ACORN USER
BRITAIN'S BIGGEST MAGAZINE FOR THE BBC MICRO · ELECTRON · ATOM
OCTOBER 1984

TRAILBLAZERS:
The origins of life on a BBC micro

SCOOP REVIEW:
Elite - Acornsoft's new blockbuster

CARTOON ANIMATION:
Move your characters around the screen

UTILITY ROMS:
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New Users

First Byte
Keyboard capers
Start making music and other noises on your Electron, under the baton of Jeremy Vine

Fly Killer
Tessie Revivis's asterisk turns into a full-blown fly that runs the gauntlet of the spray can. Design and move your own screen characters with deadly accuracy

Hints & Tips
Martin Phillips explains points that perplex readers: printing with daisywheel and dot-matrix connected at the same time; outmoded operating systems; a scrolling text window; off-the-shelf procedures; and the ENVELOPE statement

Chipping in
By programming the Beeb's 8271 floppy disc controller chip you can increase your data-handling power, says Richard Harris

All sorts
See how sorting techniques work and you'll soon be able to pick the right one for the job. George Hill sorts them out

Self-diagnosis
In the interests of cost-cutting and keeping your micro on the road, Paul Beverley helps you set up tests on the Beeb to diagnose its own ailments

Education
Primary scream
The government claims success for its 'micros in primary schools' scheme, but is it of much help in practice? To Geoff Nairn the satisfied smiles look like smugness

Modules by Microtext
Ian Birnbaum assesses Acornsoft's Microtext authoring system, which allows even inexperienced programmers to set up instructional quizzes and tests on the Beeb

Features
Trailblazers
In the first in our new series focusing on the more exotic uses that the Beeb is being put to, Chandra Wickramasinghe explains how his micro helped him advance a startling theory of life in space

Wordprint
Alex Wilson provides Atom users with a wordprocessor that makes full use of all script facilities

Yellow listing pages
You'll find all the main listings of this issue in the yellow pages

First Byte
Our fly gets its come-uppance

Hints & Tips
Simple envelope generators

Animated sprites
Move your character around

8271 programmer
Disc copier

Beeb Forum
Disc catalogue reader

Sorting
Demonstrated in colour!

Self-diagnosis
Choose a test routine

Atomic text
Wordprocessing on a shoestring

Toolkits
Sample utilities
IN THIS ISSUE...

Origins of Life 27
Chandra Wickramasinghe explains how he and Sir Fred Hoyle are using the humble BBC micro to help them research the origins of life on Earth and back up their theories on microbes coming from space.

Cartoon time 65
How to move the sprites designed last month. Look out for the free demonstration to download on Micronet and Vifewfax.

Acornsoft's Microtext 137
The National Physical Laboratory developed this language to help people who were new to programming write training and educational software. Ian Birnbaum reveals how well it succeeds.

NEXT MONTH...

Bar codes come of age
We preview the MEP bar-code reader and present listings that can be input using this device.

Buggies and Turtles
Six of these robots for schools and hobbyists are given a thorough going-over.

Sideways ROMs
Joe Telford studies the popular chips and what will work with second processors.

ACORN USER OCTOBER 1984
We’ve done it! We’ve built a mass storage system for your BBC Micro with the power and convenience of a floppy disk drive, but at a fraction the price. Get to know PHLOOPY, the remarkable new 100k drive that costs only £99 plus VAT, and a further £26 plus VAT for the interface to your BBC, operating system and connecting cables.

**How PHLOOPY does it**

PHLOOPY does not use disks to store data, but a 12-foot loop of professional-quality quarter-inch magnetic tape contained in a robust cartridge. The drive has only one moving part, the motor which drives the tape loop — hence the low price and high reliability. As the loop is driven round, each file of data it contains passes across the magnetic head which reads it or writes to it. Other people have produced tape loop micro-drives, but they’ve not been very reliable. They lacked PHLOOPY’s special secret.

**PHLOOPY’s special secret**

The heart of the invention is a brilliantly designed “byte-wide” magnetic head, made by Phi Magnetics who build multi-track heads for professional use. PHLOOPY’s head records and reads nine tracks across the width of a quarter-inch tape. That means the tape loop can be much shorter, so the typical time to access a file is reduced to a mere 3 seconds. If you’re used to waiting for a cassette tape to trundle programs into your BBC, you’ll be amazed at PHLOOPY’s performance.

**Getting it right every time**

In addition, we’ve included a feature we know you will appreciate. PHLOOPY has full error detection and correction, so you can be certain you will get back what was originally written onto the tape.

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PHLOOPY’s own software, contained in ROM, responds to standard BBC filing system and Basic commands. Most programs written to run on disk or cassette should run on PHLOOPY without problem.

And because PHLOOPY contains its own intelligent microprocessor — a second computer which does most of the hard work — PHLOOPY puts very
little load on the BBC and uses much less RAM than most disk systems.

**Installing PHLOOPY on your BBC**

You'll be amazed how simple it is to install PHLOOPY. Just plug in the interface cut two resistors (clearly marked in the instructions) and the job is done. If you should have problems our engineers are waiting to help you.

**Making a PHLOOPY Library**

PHLOOPY cartridges hold a full 100k of data or programs. Two of them come free with the drive and extra ones cost £3.75 each plus VAT. They are moulded of high impact polymers for protection and store easily on a bookshelf. Many programs will be available to purchase on PHLOOPY.

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Astronomy
Vivid graphical demonstrations which bring astronomical subjects to life. The programs include phases of the moon, solar eclipses, planetary motion—even the chance to pilot your own spacecraft!
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£9.20 Cassette/booklet

Drawstick
This friendly program can produce elaborate high resolution pictures and patterns in four colours. It enables children to create pictures, charts, maps and diagrams, and can be used as a Computer Aided Design tool. It includes a fast ‘save’ routine.
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This powerful chess program is now available for the Electron. It outclasses and outplays several well-known chess programs, and compels even experienced players to treat it with respect!
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Model B version £11.50
Electron version £9.95

Word Mover will run on your Electron. An Electron version of White Knight is now available

ELECTRON USERS!

FROM BOOKSELLERS AND SOFTWARE DEALERS

All software is for the British Broadcasting Corporation Model B Microcomputer except where indicated. Every pack includes full documentation. Prices include VAT.

40813
New Acorn micro

ACORN's new business range will be based around a repackaged BBC micro with two 16-bit second processors available. There will be eight variants under the generic name ABC—Acorn Business Computer.

Top of the range is the ABC310 running an Intel 80286 second processor giving IBM PC and XA (Popcorn) compatibility, with Ikon software and high-resolution graphics.

The 16-bit operating system will be Concurrent, a development of 3.1 from Digital Research. It is capable of performing several tasks at the same time and dividing the screen into windows.

As our picture shows, a full professional keyboard with separate numeric keys links to a box containing the 6502 processor used in the Beeb, topped by a monitor.

The monitor tips forward, giving access to internal sockets where the second processor and hardware cards can be added.

The machines should be on view at dealers in November, with deliveries starting in the New Year. The whole range comes with one double density, 5.25in drive giving 700k of storage. A 12in monitor comes as standard, as do View and Viewsheet. Second processors and other hardware can be added, right up to the top of the range configuration.

The ABC100 includes the Z80 second processor running CP/M and two 700k drives as standard. The three Plan software packages are included, and have been enhanced (see June's AV). The ABC110 is similar, but with one drive replaced by a 10Mb Winchester hard disc and colour monitor.

Whereas the 100 machines cover office productivity, the ABC200 and 210 are loosely described as 'academic workstations'. The 32016, the 16/32-bit chip is included with disc variations as above. Standard RAM is 256k. A choice of programming languages will include C, Modula2 and Pascal. The Xenix operating system comes with the Winchester on the 210.

Flagship of the series are the 'executive workstations' with the 80286 16/24-bit chip. The 300 will carry two 700k drives and monochrome monitor.

EXCLUSIVE

should be available by Easter, says Acorn. Prices have yet to be released.

Bottom of the range is the Terminal, which is exactly what its name says. It will not be expandable, and comes with terminal emulator software and Eiconet as standard. The monitor is a 14in monochrome with 32k RAM and no disc drive.

Next up is the Personal Assistant wordprocessor. It comes with one double density, 5.25in drive giving 700k of storage. A 12in monitor comes as standard, as do View and Viewsheet. Second processors and other hardware can be added, right up to the top of the range configuration.

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Using your free function key strip

THE FREE gift on this month's front cover is designed as a re-usable function key strip for BBC micros and Electrons.

Using a chinagraph pencil (about 30p from art shops), you can mark in key definitions for your own programs. It slots under the BBC's clear plastic strip, or can be taped onto the Electron. We hope you find it useful.

30,000 flock to Acorn User show

THIS year's Acorn User show was the first to be held at the new Olympia 2 exhibition hall. More than 30,000 people passed through the turnstiles over four days, but with the new venue there was little of the overcrowding which dogged last year's show.

Acorn had the largest stand running 'live' demonstrations. Said Acorn's Graham Winnard: 'For the first time we're using technical people instead of sales staff to demonstrate the products. The demonstration...
Now everyone with a BBC or IBM PC will want to get their paws on CUB's sleek new D series plastic cabinet—a triumph of ergonomics and up to the minute design. Within it is the CUB 653 MEDIUM RESOLUTION colour monitor—the perfect mate for computer users who wish to combine the advantages of brilliant, low cost colour graphics with 80 column processing software.

CUB 653's remarkable depth of colour is enhanced by minimal screen glare thanks to a super high contrast CRT. Even in well lit environments the 653 (H) x 585 (V) resolution and 0.43mm dot pitch produces 80 column text which is pin-sharp and easy to read. Owners of SHARP, RML 4802, APPLE Series, WANG and other leading computers needn't feel left out, because CUB 653's compatibility extends to these models and many more.

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Standard Resolution version also available in new cabinet. Both Standard and Medium resolution models produced in metal cabinets if required.

Available from High Street Computer Retailers and selected branches of W.H. Smith, Hamods, John Lewis Partnership, John Menzies with selected models available from larger branches of Boots.
Electron gets microdrives in Plus 3 box

Electrons will not come down in price at Christmas says Acorn, and a big sales push will be headed by the Plus 3 add-on incorporating a 3.5in disc drive.

The machine will be promoted as the basis of an expandable system which will be around for a long time, with Plus 3 proving the point. Extra hardware can be plugged into the spare cartridge socket on the Plus 1 to add interfaces such as RS423.

No firm price has been announced for the Plus 3, but it is likely to be about £250. This includes the drive and interface in the add-on box.

Special deals will be offered on combinations of Electron and add-on boxes or software, as with the Me and My Micro pack released last month.

The missing Plus 2 will supply Econet and won't be out until next year. View and Viewsheet will be released for the Electron before Christmas.

Acorn's choice of the 3.5in disc drive will no doubt anger the existing microdrive market for the BBC micro, which has plumbed for the 3in version. However, Acorn decided the standard will be set by the big business companies going for the larger format.

The Plus 3 uses the newer 8272 floppy disc controller chip as in the ABC machines. The BBC micro uses the 8271, which is in short supply and cannot support double density discs.

Bird's eye view: plenty of people with space to move

Show hit

Three new 'add-ons' for View and Viewsheet were announced: a Printer Driver Generator at £9.95 (£11.50 disc); View Index, for producing an index of pages at £14.95 on disc only; and Hi-View, a £59.80 version of View to use with the 5502 second processor.

Hi-View offers more free memory than the ordinary View but is only available on disc – the high price is to protect sales of the ROM-based View.

Torch, now part of Acorn, was showing off the Graduate, the add-on which makes the BBC IBM PC-compatible. 'We're getting a lot of interest from large companies, education and small businesses. If you put an order in now you could get one in November,' promised Adam Lewis.

Making a debut was a £65 robot construction kit from Micro Robotic Systems. Using Fishertechnik parts (as used in the BBC Buggy) several different experiments can be built. With the addition of a £32 interface, the experiments can be controlled from the BBC micro. Experiments include: a plotter engine, a robot arm, Tower of Hanoi and a sorting system. Micro Robotic Systems is at 20 Penywrn Rd, Earls Court, London SW5 9SU.

The first mouse for the BBC micro was on the AMS stand. The designer, Dave Brader, was still working on the software, but it appeared to provide a much quicker method of editing text and drawing graphics.

The device has been curiously renamed the AMX Mouse and will go on sale in October for £79.95. Dave was also promising an EPROM programmer – though it wasn't available in time for the exhibition.

New micro

BBC TV's new computer magazine series, Micro Live, will go out monthly from Friday, October 5.

Leslie Judd, of Blue Peter fame, and Ian McNaught-Davis will head up front, with special reports on America by Freff from June's Micro Live.

Producer, Patrick Titley explained that the shows will go out live and have a topical flavour. 'It will be a fast moving magazine programme – like a printed magazine.' There will be six programmes, each lasting 30 minutes on BBC2, probably at 6pm.

A bulletin board will be set up for viewers – and Patrick Titley hopes Acorn User readers will contact him with news stories.

New micro

The 310 will have a single drive plus Winchester and colour screen. Again 256k RAM is standard, but upgradable to 1Mb.

A mouse will be released next year for the 300 machines along with a modem card for the range.

Interfaces are as on the BBC, but with no TV socket and some of the connectors will be changed.

Howard Fisher, ABC project leader, said: 'Our research shows people want computers that work, and this range has been designed to meet needs we have identified. They match very specific requirements.' On the question of performance, he declared: 'The 80286 machines are up to five times faster than the IBM PC on benchmarks.'

Tom Hohenberg, Acorn's marketing manager, added: 'The ABC range is a nearer alternative for the BBC micro, aimed at business users. There is no conflict with the BBC itself.' 'We've gone for a modular technique to save space and make it a doddle for the engineers.'
Bar code listings aim to cut down typing

BAR codes are set to become more than just things on cans of beans with the launch of a reader pen for the BBC micro in October costing £50.

And Acorn User will be supporting the project by Addison Wesley, which has MEP backing, with program listings printed in bar code.

Schools will be the initial target, but a consumer pack will follow. The pen enables people to enter software without any typing and produce actual listings in the form of bar codes for distribution.

A pack consists of the reader pen, which measures 2 x 4 x 1 in, cassette or disc with demonstration and driver programs, template for producing bar codes by hand and a user guide written by AU author George Hill.

The software will decode the bar system used in supermarkets and there is a music program.

For more details contact Addison Wesley at Finchampstead Rd, Wokingham, Berks RG11 2NZ

See next month's issue!

TAXAN has released two centronics NLO printers. Their main forte is the near letter quality print (NLQ) of the dot matrix head. The two models, the KP810 and KP910, feature 160cps bi-directional printing, a half speed 'quiet' mode, friction and adjustable tractor feed plus roll paper. Both are available at £229 for the KP810 and £399 for the KP910 from Data Efficiency, Maxted Road, Hemel Hempstead, Herts.

One winner from 8000 entries

THE competition set in May's Acorn User was the most popular ever. To say we were overwhelmed at the response would be a gross understatement - more than 8000 readers entered! The incredible response, with some excellent and thought-provoking solutions, has been the prime factor in the result being delayed and we thank you for your patience! Now to the competition.

You will remember that Simon Dally set the task of counting from 1 to 1,000,000 in the quickest time possible. The first task for most of you was to decide what was meant by 'counting from one to one million' - but that was all part of the competition.

Many entries were based around using the two user and two system VIA timers to 'count' in around 0.25 seconds. These entries were disqualified because they did not count to a million - they simply counted to 250,000 each. Although the sum of the four counters is indeed 1 million, the rubric clearly stated count from one to one million.

The second most common entry was based on the fact that the computer performs so many operations in so many cycles. With the Beeb operating at 2MHz it would be possible to determine when a million cycles had been performed simply by creating loops of machine code that contained a set number of cycles. The quickest time would therefore be 0.5 seconds. However, entries using this technique were discounted because, again, a physical counter incrementing from one to one million was not involved.

The acceptable solution was to use 24 bits anywhere within the Beeb that would be loaded with 1 and then incremented to a total of one million. The three bytes needed to do this could have been the three processor registers, three memory locations or a combination of each.

After much sorting and sifting, the 8000 entries were whittled down to a final selection that all used the three-byte counter and all gave results of one second, or fractionally over. After a final four-hour deliberation late one Friday night the winner was chosen; John Faris from Oakham in Leicestershire. John's time was a staggering 1.004856 seconds.

Now, all you readers who had times of 1.00 or 1.004 seconds - don't write in. The level of timing accuracy varied and all times of one second, plus a fraction, were considered in the final analysis.

John used the accumulator (least significant byte), X register (middle byte) and a zero page RAM location (most significant byte) to act as his counter. The program was written in assembler and used macros to assemble sets of the appropriate incrementing instructions. Extra speed was gained by turning off the system timers to inhibit the household interrupts issued every 10msec, giving around a 5 per cent increase in speed.

So £1200 of wordprocessing equipment wings its way to John Faris with our hearty congratulations. Two second prizes of Acorn sparkjet printers go to Chris Wedge of Folkestone and Colin Edwards in Sussex. In addition, we are giving a special prize to the slowest entry. This is not intended as a booby prize, but as a reward for entering the competition in the spirit in which it was intended.

Finally, we are unable to enter into any correspondence regarding the competition. All decisions are final.

Once again, congratulations to all prize winners and thanks to everyone for entering.
Like the beautiful prints from Japan, Cumana disk drives represent the very highest standards in design and production. Also like the prints, Cumana disk drives represent the highest state of the art; and they not only look beautiful, they perform beautifully as well.

Cumana disk drives for the BBC Microcomputer are available in slimline single, dual and dual switchable versions. They have 12 months warranty, are fully assembled and tested before packaging, and are available at unbeatable value for money prices — from W. H. Smith, The John Lewis Partnership, Greens Leisure, Laskys, Spectrum UK, area distributors (see below) and Cumana’s national dealer network.

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- 8088 16-bit processor running at 5 MHz
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- Integral stabilised power supply
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- Software compatibility allows Lotus 1-2-3 and all popular IBM PC business programs to run without modification, subject to the constraints of the BBC keyboard and display
- Disc interface is not required
- Keyboard text and graphics supplied by BBC Model B

**THE GRADUATE**

Disc and hardware compatible with the IBM PC, the Graduate is the latest addition to the Torch range of BBC upgrades. It's MS™-DOS operating system is customised to IBM compatibility allowing exploration of the massive range of IBM compatible business software, programming aids, compilers and languages universally available from most major software houses.

**Introduction to MS™-DOS**

The Graduate offers two levels of upgrade, the G400 and the G800, both with 128K on board memory as standard (optionally 256K). This can be increased to 1.2 Mbytes with an IBM compatible expansion board. The G400, contains a single, double sided 320K formatted disc drive and provides the low cost introduction to MS™-DOS for the user who wants real 16 bit power from his Model B.

**More data storage**

A step up from the G400 is the G800 which offers twin, double sided 320K disc drives for extra data storage. Both the G400 and the G800 provide the possibility of further expansion for networking, modems, etc., via the IBM compatible hardware slots provided by the Graduate models. Each model comes complete with a well written user/technical manual and connecting leads.

**Just plug it in**

Unlike other add-ons there is no need to open the BBC to make the connection. The compact and tidy Graduate models simply plug in to the 1Mhz bus on the Model B. Within minutes you can be up and running with an IBM PC compatible system that really means business.

**The range**

Add 256K RAM, 640K disc storage and IBM PC compatibility to the BBC Micro for less than £1,000.

Graduate G400 (128K) £764 inc. VAT
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For further information complete the coupon today.

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Cable TV to transmit software for micros

A SPECIAL cable TV service aimed at home micro users is set for launch next year. Information and software will be transmitted as teletext by Thorn-EMI, one of the largest entertainment groups in the UK.

Adapters will be needed to download telesoftware, but the information pages will be accessible by anyone with a teletext television set. The service will be restricted to subscribers in major towns.

A service similar to the BBC and IBA, where teletext information is transmitted between television frames, Thorn-EMI's service will be “full-field”. This means that the whole cable channel is given over to teletext.

Richard Wolfe, who heads the project, said: “The channel will transmit 5,000 different pages every second. Each month the subscriber will be able to download between 20 and 100 different programs.”

This year we're still in an exploratory mode but we should have a commercial service running in autumn 1985.”

Thorn-EMI already transmits teletext with the Music Box cable service, but it’s squeezed between the picture frames in the conventional manner. At the moment it runs to 20 pages of music-related material: the Top Ten, tour news and video reviews.

Music Box will be available in about 40 towns by September to potentially one million homes. For £5 a month you get Music Box and three other channels. Premium services - for feature films and the like - cost about £7 a month extra. The full-field teletext service will be a premium channel.

Richard Wolfe explained: “We’re waiting for full-field teletext chips to come out next year before deciding on the hardware. Obviously with the telesoftware pages we’re looking for adapters for the popular home micros and certainly the BBC micro will be one of the machines we’ll go for.”

A full-field teletext service can offer many more pages than the IBA's Oracle, so rather than trying to compete in the mass market the IBA is revamping Oracle to attract commercial customers. As revealed exclusively in Acorn User last month, the IBA intends to add subscription-only pages of specialised information - the latest Stock Market prices for example.

As the Bill to permit this went through Parliament, John Horst MP had suspicions that by charging for teletext pages, the IBA may now, in a back door way, be entering the interactive services of cable television.

Douglas Hurd, the Home Office Minister set him straight: “The IBA is talking about a one-way service, whereas interactive services are, by definition, two-way.”

When asked about whether the IBA had considered full-field teletext, Pat Hawker, a technical spokesman, commented: “Unfortunately there are no spare channels for broadcasting full-field teletext. Instead we are expanding the conventional teletext service and will add some subscription-only pages for commercial users.”

Using Oracle, you can’t go much above 100 pages before the access time gets too long. Full-field teletext potentially offers 100,000 pages with similar access times to Oracle.

The IBA was hoping to run a full-field teletext service using the now-obsolete VHF television channels. Unfortunately the proposal was turned down and the channels went to cellular radio.

Aerial links to satellites

FOLLOWING on from August’s article on downloading weather satellite pictures, Weston Developments is offering a suitable aerial for £31.75 (plus £4.50 p&p). Called WB6/Usat, it is specifically designed for receiving satellite signals on the 136MHz band.

You need your own cable, but a filter box is available at £8.95 to match cable to aerial.

Further details from Roger Bunney, Weston Developments, 33 Cherville St, Romsey, Hants S05 8FB.

Ultracalc boost

ULTRACALC, the BBC's spreadsheet chip, has been upgraded. All reported bugs have been fixed and it now works with any BBC screen mode. When running with a second processor, the program is automatically relocated and 45K of memory is then available in mode 0.

Owners of the existing version can get the new chip for a nominal price when it becomes available at the end of this month.

Contact BBC Publications, BBC, 35 Marylebone High St, London W1M 4AA.

School challenge

BRITISH Gas is running a computer-based competition for secondary schools. Using a BBC micro program called Cedric, students have to conduct a survey in homes and suggest a plan for saving energy. The best school entry wins £1000, and there are prizes for individual students.

Teachers can obtain a free copy of Cedric from Mr R Wolfe, Education Liaison, British Gas, 326 High Holborn, London WC1V 7PT. Closing date is the end of the year.
Will you be the first Earthling to win a place?

Acornsoft are issuing a nationwide challenge to all Acorn Electron and BBC Micro users.

It's the challenge to join a new and exclusive group of computer games players: The Elite.

With 3-dimensional graphics, Elite is a game which is light years ahead of any other.

It strictly defines the rank of each and every player.

As your prowess improves, you move into higher ranks.

But make no mistake, to reach the top rank, your performance must become exceptional.

Then, and only then, will you qualify to call yourself a member of The Elite.

From harmless, you must become lethal.

In Elite, all players start as equals.

With the initial rank of “Harmless,” you will embark upon an experience unlike any that you have known before.

You will be a space trader who roams the universe, making your living from buying and selling the cargo in your Cobra space craft.

On your travels, you will encounter aggressors who are eager to put an end to your dealings.

Only the fittest will survive.

As you establish yourself as a survivor, you will win the right to a higher rank.

In all, there are nine, from “Harmless” to “Elite.” And your computer will continually tell you where you stand.

Trade with 2,000 planets in eight galaxies.

Besides survival, your success also depends on the rewards you reap from the cargo that you carry.
load your game onto cassette or disc each time you take a break from play.

When you reach the rank of “Competent” or higher, you should send us the secret code number revealed to you by your computer.

We will send you in return a special document which certifies your achievement. And you stand to win a valuable prize.

Are you ready to accept the challenge?

Elite is available on both disc and cassette for the BBC Micro and on cassette for the Acorn Electron.

With either, you will get “Elite: The Dark Wheel,” a compelling novel which sets the whole mood of your adventure. You’ll also get a flight training manual which will get you fit to roar into the unknown in your Cobra spacecraft.

Your Acornsoft dealer now has the entire package at £14.95 on cassette, or £17.65 on disc (for the BBC Micro) and £12.95 for the Electron. (For the address of your local stockist, call 01-200 0200.) Credit card holders can simply telephone 0933 79300 during office hours.

Alternatively, you can order by post from: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

You can also get a free Elite poster by ringing 0933 79300.

The cargo can be anything from foodstuffs to contraband. If you decide to trade in contraband, the rewards will certainly be higher. But so will the risks you take.

To ply your trade, you can dock at any of 2,000 planets in eight galaxies.

However, before you dock, you must use your wits to assess the planet’s political climate and the perils which may be waiting for you.

Also, in any of the eight galaxies, you may find yourself being asked to perform acts of considerable heroism and selfless courage.

Although these will bring you into danger, they can bring considerable rewards too.

We’re waiting to recognize your skills.

Achieving higher status in Elite will tax your skills to the limit. Which is why you must down-
Fighting talk on software piracy

TWO software companies have clashed this year and more could follow unless piracy can be stamped out. And it's not just down to a few big-time counterfeiters: if you have ever swapped games with friends then you too are a pirate in the eyes of the industry.

Nick Alexander, who chairs the Guild of Software Houses, claimed: 'For every legitimate tape sold, 10 or 12 copies are made.' Chris Holland of Salmander put the number nearer six but added that 'between £100m and £150m is lost in this country alone each year.'

Imagine collapsed in July and '50 to 80 per cent of the problem was due to copying,' said Nick Alexander. He cited how Salford CID seized 10,000 counterfeit copies of Imagine games in one raid. GOSH has set aside £50,000 to enable its 34 members to take court action.

Pirates fall into two categories: commercial counterfeiters who make copies by the thousand and pass them off as the real thing, and home users who make just a few copies to see if they work.

QuickSilva has started a civil action against one group of pirates after 30,000 copies were found in a single raid. Counterfeit has been found in legitimate retail outlets and street markets which were indistinguishable from the originals.

Amateur pirates can be just as destructive. One Blackburn doctor was selling £300-worth of copied Microdeal software for just £30. The company seized all his tapes and documents through the courts, and is now seeking damages 'of several thousand pounds' as 'to discourage others', according to John Symes of Microdeal. He added that similar actions were pending against a user group and a school.

Acorn's Chris Curry has claimed school computer classes harbour 'a den of thieves'. He told a Parliamentarian committee: 'You provide the software to one person and it gets copied throughout the school.' Rod Cousins of QuickSilva goes further, and thinks teachers often encourage piracy: 'If we find a teacher doing this, we are quite prepared to take him to court.'

Retailers have similar feelings. Matthew Hyams, manager of the Lion House store in London said: 'One school kid comes in and buys a program while five friends watch. Then they all go out together, presumably to make five illegal copies. Some even have the cheek to bring the original back saying it's faulty.'

The user groups have been on the receiving end of criticism. Peter Hughes who runs the Format 40/80 group takes a clear stand: 'Our group is dead against copying. I have had to turn down many applications from people - usually kids - who were obviously only interested in copying software.' However, he admitted his group was probably in a minority as many exist solely to copy and swap games.

The Format 40/80 group caters for disc users and will copy any genuine program tape to disc for members. When it was suggested this be classified as piracy, Peter Hughes replied: 'If you've bought a disc drive, why shouldn't you be allowed to get the benefits? Why should you have to buy a disc version of a program you already own?'

PSS, a Coventry software house, has adopted a policy of not advertising its magazine which carries adverts for tape or disc copies. Richard Cockayne, one of the directors, said he was 'fairly appalled' at the attitude of companies who sold copier programs.

He went on: 'In the longer term they are cutting their own throats. There's no need for such devices. We will replace any tape which doesn't load.'

He quoted the case of one 13-year-old selling pirate copies of PSS games through the classified columns: 'He was using a commercial tape copier program and had master tapes for 34 titles.'

When it comes to solutions, Nick Alexander differentiated between commercial pirates and the home user. For the professional criminals we are trying to get legislation for tougher penalties.'

He drew an analogy with video tape pirates: 'A change in legislation and some well-publicised raids drove them away - to computer software instead.'

For the small-time pirates, technical measures do stop casual copying, but the determined can usually crack protection devices. Nick Alexander hopes to 'appeal to their better nature as he feels legal remedies are inappropriate.'

Let's hope his faith is justified.

Law to beat pirates hinges on lottery

ONE raffle in November could be worth £150 million to Britain's computer industry. It's the yearly 'Private Members' Ballot in the House of Commons.'

The 20 names plucked out of the hat will be backbench MPs who get the chance to introduce their own private members' bill, but only the last six or eight have a real chance of seeing their measure become law. The lucky half-dozen or so will find themselves besieged to adopt various measures, one of which aims to outlaw pirates estimated to be costing software houses £150 million a year.

Hoping to find a friendly face amongst the MPs will be FAST - the Federation Against Software Theft. FAST, set up last July, has already got its draft bill on the stocks. In fact the measure has even been introduced in the Commons by Tory MP Nicholas Lyell, although it never had any chance of getting any further.

The situation is similar to video piracy two or three years ago. That was virtually stamped out by tough legislation. Penalties leap from just £50 on conviction to £2,000 for each offence, plus the possibility of jail.

The software industry hopes to repeat that success with a simple amendment to the video bill which amended the 1956 Copyright Act. The software measure proposes in turn amending the 1983 Act by simply adding after references to video films, the words 'or computer programme'.

Before any Beeb owner begins panic at what is in their own software libraries, a word of reassurance. Though no one is condoning amateur pirates who borrow and copy software that's not the target. 'It's the commercial pirates, the blokes who are selling stolen computer software for profit, that we're chasing,' he explained.

FAST's chairman, Donald MacLean, explained that come the day of the draw the Federation will be standing in the queue ready to pounce on the six or eight MPs heading the list.
ACORN COMPUTER SYSTEMS

BBC Model B Special Offer £320 (a)
BBC Model B + Starter Pack £348 (a)
BBC Model B + DFS £409 (a)
BBC Model B + Econet £389 (a)
BBC Model B + Econet + DFS £450 (a)
BBC Dust Cover £4 (d)
Pair of Joysticks £14.50 (d)

UPGRADE KITS
A to B £85 (d) installation £20
ACORN DFS Kit £85 (d) installation £15
Econet Kit £42 (d) installation £25
Speech Kit £47 (d) installation £15

ECONET ACCESSORIES
Terminator (Two reqd per installation) £31 (c)
File Server Level II £216 (c)
Clock with psu £35 (c)
10 Station Lead Set £22 (c)
Printer Server Rom £42 (c)
Extra Econet cable £1.50m (d)
File Server Level I £56 (c)
Econet User Guide £10 (d)

ACORN BITSTICK

The Acorn adaptation of the renowned ‘Bitstick’ graphic CAD package — the “expensive joystick” that lets you exploit the powerful capability of the BBC micro to the full. The joystick is of a robust design which achieves remarkable precision without fiddliness. Total control is available from the joystick using the on-screen menu. It can draw freehand or follow lines of shapes chosen with high accuracy, and colours can be chosen from a palette displayed on the screen. Any part of a drawing can be magnified, by a virtually unlimited number of times, and up to 48 drawings can be saved on a single disc. The discs use a visual library system for easy identification. Inside of its powerful features, the Bitstick is extremely friendly and easy to use, due to menus being displayed on the edge of the screens.

£328.00 (a) FX80 dump routine for the bitstick available.

TORCH UNICORN PRODUCTS

The TORCH Unicorn system has been in the field for over two years and is now a proven 80 system for the BBC. It gives you the potential to expand which no other system can currently offer. You can expand a single system with a 20Mb Hard Disc, have the processing power of a 32bit 68000 cpu with 256K ram and a UNIX operating system, or set up a network of up to 254 machines. All these capabilities are available NOW.

The TORCH UNICOMM Modem package is now available for the UNICORN range providing the benefits of the extensive TORCH communication packages. It offers three options: Unilview for viewdata services; Uniterm for terminal emulation; and Uninmail which allows messages and files to be exchanged between Unimail/Torcmail/Torcmaill-Plus users. Access to files can be controlled by hierarchical passwords which determine the extent of access. 280 Card ZEP100 with PERFECT Software Packages + 280 Basic £275 (a)
280 Disc Pack ZDP240 with software as above £275 (a)
20Mb Hard Disc + 4 x 400K Floppy Drive £1,950 (a)
UNICOMM Communications Package + modem £161 (a)
Unicorn 68000, Unix OS/Z80B/256K, 20MB Hard Disc, 400K Floppy £2995 (a)

ACORN Z80 2nd Processor

This processor converts your BBC into a complete business micro with all the computing power a professional would need. The system is CP/M based and is supplied with a very extensive software package. The package includes three office productivity programs, (memopian, filepian and graphplan), Systems generator program, three programming languages plus the ACCOUNTANT business program. Software is accompanied by extensive manuals that not only get you started but also answers your why's and how's. All for only £299 (a)

ACORN 6502 2nd Processor

This processor is designed for the serious computer user who wants to get more out of his computer. This processor provides increased memory — allowing up to 44K for Basic programs and up to 60K for assembly language programs, regardless of screen mode in use. (ideal for VIEW). An increase in speed means that programs run up to 50% faster. The second processor/BBC combination offer computing power comparable to systems costing twice as much. £175 (a)

TORCH GRADUATE SYSTEMS

This latest addition to the range of BBC upgrades will upgrade your BBC to a powerful 16bit business computer and make it disc & hardware compatible with the IBM PC. Its MS/DOS is customised to IBM compatibility allowing access to the massive range of IBM compatible software, programming aids, compilers and languages. It uses A8086 CPU running at 5MHz, 128K or 256K ram, single or dual drive, software compatibility allows Lotus 1-2-3, Flight Simulator and other popular IBM PC business programs to run. Connection of the Graduate is simple, with just a connection to the 1MHz Bus. The disk drives can be used in both BBC and IBM PC mode without needing an Acorn Disc Interface in the computer. The top-of-the-market GRADUATE Model G800/2 will come complete with the superb Xchange suite of programs, comprising a full feature word processor, a financial planner, a database, and a business graphics package. Although these programs are in modular form, they can be linked together to form an integrated software system that allows you to switch instantly between various tasks and to exchange information between programs. G800/2 £945 (a) Full spec & prices on application.
PRINTERS
ALL PRINTERS HAVE A 12 MONTH GUARANTEE

DOT MATRIX

This month we are adding the new KAGa printers to our range of quality dot matrix printers. These printers, with their EPSON compatible control codes, are available in 80 col & extra wide 156 col versions. Features include NEAR LETTER QUALITY print using a 23 x 18 matrix, Dot addressable graphics in 8, 9 & 16 pin modes. Text modes include Normal, Italic, Bold, Condensed, Super & Sub script, Proportional spacing. Defined characters can be placed in ROM to give personalised print. An integral 3K buffer, both friction & adjustable tractor feeds with built in paper roll holder, etc. etc. makes these superb 'value for money' printers unique.

KAGa (80 cols) £249 (a) KPI90 (156 Cols) £375 (a) (With free BBC cable).

We continue to supply the ever popular, definitive EPSON range. This 'industry standard' range provide reliability and quality 'second to none'. The budget RX80FT Dot Matrix, has 100cps and all standard printing and graphic functions as well as friction and tractor feed. The deluxe FX80 has all the above, as well as a 160cps, buffer, programmable characters etc. For wide paper use — up to 16", the RX/100 are ideal. RX80F £225 (a); RX80FT £240 (a); FX80 £318 (a); RX100 £345 (a); FX100 £450 (a).

DAISY WHEEL

The Brother HR15 daisy wheel offers features normally found in printers costing far more. Features include: 14 cps, 3K buffer, proportional spacing, underlining, bold type and shadow printing, two colour printing, super & subscript and many other features. Centronics parallel interface is fitted as standard.

Brother HR15 £349 (a) (With free BBC Cable).

The JUKI 6100 daisysheel with 20cps, 2K buffer, and switchable 10, 12, 15cps + proportional printing. A linear motor ensures optimum reliability.

JUKI 6100 £345 (a)

GRAPHICS PLOTTER/WORK STATION

Equally at home in the artists studio, hobbyists workshop, science lab or a classroom, this system has something to offer for everyone. The 3 colour graphics plotter provides both precision and versatility. The carriage can be moved with an accuracy of 0.025cm over an A4 area — the plotter being able to accept paper and far thicker materials at sizes of up to A3. The basic plotter carries 3 colour pens each of which is software selectable. Additional accessories greatly enhance the versatility of the unit without loosing the accuracy. The servo controlled drill/router, and scriber can be used on various materials. A unique Opto Sensor (using a Hewlett Packard device) turns the plotter into a high-res scanning digitiser to read & store whole diagrams and photographs.

Workstation Complete £490(a); Basic Plotter £270(a); Software on disc £3.00; Power Supply, PS12V £42; PS24V £78; Drill/Router Attachment £78; Scriber £7; Opto Sensor £72

TECHNOMATIC
All prices exclude VAT

PRINTER ACCESSORIES

EPSON
Paper Roll Holder £17 (d) FX80 Tractor Attachment £37 (c).
Interfaces: 8143 RS232 £35(c); 8148 RS232 + 2K £55(c); 8132 Apple II £56(c).
1865 IEEE + Cable £65(c).
Serial & Parallel Interfaces with larger buffers available.
Ribbons: RX/FX/MX80 £5.00(d) RX/FX/MX 100 £10(d); FX80
Dustcover £4.50 (d)

KAGa TAXAN: RS 232 Interface + 2K buffer £85(c); Ribbons KPI90/1910 £6(d)
JUKI: RS232 Interface £65(c); Spare Daisy Wheel £14(d); Ribbon £2.50(d)
Sheet Feeder £199(a); Tractor Feeder Attachment £99(a)

BROTHER HR15: Sheet Feeder £199(a); Ribbons Carbon or Nylon £3(d)

BBC Printer Lead: Parallel (42") £7(a); Serial £7(a)

Printer Leads can be supplied to any other length.

Plain Fanfold Paper with extra fine perforation (Clean Edge): 2000 9.5" x 11" £130(b); 2000 15" x 11" £18.50(b)

Labels: 2-3/4" x 1-7/16" in quantities of 1000

Single Role: £5.25/1000 (d); Triple Role: £5.00/1000 (d)

PRINTER SHARER BUFFER

A unique deluxe printer buffer/sharer providing a simple way to upgrade your computer system by allowing greater utilisation of existing equipment by reducing the waiting time for printing documents. Data from three computers can be loaded into the buffer which will continue accepting data until its 64K storage is full. The buffer will automatically switch from one computer to the next as soon as that computer has dumped all its data. The computer is then available for other uses. A LED bargraph indicates the memory usage, with LED indication showing from which computer the data is being fed from. There is simple push button control for PAUSE, RESET, and COPY facilities. The copy facility is ideal for continually printing copies of one document without 'tying up' the computer. Built in mains psu.

SP110 BUFFER/SHARER incl one cable set £275(b)

PRINTER SHARER

Three Computers to one printer (parallel).... £129(b)
Six Computers to One Printer (parallel)..... £129(b)
Cables for Three Way Sharer.... £25(c)
Cables for Six Way Sharer... £38(c)

COMPUTER SHARER

Two Printers to one Computer... £19(c)

GRAFFPAD

A low cost graphic tablet offering the performance & durability required by industrial and educational users. It is compact, accurate & reliable; working area 240 x 192mm + menu area. Comes complete with a CAD packag. £120 (b). 'Microdraw' CAD Package £217.00 (d).

VIEW PRINTER DRIVER FOR FX80/KP810

This driver allows the use of all FX80s fonts to be used in text written using the VIEW rom. If user defined characters are held in the printer buffer they can also be used within the text. Manual includes examples. Supplied on 40 or 80 Track disc. £7 (d).
MONITORS

A choice of high quality RGB and Monochrome monitors are available. The British made MICROVITEC Std/Mid/Hi Resolution 14" monitors offer a consistent reliable performance. Their resolution ranges from 452 pixels horizontal on the std res monitor to 895 pixels on the Hi res monitor. Std res monitors are also available with RGB/PAL/Audio inputs. Dual input versions also available.

143 Std. Res. RGB £175 (a); 1431AP RGB/PAL/AUDIO £225 (a); 1451 Med. Res. RGB £295 (a); 1441 Hi-res RGB £420 (a);
2031 20" Std. Res. RGB £320 (a).

Plinth for Microvitec 14" Monitors £8.50 (c).
The KAGA Vision 312" RGB monitor offers a superb performance but in a smaller cabinet with a genuine etched anti-glare screen. £358 (d). The Japanese made SANYO and the KAGA monochrome monitors provide an ideal answer for an 80 character hi-visibility display. A futuristic swivel base plinth with integral clock is available for the Kaga green monitor as an optional extra.

SANYO DM 8112CX Hi Res Green Screen £39 (a)
KAGA KX1201G 20MHz Hi Res Green with etched screen £106 (a)
Swivel Base for Kaga Green fitted with digital clock £22.50 (c)

Video Digitiser

A high quality yet cost-effective unit offering uses for the scientific, educational and home user. Feeding in a video signal (this can be from a camera, VCR etc) will output to the BBC a high quality picture, with eight different grey levels. This picture can be stored on disc, manipulated or dumped to a printer. The friendly, yet sophisticated menu-driven software comes complete with an Epson printer dump £250 (a).

SANYO DR10I DATA RECORDER

A high quality tape recorder with circuitry specifically designed for data recording. Having normal as well as data recording, as well as cue/slow and a tape counter, it makes this recorder an ideal choice for anyone wanting a reliable tape storage device. £30 (c). Cassette £3.00 (c).

ACORN ANFO3 TAPE RECORDER

The official Acorn Anfo3 tape recorder recommended for the BBC. Has a counter, automatic record level, mains/battery and comes complete with a BBC cassette cable £28.50 (c).

RH LIGHTPEN

A superior quality lightpen, features including: adjustable sensitivity, LED output to show data transmission, microswitch tip. Full software backup. £39 (c). The ‘Lightpen Colour Graphic Software’ pack helps you to draw line drawings as well as more complex drawings. Colour fill, point plotting, line, square, triangle, circle XY rulers are all available with rubber banding facility. £7 cassette. £9 Disc. The ‘Artun’ pack provides full interaction between pen and screen. Allows your initial design to be shrunk into a high res format, and these images can be stored for subsequent use. £7 cassette. The ‘Word Master’ encourages the use of correct grammar and is an excellent aid. £7 on cassette. The ‘Ed Master’ uses a quiz format, and up to 160 questions may be programmed by the teacher. £7 on cassette (d).

DISC DRIVES

TechnoDisc Drives offer the best value for money. They are fitted with high quality Slimline Japanese mechanisms & represent the state of art in disc drive technology. They are built to the highest standards in design and production and are all tested to their full performance capability before packaging. All drives are available with or without integral power supply. Dual Drives with PSU are supplied with generously rated integral switched mode power supplies. All 80 Track TEAC drives are fitted with 40/80 Track switching at no extra charge to the user. Attractively designed steel casings are painted in hard wearing BBC matching beige paint. All drives can operate in single or double density modes.

Drives are supplied complete with necessary cables, manual and formatting disc and are ready to be connected to the computer.

Single Drives

100K 40T SS TEAC £100(a)
200K 80T SS 40/80 TEAC £155(a)
400K 80T DS 40/80 TEAC £185(a)
3" 100K HITACHI Drive £115(a)

Dual Drives

2 x 100K 40T SS with psu: TEAC £300(a)
2 x 200K 80T SS with 40/80TEAC £375(a)
2 x 400K 80T DS with psu: 40/80TEAC £400(a)
2 x 400K 80T DS with psu: 40/80TEAC £425(a)

Our 40/80 Track Switching Module will take care of your frustration of not being able to read or write 40 Track software on 80 Track drives. No additional cables or accessories needed. Full fitting instructions supplied. All for only £30 (c).

The FLOPPICLENE disc head cleaning kit is the ideal way to ensure the optimum performance of your drives. The use of disposable cleaning discs eliminate the risk of recontamination and abrasion of the sensitive disc heads and ensure continuously reliable data capture and transmission.

Floppiclene with 20 disposable cleaning discs £14.50 (b)

OFFER

SCOTCH 3M DISCS

This month we are offering these high performance discs at a bumper bargain price — not to be repeated again. The current offer will be valid for orders received until 15th October only. These discs are manufactured with advanced manufacturing techniques that have enabled 3M to set the industry standard. Their quality is such that their error free performance is guaranteed for life.

Discs in pack of 10 (a) 40T SDDD £12.50(e) 40T SDDD £17(e) 80T SDDD £21(e) 80T SDDD £26(e)

DISC ACCESSORIES

Single Disc Cable £6 (d)
10 Disc Library Case £15 (d)
30 Disc Case £8.00 (c)
Lockable Storage Boxes: 30/40 Discs £14 (c) 70/80 Discs £18 (c)

KENDA DMFS

This is an alternative to the Acorn DFS with several significant advantages. *Single/Double Density "Up to" 379 Files per disc. No user ram required i.e. PAGE = 6EO "CP/M compatible file structure. *Can read DFS files. *Can read most Acorn and other protected software. Simple plug-in installation comes complete with utilities disc and manual £120 (c)
MODEMS
We stock a modem for every requirement, whether it is for the business, or private user, whether you require access to a public database or a mainframe, whether for local or international use. We also carry suitable software — see our section on ROMs.

TORCH UNICOMM
See our section on Torch for further details.

ACORN PRESTEL
The dedicated Prestel adaptor complete with integral, BT approved, auto-dial modem and software in ROM £99(a).

BUZZ BOX
A full spec, BT approved, pocket size, direct connect modem with both originate & answer modes, full & half duplex, allowing access to many databases, bulletin boards as well as intercomputer communications. It conforms to CCITT V21 300/300 Baud standard. Batteries mains powered. £65(c) BBC Lead £3.50 External PSU £8.

WS2000
A world standard direct connect modem switchable between 75, 300/300, 600, 1200/75, 1200 Baud, awaiting BT approval. It is compatible with Bell 103/113/108, 202 and CCITT V21 & 23 standards and allows you to communicate with virtually any computer system in the world. This is one of the new generation modems, that will probably cover any communications standards you would ever need. This is the modem that will cover Prestel, Micronet, Telecom Gold, Distel, Microweb, One-to-One, Bulletin Boards both in the UK and abroad, etc. etc. etc. as well as user-to-user communication. It also has a rather useful facility of 'reverse-Prestel' mode i.e. 75/1200 so that you can communicate with other users who only have a standard 1200/75 type modem. What possibly gives this modem its biggest advantage is its option of computer controlled switching between all modes of operation. In addition, separate auto-answer and auto-dial cards are available, giving this modem possibly the greatest potential of all. Mains powered. £129(c).
Please phone for details of optional extras.

TELEM0D-2
A BT approved modem complying with CCITT V23 1200/75 Duplex & 1200/1200 Half-Duplex standard, that allows communication with Vewdata services e.g. Prestel, Micronet etc., as well as using 1200 Baud for communicating with other computer users. Mains powered. TELEMOD 2 £65(b)
BBC Lead £3.50

ACORN IEE INTERFACE
This interface enables a BBC computer to control any scientific and technical equipment that conforms to the IEE488 standard, at a lower price than other systems, but without sacrificing any aspect of the standard. The interface can link up to 14 separate IEEE compatible devices. Typical applications are in experimental work in academic and industrial laboratories, with the advantage of speed, accuracy and repeatability. The interface is mains powered and comes with cables, IEE488 ROM, and user guide. £282(a)

ACORN TELETEXT INTERFACE
This interface enables a BBC Computer to receive and store teletext information transmitted by both BBC and ITV. In addition it allows the downloading of transmitted software. The unit comes with a ROM and user guide. £185(b)

TECHNOMATIC
All prices exclude VAT

EPROM II
Our current version of the highly popular Eprom programmer is now being enhanced to provide more and better facilities for easy programming by the user. The software will maintain its superiority over all currently available similar programmers. The range of eproms handled has been widened to include the eproms with lower programming voltage and byeproms which can be programmed using the fast algorithm. Control of all operations has been moved to the keyboard. The screen display has been improved to give more information. The screen editing facilities have also been modified to simplify the data entry.

Preliminary Information
* The new Eprom Programmer will now program 2716, 2732, 2764, 27128 and 27256 + 5v eproms, and all but the 27256 in a single pass.
* The programmer will be supplied with integral power supply and interfaces with the BBC via the 1MHz bus. It is fully buffered and complies with Acorn protocols. There is no power drain from the computer.
* No knobs or switches to fiddle with — total control from the keyboard.
* Fully software driven with easy to understand instructions displayed on the screen.
* Eprom type selectable from the keyboard.
* Selectable programming voltage (25/21/21.5V).
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LIFE, THE UNIVERSE AND MY BEEB

Astronomer Chandra Wickramasinghe
and his micro pursue a theory of organisms in space

Computers are now vital to space science and astronomy: first collecting information from space probes and satellite-borne telescopes, and then analysing and interpreting the results. Micros have also played a role, especially when linked to equipment launched in rockets.

However, I have a more personal story of working with micros. My research into the origins and evolution of life in the Universe is aided and abetted by my own BBC model B with Cumana disc drive, PL digitiser, Epson FX80 printer and Tandy graph plotter. It might seem an amateurish medley of equipment, but I found it better in some ways than a university mainframe computer!

My tale begins with the Lagoon and Trifid nebulae in the constellation of Sagittarius (figure 1). Here is a rich field of stars in a portion of the Milky Way, containing in addition to stars, clouds of hot glowing gas, with dark patches and striations silhouetted against a brighter background. The dark patches represent clouds of obscuring dusty material found in many galaxies and known to astronomers as "interstellar fogs".

Matter exists within these clouds in a variety of forms: single atoms, ions, molecules and, perhaps the most baffling component of all, 'dust'. These dust particles have radii in the range 1/100 to 1/3 of a micrometer and their space density by earthly standards is exceedingly low - the average distance between them is as much as 100 metres! Despite the tenuous nature of the clouds, their size - light years across - is so vast as to produce the fog patches shown in figure 1.

Light from distant stars in our galaxy is dimmed and reddened by scattering and absorption effects in interstellar dust particles. The effect is similar to the dimming of a street light seen through a fog, caused by the water droplets scattering the beam of light. Since the 1930s, a succession of attempts have been made to determine in a quantitative way the dimming - or extinction, as it is called - of starlight due to cosmic dust. In fact, the intensity of visual starlight is reduced by a factor of about 100 for every 3000 light years travelled through interstellar space. It was also readily shown that this dimming could reasonably be attributed to tiny solid particles with average radii of about one third of a micrometer. Furthermore, the smeared-out density of dust made up one tenth of a per cent or so of...
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all the stellar and non-stellar material in the immediate vicinity of the Sun.

Data on interstellar dust is being steadily added to from observations made by satellites such as the International Ultraviolet Explorer and IRAS. Much of the information has accumulated over the past two decades, and it was at the start of this period that my own work with Sir Fred Hoyle began. We set out in 1962 to find a composition of cosmic dust that could explain the available data, and we have continued in this endeavour unceasingly ever since. We first explored the possibility that the dust in space might have an icy composition, but had no success at all. Then we discussed the possibility of carbon dust grains and carbon grains overlaid with icy mantles. Here we had a limited measure of success in that observations using the latest satellites and rockets proved that at least a fraction of the dust in space was made of carbon in the form of graphite. Next we considered mineral grains and mixtures of minerals with graphite in attempts to match the full range of observational data, but woefully without luck. The precise composition of the interstellar dust stubbornly defied identification for 10 years.

Then, in 1973, we considered the possibility that cosmic dust had a predominantly organic composition. This model instantly led to a better – but not perfect – agreement with observational data than for purely inorganic grains. However, we felt that at long last we were approaching the correct solution. Then in 1979 a major breakthrough occurred. Sir Fred Hoyle and I considered the seemingly outlandish proposition that the cosmic dust grains were not merely organic, but biological: live, freeze-dried bacteria in space.

Within days of arriving at this heresy, a mathematical calculation was carried out on a BBC micro to determine the way in which such particles cause the dimming of starlight. The computation involved a solution of the well-known Maxwell’s equations with the boundary conditions for spheres having the properties of biological particles. The BBC’s highly versatile Basic language made this calculation relatively easy, and the resulting graphs were plotted on the Tandy plotter-printer. The calculated curve of the microbial model agreed almost precisely with the astronomical data (figure 2). This agreement, coming after almost two decades of failure, gave us confidence to embark further in the direction of cosmic microbiology.

Together with Mr S Al-Mufti and Dr A H Olavesen, Sir Fred Hoyle and I next set up a program of laboratory studies to look for diagnostic fingerprints of
biology at infra-red wavelengths. An infra-red spectrum of a dried out microorganism over the waveband 2.9-5.5 micrometers was compared using the digitiser with data for the infra-red source IRS7 located near the centre of our galaxy. The result, shown in figure 3, was plotted on the Tandy. Figure 4 shows a comparison between the biological model and astronomical data over another waveband, 8-12 micrometers. The correspondences seen in figures 2-4 are in our view decisive for the identification of cosmic bacteria. Bacteria resembling terrestrial bacteria, but in a freeze-dried state, seemed to be present in vast quantities on a galaxy-wide scale, giving rise to the dark fog effects.

But how, you might ask, could such a situation arise, and how does this connect with other facts from astronomy and geology as well as biology? Later, in 1965, from the works of P. H. de Ruyter (1922-1965) first showed that micro-organisms did not arise spontaneously, but were derived from pre-existing microbes. The question then arises as to how the first micro-organisms arose on the Earth. The usual theory is that flashes of lightning in a primitive atmosphere led first to the conversion of simple inorganic molecules into organic molecules which are the building blocks of life, and thence to the assembly of organic molecules into living structures. Laboratory studies have indicated that the first of these steps might well have occurred, but laboratory experiments on the second step have been singularly without success. An argument against the usual theory is that the first signs of microbial life in the Earth's fossil record occur far too abruptly for any chemical evolution to have preceded it. In fact, at the very first moment that life could have survived on Earth, about 3.8 billion years ago, we find evidence of microscopic fossils of bacteria and microfungi. There seems too little time for any 'primordial soup' to have brewed.

There is, of course, no logical reason why life should have started de novo on Earth. Our planet was assembled from cosmic material along with the Sun and the other planets some 4.6 billion years ago. The entire solar system is now surrounded by tens of millions of cometary objects in the form of a gigantic spherical halo. Although direct collisions with comets are rare, the Earth is estimated to pick up some thousands of tonnes of cometary debris each year. What this debris is made of can only be guessed at by studying the gases that escape from the comet head as seen for instance in the fan-like structures of figure 4. Sir Fred Hoyle and I have argued that comets are in fact chock-a-block with cosmic micro-organisms, and that their nuclei contain warm liquid ponds which are congenial places for such micro-organisms to breed. Indeed, studies have shown that the overall atomic composition of comet material is remarkably life-like. Moreover, fossilised remains of micro-organisms have been discovered within carbonaceous meteorites, which are thought to be spent comets. So astronomical evidence now points to life starting on Earth by contamination from comet-born micro-organisms.

Cometary micro-organisms must necessarily have been derived from cosmic dust clouds. We know that stars similar to the Sun are born within such clouds, and comets would undoubtedly be associated with these stars. The cosmic life-cycle of biology is shown schematically in the feedback loop of figure 5. In the earliest days of the Galaxy there need to have been only a small number of viable micro-organisms. Cosmic microbiology would become progressively amplified with every successive generation of stars. The great power of the feedback loop lies in the enormous replicative ability of biology: a single bacterial cell can double in a matter of hours.

At the present stage in the evolution of our Galaxy some 10 billion circuits in the loop of figure 5 would have taken place, one for every sun-like star. The total mass of material that has been biologically processed would measure some 10^8 to 10^9 tonnes.

At the time the Earth formed as a solid body, biological evolution in the galaxy would already have been well advanced, and this heritage of evolution would have been trapped in the comets of our solar system. Cometary micro-organisms would have been raining down on the Earth essentially from the dawn of its creation. At the beginning, however, hostile physical conditions would have prevented the survival of any incident organisms, in the same way that organisms would now perish at the surface of the airless Moon.

Cosmic life took root on our planet at the very first moment when survival was possible, when the Earth had acquired its oceans and atmosphere nearly four billion years ago.

According to the present point of view the influx of cometary microbes must have continued unabated to the present day, some causing epidemic diseases in plants and animals, others generally adding to the microbial flora of our planet. Furthermore, and perhaps most importantly, the evolution of living forms on our planet would seem to be primarily controlled by the entry of new genetic information from cosmic micro-organisms.

**NEXT in our Trailblazers series:**

Scientists are using a BBC micro to roast weeds and give cocoa plants the kid-glove treatment. Find out why in next month's issue.
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SCALING MUSICAL HEIGHTS

Jeremy Vine conducts a musical lesson on the Electron

In the August issue of Acorn User we published some musical listings but you may not have understood how the programs worked. This month we'll look at the SOUND command available on the Electron and BBC and show how easy it is to produce music. You may have already experimented and created the odd sound or two but creating music is more complicated – but not too difficult.

The SOUND command has four parts to it and we can best understand its use by looking at each part in turn. Type in the following line:

```
SOUND 1, -15, 100, 20
```

The sound you can hear is the C above middle C and it is playing for one second. The SOUND statement is followed by four sets of numbers, each there for a specific purpose and determining the actual noise you hear. This can be more easily understood if we name each part as follows: SOUND, C, A, P, D.

The first parameter C refers to the channel number. The Electron has four SOUND channels but unlike the BBC only one channel may be played at a time. These channels are numbered from 0 to 3, channel 0 being reserved for noise and channels 1 to 3 for tone. To hear the difference type in the SOUND statement above but change 1 to 0. Whether you type C as 1, 2 or 3 the tone will be exactly the same. These three tone channels produce the same effect and as only one can be used at any time we will use only the number 1 from now on when we need a tone. The other two channels (2 and 3) have been included to make the Electron compatible with the BBC micro.

The next parameter, A, is responsible for the amplitude of the sound and can represent one of three different things depending on the value assigned. If A is negative then the sound is 'on'; if set to 0 it is 'off'. However, if the number is from 1 to 16 inclusive an ENVELOPE of the same number will be selected. I won't cover the ENVELOPE command in this article but don't worry as we need not use it for the moment.

In my example I used –15 as the value. This means the sound is turned on. The reason for using this number is that it is the most common amplitude value used on the BBC on which you can alter the level of the sound. The amplitude level cannot be altered in the same way on the Elk but by using –15 we keep our programs compatible with the BBC.

The third parameter P stands for pitch and as the name suggests it controls the pitch of the sound output. This value can be in the range 0 to 255. Each step represents a change in pitch of a quarter-semitone and from this we can produce a range of pitches covering more than five octaves. Figure 1 shows these values and their corresponding pitches. Try changing the value of P to see how the pitch changes.

The final parameter, D, determines the duration of the sound and each step is equal to 50 milliseconds. In the example D = 20 this is equivalent to keeping the sound on for 1 second. To work this out multiply D by 50 and divide by 1000.

Now we know how the SOUND command works, and the relationship between the pitch control numbers and the pitches they create, we can start to write music on the Electron.

Type in and run program 1. The program plays a chromatic octave of the 12 semitones from middle C. If we go back to my explanation of the pitch parameter, each unitary value is equal to a quarter-semitone. Therefore four units equal a semitone and octaves will therefore occur at intervals of 48 steps, because there are 12 semitones in an octave (ie, 12 x 4). To produce a different octave use figure 1 to look up the note of your choice and change the parameter 52 in line 20. Changing 52 to 68, for example, will play the chromatic octave from E instead of C.

Now you might be wondering how to...

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**BUZZWORDS**

**Channel**—The sound generator on a BBC micro can make up to four sounds at once, so it has four channels. Channel 0 produces specific noises, while the other three produce single notes. The Electron also has four channels but in effect only one channel can produce a sound at any one time.

**Amplitude**—The volume or loudness of a sound.

**Pitch**—The frequency of a sound.

**Duration**—The length of time a note plays.

**Envelope**—The volume (amplitude) and pitch of a sound rise and fall throughout the sound's duration, and both Beeb and Electron can use pitch and amplitude envelopes to give a sound 'shape'. These are set up with the ENVELOPE statement.

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<td>160</td>
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<td>E</td>
<td>20</td>
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<td>116</td>
<td>164</td>
<td>212</td>
<td></td>
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<tr>
<td>F</td>
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<td>120</td>
<td>168</td>
<td>216</td>
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<tr>
<td>F#</td>
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<td>76</td>
<td>124</td>
<td>172</td>
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<tr>
<td>G</td>
<td>32</td>
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<td>128</td>
<td>176</td>
<td>224</td>
<td></td>
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<tr>
<td>G#</td>
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<td>84</td>
<td>132</td>
<td>180</td>
<td>228</td>
<td></td>
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<td>A</td>
<td>40</td>
<td>88</td>
<td>136</td>
<td>184</td>
<td>232</td>
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<td>A#</td>
<td>44</td>
<td>92</td>
<td>140</td>
<td>188</td>
<td>236</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Table of pitch values for each semitone

---

ACORN USER OCTOBER 1984
MAKE SURE YOUR HOME COMPUTER WORKS... FOR YEARS AND YEARS

Guarantee years of service from your home computer. Protect your investment by joining the MICRO REPAIR CLUB. After your warranty has run out can you afford the manufacturers’ repair charges which can be as high as £60 minimum?

THE MICRO REPAIR CLUB is a brand new organisation offering a unique scheme which guarantees that should your computer break down, it will be repaired at absolutely no cost.

THE MICRO REPAIR CLUB has been formed to save you money and ensure that your computer is in tip-top working condition for years to come.

A one-year membership that guarantees all repairs to your micro costs only £24.95, with an annual renewal of £14.95.

A two-year membership costs £35.95, three years £46.95. For incredible value for money a four-year membership costs only £57.95.

All prices are inclusive of VAT

THE MICRO REPAIR CLUB is backed by one of the world’s largest insurance groups and the actual repair work will be carried out by Computeraid Services, a division of Thom EMI Information Technology Ltd.

There are no greater protection. So if you own a Sinclair, BBC, Acorn, Dragon, Commodore or any other home computer join the Club by ringing the HOTLINE on 01-946 7777 or clip the coupon below and send it to:

Micro Repair Club Limited, Swan Court, Mansel Road, Wimbledon, London SW19 4AA.

I would like to join the MICRO REPAIR CLUB for _______ years and look forward to receiving my full membership pack.

I enclose a cheque for £24.95 [ ] One year’s membership

£35.95 [ ] Two years £46.94 [ ] Three years £57.95 [ ] Four years

Made payable to Micro Repair Club Limited

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Visa/Access card No: ____________________________

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Address_______________________________________

I own a ___________________ home computer and it is in working order.

Opus Supplies offer you Rambank – a 32K sideways RAM board to really boost the capabilities of your Micro.

Unlike ROMs, each block is individually write selectable and can be write protected to ensure against accidental erasure.

If you’re running short of ROM sockets, the RAM card allows you to load utilities as and when they are needed.

We’ll give you software and utilities free of charge, so you can save ROM based firmware on disc.

- Uses low power 64K dynamic RAM chips.
- Simple to install.
- Consists of 2 x 16K blocks of sideways RAM.
- 2 year guarantee.

Opus Supplies Ltd. 158 Camberwell Road, London SE5 0EE. 01-701 8668 or 01-705 6155.
create a scale. So far we have played a series of semitones but a scale consists of both tones and semitones. Program 2 gets round this problem by inserting tones or semitones in the correct sequence. Line 70 holds the data for the tones (t) or semitones (s) and line 10 gives the user the choice of scale by entering the appropriate value of the starting note. If a tone is needed an extra value of 4 is added to the variable 'note' to extend the gap to 8 and therefore a whole tone.

Let's go one step further now and play a complete tune. Using the lookup table of figure 1 we now have enough information to convert musical notes into numbers that the micro will understand. That's one half of the conversion from a musical score to numbers; the second part is to tell the computer the duration of each note. Figure 2 shows the numeric values needed for note durations. We can therefore write each note as a pair of values, the first representing the pitch, the latter the note duration.

Program 3 follows such a method and a tune has been typed into the DATA statements in the form of pitch and duration values. By changing the numbers in the DATA statements you can write in your own tunes and the tempo can be altered by changing the value in line 10.

Entering music via DATA statements is fine but for the more enterprising composer there is no substitute for having a keyboard at the fingertips. Once more this is no problem to the Electron and with a bit of thought we can simulate a keyboard instrument. When playing a musical keyboard, notes can be short or sustained, depending on how long or hard a key is pressed. However, with the Electron pressing a key doesn't have the same effect – a note can be played long after the finger has been removed because it plays for a fixed length of time. To ensure that the note is played only while a key is pressed we have to repeat a note very fast instantly to ensure that no gaps occur and that when the finger is removed the sound stops. Program 4 does this. To hear the effect type in the listing and run it.

The important parts to note are the setting of the key delays 'FX11' and 'FX12', and the conversion of a note to a number. By using the INSTR function we can use the normal qwerty keyboard to represent notes. This is done by assigning all the notes to be used to a single variable 'note$' and then using GET$ to search for the occurrence of the pressed key within the string 'note$'. The key to this is the INSTR function and INSTR works by searching for a match of the string input to the one

held in memory, in this case 'note$'. If a match is found the position of the key pressed within notes is multiplied by four to give the numeric value for pitch (four being the starting point for the note C). For example if a 'F' is pressed, the position within the string would be 1 and therefore C below middle C would be played. If the key pressed is 'I', the position returned would be 6 and 6*4 = 24. If you look this up in figure 1 you'll see the note to be played is F below middle C. By these means we have reproduced a keyboard spanning two octaves, depending on whether the key is lower or upper case.

This is not, of course, all that you can achieve with the sound chip of your Electron or BBC. In a future article we will take the story further and consider the use of the ENVELOPE command. If you can't wait, though, Martin Phillips has something to say about the subject in his Hints & Tips column.

Program 1. Chromatic octave of the 12 semitones from middle C

<table>
<thead>
<tr>
<th>Note Name</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crotchet</td>
<td>8</td>
</tr>
<tr>
<td>Dotted semiquaver</td>
<td>2</td>
</tr>
<tr>
<td>Dotted minim</td>
<td>16</td>
</tr>
<tr>
<td>Quaver</td>
<td>4</td>
</tr>
<tr>
<td>Dotted minim</td>
<td>24</td>
</tr>
<tr>
<td>Semibreve</td>
<td>32</td>
</tr>
</tbody>
</table>

Program 2. Tones and semitones to make up a scale

<table>
<thead>
<tr>
<th>Note Name</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crotchet</td>
<td>8</td>
</tr>
<tr>
<td>Minim</td>
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<tr>
<td>Dotted minim</td>
<td>24</td>
</tr>
<tr>
<td>Semibreve</td>
<td>32</td>
</tr>
</tbody>
</table>

Program 3. Pitch and duration values combine to give a tune

Program 4. Micro keyboard as musical keyboard

These programs, around which Jeremy Vine has written his article, were devised by Joe Telford

ACORN USER OCTOBER 1984
HAS YOUR BBC COMPUTER GOT ITS SIDEWAYS RAM BOARD YET?

Not surprisingly many BBC computers have got their sideways RAM boards. Solidisk Sideways RAM can be completely integrated into the BBC computer system: with 6502 and 280 second processors, Torch disk pack, teletext, Econet and Solidisk 8 - sideways ROM expansion board.

Adding Sideways RAM to the BBC computer is simple. And it will multiply the machine's power.

Here is how.

1 - HOW DOES IT WORK?
Occupying the same place as sideways ROMs (such as BASIC, DFS etc) it is treated like other sideways ROMs and therefore can replace them.
Sideways RAM can run any language, and filing system, wordprocessors, databases etc.

2 - WHAT SORT OF SOFTWARE DOES IT RUN?
Better than sideways ROM, sideways RAM can be written into. This property makes it not only possible to run the same programs as their ROM counterparts but sideways RAM can be used as Virtual Memory, RAM disc, printer buffer, Basic program store, 65C-02 assembler, zero RAM, take DFS etc, etc.

3 - WHAT OTHER SERVICES DO YOU GET WITH ALL SIDEWAYS RAMS?
Solidisk sideways RAM comes with lots and lots of free software (see list on opposite page). As a sideways RAM user, you will be able to get updated disks*, free local expert advice and free bi-monthly newsletters to keep you informed. Solidisk spend more than 1,000 man hours every month to produce free software for all sideways RAM users.
More and more free software will be available every month.

4 - WHO USES SIDEWAYS RAM?
Solidisk sideways RAM is widely used in schools for ECONET, by programmers to develop new software, in small business systems for wordprocessing and database** and now at home, even for games. New applications are being found every day, such as moving screen memory to Sideways RAM (essential for increasing memory for VIEW and VIEWSHEET), Colour Imaging System, Teletext page logger and generator, computer typesetting etc.

Sideways RAM is such a versatile and flexible instrument that it will renew your interest continually.

5 - WHICH SIDEWAYS RAM DO YOU NEED?
Solidisk sideways RAM is available in multiples of 16k, each replacing a sideways ROM. Units are in 16k, 32k, 128k and 256k.
The first step is to evaluate your needs.
You can buy a small unit to start with, and exchange it later for a larger one. Extra costs involved with upgrading are minimal. The SWR16, 16k sideways RAM is adequate for most simple tasks (running common programs or for Econet slave stations), including fast disk copying with a single disk drive.

For wordprocessor using VIEW or WORDWISE, a SWR32 will do. Large documents (20 page plus) will require something like SCRIBE and the 128k or 256k Solidisk**.

For database, unless very high speed is required, a SWR32 will suffice for most popular databases such as Beebase, Fileplus, Starbase, Datagem. Otherwise use the 128k or 256k Solidisk**. For the 6502 and the BITSTIK you will need the 256k Solidisk.

Remember - the more memory you instal inside the BBC computer, the more power you will get out of the machine.

All sideways RAM units come complete with 60+ page Sideways RAM User Manual, 1 utility diskette and 1 year warranty.

*Solidisk recommends SCRIBE and STARBASE because they exploit perfectly the inherent speed of RAM disc.

**Occasionally, some users try to solve a software problem (such as increasing the size of Wordwise) by a hardware solution (buying the 128k Solidisk). The better way is to buy Merlin's Scribe (for wait until we offer you one for free) and then increase its speed with the Solidisk. The situation regarding databases is much simpler as Solidisk works well with most of them (from 6 times speed increase with Beebase's Masterfile to 2 times with Starbase).
6 — SENDING FOR FREE SOFTWARE:

Our free software is divided into volumes and is available in single density, either 40 or 80 track 5.25" diskettes. 40 track diskettes contain only 1 volume, 80 track diskettes contain 2 consecutive volumes, (1 + 2, 3 + 4, 5 + 6, etc.)

All sideways RAM is supplied with 1 diskette, containing either VOL. 1 (40 tracks) or VOL. 1 + 2 (80 tracks) as requested. Extra volumes are charged for media and postage cost.

The following volumes are available at the present time:

- **VOL. 1:** General Utilities: Menu, STLDISC, STLOEOO, STLRF5, Printer Buffer, STLRFS, Quickly, Fastbackup, Keyboard, Word64, help!.
- **VOL. 2:** English Spelling Checker: Silexicon and English dictionary (15000 words).
- **VOL. 3:** BASIC program generator: Macro Basic. Never Bad Mode again: Virtual Memory.
- **VOL. 4:** Database: Solidisk Datafile.
- **VOL. 5:** Foreign Language Dictionary Generator: Silexigen, Silexicon source code for programmers.
- **VOL. 6:** French spelling checker (15,000 words).
- **VOL. 7:** German spelling checker (13,000 words).
- **VOL. 8:** Machine code tools: Soliton, the finest machine code monitor with disassembler, debugger, single step etc. for both 6502 and 65-C02 (for second processor. 65-C02 assembler (for second processor), UVIPROM control software, SPRITES and SPRITE generator (providing 60 sprites per 16k sideways RAM).
- **VOL. 9:** to be released in October: Solidisk Toolkit, Rubber band, and Z80 drive C (RAM disc facilities for Acorn Z80 second processor).
- **VOL. 10 to 19:** Source code for use with the Technical Manual.

7 — TECHNICAL MANUAL:

The TECHNICAL MANUAL contains extensive program listings and notes by their authors. It also covers the MACRO language programming (part of Macro Basic), MOS conventions for sideways software. Solidisk conventions for sideways RAM software, STL DFS entry points, the 65C02 programming facilities and schematic diagram. The Technical Manual package consists of the Technical Manual and 3— 80 track diskettes containing VOL. 10 to 15 and costs £10.00.

8 — LOCAL EXPERT HELP:

A list of local Solidisk experts is printed in the Sideways RAM User Manual. For the cost of a local call, they can certainly help you with installation or software advice. Potential experts are warmly invited to contact us.

**SOLIDISK DUAL DENSITY DISK FILING SYSTEM**

Solidisk Disk Filing System (STL DFS) is based on the Western Digital WD1770 Floppy Disk Controller for the BBC computer. Solidisk DFS features an AUXILIARY PORT with the possibility of having up to 8 disk drives (4 Double Sided), numbered from 0 to 7 with 2 simple connections. Thus it is possible to connect 4 x TEAC 55F (or Mitsubishi's) with the same data cable, providing 2.8MB of storage for much less than having a fixed disk (and tape streamer or more floppy disks). The total cost of such a system (DDF + 4 Mitsubishi) is around £650 inclusive. Quite a few users especially schools with a large number of pupils, will find that it is a much better choice and technically speaking, installation is much simpler.

1 — SINGLE OR DOUBLE DENSITY?

The difference is in the number of sectors per track you can get. With single density, STL DFS allows 10 sectors per track (Acorn format), with double density, this number is 16, an increase of 60% at no extra media cost.

2 — CONTENTS:

STL DFS consists of only 4 ICs to be plugged into existing sockets on the BBC computer board. They are labelled: IC 78, IC 79, IC 80 and the DFS ROM. Installation is quite straightforward and should not take more than a few minutes.

**PRICE LIST AND ORDERING (including P&P and VAT)**

<table>
<thead>
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<th>SIDEWAYS RAM</th>
<th>£</th>
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<tr>
<td>SW16</td>
<td>£43.65</td>
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<tr>
<td>SW32</td>
<td>£59.95</td>
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<tr>
<td>128K SOLIDISK</td>
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<td>256K SOLIDISK</td>
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<td>The following are upgrade prices for existing Sideways Ram Users:</td>
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<td>16 — 32 (return complete item)</td>
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<td>DD55</td>
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<tr>
<td>D55n — 1MB bus version</td>
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<tr>
<td>MITSUBISHI 2 x 80 (incl leads + manual)</td>
<td>£165.00</td>
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<td>MITSUBISHI TWIN (incl leads + manual)</td>
<td>£323.00</td>
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<th>COMPLETE SYSTEMS: (i.e. DRIVES + DDSFS)</th>
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<td>£17.00</td>
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<tr>
<td>32-DD 40</td>
<td>£23.00</td>
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<tr>
<td>64-DD 40</td>
<td>£24.00</td>
</tr>
<tr>
<td>128-DD 40</td>
<td>£29.00</td>
</tr>
</tbody>
</table>

| CPU CASE | £13.00 |  
| KEYBOARD CASE | £23.99 |  
| EPROM PROGRAMMER (use with Swi or Solidisk) | £20.95 |  
| EPROM EPROM ERASER | £20.95 |  
| 2764 PACK OF 5 | £30.00 |  
| Special offer: Eprom Programmer + 5 2764s | £54.00 |  

**HOW TO ORDER**

You can order any item using the coupon. Post and packing is only charged once. Access and Barclay card holders can place their order by phone. Educational authorities, Acorn dealers and OEMs can obtain quantity discounts.

Name: 
Address: 

Credit Card Account: 

Callers are requested to ring first for appointment.

How much do you want to spend? £

TOTAL: £

SOLIDISK TECHNOLOGY LIMITED
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SOLIDISK'S NEW TELEPHONE NUMBER:
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Epson FX80 Printer

The most popular printer in the Epson range. Features include 160CPS, 11 x 9 matrix, proportional spacing, superscripts, subscripts, graphics, many character fonts, user definable character set, margins. Tractor and Friction feed built in as standard. 10" carriage width with bi-directional logic seek for maximum speed. Centronics parallel interface standard.

ONLY £316 (£7 carr.)

**Type** | **Ribbons** | **Dust Covers**
---|---|---
MX80FT | £4.75 | £4.50
MX100/FX100 | £10.00 | £5.25
FX80 | £4.75 | £4.95
RX80 | £4.75 | £4.50
GR80 | £4.50
GP100 | £4.95 | £3.95
GP250 | £5.95 | £3.95
GP700 | £18.50
KAGA KBP10 | £5.95
CANON PW1080 | £5.95

**RX & FX PRINTER INTERFACES**

Epson interfaces fit inside the printer to allow connection using techniques other than Centronics.

RS232 | £35
ISEE 488 | £85
RS232 + 2K Buffer | £59
2K Parallel | £58

**BROTHER HR-15 DAISY-WHEEL PRINTER**

This is a high-quality daisy-wheel printer, for the price of a dot matrix. Daisy-wheel quality gives a professional look to your correspondance. Facilities include 18CPS, bi-directional print, 3K, Buffer with clear facility, carriage skip movement, text copy switch, proportional spacing, underlining, bold, shadow, super and sub-script, printing in two colours. Impact control allows use of carbon paper. Connects directly to the BBC micro with centronics parallel interface. RS232 interface is an optional extra. Other options are a single sheet feeder that automatically feeds up to 150 single A4 sheets and a keyboard to transform the printer into a sophisticated electronic typewriter.

**SPECIAL OFFER**

ONLY £339 (carr. £7)

**EPSON RX80 F/T PRINTER**

As above but with friction feed capability built in. This allows the use of plain paper sheets.

£245 (£7 carr.)

**PRINTER INTERFACE BUFFER**

This neatly packaged, self-contained unit is supplied complete with all leads, operating manual and power supply. Computer output to the printer is stored in the buffer so that the computer can continue with other tasks while the printer works from the stored contents in the buffer. 18K holds approximately 10 pages of A4, close to the full memory of Wordwise. The 48K model is very useful for extremely large documents that otherwise tie the computer up for hours while being printed.

Price: 16K £115
Price: 48K £149

**LISTING PAPER (Plain)**

| 1.000 Sheets 9 1/2" Fanfold Paper | £7
| 2.000 Sheets 9 1/2" Fanfold Paper | £13
| 1.000 Sheets 15" Fanfold Paper | £9
| Teleprinter Roll (Epson paper) | £4

**PRINTER LABELS**

(On continuous fanfold backing sheet)

| 1.000 90 x 38mm | £5.50
| 1.000 90 x 43mm | £7.75
| 1.000 102 x 38mm | £6.25
| Carriage on Printer Paper or Labels £1 50

**NEW**

**DPW1 120 DAISY WHEEL PRINTER**

At last a low cost, high quality daisy wheel printer that everyone can afford! There are no compromises in facilities available — 20 CPS, bi directional, logic seeking, print 10, 12 & 15 pitch, proportional spacing, QUME Protocols, QUME Ribbon, QUME Daisywheel 86 characters, maximum characters per line 180 at 1/15" pitch, copy capacity: 4 copies Centronics Interface. Supports all Wordstar features, paper width 13" max. Optional extras: RS232-C Interface, tractor feed attachment: single sheet feeder.

Amazing Introductory Offer: £219 (£7 carr.)

**KAGA KP810**

What do the press say:-

"At £269 this is an unbeatable product for what it has to offer..." — Educational Computing "Offers excellent value for money..." — Electronics & Computing.

This new Japanese printer has EPSON FX/RX compatible control codes and is functionally equivalent to an FX80 with the added advantage of its 'Near Letter Quality' mode. It is solidly built and features include: Normal, Italic, Enlarged, super/subscript, proportional spacing and user-defined character set. Extras over the FX80 included in the price are Near Letter Quality (NLQ) print ideal for correspondence. User-adjustable tractor feed, high speed quiet mode and 3K buffer. The printer is bi-directional and logic seeking to give a speed of 140CPS for throughput in conjunction with the standard 3K buffer. 5K RAM may be added to give more user-defined character sets. Centronics parallel interface. Watford's 12 month NO QUIBBLE WARRANTY.

Special Offer: ONLY £235

RS232 interface + 2K buffer to connect to other micros

£89

**KAGA KP910 PRINTER**

Very similar to the KP810 but with 17" carriage for really wide print. Gives 156 columns of normal print or 256 columns in condensed mode. This printer is ideal for printing out spreadsheets and can also be used for correspondence in NLQ mode.

ONLY £349

**PRINTER LEAD 36"**

Centronics lead to connect BBC micro to EPSON, KAGA, SEIKOSHA, NEC, STAR, JUKI, BROTHER, SHINWA etc. printers.

STANDARD (3 foot long) £7
EXTRA LONG (5 foot long) £10
**EPROM PROGRAMMER**

The Watford Electronics' EPROM programmer for the BBC micro is a high quality self-contained package. Programs all popular EPROMs from 2K to 10K: 2716, 2516, 2532, 2764 and 27128. All manufacturers specifications have been followed to program EPROMs at the correct speed — wrong timings could destroy your EPROMs. The unit has its own power supply so does not put heavy loads on the BBC power supply as do some other units. Connects directly to the 1MHz bus following all Acorn recommendations on addressing and bus loadings.

**SOFTWARE PACKAGE**

The software is supplied on an EPROM which plugs into the Micro and is instantly available with a single command (no time wasting as on Cassette/disc loading). It is a fully purpose designed and programmed package to simplify ROM development. The system is menu driven with many prompts to avoid any accidents.

Software facilities include:
- Load File
- Save File
- Down Load EPROM
- Program EPROM
- Verify
- Blank Check
- Editing of memory contents prior to programming
- Also included is an automatic system to allow basic programs to be put in EPROM and accessed through the ROM filing system. More than one program may be put in an EPROM. All these facilities and more are explained in the comprehensive and clear 15 page manual.

Only £79 (£3 carriage).

**WATFORD — Always a step ahead**

**TEX EPROM ERASERS**

EPROMs need careful treatment if they are to survive their expected lifetime. Over-erasure of EPROMs very rapidly turns them into ROMs! The TEX erasers operate following the manufacturers specifications to give the maximum possible working life by not erasing too fast. We use these erasers for all our own erasing work.

- **ERASER E6** — Standard version erases up to 16 chips £28
- **ERASER GT** — Deluxe version erases up to 23 chips. Has automatic safety cut-off to switch off the UV lamp when opened. £30
- Spare UV tubes £9

**NEW DESIGN PLASTIC LIBRARY CASES**

for Disc Storage 5 1/4" (holds 10) £2

**DISC DRIVES**

(All drives are NEW SLIM-LINE Type)

**NEW LOW PRICES**

(Drives Cased with Cables: connects directly to your BBC Micro)

- **CLS 100** Single, TEC Single sided 40 track 100K 5 1/4" Disc Drive £112
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- **CLD200** TEC Single sided 40 track 200K Twin 5 1/4" Drives £225
- **CLD800** Mitsubishi Double sided 80 track 800K 5 1/4" TWIN Drives £325
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P.S. You do not require a formatting disc nor the expensive 40/80 track switchable drives if you use Watford's sophisticated Disc Filing System which has all these facilities in the ROM.

**LOCKABLE DISK STORAGE UNITS**

Strong plastic cases that afford real protection to your discs. The smoked top locks down. Dividers and adhesive title strips are supplied for efficient filing of discs.

- M35 holds up to 40 discs £13
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**FLOPPY HEAD CLEANER KIT**

The heads in a floppy disc drive are precision made and very sensitive to dirt. Drive manufacturers recommend that you clean the heads approximately once a week. Unless your home or office is dust free one of these kits is a very sensible precaution against losing valuable data. A dirty head can destroy many disks before you realise the trouble. Very simple to use. Only £14

**BBC Micro WORD-PROCESSING PACKAGE**

A complete word-processing package (which can be heavily modified to your requirements, maintaining the large discount). We supply everything you need to get a BBC Micro running as a word-processor. Please call in for a demonstration.

**EXAMPLE PACKAGE**

BBC Model B Watford Electronics DFS upgrade, with 100K Teac drives in beige. Zenith 12" Hi-resolution Monitor (Green or Amber). Brother HR15 daisywheel printer. Gemini software: REECALC spreadsheet, analysis and DATABASE software on disc, 10 x 3M discs, 500 sheets fan-fold paper, 4-way mains trailing socket; manuals, all leads and BBC carrying case.

Only £1,189 (£15 carriage).

**ACCESS HOT LINE**

(0923 50234) (24 hours)

Continued
MONITORS

We stock a range of monitors to suit all needs. Choice of a monitor is a matter of personal taste so we recommend that whenever possible, you ask for a demonstration at our shop.

MICROVITCE
- 1431 - Medium resolution as used on the BBC television computer programme £174
- 1451 - High resolution, suitable for word processing in mode 0 £295
- 1441 - Super High res, exceeds the capabilities of the BBC micro £389

All Microvitc monitors are 14" RGB in their distinctive right angled case. They come with the connecting lead to the BBC and a mains plug.

KAGA
- Standard resolution with RGB and composite video inputs £195
- High resolution colour £259

Kaga monitors are 12" RGB colour with antiglare screen and user access to screen controls.

ZENITH
12" Ultra high resolution monochrome monitor. Ideal for word processing as its green or amber screen is very restful to read. The high resolution makes it good for games too - you can really see the detail that has been put into the graphics.

LEADS
- CNC for Zenith £3

RGB lead for KAGA £6

N.B. Carriage on Monitors £7 (secured)

VERSATILE BEEB SPEECH SYNTHESIZER UNIT

SIMPLY the best! - An unlimited speech synthesis system. Complete with easy-to-follow manual. Controlling software is in ROM so no cassette loading problems!

PHONEMES for word synthesis - That means unlimited vocabulary! No extra speech dictionary chips to buy!

BUILT-in Library of approximately 500 words to get you started.

ENGLISH accent - Utilises inflexion techniques to produce highly comprehensible speech.

EASY to use system - Just plug the software ROM into a socket, the Speech unit into the User Port, and away you go! No specialised 'dealer upgrade' required!

COMPACT unit - The whole system is built into a small case - easily tucked behind the computer. Auxiliary output socket provided for direct connection to an external amplifier.

HOURS of fun! - Suitable for any application - Games, Educational Programs, Specialised Packages.

We know this all seems to good to be true but DON'T BE LEFT SPEECHLESS! Order your Versatile Speech Unit now!

Only £44

Best cost less at WATFORD

WATFORD'S LAUNCH OF THE YEAR - APEX

The ultimate expansion system for the BBC microcomputer. It enables you to increase memory capacity to 2 MEGABYTES including BATTERY BACKED-UP RAM.

The system consists of a mother board which fits inside the BBC and further daughter cards can be connected externally. The internal card has the following features:

- 15 ROM/RAM sockets, 11 of which can be configured as 2716, 2732, 2764, 27128 EPROMS or ROM equivalent devices or as 6264 RAMs. Any RAM is automatically battery backed-up and it's contents preserved when the power is turned off.
- The battery is recharged every time the machine is turned on and lasts several months, depending on the number of RAMs fitted.
- There is very little extra current drain, even with a fully loaded board as only the presently active ROM is powered up. In fact the fully populated board uses only 300mA.
- The board reduces micro bus loading by up to three ROM loads, which improves reliability and performance.
- Installation is extremely simple. There is no soldering required. The board is rigidly held by two 40 pin sockets and five support posts. A ribbon cable can be brought outside the computer and up to 8 external cards added. This enables the user to plug-in up to 142 pagged ROMs. The cards have following features:
  - Each card can accommodate up to 16 devices each of which can be configured as 2716, 2732, 2764, 27128 ROMs or 6264 8K RAMs.
  - Battery backup is provided from the internal card.
  - Only the active ROM is powered up permitting many external ROMs to be added with very little current loading (100mA per card).

The system comes with controlling software in ROM. The utilities supplied are as follows:

- APEX - replies with the device number currently being accessed.
- APEX C - toggles between the colour and standard black and white messages.
- AL - loads from any device, regardless of the data type.
- AS - saves memory to any specified RAM device.
- AG - prints a directory of the devices present in the system, i.e. ROMs present and files stored. This also reports on the amount of free storage space.
- AF - asks for the free RAM devices.
- LA - repeats the last command to paged ROMs.

Continued

★ AT - enters a memory testing routine. This will write a test pattern into the memory and read it back out again. If a fault is found, it is reported to the user. This test continues until Escape is pressed.

- RDISC - activates APEX as a filing system which then treats all free APEX RAM in the system as a continuous RAM-DISC. All commands have similar format to the DFS and transfer is possible between the two systems.

The complete computer system bus is available to the user, so that other cards/devices could be added such as EPROM programmers, second processors, Winchester disc drives, clocks, etc. By nesting the cards you eliminate the tangled mass of cables that usually accumulates around the micro.

A comprehensive operating manual is supplied with every APEX Board. Please write in for further details and prices.

THE ULTIMATE DFS FOR BBC MICRO

by Watford Electronics

Highly acclaimed at The Acorn and BBC MICRO USER Shows. What do the independent press say?

Good value for money - Beebug Aug '83

A very worthwhile package - The Micro User

You'll be buying a very powerful package - Personal Computer News

Superior DFS: Excellent disc sector editor - Computer Answers

Without a doubt the most sophisticated DFS Software yet written for BBC Mico Computer. This powerful new DFS is fully compatible with ACORN DFS yet has much increased power due to additions carefully designed to make life easier in normal use. It consists of over 14K of efficiently written machine code. It is entirely self contained and so does not require a utilities disc to function.

Please write in for full technical specification.

PRICES:

DFS (Disc Filing System) ROM £29

Complete Disc Interface Kit including DFS ROM & Fitting instructions £99

Disc Filing System Manual. Comprehensive and clearly written £7.50 (no VAT)

P.S. We will exchange your existing ACORN DFS or PAGE-IT/MONITOR DFS for Watford's highly sophisticated 16K DFS for £25

Watford's DFS is exclusively available from Watford Electronics. We do NOT retail through any dealers. Every ROM carries a label with our LOGO and a serial number.

Now available:

Acorn DFS Kit £99

EPROMs & CMOS RAMs

NEW LOW PRICES

2764-250ns (8K ROM) £5.25
27128-250ns (16K ROM) £19
6116-150ns (2K RAM Low Power) £5.25
6264-150ns (8K RAM Low Power) £28

ACORN USER OCTOBER 1984
MODER 84
PRESTEL TERMINAL
For the BBC Microcomputer

"Makes Printing Childs Play"

This utility ROM is designed to simplify using
all the facilities of your printer. It has many
features:
• Selection of printer modes such as underline,
foot and shadow by 'Single Key' operations.
• From Wordwise, a single number following OC will select a mode rather than a long and
inefficient programming of control codes. This
makes using your printer with Wordwise much
more convenient.
• When using Basic (or other languages) you
can have control over the formatting of the
output to the printer in the style of a
wordprocessor. You can define page top, bottom
and side margins etc. with intelligent page
skip for banners an option. All supported printers
will now respond to form-feed etc commands.
• User defined charactes are printed as you
see them on the screen so that non-standard
characters are automatically printed out correctly.
• Commands select the options for the
following printers:
GP100, STAR, NEC MX/FX, KAGA,
LAVROM100, DMP200.
• Operates with either parallel or serial interfaces.
• Supplied with a 50 page manual that is very
comprehensive and easy to follow. Please specify
printer type when ordering so that we can send the
correct function key strip.

Price: £24

DUMPOUT 3
A highly sophisticated screen dump ROM. This
has to be the most flexible and powerful screen
dump ROM yet produced for the BBC Micro. It
puts on the screen exactly what you see on the
screen, including all Mode 7 facilities etc. We
have to admit that this is one facility that we
cannot replicate - if anyone can supply flashing
ink we would like to know!
The ROM displays the window setting facilities and
two new OSWORD calls that allow mode 7
graphics pixels to be read and plotted using the
standard graphics window system. Two commands are used to operate the dump modes:
• GIMAGE - This provides a full graphics dump of
any mode (including Mode 8). There are
various options, one of which (GIMAGE
speed) only specify the parameters you wish to change.
• V 'scale', H 'scale', - These 2 bytes numbers give you
variable control over the size of the dump from
minute to enormous. Unlike other dump ROMS the
dump does not change with mode.
• R 'O:3', - Print dump rotated by 90°, 180°,
270° degrees.
• X 'min',', max', Y 'min',', max'. - The
whole of the screen graphics window area is
dumped except when the parameters are given.
• P - Physical colour values are used for
plotting, otherwise a negative scale is used
(white darkest).
• T Two tone dump for maximum resolution.
• M 'mask'. - 8 bit colour mask.
• E - Contrast expansion to make mode 7 text
and separated graphics stand out from the
background.
• C - All mode 7 graphics are printed as
contiguous to improve the shading in graphic areas.
• !IMAGE '< mindset' - Does a fast, text only,
dump of the contents of the text window in any
mode.
• GWINDOW and WINDOW - These commands
draw the graphics and text windows,
respectively, on the screen and allow them to be
changed with the cursor keys. N.B. GIMAGE and
WINDOW work fully in mode 7.
• Designed to work with the following printers:
CP80, GP80, GP100, GP250, STAR,
KAGA,TAXAN, NEC, SHINWA, GEMINI, EPSON
MX/FX, LPWII, DMP 100/200/2000/4000,
CANON

Price including comprehensive manual
£22

Epson Dump ROM
This screen dump ROM is specifically designed
for use with EPSON FX receptionist printers and
the Kaga KPB10. It is extremely simple to use as
there is only one command to remember. It will
accurately dump any screen mode using multiple
tones as required. Mode 7 is fully supported
giving text and graphic output by variable hue.
For those who like to keep life simple this EPROM is
only £20

FORTH ROM for BBC
This ROM provides a complete implementation of
the FIG-FORTH standard (including editor)
Supplied with a large tutorial manual only
£33

TINY PASCAL for BBC Micro
£59

- All the above facilities are accessed via
function keys. An overlay is provided to give
comprehensive guidance on their functions.
- A 34 page comprehensive
instruction/operating manual is supplied.

WATFORD 1200 BAUD
FULLY AUTOMATIC CARRIER
TO USER SOFTWARE
Having purchased the WATFORD PRESTEL TERMINAL which includes the 1200/75 baud
MODEM 84 the additional purchase of the WATFORD user to user ROM based software enables you to
discover a whole new world of data
communication. This software enables you to use the MODEM 84 very powerfully:
- Send and receive error checked programs and files (even WORDWISE files) to and from other users at 1200 baud
- 8k byte transfer in under 2.5 minutes (approx four times faster than with 300 baud modems).
- The transfer of data is totally AUTOMATIC which means that the modem is automatically
switched between transmit and receive under software control.
- A chat mode is provided which also has
dispatcher switch for receive and transmit.
- A copy facility is provided which allows
transmission of any full screen output.
- A continuous line report and status report is
included.
- The software is totally function key driven
enabling easy transmission, reception and
loading of programs and files (Basic, Machine
code or Data).
- A help menu is available from within the
software as an aid to use.
- Full instructions supplied.

PRICES
PRESTEL SOFTWARE ROM ONLY
(incl. Comprehensive Manual) ... £20
PRESTEL PACKAGE comprising:
WATFORD MODEM 84, SOFTWARE ROM and Comprehensive Manuals... £82
(carr. £2)
USER TO USER SOFTWARE ROM ... £14

VIEW
VIEW WORDPROCESSOR
We are supplying the new VIEW version 2.1 allowing printing of memory contents etc.
£49

FX80 PRINTER DRIVER
Watford's own TWO Sophisticated PRINTER DRIVER for VIEW
To simplify using the full facilities of the Epson FX80 or Kaga KPB10 printers, full
facilities are provided for selecting between fonts, pitch, etc. This includes examples of use and
instructions. Available on 80 track diskette (please state which required)
£6

WATFORD ELECTRONICS
VIEW PRINTER DRIVER FOR SILVER REED
We are pleased to introduce a new range of printer drivers to complement the Silver Reed
range of printers and typewriters and the View wordprocessor. These drivers have been
officially approved by Silver Reed, for use with their printers and typewriters.
The View driver allows access to all of the features supported by the range of daisy wheel
printers (XP 700 Series, XP 500 Series). These include underlining, bold, shadow, superscript,
and subscript printing. Additionally, you can use proportional spacing on the XP 700 Drivers.
Owners of one of the typewriters in the range XP 64/64/44, using it as a printer, can also
access underlining with the XP 700 Drivers.
The features of each printer/typewriter are accessed via the two highlight codes, which
can be redefined at any point within the text. The printer drivers also extend the facilities to
view and allow the user to access the highlight codes.
The printer driver on disk with a user manual is at a special introductory price of £7.50.
Please specify printer type when ordering.

£22

£59

£33

WATFORD ELECTRONICS
Continued...
**TWO DATABASE MANAGEMENT SYSTEMS**

**DISCDATA**

Disdata is an entirely disc based database handling system. It is extremely easy to use through its comprehensive menu system. The simplicity is such that we do not feel the need to provide explanation on use in the written guidance supplied with the program. The first-time database user will rapidly become familiar with this package designed throughout to be simple and obvious. Despite the ease of use this system provides all the facilities needed for complex data handling problems. The length of database that can be handled is only limited by the total space on the discs. You can have up to 20 fields with page length records up to 254 bytes in length. Adding and deleting records, amend titles, field names and records. Sort on any field and search by any record or group of records in any field. The database may be re-formatted after creation, the system will re-write all your files for you automatically. You may add extra fields and extend the length of existing fields freely. Output formatting is very powerful. You are allowed 40, 60 or 132 column output modes going to printer or screen. Selected fields can be put in any order on the screen or printer, either across or down. Output can start or stop anywhere in the file. Decimal fields are automatically totalled and records output are counted. Version 2, now on sale has improved input and amendments procedures giving full record edit as well as the 3 extra features: String searching. Calculations on numeric fields, and the ability to create sub files from your main files.

On disc at

- Only £17

(Except specify 40 or 80 track when ordering)

**FILE-PLUS**

The File-Plus package is even more powerful and flexible than Disc-Data. It is also largely menu driven with an extensive command language for file searching. The 16K ROM contains all of the normally required routines, with lesser used options supplied on the utilities disc. All input and output formatting is controlled through screen forms. A full screen editing system is used to define a form which allows tremendous flexibility in the format in which your data is displayed. It is very easy to change form to 

- Only £43

(Except specify 40 or 80 tracks for the utilities disc)

**BUFFER & BACKUP ROM**

For those with sideways RAM fitted in their machines this utility ROM will make full use of this facility. By using the sideways RAM area for extra memory the following features are implemented:

- 4K or 16K buffer for parallel printer.
- Dumps selection of Disc files to Tape.
- Makes backup copies of tapes on to tape and disc.
- Displays contents of paged ROMs on screen.
- Menu display of ROM filing system contents on Shift Break.
- Comprehensive manual.

Only £22

**ADATA**

Gemini's 24K ROM based DATABASE Management System

Special Introductory Offer: £99

**WONDERFUL WATFORD**

**PEN PAL - VERSATILE LIGHT PEN SOFTWARE**

Do you have a light pen that never gets used? Then this piece of software is for you. This package offers many useful facilities that make the light pen a useful device to own. Facilities included are:

- **Pixel, Line and Character definition**
- **Free hand drawing**
- **All Colours**
- **Fill, Refill and stripes**
- **User defined "Brush strokes" plus character definer**
- **Grid, Scale and perspective aids 2 to 200 points palatable in one design with Candles and rubber banding**
- **Move design/character to any screen position**
- **Save and Load screens. User defined characters and line drawings for video titles, own programmes etc.**

This program has many uses in education and at home. It is supplied with a comprehensive instruction manual.

Works with Watford, RH. Acorn User. DIY and many other Light Pens.

**TAPES**

- **TAPE**
- **DISC (40 or 80)**

Price £10

**DISC EXECUTOR**

Disc Executor is a sophisticated disc utility for the transfer of your cassette programs to disc. If you have difficulties transferring your cassette software to your disc system then this is the answer. It handles locked files and full length adventures (up to 8家 blocks) and programs that load below ¢E00. It is very simple to operate with instructions supplied. It saves you time and money.

Price £10

**ADE**

Complete program development package in a 16K ROM. Full assembling and debugging facilities provided.

SPECIAL OFFER ONLY £43

**ROM MANAGER**

This ROM is unique in its capabilities. It allows you, the user, full control over the BBC Micro's sideways ROM paging system with simple to use commands. This ROM is essential for those with several ROMs. At a simple level ROM MANAGER can be used to remove the problem of conflicting command names. It provides full use of all the facilities of your ROMs. This is coupled with facilities to completely enable or disable各有 ROMs in the machine. Full ROM manager itself.

ROM MANAGER can also be used to develop sideways ROMs using the machine's standard memory. This is achieved by sending sideways ROM calls to your code in RAM, saving the expense of fitting sideways ROMs for ROM development purposes. ROM status reports are also given by the ROM MANAGER including ROM lengths, checksums, entry points supported and current filing system title.

The ROM also provides facilities to examine ROMs, list function keys for editing, modify RAM using a HEA/ASCII editor and list ROM titles neatly and concisely.

The commands given in the ROM:

- **CHECKSUM** — Generates a CRC for a specified ROM (useful for testing suspected faulty ROMs).
- **DIRECT** — Passes a command directly to a named ROM (overcomes command name clashes).
- **EXAMINE** — Allows examination of a named ROM
- **EXPLAIN**— Gives detailed explanation of the first 22 *4 codes.
- **FILE** — Passes a command directly to the current filing system (which normally receives commands after all the ROMs).
- **FUNCTION** — Lists the contents of the function keys in a warp friendly ASCII editing.
- **INCLUDE** — Allows the main memory to be used for ROM development.
- **MODIFY** — An error free editing in HEA/ASCII format
- **NAMES** — Lists the names and socket numbers of all resident ROMs.
- **RAM** — Sends command directly to the RAM based ROM routine.
- **REMOVE** — Removes RAM based ROM option.
- **SPECIFY** — Selects the default ROM.
- **START** — Sends command directly to the default ROM without having to give its name.
- **STOP** and **START** — Enable and disable any named ROM to completely eliminate command word clashes.
- **STATUS** — Information about all the ROMs fitted in the machine including socket number, name, length, whether it is enabled, whether it has service or language options.
- **VALUES** — Gives ROM MANAGER status information, such as its socket number, how many ROMs have higher priority, number of default ROM and the identity of the current filing system.
- **VECTOR** — Same as **DIRECT** just in case **DIRECT** clashes with another ROM.

All selection between particular ROM lengths, checksums, entry points supported and current filing system title.
**WATFORD – Always a step ahead**

**COMPUTER CONCEPT’S ROMS**

**CARETAKER Basic Utility** £28

**Graphics ROM** £28

**Disc Doctor ROM** £28

**Without doubt a very sophisticated piece of software for the BBC Micro. It has all the features of a professional word processor yet is easy to use.**

**SPECIAL OFFER THIS MONTH:** £32

---

**NEW LAUNCH**

**32K RAM EXPANSION BOARD**

Now Watford Electronics brings you the latest state-of-the-art memory expansion board for your BBC microcomputer. This compact board which fits inside the computer does not just give you 16K or even 20K of extra RAM but a massive 32K!!!

- There are many useful facilities available with this board:
  - The top 20K of the expansion RAM can be used as the screen display memory, leaving all the standard BBC RAM free for programs or data storage. This allows good graphics and long programs to be combined. For instance you could have MODE 0/1/2 GRAPhICS AND 28K OF PROGRAM SPACE. The extra memory can be used by virtually any language or utility such as BASIC, VIEW, WORDWISE, etc.
  - The full 32K or the bottom 12K of the expansion RAM can be used as a buffer for the printer, sound channels, RS423 keyboard or speech synthesiser. This allows very long text files to be printed while you are using 27K of program and 20K of graphics!
  - This board is the ideal complement to any word processing system. There is no need to wait for slow printers as you can turn to long text in full screen mode while printing is going on – TWO JOBS DONE SIMULTANEOUSLY!!! (an equivalent printer buffer would cost you £115+).
  - The board is compatible with a vast range of software and hardware available for the BBC microcomputer, including our own ROM expansion board and double density DFS.
  - The board is extremely easy to fit. It is supplied complete with a comprehensive manual and ROM based software with full *HELP* messages.

**SPECIAL INTRODUCTORY OFFER**

**Only:** £69 (carr. £1)

---

**GRAPH PAD**

With this popular British Micro’s Graph-pad, you can add new dimensions to your computer enjoyment. It helps you to create your own application programs by the simple use of the Graph-pad ideal for Educational use. Supplied complete with Cables, Manual and a two program cassette.

**Price:** £115

---

**SURGE PROTECTOR Plug**

Fitted in place of your normal mains plug, this device protects your equipment against mains surges. Nearly lightning strikes, thermostats, switching and many other sources put high voltage transient spikes on to the mains. This can lead to data corruption in memory and on disc and can result in spuriously crashing machines. Suitable for computers, Hi-Fi, Fridges, Freezers etc. Max. Surge current 2KAmp, max. Voltage 250. Essential for serious computer users.

**Protection for only £8.50**

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**WATFORD ELECTRONICS**

**Continued...**

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**NEW PRODUCT LAUNCH**

**BEEBMON**


The most powerful and versatile machine code monitor ROM yet written for BBC Micro. It has all the normal memory editing, moving and relocating facilities, plus all editing is with a full screen editor allowing scrolling up and down memory, entering in Hex, ASCII or standard assembler mnemonics.

In use as a debugging tool, you run code under a total emulation system. Ever felt a desperate urge to set a break point in ROM? No problem – you can even have break points on reading or writing locations in memory and on register contents. The system fully supports debugging of standard ROMs e.g. BASI C can fully and easily be run from Within Beebmon and from these DFS and other sideways ROMs can be used in total emulation mode. Beebmon can even run itself. In so doing you can nest Beebmon up to a level limited only by the memory size. Beebmon uses 256 bytes of workspace, located anywhere in memory, even on the 1MHz Bus. Beebmon effectively uses no zero page workspace so your program (e.g. BASI C) can use any or all of the base page. How does it achieve this? By providing a 6502 interpreter all programs running under it exist in a virtual BCC, so special memory locations like the ROM latch are not actually accessed by your programs, instead they alter a location in Beebmon’s workspace. Emulation also allows immediate return to Beebmon command level by ctrl-escape no matter what code is being executed at the time. All this exceptional power and flexibility is complemented by a clear and detailed manual included in a value money price of £22

---

**Disassembler ROM**

Discover the hidden secrets of BASIC and the OPERATING SYSTEM with this easy to use programmers tool.

A ROM based machine code Disassembler for the BBC micro. It enables machine code programs to be listed in BASIC/DUMP format and thus is the perfect complement to the built in assembler. It allows Sideways ROMs, files on disk or tape to be listed, and also has a comprehensive editor enabling mnemonics to be altered directly, as well as HEX, DECIMAL, ASCII and BINARY memory editing. There is also a full set of labelling facilities available (up to 3200 labels), with the major locations and routines already labelled.

Thus DIS-ASM enables any monitor program, such as BEEBMON, to be used to much greater effect and is a necessary tool to assemble memory, each time the display is altered.

ONLY £18

ONLY £39
DOUBBLE DENSITY DISC INTERFACE

We are proud to announce the launch of the Warford Electronics Double Density Board for the BBC Micro, which is supplied as a new version of the popular Warford Electronics DDS re-written to make full use of the capabilities of the new disc drive density controller.

- Storage is increased by the maximum physically possible, 80%.
- Discs may be created in either single or double density format, with both formats supported and in single density mode they are fully compatible with normal Acorn format discs.
- The density of the disc you put in is autonomously sensed by the system and you are informed of the density in the catalogue display.
- The double density system is of course faster than single density.

Worried about compatibility with single density discs? Don't be! The Warford Electronics DDSF performs an extremely comprehensive 8271 emulator so that commands passed through OSWORD & F7 are correctly interpreted. Other manufacturers thought that read and write sector alone were sufficient -- we decided to implement every command of the 8271 that was physically possible. We use all the registers including bad tracks, access deleted data, etc., etc. etc.; the emulator itself takes care of any command not programmed in the WFRS.

In conclusion, the Warford DDSF provides an extremely sophisticated disk drive system which is fully compatible with any single density disc, but which allows the use of double density discs.

At Warford we haven't forgotten those of you with small budgets, so we've produced a ROM for the BBC Micro for only £2.00. Don't stop reading - this ROM can be changed in under five minutes without any release apart. The SIDWAYS ZIF eliminates the possibility of damage to your ROMs as zero insertion or extraction force is required when changing ROMs. Included in the SIDWAYS ZIF package is a specially designed see through storage container for your ROMs which protects them from mechanical and static damage when not in use. Consider the features:

- Simple to install, no soldering or modification required for your BBC Micro.
- Uses a professional ZEROMATIC INSERTION FORCE SOCKET (ZIF) so no force is required changing ROMs.
- No further expense, ROMs are used as standard for BBC BASIC.
- The ZIF is specially designed for the storage box included stores up to 12 ROMs in perfect safety.
- The ZIF uses the existing cartridge slot on the lefthand side of the BBC Micro keyboard.
- The ZIF is compatible with any BBC Micro, with or without the BBC BASIC.
- Offers a means of installation and changing of Sideways ROMs, all without dismantling your BBC Micro. Once locked in position the ZIF socket remains as a normal sideways ROM.
- No more problems of running out of socket space, simply plug the ROM and plug a different one in.

A REAL MUST FOR PROFESSIONALS AND HOBBYISTS ALIKE

ONLY £16

BOOKS (No VAT on Books)

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ACORN USER OCTOBER 1984
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ACORN USER OCTOBER 1984

45
NOW IT'S IN THE CAN

Your graphics program comes to life — and death — as Tessie Revivis sets up the roving fly for the kill

LAST month in First Byte we used an asterisk to represent a moving fly in a simple buzzing game. Now we'll make our fly a little more realistic and put some action into the game by introducing a can of lethal fly spray.

The Electron has its own designing command, which allows the user to program a shape into a character so that it can be printed onto the screen in much the same way as our common or garden asterisk. The command is VDU23. But first we must design our fly.

To do this we use a sheet of paper marked into squares eight wide by eight deep. A suitable character planning sheet can be found on page 287 of the Electron User Guide (page 496 in the Beeb User Guide). The character itself is designed by filling in suitably positioned squares. Figure 1 shows my own effort at designing the fly — I hope you see some resemblance.

Once the character has been designed it has to be converted into a form that the Electron can understand; as it's a computer that means numbers. If you study figure 1 you'll see that each column is assigned a value, termed its 'weight', starting with 1 on the right and then doubling as you move left along the columns. To convert the character into a computer-reconisable form each 'row' is turned into a numeric value by adding the weight of each column that contains a coloured square.

This process is shown in the figures to the right of the diagram, but just to make sure it is clear in your mind let's consider the top row. If we think of a clear square as a 0 and a coloured square as a 1 the top row can be represented as 00100100. The ones are often referred to as bits, so we can say that the two 'set' bits are in the 32 and 4 column. Adding these two together gives 36, thus the computer representation of the top fly is 36.

Each of the remaining rows is treated in the same way, the net result being eight numbers.

Before working these eight values into the VDU23 statement we must decide which of the user-definable characters we wish to use to represent the fly. The basic set of user-definable characters are the ASCII characters 224 through to 255, so we can use any of these. Let's use the first ASCII character 224. Constructing the VDU23 statement is simple enough. It must be followed by the character code and then the eight definition values starting with the top one, each being separated by a comma. So the final statement looks like this:

VDU23,224,36,24,90,189,255,60,24,36

A simple two-line program shows how the fly can be printed onto a mode 4 graphics screen:

10 MODE 4
20 PRINT TAB (10,10); CHR$224

As the fly forms part of the ASCII character set it can be printed on the screen using the CHR$ function, as illustrated in line 20 above.

Designing a fly spray can proceed in much the same way. The can will obviously need to be much larger than the fly but, as we have seen, the VDU23 command allows only set-sized characters. This can be overcome simply by using several character definitions together. For example, if we plan to start the fly spray can at character 225 and make it two characters wide by three deep its layout might look like figure 2. The design of the spray can is done in sections and the complete picture produced by printing the correct sequence of characters using the PRINT TAB commands.

Figure 3 shows the top of the can designed across two character planning sheets. Calculating the numeric value is done as described above for each planning sheet. The complete definition need be only four VDU23 commands in length as the second and third rows can be identical, unless you fancy adding a base to the can or something extra that would make the third set of characters different.

The following short program illustrates how the can can be printed on the right-hand side of the screen.

Figure 1. The fly is drawn on an 8 x 8 grid, each column of which is given a 'weight' (top row of figures). Each row is given a numeric value by adding the weights of each filled square (right-hand column) and a series of figures is produced that the computer can interpret.

ACORN USER OCTOBER 1984
Figure 2. The fly spray can, being much bigger, cannot be represented on one 8 x 8 grid so it assembled from six characters.

10 MODE 4
20 VDU23, 225, 3, 7, 31, 7, 7, 7, 15
30 VDU23, 226, 192, 224, 224, 224, 224, 224, 224, 224, 240
40 VDU23, 227, 31, 63, 63, 63, 63, 63, 63, 63, 63
60 PRINT TAB (30, 2); CHR$(225); CHR$(226)
70 PRINT TAB (30, 3); CHR$(227); CHR$(228)
80 PRINT TAB (30, 4); CHR$(227); CHR$(228)

The second of the TAB coordinates, the Y value, is simply incremented by one to ensure that the next pair of characters is printed below.

The animation part of the program is set in two stages: moving the fly to and fro across the screen and moving the spray can up and down the right-hand side of the screen. Moving the fly across the screen was discussed last month and indeed there are few changes from that section of the program, PROCfly. However, rather than moving the fly along a straight path an extra line (line 105) has been inserted into the procedure that will cause the fly to move up and down slightly as it proceeds across the screen. This is produced by adding a random number generating command to determine the Y tab position within a set range. The command is RND and this is followed by a value, 7 in the program, which causes a random number in the range 1 to 7 to be found.

As we do not wish the fly to move too near the top of the screen 2 is added to this value, thus ensuring a random value in the range 3 to 10.

Creating movement with the fly spray can is done in much the same way except that movement is on the Y axis. Two keys are used by PROCfly to see if this is required, the up arrow to move the can up, and the down arrow to move it down. Normally these two keys will not return a value when tested with the INKEY$ command, however, you can force them to return ASCII values by first turning them on using a "FX4, 1 command (line 505 in PROCsetup). The ASCII codes produced by these two keys are 138 and 139 and these are tested for by lines 140 and 145 in PROCfly. If either is detected the appropriate can-moving procedure is called.

To swat the fly it must be sprayed with a cloud of the killer potion. Once the can has been moved into position the space bar will press the top, the fly will freeze in fright as the spray cloud is propelled across the screen. If the fly is in the line of fire then it crashes to the floor with a thud — otherwise it lives to fight another day.

To see just how good you are a record of the number of sprays you use is kept at the bottom of the screen.

For the main listing, which is fully annotated, turn to yellow page 97. Study this and refer to your User Guide to find out more on the commands being used in each section. Then you might feel up to adding a couple more flies and perhaps even a mobile strip of fly paper.

If you think your fly program is better than mine, send it in to Acorn User. We'll pay £20 for the best fly game we publish.

The annotated 'Flies 2' program is listed on yellow pages 97/98.
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8148 RS 232 Interface with 2K buffer x on x off £60 + VAT £69
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Martin Phillips answers your queries on two-up printing, a ‘freezing’ screen, text and title display and the envelope statement

Dot and daisy

at the same time?

IS there any way of having a dot matrix printer and a daisywheel printer connected to a micro at the same time through the parallel printer port? This question was put to me by H L Malhotra of Radlett.

Indeed it is possible, and Keyzone of Unit 4, Regeneration House, School Road, Park Royal, London NW10 (tel: 01-965 1684/1804) makes a printer-changer designed to connect two or three printers to one micro. The device costs about £75.

Mr Malhotra would also like to know if his Watford disc filing system (DFS) will work with a second processor (6502 or Z80). New ROMs are provided with both second processors. For the 6502 second processor one is a new version of Basic and the second is a combined DFS and Econet Filing System (NFS). These two ROMs are installed in the BBC’s sideways ROM sockets. The existing DFS needs to be removed and replaced by the new one, but the new Basic ROM can be added without removing the existing Basic. For the Z80 a single new ROM is provided. This is the combined DFS and Econet ROM and the existing DFS needs to be removed.

Outmoded system

in operation

B J Woolnough, who lives in Jeddah, has an Acornsoft program that will not run on his BBC computer, although it runs perfectly well on another machine. On Mr Woolnough’s micro the display ‘freezes’ after a short time and will not respond to the keyboard. It happens only with this program.

The problem, I suspect, is the operating system in his BBC. Many software houses are now producing software that will run only with the 1.2 operating system (1.2 OS). Early BBC machines were sold with a 0.1 OS, which had fewer features than the current one. If the software was designed to run with the 1.2 OS, it probably won’t work correctly with the older 0.1 OS fitted. My advice to anyone still using an 0.1 OS is to return it to the Acorn dealer and have it replaced by the 1.2 OS. The cost is a little over £10.

To test which operating system is fitted, type ‘FXO and press RETURN. A message will appear that will give the answer. A few of the first machines fitted with the disc or Econet filing systems were fitted with a 1.0 OS. This is almost the same as the 1.2 OS, but not quite, and if similar problems are experienced it would be worth getting it changed.

Text scrolling

in a window

THE following problem was encountered by Mr MacDonald of Stornaway when he was writing an index file for his cassettes.

He wanted mode 7; he wanted to reserve the top four lines to display a title; he wanted to reserve the bottom four lines for instructions; and he wanted the remaining lines to be used to display information and to be able to scroll without corrupting the title or the instructions.

It is useful to receive such an explicit request, and I’m sure this is a program that many will be able to put to good use. Mr MacDonald’s requirements can be fulfilled by using a text window after printing the title and instructions. At the same time it is possible to alter the background and foreground colours and incorporate other teletext codes to the left of the text window so that they will not be overwritten.

Listing 1 shows the technique. There are two procedures. PROCsetup contains the title strings and the four strings of instructions. PROCscreen is the procedure that performs the screen layout. Lines 160 to 220 set up the first four lines and print the title in double height. The background colour is blue (CHR$132), and the foreground colour is cyan (CHR$134). CHR$157 changes the background colour, and CHR$141 gives double-height printing. Line 200 adds extra spaces to the title to centre it.

Lines 230 to 250 similarly set the background colour to blue and the foreground colour to white for the middle...

Listing 1. For the Beeb, text scrolling in a window, with title above and instructions below

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>REM Listing 1</td>
</tr>
<tr>
<td>20</td>
<td>MODE 7</td>
</tr>
<tr>
<td>30</td>
<td>PROCsetup</td>
</tr>
<tr>
<td>50</td>
<td>END</td>
</tr>
<tr>
<td>64</td>
<td>70 DEFFPROCsetup</td>
</tr>
<tr>
<td>80</td>
<td>DIM title$(1), instr$(3)</td>
</tr>
<tr>
<td>90</td>
<td>title$(8)=&quot;Title line 1&quot;</td>
</tr>
<tr>
<td>100</td>
<td>title$(11)=&quot;Title line 2&quot;</td>
</tr>
<tr>
<td>110</td>
<td>instr$(1)=&quot;1st line of instructions.&quot;</td>
</tr>
<tr>
<td>120</td>
<td>instr$(2)=&quot;2nd line of instructions.&quot;</td>
</tr>
<tr>
<td>130</td>
<td>instr$(2)=&quot;3rd line of instructions.&quot;</td>
</tr>
<tr>
<td>140</td>
<td>instr$(2)=&quot;4th line of instructions.&quot;</td>
</tr>
<tr>
<td>150</td>
<td>ENDPROC</td>
</tr>
<tr>
<td>160</td>
<td>170 DEFFPROCscreen</td>
</tr>
<tr>
<td>180</td>
<td>FOR N=0 TO 3</td>
</tr>
<tr>
<td>190</td>
<td>PRINT CHR$132 CHR$157 CHR$141 CHR$154</td>
</tr>
<tr>
<td>200</td>
<td>PRINTSF$(16-LEN(title$(N/2)))/2)</td>
</tr>
<tr>
<td>210</td>
<td>PRINT title$(N/2)</td>
</tr>
<tr>
<td>220</td>
<td>NEXT N</td>
</tr>
<tr>
<td>230</td>
<td>FOR N=0 TO 15</td>
</tr>
<tr>
<td>240</td>
<td>PRINT CHR$132 CHR$157 CHR$135</td>
</tr>
<tr>
<td>250</td>
<td>NEXT N</td>
</tr>
<tr>
<td>260</td>
<td>FOR N=0 TO 3</td>
</tr>
<tr>
<td>270</td>
<td>PRINT CHR$132 CHR$157 CHR$154</td>
</tr>
<tr>
<td>280</td>
<td>PRINT instr$(N)</td>
</tr>
<tr>
<td>290</td>
<td>IF N=3 PRINT</td>
</tr>
<tr>
<td>300</td>
<td>NEXT N</td>
</tr>
<tr>
<td>310</td>
<td>VDU20,3,19,59,4,14</td>
</tr>
<tr>
<td>320</td>
<td>ENDPROC</td>
</tr>
</tbody>
</table>

ACORN USER OCTOBER 1984

IF YOU have a technical hitch or a programming problem let Martin Phillips give his diagnosis. We'll pay £5 if you raise a really interesting point. Please give full details of the system you're using and include a listing where appropriate, making your question as specific as possible. WRITE TO: Hints & Tips, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH.
run, list it to see the effect. Title and instructions will remain in place while the rest of the program scrolls.

The colours can be changed by changing the teletext colour codes. You don't have to type in the CHR$132 etc. each time. Instead if the shift key and (in this case) function key f4 is pressed, it will give the blue character control code. This feature of the function keys is present only on a BBC with the 12.0S and not the Electron. It will not show up on printed out listings so the CHR$ alternative has been used for the printout.

Red CHR$129 SHIFT/1
Green CHR$130 SHIFT/2
Yellow CHR$131 SHIFT/3
Blue CHR$132 SHIFT/4
Magenta CHR$133 SHIFT/5
Cyan CHR$134 SHIFT/6
White CHR$135 SHIFT/6

When typing in this program, you must ensure that all punctuation marks are exactly as in the listing or some odd effects will appear on the screen. The display could consist of a series of black and white stripes, for instance, or the title or instructions could be lost.

Readers interested in using text window reminders are recommended that this subject also occurred in the July Hints & Tips.

For Electron owners, a similar program (Listing 2) is included which uses mode 1 instead of mode 7 and the double-height procedure described elsewhere in this section.

SEVERAL readers have been trying to unravel the mysteries of the BBC's or Electron's sound system. The thing that most find confusing is the Envelope statement. This statement is followed by 14 parameters, and trying all the

Off-the-shelf procedures

FOR several years I've been saying to myself that I must build up a library of simple procedures that I can quickly "EXEC" onto the end of an existing program to save typing time. I still have not achieved this. I've included procedures in this column that can be used in such a way that it would be nice to receive such procedures that readers find useful when programming. Perhaps we could then assemble a library of these for publication and inclusion on the monthly cassette.

One procedure I use frequently is a double-height printing routine that works in any of the BBC or Electron's graphics modes. This is shown in listing 3. Once the procedure has been typed in it should be saved by typing "SPOOL "DOUBLE" and pressing RETURN. Then type list and the procedure will be transferred to tape or disc under the filename DOUBLE. To complete the process type "SPOOL again and press RETURN. This then closes the 'SPOOL' file.

To show how the procedure can then be incorporated into a program type in the following short program:

10 REM Program to demonstrate double height procedure
20 MODE 1
30 PROCdouble ("This is DOUBLE height", 9, 5)
40 END
50

Then load in the procedure by typing "EXEC "DOUBLE" and pressing return. The procedure should load in line-by-line and at the end will give an error message. Don't worry, that is normal. Now list the program and the procedure will be added to the end of the listing. When the program is run the message should be printed in the middle of the screen five lines down from the top in double-height lettering.

The use of this procedure is also demonstrated in listings 2 and 4.

lines, which will be the scrolling window. Lines 260 to 300 print out the four instruction lines at the bottom of the screen. The background colour is set to blue and the foreground colour to cyan.

Line 290 is used to start a new line after each line of instructions except the last. This line appears at the bottom of the screen, and if the cursor goes to the next line the screen will scroll, losing the top title line.

Line 310 is the key to the whole program. It defines a text window in the middle of the screen four spaces in from the left to avoid the teletext characters placed down the left-hand side columns. VDU4 puts the text window into paged mode so that the screen will scroll only when the shift key is pressed. Once the program has

Listing 2. Modified version of listing 1 for Electron owners

Listing 3. Double-height printing in any of the BBC and Electron's graphic modes

Listing 3. Double-height printing in any of the BBC and Electron's graphic modes
combinations of these parameters is a slow and laborious task. It can be greatly simplified by using an envelope generator. This is a simple program that allows the parameters to be quickly and easily changed and the sound of the new envelope heard.

Two simple envelope generators are included this month. Listing 4 is an envelope generator for the BBC and listing 5 is a simpler version for use on the Electron. The Electron doesn't have the full ENVELOPE statement and so needs a different program, although the full BBC version will run on the Electron.

The program is quite straightforward to use and understand, although it is worth reading the 'sound' chapter in the User Guide first. When an interesting sound is heard it is worth recording the parameters and a brief description of the sound. A collection of sound effects is useful when writing programs. Again, I would be interested to hear from readers who have discovered useful envelopes. Remember that an envelope will sound right only over a limited range of the pitch parameter, and this too should be varied to hear different effects.

See page 99 for listings 4 and 5

**REMinder**

WHEN de-bugging programs you often have to delete lines that are causing trouble. The easiest way to do this without forgetting the contents of the line is to edit the line, put a REM statement directly after the line number and then copy the rest of the line. Now when the program is run the rest of the line will be ignored once the REM statement is encountered. If the line is to be included again, the REM statement need only be deleted.

**Word-blocked**

MR KELLER of Heybridge has his BBC and View wordprocessor fitted up to a Silver Reed EX44 typewriter. When he tries to print out the text that he has saved on a cassette recorder the 'Block' error appears on the screen after a few lines. Mr Keller wonders if he needs a printer driver to cure the problem.

The answer is simple - use a cassette recorder with a motor control fitted. What is happening is that the printer is taking so long to print out the first block of text saved on tape that by the time it is ready for the next block, the cassette had played on and was at the wrong block. With a motor control fitted, the cassette stops after the first block and restarts when the printer is ready for the next block.

**Menu amendment**

IN MAY's Hints & Tips a simple disc menu program was printed. A problem can occur with this menu if it is used to 'LOAD a program that resides in a different place in memory from normal. What happens is that after loading the appropriate program the menu program will move onto the next line and load the following program too. To avoid this, insert a line after the offending line to end the program. Eg:

490 CHAIN "PROG1"
500 'LOAD PROG2' '3000
505 END
510 CHAIN "PROG3"

Notice that the line number ends in a 5 so that it doesn't upset the computed GOTO in line 390.

---

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<tr>
<th>Quantity</th>
<th>Product</th>
<th>Version</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Golf Doctor</td>
<td>Cassette</td>
<td>9.95</td>
</tr>
<tr>
<td></td>
<td>Golf Doctor</td>
<td>Disc</td>
<td>11.66</td>
</tr>
<tr>
<td>Overseas Postage</td>
<td>First Item</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>Overseas Postage</td>
<td>Each additional item</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

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Clearing up queries on second processor

Sir, I am writing in response to the letter from my August edition concerning his 'problems' with the 6502 second processor. It seems to me he has not understood what happens when using a second processor.

The 6502 is an eight-bit processor and because of this can address 64K directly. As a result any loader or machine code programs have to run in the second processor, hence the need to copy them across from the input/output processor (in this case the BBC micro). Some of the memory in the second processor is used to hold operating system software at location $F800. On start-up the default language is copied across the Tube to the same memory position as it occupied in the I/O processor - but this time in the memory space of the second processor.

HiBasic is a relocated version of Basic II and resides in the second processor at location $8800, giving approximately 4K for Basic programs. For machine code programs, 61K is available since the memory occupied by Basic and its workspace may be used.

Also with a second processor, HIMEM remains fixed at $8000 regardless of mode since the screen is mapped into the I/O processor and not the second processor. Memory in the I/O processor that is not being used for display purposes can still be used - effectively by poking and peaking. This may be done using operating system calls as defined in the User Guide and Advanced User Guide. It is also possible to execute code in the I/O processor from the second processor.

Now to I Crawford's questions.

When using HiBasic the gain made is the memory below the operating system and above the default language location (i.e., the location Basic occupies in an ordinary machine), this being about 1K. When the machine is switched on, Basic is copied across to the second processor and any programs loaded will be run here. The original memory is now used only for display purposes. Part of this memory (depending on course on mode) may be used by poking and peaking via the correct operating system calls, but cannot be reclaimed.

As far as ROMs are concerned, all Acornsoft's will work in the Tube. Wordwise will not work because it poking directly to the screen. The same is true for any ROM which pokes the screen directly. When this clears up some of the problems and that my comments will be of use to potential purchasers of a second 6502.

Gary Jones
Manchester

Reviewers need to compare products

Sir, As one who is involved with the BBC micro, both personally and professionally as a teacher, I must compliment you on the new format of your magazine, particularly the idea of compartmentalising the listings into separate section of the magazine. There seems, too, to be a greater variety of articles, and diversity of section.

I find your magazine a tremendous reference point for new software that may be of interest to me at home, and for developments in the field of education.

With particular reference to the educational software or developments in hardware, I add, that surprisingly, it is sometimes difficult to evaluate new material and have to rely on publications that concern themselves either with the BBC computer or with educational computing. I have found your reviews objective and fair, but could they be more comparative?

I suggest this because I do not believe the facilities to compare new software, making a realistic judgment more difficult. Software houses are still not the norm, and schools and authority education computer centres with software free for evaluation.

To take a case in point, this month (July issue) you reviewed Edufax. How much more relevant and useful it would have been if you had been able to take viewdata as a theme and attempt to compare the software available. Edufax certainly has strengths, but what are the qualities of Optima's Datext or Digital Concepts' Teletext Display Creator? My own experience would put Datext's move, copy, cycling options in a different league to those of Edufax, yet Edufax's use of error keys is clearly more friendly. At the same time, the documentation of Edufax is extensive, that of Datext restricted to a fold-up pamphlet.

Similarly, there has been a need for a comprehensive database for schools that is menu-driven and accessible directly rather than being an enhanced cassette version. Suddenly, they appear to be available in plenty, but again how can you evaluate them without purchasing each one?

I do not feel that I am a lone voice crying in the wilderness, there must be many 'non-experts' like myself in primary schools and up and down the country who seek opportunities for evaluation of new materials. Schools do not have the ability to make errors over choice of software.

David Powell
Rotherham

Bar codes in

Acorn User

Sir, May I comment on a news item in the August issue of Acorn User, which said that Wordsmiths of Somerset were the first company to offer a professional typesetting service to Wordwise users. We have been offering this service for 12 months, having done work for some other computer concepts themselves (Disc Doctor manual) and more recently Clares Micro Systems (Beta Base manual).

We are also collaborating with John Coll and Mike Bostock of MEP in generating high-quality bar codes for their bar code reader. I believe this bar code listing is the first magazine to publish bar code programs.

We can generate typeset bar codes directly from a cassette/disc program or manuscript, in different types of disc, including different types of character, etc. In fact, our service extends beyond Wordwise and we believe we are able to typeset directly from most BBC wordprocessors - including Wordwise, View and Wordsworth. An information booklet explaining our coding system is available.

Our ability to typeset from various disc formats enables us to offer an additional data conversion service of transferring data between different types of disc, i.e. accept a BBC disc and transfer the data to a Tandy 80, or Epson to a Torch, or Apple to a Sharp etc. This data conversion service normally involves a basic handling charge plus 25p per thousand for the first 500,000 characters and 20p per thousand for the remaining 500,000 characters.

Ray Lumb
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Gloucester GL52 6HX

We don't think Acorn User will be the first magazine to publish bar code listings (Byte did it a few years ago in the US), but we are supporting the MEP with its project which will be launched in October. Ray Lumb will be releasing the reader with software and documentation, while Acorn User will explain the ideas involved, and make software available in bar code format.

So interested parties should keep their eyes peeled!
announces its complete local and wide area Viewdata communications system for the BBC micro.

The first system to unlock the full power of the BBC micro, it turns the BBC into THE Viewdata/communications machine.

Become your own ‘micro-PRESTEL’. Log on to any other Viewdata system.

Create your own Viewdata bases & telesoftware. Let others access them over the phone.

Explore the new world of electronic publishing & information services.

* By far the most comprehensive and easy to use Viewdata system for the BBC micro.
* Track tested since Nov. 83 in the national ITEC program.
* Subset to be bundled by Acorn with their new Winchester file server.
* Adapts itself to Disc or Eonet Level II.
* Up to 195 frames on a disc.
* Multiple databases can be used simultaneously on a network.
* Special Education licence (Single school, multi-machine, multi-site licence).

The complete package includes SOFTWARE, MANUALS, LEADS and MODEM.

Nothing further required beyond the BBC micro and the new 600 series B.T. phone socket.

THE SOFTWARE

* SYSTEM MENU simple cursor driven selection used throughout, with powerful configuration facilities. Auto-booting.
* OFFLINE EDITOR one of the best viewdata editors available for ANY machine, combining exceptional facilities with ease of use, enabling complete Viewdata bases to be created on disk or network.
* SEARCH this enables a Viewdata base to be searched locally in exactly the same way as when on-line to PRESTEL.
* CAROUSEL for exhibition and public display, frames can be left automatically displaying in a cycle.
* FRAME PRINTER hard copy of frames, supporting parallel, serial or network printers, with graphics supported on Intrex colour inkjet, Epson FX80 & MX100 typewriter, Microline 8032, Silver Reed EX43, and text on any other ASCII printer.
* TERMINAL can log on to any other Viewdata system, single key auto-dialling, download frames to a local database, telesoftware downloading, full on-line editing, frame load and send.
* HOST enables a locally created Viewdata base to be accessed by any standard Viewdata over the phone. Also provides an on-line editor so that callers can enter messages or complete frames, saved in a private ‘intery’.
* TELESOFTWARE FORMATTER any file, text or data, as well as programs, can be turned into C.E.T. telesoftware frames and made available to callers via the HOST, providing machine independent secure file transfer through the C.E.T. standard.

REQUIREMENTS

BBC micro B, OS 1.0+, DFS 0.9+ &/or Eonet level 2 / NFS 3.34+. Also B.T. 600 series phone socket.

PRICES

FULL SYSTEM as outlined above.
£325.00 + VAT + pp

LOCAL MODE OFF-LINE SYSTEM (No communications).
Software: MENU, EDITOR, SEARCH, CAROUSEL, FRAME PRINTER, + full documentation, all as outlined above, working on disk or Eonet level 2
£45.00 + VAT + pp.

HARDWARE

INTELLIGENT AUTO-ANSWER / AUTO-DIAL MODEM the first of the new generation of intelligent modems, it is far in advance of anything else in the field.
* No buttons or knobs to set — it sets itself — and no understanding of bits and bauds needed.
* Auto-dial software driven — needs no telephone handset, making phone costs controllable.
* Auto-answer — handles incoming calls unattended.
* When calling another CommuniTel system in HOST mode, unique speed switching enables frames to be spent at high speed, creating a fast electronic mail system with dramatic phone cost savings.
* Robust, steel cased.
* BABT approved (No. S/13973/E/450348) — legal to use on public B.T. phone lines.
* All leads provided — just plug in and it’s ready to go.

DOCUMENTATION

* TUTORIAL MANUAL an excellent self-teach tutorial manual is provided.

This is properly type-set in large type and heavily illustrated with colour photographs. Further copies of this are available separately. This covers every part of the system.

* REFERENCE MANUAL a comprehensive reference manual covers the remaining aspects of the system.

SCHOOLS

Hatfield Advisory Unit for Computer Based Education have negotiated a special ‘schools deal’ and are selling the Local mode off-line system + the TERMINAL software + a book on Educational uses of Viewdata + sample database disk, under the extended schools licence for the same price: £45.00 + VAT. Enquiries to Hatfield AUCBE.

FURTHER INFORMATION

For further information and order form write to:
CommuniTel Ltd.
189 Freston Road,
London W10 6TH.
Searching for robot projects

Sir, After seeing the BBC TV series 'Computers in Control,' I am interested in learning about these robot projects. How do I link them to my BBC micro? Also, has anyone published any books on home-made robots?

Paul Dormer
Cheshire

There is a Fisherteknik robot kit which can be made up into six tinta robots: manipulator; graphics tablet; sorting machine; crane; plotter; and solar tracker. It costs £92 and links to the BBC through the user and analogue ports. Simple software is included.

The list is available from Micro Robotic Systems, 20 Penywern Rd, London SW5 8SU.

There is a magazine called Practical Robotic, and Electronics and Computing Monthly often carries articles on robots. Next month's Acorn User features a review of six turtle and buggy-type robots, with more on robotics to come in the New Year.

QL chance

SIR, The announcement that Acorn has obtained a renewal of the BBC contract for four years will be generally welcomed in our schools and colleges. This confirms that we will have a much-needed element of stability in a field where there is, all too often, constant change for the sake of change, or so it appears.

Meanwhile, the fact that Sir Clive has, not for the first time, missed not only the Bus but also the Tube could allow more time for development of the QL as a genuine competitor to the Beeb.

Kenneth Swinburne
St James's University Hospital
Leeds

Joystick aid

SIR, I would be grateful if you could list the ADVAL commands that detect joystick movement in all directions as the 'Useless Guide,' sorry, User Guide does not list them.

Robin Sasson
Slough

We think you're being a bit harsh on the User Guide, but here's the information. ADVAL (1) and ADVAL (2) are used to detect movement on one joystick and ADVAL (3) and ADVAL (4) on the other. ADVAL (1) and ADVAL (3) detect left-right movement, returning a low number when the joystick is right, and a high number when the joystick is left. ADVAL (2) and ADVAL (4) return a low number when the joystick is back and a high number when the joystick is forwards. The number returned is in the range 0 to 65535.

Analoge joysticks will return a value even if the joystick is not being moved, the number returned indicating the position of the joystick.

Elk insanity

SIR, I've been reading Acorn User for over a year now. It has always been an excellent publication and with the new printing format it's near perfect.

I say 'near perfect' because one thing is driving me mad! You keep on referring to Electron as an ELK (ugh!).

What idiot made that name up? It brings Acorn down to Sinclair standards. It even sounds like a Sinclair add-on! So please, please help me keep my sanity. Call the Electron an Electron.

Jason Cunn
Cardiff

Odd character

SIR, Congratulations on the recent improvements to Acorn User. I have a frustrating problem, which I wonder if you could solve. What does *! do? No error message is given and the filing system is not accessed.

Clive Maidment
Midddx

The '!' character has a special meaning in the operating system. 'A' represents control A, 'B' represents control B and so on. Its main use is to allow the placing of control codes in a function key definition, notably M representing a carriage return. It can be used with all the operating system commands, so a file can be saved with the name 'L' (clear screen code) resulting in the screen being cleared each time you get a directory.

The particular code you mention doesn't really do anything as it is incomplete.

Third 'first'

SIR, I am writing in response to a news item that appeared on page 22 in the May edition of Acorn User. The headline read 'Salamander first with m/c compiler', but I rather doubt that this is true. Jeremy Ruston produced a compiler that was marketed in 1983, and in January of this year we marketed a compiler written by Simon Parker. Our compiler comes on cassette for £17.95 or disc for £19.95, and is advertised in your magazine every two months. More than could BBC Basic keywords are catered for.

So it would appear that Salamander's compiler was in fact the third.

M Towle
ACK Date
21 Salcombe Drive
Nottingham
NGS 8JF

Keyboard query

SIR, I have three questions on BBC Basic. First, how do you clear the keyboard buffer? Second, how do you mix colours in user-defined graphics? Finally, what is the teletext control code for selecting graphics, as in the title page on Acornsoft's programs for the BBC micro?

Timothy Lennon
Somerset

Here come the replies, in order. "FX15,0 will clear all the internal buffers, and "FX21,0 flushes the keyboard buffer. Further information on these calls can be found in chapter 42 of the BBC and Electron user guides, and in the Advanced User Guide.

In the September issue, Harry Sinclair showed how to produce full colour sprites. Also if you are printing the graphics cursor (after VDU 5) then only points that are in the foreground colour are plotted, those pixels which are in the background colour are not so colours can be mixed by printing at the same position with different characters in different colours.

Finally, the teletext code for separated graphics is 154; it is turned off by code 153. All the teletext control codes are in the BBC User Guide on pages 486 to 489.

Unilab contact

SIR, I have already written in for details of the weather satellite project in August's magazine, but could you please let me have an address for information on the Unilab computer interface.

Jason Bryant
Gwent

The address for Unilab is: Clarendon Rd, Blackburn BB1 9TA.

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Latest round-up of games high scores

<table>
<thead>
<tr>
<th>Aviator</th>
<th>Acorsoft</th>
<th>460</th>
<th>Mark Bradshaw</th>
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<td>Zalaga</td>
<td>Aervark</td>
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Acorn User October 1984
Breaking the barrier

Sir, While playing around at my Beeb I discovered a way of program protection, quite by accident. I typed in:

"KEY 10 AS = GET $5 M CLS:"

When typed in, any program already in the computer could not be tested and break would cause 'Bad program' message to appear. I found this very interesting as I had not seen such a simple procedure as this before. I would like to know why this happens.

D Wolff
Llanellni

To understand why this works you must know a little about where the Beeb stores a Basic program and where it stores variables. Normally variables are stored in memory after the end of your program, the value of this location is held in the variable LOMEN. When the Break key is pressed the old value of LOMEN is lost (OLD resets it), and it is set up with the value $1900, which is where Basic stores your program. So if you run the program, it will overwrite the beginning of your program. You have programmmed the Break key to set up a variable, this causes the beginning of your program, and hence a 'Bad program' error when you try to run.

If you only do a CTRL-Break then a program can still be recovered by typing 'OLD'.

Fortress cure

Sir, I had the same problems as you reviewer in running Amcom's Fortress (September), namely that, after the first three lives, the machine looks up solid, switching off being the only solution.

The solution turned out to be simple. Once the program is loaded, and before the craft is crashed, hit the escape key. This works for myself every time, and was discovered thanks to Reed Photography of Chesham.

ASK a silly question, pass a fair comment, stage an angry protest—we don't mind what you write to us about (or about us). Keep 'em short, keep 'em sweet, but keep 'em coming! The address is: Letters, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 6JH.

Kitty explains how to choose software and unravels ROMs

Q I've been very disappointed with some of the programs I've bought. What tips can you give to stop me making the same mistakes again?

Peter Brown
Liverpool

A Buying software is just like buying anything you'd buy for a house, and you should look at the task in the same light.

Personal recommendation is the most reliable method, and then there are also books. When you buy the book, you will learn to trust some people and magazines more than others. Look out in Acorn User for a series of comparative reviews of programs where the major criteria in picking a particular type of software will be considered. We covered monitors in June, and this month it's basic utility ROMs.

Make sure you know what machine you have (especially if it's an upgraded model A). Don't assume a program will work, and, of course, programs labelled for different types of computer will not work. Although the Beeb and Electron are similar, don't buy Electron software for the BBC and vice-versa—unless the seller can show it works on your machine.

Before you buy, ask for a demonstration in your local dealer's shop. If they won't help, then go elsewhere. Build up a relationship with a dealer who will often be able to recommend software as he/she gets to know your tastes.

Packaging and documentation will be a good indication of quality and will be important to some people, but not others. Look out for screen shots, which many software houses are showing as standard on cassette boxes. Make sure the company prints an address for return if the program doesn't work, or that the shop will exchange.

Some shops will stock only the best-selling software, and these are usually a safe bet. Remember though that the games market is dictated by youngsters whose tastes may not be the same as yours—and their reflexes may be a lot better.

Finally, Acornsoft is soon to produce a catalogue of software and products from other companies it recommends. Look out for news in Acorn User.

Q Everyone talks about ROMs and firmware, but I bought Wordwise and a friend told me it was on an EPROM. You told me that his machine was on a ROM. What is the difference?

Helen Phillips
Birmingham

A A ROM (read-only memory) is a chip on which information is stored and cannot be easily wiped out. An EPROM is an erasable/programmable ROM, on which the information can be destroyed if the chip is exposed to ultra-violet light. If you remove the label from the EPROM, you will normally be able to see the silicon chip covered by plastic inside its casing. This means an EPROM can be wiped and then re-used whereas a ROM cannot.

Acornsoft has put View on ROMs because they are cheaper—but only if they are ordered in very large numbers. Smaller companies use EPROMs because they can be produced in small numbers, giving more flexibility and costing less in the short term. Also, EPROMs can be recalled and exchanged more easily because they are valuable—costing about £5 each. ROMs just have to be thrown away.

The best example of this was Acorn's original 0.1 operating system. This was sent out on EPROM as it was a temporary system, whereas the 1.2 version is in ROM as it will be produced in large numbers over several years.

The term 'firmware' just means a piece of hardware on a chip, such as the BBC's ROMs and the Electron's cartridges.
### Computers

<table>
<thead>
<tr>
<th>Model</th>
<th>Price (£)</th>
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<tbody>
<tr>
<td>BBC Model B</td>
<td>346.95</td>
</tr>
<tr>
<td>BBC Model B with DFS</td>
<td>407.82</td>
</tr>
<tr>
<td>BBC Model B with DFS &amp; Econet</td>
<td>439.00</td>
</tr>
<tr>
<td>BBC Model B with DFS &amp; Wordwise</td>
<td>433.92</td>
</tr>
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</table>

### Acorn Equipment

- 6502 2nd Processor: £173.04
- Z80A 2nd Processor: £260.00
- Teletext Adaptor: £198.00
- Electron Computer: £173.04

All computers come with Free Cassette Lead and Software Package. Most add-ons include free fitting and installation.

### Monitors

- Philips Hi Res: £68.69
- Microvitec Normal Res: £199.00
- Ferguson TX-90 RGB/TV: £199.00

### Light Pens and Joysticks

- Add-on Light Pen: £21.70
- JMB Full Analogue Joystick: £13.00
- Joystick Pairs: £17.25
- Hi-Fi Extension Cable: £5.17
- Atari-type joystick to BBC interface: £13.00

### Components and Cables

<table>
<thead>
<tr>
<th>Component</th>
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<tr>
<td>BASP/s/d/d diskettes</td>
<td>£13.00</td>
</tr>
<tr>
<td>BASP d/s/d diskettes</td>
<td>£22.90</td>
</tr>
<tr>
<td>XIDEX diskettes</td>
<td>£15.22</td>
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</table>

### DISKETTES

Boxes of 10 diskettes

### Addons

- ATPL ROM/RAM board: £38.00
- Light Pen: £21.69
- OEL 2000 Prestel Terminal: £87.29
- Acorn Speech Synth: £47.83
- Chip Chat Speech Synth: £26.04
- Pace Grapevine: POA

### ROM Software

- Wordwise: £34.74
- Graphics ROM: £28.00
- Print Master: £28.00
- View 2.1: £52.09
- Ultra-Cal: £56.48
- I.2 O.S.: £7.38
- Disk Doctor: £26.95
- BCPL: £86.09
- Termi: £28.65
- Commstar: £30.59

### DISK DRIVE DRIVERS

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### DUAL DRIVE DRIVERS

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<tr>
<td>Dual CHINON F051D, Slimline, 40 Track, Single Sided: £199.00 + VAT</td>
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<tr>
<td>Dual TEAC55F, Slimline, 40/80 Track, Double Sided: £169.00 + VAT</td>
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### DISK INTERFACES

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<tr>
<td>The Fabulous LVL Single and Double Density Interface: £69.00 + VAT</td>
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</table>

### PRINTERS

- CANON PW 1080A: £85.00 + VAT
- NEC PC 6023N: £199.00 + VAT
- QUEN DATA Dot Matrix Printer: £299.00 + VAT

### PRICES

All our prices are constantly moving, so please ring us to check the latest price.

All prices plus VAT

### FREE DELIVERY TODAY

(Orders over £90)
ASK ABOUT OUR INSTALLATION SERVICE
If you are in Greater Manchester, Cheshire, Lancashire, Midlands, Merseyside, West Yorkshire or South Yorkshire, if you ring us now we can send one of our highly trained staff to install your computer equipment today.
(Now for business software too!)

C TECH COMPUTERS
184 Market Street, Hyde, Cheshire
SK14 1EX
061-366 7794
061-366 8223
EDITOR ASSEMBLER MONITOR
AND DEBUGGER (Kmon)

The only Monitor with both the normal Single-Pass
AND a unique Two-Pass Assembler

In addition to interacting with the rest of the program, this Two-Pass Assembler stores the source code in a compressed format, which enables much larger programs to be assembled in memory at once, with the listing all neatly tabulated (in colour) with the minimum of memory usage. Another advantage over such as Beebug's Exmon and Watford's Beebmon is that KMON allows full disassembler labelling facilities. Neither of which have the important Two-Pass Assembler, as doesn't the Molinerx Micromon, which just does not rate.

Our normal return first class post service applies with orders despatched the same day if on credit card before 4pm.
This program also carries our full guarantee.
Remember, we are the longest established software publishers in the business...

UPGRADE to Kmon
As many people may wish to have all the facilities of Kmon we will allow £3 on your Beebmon Exmon or Micromon in part exchange.

As well as the Two-Pass Assembler
and Disassembler labelling facilities there are over THIRTY Commands...

Two-pass Assemble
Single-pass Assemble
Disassemble
Edit Memory
Examine Memory
Word Search
Byte Search
Relocate Program
Move Block
Compare Block
Insert to Source Code
Fill Memory Block
Overwrite Line
Psuedo-ops
Set Breakpoint
Clear Breakpoint
Display Breakpoint Table
Set Variable
Display Variable
Move User Table
Display User Table Extent
SFC Count
JSR to Address
List Source Code
Hexadecimal Dump
Select Printer
Delete Label
Kill Source Code
Select Paged ROM
Set Scrolling Speed
Save to Disk/Tape
Load from Disk/Tape

Supplied on ROM. KMON comes complete with a most extensive User Guide, which starts with a tutorial introduction to the use of the program, with detailed examples of the commands. This is followed by a reference section giving further details. This User Guide is extremely well written and could be easily understood by the beginner to machine language.

KMON is valuable to both beginners and the experienced machine code programmer since its use provides an excellent introduction to the use of assembly language, whilst the Two-Pass Assembler allows the experienced programmer to develop much larger machine code programs than the BBC assembler or other Monitors allow. The use of the KMON assembler also facilitates easier debugging than a separate assembler and monitor.

POWERFUL Relocator—anywhere in memory. Wide range of pseudo-ops, ORG, MEM, DFW, etc. Versatile editing facilities, can be altered by instruction RTS, LDA, etc., hex, decimal or Ascii. Source code stored in memory so available to cassette as well as disk users. Assembler will not allow you to overwrite—idiot proof!

KMON contains a full Disassembler with all O.S. calls labelled, vectors between &200 - &2FF correctly disassembled and user defined labels automatically substituted.

LABELS can be defined, erased and altered at any time. The Two-Pass Assembler automatically accesses and alters user labels. Labels can be used instead of numbers in ALL Monitor functions. Numbers and addresses can be hex, decimal or a label (or Ascii). There is a full Breakpoint handler. Etc., etc., etc...

Supplied on ROM for the BBC model B at £34 all inclusive

Kansas City Systems, Unit 3, Sutton Springs Wood, Chesterfield, S44 5XF. Tel 0246 850357
LAST month I presented a program that enables you to design multi-coloured mode 2 'sprites'. As promised, this month's article introduces a program which allows you to move your creations around the screen smoothly without disturbing any background, maintaining their original colours at all times. Not only that! If you want you can have cartoon-style animation.

You don't have to understand exactly what is going on, but it helps you to know the general picture, especially for the animation part.

Apart from its obvious job, last month's program performs three main functions:

- It organises your data into easily usable blocks.
- It sets up a table containing the start address of the data for each of your sprites and saves it with the rest of the data.
- It saves information about the width of your sprites so that this month's Mover program automatically knows how big to draw them.

The importance of these three things is that the Mover program can quickly put your data on the screen just by knowing which character you want to display and where you want to display it. If you aren't particularly interested in the details of how the program works, all you need to know is:

- It should be typed in and subsequently LOADED with PAGE set at &1900.
- You must save it before you run it.

Fatman can be moved to any position on the screen

- When you want to move a set of characters around, "LOAD them first and then run the Mover program.

As I explained last month, the designer program allows six sprites to be defined at a time but it regards them as being 8. Sprites 0 and 2 are the same, as are sprites 4 and 6. This means that if you run through them in sequence you would get sprites 0, 1, 0, 3, 4, 5, 4, 7.

In other words, if you want to produce animation effects - say, of a man walking right to left - sprite 0 should be of a man standing feet-together facing right. Sprite 1 would be man with left leg forward, right leg back, sprite 3, right leg forward, left leg back. That completes the moving right sequence. The moving left sequence is the same but with the man facing the other way. (I'm not sure whether I understand all that. It's a bit like describing Dolly Parton with your hands tied behind your back).

Anyway, when you're designing, you don't have to worry about duplicating sprites 0 and 4 - the program does it for you. If you look at the screen shots accompanying this article you'll see

The animation sequence for walking Fatman in both directions, left and right. It takes six sprites, two being repeated.
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how Fatman is organised. He is eight pixels (four bytes) wide.

If you select the animation option, Mover runs through the sprite sequence 0-3 when the cursor right key is pressed and 4-7 when the cursor left is pressed. Up cursor and down cursor just move the currently displayed sprite in the appropriate direction. The key detect routine can tell if two keys are pressed at the same time, so you can give your sprites a headache if you’re feeling evil.

That’s all you need to know if you want to start trying. Incidentally, if you don’t want to type it all in at once just stop when you’re cheesed off and save what you’ve done. Then, suitably uncheesed, load the program, list it then type AUTO XXX where XXX is a number 10 higher than the last one. You can then carry on.

Right, now for the tricky bit—full screen addressing.

A mode 2 screen is composed of 32 (0-31) horizontal ‘strips’, each eight bytes deep and 80 bytes wide. Type in the following short program:

```
10 "TV255
20 MODE 2
30 screenstart = &3000
40 FOR I%= 0 TO 31
50 G%= screenstart + I%*640
60 IF NOT I% MOD 2 THEN = 
&03003003 ELSE C% = 
&3F3F3F3F
70 NEXT = 0 TO 639 STEP 4
80 J%=I%*5 = C% 90 NEXT
100 NEXT
```

When you run this you will see the screen divided into red strips and white strips—16 of each. Every strip represents 8 deep by 80 wide = 640 (&280) bytes. Screen memory in mode 2 starts at &3000. If you pick a location on the screen—say third down, 20th byte across within the fourth strip, you know that its address will be:

`&3000 + (&280 * the number of complete strips above your chosen location—in this case 3) + (8 * 19) + 2`

If you’re puzzled as to why the last part of this equation is not (8 * 20) + 3, remember that numbering starts at 0, not 1. So the third byte down in a column is in position 2, and the 20th across in position 19.

To complete the example, the final address is shown in figure 1.

If you add an extra line to the above program:

```
110 &380A = 0
```

this will make that particular location black.

So calculating screen addresses is not very difficult. The only problem is that if you’re using this method to draw a character to the screen and the character is 24 bytes deep and four bytes wide, the calculation has to be done 96 times—pretty time-consuming. Another way of doing it is to calculate the address of each of the leftmost bytes.

Let’s take the above address as an example—&380A. The address of the location immediately to the right of that is just eight higher—&3812—and the one next to that is eight higher again—&381A. Add the following line to your program:

```
120 &3812 = &F7 &381A = &30
```

When you run it you will have three bytes in a row in strip 4—the first black, the second yellow and the third blue.

Calculating the left-hand address and then adding eight to it to get the next one is a bit more efficient, but not much. There are a few variations on this method but they all require a fair amount of calculation, and micro- processors, oddly enough, were not designed to perform arithmetic operations—logical operations are their forte.

Yet another way of doing it is by using a bit of lateral thinking. Say your sprite is 24 bytes deep—it doesn’t matter how wide it is. This means that its depth is equal to that of three of the screen strips. If your sprite is to be drawn starting exactly at the top of one strip it will finish exactly at the bottom of the next-but-one strip beneath it. Bytes within a strip are consecutive and arranged as in figure 2.

As you can see, all we have to do is calculate the addresses of A, B and C. If the sprite is four bytes wide—32 bytes in each strip—we can send our data to three lots of 32 consecutive addresses starting at A, B and C respectively, using the Y or X registers of the 6502 to increment the address relatively. This has the added advantage of not actually changing the base address. In fact it’s even easier than that. Since each strip contains 640 bytes, address B = address A + 640 and address C = address B + 640, so we can generate addresses B and C by simple addition.

Well, that’s fine for sprites that start exactly at the top of a strip, but what about ones that start within a strip?

Consider our 24-bytes deep sprite. If it starts at the top of a strip it will appear in three strips. If it starts within a strip, parts of it will appear in four strips. We need one extra address—the top of strip 4—which we get by adding another 640. All we have to do now is ensure that we write only to the bytes we want to.

The exact start point of a sprite within a strip is easy to calculate. Remember that the vertical axis (Y) has 256 possible values—0 to 255. Y MOD 8 or Y AND 7 give the remainder of Y divided by eight—the start position. If this is sub-tracted from eight the result is the

---

**Figure 1.**

To calculate address:

\[
\text{Y co-ordinate DIV 8} \times 640 + \text{Y co-ordinate MOD 8}
\]

<table>
<thead>
<tr>
<th>A</th>
<th>A+8</th>
<th>A+16</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+1</td>
<td>A+9</td>
<td>A+17</td>
</tr>
<tr>
<td>A+2</td>
<td>A+10</td>
<td>A+18</td>
</tr>
<tr>
<td>A+3</td>
<td>A+11</td>
<td>A+19</td>
</tr>
<tr>
<td>A+4</td>
<td>A+12</td>
<td>A+20</td>
</tr>
<tr>
<td>A+5</td>
<td>A+13</td>
<td>A+21</td>
</tr>
<tr>
<td>A+6</td>
<td>A+14</td>
<td>A+22</td>
</tr>
<tr>
<td>A+7</td>
<td>A+15</td>
<td>A+23</td>
</tr>
</tbody>
</table>

**Figure 2.** How bytes are arranged within a strip.

---

**Strip 1**

<table>
<thead>
<tr>
<th>B</th>
<th>B+8</th>
<th>B+16</th>
</tr>
</thead>
<tbody>
<tr>
<td>B+1</td>
<td>B+9</td>
<td>B+17</td>
</tr>
<tr>
<td>B+2</td>
<td>B+10</td>
<td>B+18</td>
</tr>
<tr>
<td>B+3</td>
<td>B+11</td>
<td>B+19</td>
</tr>
<tr>
<td>B+4</td>
<td>B+12</td>
<td>B+20</td>
</tr>
</tbody>
</table>

**Strip 2**

<table>
<thead>
<tr>
<th>B+5</th>
<th>B+13</th>
<th>B+21</th>
</tr>
</thead>
<tbody>
<tr>
<td>B+6</td>
<td>B+14</td>
<td>B+22</td>
</tr>
<tr>
<td>B+7</td>
<td>B+15</td>
<td>B+23</td>
</tr>
</tbody>
</table>

**Strip 3**

<table>
<thead>
<tr>
<th>C</th>
<th>C+8</th>
<th>C+16</th>
</tr>
</thead>
<tbody>
<tr>
<td>C+1</td>
<td>C+9</td>
<td>C+17</td>
</tr>
<tr>
<td>C+2</td>
<td>C+10</td>
<td>C+18</td>
</tr>
<tr>
<td>C+3</td>
<td>C+11</td>
<td>C+19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C+4</th>
<th>C+12</th>
<th>C+20</th>
</tr>
</thead>
<tbody>
<tr>
<td>C+5</td>
<td>C+13</td>
<td>C+21</td>
</tr>
<tr>
<td>C+6</td>
<td>C+14</td>
<td>C+22</td>
</tr>
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number of bytes in each column in strip 1 that should be written to, and the number of bytes in each column in strip 4 that should not be written to. In the program, this value is put into the X register each time a new column is to be drawn and is decremented each time a set of bytes (one to each strip) is sent. While X is positive, bytes will be written to strip 1 and not to strip 4. When X is negative the reverse is true. The value is also used to control the (negative) offset into the sprite data tables.

The only other thing you have to do is to ensure that other characters on the screen are not rubbed out as your sprite is moved about. A common way of doing this is to use what is called EOR (Exclusive OR) plotting. EOR is one of the logical operators and is very simple. If you EOR K with J to give you N, when you then EOR N with K you will get J, or if you EOR N with J you get K. EOR works by taking two binary numbers and comparing pairs of bits. Each bit in no. 1 is compared with the corresponding bit in no. 2.

If either (but not both) of the bits is set—ie = 1—the corresponding bit in the result is set. If both or neither of the pair is set, the result bit is zero—eg:

\[
\begin{align*}
6 \text{EOR} 3 &= 5 \\
6 &= 00000110 \\
3 &= 00000011 \\
\text{Result} &= 00000101 = 5
\end{align*}
\]

So if you take the value (V) you want to write to a screen byte and EOR it with the value already there (S), you will get a new value (N)—and unfortunately a new colour unless the value already there is 0. When you want to move your sprite to a new position and place the background you just repeat the operation. EOR V with the screen byte (now N) and you get the original screen byte S. On screens that are mainly black this is a very effective method.

The method I have used is different. Before any screen byte has a value written to it, its original value is stored. The original values are written back before the sprite is drawn in a new position. This way your sprite's colourings are maintained at all times and there is absolutely no disturbance of any background.

Two other parts of the program may interest you—speed control and the keypress-detect routine.

Speed control is achieved by the use of an interrupt routine. The vertical sync. pulse event is enabled by the equivalent of "FX 14, 4". This generates an interrupt every fiftieth of a second as the screen is about to be refreshed, and control is passed to a user routine whose address is contained in locations &220 and &221—the event vector. All this routine does is decrement location &77. When you run the program you are asked what delay factor you want to use. When the sprite is about to be written to the screen the delay routine is executed the number of times you have specified. The routine loads the contents of &77 into the accumulator and then continues to compare the accumulator with the current contents of location &78 until they are different—ie the vertical sync pulse event has occurred.

The key detect routine, which is very fast—it should only take 12 machine cycles out of 2 million per second to discover that no key has been pressed—examines locations &EC and &ED in the operating system workspace. If one key is being pressed, location &EC contains its internal key number—128 and &ED contains 0. If two keys are being pressed location &EC will now contain the internal number of the second key pressed + 128 and &ED will contain the internal number + 128 of the first key pressed. If no keys are being pressed both locations contain zero. You may like to modify the routine for your own purposes.

Internal numbers are with very few exceptions easily generated from the negative INKEY numbers. Take the negative number, reverse the sign, and add 1. For instance, if you wanted to test for 'A' being pressed, in Basic you would use INKEY (−66). The internal number would be 65, coincidentally the ASCII code for 'A'. To use my routine you would check for −193 (65 + 128). Negative INKEY numbers are given on page 275 of the User Guide. The Advanced User Guide also gives the internal key numbers.

Well, I hope this has given you some ideas and that you get a bit of fun out of the two graphics programs. Next month I will give you some modifications for the Design program that allow you to edit previously designed sprites and produce mirror images so you only have to design your animation characters facing one way. I will also give you a procedure that will take the data for a sprite, shift it all over by one pixel and store the new image. You will then be able to move your sprites very smoothly—one pixel at a time—by alternating the images.
MOVER PROGRAM DESCRIPTION (cont)

770 to 910 Animation. Test the left/right flag (&75). If right has been pressed the X axis value is ANDed with 3 to give a sprite number in the range 0-3. If left has been pressed, 4 is added to make the range 4-7. Since the X axis is increased or decreased only by 1 at a time this routine is always able to pass the next sprite number in sequence to the display routines.

920 to 1040 Mover. If no delay is required &76 will be negative so the delay routine is skipped. Delay (see accompanying text).

1050 to 1090 Nv. This is the vertical sync. pulse event routine which decrements &77 each time the event occurs.

1110 to 1490 Cv. Change contents of the event vector at $2200/$2221 to point to above routine. Store old contents so they can be restored when Escape is pressed to give orderly return to Basic - not strictly necessary in this case but good practice. Also enable the vertical sync. pulse event. Set variable offset into data tables. Calculate maximum allowable X axis value given the width of the sprite, and store this in &7A. This enables use of variable-width sprites from designer program. The storage area for screen background is set up by inserting addresses based on the size of the sprite into the address fields in the 'replace' routine (see below).

1500 to 1740 Start. Put addresses of control routines into table so they can be accessed quickly by the keypress detect routine.

1750 to 1890 Keycheck. Executive section of program from which all other control routines are accessed. Arranged as an infinite loop which can only be exited by pressing Escape. See text.

1900 to 2180 Keyvalid. If a 'valid' key has been pressed (ie any of the cursor control keys or Escape) an appropriate value is returned in the accumulator. In the case of Escape being pressed, the return address of the routine calling keyvalid is pulled off the stack and a jump is made to the escape routine. This ends with RTS so with no other address to return to control is passed back to Basic. See text for explanation of values tested.

2190 to 2270 Getaddress. The value returned in the accumulator by 'keyvalid'. If non-zero, is multiplied by 2 and transferred to the Y register, which is then used to get the address of the appropriate control routine. This address is inserted in place of the dummy operand in 'gotomover', which is then called by the main control section.

2310 to 2410 Escape. Replaces original contents of the event vector, flushes the keyboard buffer and returns to Basic.

2420 to 2450 Tbl. Storage area for addresses of the up/down/right/left control routines. Those with Basic 2 can replace NOP with EQU etc to define zero bytes, but it isn't necessary. Note that 10 bytes are needed since the first two bytes cannot be accessed by 'getadress'.

2460 to 2470 Otv. Two-byte storage area for original contents of event vector.

2480 Display. Loads Y register with number of bytes to be written to each strip, contained in &78.

2510 to 2640 Replace. Return the original contents of screen memory to location where last sprite has been drawn - ie delete it before drawing sprite in new position. The low bytes of the storage addresses are dummy and vary according to the width of the sprite.

2650 First. When a sprite is first drawn it is unnecessary to call 'replace' since there is nothing to replace, so the drawing routine is entered here. The start addresses of the strips are calculated and the calculation is simplified a little by accessing the $64O table in the OS ROM starting at &3C75. Start addresses of the sprite data are obtained from the table at &12F0 (lines 3270 and 3440), are modified by the offset contained in &73 and inserted into their zero page locations (&88 onwards).

3520 Loads Y register with the number of bytes to be written to each strip.

3550 to 3540 X register set up to control writing.

3550 Start of the main drawing routine.

3850 to 4170 Sh. This is what actually puts your sprites on the screen and also what saves the background. The low byte of all addresses shown as &C00 is a dummy which is changed by the routine 'cv' above, to accommodate sprites of different sizes. The sections that write to the separate strips are 'b2', 'b3' etc.

ZERO PAGE LOCATIONS USED

&70 = Number of sprite to be displayed.
&71 = X axis value - 0 to 79.
&72 = Y axis value - 0 to 255.
&73 = Y MOD 8 at first then 8 - (Y MOD 8) + 1 to control display routine.
&74 = Animation flag. 0 = no animation

1 = animation.
&75 = Left/right flag if animation selected

1 = leftpressed 0 = rightpressed.
&76 = Number of vertical sync. pulse interrupts to occur before sprite is drawn to the screen = delay factor - 1, so negative (&FF) if no delay required.
&77 = Used to sense if vertical sync. pulse has occurred. Is decremented at each such interrupt.

&78 = Width of sprite in bytes * 8 = block size.

&79 = (Width of sprite * 8) - 8 = additional offset into sprite data tables.
&7A = Maximum X axis value allowable (80 - width of sprite in bytes).
&80/&81 Start screen address for strip 1.
&82/&83 Start screen address for strip 2.
&84/&85 Start screen address for strip 3.
&86/&87 Start screen address for strip 4.
&88/&89 Start address of sprite data for strip 1.
&BA/&BB Start address of sprite data for strip 2.
&BC/&BD Start address of sprite data for strip 3.
&BE/&BF Start address of sprite data for strip 4.

&12EF is part of the sprite data tables and contains the number of bytes in each block = 8 * width (in bytes - not pixels).
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ACORN USER OCTOBER 1984
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Available fonts are:

- *Accents* Accents and miscellaneous.
- *Block* Small capitals.
- *Data* Like the bottom of cheques.
- *Greek* It's all Greek to me too!
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- *Mode 8* 50 column multi colour, memory, misery mode.
- *$ Dump* A Dump facility which will produce a screen dump of any mode from 0 to 8 (including a task only dump in mode 71) on an epson, star, CP800, MT680 or JP580 etc. etc...

The dump utility will produce negative or positive product, can magnify, and will also rotate the picture through 90 degrees as well as being able to position the picture anywhere laterally across the paper.

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- **SAVE NAME 140 160 saves your user-key protocols**
- **ADIVAL emulate standard analogue joystick**
- **PAUSE define key to freeze game**
- **NPAUSE turn off ability to freeze game**
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Large picture shows BBC Computer System and a Quickshot II Joystick. Small inset just a few of the joysticks that will work with the patch lead. Screenshot by kind permission of SUPERIOR SOFTWARE

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ANNIVERSARY ANSWERS

Simon Dally separates the winners from the wallies among the entrants to our 20-question birthday quiz featured, complete with tie-breaker, in the July issue.

Our July competition celebrating the second birthday of Acorn User was the easiest ever (thanks to the generous nature of our editor). Many of the 250-odd entrants pointed this out. But, alas, only about a third of all entries proved to be correct!

The commonest mistake made was to think that the first computer to be sold for less than £100 was the ZX81. In fact, it was its predecessor, the ZX80, though not a few of the entries thought it was the Atom. Also, an enormous number thought the Basic statement DIM AS(20,2) produces an array of 40 elements: in fact it creates 63 – remember the first element will be AS(0,0)!

A few entries even managed to get the date of the original issue of Acorn User wrong – despite the fact that all over the magazine were plastered the words 'second anniversary issue'. Ah well, if there's one thing queerer than folk, it's Acorn User competition entrants...

The correct answers were:
1(b); 2(a); 3(c); 4(b); 5(b); 6(b); 7(b); 8(b); 9(c); 10(a); 11(b); 12(a); 13(b); 14(b); 15(a); 16(a); 17(c); 18(b); 19(a).

Judging tiebreakers ('I like Acorn User because...') is never easy (so...now I know how washing-powder manufacturers feel) but in the end, we felt the best two were from M Fulker of Hungerford, Berks, who wrote: '...it gives a profusion of solutions to basic confusions and programming illusions...'; and Charles Williams of Coventry, whose slogan was: '...because it is Authoritative, Clarifying, Outstanding, Relevant, Necessary, Useful, Sensible, Educational, Recommendable, and very good value for money...

A consolation prize goes to Nick Evans of Grimsby, who appended his corny pun with the message, 'Well, what do you expect for a T-shirt?'. The duffer's prize goes to C M Hempsell of Hitchin, Herts, whose slogan was 'I like Acorn User because the competitions are so easy' – but he got no fewer than three of his 19 answers wrong...

The 20 winners of the first prizes (five packs of software) and the 10 winners of the second prizes (Acorn User sweatshirts) have all been notified.

HARD DIAMOND

This month's gem: a palindromic puzzle

R
RIR
RISIR
RISESIR
RISETOTESIR
RISETOVOTESIR
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RI

This month's problem is taken from the shortly-to-be-published Century/Acorn User Book of Computer Puzzles, which is the result of the competition we set you earlier this year, inviting you to send in your own puzzles. This one was submitted by J Oldroyd of Batley.

Look at the diamond of letters. The object is to find as many ways that the palindromic sentence RISE TO VOTE SIR can be read (a palindrome, just in case you don't know, is something which reads the same both backwards and forwards).

You may move in any direction to an adjacent letter and you can use the same letter twice or more.

Incidentally, J Oldroyd's program goes on to solve all palindromic puzzles of this nature.

Answers on a postcard, please, to October Competition, Acorn User, Redwood Publishing, 86 Long Acre, London WC2E 9JH, to arrive not later than Friday November 2, 1984. Prizes of two Acornsoft packages (worth £20) will go to the first five correct solutions taken from the bag. Century is offering six copies of the book to the runners-up.
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ACORN USER OCTOBER 1984
TAKE COMMAND OF THE 8271 CHIP

By programming the floppy disc controller you can out-perform the DFS. Richard Harris has the details

The 8271 floppy disc controller (FDC) chip is a complex piece of electronics, allowing relatively easy control of up to four disc drives. This article will try to explain how to program the 8271: it will not cover the circuitry of the disc interface since there is no benefit from altering this. The circuit itself can be found in the User Guide and Advanced User Guide.

Why bother with programming the 8271, since the disc filing system (DFS) does it all for you? There are several reasons. First, simply to know more about how your computer works, especially as little information has been made available on the disc interface. Once mastered, it is possible to write your own data handling routines which for some applications are more efficient and quicker than those in the DFS. You will also discover some of the tricks to protect your discs and, possibly, to make backup copies of other discs. It is also possible to modify protected programs: at the end I'll show you how a simple change in Aviator can be made to alter the keys used.

Figure 1 shows the overall structure of the 8271, and details of the control logic and registers are listed in figure 2.

The value obtained from the Result register gives the following information about the command just processed:

Bit 7:6 Not used
Bit 5 Set if deleted data found (see below)
Bit 4,3 Completion types:
0,0 = good completion
0,1 = system error, may be recoverable if retried
1,0 = 'fatal error'
1,1 = 'fatal error'
Bit 2,1 Completion code (see below)
Bit 0 Not used

Type Code Meaning
0,0 good completion
0,1 scan result – see later
0,2 scan result
1,0 clock error
1,1 late DMA – see later
1.1,0 ID CRC error – see later
1.1,1 data CRC error – see later
1.0,0 drive not ready
1.0,1 write protected disc
1.1,0 track zero not found
1.1,1 write fault
1.1,0 track/sector not found

Incidentally, these are the values given in the Acorn DFS errors 'Disc fault at . . . ' and 'Drive fault at . . . '

The Status register gives information about the 8271’s internal working:

Bit 7 Command busy: set to 1 if processing command.
Bit 6 Command full: set to 1 when command written to 8271 and cleared when begins processing.
Bit 5 Parameter buffer full; if set to 1 further parameters should not be written.
Bit 4 Result ready; after a command is completed bit 7 goes low and this bit is set to 1. It is cleared by reading the result register.
Bit 3 Interrupt request; reflects state of interrupt line. Cleared by reading result register.
Bit 2 Non-DMA data request; if DMA is not being used, set to 1 if interrupt is for data transfer rather than end of command.

All data transfers occur at address &FE84, both reading from the disc and writing to it.

Figure 1. Overall structure of the 8271 chip

Figure 2. Details of the 8271's control logic and registers
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<td>Jungle Jive</td>
<td>£7.95</td>
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<td>Jungle Jive</td>
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**Brainstorm – TWO PLAYERS** – A parallel with chess if not more complicated... great for a game which needs thought! Home Computing Weekly: Check Out – RECENT RELEASE 'Super graphics and sound and originality combine to make a wonderful game' Home Computing Weekly: Nov A Bloc – 'good game with clear, smooth graphics and plenty of colour' Personal Computer Games: Plankwalk – Highly recommended! Personal Computer Games: Microbe – 'The game is a great example of what can be done on the BBC. I'm addicted!' Personal Computer News: Trench – 'an excellent game which will certainly keep your fingers dexterity on the keys of your key board' Bug Bombe – 'This game is wonderful and in a great example of what can be done on the BBC. I'm addicted!' Personal Computer News: Landfall – 'A great simulation' Personal Computer Games: Space Adventure – 'The only problem I had with Space Adventure was pricing my friends, away from it! Home Computing Weekly: Jungle Jive – RECENT RELEASE 'If you enjoy choosing a character, then this is the way to go!' Personal Computer Games.

If your local RETAILER does not stock these GAMES at the SPECIAL LOW prices, simply send a cheque or PO for £2.99 for each game you want plus 50p postage and packing (however many GAMES you ORDER) to the 'GRAB IT WHILE YOU CAN!' Department, Virgin Games, 2-4 Vernon Yard, Portobello Road, London W11 2DX.
Bit 1:0 Not used
A reset is initiated by writing 1 and then 0 to the reset register. All drive control signals go low, commands in progress are aborted, status register flags are cleared, and an idle state occurs until the next command is entered. This mimics a hard reset via the reset pin.

The operation of the 8271 falls into three phases.

1 Command phase.

This starts with the issue of a command after checking the status register to ensure the 8271 is not busy. If parameters are needed these are then issued, checking before each one that the parameter buffer is empty. Failure to check may result in loss of a parameter.

2 Execution phase.

During this phase the computer can ignore the 8271 until the command is completed. This will be signalled by an interrupt. For this to occur a special chip is used to handle data transfer: a direct memory access device (DMA). The DMA can address, load and write to memory during part of the clock cycle not used by the central processor; intimately information the DMA needs is the start address in memory for the data transfer. However a DMA is not used in the BBC micro, so any data transfers needed (each byte) are signalled by an interrupt and processed by the 6502. Because of the importance of this data transfer and the high speed at which it occurs, the high priority non-maskable interrupt (NMI) is used, overriding any interrupts from internal timers, analogue to digital converters, keyboard and so on which use the interrupt request (IRQ). In the BBC micro the routine to handle NMI interrupts is based at &D00 and only very urgent needs are allowed to use it. These are the disc and Eiconet interfaces so far.

3 Result phase.

This notifies the successful completion of the command, or an error occurring during the operation.

Fortunately, the Acorn DFS provides a routine to carry out most of the complex control of the 8271: OSWORD routine with A = &7F which performs 'read/write a sector' as detailed in the DFS manual. In fact it will do much more than just read or write a sector.

As with all OSWORD routines, the 6502 accumulator (or A % if called from BASIC) indicates which routine, while the X and Y registers (or X% and Y%) hold the address of the parameter block (X = low byte, Y = high byte). The call address is &FFF1.

The parameter block is as follows:

<table>
<thead>
<tr>
<th>Offset from</th>
<th>base address</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Drive number</td>
</tr>
<tr>
<td>1-4</td>
<td>Address in memory</td>
</tr>
<tr>
<td>5</td>
<td>Number of parameters needed by the 8271 command</td>
</tr>
<tr>
<td>6</td>
<td>8271 command</td>
</tr>
<tr>
<td>7</td>
<td>1st parameter</td>
</tr>
<tr>
<td>8</td>
<td>2nd parameter</td>
</tr>
<tr>
<td>9</td>
<td>etc</td>
</tr>
</tbody>
</table>

This routine handles all three phases of the 8271 operation. On completion the byte above the last parameter will contain the value in the result register and should contain zero if successful.

In Basic a simple routine would be:

```
10 DIM block 20, data 256
1000 A% = &7F:X% = block MOD
256:Y% = block DIV 256
1010 block? 0 = drive
1020 block! 1 = data
1030 block? 5 = nooppar
1040 block? 6 = command
1050 block? 7 = param1
1060 block? 8 = param 2
1070 CALL &FFF1
1080 IF block? (7 + nooppar) < > 0 THEN PRINT "error!"
```

Before detailing the various 8271 commands, the layout of data storage (or 'format') on a disc must be understood. Data is stored in concentric 'tracks' around the disc, there being 35, 40 or 80 tracks depending on which type of 51 in disc drive is in use. The 8271 will also support 8 in drivers. Each track is subdivided into a number of 'sectors', which consist of an identification (ID) field and a data field. The number of bytes of data per sector depends on the number of sectors per track. The 'first' sector on a track is identified by the 'index hole', the small hole in the disc which allows a photocell to detect a pulse of light once per revolution of the disc. The first sector is the one that immediately follows the light pulse.

The general layout on each track is shown in figure 3 and the ID fields in figure 4.

The 'gaps' are fixed or variable numbers of bytes that prevent sectors overwriting each other if the disc revolution speed should vary slightly.

Both the ID field and the data field have additional bytes called the Cyclic Redundancy Check (CRC) bytes. The value of these depends on the value of the rest of the bytes in the field and allows a check on the accuracy of subsequent reading of the field. While reading in the bytes, the CRC value is recalculated and compared to the original CRC; if these are not equal an error must have occurred and one of the error codes is generated.

The relationship between number of sectors per track, sector size, sector length (number of bytes of data) and gap size is set out in figure 5.

Gaps 1 and 3 can be varied if desired; 2 and 4 are fixed. 1, 2 and 3 have six additional bytes, always present, which act to synchronise any reading or writing operations. This gives a total of 3125 bytes per track, with a maximum of 2560 bytes of actual data. The format command (see below) also expects details of Gap 5; this is used only with 8 in discs and should be set to zero with 51 in discs.

It might be useful to describe some tracks that can be done with the format. With a 40-track disc one can command the drive head to be stepped to any of these, ie 0 to 39. However, one can number the track in the ID field anything from 0 to 255. One could step out to track 5 and then fool the 8271 into thinking that the current track is 78, for

<table>
<thead>
<tr>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gap 4</td>
</tr>
</tbody>
</table>

Figure 3. Layout of a disc track

| Track | Drive | Sector | Sector length |

Figure 4. The ID fields

<table>
<thead>
<tr>
<th>No. of sectors</th>
<th>Size/length</th>
<th>Gap 1</th>
<th>Gap 2</th>
<th>Gap 3</th>
<th>Gap 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>0</td>
<td>128</td>
<td>16</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>256</td>
<td></td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>512</td>
<td>16</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>1024</td>
<td>16</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>2048</td>
<td>16</td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

Figure 5. Relationship between number of sectors per track, sector size and length and gap size

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<table>
<thead>
<tr>
<th>NAME BRITISH PETROLEUM</th>
<th>DEALINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bought</td>
<td>Av Price</td>
</tr>
<tr>
<td>600</td>
<td>338</td>
</tr>
<tr>
<td>Sold</td>
<td>Av Price</td>
</tr>
<tr>
<td>300</td>
<td>426</td>
</tr>
<tr>
<td>Held</td>
<td>Curr Price</td>
</tr>
<tr>
<td>300</td>
<td>438</td>
</tr>
<tr>
<td>Gross Profit</td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td></td>
</tr>
<tr>
<td>Expenses</td>
<td></td>
</tr>
<tr>
<td>Net Profit</td>
<td></td>
</tr>
<tr>
<td>% Gain</td>
<td>36</td>
</tr>
</tbody>
</table>

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- Transactions per holding
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- Printer Manager

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- Share Movement Analysis
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- File Status Report

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instance, whereas the usual DFS commands would simply report a disc error with this format. Thus one can talk about 'physical track numbers' and 'logical track numbers' (i.e., that in the ID field). Logical track numbers do not have to follow any particular sequence; they can even be in reverse order (normal is 0 outermost).

The same applies to sectors; with a 10-sector format, the physical numbers would be 0 to 9. They can be given any logical number between 0 and 255, in any order, not necessarily sequential. There are, however, advantages to using sequential addresses in ascending order. The 8271 can be ordered to load into memory more than one sector at a time—for example start at sector 3 and load in four sectors. This will occur only if sectors 3, 4, 5, 6, 7, 8, 9, and 10 have sectors 0, 1, 2, 3, 4, 5, 6.

Consider loading a program which covers more than one track on a disc without these sector offsets. The sectors on the first track will be loaded to sector 9, then the head will be stepped to the next track—to just miss sector 0, as stepping is not instantaneous. A complete revolution of the disc then has to occur before sector 0 reappears. The offset described above ensures that the first sector encountered after stepping is 0. The actual offset needed will depend on the disc drive characteristics.

8271 commands
The general format of the command byte is for bits 6 and 7 to select which drive is in use, and bits 0-5 to specify the command. OSWORD &7F sorts out which drive (specified as the first parameter); so bits 6, 7, and 6, 7 of the command appear irrelevant. The DFS manual suggests they are set to 1, 0, i.e. &40. This value should be added to the command value given below (e.g., 'read data' &13 becomes &83 for the OSWORD parameter block).

SPECIFY
Command byte = &35
Uses four parameters

This command is used to initialise the 8271 with the physical properties of the drive in use. It can also be used to tell the 8271 of any 'bad tracks' (i.e., ones that will not format correctly). Once notified of these, the 8271 will automatically step over them as though they did not exist. This saves a disc being unusable simply because one or two tracks are faulty.

This facility is not used in the Acorn DFS, though modern discs are of very high quality and 'bad tracks' are a rarity.

The parameters are listed in figure 6.

Before expanding on the initialise parameters, a brief note about disc drive mechanisms. The disc itself is rotated at a constant speed by a motor, each rotation being detected by the index pulse. Data is read off the disc by the 'head'. This has two controls: a stepper motor that moves the head across the disc in a series of steps, these being the tracks; second, the head can be 'loaded'—that is, brought into contact with the disc, allowing reading/writing of data. There is in addition a micro-switch to detect when the head is stepped outwards as far as it can go—that is, when it is at track zero.

The speed of stepping between tracks varies with different makes of drive; parameter 2 defines this as 0 to 255ms (milliseconds) in 1ms steps. Likewise the time it takes for the head to settle after loading varies and can be set by parameter 3 (0 to 510ms in 2ms steps). Parameter 4 allows two features to be set. Bits 4 to 7 set the index count; this is the number of disc revolutions that occur after the last command before the 8271 unloads the head (0 to 15; keeps head loaded). Bits 0 to 3 specify head loading time (0 to 120ms in 8 ms steps).

The Acorn DFS can set up parameters for several makes of drive using the links on the keyboard or 'FX255—see DFS manual and Advanced User Guide' for further details. Unless you have an unusual make of drive, little will be gained by varying these values.

READ DRIVE STATUS
Command byte = &2C
No parameters

Issuing this command puts the drive status into the results register which then can be read:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Not used</td>
</tr>
<tr>
<td>6</td>
<td>Drive 1 ready</td>
</tr>
<tr>
<td>5</td>
<td>Write fault</td>
</tr>
<tr>
<td>4</td>
<td>Index pulse detection</td>
</tr>
<tr>
<td>3</td>
<td>Disc write protected</td>
</tr>
<tr>
<td>2</td>
<td>Drive 0 ready</td>
</tr>
<tr>
<td>1</td>
<td>Track 0 detected</td>
</tr>
<tr>
<td>0</td>
<td>Count pin (used by 8271 for stepping)</td>
</tr>
</tbody>
</table>

'Drive not ready' is cleared by this command and should be issued during any initialisation.

READ/WRITE SPECIAL REGISTERS
Command bytes = &3D (read), &3A (write)
Uses one parameter

The parameter determines which register is involved:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;12</td>
<td>Drive 0 current track</td>
</tr>
<tr>
<td>&amp;1A</td>
<td>Drive 1 current track</td>
</tr>
<tr>
<td>&amp;17</td>
<td>Mode register</td>
</tr>
<tr>
<td>&amp;23</td>
<td>Disc control output port</td>
</tr>
<tr>
<td>&amp;22</td>
<td>Disc control input port</td>
</tr>
<tr>
<td>&amp;10</td>
<td>Drive 0 Bad track 1</td>
</tr>
<tr>
<td>&amp;11</td>
<td>Bad track 2</td>
</tr>
<tr>
<td>&amp;18</td>
<td>Drive 1 Bad track 1</td>
</tr>
<tr>
<td>&amp;19</td>
<td>Bad track 2</td>
</tr>
</tbody>
</table>

There are also three registers involved in scanning for data—see below.

The current track registers are the means to having different physical and logical track numbers.

The mode register has the following features: bits 6, 7 must be 1, bits 2-5 must be 0. If bit 1 is set, then the two heads on a double-sided disc move together (i.e., always have some physical track number). If bit 0 is clear this means a DMA is in use, if 1 the CPU is used for data transfer.

Drive control input port is the same as reading the drive status, but does not clear 'drive not ready'.

Drive control output port gives the status of various lines between 8271 and drive:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6, 7</td>
<td>Drive select lines</td>
</tr>
<tr>
<td>5</td>
<td>Not used</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Initialise</th>
<th>Bad tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&amp;0D</td>
<td>Drive 0</td>
</tr>
<tr>
<td>2</td>
<td>Step rate</td>
<td>&amp;10</td>
</tr>
<tr>
<td>3</td>
<td>Head settling time</td>
<td>&amp;18</td>
</tr>
<tr>
<td>4</td>
<td>Index count/ load time</td>
<td>Bad track no. 1 (physical address)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current track</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declaring all bad tracks as &amp;FF implies no bad tracks</td>
</tr>
</tbody>
</table>

Figure 6. The four parameters of the Specify command, useful in informing the 8271 of any 'bad tracks'.
Bit 4 Writing to tracks near centre of disc
Bit 3 load head
Bit 2 step direction
Bit 1 step
Bit 0 write enable

SEEK
Command byte = &29
Uses one parameter
The parameter is the physical track address required. The head is then stepped to the appropriate point using the current track register as the starting point. Bad tracks will be skipped. The track number is not confirmed by reading the ID field.

A 'seek track zero' is different; here the head is stepped outwards until the track zero signal from the drive microswitch is detected. If this fails after 255 steps an error occurs. A seek track zero should be performed whenever the current physical position is unknown, e.g. at power-up.

FORMAT
Command byte = &2C
Uses five parameters
This command formats one track at a time. The parameters are:

1 Track address (physical)
2 Gap 3
3 Bits 5 to 7 = sector size (0 to 4)
4 Bits 0 to 4 = number of sectors
5 Gap 1

It also requires data for the ID field of each sector, i.e. four bytes times number of sectors. Each block of four follows the pattern previously described: track number, drive number, sector number, sector size. Thus using the OSWORD routine a block of 40 bytes (for 10 sectors/track) would be pointed to by parameters 1 to 4 of the OSWORD control block.

The track number is the logical number and need not be the same as the physical number. The drive number can be anything from 0 to 255. Sector number can again be any value (see above) but sector size should be the correct value. The first set of values in the data block will be the ID of the first physical sector and so on.

Each byte of the data in the sectors is set to a value of &E5 during formatting. Formatted tracks can be checked with the 'Verify' command (see below).

READ ID FIELDS
Command byte = &1B
Uses three parameters
This command transfers a specified number of ID fields into memory from a track, starting with the one immediately after the index pulse (i.e. physical sector 0). The parameters are:

1 Track number (physical)
2 Must be set to zero
3 Number of ID fields to be read

Note that a seek to the specified track occurs, though this is not confirmed by checking with the ID field. Thus if the logical track number is different an error does not occur when reading the ID fields.

Data processing commands
All the following commands seek the specified track and confirm it is the correct one by checking the ID field. If it is not correct the 8271 will try the next two tracks before causing an error ('Track not found').

128 BYTE SINGLE SECTOR
Two parameters

&12 Read data
&16 Read data and deleted data
&0A Write data
&0E Write deleted data
&1E Verify data and deleted data

The parameters are:

1 Track number (logical)
2 Sector number (logical)

If the logical number is not the physical number, the command must be preceded by a 'seek track' command, and then change the current track register to the logical number with the special registers command.

'Verify' data reads the data and checks the CRC values, but does not transfer the data to memory.

'Deleted data' refers to sectors that have a special code and are ignored by the usual read commands, i.e. it is effectively wiped off the disc. However, the data is still present and can be read or restored if desired later on. It is another way of protecting discs; the usual DFS commands will see only a blank disc!

VARIABLE LENGTH/MULTI-SECTOR
Uses three parameters

&13 Read data
&17 Read data and deleted data
&0B Write data
&0F Write deleted data
&1F Verify data and deleted data
&00 Scan data
&04 Scan data and deleted data

The parameters are:

1 Track number (logical)
2 Sector number (logical; first if more than one)
3 Bits 5 to 7 = sector size
Bits 0 to 4 = number of sectors to be processed

See notes on previous command, and earlier notes on formatting regarding multi-sector processing. Processing multiple sectors is much quicker than doing them one at a time. Commands not processing deleted data will skip them and process the required number of normal sectors.

If an error occurs during multi-sector processing the sector at fault can be found by reading one of the 'scan special registers', number &06.

The scan command enables the 8271 to search for a byte pattern on a disc, but is of real value only when used with a DMA.

I hope this article has been some help to those wishing to know more about the disc system. I recommend reading it twice (if you can face it!), as some bits are more easily understood in conjunction with information presented later in the article.

Finally, a disc copying program (listing 1) that will make back-up copies of most discs if not all. Some copies will have to be made onto fresh, unformatted discs. This program is not written in a sophisticated way but in a manner that I hope is easy to follow in conjunction with the article. Many improvements are possible, for example to transfer all the sectors on a track at once.

With some minor changes it can also be used to change protected discs. Omit the 'format' procedure, and read and write to the same disc. In between reading and writing, CALL a machine code monitor and the data can then be examined, disassembled and changed as desired before being written back to the disc. The position of the data in memory can be found by having 'PRINT data' in the first few lines.

One change I've found useful is to alter the keys in Aviator. As set up it is impossible to use the joystick and the rudder keys (A and +) together effectively. In logical track number 72 (physical track 8), logical sector number 125 (physical sector 3) will be found a block of data holding the INKEY values (negative numbers) of the keys and used when flying. This includes &FF, &BE, &DD, &DA &C8, &BC, &CA and &A8 etc. If the &BE and &A8 are changed to &BE and &BD then keys Z and X will control the rudder — now one hand can operate these and fire with shift, while the other uses the joystick.

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- **HELP INFO** Display a screenful of useful system information.
- **MEMORY** Display memory contents.
- **MERGE** Merge a program in memory with one on disc/cassette.
- **MOVE** Move program to run at specified address.
- **NEW** As NEW, but can be issued from within a program.
- **OFF** Cancel enhanced error handling.
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For use with any BBC Micro 'B' with 1.2 MOS or later issue.

Prestel Language ROM supplied.

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Interfaces to any BT connection attached to 1200/75 baud dial up system (e.g., Prestel, Micronet, Telecom Gold).

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SWORD MASTER is one of the few two-player games around, and is designed for joystick or keyboard.
Sword Master by Ken Worrall is based on the fencing rules written in 1190 by Herman von Salza for the Deutscritter Order of Teutonic Knights. It features full-colour machine code animation of a sword duel between two knights.
'A quality game with high class graphics, one of the most enjoyable games I have played' - Home Computer Weekly
'An immensely entertaining game with excellent graphics and animation' - Personal Computer Games
'Sword Master is a unique game' - Personal Computer News
'Slickly animated and suitably medieval' - Popular Computing Weekly

TREK was the first game to take advantage of voice synthesis on the BBC micro - and uses joystick or keyboard.
Trek puts you in charge of a Starship with the task of wiping out an alien fleet. It's an excellent adaptation of the classic game with 7 screen displays, 3 on-board computers and 2 weapon systems.
Versions have been written for BBC micro and Electron to use both machines to their full. The BBC tape uses voice synthesis (if the chips are fitted).
The game has been extensively developed from Tim Heaton's famous Trek III. It barely fits into 32K.

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Order form on page 95.

ORDER FORM
ON PAGE 95

Save yourself the time and bother of typing in Acorn User listings
10 REM *** FLIES 2 ***
15 REM *** (c) Acorn User Oct. 1984 ***
20 MODE 4
25 VDU 19,0,4;0;
30 PROCsetup
35 PROCanister
40 REPEAT
45 start=0 : finish=24 : step=1
50 PROCfly
55 IF dead_flag=0 THEN END
60 start=24: finish=0: step=-1
65 PROCfly
70 IF dead_flag=0 THEN END
75 UNTIL 0
80 : 85 *** procedures here ***
90 : 95 DEF PROCfly
100 FOR pos=start TO finish STEP step
105 xpos=RND(7)+2
110 *FX19
115 PRINTTAB(pos,xpos);CHR$(224)
120 SOUND0,-15,3,1
125 key%=INKEY$(0)
130 *FX19
135 IF key%=0 THEN PROCfire
140 IF key%=CHR$(139) THEN PROCcanup
145 IF key%=CHR$(138) THEN PROCcandown
150 *FX21
155 FOR delay=0 TO 50 : NEXT
160 PRINTTAB(pos,xpos)" ;
165 IF dead_flag=1 NEXT
170 ENDPROC
175 : 180
185 DEF PROCdie
190 P=pos:pos=finish
195 dead_flag=0
200 *FX21,4
205 PRINTTAB(P,xpos)" ;
210 FOR down=3 TO 28
215 SOUND0,-15,3,1
220 PRINTTAB(P,down);CHR$(224)
225 FOR delay=0 TO 50 : NEXT
230 PRINTTAB(P,down)" ;
235 NEXT
240 *FX21,4
245 SOUND0,-15,6,10
250 PRINTCHR$(230);"Ugh!"
255 ENDPROC
260 : 265
270 DEF PROCanister
275 PRINTTAB(xcan,ycan);CHR$(225);CHR$(226)
280 PRINTTAB(xcan,ycan+1);CHR$(227);CHR$(228)
285 PRINTTAB(xcan,ycan+2);CHR$(227);CHR$(228)

Select graphics mode 4 with a blue background
Initialise screen display
Fly moves right. If dead END
Fly moves left. If dead END

Move fly across screen and at random X position.
*FX19 stops screen judder
Make buzzing noise and test keyboard
If space or ↑ or ↓ key pressed call correct procedure.
*FX21 flushes keyboard buffer
After a delay rub out fly with a space

Fly dead. Clear flag and stop buzzing noise with *FX21, 4
Start 'move fly down the screen' routine
Do dying noise
Complete 'fly moving down the screen' and turn sound off

Make a 'thud' and print dead fly
Print fly spray can on right of screen

Continued
```
290 ENDPROC
295 :
300 :
305 DEF PROC canup
310 IF ycan=2 THEN ENDPROC
315 PRINTTAB(xcan,ycan+2);" "
320 ycan=ycan+1
325 PROC canister
330 ENDPROC
335 :
340 :
345 DEF PROC candown
350 IF ycan=11 THEN ENDPROC
355 PRINTTAB(xcan,ycan);" "
360 ycan=ycan-1
365 PROC canister
370 ENDPROC
375 :
380 :
385 DEF PROC fire
390 #FX21
395 PRINTTAB(pos+1,xpos);"Help!"
400 FOR shot=xcan-1 TO pos STEP -1
405 PRINTTAB(shot,ycan);CHR$(229)
410 FOR wait=0 TO 10 : NEXT
415 PRINTTAB(shot,ycan);" "
420 NEXT
425 squirts=squirts+1
430 PRINTTAB(10,30);squirts
435 PRINTTAB(pos+1,xpos);" "
440 IF ycan=xpos THEN PROC die :END
445 ENDPROC
450 :
455 :
460 DEF PROC setup
465 VDU 23,1,0,0,0,0;
470 VDU 23,224,36,24,90,189,255,60,24,
36
475 VDU 23,225,3,7,31,31,7,7,15
480 VDU 23,226,192,224,224,224,224,224,
,224,240
485 VDU 23,227,31,63,63,63,63,63,63
490 VDU 23,228,248,248,248,248,248,248,
,248,248
495 VDU 23,229,160,84,170,85,168,80,16
,80
500 VDU 23,230,0,0,0,0,36,24,60,126
505 *FX4,1
510 xcan=32 : ycan=11 : dead_flag=1
515 squirts=0
520 PRINTTAB(2,30);"Squirts:";squirts
525 PRINTTAB(10,0);"*** Flies Two ***"
530 ENDPROC
```
Listing 4. Envelope generator for the BBC

10 REM Listing 4
20 ON ERROR RUN
30 MODE 4
40 PROC Initialise
50 REPEAT
60 PROC Screen
70 PROC Sound
80 PROC Input
90 UNTIL 0
100:
110 DEPROC Initialise
120 VDU19,0,0,0,0;REM Green background
130 VDU19,2,0,0,0;REM Colour 2 - black
140 VDU19,3,0,0,0;REM Colour 3 - blue
150 160:‘T=0:PI1=0:PI2=0:PI3=0
160 T=0:PI1=0:PI2=0:PI3=0
170 PI1=0:PI2=0:PI3=0
180 AI=127:AD=1:AR=0
190 AL=126;AL=0;P=100;D=50
200 ENDPREC
210:
220 DEPROC Screen
230:
240 PRODroflue(“ENVELOPE DESIGNER”,10,1)
250 COLOUR PRINT
260 PRINT “T=Step length”,1/255=“T”
270 COLOUR 4 PRINT
280 PRINT “PI1=Pitch Increment 1”,128=“PI1”
290 PRINT “PI2=Pitch Increment 2”,128=“PI2”
300 PRINT “PI3=Pitch Increment 3”,128=“PI3”
310 PRINT “PI1=Pitch Step No. 1”,0=“PI1”
320 PRINT “PI2=Pitch Step No. 2”,0=“PI2”
330 PRINT “PI3=Pitch Step No. 3”,0=“PI3”
340 COLOUR 3 PRINT
350 PRINT “AD=Amplitude Attack”,128=“AD”
360 PRINT “AD=Amplitude Decay”,128=“AD”
370 PRINT “AD=Amplitude Sustain”,63=“AD”
380 PRINT “AD=Amplitude Release”,63=“AD”
390 PRINT “AL=Amplitude Level”,63=“AL”
400 PRINT “AL=Amplitude Decay Level”,63=“AL”
410 COLOUR 2 PRINT
420 PRINT “F-Pitch”,0=“P”
430 PRINT “F-Duration”,1/255=“D”
440 PAINT END

Listing 5. Envelope generator for the Electron

10 REM Listing 5
20 ON ERROR RUN
30 MODE 1
40 PROC Initialise
50 REPEAT
60 PROC Screen
70 PROC Sound
80 PROC Input
90 UNTIL 0
100:
110 DEPROC Initialise
120 VDU19,0,0,0,0;REM Green background
130 VDU19,2,0,0,0;REM Colour 2 - black
140 VDU19,3,0,0,0;REM Colour 3 - blue
150 160:‘T=0:PI1=0:PI2=0:PI3=0
160 T=0:PI1=0:PI2=0:PI3=0
170 PI1=0:PI2=0:PI3=0
180 AI=127:AD=1:AR=0
190 AL=126;AL=0;P=100;D=50
200 ENDPREC
210:
220 DEPROC Screen
230:
240 PRODroflue(“ENVELOPE DESIGNER”,10,1)
250 COLOUR PRINT
260 PRINT “T=Step length”,1/255=“T”
270 COLOUR 4 PRINT
280 PRINT “PI1=Pitch Increment 1”,128=“PI1”
290 PRINT “PI2=Pitch Increment 2”,128=“PI2”
300 PRINT “PI3=Pitch Increment 3”,128=“PI3”
310 PRINT “PI1=Pitch Step No. 1”,0=“PI1”
320 PRINT “PI2=Pitch Step No. 2”,0=“PI2”
330 PRINT “PI3=Pitch Step No. 3”,0=“PI3”
340 COLOUR 3 PRINT
350 PRINT “AD=Amplitude Attack”,128=“AD”
360 PRINT “AD=Amplitude Decay”,128=“AD”
370 PRINT “AD=Amplitude Sustain”,63=“AD”
380 PRINT “AD=Amplitude Release”,63=“AD”
390 PRINT “AL=Amplitude Level”,63=“AL”
400 PRINT “AL=Amplitude Decay Level”,63=“AL”
410 COLOUR 2 PRINT
420 PRINT “F-Pitch”,0=“P”
430 PRINT “F-Duration”,1/255=“D”
440 PAINT END
Harry Sinclair's 'Design' program last month enabled you to create your own sprite cartoon characters. This program, 'Mover', lets you move them on the screen and animate them.

```
10 TV=255
20 REM LD DATANAME
30 AT, 40 MODE=2
50 PROC GASS
60 COLOUR: PRINT@TAB(6, 1), "FILE COLOUR: PRINT@TAB(6, 2)" MOVES "TAB(6, 5)"
70 COLOUR TAB
80 PRINT@TAB(4, 7), "Do you want...?": COLOURS=PRINT "Frame animation": COLOURS=PRINT "Single character": TAB(2) "movement"
90 FX=15
100 COLOURS=PRINT "Please choose.": REPEAT PRINT@TAB(16, 22), CHR$(127): INPUT@TAB(1, 4, 22), "@1=ON OR @2=COLOURS"
110 FX=15
120 IF G=1 THEN "774=0 ELSE "770="0
130 IF F=2 PRINT "Character number?": REPEAT PRINT@TAB(18, 26), "@1=INPUT(17,
140 GCLS
150 FX=15
160 PRINT@TAB(4, 12), "What delay?": INPUT@TAB(3, 15), "(0 = no delay)"
170 GCLS
180 PRINT@TAB(16, 16), PRINT@TAB(16, 16)
190 PRINT@TAB(0B, "Cursor keys control": "character movement..."
200 PRINT@TAB(16, "Escape to exit.
210 COLOURS=PRINT@TAB(0, 22), "Space to continue...": COLOURS
220 REPEAT UNTIL Betsy=22
230 GCLS
240 FOR G=0 TO 20000=0: RND(20000.10000.0): RND(20000.10000.0): NEXT@PRINT@TAB(6, 14), "MOVER!!"
250 SP=17, 75=0
260 IF 7=10, 72=100
270 7X%7€=0
280 CALL cv
290 CALL first
300 CALL start
310 CALL COLOUR?
320 END
330 DEF PROC GASS (\n340, GRS=10, 0G2STEP% 350, RTP%£000
360, OPT%L, 370.380, DATASET, 390, MODE limit
400, DECK7&1
410, DATASET, 420, DECK draw, no animation
430, DATASET, 440, DATASET, 450, DATASET, 460. draw.
470, SJR mover
480, limit
490, RTSS
500, Rightpressed
510, DATASET, 520, CLC
530, COOPM7A
540, DECK limit
550, NDCE&1
560, DECK draw, no animation
570, DECK draw, no animation
580, DATASET, 590, Stmt
590, DECK draw, 600, DECK draw, no animation
610, DECK draw, 620, Downpressed
630, DATASET, 640, DECK draw, 650, DECK draw, 660, DECK draw, 670, DECK draw, 680, DECK draw, 690, DECK draw, 700, Downpressed
```

ACORN USER OCTOBER 1984
RUNNING 'MOVER'

- THE listing can be broken down into two sections: Basic and assembler. A prior knowledge of the latter is not necessary
- for entering the program — just type it in exactly as you see it.
- Before starting ensure that PAGE has been set to &1800.
- whether you have tape or disc. To do this type:
  PAGE &1800 < return >
  NEW < return >
- You'll find it much easier to enter the assembler listing first.
- For tips on doing this see yellow page X in last month's issue.
- Enter lines 3010 to 4200 and then save what you have entered so far to tape or disc, just in case of accidents.
- Change line 340 to read:
  FOR 1% = 0 TO 3 STEP 3
- Now add the following two lines:
  1 PROCASS
  ELSE
- Run the program and correct any syntax errors that occur, then
- add the following lines to your program:
  1 PROCASS
  2% = 0
  3 FOR 1% = AE00 TO &1084

CONVERTING FOR THE ELECTRON
- MOVER will run on the Elik if a few alterations are made to the
- The alterations are in the assembler as follows:
  1970 CMP E88
  2070 CMP F86
  2120 CMP F88
  2170 LDA &C8D,X
  2880 LDA &C8D,Y
- The checksum value will be 73310.
Listing 1. Disc copying program by Richard Harris. It will make back-up copies of most—or not all—discs. With minor modification (see page 86) it can also be used to change protected discs.

```
10 DIM SIZE%$(4),gap%$(4),block% 30,dat
20 MODE7
30 PROCsetblock:PROCsetup
40 FOR K=0 TO 39:REM for 40 track drive
50 PROCseek(0,K%):PROCseek(1,K%):IF F
60 Nid(0,K%):THEN 110
70 PROCsettr(data%):PROCformat
80 PROCvalues
90 FOR X=0 TO X=9:REM for all sectors on track
100 REM assumes consecutive numbered sectors; may need changing for some disk drives
110 IF F=FNload(0,X,5,X):REM load from drive
120 NEXT X
130 IF FNload(1,X,5,X):REM copy onto drive
140 NEXT X
150 IF FNload(2,X,5,X):REM copy onto drive
160 NEXT X
170 ENDPROC
```

ACORN USER OCTOBER 1984
10 REM *****************************
20 REM ** READ FILES **
30 REM **
40 REM ** Copyright (C) A.W.CRABB **
50 REM ** 23 July 1984 **
60 REM ** for ACORN USER **
70 REM *****************************
80
90 REM Reserve workspace
100 DIM cli,6,space &filenames &dir
110 REM Define array for filenames
120 DIM file(30)
130
140 REM Define 32 call addresses
150 oscil="FFF"
160 onword="FF1"
170 osfile="FFD"
180 osgbp="FFD"
190
200 REM Read disc 'cycle number'
210 ?space=0:REM Drive number
220 ?&dir
230 XX=space MOD 256
240 YY=space DIV 256
250 CALL oscil
260 REM returned in space
270
280 REM No files yet
290 numfile=TRUE
300
310 REM Read on all directories as
320 REM osgbp reads only current
330 REM directory
340 FOR dir=23 TO 0
350
360 REM Check for " and : illegal
370 IF dir=34 OR dir=50 GOTO 770
380
390 REM Perform *DIR
400 $cli="1","DIR","CHR dir"
410 XX=cli MOD 256
420 YY=cli DIV 256
430 CALL oscil
440
450 REM Set up parameter block
460 space"=filenames
470 space"=filenames
470 space"=filenames
480 space"=filenames
490 REM Call reads files on directory
500 numfiles=38-space
510 XX=space MOD 256
520 YY=space DIV 256
530 CALL oscip
540
550 IF numfiles=38-space\$5
560 REM No files on directory
570 IF numfiles=TRUE GOTO 770
580
Program 1. Select a sort from the menu and watch the sorting process, code coloured to make it easy to follow.

```
10 REM *** ALLSORT ***
20 REM B.B.HILL 1984
30 REM version A
40 ON ERROR GOTO 340
50 CODE 7
60 REM *** MAIN PROGRAM ***

70 PROCsetup
80 REPEAT
100 FOR I=1 TO max;dest(i)=source(i); NEXT
110 PROCmenu
120 IF choice=1 THEN PROCbubble
130 IF choice=2 THEN PROCshuttle
140 IF choice=3 THEN PROCallocation
150 IF choice=4 THEN PROCinsertion
160 IF choice=5 THEN PROCshell
170 IF choice=6 THEN PROCquick(1,max)
180 IF choice=7 THEN PROCtree
190 IF choice=8 THEN PROCsort() THEN PROCwait
200 UNTIL choice=nu_ofSorts THEN PROCwait
210 VDU26,12,23,1,1;0;0;0;
220 PRINT"RETURNED TO ""BASIC"
230 END
240
250 REM *** DATA ***
260
270 DATA RUBBLE,SHUTTLE,INSERTION,SELECTION,SHELL, QUICK, TREE, END.
280
290 DATA FRED,GEORGE,ALEX,JOE,BERT,BERNARD,AMY
300 DATA JEREMY,GEORGE,PETER,STEVE,TONY,JOHN
310
320 REM *** PROCEDURES ***
330
340 REM ERROR ROUTINE
350 IF ERR=17 THEN RUN
360 REPORT
370 PRINT* at line ";EFL"
380 END
390
400 DEFPROCsetup
410 waittime=100
420 T=TRUE=F
430 nothing=0;red=124;green=130;yellow=135;blue=132
440 DIM source(100),dest(100),sort(20)
450 RESTORE 270
460 I=0
470 REPEAT
480 I=I+1
490 READ source(I)
500 UNTIL source(I)="END."
510 num_ofSorts=I
520 RESTORE 290
530 I=0
540 REPEAT
550 I=I+1
560 READ source(I)
570 UNTIL source(I)="***"
580 max=I
590 ENDPROC
600
610 DEFPROCmenu
620 PROCdouble("MENU for; ",
630 FOR I=1 TO num_ofSorts
640 PRINTTAB(4,1,2);STR(i); " ;sort(i)"
650 NEXT
660 VDU22,1,10;0;0;0;0;0;
670 choice=FNchoose(1 to ";STR(num_ofSorts)"
680 IF choice=nu_ofSorts THEN ENDPROC
690 VDU22,1,10;0;0;0;
700 PROCdouble(source(i);choice)
710 FONT=1 TO max;PRINTTAB(8,1);source(i); CHOICE; NEXT.

T
720 PROClist
730 ENDPROC
740
750 DEFPROCdouble(d$)
760 LOCAL a
770 d$=(40-LENS d$) DIV 2
780 VDU26,12;PRINTTAB(4,2);CHR$(cyen);CHR$(41);d$;C
HR$="yellow";"SORT"
790 PRINTTAB(4,3);CHR$(cyen);CHR$(41);d$;CHR"yellow"
HR$="yellow";"SORT"
800 VDU26,12,23,39,4
810 ENDPROC
820
830 DEFPROCwait
840 PROCdouble(1,max;white)
850 PRINTTAB(0,19);CHR$(55);"Press SPACE bar to c
860 LOCAL REPEAT UNTIL GET=32
870 ENDPROC
880
890 DEFPROCchoose(d$)
900 REPEAT
910 PRINT* "(;YES" then (RETURN)"
920 INPUT"""";
930 INPUT"""";
940 IF VAL(RIGHTS(d$))=0 THEN rnum=VAL(RIGHTS(d$))
950 ok=ACGc$;"$" AND valnum=AND VAL$("";n"
960 IF NOT ok THEN VDU7,11;FOR I=1 TO 39;VDU
970 NEXT;VDU13
980 UNTIL ok
990 =VAL$(
1000 DEFPROCSwap(i, j)
1010 sorted=FALSE
1020 spare=dest(i)
1030 dest(i)=dest(j)
1040 dest(j)=spare
1050 PRINTTAB(21,i)+dest(i))"
1060 PRINTTAB(21,j)+dest(j))"
1070 PROCsort(i,i, cven, T)
1080 ENDPROC
1090
1100 DEFPROClist
1110 LOCAL II
1120 FOR I=1 TO max
1130 PRINTTAB(21,I)+dest(i))"
1140 NEXT
1150 ENDPROC
1160
1170 DEFPROCSort(i;...;"colour";p)
1180 PRINTTAB(20,i)+CHR$(41)+CTRL(20,j)+CHR$(
1190 COLOUR"
1200 IF not p THEN PROCp=PROCsort(i;i);nothing
1210 ENDPROC
1220
1230 DEFPROCPause
1240 IF INKEY(waittime)
1250 DEFTRAP1
1260 ENDPROC
1270 DEFPROCSort(i;...;"colour")
1280 PRINTTAB(10,II)+CHR$(41)+CHR$colour;CHR$colour;CHR$colour;CHR$colour
1290 NEXT
1300 ENDPROC
1310 DEFTRAP1
1320 DEFPROCSort
1330 FOR I=1 TO max-1
1340 sorted=TRUE
1350 FOR J=1 MAX TO I+1 STEP -1
1360 IF dest(J)=dest(I) THEN PROCswap(J,J-1)
1370 PROCsort(J-1,J;green,T)
1380 IF dest(J)=dest(I) THEN PROCp=PROCsort(J,J-1)
1390 NEXT
1400 IF dest(I)=max-1 ELSE DEFPROCPause
1410 NEXT
1420 ENDPROC
1430
1440 DEFPROCSort
1450 I=0
1460 IF INKEY(botton=max-1;inc=1;sor Ted=TRUE
1470 REPEAT
1480 sorted=TRUE
1490 REPEAT
```

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1500 L1+inc
1510 PROCdmark(I, I+1, green, T)
1520 IF dest(I)dest(I+1) THEN PROCSwap(I, I+1)
1530 IF Inc
tion then goto I+1 inc
1540 IF Inc
button THEN bottom = bottom + inc = 1
1550 UNIL I = top OR I = bottom
1560 UNIL bottom = top OR inc = 0 sorted
1570 ENDPROC
1580
1590 DEFPROCinsertion
1600 FOR I = 2 TO max
1610 PROCPause
1620 PRINTTAB(19, 1 + 1) " :TAB(19, I+1) :"
1630 FOR J = 1 TO 2 STEP -1
1640 PROCdmark(J, J, green, T)
1650 IF dest(J)>dest(J) THEN PROCSwap(J, J-1)
ELSE J + 2
1660 NEXT J
1670 NEXT I
1680 ENDPROC
1690
1700 DEFPROCselection
1710 FOR I = 1 TO max
1720 lowindex = I
1730 PRINTTAB(19, I) :TAB(19, + 1) :"CHF: yelo
1740 FOR 1 = I TO max
1750 PROCdmark(0, J, green, T)
1760 IF dest(J)dest(lowindex) THEN PROCdmark(0,
lowindex, white, fill: lowindex = J
1770 PROCdmark(0, lowindex, yellow, F)
1780 NEXT J
1790 IF lowindex = I THEN PROCdswap(I,lowindex) ELS
1800 NEXT J
1810 ENDPROC
1820
1830 DEFPROC Shell
1840 inc
max = 2
1850 REPEAT
1860 IF inc = 0 THEN 1970
1870 PROCdmark
1880 FOR (inc = 1) TO max
1890 PROCdmark
1900 FOR inc = 1 inc
1910 inc = inc + 2
1920 FOR inc = 0
1930 FOR J = 1 TO inc
1940 ENDPROC
1950 DEFPROCpair(J, J)
1960 IF J = 0 THEN ENDPROC
1970 PROCdmark
1980 IF dest(J)dest(J) THEN PROCSwap(J, J)
1990 FOR J = (J)dest(J) THEN PROCdmark(J, J) pair(J, J)
2000 ENDPROC
2010 DEFPROCquick(J, J)
2020 LOCAL pivotindex, partitionpoint, I
2030 pivotindex = (i)indpivot(J, J)
2100 PROCdmark
2110 PROCdmark
2120 PROCdmark
2130 PROCdmark
2140 ENDPROC
2150
2160 DEFFIND(pivot(J, J)
2170 LOCAL I
2180 inc
2190 IF J = 1 THEN = 0
2200 IF dest(J)dest(J+1) THEN = 1
2210 IF J = J THEN = 0
2220 IF dest(J)dest(J+1) THEN = 1
2230 L1 = I:GOTO 2190
2240
2250 DEFFNP
2260 pivot = dest(J)

Program 2. Sort procedures unadorned

LIST
   10 DEFPROC swap(i,j)
   20 sorted=FALSE
   30 spare=dest(i)
   40 dest(i)=dest(j)
   50 dest(j)=spare
   60 ENDP

70
80 DEFPROC bubble
90 FOR i=1 TO n-1
100 sorted=TRUE
110 FOR j=max TO i+1 STEP -1
120 IF dest(j-1)>dest(j) THEN PROCsw
130 ap(j,j-1)
140 NEXT
150 NEXT
160 ENDP
170
180 DEFPROC shuttle
190 i=0
200 top=0;bottom=max;inc=1
210 NEXT
220 sorted=TRUE
230 NEXT
240 i+inc
250 IF dest(i)>dest(i+1) THEN PROCsw
260 ap(i,i+1)
270 UNTIL i+inc=top OR i+inc=bottom
280 IF i+inc=top THEN top+1;inc=1
290 IF i+inc=bottom THEN bottom=inc-1
300 NEXT
310 ENDPROC
320
330 DEFPROC insertion
340 FOR i=2 TO max
350 FOR j=1 TO 2 STEP -1
360 IF dest(j-1)>dest(j) THEN PROCsw
370 ap(j,j-1) ELSE j=2
380 NEXT
390 NEXT
400 ENDP
410 FOR i=1 TO max-1
420 lowindex=i
430 FOR j=i+1 TO max
440 IF dest(j)>dest(lowindex) THEN 1
450 odindex=i
460 IF lowindex<>i THEN PROCsw(i,low index)
470 NEXT
480 ENDP
490
500 DEFPROC shell
510 inc=max DIV 2
520 NEXT
530 IF inc<>0 THEN 580
540 FOR i=inc+1 TO max
550 PROCpair(i,i-inc)
560 NEXT
570 inc=inc DIV 2
580 UNTIL inc=x0
590 ENDP
600
610 DEFPROC pair(i,j)
620 IF j=0 THEN ENDP

630 IF dest(i)<dest(j) THEN PROCsw
640 (i,j):PROCpair(j,j-inc)
650 ENDP
660 DEFPRTC quick(i,j)
670 LOCAL pivotindex,partitionpoint,i
680 pivotindex=0
690 IF pivotindex=0 THEN ENDP
700 partitionpoint=FPartion(i,j,pivotindex)
710 PROCquick(partitionpoint-1)
720 PROCquick(partitionpoint)
730 ENDP
740
750 DEFFN find pivot(i,j)
760 LOCAL i
770 i=j
780 IF i=j THEN 1=0
790 IF dest(i)<dest(i+1) THEN =1
800 IF i+1=x0 THEN =0
810 IF dest(i)<dest(i+1) THEN =1+1
820 I=i+1;GOTO 780
830
840 DEFFN partition(i,j,k)
850 pivotdest(k)
860 i=0;inc=1
870 REPEAT
880 PROCswap(L,R)
890 IF dest(L)<pivot THEN 1=L+1;GOTO 890
890 IF 1=L=R THEN 920
890 IF dest(R)<pivot THEN 1=R+1;IF
900 NEXT 1=L+1;GOTO 990
910 NEXT 1=L+1;GOTO 990
920 NEXT 1=L+1;GOTO 990
930 NEXT 1=L+1;GOTO 990
940 NEXT 1=L+1;GOTO 990
950 DEFFN tree
960 FOR i=2 TO max
970 PROCbackup(I)
980 NEXT
990 FOR i=max TO 2 STEP -1
1000 test=dest(I)
1010 dest(i)=x0
1020 PROCswap(I,I)
1030 PROCbackup(I)
1040 NEXT
1050 ENDP
1060
1070 DEFFN procbackup(J)
1080 REPEAT
1090 IF dest(J)<dest(J DIV 2) THEN PROCsw
DCsw(J,J DIV 2)
1100 J=J DIV 2
1110 UNTIL J=1
1120 ENDP
1130
1140 DEFFN procbackup(J)
1150 LOCAL swapindex
1160 swapindex=x0
1170 IF swapindex=x0 THEN dest(J)=test
1180 IF dest(swapindex)<dest(swapindex+x1) THEN swapindex=swapindex+x1
1190 IF swapindex=x0 THEN dest(J)=test
1200 IF test=x0 THEN dest(swapindex) THEN dest(J)=test
1210 ENDP
1220 ENDP

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Paul Beverley's program for the signature analysis unit

10  CLS
20  PROCinitialise
30  REPEAT
40  PROCmenu
50  UNTIL Z=0
60  END
70
80  DEF PROCmenu
90  REM **********
100
110  VDU26,12
120  INPUT TAB(0,2)"Test number? "Z
130  VDU20,0,24,30,5
140  IF Z=0 ENDPROC
150  N%=32
160
170  REPEAT
180  IF N%=13 OR N%=1 N%=INKEY(5)
190  IF N%=32 PROCprompt
200  IF N%>32 UNTIL TRUE:ENDPROC
210  *FX19
220  CALL test
230  PROCprint
240  UNTIL N%>32
250  ENDPROC
260
270  DEF PROCprompt
280  REM **********
290
300  PRINT
310  N%+=GET
320  IF N%=13 ENDPROC
330  IF N%=47 ENDPROC
340
350  REPEAT
360  PRINT CHR$(N%)
370  N%+=GET
380  UNTIL N%>13
390  N%=32
400  ENDPROC
410
420  DEF PROCprint
430  REM **********
440
450  &%=1
460  PRINT TAB(8)"(A% AND &F000)
DIV &1000;
470  PRINT"(A% AND &F000) DIV &100;
480  PRINT"(A% AND &F0) DIV &10;
490  PRINT"A% AND &F
500  ENDPROC
510
520  DEF PROCerr_handle
530  REM **********
540
550  VDU26,12
560  REPORT
570  PRINT" at "ERL
580  ENDP
590
600  DEF PROCinitialise
610  REM **********
620
630  DN ERROR PROCerr_handle:END
640  ?FE68=0 : REM S.R. to input
650  ?FE62=81 : REM PB0 & PB7 as output
660
670  FOR opt%= 0 TO 2 STEP 2
680  P%= &C00
690  DOFT opt%
700
710  .test
720  ****
730
740  SEI
750  LDY #0
760  LDA &880
770  STA &FE60
780  LDA &81
790  STA &FE60
800
810  JSR test$X
820
830  .read_SR
840  \********
850
860  LDX &801 \ Disable clock input.
870  STX &FE60 \ i.e. enable CBI clock.
880
890  LDX &8E6A \ Dummy read of S_R.
900
910  LDA &84 \ To check S_R flag.
920
930  .ready%
940  BIT &8E6D \ Has new value
950  BEQ.ready% \ shifted in yet?
960
970  LDX &8E6A \ Read shift register.
980  STX &403
990
1000  .again%
1010  BIT &8E6D \ Has new value
1020  BEQ again% \ shifted in yet?
1030
1040  LDX &8E6A \ Read shift register.
1050  STX &404
1060
1070  LDX &81
1080  STX &FE60
1090
1100  CLI \ You can interrupt now!

Continued

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1110 RTS
1120
1130 .testX%
1140 \\
1150
1160 CFX #2
1170 BCS test2%
1180
1190 .test1%
1200 \\
1210
1220 STA &BAAA,Y \ Low ROM
1230 DEY
1240 BNE test1%
1250 RTS
1260 .test2%
1270 \\
1280 \\
1290
1300 CFX #3
1310 BCS test3%
1320
1330 .next2%
1340 LDA &CSAS,Y \ High ROM
1350 DEY
1360 BNE next2%
1370 RTS
1380
1390 .test3%
1400 \\
1410
1420 CFX #4
1430 BCS test4%
1440
1450 .next3%
1460 LDA &C00,Y \ Low RAM
1470 DEY
1480 BNE next3%
1490 RTS
1500
1510 .test4%
1520 \\
1530
1540 CFX #5
1550 BCS test5%
1560
1570 .next4%
1580 STA &7800,Y \ High RAM
1590 DEY
1600 BNE next4%
1610 RTS
1620
1630 .test5%
1640 \\
1650
1660 CFX #6
1670 BCS test6%
1680
1690 .next6%
1700 LDA &FE40 \ Internal VIA
1710 LDA &FE41
1720 DEY
1730 BNE next6%
1740 RTS
1750
1760 .test6%
1770 \\
1780
1790 CFX #7
1800 BCS test7%
1810
1820 .next7%
1830 LDA &FE80 \ Disc Controller
1840 LDA &FE81
1850 LDA &FE82
1860 LDA &FE84
1870 DEY
1880 BNE next7%
1890 RTS
1900
1910 .test7%
1920 \\
1930
1940 CFX #8
1950 BCS test8%
1960
1970 .next7%
1980 LDA &FE20 \ Video ULA
1990 LDA &FE21
2000 DEY
2010 BNE next7%
2020 RTS
2030
2040 .test8%
2050 \\
2060
2070 LDA &FE08 \ ACIA
2080 LDA &FE09
2090 DEY
2100 BNE test8%
2110 RTS
2120
2130 \n2140 \n2150 ENDP
Alex Wilson's 'Wordprint' wordprocessing program for the Atom with Star Gemini X10 printer connected

10 G.Z
19 REM SAVE
20 A$="TO$
21 I=0
22 I=I+1
23 I=I+1
24 I=I+1
25 I=I+1
26 I=I+1
27 I=I+1
28 I=I+1
29 I=I+1
30 I=I+1
31 I=I+1
32 I=I+1
33 I=I+1
34 I=I+1
35 I=I+1
36 I=I+1
37 I=I+1
38 I=I+1
39 I=I+1
40 I=I+1
41 I=I+1
42 I=I+1
43 I=I+1
44 I=I+1
45 I=I+1
46 I=I+1
47 I=I+1
48 I=I+1
49 I=I+1
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85 I=I+1
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87 I=I+1
88 I=I+1
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90 I=I+1
91 I=I+1
92 I=I+1
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95 I=I+1
96 I=I+1
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140 I=I+1
141 I=I+1
142 I=I+1
143 I=I+1
144 I=I+1
145 I=I+1
146 I=I+1
147 I=I+1
148 I=I+1
149 I=I+1
150 I=I+1
151 I=I+1
152 I=I+1
153 I=I+1
154 I=I+1
155 I=I+1
156 I=I+1
157 I=I+1
158 I=I+1
159 I=I+1
160 I=I+1

Continued
V=R*L; J#80=V; D0; ?V:?R; V'=V-1; R=R-1; U.R=S-1
154 I=0; D0; 9:?=B?; I=I+1; U.I=L; S=S+2; n
160 IN."DELETE HOW MANY""n; D=VALID; IFG<0: F.#1111"n; G.60
162 D0; ?S=S;G; S=S+1; U.(S+R)=R; ?S=S+1; I?80=S
164 S=T;G.n
189 REM SINGLE/DUPLICATE STRIKE, EMPHASISED
190 D0; ?#80=0; ?#92=0; F."OUTPUT TO PRINTER"" n; Single"n
192 IN."2 DBLE.STRIKE""3 EMPHASISED""D=R=VALID; IFR<1 ORR>0; R=1
194 IFR=2; ?#80=1
195 IFR=3; ?#92=1
196 R.
199 REM PRINT STYLE
200 P; #80=0; ?#92=0; ?#8B=1; D=0; GOS.u; IFQ=6.p
210 IN." 10 CPI"" 2 12 CPI""3 17 CPI""D=R=VALID; IFR<1 ORR>0; 6.210
212 P; #80=0; IFR=1; ?#87=80; G.r
214 IFR=2; ?#87=96; G.r
216 ?#87=156
230 IN."LEFT HAND MARGIN"D=M=VALID; IFM<0 ORM>20; 6.r
232 IFM=10; M=9
240 D=#8B=M; F."DEFAULT IS 60 LINES"n
242 IN."MAX.NO.OF LINES PER PAGE"D=L=VALID; IFL=0; L=60
244 ?#89=L
250 P; "MAX.NO.OF LETTERS PER LINE IS" ?#87=75"M
252 IN."NO.OF LETTERS PER LINE"D=C=VALID; IFC=0; C=#87=75"M
254 IN."DOUBLE SPACED Y/N"D; IFD=89; ?#8B=2
256 ?#8C=C; IN."DATE REQUIRED Y/N"D; IFD=89; ?#8B=1
258 IN."DO YOU WANT ADDRESSED HEADING Y/N"D; IFD=78; R.
262 IFD=13; G.270
270 ?#85=C-M; GOS.t; R.
299 REM PRINT TEXT
300 Q=L; ?#B=M=7; ?#8A=K=U; C=#8C
302 IN."SET UP PAPER""PRESS RETURN TO START""D; IFD<13; G.q
310 P; #2:GOS.x; U=0
314 IF#85=0; G.321
316 Z=S; P; #5:U=0; S=#2B3; GOS.q; U=U+4K
321 IF?#8B=0; G.330
322 S=#7E0; GOS.v
330 Z=0; IF?#85=0; G.h
332 S=#28A; GOS.q; P; "U=U+3K
335 S=#820; T; ?#80; ?#81; C=C+1
340 IFR=1; L=6.k
344 P; "19%; IN."END OF PAGE""ADJUST PAPER"D; U=0
346 P; #2+17
370 KF5; T; G.400
380 GOS.v; S=S+V+2
390 G.
400 P; "19%3%; IN."ANY MORE COPIES WANTED Y/N"D
410 IFD=78; R.
420 GOS.u; G.q
430 GOS.f
434 IN."INSERT ENVELOPE, PRESS RETURN"D; ?#3=M; ?#92=1; K=1; M=20
436 P; #2:GOS.x; S=#28A; C=20; GOS.q; M=#93; P; #27; 70; 19; 3; R.
449 REM OUTPUT STRING
450 V=0; X=0; Y=1; W=0; IF?#86=1; Y=2
452 D0; E=57; V; IFE<64; G.w
453 IF$E>$61;IF$E<$91;E=E;#20;G.w
454 IF$E>$91;IF$E<=$123;E=E;#20;G.w
456 IF$E$>$W0;IF$E$>$W5;B?X=X+1;GOS.E;E.i
457 IF$E$>$120;IF$E$>$127;B?X=X+1;GOS.E;E.i
458 B?X=X+1;B?X=X+1;B?X=0;Y=1;#86=0;G.i
460w B?X=E;W=W+Y
461 V=V+1;X=X+1
462 U.W=E02 OR E=42 OR E=13)
463 IF$E=42;X=X-1;V=V-1
464 IF$W=C;D0;D=V-1;U;V=W=32;D0;X=X-1;U;B?X=32
465 B?X=13;IF$Z=0;F.9
466 F=8;D0;A=A;F.0;LINK~FF10;F=F+1;U.A=A.13
467 U=M+H;IF$K=1;P."*
468 V=V-1;R.
469 REM SET UP PRINTER
470 P.17=#27&64;IF$#05=0;T=#05;P.27=#68(T).0
472 IF$#0D=1;P.27=#71;REM BBLE. STRIKE
474 P.27=#77&;M;IF$#92=1;P.27=#69;#90=1;REM MARGIN, EMPHASISED
476 F.1=#8E TO#91;A=#1;LINK~FF10;N.
478 P.27=#55&;P.27=#61;R.1;REM USA, MB=0
479 REM ENVELOPE
480 P.0;IN."NEW ADDRESS Y/N";D;IF$D=78;R.
482 S=#2A00;P."TYPE NAME AND ADDRESS";GOS.D.S=S+1
484 S=S+1;R.
490GOS.0;V=S+V;IF$S=13;R.
492 S=S+2;G
499 REM START
500 D=#2800;S=#8204;'#80=S;#8200=13;'#8201=-1;B=#2810
505 T=#81;?=#2B;F=100;=#8E=#1421B
510 R=#F7E0;IN."DATE";F
520IF$12="1 WRITE TEXT","2 EDIT TEXT","3 PRINT TEXT"
522 P.4="SAVE TEXT","5 LOAD TEXT","6 REVIEW TEXT"
523 P.7="ENVELOPE","8 END"
524 IN."D;C=VALD;IFC1;ORC=8;G.s.y
526 G.6.550200#C)
550 IN."NEW TEXT";"2 ADDITIONAL TEXT";D;C=VALD
552 IFC1;ORC=2;6.5502
554 G.6.5564D)
557 GOS.A;#80=G.s.y
558 S=#80;GOS.D.S=#80=S;6.y
570 GOS.E;6.y
590 IF$F=100;GOS.p
592 IN."CHANGE PRINT STYLE Y/N";D;IF$D=89;GOS.p
594 GOS.G.s;G.y
610 GOS.s;G.y
630 GOS.s;G.y
650 S=#8204;E=1
651 J=0;F.12
652 GOS.E;IF$E=1;IF$9;GOS.680;IF$E=1;6.651
656 IF$E=1;6.652
660 GOS.680
664 6.y
670 GOS.430;6.y
680 IN."D;F$D=90;E=0;R.
682 IF$D=69;U=S;GOS.n
684 R.
690 E.
Listing 2. Program compactor utility in machine code

```
10 REM *** SPACE REMOVER ***
20 before%=570
30 after%=872
40 count=874
50 FOR pass=0 TO 3 STEP3
60 P%=5900
70 CLS pass
80 LDA #0
90 STA after
100 STA before
110 STA count
120 STA count+1
130 LDA &18
140 STA after+1
150 STA before+1
160 .outer
170 LDY #1
180 JSR transfer
190 CMP #$FF
200 BNE all_done
210 JSR transfer
220 JSR transfer
230 .inner
240 LDA (before),Y
250 CMP #$FC
260 BEQ space
270 JSR transfer
280 BNE end_of_line
290 CMP #82
300 BNE inside_quote
310 BNE inner
320 .space
330 INC before
340 BNE update
350 INC before+1
360 .update
370 INC count
380 BNE inner
390 INC count+1
400 BNE inner
410 .end_of_line
420 DEY
430 TYA
440 PHA
450 CPY #3
460 BNE clear
470 LDY #3
480 STA (after),Y
490 CLC
500 ADC after
510 STA after
520 BCC clear
530 INC after+1
540 .clear
550 PLA
560 CLC
570 ADC before
580 STA before
590 BCC outer
600 INC before+1
610 BNE outer
620 .inside_quote
630 JSR transfer
640 BNE end_of_line
650 CMP #82
```

Listing 1. Utility in Basic to list the values assigned to all the resident integer variables in decimal and hexadecimal

```
10 REM *** INTEGER DUMP ***
20 REM (c) Acorn User ***
30 FOR loop=540 TO $468
40 'loop=RND
50 NEXT
60 PROCs_var_dump
70 END
80 ;
500 DEF PROCs_var_dump
510 CLS
520 PRINT CHR$(13);:SPC(5);"Integer Var Table Dump"
530 PRINT "Var Hex Deci"
540 VDU 29,0,24,39,3
550 ascii$=ASCII"A"
560 FOR loop=540 TO $468 STEP4
570 PRINTCHR$(ascii$):" ":
580 PRINT"loop:"
590 PRINT"loop"
600 ascii$=ascii$+1
610 NEXT
620 VDU 26
630 ENDFRC
```

<table>
<thead>
<tr>
<th>660 BNE inside_quote</th>
<th>890 JSR hexout</th>
</tr>
</thead>
<tbody>
<tr>
<td>670 BNE inner</td>
<td>900 BRK</td>
</tr>
<tr>
<td>680 .transfer</td>
<td>910 EQU:10000</td>
</tr>
<tr>
<td>690 LDA (before),Y</td>
<td>920 EQU:1009000</td>
</tr>
<tr>
<td>700 STA (after),Y</td>
<td>930 EQU:spaces removed</td>
</tr>
<tr>
<td>710 INY</td>
<td>940 EQU:13</td>
</tr>
<tr>
<td>720 CMP #13</td>
<td>950 BRK</td>
</tr>
<tr>
<td>730 RTS</td>
<td>960 RTS</td>
</tr>
<tr>
<td>740 .all_done</td>
<td>970 .hexout</td>
</tr>
<tr>
<td>750 LDA after</td>
<td>980 PEA</td>
</tr>
<tr>
<td>760 CLC</td>
<td>990 LSR A:LSR A</td>
</tr>
<tr>
<td>770 ADC #2</td>
<td>1000 LSR A:LSR A</td>
</tr>
<tr>
<td>780 STA &amp;12</td>
<td>1010 JSR digit</td>
</tr>
<tr>
<td>790 LDA after+1</td>
<td>1020 PLA</td>
</tr>
<tr>
<td>800 ADC #0</td>
<td>1030 .digit</td>
</tr>
<tr>
<td>810 STA &amp;13</td>
<td>1040 AND #15</td>
</tr>
<tr>
<td>820 LDA #$FC</td>
<td>1050 CMP#10</td>
</tr>
<tr>
<td>830 JSR &amp;FFEE</td>
<td>1060 BCC over</td>
</tr>
<tr>
<td>840 LDA count+1</td>
<td>1070 ADC #6</td>
</tr>
<tr>
<td>850 BEQ zero</td>
<td>1080 .over</td>
</tr>
<tr>
<td>860 JSR hexout</td>
<td>1090 ADC #49</td>
</tr>
<tr>
<td>870 .zero</td>
<td>1100 JMP &amp;FFEE</td>
</tr>
<tr>
<td>880 LDA count</td>
<td>1110 J:NEXT</td>
</tr>
</tbody>
</table>
The NFS chip: more differences

SINCE writing the DNFS review (Beeb Forum, August), Robin Newman brings to our attention two further unpublished differences from the existing DFS and NFS chips. He writes:

The first concerns the use of the DESTROY and BACKUP commands. When using DFS 0.9 these have to be preceded immediately with a *ENABLE command, due to their potentially drastic effects. With DNFS this *ENABLE can be omitted, in which case the prompt 'GO (Y/N)?' follows the issuing of the command. A 'Y' sends it on its merry way, and any other key aborts the command. This is particularly useful with the BACKUP command because the information 'copying from .00 to .02' (or whatever the relevant drives are) is printed before the prompt 'GO (Y/N) ?' is issued. This gives a chance for the command to be aborted if the source and destination drives have been typed in the wrong order.

The second difference concerns the NFS half of the chip. Recently I have written a Network version of the *BUILD fname command contained in the DFS chip. This is useful for forming IBOOT files etc for use on the network. To extract the filename 'fname' from the end of the command line, I have used OSARGS with A=1 (see my example in Beeb Forum, May 1984, listing 1). The 'old' NFS 3.34 incorrectly returns the address of the START of the command line, ie the byte containing the B of BUILD in this case. NFS360 (contained in DNFS) correctly returns the address of the f of fname.

The problem is that one has to accommodate both protocols. Listing 1 shows how I have done this. It is not very elegant, requiring a direct peek at the NFS ROM to determine which version it is. Does anybody know a call that returns the NFS version running in the local machine?

I hope this information will be of use to DNFS users, and that the second one will prevent others wasting time finding a bug not of their own making. It is good that Acorn has made the new NFS and DFS versions compatible as far as this OSARGS call is concerned. It would have been even better had they let everyone know about it!

Confuse the illicit copier

ELLIS THOMAS's ideas on cursor editing from within a running program (Beeb Forum, August) stimulated some thought. Adrian Robson of Hexham, Northumberland, writes...

The method described could be very useful for some applications but, in the case of file copying, it has a major failing in that it does not obtain the true file name. Let me explain.

A method of providing your programs and data files with greater security is to use non-alphanumeric ASCII codes in the file name. For example 240, which is 'p' in mode 7. To do this you must use an OSFILE call to create the file. Anyone subsequently using LOAD or *LOAD on the file will find that the file name prints on the screen with '?' for the non-alphanumeric ASCII codes. They will be unable to save the file using SAVE or *SAVE with the correct file name. Even if they knew the file name, they would be unable to enter it directly from the keyboard.

In operation two methods are available for providing the required security: the program could be executed by using CHAIN**, thus avoiding the non-ASCII characters in the file name. The program checks that bytes &3B2-&3BD contain the expected file name and refuses to run correctly if it does not. OBYTE &A0 can, of course, be used to access the name.

The second method, applicable to data and machine code files, is to load the file via an OSFILE call using the correct name in the control block. However, the former method is recommended as it causes greater confusion to the illicit copier.

This technique can also, of course,
be used for data or machine code files. Now we obviously require a method of taking legitimate back-ups of our protected files and it is equally obvious that the cursor editing method will not work in this case. The only method available involves access to page three and using an OSFILE call to save the file. This has the additional advantage of simplicity compared with the cursor editing method.

The comment that cursor editing will minimise problems with new OS releases is valid. However, it is more likely that the screen format of the "OPT 1.2 load message will change on future releases rather than the internal header block format or location. Anyway, the risk and consequences of either is so minimal that they can be only a minor consideration when deciding on the best method for arranging for automatic file backup for your own programs and data.

In conclusion, the cursor editing method is a sophisticated means of arranging file copying, but sophistication is not an end in itself, no matter how well it is justified. To coin a phrase, the cursor editing method when applied to file copying is equivalent to using a hammer to crack a nut and then missing the nut!

### The Serial Port

ONE aspect of the Beeb not often touched on is the RS232 serial port. Perhaps this is because the pin-out diagram in the User Guide is incorrect, as John Gallagher of Carlow, Ireland, points out.

The diagram of the five-way DIN plug on page 406 of the User Guide is incorrect in that the indentation representing the plug case earth should be at the top of the diagram. The connections are otherwise correct.

![Diagram of the five-way DIN plug as printed in the User Guide. The indentation should be at the top](image)

Alan Crabb's disc catalogue reader program is printed on yellow page 103

John also offers testing techniques...

A simple test of the operation of the RS243 output is the following. Connect pins A and B together and pins D and E together (Data out to Data in and CTS to RTS). Type in the following series of commands.

- FX7.1 < CR >
- FX8.1 < CR >
- FX3.5 < CR >
- FX2.1 < CR >

Now press any letter on the keyboard and if the serial port is operating properly the screen will print 'Syntax Error' continuously at a slow rate. The screen will also display multiple prompts. If the DIN plug is removed the screen display will halt. The test is crude but effective...

Finally, John provides serial connections for an Epson printer...

1. Connect data out line to pin 3 of the printer.
2. Connect data in line to pin 2 of the printer.
3. Connect ground to pin 7 of the printer.
4. Connect RTS to CTS.

The printer will now print in the serial mode in response to the printer-type command "FX5,2" and the switch-on command Control B or VDU2. Note that the baud transmission and reception rates may require setting using "FX8,n" and "FX7,n" if the default values do not match.

### Get the Measure of your Files

ALAN CRABB of Shaftesbury took up the challenge to write a program that will read a disc's catalogue and return the length of each file on it (Beeb Forum, August). Alan wins the promised £10 note. Let him explain...

The program (listing 2) as it stands will print all the files and their load/execute values on the disc in drive 0. The program is completely Tube compatible and uses only 'legal' methods (routines can be written legally, not accessing the DFS catalogue directly).

The listing is fairly well documented but a few extra notes might help.

The OSWORD call with A = &7D returns the disc's 'cycle number' (the number of times the disc contents have been altered). X and Y point to a single byte which contains the drive number and returns the cycle number.

The checks in line 370 for illegal directories test for A and B. The Acorn DFS seems to interpret the "A" in a funny way and the colon is used for drive selection.

The OSGBPB (get block, put block) may be new to most readers. It is documented on page 339-42 of the Advanced User Guide (I do not have an Acorn DFS manual - anyone got one for sale?). The call with A = 8 is used to 'read file names from the current directory' - hence the loop through all normal directories at line 340. The parameter block pointed to by XY is set up as follows:

- CYCLE number
- 4 Pointer to block for return of names
- 5-8 No. of files to be read decremented by DFS
- 9-0 Initially 0, incremented in eights by DFS

The data is returned in the format: length of filename1 length of filename2 end of filename

The length is always 7 and filenames end in spaces if they are shorter.

Finally, lines 800-860 print all the information using functions returning the load, exec and length of each file. The functions may be extracted but be sure to define some workspace for them.

### Neat Toggling

READERS may be interested to see the assembler routine in the Beeb Forum suggestion for August, 'Printer on, printer off', page 65, reduced from 67 to 14 bytes, writes Robin Tracy of Sutton, Surrey.

```
100 DEF Printer On = 0
200 DEF Printer Off = 1
300 DEF Printer Out = 8
400 DEF Printer Error = 9
500 DEF Printer Load = 11
600 DEF Printer Print = 12
700 DEF Printer Control = 13
800 DEF Printer Baud = 14
900 DEF Printer Address = 15
```

In general, Exclusive OR (EOR) does not seem to be as widely applied as it might be. EOR can be used to toggle between any two integer values. There is usually a saving in space too.

Suppose you wish to toggle between 'n' (ASCII 110) and 'y' (ASCII 121) then Exclusive OR does it neatly.

```
105 X = 110
110 DEF1 = 121
120 X = X + DEF1
130 IF X = 110 THEN 145
140 PRINT "YES"
```

To discover '23' enter the line

```
P.121 EOR 110.
```

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SEE HOW THEY SORT

A colourful demo by George Hill shows how data is put in order

ONE OF the most frequently performed tasks in computing is sorting, but there are many different methods, as the accompanying programs illustrate. This article will assess their advantages and disadvantages, and compare their performance in various situations.

What items are to be sorted? The example programs use lists of boys and girls names, stored in an array. The sorting algorithms, however, can be applied to virtually any data which can be put in order – integers, floating-point numbers, strings, records with a key, for example.

Two words there need explaining. First, what is an algorithm? It is difficult to define precisely, but if you describe your method for doing something without recourse to any specific computer language, then you have probably stated the algorithm.

Second, what is a record? It is a collection of pieces of information, all of which 'belong' to a single item – for example, a person's name, address, telephone number, age, sex, etc. Basic does not recognise records, but they are a fundamental concept in languages that deal conveniently with data processing. Most important sorting methods must be able to deal with records, and some must be able to sort records from disc or tape files.

There are two programs. Program 1 allows the various sorts to be operated by selection from a menu. Sixteen assorted names will be sorted slowly, with colour coding to help you follow the sorting process as it occurs. Program 2 consists of the sorting procedures only. They are shorn of all the trills of program 1 that allow the sorts to be watched in action. It serves two purposes: first, to allow you to see how the sorting algorithms are translated into Basic; second, to allow you to copy and adapt them for your own use, should you need to sort some data in a program of your own.

Bubble sort

The first and most commonly understood and used sort is the 'bubble' sort. There are many variations of it, but the simplest and most obviously 'bubbling' algorithm is as follows:

The starting list has n items. Compare the bottom two items (n and n–1). If the lower one is smaller, swap them, otherwise do nothing. Now compare the next two items (n–1 and n–2). Swap, or don't swap as before, so that the smaller item ends up higher. Repeat the process until the smallest item in the list reaches the top. Now start at the bottom again, and repeat the swapping procedure until the next smallest item is in position 2. Go on until the list is in order.

The procedures required for this are PROCbubble and PROCswap(i,j). PROCswap simply swaps the array items dest[i] and dest[j], and sets the flag 'sorted' to FALSE. This latter is a simple way of avoiding retesting already sorted items. If no swaps take place in any pass up the list, then the items must already be in order, so we should exit from the procedure.

Program 1 uses a number of conventions. Items being compared are indicated in green. When they are swapped they are shown in cyan (pale blue). When the program is run and 'bubble' is selected you will see the source list of names on the left and the destination list on the right. The items will be bubbled up from the bottom and will reach their appointed places as described above.

There are pauses generated by INKEY(waittime). These stop the program running so fast that you cannot follow it. If you still find it too fast, 'waittime' is set in PROCsetup. Increase it to 200 for a two-second pause, 300 for three seconds, and so on. If you want to 'single-step' the program, set it to 100,000 (or higher), then you will get the next step on hitting any key.

This seems an appropriate moment for a quick skim through program 1. The main program is very simple. A number of variables and arrays are set up (PROCsetup), and a sorting method chosen from the menu. The sort then takes place, and you are returned to the menu after pressing any key. The last choice terminates the program. Any sort can be aborted by pressing the ESCAPE key, which returns you to the menu.

The sort names ('BUBBLE', etc) and the names to be sorted are in data statements and can be added to simply by adding items to the data statement. The number of sorts is limited to 20, and the last one must be 'END'. The number of items in the arrays is limited to 128 – though this could easily be increased – and the last one must be '***'. If you increase the number of names beyond 18 it will not be possible to use the 'before your very eyes' element of the program. An adaptation of the program, using the sorting procedures of program 2 but no display, was used with various numbers of data items to produce the timings in table 2, of which more anon.

The display is in mode 7 and the text colour characters are defined as variables (eg, red = 129) in PROCsetup. This makes the subsequent colouring easier to follow. The total number of items in the array is 'max', while the number of sorts is 'num_of_sorts'. The unsorted array is source[i] while dest[i] is the array that is sorted by the various procedures.

PROCmenu is straightforward.

PROCchoose(i,s) is a useful general-purpose function that allows you to pass a string of the form '1 to 20' or '1,2,3,4 or 5' to it, and to select only valid numbers in the stated range. Its limitations are that the left number must be between 0 and 9, and the right number must be between 1 and 999.

PROCdouble produces a heading and sets the text window.

PROClrwa clears any residual colours on the destination list, and waits while you check that the sort has worked.

PROClist simply lists the destination array.

PROCsection(i,j,colour) colours a section of the array in the chosen colour.

George Hill's colour-coded sort demo and procedures are listed on pages 104–106

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PROCmark(i,j,colour,pause) marks two items in the chosen colour, and if pause is TRUE (T is TRUE, F is FALSE), a pause is generated by PROCpause for ‘waittime’ hundredths of a second.

PROCswap(i,j) swaps two items of the destination array, and adjusts the display.

Shuttle sort
The second sort, called ‘shuttle’, is a variation of the bubble sort. It pushes the biggest item down to the bottom, bubbles the smallest up to the top, then pushes down the next biggest and bubbles up the next smallest. It is attractive in concept but takes the same number of passes as the bubble sort and, due to the cumbersome coding necessary, is much slower.

Insertion sort
The third sort is an ‘insertion’ sort, whose algorithm is as follows:

Start with the top two items and swap them if necessary to get them in order.

Now take the third item and insert it (by bubbling it up) into its correct place among the items already sorted.

Now take the next item, and insert it in its correct place.

Repeat till you get to the bottom item in the list.

Selection sort
The fourth sort is a selection sort. Many sorting algorithms can be adapted to be a selection sort. The principle of selection is as follows:

Do all the comparisons necessary to decide where an item goes before actually doing any swapping. Swap only when you know the item’s destination.

This has enormous advantages in large-scale sorting operations, where the items to be sorted are complicated records and moving them is time-consuming.

Taking this principle to its extreme, we can often avoid moving the items. We could have a set of ‘pointers’ to the records and carry out comparisons on the ‘key’ field – eg the surnames. Instead of moving the records, we move the pointers. We finish with a sorted set of pointers, which in many cases is just as good as a sorted set of records. We can recall them in alphabetical order, for example, and if it is necessary to sort the records themselves, we know where they have to go before we start moving them about—an obvious advantage which lets us minimise the number of moves necessary.

The selection sort here uses the same basic method as the bubble sort. It works as follows:

Start at the top, and ‘remember’ item one.

Compare it in turn with each of the items below it.

If an item is smaller, then ‘remember’ it instead.

Go on comparing and ‘remembering’ until the bottom of the list is reached. The ‘remembered’ item is now the smallest.

Swap it with item one (unless it was already there).

Repeat this with item two, three, etc until the items are sorted.

The program marks the position for replacement in red, and the remembered item in yellow. The countdown is followed by a green marker.

The disadvantage of these methods is that they tend to move up the list rather slowly. The bubble sort operates much faster on a partially sorted list than on a random one, and has its ‘worst case’ when the items are in reverse order. (Every time a comparison is made a swap has to be carried out, and the ‘sorted’ getout flag never gets set.) If only one item is out of order, then only one pass will be necessary to place it, and the ‘sorted’ flag is set on the next pass. The Shell sort is a brilliant method of making the items move more rapidly, and cutting down drastically on the time needed.

Shell sort
In the shell sort items are first compared which are separated by half the list.

For an array with 16 members we compare (and swap as necessary) items 1 and 9, 2 and 10 etc.

Return to the top of the list, and halve the comparison interval, ie, compare items 1 and 5, 2 and 6 etc. If an item is swapped, it must be swapped up as far as it will go at this interval. (Thus if we have to swap items 13 and 9, we must compare the new 9 with 5, and then if swapped 5 with 1, otherwise an item might get ‘stuck’ in the bottom half.)

Now compare items 1 and 3, 2 and 4, etc. Items must be ‘back compared’ if swapped as before.

A single pass down the list will eventually produce the sorted order.

Figure 1. Graph of sorting times for bubble, shell and quick sorts

ACORN USER OCTOBER 1984
<table>
<thead>
<tr>
<th>METHOD OF SORTING</th>
<th>NUMBER OF ITEMS, timed in seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Bubble</td>
<td>0.83</td>
</tr>
<tr>
<td>Shuttle</td>
<td>1.08</td>
</tr>
<tr>
<td>Insertion</td>
<td>0.68</td>
</tr>
<tr>
<td>Selection</td>
<td>0.61</td>
</tr>
<tr>
<td>Shell</td>
<td>0.67</td>
</tr>
<tr>
<td>Quick</td>
<td>1.43</td>
</tr>
<tr>
<td>Tree</td>
<td>1.56</td>
</tr>
</tbody>
</table>

Table 1. Time trial results for each sort

The mathematical reasons for the efficiency of this method are not clearly understood, but it produces remarkably consistent results, and is the method I would recommend if you want to sort medium amounts of data (50 to 500 items, say).

The last two methods in this brief survey are the most difficult to understand, and are valuable if large amounts of data must be sorted (from 200 to many millions of items).

**Quick sort**

The quick sort algorithm is as follows:

- Look at the list and choose a 'pivot' value. Don't be too fuzzy, but it will be better if the pivot is somewhere near the middle of the list.
- Now sort the list so that a 'partition' appears, above which all items are smaller than the pivot, and below which all items are less than or equal to the pivot. (It is not implied at this point that the items in either half are in order, nor is it implied that the pivot value is at the partition point.)
- Now look at the top section (above the partition) and find a pivot. Divide it around a partition as above.
- Repeat this sequence until the section partitioned is in order.
- Go on until each sub-section left is similarly sorted.

Horrible, isn't it?

Actually it is an ideal algorithm for recursion, which accounts for my rather awkward explanation. Recursion is hard to explain at the best of times.

Let's look at one bit of quick sort to get the idea. We are trying to sort the numbers 4, 2, 9, 7, 1, 3. Choose a pivot. I choose 4. (At least it is not the smallest, as the next number (2) is less, so it is somewhere near the middle.)

Let's call the first item 'left', and the last 'right'. Imagine pointers (L and R respectively) pointing at each. Swap the L and R values. This ensures that there is one item in the bottom half which is less than or equal to the pivot. So the order now is:

\[ 3, 2, 9, 7, 1, 4 \]

L R

Move the left pointer along until it hits a value greater than or equal to the pivot (4):

\[ 3, 2, 9, 7, 1, 4 \]

L R

Now move the right pointer until it either coincides with the left, or hits a value less than the pivot (4 - remember?):

\[ 3, 2, 9, 7, 1, 4 \]

L R

Swap the values at L and R:

\[ 3, 2, 1, 7, 9, 4 \]

L R

Move L right until it hits a value \( \geq \) pivot:

\[ 3, 2, 1, 7, 9, 4 \]

L R

Move R left until it meets L, or a value < pivot:

\[ 3, 2, 1, 7, 9, 4 \]

L R

The section is now partitioned. L points to the first number in the bottom half. All numbers to the left of L are \( < 4 \), all to the right are \( \geq 4 \).

You now repeat the process on 3, 2, 1 and 7, 9, 4 until the section is sorted. A section is sorted when you cannot find a pivot - all values are equal - or there is only one item in the section.

When you follow it using program 1, I recommend a long 'waittime'. The section being partitioned is turned blue. Cyan again marks items being swapped. The left pointer is yellow, and the right green. The pivot value appears in red to the top right of the list to remind you of its value. Don't feel inadequate if you don't follow it first time. I didn't, and I wrote it! Check each time

that, at the end of each section, the values above the yellow or green marked value are less than the pivot, and those below are greater or equal.

**Tree sort**

The final sort is the tree sort or heap sort. The values are treated as a binary tree. This may become clearer if you look at the examples below. The algorithm is as follows:

- Sort the tree out so that the biggest value is at the top (or root - computing trees are upside-down) of the tree, and so that all 'children' are smaller than their 'parents'. This is called a 'partially ordered tree'.
- Now extract the value at the bottom of the tree (its rightmost 'leaf' - upside-down tree, remember).
- Replace it by the 'root', which must have been the biggest value, and so belongs at the bottom.
- Now find the right place to replace the removed leaf by swapping the larger values up towards the root, until the leaf slots in.
- Repeat with the next leaf, and continue until sorted.

Confused? Let's watch it in action for the same six numbers as before, 4, 2, 9, 7, 1, 3.

As a tree they are:

\[ 4 \]

\[ 2 \]

\[ 9 \]

\[ 7 \]

\[ 1 \]

\[ 3 \]

Start at the 2, and follow it up to the root 2.4. For the partially ordered tree every parent must be bigger than its children:

- 4 is bigger than 2, so leave them.
- 2 is \( < 4 \), so swap them.
- Move on to 7 - 7, 2, 9. Needs changing to 2, 7, 9, and the tree is now

\[ 9 \]

\[ 7 \]

\[ 4 \]

\[ 2 \]

\[ 1 \]

\[ 3 \]

Move on to 1 and follow it up - 1, 7, 9. No change needed.

Move on to 3 and follow it up - 3, 4, 9.
No change needed. Note that 9 is bigger than 7 or 4, 7 is bigger than 2 and 1, 4 is bigger than 3.

To sort the tree, extract the 3, and put the 9 to the bottom:

\[ 7 \]

\[ 4 \]

\[ 2 \]

\[ 1 \]

\[ 9 \]

Where does the 3 go? Look for the larger child of the empty root. This is the 7. Compare it with the 3. If it is bigger, move it up to the root, and look
at its children:

```
7
* 4
2 1 9
```

Look at the larger child (2). It is smaller than 3, so replace 3 where the * is:

```
7
* 4
2 1 9
```

The subsequent stages in the sort are:

```
4 3 1
2 7 9
3 2
2 1 4 7 9
2 3
1 4 7 9
```

and the tree is now sorted!

In program 1 the tree's 'generations' are coloured. The root is magenta, first generation is red, second generation yellow, third generation blue, fourth generation (one item only) magenta again. Items being compared are green, and items being swapped are cyan. When an item reaches its correct slot it is white.

Pros and cons

What are the advantages and disadvantages of these methods? Let's ignore the shuffle sort, which seems to have no advantages. The bubble, insertion and selection sorts are all reasonably easy to code, and for small amounts of data there is little to choose between them, though the selection method is clearly faster, as it avoids unnecessary swapping — comparisons are much quicker than swaps.

The shell sort becomes more efficient in the medium range, though it takes a little more careful coding.

The quick sort and tree sort come into their own only on larger amounts of data. Even with 128 items the quick sort has caught up and overtaken the other methods, but the tree sort is still behind shell. On larger amounts quick and tree sort get well ahead. The quick sort is an $O(n\log n)$ method, while the tree sort is an $O(2n\log n)$ method. Their times increase much less rapidly as the number of data items increase (for further information I refer you to Stan Froco's article in the February 1964 issue).

One more type of sort needs to be discussed. These are sorts that can be applied to large files. The problems arise when the data cannot all be held in memory at once. Two important sorts which can deal with this situation are the merge sort and the tournament sort, or a combination of the two. These will be illustrated in a later article.

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WHAT do you do if you suspect your computer has a hardware fault? If you have a dealer near at hand and your machine is still under warranty there’s no doubt as to the best course of action. But if your machine is out of warranty and if you don’t have a good dealer nearby, you have a problem!

Now, assuming you have some idea about electronics—for example, you know one end of a soldering iron from the other and you are bold enough to tinker with your machine—where do you start? The problem is that it’s a complex piece of hardware and most of the test techniques available involve expensive pieces of equipment. Suppose you haven’t even got an oscilloscope. Is there anything you can do? Well, in this article I hope to show you a technique that is used in industry for fault-finding microprocessor systems.

The commercial test units are not cheap, but we can take advantage of the versatility of the BBC microcomputer and use the technique with minimal external hardware that can be made up fairly cheaply on an old bit of Veroboard.

The technique, ‘signature analysis’, involves actually running a program in the computer under test to check whether the computer is functioning properly. This means that it cannot be used for testing a totally dead machine, but despite this it is a useful technique with the major advantage that it can be done cheaply.

The basic principle

While the test program is running a probe is used to pick up a data stream from one point in the circuit. The hardware compresses this data stream into a 16-bit number, which is read into the computer itself. The number produced by testing any given point (referred to as its ‘signature’) doesn’t have any particular significance in itself, but it will be characteristic of the data stream that produced it. Thus, by comparing it with the expected signature for that point, you can tell whether or not that part of the computer hardware is working properly.

The test routines are tried out on a known working system and the signatures obtained at various test points, such as address and data lines, are noted. These can then be compared with the signatures obtained on a suspect system and, when false signatures appear, it becomes clear that there is a fault. It is important, however, that no interrupts are allowed to occur during the test period as these don’t happen at the same time in any given test run and will thus give a different signature each time the test is tried.

If the test routine is changed in any way all the signatures will be different, so the routines, once set up, must not be changed. If you want to use the test routines they must be copied faithfully from the listing, then you can use the signature values given in tables 1 and 2. If you want to use different routines, they need to be tried out first on a computer known to be working properly and the signatures recorded. By using different routines you can ‘exercise’ different parts of the circuit such as the keyboard, display and printer interface.

A number of faults occur commonly in digital systems, and many can be detected by the signature they produce. For example, if a line is permanently low the signature will be 0000, and if the line is permanently high the signature will have a particular value depending on the duration of the test. This value can be found by putting the data probe on the +5V line. If two lines come up with the same, but incorrect, signature the chances are there is a short-circuit somewhere between those two lines.

Hardware

The circuit used is shown in figure 1, and if you read last month’s article, which dealt with hardware random number generators, you will probably recognise part of the circuit. The hardware of the analyser consists of a 16-bit shift register connected to form what is known as a ‘ring counter’ or ‘chain-code generator’. This generator is used as a data-compressor to produce the signature of the incoming data. The data, as it comes in, is Exclusive ORed with the other feedback lines of the ring-counter. There is a reset line so that the counter can be made to start at zero at the beginning of each test.

This is all that is required at the heart of a signature analyser, but commercial units are self-contained in that they have their own display to indicate the
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Figure 2. The wire link on the keyboard PCB that carries the 1MHz E signal

signature obtained – usually a modified seven-segment display. In our case, to cut the cost down, we use the computer itself to read and display the signature. The number held in the two eight-bit registers is read into the micro by using the shift register on the 6522 VIA. To do this, the P87 line is used to disable the normal clock pulses and allow the pulses coming out of CB1 to clock the registers as the data is read into the VIA on CB2. P80 is used to reset the registers.

Care should be taken to keep leads as short as possible and adequate decoupling should be provided as suggested on the circuit diagram. The clock signal used during the analysis is the 1MHz E line, which is easily available on the keyboard PCB as shown in figure 2. This line is used in preference to the 2MHz line because much of the

input/output, both internal and external, takes place at 1MHz. Thus if a 2MHz clock is used it is difficult to obtain a stable signature.

Even when the 1MHz clock is used problems are caused by the dual-speed clock that the Beep uses (1MHz/ 2MHz). You will find that there is occasional variation in the signatures produced on the data lines, usually only of 2 or 4 in the least significant hexadecimal digit – i.e., there’s some variation in one of the last three bits of the data stream. This takes place as the 6502 is reading the value held by the VIA. Such variation should not, of course, be taken as an indication of a fault in the circuit.

A part from having the test leads as short as possible, it is a good idea to screen them. If they are not screened and the lead carrying the 1MHz clock

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Table 1. Signatures on the main processor bus lines for each of the eight tests

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self-explanatory. The display it produces is a line of text asking for the number of the test to be carried out. This information remains on the screen, while the results are shown in a text window underneath. After selecting the test required and pressing return, you can either have that test running repeatedly, displaying the results on a scrolling screen, or do the test once at each test point. For a continuous output, press Return again.

If any other text is typed in it will be displayed on the screen and then, when you press return, the test is carried out once and the result displayed opposite the text that you entered. This enables you to type in the name of the test point and then do the test. For example, you could put the test probe on the first address line, type in A0 and then Return, and the signature for the A0 line would then be displayed. You can use CTRL-B to switch on the printer and CTRL-C to switch it off, so you can produce a printout of the signatures for the various test-points on each of the tests.

If you want to change to a different test, press Return followed by N (for Next) and it will go back to displaying the prompt, which asks for the test number. If you are using a printer, switch it off before you do this. The sequence is 'CTRL-C, return, return, N'.

As it stands, the program offers eight different tests covering the lower half of the RAM, the upper half of the RAM, the upper and lower halves of the ROM, the internal VIA (VIA-A, IC 3), the disc controller chip (IC 78), the video ULA (IC 6) and the ACIA (IC 4). Any further tests can be added to the end of the existing tests, simply using the same format. The signatures resulting from these eight tests are given in Table 1, and some of the signatures at particular points on the ICs in Table 2.

These signatures should be the same whatever machine you are using as except that, as already mentioned, you tend to find that the signatures on the data lines are different by either 4 or 2 in the least significant hex digit. Having said that, you may find certain variations and, considering the amount of data in Table 1, there's more than likely to be one mistake or more. Ideally you should make up this unit before your computer goes wrong. You can test out the routines on your machine and make any necessary changes to the list of signatures.

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COULD DO BETTER

Despite the government's micros scheme progress is patchy in primary schools, argues Geoff Nairn

IN A BLAZE of publicity Prime Minister Margaret Thatcher announced the Micros in Primary Schools Scheme in July 1982. By the end of this year every primary school in the country should have a microcomputer, which should be making a valuable contribution to all areas of the primary curriculum. Well, that's the theory. With just three months to go, it's worth examining how successful the scheme has been to date and whether the Government is on target.

Under the scheme, a school can buy a single micro for half price, with the Department of Trade and Industry footing the rest of the bill. The machine has to be British, hence the choice of a Sinclair Spectrum, a Research Machines 480Z or the BBC model B. To date 20,000 of the 27,000 primary schools in England and Wales have taken up the offer, and 80 per cent of these have plumped for the Beeb. The Electron arrived too late for the scheme.

As a comparison, the earlier Micros in Schools scheme for secondary schools boasted a take-up figure of 100 per cent when it closed in 1983. In fact their pound-for-pound subsidy has been extended so secondary schools can upgrade their Beeb with a disc and Econet interface, and buy both a Walters dot-matrix printer and a Microvitec monitor — all British makes again. For the more ambitious schools, a BBC Buggy and a Vela instrumentation kit can also be bought for half price.

For the primary school the situation is rather different. Once you've bought your Beeb, apart from a monitor and cassette recorder, that's your lot. No follow up scheme is planned — in the words of Kenneth Baker, the Minister for Information Technology: 'The DTI is yet to decide whether further schemes of support are necessary.' If no further support is forthcoming, then it is difficult not to see the primary scheme as anything more than political propaganda.

That may seem a rather harsh view, but one solitary micro in a school of 350 children is unlikely to make much impact, especially if precious time has to be wasted loading programs in on cassette. Just from talking to teachers around the country, the one thing they really want is a disc drive. And although some local education authorities (LEAs) have set up their own disc drive subsidy schemes — Nottinghamshire and Walsall for example — there is clearly a cause for a nationwide initiative. The one argument that there are no British drives available no longer applies, for a company, Dual Track Technology, now make such a thing.

The Department of Education and Science (DES) oversees the primary scheme through the Microelectronics Education Programme (MEP). The MEP, to quote the blurb, 'aims to help schools to prepare children for a life in society where computers are commonplace.' But the MEP has less than two years to finish the job; the group is due to be wound up in March 1986. Of course, the MEP sees itself very much in a 'pump-priming' role, the idea being to provide the initial hardware, software and training, and after that the LEAs should take over. The trouble with that argument is that different LEAs have different priorities: the much-publicised 'league table' of LEA spending shows that on something as mundane as textbooks the 'top' authority spends six times as much per pupil as the one at the 'bottom'. It is difficult to make a case for more computers if the schools in your county do not have enough money for textbooks.

With the current financial restraints facing all LEAs, what may seem like pump-priming to Sir Keith Joseph to others can seem like an abdication of responsibility.

In fact, this theme of self-reliance and 'hoping' that LEAs take up the challenge seems to permeate the whole primary scheme. With training, for example, the DES makes it a requirement of the subsidy scheme that two teachers go on a two-day course on using their micro. In two days, a teacher who has never used a computer before can just about get the hang of operating the Beeb — plugging it in, using the cassette recorder etc. To expect that teacher to then start using the computer in a challenging way, or

KENNETH BAKER: 'DTI yet to decide on further schemes'
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even to pass on precious knowledge to other teachers, is a mite ambitious. Many education authorities do go beyond this minimum level and set up excellent in-service training courses – Walsall, for example, runs 25 different computing courses for teachers. But many do not.

One criticism levelled at the MEP by the NUT (the teachers’ union) especially is that they have tended to concentrate on developing software rather than training courses. There is little point in producing educational software if there aren’t the teachers who know how to use it, says the NUT. To meet such criticism, the MEP set up a small primary project team in September 1983, to assess the needs of primary schools in both teacher training and resources. They still don’t actually train teachers though, rather they train computing advisors who then go out into the regions and train the teachers.

On the question of training, you would naturally imagine that the colleges of education, who after all are responsible for training tomorrow’s teachers, would be at the forefront in this area. Again, a few colleges do run courses in educational computing for all their potential teachers, but sad to say they are the exception rather than the rule. Two primary school teachers I talked to, who had both graduated within the last two years, emphasised this point. One said that computers had not figured on the syllabus of her college at all, while for the other his computing experience was confined to one afternoon’s demonstration of arcade-type games.

And so we come to the all-important software. In 1982, when the scheme first started, BBC micros were a bit thin on the ground, as was educational software to run on them. The MEP helped to spawn several software groups such as Netherall, Five Ways, the Chelsea Science Project and ITMA who did – and still do – come up with some sound educational software, although most of it is for secondary school subjects. Since that time a variety of software houses have started producing Beeb software for primary schools. Now, the problem is not one of a lack of software, but rather how does a teacher find out what’s available and whether it’s any good? Still worse, where does the money come from to buy software – educational software invariably costs more than the average ‘arcade’ game.

Talking of software, the MEP is the body responsible for the Microprimer pack, which comes with every Beeb bought under the DTI subsidy scheme. It aims to be an introductory ‘self study’ course for teachers, so that they can at least get started using the Beeb in their classroom. Unfortunately it is often the only software a school has – apart from the Beeb’s Welcome tape that is. As the MEP is the first to admit, the Microprimer pack was developed in a hurry and to meet a specific need. It would be a shame if teachers judged all primary software on the basis of one package.

Is the primary scheme a success? Well, I do not doubt that by the end of this year pretty well every primary school will have its very own micro – and most of them will be Beeb. Quite a few will be locked away in store cupboards because no one in the school knows how to use them. On the other hand others will be in use every day, with children of all ages and abilities feverishly tapping away. And a good few more will be wheeled out on Friday afternoons for the ‘computer lesson’, which consists of teacher typing and children watching.

And so, what for the future? Number one priority: every teacher should at least know how to use their Beeb. A disc drive would be nice as well. Oh, and a few more Beeb’s wouldn’t go amiss. A tall order? Not if the Government is serious in preparing children for the future. As a spokesperson for the DES said, ‘It’s very easy to criticise the scheme, but no other country has done anything similar.’ It’s also very easy to be complacent and make political capital.

There’s plenty of educational software available now but most is for secondary schools. Educational programs cost more than ‘arcade’ games and there’s no government money to buy software.
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FRAMING THE RIGHT QUESTIONS

Ian Birnbaum reviews Acornsoft’s Microtext system, a powerful aid in programming instructional modules

MICROTTEXT is an authoring system. It was designed by the National Physical Laboratory, implemented on the BBC micro by Ariande Software, and is published by Acornsoft in cassette and disc form. My comments are based on the disc version.

An authoring language aims to allow the programmer to implement training and instructional programs easily and efficiently by providing special facilities for dealing with common situations. For example, scanning a student’s answer for one or more keywords and then branching if they are present is complicated in Basic, but easy in an authoring language. Indeed, Microtext claims to be so easy to use that, for some cases at least, the designer and encoder of the module need only have a cursory knowledge of programming.

Microtext has its origins in a computer system called Mickie, a medical interviewing computer, developed in the 1970s. It used a language called Questext which allowed doctors to set up modules without extensive programming knowledge. Questext was extended to cater for more varied training on (non-micro) computers, and became Edutext. However, Edutext in Basic was slow and bulky, so it was rewritten in assembly language and implemented on micros; this is Microtext.

Advantages

The easiest way to describe Microtext is by considering the advantages it offers over Basic. This gives the correct context because the system stands or falls on its ease of use for the purpose of creating instructional programs.

There are many advantages to the system in this respect. First, Microtext is frame-oriented: the essential unit is a screenful of information, a frame. In this sense it is very like viewdata systems. However, it is more sophisticated in that control information is part of the frame itself. It therefore combines the ease of use of viewdata with the flexibility of a programming language.

In Basic, the relationship between a screenful of information and the instructions required to produce that frame and to branch to another is exceedingly opaque. The programmer has to project from language to screen to provide the link: Basic offers no real assistance in itself. As a consequence, debugging by frame – the natural approach – is not easy. In Microtext, it is simple because the programmer creates one frame at a time by placing characters on the screen in the position they are to appear when the program is executed. In the frame, control information is included that instructs the computer which frames to branch to next and on what criteria.

Microtext allows simple debugging as it is simple to switch from running or testing to editing a module. If the frame layout is not correct, or an unexpected branch is made, pressing the escape key followed by S (for Stop) switches to a full-screen editor. The system offers single-stepping through the frames if required.

When most instructional programs are run – in Basic or any other language – errors that occur are usually observed at the frame level or at the link between frames. In Basic, this does not assist debugging, but in Microtext the link is absolutely clear, so errors are easily remedied.

Microtext offers exceptional facilities for accepting user responses. The programmer can specify whether spaces are to be ignored between words; whether an exact match is required or whether a response should contain, begin with, or end with a set of characters. The programmer can combine separate criteria using ‘or’, ‘not’ and ‘and’ (ordered or unordered) to produce complex branching decisions. Both textual and non-textual data are supported, and with the latter numeric-range tests are available (eg, less than and greater than).

There is no need to compare these facilities with Basic: there is no contest!

A programmer can design a form on the screen with headings, and when the frame is run the cursor will move from heading to heading as the user responds. In this way complicated forms can be set up with minimum trouble.

Microtext allows a complete summary of the user’s responses to be created. In instructional programs, it is very useful to store these for later analysis. This might be used to give the student or teacher a record of achievement, or to record in variables information required for future modules (a module is a collection of frames, all loaded into memory at one time, which constitute the file being run). Microtext implements both these approaches, the first simply, although the latter is rather more complicated.

In Basic none of these facilities is provided, and the programmer must save the relevant information, and generate appropriate screen displays.

If the user types Help (or even just ?) in Microtext when responding to a prompt, the system automatically branches to a help routine, if one exists. Typically, the first help frame will be a menu with a variety of choices (eg, start again; get help on this topic or on this question). Each frame can contain a different destination frame if required: this is achieved by putting HELP followed by the frame required.

In Basic, it is possible to create a similar system by using a common input routine which always branches when Help is entered. However, this is by no means a trivial task.

There are two sorts of variables in Microtext: system variables and user-defined variables, ie reserved words which hold specific information. These

The Microtext system (including manual) costs £49.85 for the cassette version and £59.80 for the disc, available from Vector Marketing, Dennington Industrial Estate, Wellingborough, Northants NN8 2RL. Tel: 0933 79300. (Acornsoft is on 0233-316639).
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are ANS (holds the last answer given), TIME (contains the elapsed time since last initiated) and RANDOM (generates and holds a random number). User defined variables are similar to Basic's, but it is not necessary to differentiate between string and numeric variables. The contents of a variable may be displayed by use of angled brackets; for example, if NAME contains the user's name, then:

Are you ready, <NAME>?

will give a personalised question. Moreover, a list of variables can be created using something like =PLAYER <NUMBER>., where NUMBER is a variable incremented elsewhere; giving separate variables PLAYER 1, PLAYER 2 etc. This powerful feature is not available in Basic.

All *commands in the BBC's operating systems (and so all *FX commands) between packages on the BBC micro and between machines. In the former case, a wordprocessor could be used to set up a frame: each frame is stored in ASCII (although text compression is used). In the latter case, it is important only to use graphics commands which exist in all systems (eg for Commodore systems there is no point using teletext colour and graphics).

Microtext contains error checks to ensure material is not overwritten. Thus, if you edit a module and then attempt to load another without saving the first, a message appears. A simple safeguard, but important.

Disadvantages

For no system is perfect, and there are some disadvantages to Microtext when compared to Basic, but they by no means overshadow the advantages. Let us consider them briefly.

Microtext supports only integer arithmetic. This clearly presents some restrictions, which is a pity with, for example, maths.

Microtext is not structured. All control in a program is achieved via conditional or unconditional branches (ie the equivalent in Basic of GOTO, or IF...THEN statements. I don't regard this as a handicap because, as a frame-orientated system, the structure is already incorporated.

Memory is rather short with cassette and disc versions: about 14k and 11k left for mode 7 programs respectively. This leaves room, just, for a 30-frame module in the disc version and 40 frame with cassette (lots of variables will cut these down). On a disc version this is not problematic, since one module can call another.

The memory problem can be solved by a second processor or the ROM. These options are essential in a graphics mode: mode 4, for example, allows just six frames. Modes 0, 1 and 3 are impossible without the second processor or the ROM (modes 2 and 5 are never supported).

At present, the Microtext package is needed to run any module. However, a delivery system (without the editing facility) will be available which sits securely with the module and is loaded with it. This is produced by a publishing system, and will be very valuable for, say, education authorities that wish to produce packages in a resource centre for schools. Questions of copyright have yet to be fully resolved.

There is no simple access to the contents of the analogue port from Microtext, except by using *FX128 and getting the values of the X and Y registers. Nor is there access to a printer from within a module (ie no VDU2 or VDU3). The only access is at command level to print copies of frames, or to dump the summary (these may be activated at RUN time by preceding them by $). However, I'm sure someone will find a solution.

The COPY key is not available for normal use in edit mode; instead it pushes a space into a line and moves the rest of the text to the right by one character without wrap-around. This is a pity, especially when one considers the eighth disadvantage - there is no teletext graphics editor. This makes creation of double-height characters tricky, and makes 7 graphics laborious. All teletext graphics codes need two function key presses to make them active (in other modes these produce foreign characters eg 6); this is also tedious. However, inclusion of a full teletext graphics editor would have left less space for modules. There are two solutions: use a graphics editor on a chip which can be used via a * command, or a separate package to create a frame and then load it in ASCII into Microtext. However, to do this it will be necessary to incorporate it within the existing module in some way, because Microtext does not allow subsets of modules to be loaded. Again, someone is bound to find a way round this.

Microtext in use

Microtext comes with a 120-page manual, a reference card and a demonstration package. The manual is comprehensive, though not that easy for beginners. I think Microtext is accessible to newcomers, but I suspect a
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\[< \text{FUSE} > \] > 270

At \("210\) we define the variable FUSE by (FUSE = "FUSE/3 AMP").

This solves our problems, and also allows 'Fuse' should be 13 amp and similar answers. Moreover, it treats 'Fuse is wrong' as only partly right and responds with 'What is wrong with the fuse?'. Notice, finally, that Microtext will treat both 3 amp and 3amp as the same.

We see from this how easy it is to edit, but we haven't perfected the program. We need to edit other frames to be consistent with the changes we've made, and more crucially, we still haven't caught all the right answers. The moral from this is that even the simplest module that uses free format responses will need considerable testing and editing.

Microtext makes editing easy, but there is no substitute for careful educational design and thorough testing; indeed, the powerful facilities of Microtext make this even more important.

In this example, we have been examining the program in RUN mode. When editing, we momentarily entered COMMAND mode and directed the system into EDIT mode. Then back through COMMAND mode to RUN mode again. This process is adequate for testing and debugging, but Microtext provides one further mode precisely for testing: TEST mode. Without too much detail the essential differences are that it is more difficult in TEST to delete or overwrite an edited module without saving it, also the Escape key always fully interrupts a program.

Most of the other facilities are available in RUN or COMMAND modes, though some are slightly more convenient to use in TEST mode. It may seem then that TEST adds virtually nothing new, but this is not so. Most programs will consist of a whole series of modules and it will often happen that one module will call another. When testing a system, we don't want to lose our edited module in this way—hence the need for TEST.

On balance, the introductory package of modules is well-thought-out and reasonably varied. The average user will gain much from working through the modules, examining how they were programmed and—most importantly—altering the modules as we have done here.

Educational implications

Used with the right application, Microtext is very valuable. I believe it is possible to teach relative beginners how to program with the system, thus opening the way to program designers implementing their own code. However, more advanced uses (eg, creative uses of variables) and the implementation of complex teletext screens will require a more professional approach. There is no doubt, though, that the use of Microtext will make the professional programmer far more efficient, given the right application.

The great danger with Microtext, however, is that its very ease of use will encourage teachers and LEAs to program with it, and thus restrict the types of program available. Microtext can only be used to implement programs which are susceptible to frame-by-frame analysis. This is a wider range, certainly, than straightforward instructional and training packages—for example, adventure games are possible, although there would be severe memory constraints—but it is a distinct subset of educational software. Packages that use animation will not be viable, as far as I can tell, and of course, no more than four colours will be available; moreover, as we have seen, only integer arithmetic is possible. And, more generally, not all educational design intentions can be accommodated by a frame-oriented language.

However, this said, Microtext clearly points the way, and with Microtext Plus on the horizon, which should allow floating point arithmetic, a full interactive graphics editor and some expert system techniques incorporating generative rules, I think we will see the decline of Basic as a language for computer-assisted material in education and training.

Microtext is a superb technical achievement for a 32k machine, and I look forward to seeing what creative educators can do with it. I regard it as a tremendously important development, and quite possibly the shape of things to come in the construction of instructional and training packages, especially in conjunction with video disc technology.
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ATOMIC TEXT

Alex Wilson cures writer's cramp with 'Wordprint'

Seldom is the inexperienced owner of a printer offered help in the manual that comes with the peripheral. It's no longer a matter of attaching a cable and off you go – there's a lot more to a printer than an electric typewriter. For a start, different type-styles are available at the press of a few keys. Yet working from the manual produced the following comment from one newcomer to printing: 'I eventually worked out how to use the printer in text mode from the single example of how to enter control codes given in the Epson booklet.' Try the Star Gemini 10X booklet (reputed to be better written than previous ones!). It doesn't even have one example. Many users are therefore unlikely to get value from the machines they buy.

My program will, I hope, tender a guiding hand to frustrated beginners. Wordprint is a wordprocessor program written for domestic use on a 12k RAM Atom driving a Gemini 10X printer, and it should cause little trouble with a Beeb (the cable is the same as on an Atom) or an Epson (if George Hill is right about the control codes). It is offered for those who do not have the money to spend on a commercial wordprocessor.

So how do you get at all those extras you've paid for – italics, variable characters per inch, underlining, subscripts and so on? (Forget about screen dumps and downloading characters – time enough for them when you find out how to include the others in your programs.) Master the control codes first then it must be easier. These are shown as CHR$(27) CHR$(n) . . . or ESC n . . . but how do you get them into your program? You can't stop and press Escape-this or that, so it's as well to understand what is required. Those who already know can skip over the next few paragraphs.

The printer expects items in binary form from the computer. Some in ASCII will be numbers and some letters. Then there will be control codes, which will not be printed. The escape code is the most frequently needed and on receipt of a byte containing 27 the printer interprets this as a change of instruction.

The difficult codes are $2 and $3 or CHR$(2) and CHR$(3), as these enable and disable the printer, in particular $27$6$6$2 and $27$6$6$3, which set 12 characters per inch and 17 CPI.

Try entering

PRINT $2; PRINT $27$6$6$1; PRINT "HELLO"

Your printer should print HELLO as you expected it. Now change it to read PRINT $27$6$6$2 and then $27$6$6$3. In theory these ought to change the print to 12 and 17 characters per inch respectively. Instead it is probable that HELLO was printed out exactly as before and then nothing at all for the instruction with $3 in it. These can be dealt with successfully by putting the value into A then applying LINK /FF10, for this enters the printer driver after the switch.

Other controls can be sent directly with say, PRINT $27$6$1, which sets bit eight to 0, or as part of a string. For example, if a string is ABCDEF, sent to the printer: 

53/AB/BC/27/52/DE/27/87/1/F,

then the first control sets standard ASCII, and ABC would be printed in normal print, the second control sets italics and DE would be in italics. The further control sets enlarged mode so that F will be enlarged italics. Note /N/ is to indicate that we are talking about a single byte number, not to be confused with 27 which would normally be sent and printed as 2 followed by 7, i.e. ASCII 50 and 55. If you are unsure of this try

B = 2800; ?B = 27; ?B$1 = 66; B$2 = 3; I = 0; DO; A = 71; LINK /FF10; I = 1 + 1; UNTIL I = 3; PRINT" HELLO"

This should get HELLO printed at 17 CPI. Alternatively, start a new program at /2900 with

10 REM31221:

This will list just as you typed it. Now type 10 REM and three spaces and return. Poke 0 into each of the spaces (/?2906 = 2908) and LIST. This will appear to be 10 REM and little else. Follow this with

? /2906 = 3; ? /2907 = 12;

These are Atom control codes. Listing will switch off output to the printer and will clear the screen. You have just done PRINT $3 $12 $21 which also

The 'Wordprint' program is listed in the yellow pages section on pages 109–111.
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Line 478 ensures that the eighth bit (most significant bit) is 0. The printer sets this randomly which can be frustrating.

PRINT #75550 is to obtain the US set so that the hexadecimal sign is shown as &. This can be altered to give foreign language types. The line between 300 and 440 have PRINT statements: PRINT $2 and $3 are Atom commands. PRINT $17 and $19 are Star commands. These enable and disable the printer driver and put it ‘on line’ and ‘off line’. (Both sets are included to show the order of use.) PRINT statements do not have to be separate; PRINT $27$566$1$27$561 is acceptable to the Atom and the printer instead of PRINT $2$, PRINT $27$566$1$. PRINT $27$561.

Now for the operating instructions. The screen shows DATE. Type date or return. Anything input here will be kept as date.

The screen shows Options 1-8:

1 WRITE TEXT subdivides into 1-New
2 EDIT displays text in lines 0-9, in columns 0-28. Available options are A, B, D, I, N, Z.

How the Text Edit routine appears on the screen

Text and 2-Additional Text. New Text will start again and all previous text will be lost. Additional Text adds text at the end of current text. ZZ will return to option point. Text can only be added in the middle using EDIT.

2. EDIT displays text in lines 0-9, in columns 0-28. Available options are A, B, D, I, N, Z.

A - Amend, change letters one for one
B - Back, moves back to previous screen
D - Delete, deletes a stated number of letters starting from a given point
I - Insert, inserts a piece of text and moves up the remainder
N - Next, displays the next screen
Z - end of edit

Edit errors
*CANT GO BACK* - BACK requested but screen showing start of text.
*END OF TEXT* - NEXT requested at end of text.

Printcontrol characters
Left square bracket (ASCII 91) - Italic
Backslash (92) - Underline
Right square bracket (93) - Cancel italic
Up arrow (94) - Enlarged print
Shifted (SH) At (96) - Cancel enlarged
SH left square bracket (123) - Superscript
SH backslash (124) - Cancel underline
SH right square bracket (125) - Subscript
SH up-arrow (126) - Cancel super/subscript

Star (42) - Linedef
Place PCC immediately before the first letter to be changed. Cancel PCC just after the last letter -i.e., before the blank. Include a space after commas and stops. The program automatically left-justifies and looks for the final space in the line.

3 PRINT TEXT (sub-option CHANGE) PRINT STYLE). Three print styles can be selected: 10 CPI, 12 CPI and 17 CPI. Left-hand margin, lines per page, letters per line, and letter-heading are included in print style routine.

4 SAVE TEXT A name up to ten letters is asked for, two Record Tape messages are printed and there's a 10-second delay before the second.

5 LOAD TEXT Start tape before the recording. Each file name will be displayed. Press CTRL when the correct one shows.

6 REVIEW TEXT shows text as in the edit mode but without line and column numbers.

7 ENVELOPE to address envelope.

8 END of run.

At the end of each text input 'O.K.' is printed. If 'N' is typed in, the line is not accepted. The screen editing facility is still available in the usual way.

An asterisk during text input will be translated as a new-line indicator. Star-space-star will linefeed twice.

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Text input uses the normal Atom input so that strings are restricted to 64 characters. The request for a headed address in line 270 uses the WRITE TEXT routine and must also be ended with the string "ZZ". All text input is in upper case. The output to the printer reverses this with #20 (Exclusive OR 32). This arrangement has been found to be better than locking into lower case and shifting for upper case, because it avoids filling the screen with white-background letters.

Edit falls into two parts: the edit options and the print control characters (PCC). Having edited the English, it is possible to operate on the PCCs using the same options. Each PCC can be entered immediately before or after any other, giving say, italics, enlarged and underlined until each is cancelled. If none is entered then printing is done in standard print. There are about 40 options for the Gemini; some duplicated, but these were selected as being the most useful. If some machine code is introduced to speed up the program then twice as many PCCs can be used by recording the first occurrence as 'on' and the second as 'off', instead of using different signs for each.

The program up to line 71 should be typed without the leading space or REMs. Line 71 is then at #2857 as required in line 505, which sets the error-handler. The text in line 72 should be re-written to show your address. One leading space is required here, for line 316 needs this to start at #2869. In line 26 the address of the first character after the quotation mark has to be #298A to make lines 20 and 22 work correctly.

Within each main option, all variables are local. To list all the variables would take too much space. The print options set in lines 200–202 are held in locations #85–#8D. They are unpacked when required in line 300.

S and T are used throughout as string pointers for text. B is the text string and D is used as a general-purpose string.

#8200 holds 13 and #8201 has -1, for use in the dummy file in the Save routine. The text starts at #8204 and each file carries its end address in #8202, #8203.

The strings can be dimensioned if you prefer and BBC converters can carry the print options forward in suitably named variables. They may also find the articles on Beeb to Atom conversion (Acorn User, from April 1984) a help. The hardest parts to recognise are the abbreviated statements F., N., IN., G., GOS., U. R. These stand for FOR, NEXT, INPUT, GOTO, GOSUB, UNTIL, RETURN. It would be nice to see this program followed up shortly with a BBC version. Meanwhile, try your luck with the Wordprint editor.

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<tr>
<th>TITLE</th>
<th>PUBLISHER</th>
<th>PRICE</th>
<th>MICRO</th>
<th>REVIEWED</th>
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<tr>
<td>1 (→) Frak!</td>
<td>Aardvark</td>
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<td>20 (7) Mr Wimpey</td>
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B = BBC  E = Electron  Prices in brackets are for disk version.

### BUBBLING UNDER

- Quick Thinking (Mirrorsoft)
- Brainstorm (Virgin)
- Java Star (Shards)
- Sea Adventure (Virgin)
- Compiled by RAM/Computer

Jet-power Jack (Micro Power)
Lords of Time (Level 9)
System 15000 (Ferranti)
Nifty Lifty (Visions)

Cosmic Cruiser (Beau Jolly)
Hulk (Adventure International)
Eagle Empire (Alligata)

---

**FRAK! has done it. Straight into pole position. Visitors to the AU Exhibition will have seen why it's up there, and what happens when you get to the later stages. Our Editor (who's appaling at games) barely managed to scroll past the first screen, but the real players can get to the end of the trail when the screen is repeated, upside-down!**

**Aviator has stalled after its No 1 entry last month, but Acornsoft's fortunes will no doubt be revived by the newcomer Elite, reviewed in this issue.**

**Other releases to look out for are Micro Power's Dune and a Grand Prix racing game from Software Invasion (complete with bends) to rival Atari's Pole Position and Superior's Overdrive. Quicksilva also has a racing game under way produced with Atari's blessing.**

**Football Manager's progress can expect to be given a helpful boost upwards by the start of the new season, probably from Everton fans hoping to repeat their team's success over awe-inspiring Liverpool in the Charity Shield. Micro Olympics will no doubt continue going for gold but will have a job overhauling the yo-yoing Frak! No doubt the Olympic game will be boycotted by our Eastern-bloc readers because of its commercialism in featuring advertising on back-ground hoardings.**

**Adventure fans are making their presence felt with four placings, two of them, TKY and The Hobbit, showing a lot of staying power in the chart.**

**Our tip for next month's top match? Still Frak! But watch out for Elite jumping in and a major campaign from Software Invasion with its 3D Grand Prix.**
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TOOLKITS ON TRIAL

Bruce Smith finds firm favourites among five utility ROMs

The ability of the BBC micro to accept a variety of extra ROM-based software that can be used concurrently with Basic or even replace Basic has always been an important aspect of its design, and it goes some way to compensating for the small amount of user memory available, especially in the high-resolution graphics modes. (With extra hardware, of course, the Electron has similar potential.)

Independent suppliers have been quick to jump on the bandwagon of ROM-based software (normally termed firmware), producing a variety of programming goodies. As many of you are aware, the choice is confusing. What exactly does the firmware do? Is it as good as the others? If not, which one is the best? And so on.

In an effort to help you through this firmware jungle a comparative review of groups of firmware will be appearing in future issues of Acorn User. This month I start the ball rolling with a look at ROMs containing Basic programming aids or utilities. Future issues will focus on machine-code monitors, databases and wordprocessors.

The Jargon

Rom-based software for the Beeb is often called a 'utility'. This word really means an aid to programming, a program that will allow you to perform a certain task with minimum fuss. Consider what would happen if you had a longish program in which you wanted to replace all occurrences of one variable with another. No problem if the variable has been used only a few times. You simply edit it in using the cursor control and Copy keys. But what if there were ten, 20 or even 30 occurrences of the variable? To edit each one by hand would be laborious. The best answer is a utility program that would do the whole job for you. Enter the name to be replaced, the new name and the utility does the rest! Because of the usefulness of these types of commands a collection of them is generally termed a 'toolbox' or 'toolkit', as they are thought of as supplying a collection of tools for the programmer.

A usable utility

The most obvious way to write a utility program is in Basic, and listing 1 provides an example that lists the values assigned to all the resident integer variables in decimal and hexadecimal. Trouble is, writing a utility in this way has many drawbacks. First, where do you put it? The most obvious way is to incorporate it in the main program as a procedure, as demonstrated in the program. A library of utility procedures could be stored on tape or disc as ASCII files and simply spoolled in as required. However, this eats up memory and means that the final program will need editing to remove the utility when it is complete — shades of Catch 22.

An alternative method would be to place the utility in a different part of executing machine code doesn't involve the complicated rigmarole of changing PAGE etc. — a simple CALL to the start address will suffice. Machine code also operates much faster than an interpretative language such as Basic.

Listing 2 provides a simple program compactor. Type it in, run it, and save the machine code to tape or disc using:

"SAVE "SPACE" C00 + FF C00"

Using the program simply involves "RUNing it or, if already present, CALL &C00. The effect of the program is to remove all spaces, except those within quotes, from the program at PAGE so that it requires less memory space. This utility needs to be used with care. For example, the line:

500 DEFPROCdemo BYTE% = 0

is legitimate, but after deleting the space the line will be:

500 DEFPROCdemo BYTE% = 0

which will cause an error at run time. The way around this is to place a colon between the procedural name and the variable, thus:

500 DEFPROCdemo : BYTE% = 0

Similar care should be exercised when using the assembler to differentiate, between a label name and the opcode to prevent them from turning into one long label name!

Using machine code in this way has its disadvantages — it still uses up memory. This may not be a problem if only one utility is required, but finding space for two or more useful utilities well out of the way is not easy. Also, once a machine code program has been assembled into a particular area of memory it can normally only be loaded back and used correctly in that same area, unless some fancy coding techniques have been employed to make it relocatable. Thus a program assembled to run in the soft character buffer is not much good if your program makes use of the definable character facility! A way round this would be to assemble code into several areas and load the required one in, but this is

---

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**U-TOOLS**
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Bruce Smith's example utilities in Basic and machine code (listings 1 and 2) are on yellow page 112
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fiddly and time-consuming, especially for tape users.

Inside track
Home-brewed utilities therefore have their disadvantages – they have to be written, they use up precious memory, and they are not always easy to use. The best compromise is to use machine code stored within EPROMs using the sideways ROM facility of the Beeb. The advantages are many. The utilities are always on hand because they form part of the micro itself, and that also makes them 'portable'; you are not dependent on disc drives or cassette recorders to get at them. Virtually all the commands are implemented as commands because the ROM itself contains an interpreter that recognises them. Thus our compacting program, if found in a toolbox, might be executed just by typing "PACK" or "CRUNCH". Because ROMs occupy the same area as Basic, they are transparent to the user, thanks to some clever electronics, and do not normally require any user memory.

There are disadvantages, of course. For a start, outlay – most items of firmware normally cost at least £22 and they need to be fitted into the machine. A dealer will often do this if you buy from him, but the mail order buyer is on his own.

What's around
Toolbox The only serious item of tape-based utility software I have encountered is BBCsoft's Toolbox. This is a neatly packaged book with accompanying cassette of programs. It obviously suffers from all the aforementioned problems and at £21 is not cheap. However, for anyone wishing to learn about the techniques involved in utility programming it is a useful introduction. Twenty-five utilities are provided, 13 of which are written in Basic and 12 in assembler. A good range of programs are provided and these include sorting routines, a variable dump, a REM stripper and program formatter. Each program is discussed in the accompanying text.

It has to be said, however, that EPROM-based software is really a must for the serious utility user.

Addcomm The Addcomm from Vine Micros is probably the best value for money out of the toolkits. Although it does not come out on top in table 2, the overall command content is undoubtedly the best. In addition to the 31 Basic programming utilities the EPROM provides some useful enhanced graphics facilities, including circle and ellipse drawing commands, colour fills and commands to scale and rotate your creations.

A simple implementation of Logo graphics is also included providing turtle graphics commands such as PEN, LMOVE, ROTATE, ANGLE and so on.

The commands are implemented not as operating system commands (ie., commands prefixed by an asterisk) but instead they are entered directly as they are. This is because the Addcomm interpreter traps the errors that Basic would normally throw up and then tries to interpret the command that caused the error as an Addcomm command. This is good in theory but it can lead to confusion as it sometimes interprets Basic errors as Addcomm errors and displays the wrong error message.

Finally, Addcomm offers 40 commands to the user, though I consider only 37 of these usable. The other three allow the user to jump out of loops – naughty! This should be ignored by the user as they are not good programming practice. My plea to Vine Micros would be to delete these computer nasties from the instruction set and replace them with better error-handling.

Caretaker I'm a little disappointed with Caretaker. Over the past couple of years Computer Concepts has produced some of the best firmware for the BBC micro, but Caretaker falls some way short of the company's high standards. Of its 18 commands, I consider three to be space-fillers, although they are useful sometimes. CURSOR allows the cursor to be turned on and off, while TABSTOPS and NOTAB allow the user to determine the new position of the cursor on the screen. What disappoints is that it is rather run-of-the-mill, and shows none of the originality we've come to expect from CC. Useful enhancements, however, are those of single key command entry, emulating the Electron, as is the ability to save specified sections of program such as important procedures. Caretaker also scores on its EXCHANGE facility, which allows a good degree of control in selecting global or selective search and replace.

Toolkit Beebugsoft's Toolkit scores well in the five standard ratings section of table 2. The variable dump commands are extensive and include listing of procedure names and arrays in addition to integer and real variables. The enhanced line editor is useful, allowing program scrolling in any direction and listing of any erroneous line, highlighting the error at run time.

A couple of commands seem somewhat dubious, however. The ability to be able to perform OLD within a program would be needed on very few occasions, and I can think of no occasion when it has been necessary to perform NEW from within a program.

Toolstar This is not essentially a Basic toolkit but a general utilities aid, as it includes machine code and disc utilit-

<table>
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Table 1. Facilities at your command
ties. As table 1 shows, only eight of its 22 commands are Basic-oriented and this should be borne in mind when you come to your decision. In essence, Toolstar is suited to the advanced programmer who dabbles in machine code and Basic and uses discs.

The global search and replace facility is a good implementation and the toolkit's built-in software allows you to add your own RAM-based commands. A very interesting feature. The Toolstar manual is excellent - by far the best I have seen produced for an item of commercial software; indeed it is much better than many computer user guides. Its 156 spiral bound pages are colour-coded, and copious use of examples makes it a joy to read.

U-Tools The U-Tools box offers a good, steady variety of utilities. One of the more interesting features is a command that will not only save a program but also lock it so that it can 'RUN', though it is a shame that it can be used efficiently only with machine code programs. A variety of program-crunching commands are on offer, plus an error-trapping wedge that lists an erroneous line before printing the error message.

U-Tools is the only toolbox to provide an intelligent screen dump of any of the graphics modes to an Epson or Epson compatible printer such as Star. The dump provided is large - 23 x 16.5cm - and it is produced down the paper.

Which one?
Before choosing which Basic toolbox you want to buy it is worth making out a list of items that you feel it should contain - in other words, the commands that would be most useful to you.

My own preference is the Addcomm, followed by Toolkit, finances allowing. From table 1 I would seem that the best combination would be Addcomm and Caretaker, as they cover the entire range of utilities. However, these two ROMs seem to be incompatible as some Addcomm commands will not function with Caretaker present.

At the end of the day, however, it should be a personal choice.

ADD 40 COMMANDS TO BBC BASIC WITH ONE ROM

COMPATIBLE WITH: Acorn RPS, Amcom(Face) RPS, Wilson RPS, Wordwise, Disc Doctor.
Model B: BASIC 1 or 2, OS 1.20

LOGO

LOGO is used to position the LOGO cursor, usually used prior to further LOGO statements.

ANGLE is used to set the intended direction of the LOGO cursor, the angle being described in degrees.

ADVANCE is used to move the cursor in the direction as set by ANGLE, the distance described in the ADVANCE statement.

ROTATE gives the cursor a new direction by turning it a certain number of degrees anti-clockwise from its previous direction.

SHIFT defines the kind of trail left by the LOGO turtle using the internal plot code.

CIRCLE and CIRLINES are the LOGO equivalents of the similar advanced graphics commands, the shape centre being the current LOGO cursor position.

LINK is used to return the position of the LOGO cursor from a SCALABLE screen.

These commands are unlike those on any other ROM, since they are used in exactly the same way as the standard BASIC commands - i.e. any numeric/string expression, multi-line statements, access to any variable, and, of course no stars! ADDCOMM CARETAKER TOOLKIT TOOLSTAR U-TOOLS

Ease of use 8 7 7 7 7
Range of utilities 8 7 6 5 7
Documentation 8 5 5 10 5
Error messages 5 6 9 6 6

Five standard utilities ratings

BAD PROGRAM CORE 9 10 6 8 7
FIND STRING 8 9 9 7 8
GLOBAL SEARCH & REPLACE 8 9 8 7 9
PROGRAM COMPACTOR 9 9 7 N/A 9
VARIABLE DUMPS 7 8 10 N/A 8
TOTAL 68 63 69 52 64

N/A = Not available.
*FINID not directly available but can be implemented using global search and replace facility and specifying same search and replace strings.

Table 2. How they score on a scale of 1 to 10

ADD40 COMMANDS TO BBC BASIC WITH ONE ROM

LIST can be programmed, unlike LOGO, and under the user's control, multiple statement lines can be split up into their component parts allowing for greater ease of reading.

ADD40 is similar to the LOGO statement but more powerful in that it enables the user to jump to 'labelled lines' allowing for neat and more readable programmes.

ADD40 allows the user to sort all or part of a string array into alphabetical order using a simple statement. Invaluable for data processing.

SEWIN and WIN allow the user to define, using SEWIN, and display, using WIN, up to seven complete windows on the screen. The user being able to select and return to previously deselected windows at will, the cursor maintaining it's last used position within that window.

ADD40 is a simplified character designing facility using an enlarged grid that enables the user to quickly and easily construct or alter graphic and pseudo-alphanumeric characters.

ADD40 is used to reduce the size of all or part of an existing program by intelligently appending lines together.

ADD40 is used to search all or part of a program to find any defined character or set of characters.

GROK and SEED are two related commands that enable the user to replace a character or group of characters with any other character or group of characters, under total control of user.

ADD40 is used to list all, or alphabetically selected, variable names.

ADD40 is a simple command to confirm that a copy to tape or disc is exactly the same as the original program in memory.

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- NEW RELEASE

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ACORN USER OCTOBER 1984
STAR STATUS

Tony Quinn goes boldly to Cambridge on an Elite mission

'Elite', Acornsoft, BBC B, £14.95 (disc £17.95), Electron, £14.95

SPACE is the final frontier as far as Acornsoft is concerned, and the company reckons to have cracked it with the new release, Elite.

This game has been the subject of the biggest security operation the company has ever mounted, to ensure no details leaked out before the launch this month. It is still so secret that even I don't have a copy!

Acornsoft spirited half a dozen journalists up to Cambridge and locked them in a room to review the game. So, this is not a full review, but my impressions after bashing away for a couple of hours. However, having written my escape clause, I must say Elite looks superb.

Imagine a subtle blending of Aviator and Starship Command, a sprinkling of the Star Wars films, shaken with a trading adventure, served up with some secret ingredients and you have Elite.

It sounds ambitious but it's all there, wrapped in a short science fiction novel that sets the scene, a substantial training manual, a poster identifying the foes and friends you are likely to encounter and a postcard giving entry to the competitions that Acornsoft plans to base around the game. Not bad for £15. Plus, the disc is filled out with some special bits and pieces. You'll have to play to find out what they are - I've no idea!

The idea of the game is to start off with a simple space ship and build it up and your reputation up to Elite status.

Budding Han Solo's start the game with a sparsely equipped space ship and a small supply of money. The ship is docked in a station orbiting a planet. Pressing various function keys gives information on the planet and enables the raw pilot to buy various goods from food and drink to drugs. Having stocked up, the ship is launched into space and the course set for another planet.

Once a destination has been fixed, the ship goes into hyperspace and after a few seconds emerges near the chosen planet. Then it's a dash to reach the orbiting space station before the pirates pounce. The ship has then to be docked by plotting a flightpath along a line leading from the centre of the planet into the station. The entrance is a slit, and the station is rotating, so the ship has to match rotation, otherwise it just won't fit.

Your wares can then be traded, preferably for a profit. Any credits earned can be used to fund the next flight and buy better equipment for the ship.

As you trade and equip the ship until it's bristling with weaponry and everything money can buy, it becomes tempting to play naughtily. Illicit cargoes such as slaves and drugs can be bought. You could be in trouble with the law but it's a good way of making a fast buck. Then you can attack space stations for the fun of it, and even try trading with one of the deadlier planets. The risks are high, but so are the profits.

That's the theory, now for the action. The colour screen shot shows a typical view of space, except there are a lot of nasties around. (This shot was specially set up and you are unlikely to meet so many different types of enemy at once.) Views to the front, rear and both side of the ship can be called up. Instruments at the bottom of the screen give compass, a three-dimensional map of space and other ships within range, and the status of energy banks and weapons.

Controlling the ship takes some getting used to, as it's difficult to know where you are and which way to go, especially when someone's shooting at you. The keys are a bit awkward: there are a lot of them, and some are in strange places.

Elite apparently uses up just about every spare byte there is in the Beeb's memory (and some it shouldn't!). The graphics impressed even the Cambridge gurus when Elite's two student authors showed them off. Circles and ellipses are drawn in full in real time with hidden line removal. The 3D effects are astounding, and the suns have to be seen to be believed. Screen graphics modes 4 and 5 are used at the same time to give accurate plotting and colour for the display. Screen width is reduced to speed up plotting and save memory. The reason for the strange keys? Simply because they are next to each other in the operating system's look-up table.

How much work the BBC is doing when plotting the suns and planets is shown as you fly towards them. If you look straight ahead, the game is slowed down! To get there quicker look to the side or behind.

So how do we sum this one up? Well, it's the best game of its type and all Meteors/Starship Command/Defender/Aviator freaks will love it. Players who like adventuring might well be hooked by the trading aspects. And then on the disc version there are those things called 'missions' where a task is set. Finally, there's the unknown: no-one has yet reached the ultimate Elite status, and there's even a ship out there that no-one has yet come across. Apparently it eats spaceships, so watch out.

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SPREAD THE MESSAGE
Bulletin boards offer real person-to-person contact, says Jeff Ashurst. Why not join?

BULLETIN boards have been set up by enthusiasts motivated by an interest in microcomputer communications, rather than by commercial gain. True, some BBs are associated with, or sponsored by, small micro businesses, but this aspect is secondary to their main function of providing a way to exchange information.

With this aim, the Association of Free Public Access Systems (AFPAS) was founded, and each system operator (SYSOP), with one exception at the time of writing, is a member, under the chairmanship of Fred Brown, SYSOP of Forum 80 in Hull, incidentally. This was the first microcomputer bulletin board set up in Britain — just look what he started!

Under the umbrella of AFPAS, BB operators have adopted as their standard the V21 transmission protocol of the CCITT (Consultative Committee for International Telegraph and Telephone), which specifies receive and send rates of 300 bits/second, or 300 baud.

Let’s assume you’re sitting comfortably with your micro, telephone, a V21 modem and some suitable software. You are free to make whatever use you choose of the bulletin boards, from electronic pen pals to serious information exchange. But where are these boards? And which are the best?

Well, the table on page 169 should answer most of your questions. It lists bulletin board systems with their telephone numbers and operating hours and brief comments regarding special interest groups (SIGs) catered for and other points of note. You will notice a few boards with the comment ‘ring-back system’. To access these, call the number, allow the telephone to ring once (ie one double ring), replace the receiver and call again. On the recall, the modem will respond with its high-pitched tone. Then, as with the others, switch your modem to ‘on line’ or ‘data’ and replace the handset fairly quickly.

As to what makes a ‘good’ bulletin board, the answer must be subjective to a degree, but I suggest the following criteria:

- BBC-related information and software.
- Other special interest material.
- On line 24 hours daily.
- Within local call range of your phone.

The last condition cannot always be fulfilled, but should become more and more possible as BBs proliferate. The systems listed are sprinkled from Cumbria to Southampton. I’ve never heard of any in Scotland, Ireland or Wales, but it’s difficult to believe there are none. I’ve also included a Swedish board specialising in BBC matters.

Systems are coming on line all the time. If anyone knows of, or operates, a board that does not appear in the table, please let me know, either via Acorn User or by leaving a message on Liverpool Mailbox.

Roughly half the boards are on line 24 hours per day. The others operate in specific time bands on particular days, which can be restrictive. It is, however, understandable that system operators (and their families) need their telephone line for other uses. Clearly the best solution for BBs is to install a second, dedicated phone line. Even with 24-hour access, however, the better boards are more often than not engaged, with some SYSOPs reporting around 50 calls on a typical day. You must expect a sore dialling finger!

After logging on with your name and home town, you will find that bulletin boards operate invariably on a ‘layered menu’ principle. The main menu will allow you to read or enter messages of general interest, but it will also offer access to SIGs, software for downloading and often features such as news, prices of peripherals, electronic mail and information about the system. Electronic mail consists of messages addressed to individuals by name, and is readable only by the recipient (although you can’t prevent the SYSOP from having a look).

Software
Communication — questions and answers, information, mutual help — can be achieved using so-called ‘dumb terminal’ software, that is to say a program which simply outputs characters from your keyboard and displays incoming characters on the screen. Such a routine, by Paul Beverley, was published in Acorn User of November 1982. I have also used ‘VDUPROG’ from Mike James’ book The BBC Micro — An Expert Guide.

To download the free software available, however, you will require a ‘smart’ program. The best of these are available as communications ROMs, and are advertised regularly. A good example is Pace’s Commissar. Using sophisticated firmware of this type it is possible to select the receive and send rates, the word length and parity (see July’s issue), and to both upload and download files reliably. A suitable modem enables access to bulletin
AID has now established itself as the finest machine code monitor ROM for the BEEB. With its unique DUALSCREEN operation so far in advance of the competition, AID puts unprecedented debugging power into your hands. No other monitor can begin to tackle machine code graphics – something AID takes effortlessly in its stride! Beginner or expert, you cannot afford to be without DUALSCREEN AID.

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"The Micro User" January 1984

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## INTERESTING BULLETIN BOARDS FOR BBC USERS

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<th>NUMBER</th>
<th>HOURS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASUG</td>
<td>(0742) 667983</td>
<td>24 hours daily</td>
<td>Apple user group BB. Ring-back system</td>
</tr>
<tr>
<td>BUG</td>
<td>010 468 463</td>
<td>24 hours daily</td>
<td>Swedish-based English language board for BBC users. (Watch the bills on this one!)</td>
</tr>
<tr>
<td>CABB</td>
<td>01-631 3076</td>
<td>24 hours daily</td>
<td>Acorn, Commodore and Sinclair SIGs</td>
</tr>
<tr>
<td>CBBS Cumbria</td>
<td>(06992) 314</td>
<td>Daily 1800-2200</td>
<td>Ring-back system. Multi-standard: V21, V23 and Bell 103. Downloading and CP/M SIG</td>
</tr>
<tr>
<td>CBBS London</td>
<td>01-399 2136</td>
<td>Sun 1700-2200</td>
<td>Temporarily off line after lightning strike</td>
</tr>
<tr>
<td>CBBS Surrey</td>
<td>(04862) 25174</td>
<td>24 hours daily</td>
<td>User friendly CBBS board. Popular – usually engaged</td>
</tr>
<tr>
<td>CBBS SW</td>
<td>(0626) 690014</td>
<td>24 hours daily</td>
<td>Wednesday 1200/75 protocol. Sirius and Tandy SIGs</td>
</tr>
<tr>
<td>Centbull</td>
<td>01-606 4194</td>
<td>24 hours daily</td>
<td>Display Electronics board. Very user friendly, News and Product information, including BBC interest section</td>
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<td>Distel</td>
<td>01-679 1888</td>
<td>24 hours daily</td>
<td>STC Electronic Services BB. Also other protocols: (0279) 441188 for V22 (1200/1200) or (0279) 441222 for V23 (1200/75)</td>
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<td>Forum 80 Hull</td>
<td>(0482) 859169</td>
<td>Mon-Fri 1900-2230; Sat/Sun 1300-2230. Daily 0000-0700</td>
<td>Telephone and ask for Forum 80</td>
</tr>
<tr>
<td>Forum 80 London</td>
<td>01-902 2546</td>
<td>Evenings and weekends</td>
<td>New Hull-based BB specialising in information exchange for radio amateurs</td>
</tr>
<tr>
<td>HAM-NET</td>
<td>(0482) 497150</td>
<td></td>
<td>BBC SIG and download section. Other SIGs include Microwave for radio amateurs. Britain’s first 24-hour BB</td>
</tr>
<tr>
<td>Liverpool Mailbox</td>
<td>051-428 8924</td>
<td>24 hours daily</td>
<td>BBC SIG: Download planned on receipt of sufficient software</td>
</tr>
<tr>
<td>Mailbox 80 W Midlands</td>
<td>(0384) 635336</td>
<td>1730-0830 Also all day Sun</td>
<td>BB under development running on BBC</td>
</tr>
<tr>
<td>Manchester BB</td>
<td>061-427 3711</td>
<td>Sun-Thurs 2230-0000; Fri 2330-0200; Sat 2230-0200</td>
<td>Maplin Electronics board: product information</td>
</tr>
<tr>
<td>Maptel</td>
<td>(0702) 552941</td>
<td>Out of office hours</td>
<td>BB dedicated to Acorn/BBC matters</td>
</tr>
<tr>
<td>Microweb</td>
<td>061-456 4157</td>
<td>24 hours daily</td>
<td>N Birmingham. Ring-back system</td>
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<tr>
<td>NBBBS</td>
<td>(0827) 288810</td>
<td>24 hours daily</td>
<td>Run by Radio and Electronics World magazine</td>
</tr>
<tr>
<td>Rewtel</td>
<td>(0277) 232628</td>
<td></td>
<td>Helpful general interest board</td>
</tr>
<tr>
<td>Southern BBS</td>
<td>(0243) 511077</td>
<td>Daily 2000-0200</td>
<td>CP/M BB, ie when logged on, CP/M commands can be entered directly</td>
</tr>
<tr>
<td>Stoke ITEC</td>
<td>(0782) 265078</td>
<td></td>
<td>BB SIG. Hopes to have full menu of BBC related items at future date</td>
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<tr>
<td>TBBS Blandford</td>
<td>(0258) 54494</td>
<td>24 hours daily</td>
<td>BBC SIG and download section</td>
</tr>
<tr>
<td>TBBS London</td>
<td>01-348 9400</td>
<td>24 hours daily</td>
<td>To start in near future, with V21 (300/300) and V23 (1200/75) protocols and Prestel-type graphics</td>
</tr>
<tr>
<td>TBBS Nottingham</td>
<td>(0602) 289783</td>
<td>See comments</td>
<td></td>
</tr>
<tr>
<td>TBBS Southampton</td>
<td>(0703) 437200</td>
<td>24 hours daily</td>
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boards, Prestel or even allows your micro to emulate a specific mainframe terminal. Smart software also allows you to compose messages in advance, dial the BB number, upload to the board, download any messages and log off. Messages can then be studied at leisure, or saved to tape or disc, without running up a phone bill.

Once you've logged on, selecting 'SIG' from the main menu will produce a sub-menu of special interest groups, such as BBC, Commodore, Tandy, etc. This is where you will find questions, answers and information on the specific topic selected. BBC owners seem to be quite widely catered for, but remember, the success of a SIG, and of the board in general, depends upon the input. So write. Ask a question. Leave a message. Questions produce answers which, in turn, generate further comments. The more you put in, the more you get out.

Hardware
Looking at modems, several manufacturers are now marketing products built around the AM7510 chip, which offers the facility of switching between not only CCITV V21 (300/300) and V23 (1200/75) standards but also the US Bell 103 standard. The Bell standard specifies 300 bits/second transmission but at different frequencies to V21. These switchable modems are really superior to single standard devices, and obviate the need to place oneself in one camp or the other, bulletin boards or Prestel, when buying. As yet there is a price premium, but I expect costs to fall.

The future
To date, most of the successful software packages to run bulletin board systems, including TBBS, CBBS and Forum 80, have been written for Tandy machines. Historically, this is because the BB idea was imported from the US, and the Tandy micros have proved to be popular American workhorses.

Now, however, people are developing BB programs to run on the Beeb, and some of these should find their way to the market place, either as software offerings or software/hardware packages. Torch is already moving in this direction with a modem and software combination giving access to Prestel (August issue).

The last hurdles are now falling, and the field should soon be wide open, in terms of choice, to individuals and organisations who want to operate a BBC-based host system. Incidentally, further information on AFPA can be obtained from Fred Brown at 421 Endike Lane, Hull HU6 8AG—but please don't forget a sae.

Under the auspicies of the government's Micro-electronics Education Programme (MEP), consideration is being given to a BB system for schools — Joe Telford, in July's issue, mentioned CECETEL, the experimental service for schools in Cleveland. This system is hosted by a BBC micro.

The concept of a board with a specific aim gives, I think, a pointer to the way the bulletin board phenomenon will develop, ie with an increasing amount of specialisation. At present we have two dozen boards in the UK, all broadly aimed at the serious hobbyist. Given many times that number, I expect to see some systems carrying information relating to specific interest groups. Probably the first example of this is the new HAM-NET board in Hull (see table).

In the US, with several thousand systems, there is even a bulletin board carrying details and telephone numbers of bulletin boards!

In conclusion, I must say to new and prospective modem owners that I hope you find as much satisfaction in communications as I do. Old hands will know what I'm talking about already. Bulletin boards occupy a special place in this expanding dimension of micro-computing. Yes, we need viewdata for share prices, flight times, weather forecasts and the rest, but to exchange information with real people is a much more rewarding idea.

ACORN USER OCTOBER 1984
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ROUTE OF

ALL EVIL

‘Blagger’, Alligata Software, 178 West Street, Sheffield S1 4ET, £7.95

FOR too long the air at computer clubs has been filled with the insane rantings of the owners of certain other (48k) micros about the Beeb’s incapacity to play M——c M——r and J-T S——L W——y. Well, now we have at least a first layer of defence in the form of Blagger.

The scene is set with a red-haired robber, a ‘blagger’, working his way through a number of different shops, collecting five keys in each (left in increasingly awkward corners) and taking them to open a safe. At the end of 20 screens – if he ever gets that far – he finally escapes.

The game uses the top half of a mode 2 screen to show the shop interiors, which contain an assortment of platforms, walls, conveyors, and disappearing ledges. Each screen is a complex arrangement of these features and a good deal of thought is required to work out a successful route. At each level, a number of well-animated sprites parade up and down or to and fro. These are fatal to the touch, as are the bushes which are dotted around the place. The bottom half of the screen shows your score, level, number of men etc.

The sound effects are fairly basic and can’t be turned off, but they didn’t prove too grating during play.

A rather more annoying oversight is the lack of an option to start the game at any level. I suppose this should mean that the game will last longer before being solved, but it is aggravating to have to complete the easy levels on each attempt before getting to the one you’re working on. A practice mode would be very useful.

Nevertheless, Blagger is an entertaining game with smoothly animated graphics and plenty of variety. I confess to not having proceeded very far, but then there’s no history of blagging in the family and I’ve been trying to go straight, honest guy! Simon Williams

HUSTLER AT

FOR POSITION

‘Horse Race’, Dynabyte Software, BBC B (32k) and Electron, £6.95

YOU are given £1,000 which you must bet on up to six horses to try to bust the bookies. The computer gives you named horses and their odds, and you may put up to £999 on each one. You then see the six horses raced across the screen.

The graphics in Horse Race are superb – the animals are drawn in detail and their movement depicted correctly. You can see their tails move, and all the detail on the jockeys. Two stands are displayed and a commentary board shows which horses have been bet on and which one is in the lead. The game displays people near the ropes waving, flags flapping on the stands, and a very detailed camera car driving alongside the runners.

The sound too is superb. It plays a different tune while loading, before betting, and after each race. You can hear the hooves of the horses and the thud of jockeys falling off.

You select a game for between one and six players, and the number of races to be run. There’s no sound on or off option, but surely nobody would want to turn off such good sound effects.

Horse Race is user-friendly and supplied with excellent instructions. It’s repetitive in that it’s the same thing every race, only the names and odds change, and it’s also boring playing by yourself because there’s no skill to it: you place your bet, sit back and the computer does the rest.

When playing with many people, though, it can become quite exciting. Ian Bretteil

THE KEYBOARD

‘Pool’, Dynabyte Software, BBC B (32k) and Electron, £7.95

THIS version follows the same rules as real pool, except that there are only three balls of each type. There are versions for the BBC and the Electron and they differ in that the latter doesn’t play a tune while loading and the music at the start is played on only one channel instead of the Beeb’s three. The Electron version also lacks the extra effects obtained in mode 7.

The sound is good on the Beeb. As well as the ‘loading’ tune, the computer plays The Entertainer at the start of the game and at the completion of each frame.

During play, however, sound is scarce, just short beeps when balls collide and two low beeps for a foul shot. It would have been nice to have an effect for potting, and perhaps a tune playing in the background.

The graphics are reasonable. There are eight large balls on the table: one cue ball, one black, three red and three outlined red balls, which move very smoothly.

You are offered the options of sound on or off and the number of frames to be played. It would have been an advantage to have a joystick option as well.

The control of Pool is easy and responsive. Each player has four direction keys and a shoot key. The length of the cue determines the strength of the shot.

Would it be asking too much to have a topspin and backspin option as well as the ordinary shot included?

Overall, Pool is a good game, with acceptable graphics and good sound effects (apart from during play), and it is supplied with excellent instructions. A nice feature is that it displays what you did wrong, eg, ‘White ball down’. A drawback is that for people using TVs the red outlined balls and the cue don’t show up on the green table. Ian Bretteil
A World Of Information
Available to you with Nightingale, the new multi-function modem from Pace.

Nightingale is by far the most versatile modem available, at the price, for either home or business use. It offers Prestel/Viewdata baud rates (1200/75 & 75/1200) alongside 300/300 baud full duplex for communication between the BBC and other computers, including bulletin boards.

Nightingale will operate at both European and Bell frequencies for compatibility with CCITT and American systems.

The state-of-the-art modem chip technology employed in Nightingale requires minimal support circuitry resulting in low power consumption, low cost, high quality and extreme reliability.

Nightingale being 'hard wired' is not subject to the noise interference errors common to outdated acoustically coupled devices. In addition Nightingale features a simple self test facility for easy installation.

Nightingale utilises a fully buffered RS 423/232 serial interface and is supplied complete with a lead suitable for connection to the BBC micro, other leads are available on request.

However, in order to use such a versatile modem to its fullest potential, you will require equally sophisticated software. This is where Pace can offer you a total solution — Commstar, unquestionably the most comprehensive communications software available for the BBC.

Supplied on Eprom, Commstar is instantly accessible, simple to use and extremely flexible. Just look at the possibilities: access Prestel, Micronet, Viewfax, Homelink and Telecom Gold, rummage through bulletin boards and chat to literally thousands of other computer users, but there's more. Commstar can be used to emulate specific terminal types such as VT 100 by means of a configuration disc, thus providing the opportunity to use the BBC as an inexpensive work station for a main frame or mini-computer.

The complete Nightingale/Commstar package for the BBC micro including the modem, cabling and the Commstar Eprom and manual is just £139 plus V.A.T. Nightingale is available separately for the BBC and other computers at £119 plus V.A.T. and Commstar is £29.57 plus V.A.T. Further details are available, please telephone or write for comprehensive fact sheets.
 software reviews

laying the foundations

"Chickaroo" by John Cassar, Screenplay, BBC B. £7.95

This is an educational game for up to four players, designed to improve a child's word recognition.

A word is displayed at the top of the screen with one letter missing. A chicken then hops along the screen laying six eggs, which begin to move about. The child must shoot an egg, which reveals a letter. If the child thinks the letter fits into the gap in the incomplete word he presses return. Otherwise he continues shooting.

If the child gets the letter correct, a small bird flies up and takes the letter down.

Chickaroo comes with two files, each containing 50 words, and a parent or teacher may enter up to 50 of his/her own words, which may be saved.

The graphics are reasonable and do their job (they don't need to be too elaborate) and are smooth, though for some reason the small bird is flickery.

Some kind of sound effect is to be heard all the time except during the instruction session at the beginning: when the eggs are moving, on reaching 200 points, firing, successfully shooting an egg, little bird flying, Chickaroo hopping, and getting an answer right and wrong.

Up to four players can play, and you are allowed to load and save files. The game is controlled from three keys and

fueled and minerals.

Sound is scarce. Beeps accompany the movement of your ship, and there's an effect for visiting and leaving planets.

Star Trader seems similar to Startrek and Galaxy. It's slow and boring with hardly any variation - the process is the same for each planet.

You may load and save games, and you are given very clear instructions, demonstrating each part of the display.

ian brettell

five-star trading post

"Star Trader", First Byte Software, BBC (32k), £7.95

The object of Star Trader is for you, as commander of an expedition starship, to explore the five star systems and their planets, trade with the inhabitants, and mine the area. If any planet is inhabited, you must persuade the population to join the Empire.

You must seek out the Ultimate Computer, as your planet needs its resources.

A corner of the screen displays the five 'single character' star systems. You must move your 'block' or space ship over the system, then press 'v' for visit. The screen flashes, and you then have the system's many planets to orbit, explore, mine, and do trade with.

These are just different-sized dots.

The rest of the screen is divided into three sections. One of these shows your status, fuel, time, food, water and air; another is your inventory, showing your trade; and the third displays details of the planet you're currently orbiting, its temperature, atmosphere, population type, attitude, water, food,

ian brettell

flushed with success

"Corporate Climber", Dynabyte Software, BBC and Electron, £7.95

In this game you're an office tea boy whose aim in life is to rise through power and become company president, having a key to the washroom. On your way you have to watch out for taxmen in the lifts, and make sure the strain and stress doesn't raise your blood pressure too high, resulting in a heart attack.

Various objects are scattered about on your way.

You are represented as a little man with a cap, and it looks as though he is carrying a tray. You can see the office building, marked off in stages, with a toilet at the top, marked vacant.

There are lifts going up and down, with taxmen aboard - and they kill you!

Bonus objects include telephones, cups of tea, acorns, keys, chairs and suitcases, all shown in good detail, with colour well-used. The lifts move very quickly and can sometimes be a bit flickery.

A pleasant tune plays all through the game, and the only other sound effect is a ping, for when you rise up a level, and for collecting objects. There's an option for sound on or off, three levels of difficulty, but no joystick option.

Corporate Climber is a good, original game, with good sound and visuals, and it comes with adequate instructions.

I reviewed an Electron version on a BBC and found it fast and a little too hard. The speed probably accounts for the flickering graphics. On an Electron the game is much slower and I cleared the first screen first time, whereas I've never managed this on a BBC.

ian brettell

more games reviews on pages 179 and 182
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ACORN USER OCTOBER 1984
SEVENTH

HEAVEN

'SUPER-7' compendium, DACC, BBC, £8.95

SEVEN games on one tape? They can't be any good!

That was my initial reaction. But they can be good. None of them is of the standard of the real bestsellers, but they are good value if you want a change, and two of them seem pretty original.

I had never seen anything quite like Fire Chief, in which you rescue people from tall buildings, and put out fires. The aim is to deal with as many fires as you can without running out of fuel or water. A really good game requiring speed of thought and reaction, and forward planning.

Creatures of the Deep has you sitting in a boat fishing. Simple controls allow you only to raise and lower your line. The aim is to catch fish by reeling them into the boat. You must avoid the various monsters, or if you catch them by mistake you must remove them from your line by the appropriate method. You fish against the clock, and your catch is given in kilograms.

The other games are less original but still attractive, all with good graphics. They are:

Space Rescue—a two-screen game, with an easy first screen, and then a second screen in which you have to pick up men from the planet surface and return them to the spacecraft.

Bouncer—a bat 'n' ball game with a twist which rendered me totally incapable of hitting the ball.

Chopper Chase—a nice little anti-tank warfare game.

Space Pilot Test—a Defender-type game but without a corridor. All the action takes place on a single screen.

Guns of Navarone—a gunnery simulation game, needing judgment of elevation and power to hit the attacking helicopters and destroyers.

The picture is of Creatures of the Deep in action. The tape transferred to disc with little trouble, as none of the games has voracious memory requirements. I ran them all successfully at PAGE = &1200, needing no shifting.

George Hill

INSECT

INFESTATION

'Bugblaster', Alligata Software, BBC and Electron, £7.95

A CENTIPEDE comes down from the top of the screen, and you play the title role in Bugblaster—you must shoot it. There are mushrooms scattered around, which get in the way of both of you and the centipede. There are bonuses for shooting Brian, the mushroom-poisoning scorpion, and spiders. You are a small base at the bottom of the screen that moves left, right and about five lines up and down.

Bugblaster uses four direction keys and a shoot key, and includes a hall of fame.

The objects and characters are well drawn, showing good detail, and colour is well used. All mobile objects move smoothly and without flicker.

There are sound effects for the centipede's movement, firing, spiders and snails appearing, and for a bonus man every 10,000 points, but a tune before only the colours change and the speed increases. More variation in screens and attention to detail in game options would have made it very good.

Ian Brettell

BOUNCING

TO SAFETY

'Lemming Syndrome', Dynabyte Software, BBC (32k) and Electron, £7.95

MAD Marco is on the rampage and has blown up the bridge to the mainland. The people are panicking, jumping into the shark-infested waters rather than facing him. You are lifeboat Lennie, and using your raft, must bounce the people to the other side, avoiding sharks and Mad Marco with his dynamite.

The scenery in Lemming Syndrome is well drawn, though motionless, and includes a blown-up bridge over a river, and hills. The movable objects—your lifeboat, people, sharks, and dynamite—travel smoothly.

You can alter the speed of the game and thus degree of difficulty, have sound on or off, and you can choose to control your raft in proportional or absolute mode. In proportional mode the raft moves left or right a pixel at a time; in absolute there are three set positions to which the raft may move—left, middle and right. Using the absolute method is much easier. The only option Lemming Syndrome lacks is a joystick.

Lemming Syndrome has excellent graphics, good sound, is very flexible with its many options, and is supplied with good instructions. Underneath the fancy graphics, and a well thought out background around Mad Marco blowing up the bridge, Lemming Syndrome is just a variation on the Breakout theme. It's the same all the way through and, though quite a testing game, it becomes boring.
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SOFTWARE REVIEWS

TRENCH

WARFARE

'Trench', Virgin Games, BBC B, £7.95

You have been chosen to destroy the invincible Termination Planet, which threatens the universe. Only one weak spot has been found, an exhaust vent, and you are given only one chance. You must steer your X-winged fighter along the trench, avoiding the alien ships and lasers. When you get close to the vent, your attack computer is engaged, and you must position the sights over the small hole, fire, and retreat.

The graphics are nothing special in Trench (written by Phil Wilkes), though they do the job sufficiently. You can see the eponymous trench, which scrolls quite nicely, your X-winged fighter, alien ships and firing lasers. At the bottom of the screen is a message centre which tells you how many miles to go and, after the game, what happened, eg, 'Hit by laser'.

You can hear an engine noise all the time, the pitch of which varies with your altitude. There are other sound effects when alien ships close in, lasers fire, for being killed, and for the run-up to the end of the trench before missile-release.

There's a joystick option, Clares or BBC but once you've selected keyboard or joystick you can't change, so if you enter Clares joystick when you have BBC you have to reload the game. There are nine levels of play. Increasing the difficulty level makes the trench longer. There's no sound on or off option, or game pause.

The first few times I played Trench I found it much too hard, being hit by lasers all the time. I stuck with it, though, and now I can place a missile, though I usually get blown up along with the Termination Planet. Success seems to be random, depending on whether a laser hits you or not. Trench is nothing special, with standard graphics, though quite good sound, and I feel it is too difficult.

Ian Brettell

FOR THE COUNT

'Shaping Up', Acornsoft, 4a Market Hill, Cambridge CB2 3NJ, £9.95

The number of computer-assisted learning programs for the pre-school child is not large. ICL, under the guile of Acornsoft, has tried to do something about this one with Shaping Up, a program designed to foster appreciation of simple numbers.

A different shape is used for each of the nine numbers, so the child will see ducks, teddy bears, trains, houses and a number of other familiar shapes, depending on the figure being illustrated. A stencil is supplied with the pack so that the shapes depicted on the screen can be drawn on paper to strengthen the connection between the two media. Instructions to this effect are displayed on the screen. The numeral associated with the number of objects is also shown, and a stencil shape is again supplied.

The child is asked to press the red function keys the same number of times as the number given. Different red keys give different shapes, in an attempt to remove any association that may be built up between the number and a specific shape. If the right number of keys is pressed before RETURN, a reward is provided in the shape of a yellow train, chuffing across the screen with the appropriate number of trucks.

Options are offered to change the level of sound effects and to start with any of the numbers.

While the idea is sound and the images chosen are easily recognised and of a good size, the program is heavily over-priced. If it was included in a combined package or offered at about half the cost it would give reasonable value. As it is, a good beginner's book on basic numbers might be of more use.

I don't like the instructions on screen, which are neither clear nor of value to the child. This kind of instruction should have been included in the packaging. Also, the numerals are rather small, only about twice the height of a normal mode 5 character. The whole package suggests that its inspiration came from a programmer and not a teacher.

Simon Williams

SCROLLING INTO OTHER-WORLDLY DANGER

'A Maze in Space', Opus Software, BBC (32k), £9.95

Here's yet another version of Scramble, though with a few changes and extra facilities. You must first fly up to the planet, avoiding its moons, meteors and defences. You then go down to the planet and seek and destroy your target, the alien command space station, shooting daleks, fuel dumps, rockets, and planet defence. A Maze in Space goes a step further with vertical scrolling, so you can go up and down into caverns.

You are told which state your target is in, but that can be quite a large area. You have only one life, as the game uses shields, which decrease if you bump into an object, and once they are at zero you're finished. Sometimes you get caught in a space warp, which returns you to your starting point.

Before loading the game itself, the game objects and full instructions are presented.

The graphics are fair, the objects being quite detailed and good use made of colour, though the planet's moons are only in block graphics and the maze drawing is flickery, especially going upwards. At the top of the display is your score, present stage, and state of shields, and during play the computer warns of failures to your guns, low shields, and lack of fuel.

A nice tune plays while the instructions are displayed and other effects during the game are similar to those of Rocket Raid. You can select sound on or off, joysticks, fast or slow game, fixed or random start position, and there's a freeze-game option.

A Maze in Space is a good attempt to improve on Scramble and if the flicker from the scrolling could be reduced it would much improve the quality of the program.

Ian Brettell
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Scribe is a screen-oriented, integrated word processing system specifically designed for non-technical personnel. Text and command functions are fully prompted.

The program comes in a chip with five minute fitting instructions, a 5½" floppy disc containing the printer driver and a comprehensive instruction manual.

Among the many features available are:
- Create up to 255 pages in a single document.
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- Search and replace — item by item or globally throughout the document.
- "Go to page" — next and previous using up and down cursor keys or go directly to page numbers.
- On screen underlining.
- Format line controls document width and allows setting of right and left margins.
- Tabs set on format line as required.
- Automatic centre and decimal tab.
- Text reformatting.
- Split page and dynamic page break display.
- Word count and display of cursor position by column & line number.
- Will use disc surfaces 0 to 3 as allowed by the BBC system.
- All disc filing operations menu driven, eg. re-name, copy, delete document, compact and catalogue disc, etc. No knowledge of the disc system required.
- Exec document — allows conversion of BASIC programs for editing by word processor and then re-conversion back to either text or program files.
- File merge — one or more documents or other text files may be merged in sequence from any disc drive between 0 and 3.
- Automatic page numbering with page number insertion at any point on the page.
- Headers and footers.
- Total facility print module including selection of serial or parallel output, global printer control codes, page numbering offset, print from page to page, repeat print, etc.
- Selection of up to nine user definable keys for insertion of printer control codes into text, with up to five codes allocated to each key.
- Control number of page display lines for scroll speed increase.

The program comes attractively packaged in a simulated leather grain wallet which contains the manual, disc, chip & function key legend strip.

MERLIN DATABASE COMING SOON
Merlin Database is a database system designed exclusively for the BBC disc based computer. It provides for the structural input of text and numerical data which is stored permanently as a record on the computer. A group of records constitutes a database. Any number of databases may be created using Merlin Database.

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- High powered forms layout & editing using Scribe (alls. rt. justify)
- Arithmetic calculations & accumulators
- Conditional report writing
- Semi programming facility for forms & report generation

Other Facilities
- Mail merge using Scribe
- Conditional mail merge
- Automatic reformatting of lines
- Capable of conditional transfer of information between databases.

Database comes in chip with manual, simple fitting instructions & systems disc. Also planned is the production of Database Integrated with the Merlin Scribe word processor in a single chip although the database is designed to integrate easily with Scribe in a separate chip.

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Adventure into BBC BASIC

by Miles ELLIS
Computing Services
University of Sheffield
and
David ELLIS

A book with a difference! This is far more than a conventional teach yourself programming book. By using a sophisticated and exciting adventure game Miles Ellis, with the aid of his twelve-year old son, has designed a program which will be enjoyable from the outset as well as teaching the beginner the basic principles of good programming style, the use of sound effects, colour, graphics, program editing, and the storage and reloading of tapes.

With its innovative approach this book is outstanding because it has dared to turn the basic concept of teach yourself books on its head. In this way it captures and retains the interest and overcomes the frustration of so many would-be programmers.

An accompanying cassette tape and disc of the Adventure Game are also available for the BBC Microcomputer Model B.

CONTENTS

• What's it all about? • Some basic principles • Sound effects • Using the right procedures • Seeing is believing • Variety is the spice of life • Communication is the name of the game • Adding it all up • Some characters to play with • A bit more flexibility • Improve your graphics • Get animated • Another way of expressing yourself • Dealing with sets of data • Saving your results • More advanced sound • Some other useful features of BBC BASIC • Appendixes • Index

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ACORN USER OCTOBER 1984
One of the most important peripherals to follow in the wake of the BBC micro is the sideways ROM socket board. A number of multi-socket boards have been available for a while now: ATPL, Sir Computers and Watford Electronics have all produced 12-socket boards. A problem associated with some of these is power drain on the host micro, for the Beeb wasn't designed to house such equipment. Another problem is that the physical limit to the number of ROMs available is 16. 'Sideways RAM' has been one answer to the problem, but this means an outlay of up to £45.

For those on a budget there's now another alternative. Both National Micro Centres and Viglen Computer Supplies have stepped in to provide a single exterior sideways socket into which ROMs/EPROMs are simply and quickly inserted. The former has opted for a zero insertion (ZIF) socket, while the latter has taken a more novel approach.

The Viglen socket is really a cartridge ROM edge-connector that is connected via a ribbon cable to an internal ROM socket. Each ROM/EPROM is housed within its own cartridge and simply slotted in when required.

I wanted to see how each system stood up in general use, so I put each in a primary school computer for a fortnight and allowed the children to use the system.

The ROM extension socket from National Micro Centres comprises an extension cable with sockets, a ZIF socket, two pieces of double-sided sticky tape and an 'ashtray' aperture cover (figure 1). The system is designed for ROMs/EPROMs to be effortlessly inserted without damage to their legs or to the socket connections. The system is a little more tricky to install but, following the simple yet adequate instruction sheet, it took only 10 minutes.

At the Beeb end a 28-pin socket fits into IC 52, where Basic usually resides. The socket uses round pins, which are both strong and safe for the main board socket. I was very pleased to note that NMC had not opted for the large, square-pinned plugs that do so much damage (remember the old OS 1.00 EPROM board)! To this a double ribbon cable is soldered and passes over the recessed area beside the power supply to the 'ashtray'. At this end a small board contains another 28-pin socket into which the ZIF socket will plug. Here the whole operation became rather amateurish.

The board is attached to the underside of the keyboard cover by double-sided sticky tape. It worked, but I found that after a while it became weak either due to rough treatment or the warm working environment. With the keyboard cover replaced the ZIF socket is plugged in and all is ready (figure 2).

Unlike the Viglen cartridge, the ZIF socket is not clearly marked as to which way the ROMs are to be inserted. The rule is implicit: keep the ROM's notch away from you. However, one teacher got it wrong and one 2764 EPROM was ruined. A clearly labelled socket would have avoided this.

In use the system did not always function with all firmware. It appeared to work with some EPROMs and not others. Unfortunately, the Edward/ROM would not function at all, even after calling it with *FX 142,12, which should initialise any firmware in this socket. This problem is probably due to the fact that no additional circuitry is included to provide for data loss over the length of cable.

Unfortunately, the computer must be switched off before a chip can be inserted/removed. Apart from the inconvenience it is yet another easily forgotten operation that could lead to the loss of an EPROM/ROM.

My overall impression of this system is not one of confidence. I was disappointed with quality of the ZIF socket and the presentation of the system.

The Viglen sideways ROM cartridge system comes solidly packed in a plastic case and comprises a ROM extension cable and socket, an empty cartridge, a cartridge storage tray and various covers for the socket, edge connector and the Beeb's 'ashtray' (figure 3). Following the simple instruction sheet Viglen provides, installation was easy and non-traumatic. The computer end of the ribbon cable is provided with a specially tooled 28-pin plug that is simplicity itself to insert, thanks to the excellent cable connection and its strong rounded pins. The ribbon cable proved long enough to run just under the keyboard edge and emerge by the loudspeaker and it didn't foul any components. The edge connector is provided with two flanges, each of which engages within the 'ashtray' slot to the left of the keyboard (figure 4). This results in a surprisingly strong and neat socket. Five minutes...
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and the job was complete.

Each ROM is now ready to be installed in its 60 x 20 x 30mm cartridge (figure 5). This is achieved by removing two screws from the cartridge top and pushing the ROM into a 28-pin socket mounted on a small printed circuit board. Correct orientation is aided by the suitable markings on the base-plate. Each cartridge includes additional components to allow for any losses across the data cable. This adds to the production costs but Viglen has made a wise decision to include this feature. As a result, the three cartridges used by my class of ten-year-olds performed faultlessly over the two-week period, passing the standard 10-year-old 'dropping', 'standing-on' and 'handling' tests.

Two features of the system I particularly like are the fact that it takes no additional power from the BBC micro in its operation and that cartridges may be inserted or removed with the micro switched on and working.

In case the owner wants to remove the socket from the computer, Viglen provides a blank plate to cover the aperture. This clips into the 'ashtray' and is unobtrusive. As the user’s cartridges grow in number, each may be stacked in the storage tray.

Overall, this is a very successful system that met with the complete approval of children and staff.

Both the NMC and Viglen extension sockets provide a cost-effective alternative to multi-socket boards, if you don’t mind swapping firmware and out of the computer as required.

A problem of using a sideways socket system in a school environment is that cartridges/ROMs can get misplaced, and the possibility of theft must also be taken into account when using these systems in a ‘public’ environment. These problems however, must be weighed against the advantage of having expensive firmware quickly and easily available to swap among any number of suitably fitted computers.

Having used both systems over the month, I can recommend only the Viglen ROM cartridge system for school use. Each element is well designed, strongly built, and functions faultlessly. The risk of handling ROMs/EPROMs is too great to be a viable proposition: the extra expense of each cartridge must be measured against this. Also, the ZIF socket cannot be relied on to work with all ROMs/EPROMs, its application must be limited.

For the home user, each of these ROM sockets appears to be a useful answer to the problems posed by the plethora of ROM-based software now available. Obviously, the NMC ZIF socket means that ROMs/EPROMs may be quickly and conveniently inserted and removed. However, the onus is on the user to provide safe handling and storage for his/her firmware. The problem is not so acute with the Viglen system as each ROM is well and truly protected. Whether the cartridge system is worth the extra cost is up to the user to decide.

### REVIEW SUMMARY CHART

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**KEY:** 5 . . . Excellent 4 . . . Good 3 . . . Satisfactory 2 . . . Poor 1 . . . Very bad

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**Figure 4. Inserting a cartridge into the Viglen socket**

**Figure 5. Inserting a ROM into the cartridge**

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### DATASHEET

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<th>Product</th>
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<th>Cable length</th>
<th>Special requirements</th>
<th>Price</th>
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<td>Product</td>
<td>Sideways ROM cartridge socket</td>
<td>Viglen</td>
<td>2764 and 27128 EPROMs</td>
<td>470mm</td>
<td>ROM cartridges</td>
<td>Socket: £19.95 inc. VAT, Cartridges: £6.95 inc. VAT, £4.95 each for 10 cartridges</td>
<td>Viglen Computer Supplies, Unit 4, Trumpers Way, Hanwell W7 2QA.</td>
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<td>National Micro Centres</td>
<td>Zero insertion force (ZIF) socket</td>
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</table>

ACORN USER OCTOBER 1984
The BBC Micro can now give an astonishing new account of itself.

Because with Acornsoft's new 16K ViewSheet ROM, it develops a head for figures which can save you a vast amount of arduous brainwork.

Imagine, for instance, that you had to make several adjustments to a balance sheet.

If you made those adjustments on ViewSheet, it would revise the balance automatically in a split second.

Or imagine that you had to add 15% VAT to every figure on a price list containing 500 items.

ViewSheet can add the tax to each and every one of those items simultaneously. And once again, in virtually a second.

As simple as pencil and paper.

ViewSheet is a computer-based spreadsheet, the figure processing version of a word processor.

With 255 columns in width and 255 rows in depth, it's also one of the largest spreadsheets on the market.

Originating the sheet is as easy as originating an ordinary worksheet with pencil and paper.

Because ViewSheet comes with an easy-to-follow reference card.

It enables even the most inexperienced users to feed all the data they need to use, and store on disc or cassette, into the BBC Micro.

You can nominate headings and subheadings. And you can create bar charts to display figures graphically.

Ten windows for perfect vision.

The sheer size of ViewSheet makes it impossible for the whole sheet to be visible on the monitor at once.

That's why ViewSheet has ten windows, enabling you to see up to ten different sections of the sheet at any one time.

You can summon the windows onto
the screen at the press of a key.

You can cross-reference sections, or even reposition them on the sheet, whenever you need to.

And you can print them out individually, as well as all together.

The possibilities are virtually endless.

By creating special disc files from ViewSheet, you can link two or more spreadsheets together. This means you can build models much bigger than the BBC Micro's considerable memory.

ViewSheet is also compatible with Acornsoft's View word-processing package. This enables you to produce reports and documents which combine text and figures.

In addition, you can use ViewSheet in any screen mode, making the most of the BBC Micro's potential. And if you use it with the 6502 second processor, you'll have no less than 30K of workspace in any mode.

For only £59.80, you too can have figures like this. The ViewSheet ROM can be fitted by your BBC Micro dealer in less than three minutes. And with its straightforward user guide, function key card and reference card, it'll soon have you juggling figures at lightning speed.

Indeed, at only £59.80, it's an invaluable asset for anyone involved in professional or personal finance, forecasts, formulae and analysis.

ViewSheet's operations and functions in brief.

The operations supported by ViewSheet are:
addition, subtraction, multiplication, division, exponentiation and bracketed operations.

And the functions supported are: ABS, ACS, ASN, SIN, SGN, RAD, ATN, COS, DEG, EXP, INT, LN, LOG, PL, SQR, TAN, MIN, AVERAGE, MAX, CHOOSE, LOOKUP, COL, IE, READ, ROW and WRITE.

Acornsoft
56 Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2PL. Tel: 0933 79300.
**BUFFER MAKES ROM VALUE FOR MONEY**

Buffer and Backup ROM, Watford Electronics, £16 plus VAT.

This ROM is one of the latest to be offered from Watford, and comes with an eight-page manual explaining its functions. The ROM can be IBOTTed using SHIFT LOCK-SHIFT and BREAK. A menu is displayed on the screen that offers three alternatives: ROMLOOK, D-TAPE, and TCOPY.

ROMLOOK allows the user to examine the contents of any other ROM. It will list the contents of any ROM in a similar format to the disc "DUMP" command, but unfortunately where the ASCII code is a single digit, the program does not compensate by inserting a space or a 0, so the printout is very ragged.

D-TAPE allows programs to be selectively transferred from a disc (or a series of discs) onto a tape. It will, if required, put a menu at the start of the tape for easier program selection. This menu program was very basic and would have benefited from attention to layout. The user is able to select the files to be listed on the menu. This means that data files need not appear on the menu.

TCOPY is a program to transfer tape files to tape, disc or Hobbit. I could not get this to work at all. It simply came up with the "Header?" message and would not load tape files that I know will easily load from tape. I suspect the problem is connected with the sideways ROM board slowing down the timing.

The ROM contains two more utilities, "VAR" and "BUFFER." "VAR will list all the variables and their values. Array variables are listed, but only the number of elements and dimensions are shown.

"BUFFER" for me is what makes this ROM valuable for money. It makes use of any RAM on the sideways ROM board as a printer buffer, if required. When the computer is switched on a message appears at the top of the screen displaying the free memory in RAM, if RAM is present on the ROM board. The printer buffer is activated using "FX5,3 when all data destined for the parallel printer port (it does not work with the serial port) is first routed through this memory space. Since all the data has been accommodated on the RAM, control of the computer returns to the user, while the data is sent out bit by bit from the RAM to the printer.

To make use of this facility one needs to load only the ROM chip, but either one or two 8K RAM chips (at $240 each) as well as a ROM board. This is still cheaper than buying an 8K or 16K printer buffer, and one then also has use of the extra RAM for other purposes. Some ROM boards will accept RAM only as two 8K chips, whereas others will accept 1 8K RAM.

Martin Phillips

**AMPER SAND ADDS**

**COLOUR BOARD**

AmperSand Colour Module, Atom, £13.75 (kit). AmperSand Computers, 86 Neal Road, West Kingsdown, Kent TN45 5DQ.

Observant readers may have noticed in the small ads section two gentlemen, Messrs White and Worrall, offering construction details for a cheap colour module for the Atom. It can now be revealed that these gentlemen are known collectively as AmperSand Computers (another Acorn User scoop) and their board is now been put through its paces.

It is offered in four packages, to suit every level of competence. The one tested was a ready-built board, but we also built one ourselves, using the notes provided. Construction is reasonably straightforward for anyone with any experience and the parts used are all standard components, readily available from any decent supplier—ours cost £3 to build, excluding the Veroboard. (The ready-assembled unit costs £21.50). A PCB foil pattern and overlay is provided and the notes are well written.

The board takes the signals from the 6847 VDG and converts these, using a series of TTL components to the correct signals necessary for PAL receivers (the 6847 was designed for the American NTSC standard). All the necessary signals are present on PL4 (now you know what it's for) and the board plugs into this, allowing it to be mounted inside or outside the case. Anybody who has ever tried to remove the Acorn colour card will know what a blessing this is! One capacitor is removed from the Atom PCB and a single wire inserted; this is the input to the Astec modulator. After that, it's a matter of setting up and adjusting a trimmer, until the colour is satisfactory—this is a five-minute job.

The construction notes come with demonstration listings. There is a superb pattern generator, a lovely (and extremely fast) flag drawing program and an absolutely awful 'fruit machine' game.

What about the colour? Well, it was found to vary, according to the make of TV used. However, the colour register was as good as the Acorn board, if set properly, but with none of the problems associated with that board.

All in all, a nice design and one to be recommended. Even if you buy the ready-built version, it is still excellent value.

Barry Pickles
**Electronic News**

**Programming the Electron**

A must for Acorn Electron users – a book to teach you how to make the most of the sophisticated features of this microcomputer.

After a short introduction to the machine and how to get it started, some general points on programming techniques are presented followed by more specific features of Electron BASIC including graphics facilities, string handling, mathematical functions, random numbers and sound. Subsequent chapters introduce bits and bytes, hexadecimal numbers and assembly language programming, interfacing features and file handling. Appendices cover technical specification, error messages, ASCII codes and the 6502 instruction set.

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**IDC IDC CONNECTORS**

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ACORN USER OCTOBER 1984
Astounding action by Amstrad

IT IS unusual for Acorn Abuser to mention machines from other manufacturers, but this month we make an exception for the Amstrad H111. This machine is so different from conventional micros that Hermann Hauser was heard to comment 'Was ist es?'

Imagine a machine with no monitor or keyboard, but physical icons, in-built radio interface and three-speed disc drive and you'll realise why Kai Gooney will describe it as 'the shape of things to come' next year.

The principle behind the machine is distributed computing. Whereas current home micros have a central microprocessor driving the memory chips and peripherals, the H111 has peripherals which drive themselves. The central board merely focuses the current input device to the central output device. Amstrad calls this central board the 'amplifier', a term soon to become a household word.

The input devices are a three-speed disc drive, cassette recorder and switches and dials on the amplifier. Of these the disc is the most notable. It is an internal Amstrad design and the company has made a surprising choice.

According to a spokesman the 'turntable' (Amstrad name for disc drive) will take either 7in or 11in discs at any of three speeds – 33, 45 and 78rpm. With most makers going for 3in or 5 1/4in drives, this may seem surprising. However, Amstrad is hedging its bets, as the spokesman mentioned the possibility of a 'compact' disc, presumably 3.5in.

The interesting thing is that the discs are read-only serial access, surely the biggest quantum leap backwards since Sinclair microdrives. The large surface area does however give a massive storage capacity and, at 78rpm, performance should be better than the aforementioned microdrives.

Rather than going for boring colour monitors as output devices, the H111 has a pair of 50-watt loudspeakers with optional earphones. This results in astounding sound effects for a new range of arcade games, although experts believe colour graphics could be difficult. Amstrad do sell colour monitors, but these only receive BBC programmes, so there is obviously an Acorn link-up here.

Software authors will have to learn new skills, as the H111 has a non-standard Basic. We'll describe it later on when we have worked out how to use it.

Amstrad makes it clear that most conventional programming languages are no good because they have no structure comparable to the basic of the H111. Whilst it is incredibly simple to program the H111 to produce sounds identical to the human voice or musical instruments, it will take time to generate any numbers.

The system software design is brilliant. Amstrad has reassuringly continued the policy of producing products only when they are finished. Consequently the operating system is not 0.1; it doesn't hang off the back of the machine, in fact it doesn't exist at all. A look inside the amplifier proved there are no standard microprocessors, ROMs, or RAMs, but cheaper, less sophisticated circuits.

After detailed analysis Acorn Abuser found that the work of a processor and the obligatory 64K of RAM was all being done by a single transistor. Damn clever.

Amstrad has recognised the need for machines that will communicate with each other and has provided an ingenious solution. Rather than opting for network interfaces which are slow and localised, H111 has a radio interface called a 'tuner' (something of a misnomer because it can do nothing with tunes). Software is input via the tuner and processed directly without the need for storage on cassette. However, software can be saved onto cassette and Amstrad claims this could cut costs by 90%, so software houses should rush to support the H111. Hmmm. The tuner shares the same irritating limitation as the disc drive in being read-only, but we are sure an enterprising company will produce a cheap writable tuner.

Envelope of the month

Ms. Cherry Hinton
Acorn Computers, Ltd.
Fulbourn Road
Cambridge, CB1 4JN ENGLAND
Envelope as addressed to Acorn from Microscope-84, Texas

■ ALL these business machine rumours! According to the rag's it's an Advanced Business Machine, it's an Acorn Business Machine, it's a Personal Workstation Range, it's based on the 6502, it hasn't got a Z80, it has got a Z80, the big one's a 68020, it's a 16032, it's an 80286. Of course, prediction is a little difficult when Acorn are so secretive. But if you read Acorn User, it's as easy as ABC.

■ DOES Oric Muser know something we don't? We're just hearing reports from the Palace that as well as Prince Andrew being an Aviator addict, Prince Charles is dating a girl called Diana...

■ MARKETING man Tom Hairbrush has received an apology from Computer Weekly over an article they published naming him Tom Hamburg. Uncle Tom, as he's known to his friends, described the article as 'the pits of journalism'.

■ SPEAKING of pits, it's a trifile embarrassing for Auntie Acorn when the Acorn-sponsored car crashes on Acorn race day. R&D, as they are said to be releasing the 1.0 engine 'within a month'. (That's just longer than 28 days).

■ MESSAGE to an Acorn director. Our Editor wants his £5 loan back - or he'll spill the beans about his guitar playing.

■ ANOTHER Acorn director in trouble is Peter Winalot for blowing the engine on a Ford Caterham racing car on a practice circuit at Silverstone.

■ HAD anyone heard of MSX before Chris Curry started being paranoid about it?

■ IT WAS so nice to receive a postcard from Barry Wooden-top on his holidays. He goes to Silicon Valley each year 'to get away from it all'. Oh Barry, if you're reading, there are two r's in 'squirrel'.

■ WHY does Acornsoft's new marketing manager Jeremy Piston-Engine wear such outlandish bow-ties? Is he one of the elite?

■ ASTOUNDING fact 1001: Computer Concepts boss Chas Moir is a carrot fanatic.

■ TRIED typing the command 'daytona' in on View?
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