls the error handling routine RST 8.

The error handling routine resets the stack and so on, and then jumps to the routine whose start address is indicated by the system variable ERR-SP 23613/4, normally 1303h. This prints the error/code etc and sets up the continue parameters. 1303h is placed in the address held in the system variable ERR-SP at the start of running a Basic program, and is, in fact, the first address on the machine stack, but ERR-SP address can move around in memory with the build up of the GOSUB stack.

It is, however, possible to alter this to send the error routine elsewhere, and this is what most programmers use to send the error handling routine to an address in ROM which will cause a crash.

If you are a bit more selective, you can send the error routine back to address 1B7Dh and continue with the program as though nothing had happened. This is not a simple case of putting 1B7Dh into the address held in ERR-SP, as on return from the error handling routine the stack will be incorrectly set up without 1B7Dh as the ERR-SP return address. In fact, it will end up with 1B76h as the ERR-SP return address and the GOSUB stack corrupted.

Reset the stack

What you need is a very small machine code routine to reset the stack each time break is pressed, with address 1B7Dh as the error return address as follows:

```
LOOP CALL 1B7DH
JR LOOP
```

and set up ERR-SP with the address loop. Machine code programmers will see that this will put address LOOP+3 as the future return address from error routine (that is the instruction JR LOOP) ensuring that the stack is correctly set up for further break key presses.

This five-byte routine can be placed anywhere in memory and the address held in ERR-SP, poked with the start address of the routine. As an example, we can use a LINE 1 REM statement and assume the start address to be 23760d, with no Microdrive(s) connected. So the Basic program will start with Listing 1.

Line 1 holds the machine code poked in by the direct commands and Line 10 sets up the address in ERR-SP to hold 23760d.

As an example of an unbreakable Basic program add Listing 2.

When run, this program will be unbreakable, and even the out-of-screen error reports will be ignored when part

Listing 1

```
1 REM ØØØØØ
POKE 23760,205:REM direct comman
d
POKE 23761,125:REM direct comman
d
POKE 23762,27:REM direct command
POKE 23763,24:REM direct command
POKE 23764,251:REM directcommand
10LET A=PEEK 23613+256*PEEK 2361
4:POKE A,208:POKE A+1,92
```

Listing 2

```
  20 FOR A=1 TO 100
  30 LET X=RND*256: LET Y=RND*17
6: LET R=RND*(256-X)
  40 CIRCLE X,Y,R
  50 NEXT A
  60 PRINT AT 11,10;"PRESS ANY K
EY"
  70 IF INKEY$="" THEN GO TO 70
  80 IF INKEY$<>"" THEN GO TO 80
  90 CLS : GO TO 20
```

circles only are drawn. To make it unmergeable, you must save it as a Code program, so add Listing 3.

Other points to watch for are that line 100 retains the ERR-SP address; line 110 pokes ERR-SP with a value that will cause a crash if break is used while loading the program, while line 120 finds the end of the Basic program.

Line 130 saves the Basic with the system variables so that it will auto run. The correct address for ERR-SP is reset in line 140, so that line 10 will be correct. To save the program enter GOTO 100 as a direct command and to load the program you must now use LOAD "BASIC" CODE or LOAD "" CODE.

There is one final point to watch for — the use of stop in inputs. If this is used in normal numeric or string variable inputs, the program will stop with no way of restarting. This happens because the break will have occurred at address 21D0h and not 1B76h. Any other illegal input will be ignored.

This is not a problem because anyone using stop as an input wants to break into your program in order to list or copy it and must suffer the consequence of having to switch off the Spectrum and start again. No point feeling guilty about this little trick.

Finally, input line should be avoided as there is no error trapping of inputs in the ROM and as such this command may lead to the program 'hanging up'.

Easier word count

Following on Mike Lewis' article on adding a word count to Tasword 2 (issue 88) the following routine may be of interest. It does away with the need to PEEK and POKE initial and final values, and can be placed anywhere in free memory.

Once you've either entered the assembly listing (below) or poked the values in the decimal dump into memory, all you need do is return to Basic from Tasword then enter PRINT USER start address. An accurate word count should be produced in a couple of seconds.

Listing 3

```
 100 LET LO=PEEK 23613: LET HI=P
EEK 23614
 110 POKE 23613,0: POKE 23614,0
 120 LET B=PEEK 23653+256*PEEK 2
3654
 130 SAVE "BASIC"CODE 23552,B-23
552
 140 POKE 23613,LO: POKE 23614,H
I: RUN
```

Decimal Dump

```
33, 0, 125, 1, 0, 0, 17, 0, 64, 126
254, 32, 32, 12, 30, 0, 35, 21, 32
245, 124, 254, 205, 32, 237, 201, 123
61, 40, 242, 3, 28, 24, 238
```

This decimal dump can be poked into free memory to give a word count routine.

Assembly Listing

```
0010          LD   HL,32000d   :  Get start of text file.
0020          LD   BC,0000h    :  BC = word count,initially zero.
0030    L3    LD   DE,4000h    :  D  = Chrs. per line counter (64d)
                               :  E  = word flag  0 = space  1 = word
0040    L2    LD   A,(HL)      :  Get current chrs from text
0050          CP   32d         :  and check for space code.
0060          JR   NZ,L1       :  If not space then jump.
0070          LD   E,00h       :  Ensure space flagged.
0080    L4    INC  HL          :  Move to next text chr.
0090          DEC  D           :  Decrease chr/line counter and
0100          JR   NZ,L2       :  check for end of line.
0110          LD   A,H         :  If at end of line then
0120          CP   CDh         :  check for end of text file
0130          JR   NZ,L3       :  ie   HL = CD00h
0140          RET              :  If end of text file return to
                               :  BASIC with BC = count.
0150    L1    LD   A,E         :  Check for flag = 0 .ie new word and
0160          DEC  A           :  if not then jump back
0170          JR   Z,L4        :  to main routine
0180          INC  BC          :  Increase word counter
0190          INC  E           :  flag 'word found', E = 1 and
0200          JR   L4          :  jump back.
```

PICTURE THIS

Colourful pictures can be stored in the Amstrad's memory and re-drawn using this routine from John Keneally.

The following utility for the Amstrad CPC464 allows pictures to be drawn in four colours (out of a possible 27) and be recreated in user programs. Pictures are stored from address 43902 downwards in a picture buffer. Space must be reserved in the user program by the MEMORY command.

Pictures are numbered from 0 upwards. The picture currently being drawn can call up any previous picture and put it anywhere on the screen. The whole picture can then be re-drawn by clearing the screen and using the draw command.

Listing 1

```
10 REM -----DRAW UTILITY-------
20 REM For AMSTRAD CPC464
30 REM Copyright J. Keneally
35 REM -----
40 REM ***INITIALISATION****
50 MEMORY 40000:MODE 1:i1%=2:i2%=10:i3%=18:i4%=25
60 INK 0,i1%:INK 1,i2%:INK 2,i3%:INK 3,i4%
70 ad=43902:x%=320:y%=200:PRINT CHR$(23);CHR$(1);:m%=0:c%=
1
80 CLS:x1%=-1:x2%=-1:y1%=-1:y2%=-1:pn%=0:ac=ad:POKE ac,0:P
OKE ac-1,0
90 DIM pi%(10):WINDOW £1,1,40,24,25:pm%=0:ft%=0:DEG
100 FOR i%=1 TO 6:READ P2%(I%):NEXT
110 DATA 4,4,5,2,6,3
115 REM
120 REM *** SCAN FOR COMMANDS ***
130 GOTO 150
140 PLOT x%,y%,3
150 PLOT 700,0,3:PRINT CHR$(23);CHR$(1);:MOVE x%,y%
160 a$=INKEY$:IF a$<>"" THEN 180
170 MOVER -4,0:DRAWR 8,0:MOVER-4,4:DRAWR 0,-8:MOVER 0,4:m%
=m% XOR 1:GOTO 160
180 a$=LOWER$(a$):IF m%<>0 THEN MOVER -4,0:DRAWR 8,0:MOVER
 -4,4:DRAWR 0,-8:m%=0
190 PRINT CHR$(23);CHR$(0);:PLOT 700,0,c%
195 REM
200 REM * Test for arrow keys *
210 IF a$=CHR$(240) THEN y%=y%-2*(y%<398):GOTO 150
220 IF a$=CHR$(241) THEN y%=y%+2*(y%>32):GOTO 150
230 IF a$=CHR$(242) THEN x%=x%+2*(x%>64):GOTO 150
240 IF a$=CHR$(243) THEN x%=x%-2*(x%<574):GOTO 150
245 REM
250 REM * Dispatch command *
260 ON INSTR("dpfxlericzustghkab",a$) GOTO 280,340,360,380
,400,410,530,540,570,580,590,730,600,720,730,790,930,940
270 GOTO 150
280 ac=ad
290 i%=PEEK(ac):IF i%=0 THEN 150
300 i1%=i% AND 15:c1%=INT(i%/16):c%=c1% AND 7:c1%=c1% AND
8
310 i2%=p2%(i1%)
320 FOR i%=1 TO i2%:ac=ac-1:p1%(i%)=PEEK(ac):NEXT:ac=ac-1
330 GOSUB 1110:GOTO 290
340 INPUT£1,"Picture No. "ipn%:IF pn%>pm% THEN PRINT£1,"IL
LEGAL":GOTO 340
350 CLS £1:GOSUB 1710:GOTO 150
360 IF pn%<>pm% THEN 150
370 GOSUB 1710:ft%=0:pm%=pm%+1:pn%=pm%:ad=ac-1:ac=ad:POKE
ac-1,0:GOTO 150
380 IF ft%=0 OR pn%<>pm% THEN 150
390 GOSUB 1770:POKE ac,0:POKE ac-1,0:ft%=ft%-1:GOTO 150
400 x1%=x%:y1%=y%:GOTO 140
410 c1%=0
420 i1%=1:p1%(1)=(x1%-64)/2:p1%(2)=y1%/2:p1%(3)=(x%-64)/2:
p1%(4)=y%/2
430 IF x1%<0 THEN 500
440 IF p1%(1)<0 OR p1%(3)<0 THEN PRINT£1,"Outside screen":
GOTO 150
450 INPUT£1,"Angle (+ve) "iv:IF v<>0 THEN 480
460 GOSUB 1110:POKE ac,(c1%*c%)*16+i1%:FOR i%=1 TO 4:ac=ac
-1:POKE ac,p1%(i%):NEXT
470 ac=ac-1:POKE ac,0:ft%=ft%+1:x1%=-1:x2%=-1:GOTO 150
480 i1%=3:p1%(5)=v:CLS £1:GOSUB 1110:POKE ac,c%*16+3:FOR i
%=1 TO 5:ac=ac-1:POKE ac,p1%(i%):NEXT
490 GOTO 470
500 i1%=2:p1%(1)=(x2%-64)/2:p1%(2)=y2%/2
```

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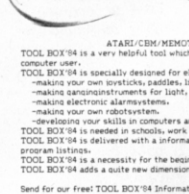

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The commands

p	select a picture (0,1, etc.).
d	draw selected picture.
f	finish current picture and advance to next. Arrow keys . . . move the cursor.
l	mark start point for line or arc draw.
e	mark end point for line or arc and draw it.
r	mark one corner for a rectangle.
m	mark opposite corner and draw filled rectangle.
i	partial infill function.
t1	mark first point of triangle.
t2	mark second point of triangle.
t3	mark third point and draw triangle.
z	clear screen.
k	re-draw a previous picture number at cursor position.
x	delete last command. (Clear screen and draw using (d) command to see effect).
b	set border colour and the four ink colours.
c	select an ink for future drawing.
g	display coordinates of cursor.
u	display length of picture buffer space used so far.
k	save/load picture buffer to cassette.

Note: The routines from line 1000 onwards must be incorporated to use the pictures in other programs. To use, first use GOSUB 1600 to load the picture buffer (after reserving space for it using the MEMORY command. The (u) command will tell you how long the buffer is. Use a value of 43902 (minus this length). Pictures can then be drawn by setting pn%= picture number and doing GOSUB 1700: GOSUB 1000.

Program notes

50-110	Program initialisation routine.
130-170	wait for command and flash cursor.
180-270	dispatch command.
280-960	activate the commands.
1000-1520	main draw functions routine.
1120-1130	draw line.
1150-1190	draw rectangle
1200-1310	draw arc.
1320-1480	Routine to allow shapes to be filled in.
1490-1500	draw triangle.
1510-1520	draw another picture.
1600-1620	routine for loading picture buffer.
1700-1800	Routine for the selection of pictures.

Listing 1 (cont)

```
510 IF p1%(1)<0 OR p1%(3)<0 THEN PRINT"Outside screen":GOT
0 150
520 GOTO 460
530 x2%=x%:y2%=y%:GOTO 140
540 i1%=4:p1%(1)=(x%-64)/2:p1%(2)=y%/2
550 GOSUB 1110:POKE ac,c%+16+4:FOR i%=1 TO 2:ac=ac-1:POKE
ac,p1%(i%):NEXT
560 ac=ac-1:POKE ac,0:ft%=ft%+1:GOTO 150
570 INPUT £1,"Select colour "ic%:GOTO 150
580 GOTO 150
590 pn%=pm%:GOSUB 1710:PRINT£1,"Used ";43902-ac:GOTO 150
600 PRINT£1,"Which point (1 to 3)?"
610 a$=INKEY$:IF a$="" THEN 710
620 IF a$="2" THEN 700
630 IF a$<>"3" THEN 610
640 p1%(1)=(x1%-64)/2:p1%(2)=y1%/2
650 p1%(3)=(x2%-64)/2:p1%(4)=y2%/2
660 p1%(5)=(x%-64)/2:p1%(6)=y%/2
670 i1%=5:GOSUB 1110:POKE ac,c%+16+5
680 FOR i%=1 TO 6:ac=ac-1:POKE ac,p1%(i%):NEXT
690 ac=ac-1:POKE ac,0:ft%=ft%+1:CLS £1:GOTO 150
700 x2%=x%:y2%=y%:CLS £1:GOTO 140
710 x1%=x2%:y1%=y%:CLS £1:GOTO 140
720 PRINT£1,"Load (1) or save (s) ";a$:IF a$="s" THEN 760
740 IF a$<>"1" THEN 730
750 GOSUB 1610:GOTO 150
760 pn%=pm%:GOSUB 1710:OPENOUT"PICT"
770 PRINT £9,pm%,ac,ad:CLOSEOUT
780 SAVE"!PC",B,ac-2,43905-ac:GOTO 150
790 INPUT £1,"Which Picture? "ipn%:IF pn%>pm% THEN 150
800 GOSUB 1710:ac=ad:o1%=(x%-64)/2-PEEK(ac-1):o2%=y%/2-PEE
K(ac-2)
810 GOSUB 820:GOTO 900
820 i%=PEEK(ac):IF i%=0 THEN RETURN
830 ii%=i%:AND 15:c1%=INT(i%/16):i2%=p2%(i1%):c%=c1% AND 7
:c1%=c1% AND 8
840 FOR i%=1 TO i2%:ac=ac-1
850 IF i%<3 OR i1%<3 OR ii%=4 OR ii%=5 THEN 880
860 IF (ii%=3 AND i%>5) OR (ii%=6 AND i%<>3) THEN 880
870 p1%(i%)=PEEK(ac):GOTO 890
880 IF (ii% AND 1) <>0 THEN p1%(i%)=PEEK(ac)+o1% ELSE p1%(i
%)=PEEK(ac)+o2%
890 NEXT:ac=ac-1:GOSUB 1110:GOTO 820
900 p1%=pn%:pn%=pm%:GOSUB 1710:POKE ac,6
910 POKE ac-1,(x%-64)/2:POKE ac-2,y%/2
920 POKE ac-3,p1%:ac=ac-4:POKE ac,0:ft%=ft%+1:GOTO 150
930 c1%=B:GOTO 420
940 CLS £1:INPUT£1,"Border colour "ii%:BORDER ii%
950 FOR i%=0 TO 3:PRINT£1,"Ink"ii%;:INPUT£1,"colour "ii2
%:INK ii%,ii2%:NEXT:CLS £1:GOTO 150
960 FOR i=43902 TO 43800 STEP -1:PRINT PEEK(i);:INPUT a$:N
EXT:STOP
990 REM
1000 REM ****************************
1010 REM **** START OF DRAW AND ****
1020 REM **** LOAD SEGMENT. To be ***
1030 REM **** included in your own **
1040 REM **** programs. **************
1050 REM ****************************
1060 REM To use, define array p1%(6), and
1070 REM variables ac,ad,pm% and pn%. These
1080 REM must not be used for other things.
1090 REM ****************************
1100 REM ****** DRAW ROUTINE ******
1110 GOSUB 1140:ON i1% GOTO 1120,1150,1200,1320,1490,1510
1120 MOVE j1%,j2%:DRAW j3%,j4%,c%
1130 RETURN
1140 j1%=2*p1%(1)+64:j2%=2*p1%(2):j3%=p1%(3)*2+64:j4%=2*p1
%(4):RETURN
1150 MOVE j1%,j2%:DRAW j3%,j2%,c%:DRAW j3%,j4%
1160 DRAW j1%,j4%:DRAW j1%,j2%:IF c1%=0 THEN RETURN
1170 IF ABS(j1%-j3%)<ABS(j2%-j4%) THEN 1190
1180 FOR i%=j2% TO j4% STEP 2*SGN(j4%-j2%):MOVE j1%,i%:DRA
W j3%,i%:NEXT:RETURN
1190 FOR i%=j1% TO j3% STEP 2*SGN(j3%-j1%):MOVE i%,j2%:DR
AW i%,j3%:NEXT:RETURN
1200 dx=j3%-j1%:dy=j4%-j2%:IF dx=0 THEN tr=90*SGN(dy):GOTO
 1250
1210 tr=ATN(dy/dx):IF dy<0 THEN 1240
1220 IF dx>0 THEN 1250
1230 tr=180+tr:GOTO 1250
1240 IF dx<0 THEN tr=180+tr ELSE tr=360+tr
1250 a2=SQR(dx*dx+dy*dy)/2:tt=p1%(5)/2
1260 IF tt=90 THEN a3=0 ELSE a3=a2/TAN(tt)
1270 x0=j1%+a2*COS(tr)-a3*SIN(tr)
1280 y0=j2%+a3*COS(tr)+a2*SIN(tr):r=SQR(a2*a2+a3*a3)
1290 PLOT j1%,j2%:FOR t3=180+tt-tr TO 180+tt-tr-p1%(5) STE
P -5
1300 DRAW x0+r*SIN(t3),y0+r*COS(t3):NEXT
1310 RETURN
1320 MOVE j1%,j2%:i4%=j2%:i%=TESTR(0,0):GOSUB 1470
1330 WHILE i1%>=i2%:MOVE i2%,i4%:FOR i5%=i2% TO i1% STEP 2
:IF TESTR(0,0)=i% THEN PLOTR 0,0,c%
1340 MOVER 2,0:NEXT:i4%=i4%+2
1350 MOVE i2%,i4%:IF TESTR(0,0)<>i% THEN WHILE (TESTR(0,0)
<>i%) AND (XPOS<i1%+10):MOVER 2,0:WEND ELSE WHILE (TESTR(0
,0)=i%) AND (XPOS)i2%-10):MOVER -2,0:WEND:MOVER 2,0
1360 i2%=XPOS
1370 MOVE i1%,i4%:IF TESTR(0,0)<>i% THEN WHILE (TESTR(0,0)
<>i%) AND (XPOS)i2%-10):MOVER -2,0:WEND ELSE WHILE (TESTR(
0,0)=i%) AND (XPOS<(i1%+10):MOVER 2,0:WEND:MOVER -2,0
1380 i1%=XPOS:WEND
1390 j2%=j2%-2:MOVE j1%,j2%:i3%=j1%:i4%=j2%:GOSUB 1470
1400 WHILE i1%>=i2%:MOVE i2%,i4%:FOR i5%=i2% TO i1% STEP 2
:IF TESTR(0,0)=i% THEN PLOTR 0,0,c%
1410 MOVER 2,0:NEXT:i4%=i4%-2
1420 MOVE i2%,i4%:IF TESTR(0,0)<>i% THEN WHILE (TESTR(0,0)
<>i%) AND (XPOS<(i1%+10):MOVER 2,0:WEND ELSE WHILE (TESTR(0
,0)=i%) AND (XPOS)i2%-10):MOVER -2,0:WEND:MOVER 2,0
1430 i2%=XPOS
1440 WHILE i1%>=i2%:MOVE i2%,i4%:IF TESTR(0,0)<>i% THEN WHILE (TESTR(0,0)
<>i%) AND (XPOS)i2%-10):MOVER -2,0:WEND ELSE WHILE (TESTR(
0,0)=i%) AND (XPOS<(i1%+10):MOVER 2,0:WEND:MOVER -2,0
1450 i1%=XPOS:WEND
1460 RETURN
1470 WHILE i%=TESTR(0,0):MOVER 2,0:WEND:i1%=XPOS-2
1480 MOVE j1%,j2%:WHILE i%=TESTR(0,0):MOVER -2,0:WEND:i2%=
XPOS+2:RETURN
1490 MOVE j1%,j2%:DRAW j3%,j4%,c%
1500 DRAW p1%(5)*2+64,p1%(6)*2:DRAW j1%,j2%:RETURN
1510 b1=ad:b2=ad+2:pn%=pn%+p1%(3):GOSUB 1710:ac=ad:o1%=p
1%(1)-PEEK(ac-1):o2%=p1%(2)-PEEK(ac-2)
1520 GOSUB 820:pn%=p1%:ac=b1:ad=b2::RETURN
1530 REM
1600 REM *** PICTURE LOAD ROUTINE ***
1610 OPENIN"!PICT":INPUT £9,pm%,ac,ad:CLOSEIN:pn%=pm%:ft%=
0:LOAD"!PC",ac-2:RETURN
1620 REM
1700 REM ** PICTURE SELECT ROUTINE **
1710 ad=43902:i%=0:ac=ad:WHILE i%<pn%+1
1720 i%=PEEK(ac):IF i%=0 THEN 1760
1730 ii%=PEEK(ac+1):IF ii%=0 THEN 1760
1740 ii%=ii% AND 15:ac=ac-1-p2%(ii%)
1750 GOTO 1730
1760 i%=i%+1:ac=ac-1:WEND:ac=ac+1:RETURN
1770 ac=ad:i%=1:WHILE i%<ft%
1780 ii%=PEEK(ac) AND 15:IF ii%=0 THEN i%=ft%:GOTO 1800
1790 ac=ac-1-p2%(ii%)
1800 i%=i%+1:WEND:RETURN
1810 REM **************************
1820 REM *** End of segment ******
1830 REM **************************
```

MIXED MODES

Orrall Cornelius completes his game from last issue, this week with the focus on the display list.

Listing

```
2190 FOR SND=1 TO 36:READ ANS,BNS:SOUND 1,ANS,10,10:FOR BB=1 TO BNS:NEXT BB:SETCOLOR 4,1,ANS:NEXT SND
2200 DATA 121,50,96,50,91,50,81,200,121,50,96,50,91,50,81,200,121,50,96,50,91,50,81,100,96,100,121,100,96
2210 DATA 100,100,200,96,50,0,1,96,50,100,50,121,150,0,1,121,50,96,100,81,100,0,1,81,50,91,150,96
2220 DATA 50,91,50,81,100,96,100,121,100,100,100,121,300,0,2
2225 SOUND 0,0,0,0:FOR T=1 TO 200:NEXT T
2230 FOR P=1 TO 200:SETCOLOR 0,1,P:SOUND 0,P,6,10:POSITION 0,8:? #6;"YOU SCORED ";P;" POINTS"
2240 IF P)SE THEN 2260
2250 FOR T=1 TO 5:NEXT T:NEXT P
2260 SOUND 0,0,0,0:FOR T=1 TO 200:NEXT T
2270 X=USR(1664):END
10000 RESTORE 10050:GRAPHICS 7+16:COUNT=5
10010 DLIST=PEEK(560)+PEEK(561)*256
10020 POKE DLIST+3,71
10030 READ A:IF A=999 THEN 10110
10040 COUNT=COUNT+1:POKE DLIST+COUNT,A:GOTO 10030
10050 DATA 7,7,7,15,15,15,15,15,15,15
10060 DATA 15,15,15,15,15,15,15,15,15,15
10070 DATA 15,15,15,15,15,15,15,15,15,15
10080 DATA 15,15,15,15,15,15,15,15,15,15
10090 DATA 15,15,15,2,2,2,2,2,2,2
10100 DATA 2,2,2,2,999
10110 POKE DLIST56+4,65
10120 POKE DLIST57+4,32
10130 POKE DLIST58+4,156
10132 SETCOLOR 4,6,12:SETCOLOR 2,0,12:SETCOLOR 0,6,4:SETCOLOR 1,0,4
10133 POKE 87,2:POSITION 0,0:? #6;"SPACE DODGER DELUXE"
10134 POSITION 0,2:? #6;" D AND C.CORNELIUS"
10135 POSITION 8,1:? #6;"BY":POKE 752,1
10136 POKE 87,8:COLOR 1:FOR I=1 TO 320 STEP 5:PLOT 1,2:DRAWTO I,36:NEXT I
10137 FOR T=2 TO 40 STEP 7:PLOT 0,T:DRAWTO 319,T:NEXT T
10140 SCREEN=PEEK(88)+PEEK(89)*256
10150 SCREEN=SCREEN+4*20
10160 SCREEN=SCREEN+40*40
10170 HIBYTE=INT(SCREEN/256):LOWBYTE=SCREEN-HIBYTE*256
10180 POKE 88,LOWBYTE:POKE 89,HIBYTE
10185 POKE 755,1:POKE 87,0:POSITION 2,0:? "THE OBJECT OF THIS GAME IS TO:"
10186 ? "DODGE THE HORDES OF ALIEN SHIPS"
10187 ? "AND DOCK WITH  YOUR MOTHERSHIP!"
10188 ? "THIS IS NOT EASY,SO BE CARFULL!"
10189 ? "TO HELP YOU,YOU WILL FIND THAT THE"
10190 ? "MOTHER SHIP HAS A SPECIAL TRACKING"
10191 ? "DEVICE TO ENSURE THAT YOU DOCK SAFLY!"
10192 ? "AND IF YOU DOCK,DO NOT REST!!YOU WILL"
10193 ? "FIND THE NEXT WAVE ALOT HARDER!!!!!!!"
10200 ? "WHEN STARTING BE READY FOR ACTION AT"
10202 ? "AT ANY MOMENT.HAPPY DOCKING!!"
10203 FOR T=1 TO 3:RESTORE 10220
10205 IF T=3 AND AU=1 THEN RETURN
10210 FOR P=1 TO 25:READ DA,DB:SOUND 0,DA,10,8:SOUND 1,DA+2,10,8:SOUND 2,DA+4,10,
      8:SETCOLOR 4,1,DA
10212 FOR D=0 TO DB*15:NEXT D:SOUND 0,0,0,0:NEXT P:SOUND 0,0,0,0
10220 DATA 60,1,64,1,60,2,80,2,76,2,60,1,64,1,60,2,53,2,80,2,60,1,64,1,60,2,80,2
10230 DATA 91,1,80,1,76,4,80,1,91,1,102,2,108,1,121,1,80,2,162,2,121,4
```

Listing (cont)

```
10235 FOR I=1 TO 3:SOUND I,0,0,0:NEXT I
10240 FOR D=1 TO 100:IF PEEK(53279)<>7 THEN RETURN
10250 NEXT T
10260 IF PEEK(53279)<>7 THEN RETURN
10270 GOTO 10260
20000 GRAPHICS 2+16:SOUND 0,0,0,0:AU=0
20010 POSITION 2,2:? #6;"DO YOU REQIURE"
20020 POSITION 1,4:? #6;"THE INSTRUCTIONS?"
20030 POSITION 3,6:? #6;"OPTION IF YES"
20040 POSITION 3,8:? #6;"START IF NO!!"
20045 POSITION 1,10:? #6;"SELECT IF AUTOPLAY"
20050 FOR I=1 TO 1000:FOR T=1 TO 255
20060 IF PEEK(53279)=3 THEN RETURN
20070 IF PEEK(53279)=6 THEN 163
20075 IF PEEK(53279)=5 THEN AU=1:GOTO 162
20080 SETCOLOR 0,1,T:SOUND 0,T,2,10:NEXT T:NEXT I
```

Lines 10000 to 10202 provide an illustration of display lists. Type these lines in and modify the PRINT statements, and you should see four lines of #6 GRAPHICS 2 at the top of the screen, then 40 lines of GR.8 for your high-resolution drawings (the grid is under the GR.2 writing). Finally, you should get 11 lines of mode 0 for normal text writing.

In line 10133 the program accesses GR.2 by poking location 87 with the graphics mode number, which is 2, and the same in line 10136. The only difference here is that this time it accesses GR.8 by poking location 87 with 8. Accessing GR.0 isn't so simple, as you have to calculate where you want GR.0 to start on the screen (10140-85).

You should try to avoid on-screen input when the display list is still on screen: if the input is too long it may carry on to the bottom of the screen, and this won't look too pleasant. To see this, run the program and break it during the music and display list.

List the program and on the border you'll see black lines stretching from the left of the screen to the right. Once the listing has filled the border the uppermost part of the listing will be pushed up onto the GR.0 listing until it reaches the GR.8 drawing and disappears.

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STILL GOIN

Sinclair's best-seller still holds its own against strong competition. Gavin Monk evaluates the reasons for its success.

When the ZX Spectrum was launched in spring 1982 it offered fantastic value for money, and demand soon exceeded supply. Now things have changed, and competitors have had a chance to catch up enough to influence Sinclair's plans. For instance the 16K version is not now being manufactured. With Atari and Commodore chopping their prices, will Sinclair follow?

The answer to these questions lies mainly with Sinclair but it's a fair bet that very soon the 48K model will cost around £100, which would offer better value.

In order to give the Spectrum a new lease of life the Spectrum Plus has been launched.

Features

The Spectrum offers 16K ROM, 48K RAM (16K models may still be available), 192 by 256 pixel graphics, eight colours plus flash and bright options, 21 user definable graphics, single channel sound, single key entry with syntax checking, a membrane qwerty keyboard, cassette interface, TV output, and a user port.

The 16K ROM contains both the Basic and operating system which are both more or less bug free. Of the 48K approximately 41K can be used to store programs, data, etc. The screen takes up almost all the other 7K and the rest is taken up by the systems variables, printer buffer, and user defined graphics area.

Although the graphics are 192 by 256 pixels, an area of only 176 by 256 pixels can be used for high-resolution work in Basic, as the bottom two lines of the screen are for input messages and error reports. The two lines, however, can be used in the same way as any other screen area from machine language. The screen is memory mapped but in a non-standard fashion.

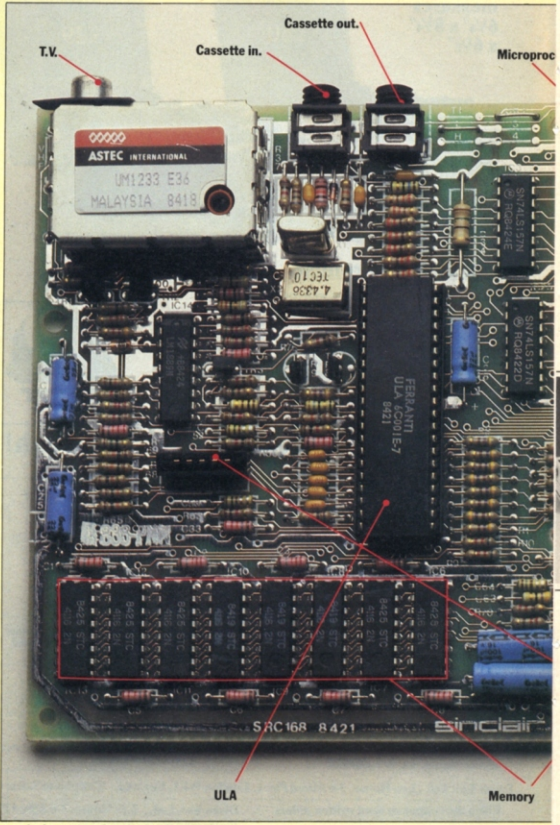
Screen memory starts from 4000 hex and ends at 5800 hex, then followed by the attributes file. The screen is mapped by dividing it into three sections: top, middle, and bottom, each containing eight screen lines. The memory map for the screen is now laid out as follows: The top row of line 0 followed by the top row of line 1 etc up to line 7, then the second row of line 0, then the second row of line 1 etc up to line 7. This is repeated until the top section is mapped and then the same occurs for the middle and bottom sections. If you have access to a Spectrum, run the following program to show you the effect.

```
10 FOR I=16384 TO 22527: REM screen map
20 POKE I, 255
30 NEXT I
```

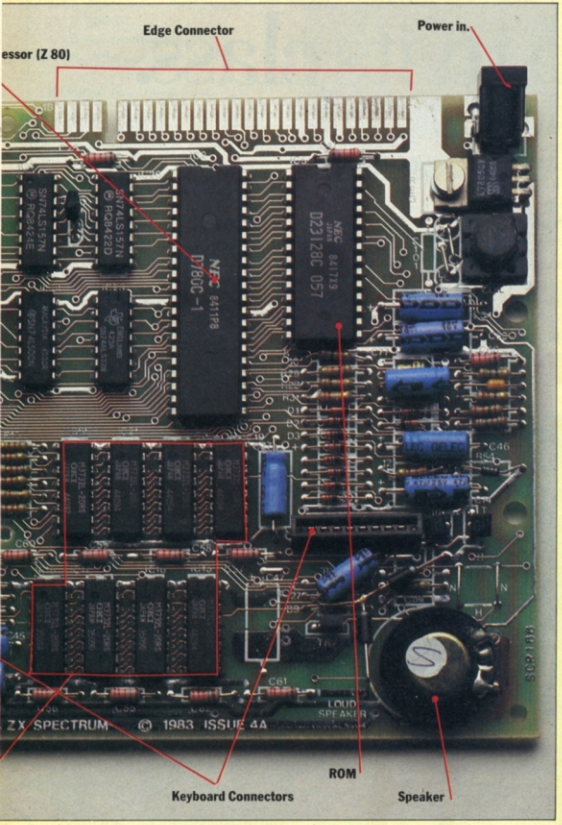
This of course doesn't matter in Basic much, but it's a headache for machine code programmers. This is why several commercial software programs use the screen in three different parts.

The Spectrum supports eight colours which can be set to appear on the screen extra bright, flashing, bright and flashing or just normally. However, the colour resolution is only 32 by 24 from both Basic and machine language. This causes great problems as high-resolution graphics colours tend to get mixed up. This means that careful planning is needed when programming.

The user defined graphics (UDG) allow another 21 characters to be added to the character set. An almost infinite range of characters can be defined for games writing but Greek letters, subscripts, and the like are possible too. The UDG area on the memory map occupies the top 168 bytes of RAM although it can



IG STRONG



be moved by poking suitable values into the system variables.

Sound is one of the Spectrum's failings. Without an external audio amplifier it sounds like a small squeaky animal, and it is not only quiet but also limited. The program execution halts during sound output so continuous sound from Basic is near impossible. However, sound output is also present on both the mic and the ear sockets at the rear of the computer, so it can be amplified or recorded easily.

The single key entry method is often criticised but it's easy to use once you learn which functions are on which keys. Unfortunately system keywords must be used, so even small words like TO must be entered using the correct function keys — both symbol shift and F must be pressed. Why not T, then O? However, it does prevent the entry of invalid commands and along with the built-in syntax checker prevents many errors in program entry.

Once a line has been typed in and the Enter key pressed the line is checked by the computer to see if it contains a syntax error. If so, the line is kept in the edit area of the screen (the bottom two lines) and a flashing question mark appears where the error was detected. This means silly typing errors can be detected and corrected before the program is run. Once the line's syntax has been checked and found to be correct, the line is accepted and displayed on the upper screen along with the lines close to it. This neat idea means the program lines always appear in order on the screen even when editing.

The Spectrum's keyboard (or lack of it) is famous. It is made from a special membrane onto which rubber keys are pressed causing contact. It may be acceptable to the novice who just wants to learn to program and play a few games, but a lot of typing requires the addition of a full-size keyboard (see hardware section).

Sinclair must have realised its mistake with the keyboard as the Spectrum Plus is really only a normal Spectrum with a 'real' keyboard added.

The reliable cassette interface operates at 1500 baud. A slight quirk is that the ear lead must be removed when saving to prevent feedback. No cassette motor control is present which can be annoying should you forget to switch off the tape recorder. Basic programs, data files (numeric and character), machine code, and screen displays can be saved and all except for screens can be verified. Cassette files can be given a ten-character file name which is displayed on the screen when the files are loaded back. This means that you don't have to remember the file names or load each file to see what it is.

The TV output is excellent and a clear stable picture is displayed. Early issue one and two Spectrums play up when used with certain makes of TV but this has been cleared up with the release of the issue three board. A composite colour or black and white monitor can be run straight from the new issue three Spectrums as the video signal is present on the user port. Issues one and two need a small link to be added to the circuit board first. Output on a composite monitor matches that of a good TV.

At the back of the Spectrum is a large hole through which the circuit board is exposed. This is known as the user port or edge connecter. It contains almost every single line that any user would ever want, except the RAM CS line has been excluded. This means no memory mapped devices can be added to the Spectrum and all interfaces must be addressed via a port.

Basic

Spectrum Basic was carried over from the ZX80 and ZX81 and was enhanced

31 ►

Ask an expert why the Electron's the best micro in its class.

Most schoolchildren will tell you that one computer prevails in British classrooms today. Acorn's BBC Micro.

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The £199 Acorn Electron.

Like its £399 stablemate, but unlike any other micro, the Electron speaks BBC Basic. Which means that children can easily carry on with their computer studies at home. And their parents can quickly start catching up, because BBC Basic is such a simple language to learn.

However, language isn't the only thing which makes the Electron outstanding among every other micro in its price range.

A powerful choice.

The Electron is a 64K microcomputer which has 32K of RAM, combined with another 32K ROM.

This simply means that it has more power than most people ever need from a home computer.

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For example, its graphics have the highest resolution of any home computer bar none.

This is because Acorn specially designed the chip that controls the graphics. And it's among the most advanced chips of its kind.

Indeed, it delivers twice as many characters across the screen as the Electron's nearest rival.

It expands into a system.

With the Electron, even total newcomers have been surprised at how quickly they can find their way into the complex world of computing.

Where many computers have keyboards which are confusing and clumsy to operate, it has a keyboard just like an ordinary electric typewriter's.

And for issuing main commands, there are single entry keys. Instead of literally spelling out the command, letter by letter, you just push the relevant key and it's issued.

There's also a built-in loudspeaker which gives high quality sound.

And what is perhaps most exciting is that the Electron has the capacity to grow with your knowledge and ambition.

With Acorn's Plus 1 expansion module, it can link up with a printer, joy sticks and fast-load cartridge software including View and Viewsheet word processing and spread sheet programs.

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All you need is your television set and a cassette recorder.

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Some home computers respond pretty slowly to your commands. After you've pressed the keys, they leave you twiddling your thumbs for more than a mere few seconds.

The plodders, however, are a very long way behind the Electron.

In fact, on processing speed, a recent bench test survey ranked the Electron up with such high fliers as the IBM PC and the Apple III. Both are machines which cost well over £1,000.

It's an astonishing accolade when the Electron makes no greater claim than to be a micro which is designed to become part of the family.

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With your Electron, you'll receive a free introductory cassette.

It will give you a taste of the exceptional colour graphics. It will show you how the Electron can play and notate music.

And when it's given you some new ideas about home accounting, it will challenge you to a few games and even spend a few seconds doing your whole family's biorhythms for you.

But remember, although it holds 15 programs, the cassette will only give you a glimpse of the Electron's full potential.

Because the potential is as infinite as your own imagination.

No shortage of software.

Although the Electron is still a relative newcomer to the market, the range of software available for it is considerable.

Besides plenty of games, there are many educational programs for children of all ages, from playschool to A Level.

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You can find the Acorn Electron with its full complement of accessories and software at local Acorn dealers and major high street stores.

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HARDWARE PRO-FILE: SPECTRUM

◄ 27

and extended. For the first time on a Sinclair machine multi-statement lines were allowed. Sound and graphics commands were added along with the keywords ready for the Microdrives when they arrived.

There are some obscure commands in Spectrum Basic and their operation differs slightly from other Basics.

DIM is used to dimension arrays and subscripts start at 1 (not 0 as in most other Basics).

TO is used in string splicing (as well as for loops) *ie* If a$= "ZX Spectrum" then a$(5 TO 8)= 'pect'.

ATTR checks the attributes of a given screen position.

IN and **OUT** read and write to a specified port.

POINT — gives a 1 or 0 depending on if a specified pixel is set or reset.

SCREEN$ gives the character at a specified screen position.

VALS evaluates a string as a numerical expression and places the result in a string.

BEEP produces a note of pitch and duration specified.

BORDER, PAPER, INK set colours as specified.

The Spectrum stores numbers to an accuracy of nine digits with the largest around 10^{38} and smallest $4_{e}10^{-39}$. The main drawback to Spectrum Basic is that line numbers can range only from 1 to 9999 and must be integers. You can soon run out of line numbers if you follow the standard practice of separating lines by 10.

Numerous manufacturers produce add-ons for the Spectrum.

Hardware

The Spectrum has more hardware available for it than any other home computer. Sinclair supplies much of it.

Now that production of Sinclair's low-cost ZX printer has ceased the Alphacom 32 is the only one available that can be plugged straight into the Spectrum. It produces a 32 character per line output on blue heat sensitive paper, and in all other respects is the same as the ZX printer.

Interface 1

This is really several interfaces in one for £49.95. It provides RS232, networking, and the hardware to drive up to eight Microdrives. The RS232 socket is a nine-pin inverted D-type socket. It can be used for driving printers, modems, and interfacing to other computers. Baud rates from 50 to 19,200 can be set but the transmit and receive baud rates must be the same. This means that connection to most modems is very difficult unless they are going to be used only to transmit or receive all of the time.

Networking between other Spectrums and QLs is possible and fast. Both programs and data can be transmitted and received over the network although it is only really practical to transmit data to a QL. It does however mean that Microdrives, printers etc can be shared by several users. The most useful feature of Interface 1 is its ability to drive up to eight Microdrives. At a cost of £49.95 the Microdrive offers fast storage and reliability. Access time ranges from almost nought to ten seconds per file and once a file has been found data is transmitted at 16K per second.

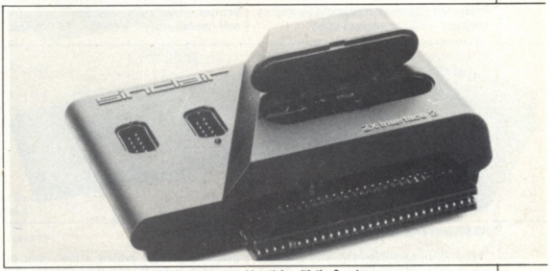
The Microdrive system does, however, have two main drawbacks. The cartridge cost of £4.95 for 90K storage is expensive, and no mass duplicating service is available yet. The first problem will diminish as cartridge prices should eventually fall to around £2. The second is more serious as duplication is only possible by connecting several Spectrums together via the network and plugging eight microdrives into each.

Interface 2

This provides a ROM cartridge socket and two joystick sockets. The maximum size of a ROM cartridge is 16K and when one of these is inserted the entire Basic ROM in the Spectrum is paged out. This means programs on ROM cartridges cannot call ROM routines and the programmer must start from scratch. What's more, ROM cartridge programs cannot use the Microdrives, so should utilities ever be released on ROM cartridge it seems they will still have to use cassettes for data storage. The joystick sockets mimic keys 1–5 and 6–0 and work as well as can be expected.

Many other interfaces are available from independent suppliers, mainly for joysticks, Centronics printers, speech synthesis, sound synthesisers, and input/output ports.

The *Kempston joystick interface* was one of the very first joystick interfaces for the Spectrum. It is read by using port 31 and also works with the ZX81. The *Kempston Pro joystick interface* is new and works with Sinclair, cursor keys and the Kempston (port 31) protocols. The interface also contains a ROM cartridge socket. Others include the *RAM Turbo joystick interface* which has exactly the same protocol, the *AGF cursor interface* which is compatible with the cursor keys and the *AGF programmable interface* which makes hardware programmable by flying leads and clips.



The Interface 2 allows you to use ROM cartridges and joysticks with the Spectrum.

The *AGF Protocol 4* is hardware programmable by custom cards. As supplied it can be made compatible with Sinclair, Kempston, cursor key, and one other mode. It also contains a computer reset button for clearing machine code programs.

Protek's cursor key interface is the same as the *AGF cursor interface*, while the *Protek Pro interface* is compatible with Sinclair, Kempston, and cursor key protocols.

DK'Tronics makes several joystick interfaces, which carry several different protocols.

A cheap way to add ROM cartridges to your system for those who prefer keyboard control or already own a programmable interface is provided by the AGP ROM slot.

Currah's Microspeech interface produces speech via the allophone method using built-in software. Each key press is also enunciated with sound output through the TV speaker. This unit has an increasingly large amount of software support. The *Cheetah Sweet Talker* also uses allophones but the allophone numbers must be ouptut via a port. Many expansion sound boards are available, all rather similar, and offering three-channel sound facilities.

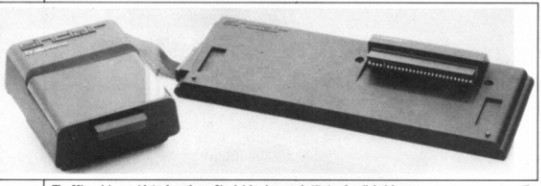
32 ►

Several *floppy disk interfaces* have been announced but few have taken off. The early versions were hard and slow to use but the new Morex one looks promising.

Input/output port interfaces are easy to come by and all seem to offer a standard 8-bit I/O port for connecting relays and so on.

Many *Centronics and RS232 interfaces* use cassette software to change the standard LPRINT and LLIST commands so they now output via the Centronics port. Companies selling this type of interface include Cobra, Hilderbay, Tasman, and Kempston.

Within the last few months, however, two new interfaces have arrived which contain their software on EPROMS — the Kempston E and ZX LPRINT III. These are both Centronics-type and contain software to give screen dumps via the COPY command as well as working with LPRINT and LLIST.



The Microdrive and Interface 1 are Sinclair's cheap substitutes for disk drives.

The *Rotronics Wafadrive* is a direct competitor with the Sinclair Interface 1 and Microdrive. For £129.95 you get two drives, an RS232 port and a Centronics port. The Wafadrive is not compatible with the Interface 1 and a different type of tape is used for storage.

Of course, keyboards are not true interfaces but a series of electrical switches, but a large number are available and most can hold Interface 1 inside. The most popular is the Fuller FDS, but other alternatives worth a look are those from Transform, Dean Electronics, and DK'Tronics.

Software

The Spectrum also has more software than other micros. About 90 per cent is games with the rest being educational, utilities, and specialist interests.

The Spectrum has been treated to versions of almost every arcade game, some of them matching the originals. But the most popular ideas are original ones which have produced such inspired games as *Jet Set Willy, Manic Miner, Sabre Wulf, Lunar Jetman, Atic Atac, Ant Attack*, and *The Hobbit*.

Educational software ranges from spelling and punctuation practice to GCE O-level revision packages.

The two most popular utilities are *Tasword II* and *Masterfile*. These are both Microdrive and full-size printer compatible and Sinclair will be giving them away free with its Interface I Microdrive system.

This review was written using *Tasword II*, so from personal experience I can recommend it. It produces 64 readable characters per line on the screen with justification of both the left and right-hand margins. The maximum file length is 320 lines and the line and column count is displayed on the bottom line. Printer control characters can be written into the text to give underline, italics, and the like. Pressing the Edit key accesses two useful help pages.

The second page deals more with formatting, setting margins, and block commands. Pressing the Stop key (Symbol Shift A) in text mode takes you to the main menu, which offers several facilities including Save, Load, or Merge text to cassette or Microdrive, print text, return to text or Basic, define graphics/printer, and save *Tasword*. All are self-explanatory except for define graphics/printer which allows you to alter the codes that will be sent to your printer, to produce special effects such as underline and bold strike. Control codes for your type of printer interface must also be entered and almost every type of Centronics or RS232 interface can be used.

Tasword also drives the ZX and Alphacom 32 printers although print quality is poor. *Tasword* does fall down on its lack of a block delete command which means large areas of text not required must be deleted line by line.

Sinclair gives away *Tasword II* when you buy the expansion system consisting of a Microdrive and Interface 1.

Masterfile is possibly the only decent database program available for the Spectrum, with its instant searching and sorting of fields, multiple report formats, up to 51 characters per line, 26 fields per record, and a number of records limited only by memory space. *Masterfile* holds approximately 32K of data which can be searched for almost anything you care to think up. Numeric, character, greater than, less than, equal, and not equal searches can be carried out with immediate results.

Setting the report and data formats ready for *Masterfile* takes a little time and good planning is needed for best results. However the excellent manual gives details of all of this plus a step by step example to follow. Data files can be saved to cassette or Microdrive as required but printing can only be produced on a ZX or Alphacom printer with the standard package. However, the manufacturer, Campbell, has released MP-Print, which allows printing of data to full-size printers via most of the popular interfaces. Report widths are variable and all this is done without any reduction in data space. *Masterfile* is another package now given away with the Spectrum expansion system.

Several companies produce Z80 assemblers and monitors for the Spectrum but *Hi-Soft* and *Picturesque* stand out. Newcomers to machine code would do best with *Picturesque*, while the more experienced would prefer *Hi-Soft*. Both packages offer all the following facilities: storage of files to cassette and Microdrive, assembly from Microdrive of huge files, printouts to both full size and ZX/ Alphacom printers.

The main difference between these two packages is in the editors. *Hi-Soft*'s is simple, line-based and operated by using single letter commands, like P and G which stand for Put and Get but really are just Save and Load. The *Picturesque* editor is more user friendly with keywords (as in ZX Basic) and a neat 40 column display. It produces automatic field spacing by pressing the space key.

An abundance of languages is available including Forth (Abersoft and East London Robotics are the most popular producers), Pascal (Hi-Soft), C (Hi-Soft), Micro Prologue (Sinclair), and Logo (Sinclair). None aims to teach the language and only details of use are given. So if you want to learn Pascal, for instance, you must buy the package and instruction book.

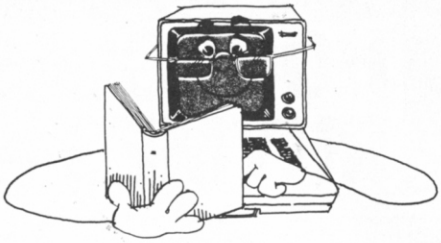
Verdict

The Spectrum is ideal for playing games, learning about programming and hardware, word processing and filing. It's a good machine for a good price.

It is probably too limited for a small business, but with a full keyboard, Microdrives and some of the excellent software, it may still be worth considering.

Specifications

Price	£129.99, £179.99 for Spectrum Plus
Processor	Z80A
RAM	48K,
ROM	16K
Storage	Cassette as standard, Microdrives can be purchased
Available	High street stores



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HOURGLASS RHYMES

Mike Gerrard fumbles around in the darkness of Dorcasia, in search of a dozen ways to die

'Success depends on good fortune and a lump of meat.' No, this isn't subtle propaganda being put out by your local butcher, but one of the messages you get to explain why you're dead yet again in *The Runes of Zendos*, the latest animated adventure release for the Spectrum (£7.95) from Dorcas Software, whose earlier *Oracle's Cave* proved so popular. But death comes in a variety of ways — in fact as there are 12 adventures in one, it comes in an almost infinite variety of ways.

The mid-ground between adventure at one extreme and arcade at the other is a rather hazy area, but this animated effort is definitely at the adventure end of the market. No need for a joystick option, it's keyed-in commands all the way.

Any adventure with the word 'runes' in the title tells you that it's going to be set in some mythical land, whose peaceful existence has been or is about to be threatened by some evil power. In this case the land is Dorcasia, and the evil power belongs to Zendos the wizard.

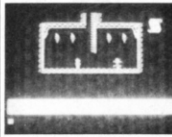
The problem? Perpetual darkness. Where do you confront Zendos? Deep within his mysterious and magical castle. What's he done? Trapped the spirit of each month of the year in a runic hour glass and hidden them all. What do you have to do? Seek and destroy, dear hero, seek and destroy. How? By reading, deciphering and incanting the mysterious runic inscription round the base of each hour glass.

When you load the game up you automatically begin with adventure one, discovering that 'You are in the January hallway where you find a skull and crossbone key'. At any point, though, if you want to go to one of the other adventures you simply type ADVENTURE TWO (or whatever) to take you to the appropriate hallway. You can't leave an adventure half-completed and return to it, however — if you go back to adventure one then you begin again in the January hallway. You can, though, save your progress to tape or Microdrive at any stage.

The top part of the screen is given over to the graphics. You, the hero, seem fetchingly clad in a romper suit, which doesn't altogether inspire much confidence in your fighting abilities. Beneath the picture is room for up to seven lines of scrolling text, and another couple of input lines for you beneath those. To move around, you press the initial keys for left, right, up and down, toddle along or climb ladders as appropriate. The movement is reasonably smooth, but slow.

'You are in the January hallway. . .

Each room you come to will present you with a new object or objects, though the majority of them have some obstacle in the way — dragons, dwarves, cooks, butlers and even singing birds. For example, taking the key from that first room and climbing up brings you to a room where a nimble, cheeky elf is guarding a tiny stone tablet. The commands that are understood allow you to ATTACK ELF, if you wish, or GREET ELF if you're feeling more friendly, or even GIVE KEY TO ELF if you're in a really generous mood.



Zendos and seasonal spirit-glass

In the top left of each screen are two figures showing the relative strength of you and the other character. So the approach you take depends on that, and whether they appear friendly or not, what weapons you have, whether you have any other objects that might appeal to them, and so on.

You start with 25 units of strength and 25 of provisions, with a luck factor of 10. To build up your strength you can eat your provisions. As you proceed you'll find edible objects lying around: apples, cheese and sandwiches, for instance.

Muff job

Runes works in adventure fashion, in that if you want to get past the bird whose shrill singing pierces your ears, you have to get the ear muff from somewhere else. You also soon learn that ticking clocks are to be left well alone. The size of each adventure area is not enormous, about eight rooms or so, but you need to play through them all in order to pick up clues, which you also get from reading assorted scrolls an parchments.

Other clues are obtained by making a reckless assault on some powerful individual — death is never in vain, as you're frequently told what it was you were lacking, such as the lump of meat mentioned above, or the corkscrew when you try to get past the butler.

You must start piecing these together, and working out which keys open which trapdoors and gateways. The problems aren't tricky, for the most part, but making sense of everything is another matter.

Verdict

It's a game that younger players would get a lot of pleasure from, and the graphics are quite well done, especially in the fight sequences. There are also a few amusing sound effects. The avid adventurer might demand a little more, but I found myself happily engrossed in it for a few hours.

One glaring problem, though, is the lack of a REDESCRIBE or LOOK feature. By the time you've seen off a beast, the location description will have scrolled off the screen and it's all too easy to forget what it was you were originally after — the graphics aren't that good, and daggers and swords tend to look similar.

The only solution is to leave the location and come back again, and that means a lengthy wait.

These snags apart, *The Runes of Zendos* is still one of the more successful attempts at animated adventure.

Help spot

Rather more complicated problems are to be found in the land of *Valhalla*, as reader Richard Henriques of London SW16 has discovered.

Richard's question was 'What do I do to find the quest objects?'

So far he's mapped out an 8×8 grid, and surmised that the bottom right-hand quadrant is 'Valhalla'. All I can say is that the completed map is a 9 × 9 grid, and Valhalla itself is a single location in that grid. If you say where the first quest object is located then that gives the game away completely, but you can make helpful general advice — such as stock up on food and wine to keep your strength up.

Any you can't carry or eat and drink yourself, summon a good character to carry for you, then summon them again when you want to get the food or wine off them. This also applies to weapons — and even the quest objects. Stay on the side of the good guys . . . end of this week's sermon.

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ON THE DRAWING PAD

The Penman Plotter is flexible, accurate and draws pretty pictures. Even better, it is good value, says Kenn Garroch.

The Penman Plotter is probably one of the most unlikely looking gadgets I've ever seen. It's a fully functional, intelligent plotter that can cope with up to A3 size paper. At the moment, it is only available for the BBC, Apple, and IBM but, as it works through an RS232 channel, it can be connected to any machine with this interface. Costing about £250, it is a high quality product that could well take off.

First impressions

The Penman is packed in one of those boxes that is made to be carried away. With it come three sets of pens (the Hewlet-Packard type), some demonstration software, an RS232 cable, a power supply, some paper, and a set of three adaptors for other types of pens.

The plotter itself has a rather fascinating design. At first sight, it appears to be a large plastic box (33.5cm×12.5cm ×5cm) with very few distinguishing features, apart from the RS232 and power sockets.

Closer examination reveals that this houses the turtle-like plotter, the cable, and all the fancy electronics that control the system. The plotter head sits snugly inside the case which, when removed, has a trailing ribbon cable attached to it. This is used to send commands to control the motors and pen lifting mechanism.

The underside of the remote unit reveals a little more about the workings of this strange beast. There are two small motor-driven rubber wheels and a trailing bogie, in a triangle. Two light sensors on either side sense such things as the edge of the paper. Using the triangular base, the outline of any shape can be constructed by moving it around; a similar idea to using two pins and a piece of string to draw an ellipse.

For demonstration purposes, the Penman has a built-in set of routines that allow it to strut its stuff, without having to connect it to a computer.

Technical items such as this car are easily drawn.

In use

After admiring the demonstrations, it was obvious that the time had come to hook the Penman to a computer. The review model came with software for the BBC micro and connection is simply a matter of plugging the cable into the RS232 socket on the plotter, and the RS423 on the BBC.

The Penman Plotter in action.

Auto booting the disk gives an introductory screen and revealed one of the other uses for the Penman. It can be driven around as a mouse. The current position/vector is fed back to the computer and used to position a cursor on the screen. The only drawback in using it in this mode is that it doesn't feel like a mouse, as you can't move it in all directions without twisting it. Apart from this, selecting the menu options is easy. There are a number of demonstrations options with the supplied software, from simple plots to a program that pages in Acornsoft *Logo* and runs a program in it. The latter is quite neat as it allows anything that would normally go on the screen from *Logo* to be plotted out on paper *ie* the Penman becomes a real-time turtle.

Another part of the demo program outlines a whole list of predefined procedures that allow the plotter to be programmed from Basic. The details for these are not terribly explicit but at least the manufacturers have tried to allow for simple programming.

Using these procedures is quite easy, simply load in the program that contains them, knock off the first ten lines or so, and renumber from line 1000. All that then needs to be done is to write a program that includes the routines.

One niggle here is that it is rather difficult to work out which procedures use other procedures so, once the program is finished, the unused ones can be removed to save space.

The accuracy is claimed to be 0.1mm in cartesian mode and .035mm in polar mode. The latter looks very good when drawing curves but a change of direction in cartesian mode can cause small errors to creep in.

Plotting is usually started with the plotter in the home position — the top left-hand area of the paper. If drawing takes a lot of movement, it is generally a good idea to go home fairly often, otherwise the accuracy gets progressively worse.

One thing that shows the intelligence of the machine is when it appears to get wrapped up in its cable, it works out how far round it has gone and spins the other way until it is unwrapped.

The plotting is always very definite and its three colours produce a plotting quality that is only surpassed by more expensive plotters. Commands are sent down the RS232 and stored in a buffer — similar to using one of those ballpoint pen printer/plotters, although the commands are not the same.

Programming it directly is not to be recommended, as the commands are pretty complex. It needs a start command, the command itself, and an end command. Using the predefined Basic procedures is a lot easier and less time consuming, unless you want to install it on another machine.

The Penman also handles tricky designs.

Verdict

I was very impressed with the Penman Plotter. Its price and flexibility, plus the fact that it can cope with up to A3 paper put it a cut above the competition. If you need good quality plotting at a resonable price, the Penman is without doubt a good buy.

REPORT CARD: 1 TO 5

Features	●●●●●
Documentation	●●●●
Performance	●●●●
Overall value	●●●●

Product Penman Plotter **Price** £249.55 for basic unit including PSU. The software for the BBC is £25 for disk; not yet announced for cassette. **Availability** Penman Products 0903-20908.

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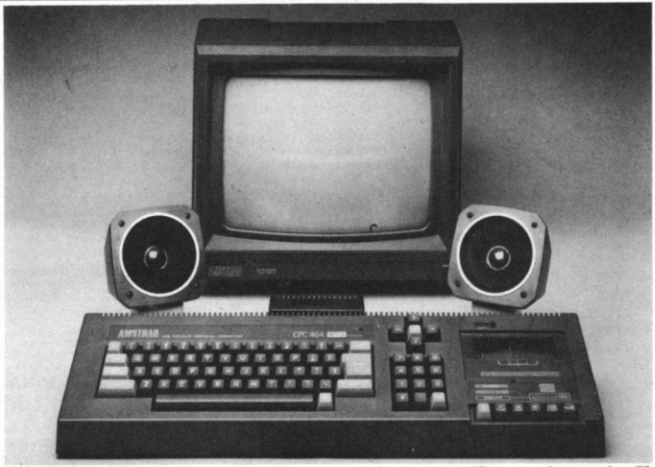

The dk'tronics Amstrad speech synthesizer and powerful stereo amplifier uses the popular SLO/256 speech chip and has an almost infinite vocabulary. It is supplied with a text to speech converter for ease of speech output creation. Everything you wish to be spoken is entered in normal English, without special control codes or characters, it is therefore extremely easy to use. The voicing of the words is completely user transparent and the computer can carry on its normal running of a program while the speech chip is talking. The speech output from SLO/256 is mono and directed to both speakers.

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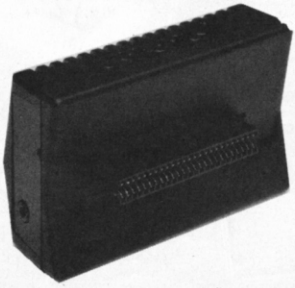

The solution to the problem was extremely complicated, it required hours of programming to enable the computer to look at the individual letters that make up each word and compare their relative position to each other before deciding on the appropriate sound.

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As well as the Commodore's own 8 hardware sprites, BASIC Lightning has its own software sprites. Up to 255 can be defined with user selectable dimensions. These can even be several screens wide. They can be scrolled, spun, mirrored, enlarged or inverted with phenomenal speed and smoothness.

A Sprite Generator Program (written in BASIC Lightning) is also supplied and can be used to design, edit and store all your sprites for use in your main program.

White Lightning is a complete games writing package comprising a high level, Forth based, multi-tasking games writing language, the extended BASIC (see BASIC LIGHTNING) and a powerful sprite Generator Program. Programs can even be written in a combination of Forth and Commodore BASIC and the final program, which will run independently of White Lightning, can be marketed with no restrictions whatsoever.

The Basic Lightning part of the package can be used to experiment quickly and easily before the Forth program is developed.

The speed of White Lightning has to be seen to be believed and a full demo is included. As with Basic Lightning, hardware sprites are supported, together with 255 software sprites which can be scrolled, spun, reflected, enlarged or inverted.

MULTI-TASKING Without doubt the most powerful feature of the Lightning series of languages is the multi-tasking facility. This allows two programs to be run concurrently and makes those smooth landscape scrolls etc. effortless.

The BASIC Lightning Sprite Generator Program is also included in the package.

Commodore 64 Machine Lightning is probably the most advanced games writing utility available on any micro. It comes in 4 parts:

MACRO ASSEMBLER/ MONITOR/DISASSEMBLER This is probably the most comprehensive machine code development system available for the Commodore 64 with features too numerous to mention.

BASIC LIGHTNING BASIC Lightning, the multi-tasking BASIC is also provided to facilitate experimentation in preparation for later assembly.

SPRITE GENERATOR Used to develop all the graphics for the final game. The Sprite Generator has numerous functions including enlargement, rotation and reflection.

OBJECT LIBRARY This is Machine Lightning's most powerful feature. 10k of re-entrant code with more than 130 documented entry points. These are the routines that provide all the superfast graphics routines in White and Basic Lightning. They contain virtually every routine you'll ever need to write an Arcade Game and multi-tasking in Machine Lightning is covered in the comprehensive accompanying manual.

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GAMEPLAY

SPECTRUM

BOILER HOUSE

The first thing you see when you start to load *Boilerhouse* is the short header program called 'Boilerboot', which on this occasion seemed more than appropriate as I wanted to boot the game out of the window.

What was it? The relentless off-key music? Well, that didn't help, nor did the fact that although it has a Kempston joystick option, when I chose that option the game froze as soon as I moved the joystick and I had to reload. The same thing happened again, so I had to use keyboard control. The game does also support (in theory at least) an Interface 2 joystick.

The other drawback was that there seems to be no way to

break out of the game once you've chosen which of the nine skill levels to go for.

You can't try a different level as you appear to have infinite lives.

The idea behind the game is that you're in a room with four boilers, and you have to ensure that none of them overheats or they'll explode. Beside each boiler is a pressure valve and you must move your man till he's in front of this. Pressing the key 5 releases the pressure on the boiler (keys 1-4 govern movement). Meanwhile, of course, pressure is building up elsewhere, so off you go to the boiler that seems in most danger of imminent explosion.

The boilers are on two different levels, and you must climb a ladder to get to the two on the upper level. The ones upstairs, though, are on either side of a divide, and you must constantly move the ladder either side of the divide in order to run up to each of the boilers in turn. When you're on the ground you move the ladder by pressing the left or right key and key 5 simultaneously.

The game is far from easy, yet it soon becomes boring.

It is also one of those frustrating games where you have to be placed absolutely right in order to do things. You spend a lot of time inching back and forth, not a good game. **Mike Gerrard**

Rating 5/10
Price £6.95
Publisher Front Runner 01-992 8055

DRAGON

ARCADIA

A new Imagine release for the Dragon? Just like old times, really, apart from the small fact that both Imagine and Dragon Data are now bankrupt. It shouldn't be too surprising to discover then that this is a pretty bankrupt piece of software.

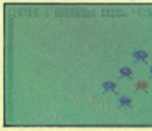
Arcadia was well received when it came out on other machines, but that was about a hundred years ago when Imagine had cash in the bank and people were glad of something that took *Space Invaders* a stage further. Now, even for the Dragon's aching limbs, we've seen much better.

The game is in the familiar space invaders style. You control your laser at the bottom of the screen, and you have five lives.

It's a game for one or two players, with joystick or keyboard control — and a wide choice of keys are available.

For a game that's taken at least a year to be converted for this machine, you'd think they'd have got it right and allowed the program to loop back to the beginning after a game to enable you to switch choices. Instead you're stuck with the first one you make.

The first screen contains . . . is it a bird, is it a plane? Whatever it is it travels in groups and flits across the screen, going off the left edge and coming back onto the right side in ever-descending circles.



Clear this wave and another begins, and another, and the only way to progress to the next level is by surviving while a counter ticks down from 99 to zero. Lose a life and it starts at 99 again.

While everything is smooth-moving, you soon learn that in order to survive you have to adopt the old *Asteroids* techniques and blast all the aliens bar one, and then keep out of the way of this one while the clock ticks away. This does prove rather boring.

Everything is reasonably fast and smooth-moving, but there's nothing very mega about the game. **Mike Gerrard**

Rating 5/10
Price £5.50
Publisher Beau Jolly 051-236 8100

SPECTRUM

ZIGGURAT

A ziggurat, as anyone with a copy of the complete Oxford English Dictionary knows, is an Assyrian or Babylonian temple-tower. Whether that's of any use to you in this bargain-basement adventure, I don't know. All the insert tells you (in no less than five languages) is: 'Adventure game — standard commands *eg* get, look, examine, WENS' etc.

Load it up and where are you, then? You're in a room with a view. The top half of the screen presents you with three walls of the room, the far one has a barred window in it, the other two are blank. There's also a wine bottle. Examining the window reveals a hungry tiger

on the other side, while smashing the wine bottle provides you with a green key. The only exit is North, which takes you to 'A very cold room,' then on to 'A bright room,' followed by 'A grotty room,' and so on in much the same vein.

If the room descriptions all sound very similar, then you should see the rooms.

So what about the tasks? After the first eight rooms, and discovering a rusty sword and eight coins, you face a locked door. The key doesn't fit the lock, so on the wine bottle principle I tried 'Smash door' which led me to another set of rooms. There was some raw meat in one, and I carried this round but still got eaten by the tiger when I stepped into that room without being given a warning. Next time I returned the meat to the start, fed the tiger through the bars, and guess what? The meat must have been off, you're told, and the tiger dies. Back to the tiger room, discover a blue key, find a bronze ring, pick up more coins, then locate a room which has a lift to the surface.

I soon grew tired of the boring graphics and descriptions. The best and the worst that can be said is that it is a cheap adventure. **Mike Gerrard**

Rating 4/10
Price £2.99
Publisher Software Supersavers 051-428 7990

COMMODORE 64

FORT APOCALYPSE

Now this is what I call a game. *Fort Apocalypse* was originally a smash-hit on the Atari. It has now been faithfully converted for the Commodore 64.

Fort Apocalypse is a tightly defended stronghold in which 18 of your buddies are confined. Using your rocket copter, a powerfully equipped helicopter, you must penetrate the fort's innermost chambers and carry out a daring rescue. The chopper can turn and fly horizontally and vertically, firing or bombing in the appropriate direction.

You always begin near a fuel depot where you fill up before commencing your daunting task. To assist you, a long-range Navatron at the top of the screen shows where you are in relation to the terrain and the oncoming enemy forces.

You must bomb a path through the gates leading to the Draconis level. Believe me, it's no piece of cake trying to hover and bomb a gap through the defences while being fired upon from all sides by missile firing Robo-choppers, Kralthan tanks and self-propelled mines.

If you manage to smash a big enough hole in the gates without getting blasted from the skies, you must descend into a

series of low-roofed chambers where the first of the prisoners can be seen scuttling to and fro.

To rescue one, you simply hover close to him and he will be picked up automatically. Harder than it sounds — the enemy are about and the chambers make manoeuvring a nightmare. More gates bar further progress.

Beautifully smooth scrolling, crisp animation, lots of noisy battlesounds, much variety and a really mean challenge — one of the best all-action games you could wish to get obliterated in. **Bob Chappell**

Rating 9/10
Price £9.99, **Supplier** US Gold 021-359 3020.

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"I hate this game. I seem to be missing all my favourite TV shows" **ADAM BOWLES.** ***(Poor old Adam)***

TELL US WHAT YOU THINK.

GAMEPLAY

SPECTRUM

DOOMDARK'S REVENGE

Luxor lolled in his throne and knocked back another goblet of mead. 'Luxor the Moonprince, Lord of Midnight — it's got a nice ring to it,' he thought. And he could dine out for the rest of his life on the story of how he stuck his dagger in Doomdark's giblets.

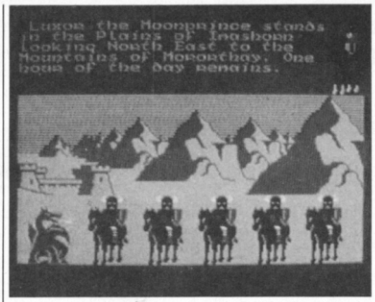
Pity about the kid though. He'd sent the little moron up to the Tower of Doom with instructions to smash the Ice Crown, and not only had he done it — he'd come back in one piece. It had to be the truth, Luxor reasoned. There it was in black and white in the manual for *Doomdark's Revenge*.

And he was beginning to find the last couple of chapters disturbing. Morkin, heir to the throne, had suddenly stopped messing around with computer games (smashing Ice Crowns, stomping around being utterly bold and the like) and had taken an interest in girls. First he starts interfering with the Lord of Dreams' daughter, then next morning, if you please, he falls in love with Shareth the Heart-stealer and goes running after her.

'I never knew Doomdark had a daughter,' he mused. 'Still, good riddance to the brat — wonder why it's called *Doomdark's Revenge*?'

His question was answered when Rorthron the Wise blew in. Shareth was holding Morkin hostage; Tarithel, the jilted bride, had run off looking for Morkin, and the Lord of Dreams had a funny look in his eye. 'Suppose I'd best go and look for the little swine,' he muttered, and headed north to the Ice-mark.

Doomdark's Revenge uses the same graphics system as *Lords of Midnight* — you control a



number of characters and see the world through their eyes. But the interaction of the characters is much more complex. In *Lords of Midnight* you started with four characters whose job was to recruit allies, and either the ally would join you or he wouldn't.

In *Doomdark's Revenge* they have more of a mind of their own, so if you approach the wrong bloke (Badbazza the barbarian, say) he's as likely to tear your head off as join you. The other characters are often off on quests of their own, and initially Shareth isn't nearly as well organised as Doomdark was. You're in the persuasion business and so is she, so you'll find the situation a lot more fluid. Your supporters may change sides, fight among themselves, refuse to cooperate — it's a real bundle of laughs.

You've got five tribes to deal with — Giants, Dwarves, Ice-lords, Barbarians and the Fey, and it may be helpful if I pass on a few hints. As yet I haven't managed to recruit a Giant, but they haven't attacked me so they're probably neutral. The Dwarfs in general aren't much use. They're shiftless, treacherous and cowardly, and even if you manage to recruit one he's liable to skive off at the first available opportunity, leaving you in the lurch.

The Fey are your best bet, although some (watch out for Thigrak) can be troublesome. But even the troublemakers here can be recruited provided you can recruit their leige lord, or keep their sworn enemies out of sight.

Initially the Barbarians can seem bad news, but it's a mistake to assume that they're not worth approaching. If you head straight north on entering the Icemark you'll probably run into a bad lot, but run like mad in a north-easterly direction and the immediate danger should pass.

Once you've started a game the immediate problem seems to be survival. There's a fairly unpleasant barbarian war band due north, but if you can avoid them and recruit a few followers the danger passes. The armies here seem to have less staying power than in *Lords of Midnight*, and you get a much clearer advantage by being on the attack, so it can sometimes make sense to go for a superior force, and run for your life the next day.

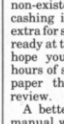
Running off immediately doesn't seem to work — they follow you and catch you off guard, so in the case of the war band it's best to wear it down with a series of short attacks.

So far, the best I've managed in this one is survival. Morkin is probably somewhere up to the north-east, but I haven't got that far, and although there's probably a quest involved as well as a military conflict I haven't managed to identify any structure to it. Once you reach breakthrough point on survival (I reckon recruiting around ten lords) the game could probably go on for some considerable time.

So as far as I'm concerned, those long winter nights look much brighter now those nice people at Beyond have given me *Doomdark's Revenge*. There are only two blots on the horizon. First, my review copy's almost as difficult to load as *Lords of Midnight*. It uses a fast loader of sorts, and one of those tiresome RAM checks that happily resets the Spectrum two times out of every three — Beyond should get its act together just in case it ever launches a game that isn't worth the extra effort.

The other problem is the non-existent map. Beyond is cashing in by charging £1.95 extra for said map, but it wasn't ready at the time of review, so I hope you lot appreciate the hours of scribbling on squared paper that's gone into this review.

A better drawing with the manual would definitely have been appreciated. **John Lettice**



Rating 9/10
Price £9.95
Publisher Beyond Software 01-837 2899

AMSTRAD

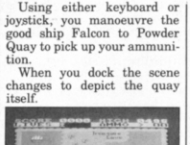
ROLAND AHOY

I must say the Roland theme is beginning to wear a bit thin. This latest epic from Computersmith has him as the Captain of a pirate vessel trying to avoid mines (a strange anachronism), collect gunpowder, blow a hole in the harbour bar, collect treasure, and deposit it in a secret cave. It's all rather involved, but fairly obvious once you start playing.

There are four main screens — the main one is the map which shows Golden Harbour and Powder Quay along the bottom, with the rather square island above containing Treasure Cove.

Using either keyboard or joystick, you manoeuvre the good ship Falcon to Powder Quay to pick up your ammunition.

When you dock the scene changes to depict the quay itself.



A cannon starts discharging its contents in your direction and, unless you avoid the cannonballs and collect your ammo quickly, a fireball will sink your vessel.

You will need to make several visits to Powder Quay, as the harbour bar will take eight consecutive hits before yielding a hole large enough for the Falcon to pass through. When you do reach Golden Harbour (a third screen), the locals are no friendlier than at Powder Quay and bombard you with further missiles.

If you manage to steal the goodies without being hit, you will need to plough the Main again to reach the 'safety' of Treasure Cove.

Here you may deposit the goods, providing you can avoid the falling rocks and a malicious green spiker, angry at being relegated from a game of *Pacman*. A pirate's life is not an easy one . . . .

And that's really the problem with this game; the concept's interesting enough, but you have to do an awful lot to earn your pennies. If you hit anything either ashore or at sea, the harbour bar is automatically restored and you have to start from scratch which can be very frustrating.

The graphics are very mixed, with the boat and mines particularly poor, but the scene at Golden Harbour is nicely put together.

Roland Ahoy! walks the tightrope between addiction and frustration none too confidently. **Simon Williams**

Rating 5/10
Price £8.95
Publisher Amsoft 0277-230222

OFFICE BONUS

A complete office package for the Beeb for £6? Shoving aside his disbelief, Colin Cohen tends the Mini Office.

A series of office automation programs for £6? Is somebody pulling somebody's leg? For this price (£2 more for disks) you get a word processor, database, spreadsheet and graphics. The last two are integrated and all but the word processor came with a demonstration data file and there are 32 pages of instructions.

I doubt if any serious user would be happy with the programs, but for the price they are ridiculously good. The instructions (you need good eyes) are at least as good as you would expect for the price, though they are written for the tape version and the disk has minor (undocumented) variations. Tape users chain the programs from the menu that is generated by booting. However, for one reason or another, the programs

have been highly protected and the word processor program is so well trapped that you can only leave it for another part of the suite by turning off the machine and restarting. This applies to both tape and disk.

Unless you are especially keen on tape to disk copying get the disk — it's only £2 extra. Disk users can only access Drive 0 in any program, which can mean a fair amount of disk swapping to save or load as the disk is write protected.

Word processing

On entering the word processor you are given a menu which controls both text entry and printing, and escape always returns you to this page. The first thing you notice is that you are given a choice of two text entry sizes, the normal size with 22 lines per screen, or ten lines in double height. This is a joy for young children (and possibly the partially sighted). In either the use of colour is good and you are shown the elapsed time (there is a rather erratic method of automatic typing speed calculation) and the number of characters free. For disk users this is normally a miserly 2,600.

If you have a disk machine you can reset Page to &E00 (5,500 characters) or &D00 (5,756 characters), but clearly it must be done before you load the program; set it too low and you'll crash the whole system.

The program provides the normal facilities from the function keys: some are only available via the menu and some from the edit screen. You can copy, delete (both in a similar way to Basic), save, load and print. The latter is interesting as you can print out in double size if you have an Epson (from single or double size display). This makes it a marvellous word processor for a child, and while it is not possible to load *Wordwise* files into the Mini Office a whole series of MO files can be concatenated into *Wordwise* if, for instance, a school wanted to print out a series of children's exercises.

The main drawbacks to this part of the suite are the restricted memory, and the slowness of the screen's response to key presses which can mean that if you hold the delete key (rather than tap it for each character) it will go on deleting for several seconds after release. Finally, the cursor is not visible while a key is pressed which adds to the excitement of copying.

Database

The database also makes good use of colour but is unexceptional of its kind. Field lengths are limited to 23 characters, but can be string or numeric. A typical six-field address record takes up about 100 bytes and you can fit some 120 of these records in. Apart from size the main drawback is that you must use caps for instructions or you get no response. You can search any one field (for part as well as whole strings), or sort on four, but the sort must be on the same basis for each field. Browsing is also possible.

Spreadsheet

If you've never dealt with a spreadsheet before, this is the ideal introduction. Drawbacks are as with the other programs and relate to size, though you can produce a grid up to 26 by 27 cells, which is big enough for home use. It's easy to extend the number of cells in an existing grid within these limits and it's easy to position the headings. Control is from 20 function keys enabling you to set the formulas between cells and display, print load or save. Although you can scroll in any direction the BBC only allows viewing 40 columns by 24 lines at any one time and in monochrome only. One nasty habit is the suppression of error messages, so if you try to save on the write protected disk the only warning you have is the very short time the drive lights are on.

Graphics

Perhaps the nicest part is that having saved a spreadsheet you can go into a graphics program that displays any one line as a pie chart, histogram or graph in glorious colour or print it out. Columns/segments are labelled A-Z, rather than with the names you give to the spreadsheet, but the title is shown and you can toggle between the display and a page.

Verdict

Despite my carping criticisms the programs are quite exceptional value. It is the first affordable program suite I have seen and if you're interested in a spreadsheet or database I strongly recommend beginners to get this first. You can find out what you need so you really understand the sales jargon on much more expensive programs, which can cost up to ten times more.

REPORT CARD: 1 TO 5

Features	●●●●
Documentation	●●●
Performance	●●●
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Vic 20, C2N, 16K RAM, 8K RAM, 3K super expander, programmer's aid, m/code monitor, motherboard, soft-switch, intro Basic 1 & 2, 12 cartridges, tapes, joysticks, books — £180. Tel: 01-863 5113 Deepak.

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Wanted quality dot-matrix printer for word processing. Also want suitable interface for Spectrum. Tel: 0959 75030.

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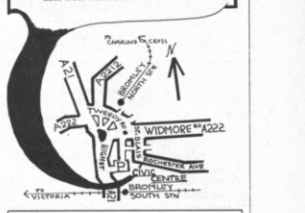

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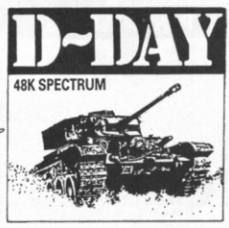

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QUIT

Here's one last blast of Christmas spirit before you take the decorations down and sweep up the pine needles. Just before we put up the shutters for the festive season there was a late entry in the Christmas carols free-for-all from John Brown of Cirencester. Look to your laurels, Anon!

The first one is to the tune of 'God Rest Ye Merry Gentlemen.'

The Pre-Christmas Boom Carol

Oh come ye high street traders
spare a thought for Santa's elves,
As each and every MSX comes
gladly from your shelves.
If we were only Japanese we'd
make a few ourselves!
Crying, 'Vital for every girl and boy, a source of joy,
Massive savings on the latest micro- toy!'

Now you may rub your hands with glee and grin without restraint,
As fathers hand out Access cards while mothers nearly faint;
But won't you hate the next six weeks of customer complaint!
Crying, 'Vital for every girl and boy, a source of joy,
Massive savings on the latest micro- toy!'

And pity that poor software pirate shivering in the cold,
He can't afford a Porsche yet his Ferrari's growing old —
But you can bet he'll buy just one of each new title sold!
Crying, 'Vital for every girl and boy, a source of joy,
Massive savings on the latest micro- toy!'

To the tune of 'Good King Wenceslas'

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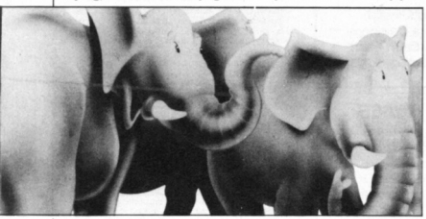
Spectrum Pluses sold so well
His market share was weakening
Spied a lowly graduate
Clutching bold designs who
Tramped the cold streets of the town
Fingers turning blue-oo-oo

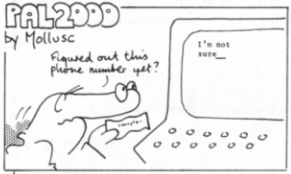
'Hither, henchman, stand by me
Notice yon man, thither —
Tell me if you can descry
What he carries, whither?'

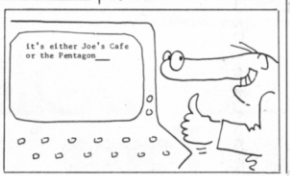
'Sir, he lives in Ruislip, where
Light bulbs of low wattage
Illuminate th' interior of
His electronic co-ottage.'

'Bring me chips and soldering iron,
Data buses various,
Lest this young man should expire
In business so preca -arious
We must rescue talent rare
Of such far- sighted men —
Or we shall find Sir Clive Sinclair
Has beaten us aga- ain!'



If Commodore's elephantine advertising campaign gave you the feeling that you'd seen it before somewhere, here's the answer. 'How to increase the size of you memory', the brochure trumpeted, and over the page was a herd of happy elephants picked out in front of none other than the 48K Lynx. 'Expandable, not expendable' was its slogan in those days. Which days? Goodness knows . . . they're lost in the mists of time.





NEXT WEEK

Enterprise appraised
Here at last, the Enterprise 64 gets the once over in a full Pro-Test of a production model. Was it worth the wait? Is it worth the price?

BBC sines on
Brush up your BBC's trigonometry with this program to add to your wavy line store.

Spectrum castled
Not just another Hunchy, this Spectrum game will have you rolling out the barrel all over again.

Mousey
Can AMS's mouse and software turn your BBC into a Macintosh lookalike? Find out in our Pro-Test.

Teletextual
Now Spectrum users can tune into Teletext with the TTX from OEL.

Musical dreams on the Beeb
A music generator for the BBC that beats the competition hands down.

IBM QED
Yet another desktop package for the IBM — but how does it measure up?

PCN DATELINES

Event	Dates	Venue	Organisers
CADCAM Intl Show	Jan 8-10	NEC, Birmingham	EMAP Intl Exhibitions, 01-837 3699
Mini/Micro Computer Exhbn Conf	Jan 13-16	Stockholm, Sweden	Sollentuna Massan, Box 174, S — 191 23 Sollentuna, Stockholm
Which Computer?	Jan 15-18	NEC, Birmingham	Clapp & Poliak 01-891 5051
High Technology & Computers Education	Jan 23-26	Barbican, London	Computer Marketplace Exhibitions, 01-930 1612
Computer Exhbn — Computer Thai	January 23-26	Bangkok, Thailand	Conf & Exhbn Management Services, Ltd, 61/5 Langsuan Soi 2, Ploenduit Road, Bangkok 10500
Intl Microcomputer Fair	Jan 29-Feb 3	Frankfurt, Germany	Collins & Endres, 01-734 0543
Apricot & Sirius Computer Show	Feb 5-7	Kensington Town Hall, London	Paradox Group, 01-241 2354
Intl trade show for home comps, software, etc — LET	Feb 17-19	Olympia, London	Turret-Wheatland, 0923-777000
Intl Computer Graphics User Show and Conference	Feb 19-21	Barbican, London	Mountbuild, 01-486 1951
MEXCOM	Feb 25-28	Mexico City, Mexico	AESI Ltd, 01-379 7628

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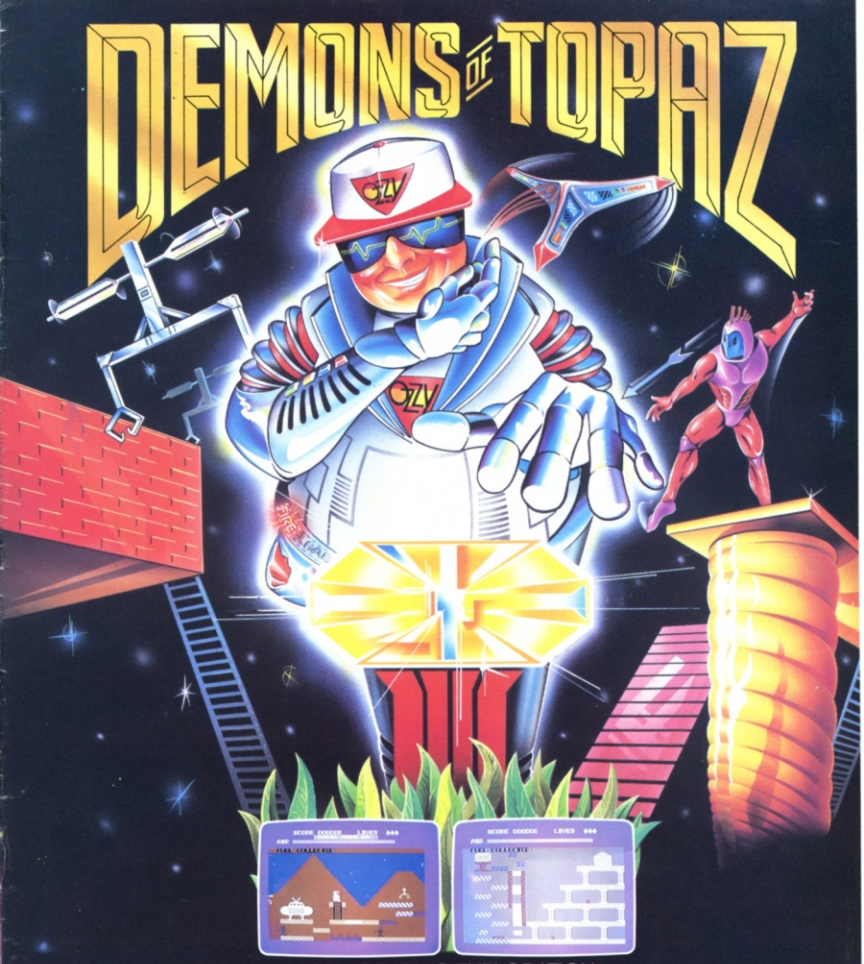

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