40p EVERY WEEK · No 109 · MAY 4

PERSONAL Computer NEWS

STILL ONLY 40p

THE 'NEW' BBC MICRO REVEALED

MEMORY • FEATURES • PRICE
–full details inside

SPECTRUM GRAPHIC MAGIC

THE ORIC ROM REVEALED

MSX DISK DRIVE REVIEWED

EXTRA MEMORY FOR THE 64

WELCOME TO THE WORLD OF DATACOM

EXECUTION - They told me it would be bad but I never thought it would be like this...must keep a clear mind... can't afford to panic...time is fast running out...don't think my nerves will stand much more of this!!! A brain straining memory bashing game of words.

SNAIL PACE - Unbearable excitement. 30 'thoroughbred racing snails' battle to the finish. Super features include computer calculated odds, form guide, excellent sound effects, smooth m/c graphics. Rivetting excitement guaranteed.

INTERPLANETARY TRADER - The most addictive, mind blowing, feature packed space adventure you will ever experience on your AMSTRAD CPC 464. Defend your cargo against space pirates...navigate asteroids, black holes, magnetic storms...Total concentration is required in your quest to become a GALACTIC MEGABILLIONAIRE!!!

DATACOM PUBLICATIONS:
407F Hockley Centre,
Birmingham B18 6NF.
Tel: 021-233 1800

Trade enquiries welcome

All games just

£5.95

Each

These games will be available from your dealer or **POST FREE*** direct from: DATACOM PUBLICATIONS using the coupon provided (or just write in)

* U.K. only - Overseas add £1 p & p

Name.....

Address.....

.....

Please rush me ☐ Tapes of Interplanetary Trader

☐ Tapes of Execution

☐ Tapes of Snail Pace

Tel: .....

I enclose a cheque/P.O. for £.....

PCN 1

MENU

COVER STORY

'New' BBC revealed 1

Details of Acorn's latest incarnation of the BBC Micro have been revealed, answering many of the criticisms levelled at the Model B but also raising some new questions. Get the full details.

OUTPUT

Inside Oric's ROM 10

An anatomy lesson for Oric enthusiasts — bare-bones programming made easier.

Acorn Attack 15

Frantic arcade activity as you save the world again. This Galaxians-type game is fully up to commercial quality (at the cost of a few sore fingers).

Writing adventures 20

First of three parts takes you step-by-step through the process of writing adventure games, regardless of your machine.

Commodore decompression 22

How to get more than the 38.99K of memory free for programming from your Commodore 64. With a few handy routines you can get close to the full 64K.

HARDWARE

MSX grows a disk 29

The first MSX disk system has arrived — check out our review of this welcome addition to the range.

SOFTWARE

Spectrum Light Magic 37

Power to your pictures with an outstanding graphics utility that makes the most of the Spectrum's display capabilities.

QL monitored 38

Steps to easier machine-code with a comprehensive set of tools for assembly and disassembly on the bigger Sinclair.

Megabasics 39

Nothing akin to an expanded Basic, Megabase is a powerful database at a budget price running on Commodore 64 and Oric Atmos. Some novel features make it stand out from the crowd.

REGULARS

Monitor 1

Life gets tough for the pirates; all quiet at communications show; IBM beaten to the punch; and recent competition winners named.

***PCN* Charts** 5

Random Access 7

More letters telling us what you want from the magazine. Why not join the debate.

Routine Enquiries 8

Microwaves 9

Communications 17

Bulletin boards look to the airwaves.

Dungeon 27

Workbench 30

How to spot a resistor when it crosses your path.

Software Pre-View 33

A page full of new releases.

Gameplay 34

Billboard 40

Quit 44

Who's a wally, then?

MONEY

COVER STORY

£500 SON OF BEEB

The long-awaited successor to the BBC Micro is due to be launched today (Wednesday) and while it looks like answering many of the criticisms levelled at the old machine, the newcomer raises a few questions of its own.

The specification is impressive. The major changes include the addition of 32K of RAM, taking the full complement up to the now standard 64K. The operating system and Basic language have been combined on a single 32K ROM, and a DFS is now included as standard.

The new model, designated the Model B Plus and priced at £500, also features a new Floppy Disk Controller, new screen modes, and a substantially different memory map. The circuitry is very similar to the original BBC design, although a complete new circuit-board design has been implemented to accomodate the changes.

Of the additional 32K of RAM, about 20K has been provided as 'shadow' or paged RAM for the new screen modes. The handling of sideways ROM has been changed as well, with two extra ROM sockets bringing the total up to six — not eight as rumoured. The board will also accommodate a 32K ROM instead of 16K.

The new DFS is dubbed 'Acorn 1770 DFS 1.0', and is a 16K ROM functionally identical to DFS 1.2, although it offers extra utilities in the shape of *FORM40, *FORM80, *VERIFY and CLOSE commands. On the current Beeb these are called from disk.

Senior dealers were notified of stock availability earlier this month and Acorn's seven distributors have all placed orders. Although scheduled for launch today, the B Plus will make its public debut at the Electron & BBC Micro User show this coming weekend.

While the Plus satisfies some of the drawbacks of the Model B, it puts some doubt on the rest of the Acorn product line. The £500 price-tag is ludicrously high, although arguable on the basis of an expanded Model B with DFS. It leaves Acorn promoting a 64K machine at more than twice the price of its 64K rivals, the Commodore 64 and Amstrad CPC464. In addition, the new Amstrad with built-in drive and colour monitor at £440 points up the deficiencies in Acorn's pricing.

The company is contractually committed to produce the still-rumoured BBC C and although outside design contractors have been approached, the undisclosed specification remains unaccepted by the BBC Microcomputer Project team.

The other question mark on pricing arises out of the likelihood that the Plus circuit board is a butchered version of the unreleased ABC range. Even allowing for the extra 32K of RAM and the DFS, Acorn should be producing Pluses a lot cheaper than it could manufacture the old Model B.

Disk storage for computer users on the move — Actel has released the Epson PF-10 drive, weighing in at a couple of bags of sugar and offering 350K of storage. It will work with Actel's own Pixie lap-held or any other Epson portable micro. The price tag is £360, exc. VAT.

PARIS FIRMS IN ORIC BIDS

Oric will probably be sold to a French company this week — not, as reported elsewhere, last week.

Oric's creditors are meeting today (Wednesday, May 1) to consider the remaining bids for the company, and the most plausible of these seem to be a series of three offers from Paris-based computer and software distributor SPID.

If one of SPID's offers is accepted it is likely that Oric will relocate to Paris and any remaining UK operation will have branch-office status. A further offer from France is still outstanding — it is likely that this is the one from Oric's French distributor, ASN. The ASN offer was hot favourite shortly after Oric crashed, but two months on it doesn't seem to be as attractive as the SPID offers.

But even if the matter is settled this week it's hardly likely to be a signal for rejoicing among Oric's creditors. They are owed around £6 million, and the highest estimate of the purchase price is £3 million.

Barry Muncaster, Oric's founder, is even less enthusiastic. When Oric crashed he was involved in a UK bid for the company. His syndicate offered £1 million, and he reckons any offer that is accepted will be of that order.

'You've got to be something of a lunatic talking big money. We founded Oric on £250, and we could do it all over again for £500,' Muncaster assured reporters.

This could be a chilling thought, depending on your point of view.

But one silver lining is the fact that we may be seeing the colourful figure of Barry Muncaster back at the new-look Oric, in whatever shape or form it takes.

Barry has been acting as an adviser for various people, although he won't specify whether this is for one, several or all of the bidders.

The receiver has gone on record as being perplexed by Mr Muncaster's status, but in all probability he'll wind up on the winning side . . .

TAVA'S FLYING START

IBM's flirtation with high tech in the shape of the PC AT hasn't exactly been wildly successful so far, and now it's starting to look embarrassing. If you want to buy an IBM PC AT you'll have problems, but if you're willing to settle for an AT-compatible portable with 80×25 LCD screen you might just be on to something.

Computer Frontiers (Letchworth 73374), a UK/US group that already produces a range of PC compatibles, last week launched the Tava Frontier Flyer. The Flyer weighs 15lbs, comes with 256K of memory as standard and has twin 360K 5¼in disk drives. It uses the Intel 80186 CPU, and is AT-compatible. It should be available from Computerworld, price £2,500, in the very near future.

It may seem confusing to have AT compatibles on the market before the AT itself is widely available, but there's a simple explanation. IBM uses the 80286 processor in the AT, and this is in fairly short supply. Compatibles, on the other hand, can use the similar 80186, which isn't.

The Tava itself is a neat briefcase-sized system. It's mains-only powered, although a battery pack should be available in the future for the masochist tendency. Later versions of the machine are also to feature a built-in modem, and this applies to the UK as well as the US version.

Tava Frontier Flyer: IBM AT clone but based on the 80186 processor.

Mega memory on board

Memory limitations needn't pose software problems in the future. Lotus and Intel have announced specifications for a memory board that allows PCs to address up to 8Mb of RAM.

But the only software to make full use of the board is a new version of Symphony, available from July. Other software packages will have to be re-written.

Version 1.1 of Symphony will be able to make use of 8087/80287 co-processors to speed up calculations. It also offers a macro library. A micro-mainframe link, Symphony Link, extends Lotus's flagship by providing 3270/Irma interfacing.

Lotus also announced plans for a revised version of 1-2-3 that will make use of enhanced memory as well as offering additional features.

The latest date given for the company's integrated package for Apple's Macintosh, Jazz, is May 27.

IN BRIEF

Spectrum and QL interfaces due soon

Kempston is going disk, with interfaces for both the Spectrum and the QL. Both interfaces will work with standard BBC disk drives, so it will be possible for owners to switch between the three machines at minimal expense.

The Spectrum interface costs £99.95 and includes a built-in operating system in its own ROM. The QL interface will cost £129.95 and will include extra tool-kit commands.

The company is also releasing a 'proper' Centronics interface for the QL. Most QL Centronics interfaces plug into one of the serial ports and are basically converters, but the Kempston fits into the ROM cartridge slot, leaving both serial ports free. It will cost £39.95.

Sanyo throws in extras with MPC100

In the competitive (if not ruthless) world of micro prices, Sanyo has responded on the cost of its MSX system with a package deal that claims to be worth £50.

With every MPC100 machine Sanyo will be giving away a cassette recorder normally costing £28, plus a joystick and a 'Talking Software' tutorial pack. Full price of the machine plus package is 5p under £300.

Aries chops chip prices on Beeb boards

Aries Computers has cut the price of its RAM chips for the BBC sideways ROM boards, offering 16K of RAM for £24. An 8K bank can be had for £11.50 inc VAT. More details on 0223-862614.

IBM Topview due

IBM has at last got its act together on windows and will be shipping Topview during the summer. Compatible with the PC, AT and XT models, Topview offers mouse control, multiple windows, pop-up menus and the frills like calculator and alarm clock.

Expect it in your dealers in July for £156 — but check out Digital Research's GEM first.

Pet switch on to BBC

Pet printer owners are being offered a new option by Intelligent Interfaces (0789-296879). Using the Commodore Printer Version of its Sysscon 6 interface, price £136 plus VAT, you can hook the printer up to a BBC micro.

COURTS CLOSE IN ON PIRATES

The climate is heating up for software pirates with renewed pressure coming from the courts and Parliament.

Bath magistrates recently fined a London council worker £400 for trades descripton offences on two computer games. The two programs were New Generation's *Knot in 3D* and Quicksilva's *3D Ant Attack*.

The games were being sold at half the normal retail price, which attracted the attention of New Generation's managing director Rod Evans. He obtained copies and identified them as fakes before calling in trading standards officers.

The officers took several months to find the culprit, eventually tracking him down to his London office. 'The investigative work carried out by the Trading Standards Office was considerable and they should be congratulated,' said Evans.

In a separate case the following day, four defendants appeared in a High court action brought by a group of software companies, including Artic, Thorn EMI and Mirrorsoft. The four admitted copying software and agreed to a court order not to repeat their activities.

Because of the financial circumstances of the four, it was decided not to press for damages.

And on the same day, the Copyright (Computer Software) Amendment Bill received an unopposed third reading in the House of Commons.

The Bill has now passed to the House of Lords. If, as expected, it goes through the upper house without opposition, it should become law by mid-summer. More prosecutions would follow, bringing substantial penalties of increased fines and perhaps imprisonment.

MODEM DEMO

For those who missed it, last week saw the start of the Communications London show at Earl's Court. The show was aimed more at the serious user than the home hacker, the only home comms launches being Tandata and Steebeck. Even these two agreed that their modems were a bit out of the home price-range.

The Steebeck offering was the Minimo Plus, featuring auto-dial and auto-answer facilities, plus a baud-rate scan system when the modem answers a call. All the features are software-controlled and the speeds available are 300/300, 1200/75, 75/1200, and 1200 half-duplex.

The price is £245 which, for all its features, compares well with other BABT-approved modems.

Tandata introduced its new Tm512, which also features auto-dial, auto-answer, baud-rate scan, and the same speeds as the Minimo Plus — and of course BABT approval.

In addition, the modem has its own microprocessor, which allows telephone numbers, IDs and passwords to be stored internally in non-volatile memory.

The price is £339 excluding post and packing, and like the Minimo Plus the Tm 512 has a telephone socket on the back, allowing manual dialling.

Steebeck is on (0635) 33009 and Tandata on (06845) 68421.

Follow-up to Tir-Na-Nog

Young Cuchulainn out for a stroll in Dun Darach.

Gargoyle Games is to release the 'prequel' to *Tir-Na-Nog*, at the end of May. *Dun Darach* is the city in which the young Cuchulainn searches for his companion Leog.

Similar graphics techniques to *Tir-Na-Nog* have been used, but more attention has been given to the content of the game. *Dun Darach* is peopled by animated characters who will do their best to part you from your valuables. To progress you have to join in the economic life of the city by gambling, working, stealing and barter.

Meedmore buys up Stack stock

Stack Computer Services, which went into liquidation earlier this year, has gone, but its range of products remains. Meedmore Distribution of Netherton in Merseyside (051 521 2202) has bought up all the existing product line and will be offering most of it for sale under its own name, the exception being the light-rifle.

Anyone who has had problems with Stack equipment can get it repaired by Meedmore at a flat rate of £5.35, including post and packing. If you need repair and a repack to the standard of the original packaging this will cost £6.50. Again this flat rate covers the whole product range.

Meedmore's main business is in medical electronics but it was a distributer for Stack. The reason for acquiring Stack's stock, packaging and repair operation was, according to a Meedmore spokesman, the fact that the components are similar for both businesses.

View From THE U.K.

Amstrad in the cut-and-thrust

In UK terms the Amstrad micro was the undoubted success story of last year. The Sinclair Spectrum and the Commodore 64 may have sold more, but it was Amstrad that came from a standing start, launched on time and carved out a slice of the market respectable enough to annoy a goodly number of 'established' micro producers.

The Amstrad is a successful formula — the original machine is good value, and the 664 with disk drive seems, if anything, even better value.

Next year Amstrad could have the same competitors, but in addition will be facing the new Ataris. The STs will be heading for the same 'value for money' market, and down below, at £170, the 130XE will be looking very good value. Commodore will have the 128, and probably the Amiga, and these two machines are likely to bracket the Amstrad in the same way, pricewise. It's difficult to say what Sinclair will have by then, but considering the competition a good money-making idea might be handy.

The problem is that, while the manufacturers are going overboard to launch 68000 wonder machines, they're not actually paying much attention to entry-level machines. The cheap, first-time buyer machines that will be sold in the next year will be almost exclusively cut-price machines reaching the end of their natural life, or revamped versions of older machines.

So whereas two years ago a first-time buyer could go out and buy something that was cheap and revolutionary, this time round you'll be able to choose cheap or revolutionary but not both. Now the interesting thing about the Amstrad is that it is neither, and this could turn out to be a problem, because you might not want to buy a pricier Amstrad when you can get a discounted machine much cheaper, or else go for something much more advanced.

VIEWDATA FANS IN ON THE ACT

For corporate megalomaniacs who want to set up their own rival to Prestel, ACT has the answer. Apricot Viewdata will run on an Apricot Xi10S micro and can provide up t 8,000 pages of information.

The system will support as many as 200 terminals connected through public telephone networks or internal telephone exchanges. It also offers Prestel compatibility, so you can have the best of both worlds.

ACT managing director Tony Bryan is more than a little smug about the new system: 'Until now, businesses requiring such a service have had to invest in minicomputer systems costing upwards of £100,000.'

Apricot Viewdata comes with Apricot Xi10S — with 10Mb hard disk and 512K of RAM — ACT colour card, colour monitor, viewdata software and multiplexor for the almost miserly price of £9,930.

ACT expects potential users to include financial institutions, banks, building societies and travel agents.

The company also mentions — perhaps hopefully — possibilities in agriculture. We expect the number of farms requiring 200 terminals to be strictly limited.

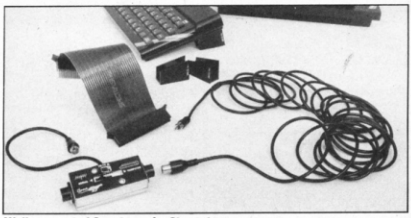
Apricot Viewdata system: Xi10S micro, colour monitor, modern multiplexor (16 lines) and software, with access to 8,000 pages from 200 terminals.

FOUR CHEETAH LINKS

Cheetah has launched four new Spectrum add-ons. Heading up the list comes a dedicated cassette recorder that, although billed for the Spectrum, should work with most micros except Commodores. It costs £30.

The Spectrum extender cable is a ribbon cable with a connector that will allow you to plug things into the user port from 6in away. The extender costs £7.95.

A pair of sticky toes for raising your Spectrum a couple of inches will set you back £2.99, while for £1.50 you can buy 15ft of extension lead that Cheetah says will allow the computer 'to be sited at a comfortable distance' from the screen.



Well-connected Spectrum, by Cheetah.

PCN plotter winners

For the hundreds of you who entered our recent plotter competition — here are the results you've been waiting for.

In return for answering four questions on a robotics theme, we offered two superb Penman Plotters, with ten runners-up prizes of £50 discount vouchers.

The answers we were looking for were: Isaac Asimov (together with John Campbell) formulated the Three Laws of Robotics; Marvin the Paranoid Android starred in *The Hitch-Hiker's Guide to the Galaxy*; R2D2 and C3PO co-starred with Mark Hammil and Harrison Ford in *Star Wars*; and Doctor Who's robotic friend was K9.

The first two entries out of the hat came from Ewan Evans, of Ellon, Aberdeenshire, and Simon Locke, of Hammersmith, London W6. Penman Plotters are on their way.

The ten runners-up were John English, of Birmingham; C Riley, of Cwmbram, Gwent; SG Mitchell, of Basingstoke, Hants; Andrew Waces, of Newport, Gwent; John Bradley, of Buckfastleigh, Devon; N Haddy, of Hayes, Middlesex; B Banham, of London NW2; TC Rothwell, of Bolton, Lancs; Anthony White, of London N11 and JB MacMichael, of Glengarnock, Ayrshire.

View From AMERICA

Jack Tramiel: man with many missions

A book published recently offers a remarkable insight into the character of one of the heroes of the moment — none other than J Tramiel, Esq.

Michael Tomczyk's *The Home Computer Wars** is subtitled 'An insider's account of Commodore and Jack Tramiel' — and Mr Tomczyk is an insider indeed, former assistant to the great man.

A major point of interest is the origin of so many of Tramiel's classic quotes. The author reveals, for example, the following from 1980: 'We have to be a mass-market company. I want to bring down the price of computers, like we did with calculators... we're spoiled. We have to learn to live on a diet. We have to sell to the masses not the classes.'

Again, discussing the prospects for launching the Vic-20: 'The Japanese ae coming — so we will become the Japanese.'

The Tramiel aura apparently went to work on Mr Tomczyk early. At his interview with Tramiel, Tomczyk says Tramiel managed to sum up his life in five minutes: 'He just absorbed me like a mystic.' A vital key to Mr Tramiel's business success, no doubt.

But there's a lot more. There's Tramiel the family man, who was more than gratified to be able to set up business at Atari with his sons. Tramiel the Auschwitz survivor setting out to make his fortune in America. Tramiel the socially concerned who once said: 'If I thought it would do any good I'd take the money and buy food for the poor and the hungry, but the food would be gone and people would be hungry again. We have to do something more.'

But finally, and above everything, is Tramiel the industry myth — as ruthless, successful and blunt as the stories say. The man who could threaten, personally, one of his top executives: 'If you send one more telex to Japan I'm going to make you pay for it.'

**The Home Computer Wars*, by Michael Tomczyk, is published by Compute! Publications, distributed in the UK by Holt-Saunders.

CHARTS

GAMES

TW	LW	TITLE	PUBLISHER	MACHINE	PRICE
1	1	Softaid	Softaid	SP, C64	£4.99
2	2	Wld Series B'ball	Imagine	SP, C64	£6.95
3	3	Spyhunter	US Gold	SP, C64	£9.95
4	4	Brian Jacks S/star	Durrell	SP, C64, AC	£7.95
5	6	Ghostbusters	Activision	Various	£9.99
6	5	Gremlins	Adventure Int	Various	£9.95
7	7	Impossible Mission	CBS/Epyx	C64	£9.95
8	9	Starion	Melbourne	SP	£7.95
9	8	Bruce Lee	US Gold	SP, C64, AT	£9.95
10	10	Moon Cresta	Incentive	SP, C64	£6.95
11	18	Pitstop 2	CBS/Epyx	C64	£10.95
12	13	Grand National	Elite	SP, C64	£6.95
13	14	Dragontorc	Hewson	SP	£7.95
14	11	Sorcery	Virgin	SP, C64, AM	£8.95
15	—	Gyron	Firebird	SP	£9.95
16	15	Raid over Moscow	US Gold	SP, C64	£9.95
17	17	Combat Lynx	Durrell	Various	£9.95
18	16	Pole Position	Atarisoft	Various	£9.95
19	12	Airwolf	Elite	Various	£6.95
20	—	Death Star Int	System 3	SP	£7.95

SPECTRUM

TW	TITLE	PRICE
1	Softaid	£4.99
2	Spyhunter	£9.95
3	Wld Series Baseball	£6.95
4	Starion	£7.95
5	Brian Jacks S'star	£7.95
6	Gremlins	£9.95
7	Grand National	£6.95
8	Moon Cresta	£6.95
9	Bruce Lee	£9.95
10	Gyron	£9.95

COMMODORE

TW	TITLE	PRICE
1	Softaid	£4.99
2	Wld Series Baseball	£7.95
3	Impossible Mission	£9.95
4	Pitstop 2	£10.95
5	Gremlins	£9.95
6	Pole Position	£9.95
7	Brian Jacks S'star	£7.95
8	Rocketball	£7.95
9	Super Huey	£9.95
10	Int Basketball	£5.99

MICROS

BELOW £1,000

TW	MACHINE	PRICE
1	Spectrum	£129
2	Amstrad	£349
3	CBM 64	£179
4	BBC B	£399
5	Atari 800XL	£125
6	Electron	£129
7	Einstein	£499
8	CBM 16	£140
9	MSX (series)	£250
10	Sinclair QL	£399

ABOVE £1,000

TW	MACHINE	PRICE
1	IBM PC/XT	£2,340
2	ACT Apricot	£1,760
3	Compaq	£2,064
4	Olivetti M24	£1,776
5	Wang Professional	£3,076
6	Ericsson PC	£1,917
7	Macintosh	£2,064
8	ITT Extra	£1,997
9	Columbia PC	£2,478
10	Corona PC2	£2,498

These charts are compiled from both independent and multiple sources across the nation. They reflect what's happening in high streets during the week up to **April 25**. The games chart is updated every week. The prices quoted are for the no-frills model and include VAT. Information for the top-selling micros is culled from retailers and dealers throughout the country and is updated every month. PCN Charts are compiled exclusively for us by RAM/C, who can be contacted on 01-892 6596.

SOUTHEND'S PRINTER SPECIALISTS

Mannesman Tally MT80+	£219
Brother HR5	£149
Fast Text 80	£179
Centronics GLP	£211
Epson P40	£95
Sakata 1200+	£310
Brother M1009	£190
Shinwa CPA80	£210
Printer/Plotters:	
Sakata SCP800	£205
Quendata DMP 1100	£199

3" DISKS

CF2 by Maxell **£5.95**
Box of 10 **£52.00**

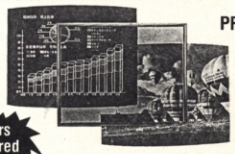
Access/Visa. Telephone orders welcome.
All prices include V.A.T.
from

MINNIE MICRO COMPUTER STORE
12, Eastern Esplanade, Southend

REPAIR SERVICE for Spectrum, BBC, Commodore & Amstrad.
Telephone for details.
0702 62033

TV • FILTER the eye guards.:

Cuts 100% of ultraviolet rays, absorbs 32.5% of visible light, eliminates flicker and white noise.



PROFITABLY SPEAKING

Dealers Required

ALL HUMAN EYES FACING CRISIS!

For HOME TVs and CRT DISPLAY

"TV FILTER"
Ideal for your home TVs . . . To watch TVs with more comfort.
Securely protects children's eyes by watching TVs so closely
"TV FILTER"
For the office computer CRT displays . . . To execute routines more comfortably
Perfectly prevents computer operators from OA disease (typically, fatigue of the optic nerves)

A Must for Offices and Homes Especially effective for Video

CRT operators who must work in front of a display tube can suffer eyestrain from very long exposure at close range. The situation is the same for children who sit too close to the TV screen.
A TV Filter is best for such circumstances.
TV Filter prevents eyestrain in CRT operators and children.
When it is used, viewing conditions appear the same as those forviewed at the proper distance.

For CRT DISPLAY ONLY

"TV FILTER COR"
For the office computer CRT display receiving unwanted light from reflection . . . The "TV FILTER" eliminates irritations caused by reflected light
"TV FILTER CX"
For those who cares safe conditions when operating the computer CRT displays . . . The "TV FILTER" securely protects you from the hazardous X-rays

- Models for general use (9"-26")
- Models for office computers and word processors

DISTRIBUTED BY:
WIRELESS & ELECTRONICS LTD
5 Lansdowne Way
London, SW8 1HL
Tel: 01-735 7910
Telex: 267775 AHMCO G

Is the Information Revolution Passing You By?

If you use an Apple, IBM, BBC or ACT micro then you could be missing out on the information revolution of the decade. Today there are literally hundreds of databases worldwide, which can be accessed by a microcomputer fitted with a Nightingale modem and using appropriate software. These data bases include Prestel, Micronet, Homelink, Telecom Gold, various 'Bulletin Boards' and massive American Databases such as 'DIALOG' and 'The Source'. Micros can also be used to send telex messages.

A world of information is available to you now when you install the Nightingale modem from Pace. There are hundreds of thousands of 'pages' of data available on Prestel, free computer software on Micronet, homebanking facilities available with Homelink, Company facts, Educational information, magazine and news articles available with Knowledge Index and the ability to communicate with other micro users direct, or via 'bulletin boards'.

The Nightingale modem is only £136.85 inc. VAT. If you do not already have suitable communications software Pace can supply this complete with a manual and full installation instructions.

NIGHTINGALE - The Modem

By far the most versatile modem available, at the price, for either home or business use, Nightingale will enable your micro computer to send and receive data utilising an ordinary P.O. Telephone Line. It offers Prestel/Viewdata baud rates (1200/75 & 75/1200) alongside 300/300 baud full duplex for communication between computers.

The state-of-the-art modem chip technology employed in Nightingale requires minimum support circuitry resulting in low power consumption, low cost, high quality and extreme reliability. It also features a simple self test facility for easy installation.

Nightingale complies with the vigorous specifications laid down by British Telecom and is fully BABT approved.

SPECIAL INTRODUCTORY OFFER

For a limited period, when you order the Nightingale modem you will receive discount vouchers entitling you to the following:-

KNOWLEDGE INDEX

20% discount off standard enrolment fee (normally £25)

This remarkable collection of databases includes over 22,000,000 items covering Agriculture, Books, Business, Electronics and Computing, Corporate and Company News, Education, Engineering, Government Publications, Legal Information, Magazine Articles, Mathematics, Medicine and News/Current Affairs (The enrolment fee also includes 2 hours of free access time).

ONE TO ONE

50% discount off standard enrolment fee (normally £50)*

One to one is an electronic message service designed to give you the communications capabilities of a telex at much lower cost. By using your micro fitted with a Nightingale modem you can produce telexes, letters, reports and contracts, and send them in seconds to any destination. Courier delivery, priority mail and radio paging are also included in this highly efficient communications service.

To Pace Ltd., 92 New Cross Street, Bradford BD5 8BS

Please supply:

- ☐ modems at £136.85 inc. VAT & carriage
- ☐ modems & software pack for BBC micro at £159, inc. VAT & carriage
- ☐ modems & software pack for Apple II/IIe at £279 inc. VAT & carriage
- ☐ modems & software pack for IBM PC* at £269 inc. VAT & carriage
- ☐ modems & software pack for ACT at £269 inc. VAT & carriage

Name .....

Address .....

Cheque enclosed £..... or please debit my Access ☐ ——————

Barclaycard ☐ —————— (Please tick)

If you require further information on the above communications products for other computer systems, please write enclosing a stamped addressed envelope.

*Assumes IBM micro fitted with RS 232 interface. Please allow up to 28 days delivery.

PACE

"Bringing tomorrow a little closer"

PACE SOFTWARE LTD.
92 NEW CROSS STREET,
BRADFORD. BD5 8BS
Tel.(0274) 729306
Telex 51564

RANDOM ACCESS

Share your words of praise or send us a rocket about *PCN*. We want to hear your views and feelings on the articles we print — and those you feel we ought to. Write to *Random Access, Personal Computer News, Evelyn House, 62 Oxford Street, London W1A 2HG*. You could win £15 for the best letter of the week.

Give printers a fair run of pages

I was most interested in Mike Howard's letter in issue 107. At the same time, I wonder if it is not dangerous for editors to ask what readers think — the resulting deluge might well make the Flood appear a drought!

There is much to be commended in Mr Howard's suggestions, but is he not crying in the wilderness when, in the same issue that his letter appears, the article on printers, to which I have been looking forward, comprises a short piece of text followed by a large number of graphs? I was surprised to see a piece such as this in *PCN*. It is too sketchy to prove of much value, and no indication is given of what the ratings are based on. I haven't the slightest doubt that Kenn Garroch has well-considered opinions to put forward on the subject, since his comments in the pitifully short text are apt and useful. An article such as this could have been of real value if given sufficient space and it deserved much better treatment. The purchase of a printer is an important step, ranking second after the purchase of a computer.

While I've seen a number of articles drawing together information about printers, these do not always tell the reader what he ought to know about the machine. Features available on printers are so varied that one needs to know about them to make a decision. A typical example is the question 'Does the printer have the facility of elite script?' Such a facility is so important to me that without it a printer would be useless. Then there is the question of alternate character sets — how many and what are they?

This is the sort of information that a prospective purchaser needs to have, in addition to more obvious things like paper width and interfaces.

In the space allowed Mr Garroch for this article there was never any hope of such treatment. Yet a few pages further on, a whole page is given to an excellent review of a machine-specific mouse, and later still another for a review of the upgrade *Wordwise*.

Your Dungeon page is always interesting, and the Workbench articles have a considerable value to those interested in projects and hardware hints. The Gameplay pages, one supposes, need to be included, and seem to get about the right amount of space.

It is the specialist feature article that seems to suffer, being squeezed into minimal space.

Counting the inside front and both sides of the back cover there are no fewer than 30 pages of advertising of various kinds in issue 107, out of a total of 55, and it seems likely to me that this is at the root of the space problem. Whilst the need for it is obvious, the way it scatters through the mag, interrupting articles and managing to be generally irritating, causes me to take the view that I will not read adverts which do this.

P Craddock,
Walsall

To give the survey of printers the space you desire would take nearly half of the magazine. In fact, three-quarters of the models mentioned have been reviewed by PCN *in the past — we could hardly reprint that amount of information —Ed.*

Read between the program lines

Mike Howard made some very interesting comments in his Star Letter in issue 107. I agree in principle with his views on wider coverage of the alternatives to Basic, but there are two points to be made.

Firstly, most add-on languages come at a considerable cost. Secondly, they are compiled and stored on tape or disk rather than being interpreted and in ROM. So a potential user must first fork out yet more money and then tolerate the inconvenience of loading the language and using the compiler — small wonder, I think, that most people stick with Basic.

Mr Howard also suggests that the program listings are only of interest to 'raw beginners' and that more theory and algorithms should be included. I am gratified that he thinks I took a step in the right direction with *Wheels Within Wheels (PCN*, issue 103), but I think there are several more points to make. Many readers of the magazine will not have available the considerable amount of time needed to produce a properly presented and debugged program, even one written in Basic, so will appreciate having it 'ready made'.

If the listing is fully explained, readers with the inclination can use it as a starting point for their own version. Some programs lend themselves to ready conversion for other machines because they are based on an algorithm, for instance a program to print the calendar for any given year, but others are very machine-specific.

Algorithms and equations for almost anything are widely available in text books if you feel disinclined to derive your own; not so easily available are the little programming 'tricks' which are not detailed clearly in the machine's manual but which can be learned by reading listings. (I wouldn't claim this for *Wheels Within Wheels* by the way, I've learned a good deal about Superbasic since.)

I think it is easy for those of us with a reasonable amount of computer experience to forget the bafflement we felt when first setting up a FOR...NEXT loop. I suspect this magazine is read largely by intelligent people of widely differing computing knowledge, so the articles printed should reflect this.

James Lucy,
Maldon, Essex.

I think we've got another four cases of data listing blindness out there, Doctor.

The curse of Sir Clive — Microdrives

It seems to me that the Sinclair Spectrum is coming to the end of its lifespan. It doesn't compare well with any micro on the market at the moment and the only plus point in its favour is its enormous software support.

There is no doubt in my mind that Sir Clive is to blame for the Spectrum's approaching demise. He has failed to support the machine with decent add-ons.

Why oh why did he opt for Microdrives which he had to develop himself when he could have easily gone for a floppy disk system. Even the QL had the dreaded Microdrives fitted. Most people I know who work in computer shops have said that the only thing that would stop them from buying a QL are the Microdrives.

Of course you can buy add on floppy disk drives, but that seems to defeat the purpose of buying the QL as a low cost small business computer.

Even the humble Spectrum has some excellent serious software like *Tasword*, *Masterfile* and *Omnicalc*, but using them with Microdrives is a hit and miss affair.

If Sir Clive wants to keep the Spectrum alive he should scrap the Microdrives and start making floppy disks instead.

Timothy Kemp,
Norwich, Norfolk

ROUTINE ENQUIRIES

Suffering from circuit crunch or data dyslexia? Want some sound advice on speech synthesis or the best type of printer? Then consult the experts. But remember, no SAEs, 'cos we can't reply personally. Address your queries to Routine Enquiries, *PCN*, Evelyn House, 62 Oxford Street, London W1A 2HG.

A turnoff for the Oric Keyboard

Q I need some information about the Oric-1's system. I'd like to know how to turn off the keyboard, to increase the speed of my programs. I'd also like to know how to change the display area on the screen.
David Goodrum,
Norwich

A CALL #E6CA turns off the keyboard scanning, but don't use a WAIT after it in your program. WAIT uses the keyboard scan as a counter. CALL #E804 re-enables the scanning. You should get something like a 20 per cent improvement in most programs.

The parameters for the top and bottom screen lines are held in locations 621 and 622. DOKE these addresses with the normal screen start address (48000) plus an offset. For example, to shrink the scrolling display area to the lines between 10 and 20 DOKE 621,48000+10*40 : DOKE 622,48000+20*40. The depth of the display (number of lines to scroll) is held in the byte at 623 — don't forget to change the value here if you alter either of the others.

Monitor on Spectrum: composite v RGB

Q You have often mentioned how to drive composite video from the Spectrum and given sources for at least two RGB interfaces. But which method gives the better image? I intend to purchase a combined TV/monitor and have spotted them with both types of video input.
A M Foggle,
London NW6

A A video monitor is basically a cut-down TV set with the tuner removed (perhaps it should be the other way around since the monitor came before the TV). A colour monitor has three electron guns inside the tube, one for green, one for red and one for blue. The amount of power fed into each of these gives the colour mix on the monitor screen.

The difference between RGB and composite video technology is in the way the signals are coded for transmission between the computer and the monitor. RGB takes the red, green, blue and syncronisation signals from the video generator and each one is sent via a separate wire to the monitor. This method means that there is little interference between the signals, but the plugs and cables are more expensive.

The composite video signal is made up from the red, green, blue and synchronisation signals, which are combined together to form a single composite signal. This can then be sent down a single shielded cable to the monitor, which decodes them into the colours and sync for the electron guns in the monitor.

RGB will usually give a better picture than composite because the video signals do not go through as much processing before they are displayed. However, the quality of the picture depends a lot more on the quality of the monitor than the method used to feed the signals into it. The difference in quality between RGB and composite will be noticeable only on a high-quality colour monitor. The dual TV/monitors you mention are generally adapted TV sets that allow a signal to be injected between the tuner and the tube. The resolution and hence quality of picture on TV sets is usually not as good as on purpose-built monitors, so it really doesn't matter whether RGB or composite is used. In the final analysis composite video is cheaper since it is easier to obtain from the Spectrum than RGB. Composite TV/monitors are also cheaper — again, you pays your money and takes your choice.

Interfacing riddles on the Spectrum

Q I am considering buying an Epson FX80 printer and a couple of disk drive units for my Spectrum. I've seen two interface units that would do the job, namely the Beta interface from Technology Research and the SPDOS system from Watford Electronics. These two both had good write-ups but I would like to know, if I bought one of these units, whether I would be able to run a disk drive and printer simultaneously.

If this is not possible, I would be grateful for any advice you could give on the problem.

I believe the Discovery 1 has the interface I need built in, but it was purposely designed for the Spectrum. As I intend to upgrade to another computer next year I don't know if I should buy it.

Just to confuse matters further, I would also like to buy a modem. Is it possible to run modem, disk drives and printer all together?
Roy Lindo,
BFPO 113

A To drive an FX80 you'll need either a Centronics or an RS232 interface for the Spectrum, depending on which interface the FX80 has. The Discovery 1 has a built-in Centronics port and is a relatively efficient drive as well but, as you say, it is Spectrum only, and you'd have to sell it if you changed machines.

You should therefore be looking at interface units rather than complete systems, so that you can use your drives with your new machine. The SPDOS system is probably the more attractive of the two you mention, but both should run with an RS232 or Centronics interface with no problem. If you settle for SPDOS you can probably get an interface from Watford Electronics at the same time.

The modem is a thornier problem, as you'll need an RS232 interface to drive this. If you shut one eye and concentrate hard it's possible to think of a way where you could drive a Centronics and an RS232 interface at the same time, or even two RS232 interfaces, but if you're not liable to want to run the printer and the modem simultaneously it's probably not worth the bother.

So you'd be talking about one of the following systems:

1. FX80 with RS232 interface and an RS232 interface for the Spectrum, in which case you'd just plug into printer or modem.

2. FX80 with Centronics interface, an RS232 and a Centronics interface for the Spectrum, in which case you'd have to switch interfaces.

3. FX80 with Centronics interface and a switchable RS232/Centronics interface for the Spectrum (*eg*, the Euroelectronics).

As far as we know there aren't any dual, as opposed to switchable, interfaces for the Spectrum, but if you wait a fortnight everyone who makes one will write in to us complaining.

But if you really want to upgrade your computer in the next year, and you take into account the amount of money you're going to spend on your Spectrum-based system, you might want to look at another avenue. The assembled kit — printer, disks, interfaces and modem — is going to cost you a fair amount, and depending on what sort of machine you want to upgrade to you could find it cheaper in the end to upgrade now rather than buying Spectrum add-ons first.

Atari links the new and the old

Q I have read a great deal about the forthcoming Atari computers. Will they be compatible with my current Atari peripherals or will a new range of add-ons be released for the new models?
S Mackenzie,
Richmond, N Yorks.

A The XE range of machines will certainly be compatible with your old Atari equipment and software. Compatibility with the more advanced ST models is open to doubt. However, Atari has announced a whole new line of add-ons for the new computers.

Although UK availability and prices are not available, the following is a partial list of the equipment Atari had on show at this spring's CES show in US:

- A new monochrome monitor for the current Atari XLs and new XEs which comes with a built-on 80-column adaptor so that every Atari machine can display the wider screen standard in business applications.
- A 300 baud modem and a series of eight printers was also revealed covering just about every printing capability and price range imaginable.
- Two monitors for the ST range, one black and white, the other an RGB colour unit.

Memotech user seeks company

Q Can you tell me if there is a Memotech user group?
B Smith,
Halstead, Essex

A Yes, the Memotech Owners Club is at 23 Denmead Road, Harefield, Southampton.

MICROWAVES

Send your hints and tips to Microwaves, *PCN* 62 Oxford Street, London W1A 2HG.

Obtaining a 40 column display on the BBC

One of the problems with the BBC's 16 colour Mode 2 display is that it allows only 20 characters per line. The following routine redefines each character as it is printed so a 4×8 matrix is used rather than 8×8, giving a 40 column display.

The relevant procedure is PROCSMALL and is called with PROCSMALL(X,Y,C,M,M$), where X and Y are the graphics screen coordinates for the start of the message, C is the colour, M is mode to be used (any graphics mode 0,1,2,4,5), and M$ is the message. Note that on many television sets, the 160 column display in Mode 0 may well be unreadable due to the low resolution.

Jonathan Temple, Beeston, Nott.

```
10 FOR M%=6 TO 0 STEP -1
20 MODE M%
30 RESTORE
40 PRINT"MODE ";M%
50 FOR N%=1 TO 4
60 READ X,Y,C,M$
70 PROCSMALL(X,Y,C,M$,M%)
80 NEXT,
90 END
100
110 DATA 0,768,1,"The quick brown fox jumps "
120 DATA 0,704,1,"over the lazy dog! "
130 DATA 0,576,3,"THE QUICK BROWN FOX JUMPS "
140 DATA 0,512,3,"OVER THE LAZY DOG"
150DEFPROCSMALL(X,Y,C,M$,M)
160!&80=!&CF0:!&84=!&CF4
170LOCAL A%,X%,Y%,L%,C%
180 M=-((M=0)*8)-((M=1)*16)-((M=2)*32)-((M=4)*16
)-((M=5)*32)
190VDU 5,18,0,C
200FOR L%=1 TO LEN(M$)
210?&70=ASC(MID$(M$,L%))
220VDU 23,255
230A%=10:X%=&70:Y%=0:CALL &FFF1
240FOR Y%=1 TO 8:C%=0
250FOR A%=0 TO 6 STEP 2
260IF (Y%?&70 AND 2^A%) THEN C%=C%+2^(A%/2)*16
270NEXT:VDU C%:NEXT
280C%=?&70 AND &DF:MOVE X,Y
290IF C%=77 OR C%=87 THEN X=X+8
300VDU 255:X=X+M:NEXT:VDU 4
310!&CF0=!&80:!&CF4=!&84
320ENDPROC
```

Creating Amstrad games with a bang

When writing games for the Amstrad CPC464, with explosions, it is sometimes an enhancement to make the screen shudder during the bang. The first two OUTS turn it on; the second two turn it off.

```
OUT &BC00,8:OUT &BD00,1
OUT &BC00,8:OUT & BD00,0
```

The following routine is a simple, but flashy way to clear the screen:

```
LOCATE 1,1:SOUND 130,0,50,3,0,0,1:PRINT
STRING$(25,11);
```

T M Mughal, Southall, Middx.

Spritely collision on the Spectrum

I was impressed by the Spritely Movements article on the Spectrum (*PCN* issue 99, followed up in *PCN* issue 107) which allowed up to 16 sprites on the screen at any one time.

The routine includes collision detection but, as it stands, it does not tell you which of the 15 sprites is involved in the collision with the 16th. To rectify this, load your copy of the machine code, and enter the following as direct commands:

```
POKE 64864,90
POKE 64955,34
POKE 64956,250
POKE 64957,250
POKE 64958,24
POKE 64959,175
```

Save your modified version using:

```
SAVE "CONTROL" CODE 64256,704
```

To find out which sprite was involved in the most recent collision, just `PEEK 64250/8+1` which will return the number of the sprite (1-15).

Dennis Hughes, Walton, Liverpool

Connexions

Magic Mouse

FOR THE COMMODORE 64 £59.95 INC. VAT.

- CREATE HI-RES GRAPHICS
- TRANSFORM YOUR OWN PROGRAMS
- COMES COMPLETE WITH DISC AND TAPE SOFTWARE - NO EXTRAS REQUIRED
- SOFTWARE INCLUDES HI-RES GRAPHICS PACKAGE, MOUSE CONTROLLER, SPRITE DESIGNER, ICON DESIGNER.

PHONE FOR YOUR NEAREST STOCKIST TEL: 01-441-1282

ANOTHER CONNEXIONS PRODUCT FROM:
SMC SUPPLIES, 11 WESTERN PARADE, GREAT NORTH ROAD, BARNET, HERTS EN5 1AD Telex: 295181 SMC G

AMSTRAD USERS SPECIAL OFFER!

A "frustrated" order means that we have a limited quantity of interfaces in stock. These interfaces have been designed and manufactured by us and are ready for immediate delivery. They are uncased and have many features, including:

- ★ Full RS232 interface (8251)
- ★ 8 software controlled baud-rates (with Parallel Option) (9600,4800,2400,1200,1200/75,75/1200,300,Ext.)
- ★ 24-bit Parallel Port Option (8255)
- ★ 2 "Sideways" ROM Operating System Included.
- ★ Fully compatible with the Disc System.
- ★ Ideal for Software Houses intending to produce "Sideways" ROMs of their own or the serious user.

Write or Telephone for more details

SKYWAVE SOFTWARE

73 CURZON ROAD, BOURNEMOUTH (0202) 302385

ROOTING IN ROM

Taking advantage of the Oric's built-in ROM routines in your machine code programs saves time, but first you have to find out where they are — with a little help from Martin Bolter.

While the Oric has some useful features for machine code programmers – such as the DEEK, DOKE and HEX$ commands and the facility to extend commands and functions using the exclamation mark and ampersand signs – the lack of any significant information on the workings of ROM can be a serious drawback. Why write a lengthy machine code routine that – if only you knew where to find it – could be replaced with a call to an existing ROM routine, achieving the same end?

Careful and systematic detective work is required to identify ROM routines. The starting point of any detective work is to gather known information and clues and to eliminate suspects. With the Oric ROM we have four major sources for our enquiries.

First, some addresses have been revealed by the manufacturers or published in a variety of sources. These fall into two groups – addresses in the ROM and those in RAM pages 0 to 4. They serve two purposes: they can either be eliminated from our enquiries or they can be interrogated further for pointers to other routines that are called from within them.

For example, if you wished to find a routine that prints a message on the status line you could start with the known address of the CSAVE routine which must include this feature. If we follow this routine through from its start at E4AB we soon discover a subroutine at E576 which is called to display a message, stored elsewhere as ASCII code, on the status line. To use this, input LDX with the low byte of the message store address, LDY with the high byte and then JSRE576.

At this stage it is worth having a printed disassembly of the ROM. If you do not have a printer and/or disassembler, Bob Maunder's *Oric-1 Companion* has a full ROM disassembly. A word of caution, however – many useful clues are hidden by dummy instructions. A disassembly of C9EE onwards, for example, will include a BIT5AA2 instruction. The BIT instruction is a dummy which conceals two LDX instructions. If the first LDX is used, the second is ignored because BIT is operated with no effect.

Whenever you come across a BIT instruction and, less frequently, a ROR, regard it with suspicion. In the *Companion*'s disassembly there is also an occasional confusion between instructions and ASCII, control and attribute codes.

Our second set of clues from RAM addresses enables us to do some tracking through the ROM. For example, knowing that 020C holds information on the caps on/off toggle, we can search for references to this address. Thus we discover that F64A gives the toggle effect of PRINT CHR$(20). F735 gives a clear status line without affecting the toggle action. Incidentally, a clue to the real identity of the ROM author (with the inevitably bugged spelling) is revealed by CALL F70E:CALL F735:CALL F729. Table 1 gives details of RAM address functions.

Locations C2AC onwards provide the third set of clues. Here can be found a list of most of the error messages in ASCII form; others are scattered about the ROM. If the routine to display one of these messages is located, it is possible that the routine preceeding it will be involved in a process which, if it fails, will result in the error message. ?EXTRA IGNORED is stored at CDE8. The start of the display routine is at CDE0.

Tracking back, there are further clues in the form of CMP instructions relating to the ASCII codes for the semicolon, quotation marks and comma. It follows that the INPUT routine starts at CCC9. This is confirmed by later evidence, as we shall see. Table 2 gives a list of error message routines.

The fourth, and by far the most important, set of clues lies in the keyword tokens, a complete list of which is given in Table 3. Note that the tokens C2 and C5 represent the keywords TAB and SPC *with* the first bracket. A search for keyword tokens in the ROM reveals a few routines. TAB(and SPC(both appear in the PRIME routine from CB61 onwards. This method is not very productive, however, and with a few exceptions, seems to apply for tokens C2 to D5 only.

Keywords are stored in ASCII form between C0EA and C2AA in token value order. Playing a hunch (in the best traditions of fictional detective work) led me to the ROM area immediately before the keyword area. Here there are plenty of addresses.

This area from C006 contains the address minus one for each keyword routine in token order with the exception of keywords that require a preceeding command – *ie* those with token value C2 to D5. In some instances the addresses given are merely staging posts to distinguishing routines or JMPS from the main routine (notably with the sound and HIRES keywords). Table 4 gives a list of ROM routines.

The principles of this can be applied equally well to the Atmos and it should not be difficult to apply the results to the Atmos ROM.

The information is not exhaustive, but should lead Oric owners to some of those elusive routines like the string storage and recall ones.

Table 1 – RAM addresses

12/13	screen location for PRINT
14/15	envelope period for sound chip
18/19	start address of keyword table
1A/1C	JMP CBED used when program breaks
1F/20	GCL/GHC
21/23	JMP to DEF USR routine. If unused jumps to error routine
30	TAB reference point. Should hold 0, but holds 13
31	LPRINT characters per line
33/34	value for WAIT
35	next 17 bytes hold file name for cassette transfer
3A onward	hold current program line in ASCII and token form. Continuously updated
5F/60	start address for CSAVE
60/61	end address for CSAVE
63	specifies whether AUTO or not
64	specifies Basic or machine code file for tape transfer
67	cassette transfer speed
9A/9B	start address of program
9C/9D	end address of program
9E/9F	top of dynamic variables
A2/A3	HIMEM value
AE/AF	line number for next DATA statement to be READ
D0/D5	floating point accumulator — 1 byte for mantissa, 4 for exponent and 1 for whether positive or negative
E2 onward	processes current program line, checks and ignores spaces between keywords and diverts to ELSE routine
208	key pressed. 56=no key
20C	upper/lower case flag
215	PATTERN value
219	HIRES x-axis cursor position
21A	HIRES y-axis cursor position
228/22B	JMP to EC03- NMI interrupt vector
22B/22D	JMP to F430 – RESET routine

238/23A	JMP to CB61 – PRINT routine
23B/23D	JMP to C5F8 – get keyboard character
268	TEXT/LORES x-axis cursor position
269	TEXT/LORES y-axis cursor position
26A	various flags for toggles – keyclick, cursor, screen etc
26B	PAPER value
26C	INK value
26D/26E	screen start address
26F	number of TEXT/LORES rows
276/277	timer continuously counting down from FFFF
2E1 onward	hold values for various functions (PAPER, INK, SOUND, MUSIC, PLAY, CURSET etc)
2F4/2F6	JMP to ! routine. If undefined diverts to error routine
2FB/2FD	JMP to & routine
307	key repeat/Basic interpreter speed – inversely related
30E/10	JMP to interrupt routine. POKE 30E with 64 (decimal) to disable interrupts

Table 2 – error message addresses

C483	Out of memory
C9EE	Return without GOSUB
C9F1	Undefined statement
CC3A	Printer error
CCAA	Redo from start
CDE0	Extra ignored
CE86	Type mismatch
CFE4	Syntax
D29D	Bad subscript
D2A0	Illegal quantity
D2A5	Redim'd array
D41E	Illegal direct
D421	Undefined function
D53F	Formula too complex
D6C7	String too long
DA22	Bad until
DA72	Display type mismatch
E97C	
DBE0	Overflow
DE5B	Division by zero
E54A	File error/load aborted

Table 3 – keyword tokens

80	END	**8D**	FOR
81	EDIT	**8E**	LLIST
***82**	INVERSE	**8F**	LPRINT
***83**	NORMAL	**90**	NEXT
84	TRON	**91**	DATA
85	TROFF	**92**	INPUT
86	POP	**93**	DIM
87	PLOT	**94**	CLS
88	PULL	**95**	READ
89	LORES	**96**	LET
8A	DOKE	**97**	GOTO
8B	REPEAT	**98**	RUN
8C	UNTIL	**99**	IF
9A	RESTORE	**C9**	THEN
9B	GOSUB	**CA**	NOT
9C	RETURN	**CB**	STEP
9D	REM	**CC**	+
9E	HIMEM	**CD**	–
9F	GRAB	**CE**	*
A0	RELEASE	**CF**	/
A1	TEXT	**D0**	↑
A2	HIRES	**D1**	AND
A3	SHOOT	**D2**	OR
A4	EXPLODE	**D3**	>
A5	ZAP	**D4**	=
A6	PING	**D5**	<
A7	SOUND	**D6**	SGN
A8	MUSIC	**D7**	INT
A9	PLAY	**D8**	ABS
AA	CURSET	**D9**	USR
AB	CURMOV	**DA**	FRE
AC	DRAW	**DB**	POS
AD	CIRCLE	**DC**	HEX$
AE	PATTERN	**DD**	&
AF	FILL	**DE**	SQR
B0	CHAR	**DF**	RND
B1	PAPER	**E0**	LN
B2	INK	**E1**	EXP
B3	STOP	**E2**	COS
B4	ON	**E3**	SIN
B5	WAIT	**E4**	TAN
B6	CLOAD	**E5**	ATN
B7	CSAVE	**E6**	PEEK
B8	DEF	**E7**	DEEK
B9	POKE	**E8**	LOG
BA	PRINT	**E9**	LEN
BB	CONT	**EA**	STR$
BC	LIST	**EB**	VAL
BD	CLEAR	**EC**	ASC
BE	GET	**ED**	CHR$
BF	CALL	**EE**	PI
C0	!	**EF**	TRUE
C1	NEW	**F0**	FALSE
C2	TAB(	**F1**	KEY$
C3	TO	**F2**	SCRN
C4	FN	**F3**	POINT
C5	SPC(	**F4**	LEFT$
***C6**	@	**F5**	RIGHT$
C7	AUTO	**F6**	MID$
C8	ELSE	***F7**	GO

Table 4 – ROM addresses

C941	END	**CA61**	REM
C6A5	EDIT	**E95B**	HIMEM
CC8C	TRON	**E974**	GRAB
CC8F	TROFF	**E994**	RELEASE
C9E0	POP	**E9A9**	TEXT
D9C6	PLOT	**E9BB**	HIRES
DA16	PULL	**F415**	SHOOT
D937	LORES	**F418**	EXPLODE
D8AC	DOKE	**F41B**	ZAP
D9FA	REPEAT	**F412**	PING
DA16	UNTIL	**FB26**	SOUND
C841	FOR	**FBB6**	MUSIC
C824	LLIST	**FBFE**	PLAY
C832	LPRINT	**F02D**	CURSET
CE0C	NEXT	**F064**	CURMOV
CA0A	DATA	**F079**	DRAW
CCC9	INPUT	**F331**	CIRCLE
D0F2	DIM	**F2E5**	PATTERN
CC0A	CLS	**F093**	FILL
CCFD	READ	**F0A5**	CHAR
CAD2	LET	**F17F**	PAPER
C9B3	GOTO	**F18B**	INK
CA3E	IF	**E93F**	STOP
C91F	RESTORE	**CA78**	ON
C996	GOSUB	**D89D**	WAIT
C9E0	RETURN	**E7AA**	CLOAD
D894	POKE		
CB61	PRINT		
C96E	CONT		
C773	LIST		
C738	CLEAR		
CCBA	GET		
E80D	CALL		
CC89	!		
C719	NEW		
CBCA	TAB(		
C871	TO		
D459	FN		
CB6B	SPC(		
E7A9	Contains token for AUTO		
EA41	ELSE		
CA4D	THEN		
CFA8	NOT		
C898	STEP		
CF91	+		
CF8D	–		
D40D	=		
DF12	SGN		
DFA5	INT		
DF31	ABS		
D3D6	FRE		
D3FA	POS		
D917	HEX$		
E22A	SQR		
E34B	RND		
DC79	LN		
E2A6	EXP		
E387	COS		
E38E	SIN		
E3D7	TAN		
E43B	ATN		
D87D	PEEK		
D8C8	DEEK		
DDD0	LOG		
D7EB	LEN		
D4D8	STR$		
D81C	VAL		
D7FA	ASC		
D75B	CHR$		
D8EE	PI		
DF00	TRUE		
DEFC	FALSE		
DA4F	KEYS	**E7DB**	CSAVE
D9B4	SCRN	**D401**	DEF
C98B	RUN (CALL# C765 achieves effect)		
D79B	RIGHT$	**EFA6**	POINT
D7A6	MID$	**D76F**	LEFT$
CBED	jumped to on program break		
C5F8	gets keyboard character		
F430	RESET routine		
E6CA	keyboard interrupts on		
E608	keyboard interrupts off		
D3FD	produces value from Y register		
F57B	prints character from accumulator		
D867	floating point to integer		
D8D5	integer to floating point		
F729	prints CAPS on status line		
F735	clears CAPS message		
E4A8	actual loading part of CLOAD		
E57B	actual saving part of CSAVE		
F70E	displays authors' names		
F64A	CAPS on/off toggle		
F42D	cold start routine		
F7E0	defines alternate characters		
C6E8	finds address of first byte of specified line		
E79D	ASCII to integer		

***denotes reserved word not used in Oric 1 Basic. In V1.1 ROM, 82 and 83 are tokens for STORE and RECALL respectively.**

Instead of computers catc
technology now has to ca

The way we see it, technology has suddenly got quite a race on its hands.

There's no other home computer in the world that's so expandable or so updatable as the new Enterprise 64.

And if you're wondering quite how we've managed that, kindly take a closer look at the outputs on our remarkable new machine.

You'll notice that amongst all the usual sockets and terminals, we've gone and incorporated a special 66-way expansion port.

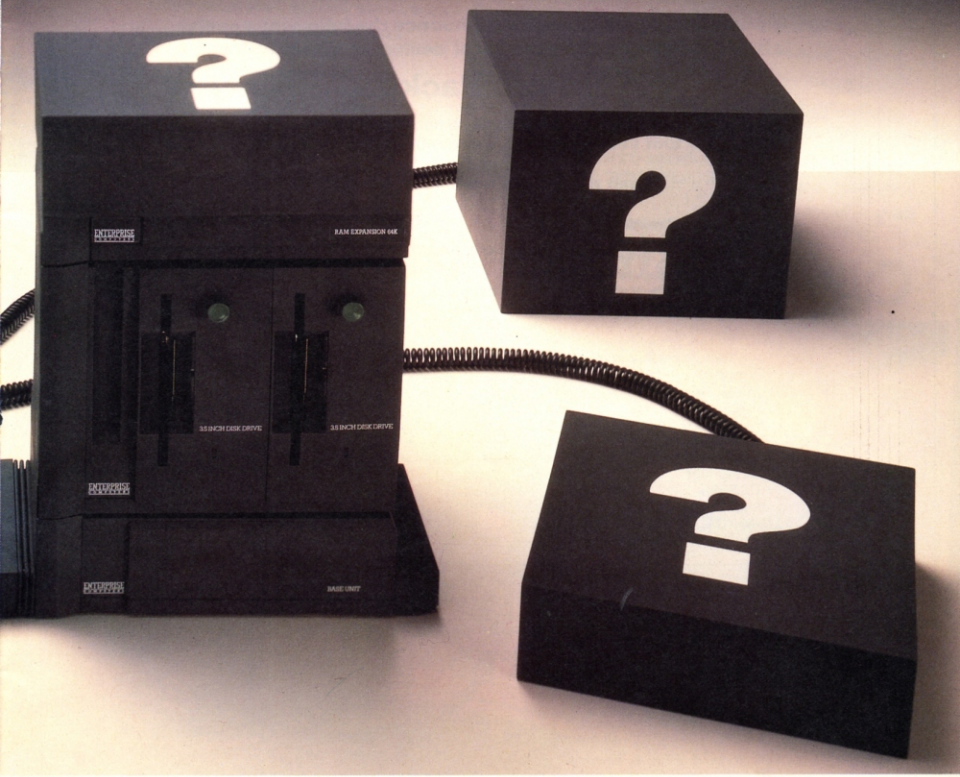
This will accept a whole range of new peripherals that are in the pipeline. Including those that are a mere twinkle in the eyes of our hardware designers.

We thought this expandability principle was such a good idea, we applied it to the Enterprise's memory, too.

Even in its most basic 64K form, this puts more user RAM at your disposal than almost any other competitor.

But plug in our special Rampacks to the base unit, and you can progressively increase that figure to a truly extraordinary 3,900K.

hing up with technology, tch up with a computer.



Not that that's the only challenge we present to today's ambitious programmers.

With a screen resolution of up to 672 x 512 pixels, 256 colours and a high speed video processor, the Enterprise will outgun all but the highest quality TV monitors.

And the sophisticated sound chip generates no fewer than 4 voices across 8 octaves in full stereo.

Combine the two and you can create effects that leave today's games looking like pub video tennis of the mid-seventies.

For anyone with literary aspirations, the Enterprise also comes complete with an integrated word processor.

Whilst the really serious user will be delighted to discover analogue RGB and TV outputs, as well as parallel, RS423 serial and network ports.

Both Cobol and 'C' will be available with CP/M running, and you can even use Lisp, Forth and Z80 assembly language on cartridge without encroaching on user RAM.

The new Enterprise 64.

It hasn't just overtaken technology. It's left every other home computer straggling in the distance.

ENTERPRISE
COMPUTERS

WITH OBSOLESCENCE BUILT-OUT

MODEM HOUSE

The Single Source Solution for ALL Computer Communications.

Modem House are pleased to announce the following special offers, available from your local dealer, or direct by mail.

Micro Packs

All micro packs include all necessary items to turn your micro into a communicating machine

Open the door to a whole new world.

Spectrum (all models)

VTX 5000 modem	£49.95
Optional extras for use with VTX 5000	
User to User software (on cassette)	£3.95
Ascii format software to link to bulletin boards etc	£6.95

MICRO PACKS

BBC B micropack	£59.95
Commodore 64 micropack	£99.95
Commodore Pet range	£99.95
Apple II range excluding IIc	£99.95
Apple IIc	£129.95
Dragon 32 & 64	£59.95
Tandy Model 1 & III	£99.95
MSX machines including word processor and database	£199.95
ACT Apricot	£179.95
ACT Sirius	£179.95
Victor 9000	£179.95
IBM PC & most compatibles	£179.95
Dec Rainbow 100	£179.95

★★ **Sinclair QL Complete Comminications Pack including V21/V23 Auto Answer Modem P.O.A.** ★★

MODEMS

Modem 1000	£49.95
Modem 2000	£54.95
Telemod 3	£139.95
Teletext Adaptors	
TTX 2000 (Spectrum all models)	£129.95

Optional Extras & Spares

BBC (Micronet) Rom	£15.00
IBM PC Colour Rom	£57.50
IBM PC Monochrome Rom	£57.50
IBM PC Hercules Rom	£57.50
Leads	P.O.A.

A complete range of multi baud rate modems are also available at prices ranging from just over £100 to over £2,000. We think it is the biggest stockholding in Europe. Just ring:

Modem House
Computer Communication Consultants.
Iolanthe Drive,
Exeter.
Tel: 0392 69295

OUTPUT: BBC

ALIEN ATTACK

Stand fast to repel those nasty aliens with their deadly missiles in this action-packed machine code game from Bjoern Thomassen.

Aliens are coming in to Attack your BBC Micro. Your mission is to shoot down as many as possible. The aliens dodge like mad, and drop nasty little missiles.

The listing is in the form of a set of data statements with a loader tagged onto the beginning. At the end of each line there is a three digit checksum.

To load, first of all enter PAGE=&2900 to make space for the code. Next type in the loader program and run it.

Once the loader program is correct run it and then type:

```
*SAVE ATTACK1 1100+&11E8 1100
```

Save it to tape or disk and then it can be run with *ATTACK1, *RUN ATTACK1, or *LOAD ATTACK1 and then CALL &1100. After that, only ATTACK1 need be loaded since the game is 100 per cent machine code.

Listing

```
  0L=0
  1FOR T=0 TO &11E8 STEP 8
  2CH=0
  3FOR S=0 TO 7
  4READ A%:A=EVAL("&"+A$)
  5 ?(&1100+T+S)=A:CH=CH+A
  6NEXT
  7READ A$:IF EVAL("&"+A$)<>CH THEN PR
INT"DATA ERROR IN LINE "1L*10+100:END
  8L=L+1:NEXT
  9END
100 DATA A9,01,A2,00,A0,2F,20,F1,32C
110 DATA FF,AD,02,2F,69,28,8D,02,30B
120 DATA 2F,A0,00,B9,00,22,20,EE,2B8
130 DATA FF,C8,C0,E7,D0,F5,A9,33,60F
140 DATA 8D,70,21,A9,30,8D,57,21,2FC
150 DATA 8D,5B,21,8D,59,21,8D,5A,2F4
160 DATA 21,A9,C5,8D,40,19,A9,D7,397
170 DATA 8D,41,19,20,12,17,A5,EC,2C1
180 DATA C9,C9,D0,FA,A9,00,A2,00,4AF
190 DATA A0,21,20,F1,FF,A9,08,A2,424
200 DATA 0E,A0,21,20,F1,FF,A9,16,39E
210 DATA 20,EE,FF,A9,02,20,EE,FF,4CD
220 DATA A9,13,20,EE,FF,A9,0F,20,3A1
230 DATA EE,FF,A9,07,20,EE,FF,A9,553
240 DATA 00,20,EE,FF,A9,00,20,EE,3C4
250 DATA FF,A9,00,20,EE,FF,A9,13,471
260 DATA 20,EE,FF,A9,0A,20,EE,FF,4CD
270 DATA A9,0C,20,EE,FF,A9,00,20,388
280 DATA EE,FF,A9,00,20,EE,FF,A9,54C
290 DATA 00,20,EE,FF,20,41,16,20,2A4
300 DATA AB,16,20,42,17,A9,05,20,208
310 DATA EE,FF,A9,09,8D,45,19,A9,23A
320 DATA D0,12,CE,45,19,AD,45,19,319
330 DATA 10,F5,A9,28,8D,46,19,20,2E2
340 DATA EF,15,CE,46,19,18,F8,A9,3E2
350 DATA 28,8D,46,19,20,56,13,A9,246
360 DATA 09,8D,45,19,20,D0,12,20,216
370 DATA EF,15,20,06,16,20,4C,15,1C1
380 DATA AD,47,19,F0,2B,AE,45,19,334
390 DATA BD,00,1B,9D,20,19,BD,60,2C8
400 DATA 1B,69,10,9D,2E,19,A9,00,221
410 DATA BD,44,19,20,76,14,A9,01,23E
420 DATA 20,36,17,A9,04,20,EE,FF,327
430 DATA 20,52,16,A9,05,20,EE,FF,343
440 DATA AE,45,19,BD,00,1D,AB,B9,347
450 DATA 00,1C,C9,01,D0,03,20,EB,2C4
460 DATA 14,B9,00,1C,C9,02,D0,07,2D7
470 DATA 20,00,15,B9,00,1C,C9,03,1D6
480 DATA D0,06,20,1C,15,20,1C,15,17B
490 DATA B9,00,1C,C9,04,D0,09,20,29B
500 DATA A5,13,20,A5,13,20,A5,13,268
510 DATA 20,D0,12,AD,44,19,F0,09,305
520 DATA 20,76,14,20,B2,14,20,76,226
530 DATA 14,AD,30,19,F0,09,20,7C,28F
540 DATA 15,20,B8,15,20,7C,15,AE,261
550 DATA 45,19,FE,00,1D,CE,45,19,2A5
560 DATA 20,EF,15,CE,46,19,10,05,266
570 DATA A9,28,8D,46,19,AD,45,19,2CB
580 DATA C9,FF,F0,03,4C,D4,11,20,40C
590 DATA 56,13,20,E3,13,20,56,13,208
600 DATA AD,1F,19,D0,03,4C,CF,11,2E4
610 DATA 20,7F,15,AD,44,19,F0,03,2AE
620 DATA 20,76,14,A9,00,8D,50,19,249
630 DATA 8D,1F,19,8D,44,19,A9,02,25A
640 DATA 20,36,17,20,12,17,20,CB,1A1
650 DATA 16,AD,70,21,C9,31,F0,06,344
660 DATA CE,70,21,4C,44,11,A9,0F,2B8
670 DATA A2,01,20,F4,F1,4C,11,11,324
680 DATA A9,00,8D,47,19,AE,45,19,2A2
690 DATA BD,20,19,85,70,8D,2E,19,2EF
700 DATA 85,71,A2,00,A0,00,A5,71,34E
710 DATA C9,35,90,22,A5,71,C9,80,40F
720 DATA B0,1C,A5,71,C9,7F,D0,06,400
730 DATA A5,70,C9,E0,B0,10,8D,00,43B
740 DATA 1A,51,70,91,70,C9,55,D0,3CA
750 DATA 05,A9,01,8D,47,19,EB,18,29C
760 DATA 98,69,08,AB,C0,20,D0,CE,42F
770 DATA 18,A5,70,69,01,85,70,8D,319
780 DATA 48,19,A5,71,69,00,85,71,2D6
790 DATA 20,3F,13,D0,0D,18,A5,70,27C
800 DATA 69,78,85,70,A5,71,69,02,357
810 DATA 85,71,E0,2C,D0,A6,68,AD,485
820 DATA 48,19,4A,4A,4A,0A,0A,0A,15D
830 DATA A9,19,3B,A8,68,19,8D,2D2
840 DATA A9,19,8D,4A,19,60,A2,00,254
850 DATA AD,40,19,85,70,AD,41,19,302
860 DATA 85,71,A0,00,BD,60,1A,51,31E
870 DATA 70,91,70,C9,11,D0,05,A9,3C9
880 DATA 01,8D,1F,19,E8,18,98,69,2C7
890 DATA 08,A8,C9,20,D0,E6,18,A5,40C
900 DATA 70,69,01,85,70,BD,48,19,2BD
910 DATA A5,71,69,00,85,71,20,3F,2D4
920 DATA 13,D0,0D,18,A5,70,69,78,2FE
930 DATA 85,70,A5,71,69,01,85,71,36C
940 DATA E0,34,D0,BE,60,AE,45,19,40E
950 DATA 1B,BD,20,19,69,01,9D,20,235
960 DATA 19,BD,4B,19,BD,2E,19,69,274
970 DATA 00,9D,2E,19,20,3F,13,D0,226
980 DATA 1B,BD,20,19,69,78,9D,20D
990 DATA 20,19,BD,2E,19,69,02,9D,245
1000 DATA 2E,19,C9,00,90,0C,BD,00,2E9
1010 DATA 1B,9D,20,19,BD,60,1B,9D,266
1020 DATA 2E,19,60,A9,81,A2,9E,A0,381
1030 DATA 7A,20,F4,FF,E0,FF,D0,03,5CA
1040 DATA 20,55,14,A9,81,A2,BD,A0,3B2
1050 DATA FF,20,F4,FF,E0,FF,D0,03,5C4
1060 DATA 20,34,14,A9,81,A2,B6,A0,38A
1070 DATA FF,20,F4,FF,E0,FF,D0,23,5E4
1080 DATA 14,A9,00,8D,4B,19,8D,2F,2DF
1090 DATA 44,19,A9,00,28,36,17,18,1B8
1100 DATA AD,40,19,69,08,BD,42,19,25F
1110 DATA AD,41,19,69,00,8D,43,19,259
1120 DATA 20,76,14,60,AD,41,19,C9,2DA
1130 DATA 7A,D0,09,AD,40,19,C9,A0,3E6
1140 DATA 90,01,60,18,AD,40,19,69,27B
1150 DATA 08,8D,40,19,AD,41,19,69,25E
1160 DATA 00,8D,41,19,60,AD,41,19,24E
1170 DATA C9,78,D0,08,AD,40,19,C9,3EB
1180 DATA 80,B0,01,60,18,AD,40,19,2BC
1190 DATA E9,07,8D,40,19,AD,41,19,2DD
1200 DATA E9,00,8D,41,19,60,A0,00,2D0
1210 DATA A2,00,AD,42,19,85,70,AD,34C
1220 DATA 43,19,85,71,A9,55,51,70,311
1230 DATA 91,70,E8,D0,F6,E6,71,E0,353
1240 DATA 70,8D,48,19,A5,71,69,00,2DD
1250 DATA 85,71,20,3F,13,D0,0D,18,25D
1260 DATA A5,70,69,78,85,70,A5,71,401
1270 DATA 69,02,85,71,EB,E0,04,D0,3FD
1280 DATA 9E,68,AD,48,19,60,A0,00,2D0
1290 DATA 8D,42,19,BD,48,19,AD,43,2C6
1300 DATA 19,E9,00,8D,43,19,20,3F,24A
1310 DATA 13,C9,07,D0,1D,18,AD,42,2D7
1320 DATA 19,E9,77,8D,42,19,AD,43,351
1330 DATA 19,E9,02,8D,43,19,C9,25,2E8
1340 DATA B0,08,20,76,14,A9,00,8D,298
1350 DATA 44,19,60,AE,45,19,18,BD,29E
1360 DATA 20,19,E9,07,9D,20,19,BD,28C
1370 DATA 2E,19,E9,00,9D,2E,19,60,274
1380 DATA AE,45,19,18,BD,20,19,69,283
1390 DATA 08,9D,20,19,BD,2E,19,69,248
1400 DATA 00,9D,2E,19,C9,7F,90,03,28F
1410 DATA 20,EB,14,60,AE,45,19,18,2A3
1420 DATA BD,20,19,E9,00,9D,20,19,2B5
1430 DATA BD,2E,19,E9,00,9D,2E,19,2D5
1440 DATA 9D,2E,19,20,3F,13,C9,07,226
1450 DATA D0,11,18,BD,20,19,E9,77,34F
1460 DATA 9D,20,19,BD,2E,19,E9,02,25C
1470 DATA 9D,2E,19,60,AD,50,19,D0,32A
1480 DATA 2A,AE,45,19,BD,2E,19,79,3B3
1490 DATA 35,90,20,BD,2E,19,C9,7B,32D
1500 DATA B0,19,A9,01,8D,50,19,18,281
1510 DATA BD,20,19,69,08,BD,51,19,25E
1520 DATA BD,2E,19,69,00,8D,52,19,265
1530 DATA 20,7C,15,60,AD,00,70,00,253
1540 DATA AD,51,19,85,70,AD,52,19,324
1550 DATA 85,71,A9,11,51,70,91,70,372
1560 DATA 18,A5,70,69,01,85,70,BD,319
1570 DATA 48,19,A5,71,69,00,85,71,2D6
1580 DATA 20,3F,13,D0,0D,18,A5,70,27C
1590 DATA 69,78,85,70,A5,71,69,02,357
1600 DATA 85,71,E8,E0,07,D0,D3,60,4CB
1610 DATA 18,AD,51,19,69,01,8D,51,277
1620 DATA 19,8D,48,19,AD,52,19,69,28B
1630 DATA 00,8D,52,19,20,3F,13,D0,23A
1640 DATA 1D,18,AD,51,19,69,78,8D,2BA
1650 DATA 51,19,AD,52,19,69,02,8D,27A
1660 DATA 52,19,C9,80,90,08,20,7C,2E8
1670 DATA 15,A9,00,8D,50,19,60,AE,2C2
1680 DATA 46,19,BD,00,1E,85,70,BD,2EC
1690 DATA 00,1F,85,71,A0,00,BD,00,272
1700 DATA 20,51,70,91,70,60,AE,46,336
1710 DATA 19,1B,BD,00,1E,69,01,9D,213
1720 DATA 00,1E,BD,48,19,BD,00,1F,1E8
1730 DATA 69,00,9D,00,1F,20,3F,13,197
1740 DATA D0,1E,1B,BD,00,1E,69,78,2C2
1750 DATA 9D,00,1E,BD,00,1F,69,02,282
1760 DATA 9D,00,1F,C9,80,90,09,18,286
1770 DATA BD,00,1F,E9,4A,9D,00,1F,2CB
1780 DATA 60,A0,00,B9,30,21,20,EE,318
1790 DATA FF,C8,C0,16,D0,F5,20,B6,508
1800 DATA 16,60,18,A2,01,BD,57,21,266
1810 DATA 69,01,9D,57,21,C9,3A,D0,352
1820 DATA 25,A9,30,9D,57,21,EB,FE,3F9
1830 DATA 57,21,BD,57,21,C9,3A,D0,380
1840 DATA 15,A9,30,9D,57,21,EB,FE,3E9
1850 DATA 57,21,BD,57,21,C9,3A,D0,38D
1860 DATA 05,A9,30,9D,57,21,A9,1F,2B8
1870 DATA 20,EE,FF,A9,01,20,EE,FF,4C4
1880 DATA A9,01,20,EE,FF,A2,03,A9,405
1890 DATA 11,20,EE,FF,A9,06,20,EE,3DB
1900 DATA FF,BD,57,21,20,EE,FF,CA,50B
1910 DATA F7,60,A9,11,20,EE,FF,A2E
1920 DATA A9,06,20,EE,FF,A9,1F,20,3A4
1930 DATA EE,FF,A9,10,20,EE,FF,A9,55C
1940 DATA 01,20,EE,FF,AD,70,21,20,36C
1950 DATA EE,FF,60,A2,09,BD,60,1B,430
1960 DATA A9,20,9D,57,21,A9,19,20,265
1970 DATA CA,10,F2,A9,04,20,EE,FF,486
1980 DATA A0,00,A9,1F,20,EE,FF,A9,41E
1990 DATA 01,20,EE,FF,A9,10,20,EE,3D5
2000 DATA FF,A9,11,20,EE,FF,A9,02,472
2010 DATA 20,F1,FF,B9,90,21,20,EE,405
2020 DATA FF,C8,C0,10,D0,F5,A9,05,50A
2030 DATA 20,EE,FF,A5,EC,C9,E2,D0,619
2040 DATA FA,60,A2,09,AD,00,2F,29,30A
2050 DATA 48,69,3B,8D,0A,2F,8D,2F,15C
2060 DATA 2E,01,2F,2E,00,2F,AD,00,168
2070 DATA 2F,9D,00,1B,4A,4A,4A,9D,262
2080 DATA 60,1B,CA,10,DF,60,0A,0A,2A8
2090 DATA 0A,A0,19,AA,A9,07,20,F1,32E
2100 DATA A9,00,A2,00,A0,00,20,F1,377
2110 DATA 00,2F,29,48,69,38,8A,8A,155
2120 DATA 2E,02,2F,2E,01,2F,2E,00,0EB
2130 DATA 2F,AD,00,2F,4A,4A,4A,4A,233
2140 DATA 4A,8D,01,2F,F0,E1,A9,13,393
2150 DATA C8,EE,FF,A0,00,2E,2B,EE,3E7
2160 DATA FF,AD,01,2E,20,EE,FF,A9,491
2170 DATA 00,20,EE,FF,A9,00,20,EE,3C4
2180 DATA FF,A9,00,20,EE,FF,CE,00,4B3
2190 DATA 2E,D0,BC,60,A9,00,20,EE,3D1
2200 DATA FF,CE,00,2E,D0,F5,60,00,3E7
2210 DATA 20,EE,FF,A9,00,20,EE,FF,4C3
2220 DATA A9,00,20,EE,FF,CE,00,2E,3B2
2230 DATA D0,BC,60,00,20,EE,FF,CE,4C7
2240 DATA 00,2E,D0,BC,60,D0,BC,60,486
2250 DATA 00,00,00,00,00,00,00,00,000
2260 DATA 00,00,00,00,00,00,00,00,000
2270 DATA 00,00,00,00,00,00,00,00,000
2280 DATA 00,00,00,00,FF,FF,00,00,1FE
2290 DATA 00,00,00,00,00,00,00,00,000
2300 DATA 00,00,00,00,00,00,00,00,000
2310 DATA 00,00,00,00,00,00,00,00,000
2320 DATA 00,00,00,00,00,00,00,00,000
2330 DATA 00,00,00,00,00,00,00,00,000
2340 DATA 01,00,00,00,00,00,00,00,001
2350 DATA 00,00,00,00,00,00,00,00,000
2360 DATA 00,00,00,00,00,00,00,00,000
2370 DATA 00,00,00,00,00,00,00,00,000
2380 DATA 00,00,00,00,00,00,00,00,000
2390 DATA 00,00,00,00,00,00,00,00,000
2400 DATA 00,00,00,00,00,00,00,00,000
2410 DATA 00,00,00,00,00,00,00,00,000
2420 DATA 00,00,00,00,00,00,00,00,000
2430 DATA 00,00,00,00,00,00,00,00,000
2440 DATA 00,00,00,00,00,00,00,00,000
2450 DATA 00,00,00,00,00,00,00,00,000
2460 DATA 00,00,00,00,00,00,00,00,000
2470 DATA 00,00,00,00,00,00,00,00,000
2480 DATA 00,00,00,00,00,00,00,00,000
2490 DATA 00,00,00,00,00,00,00,00,000
2500 DATA 00,00,00,00,00,00,00,00,000
2510 DATA 00,00,00,00,00,00,00,00,000
2520 DATA 00,00,00,00,00,00,00,00,000
2530 DATA 00,00,00,00,00,00,00,00,000
2540 DATA 00,00,00,00,00,00,00,00,000
2550 DATA 00,00,00,00,00,00,00,00,000
2560 DATA 00,00,00,00,00,00,00,00,000
2570 DATA 00,00,00,00,00,00,00,00,000
```

16 ▶

Listing (cont)

```
2580 DATA 00,00,00,00,00,00,00,00,00,000
2590 DATA 00,00,00,00,00,00,00,00,00,000
2600 DATA 00,00,00,00,00,00,00,00,00,000
2610 DATA 00,00,00,00,00,00,00,00,00,000
2620 DATA 00,00,00,00,00,00,00,00,00,000
2630 DATA 00,00,00,00,00,00,00,00,00,000
2640 DATA 00,00,00,00,00,00,00,00,00,000
2650 DATA 00,00,00,00,00,00,00,00,00,000
2660 DATA 01,00,01,00,78,00,01,00,07B
2670 DATA 00,00,02,00,65,00,02,00,069
2680 DATA 00,00,02,00,66,00,02,00,06A
2690 DATA F2,30,4F,4B,45,8D,00,00,22E
2700 DATA 2C,D5,93,69,D9,8A,06,86,3EC
2710 DATA 2C,41,94,BB,56,DF,20,26,334
2720 DATA 2C,32,3B,3E,44,4A,50,56,2B8
2730 DATA 5C,62,68,6E,32,0A,5B,4F,27A
2740 DATA 50,54,20,4F,00,00,3C,00,14F
2750 DATA 2E,53,54,20,20,20,4A,53,1D2
2760 DATA 00,20,50,4F,4B,45,42,41,1D2
2770 DATA 52,0D,00,46,23,20,20,20,128
2780 DATA 20,20,20,4C,44,41,20,20,274
2790 DATA 32,30,3D,3A,4C,44,58,20,1D4
2800 DATA 23,31,3A,4A,53,52,20,26,1C3
2810 DATA 46,46,46,34,0D,00,50,11,174
2820 DATA 2E,4D,41,49,4E,20,4A,53,210
2830 DATA 52,20,45,59,0D,00,00,00,1C2
2840 DATA 12,20,20,20,20,20,4C,11E
2850 DATA 44,41,20,52,45,54,4E,0D,1EB
2860 DATA 00,44,18,20,20,20,20,11C
2870 DATA 20,43,4D,50,20,23,30,3A,1AD
2880 DATA 42,4E,45,57,20,4C,44,41,274
2890 DATA 00,6E,2A,20,20,20,20,20,138
2900 DATA 20,4A,53,52,20,50,4F,4B,219
2910 DATA 45,42,41,52,3A,4A,53,52,243
2920 DATA 20,56,42,41,52,3A,4A,53,222
2930 DATA 52,20,50,4F,4B,45,42,41,1D2
2940 DATA 52,0D,00,78,12,2E,4F,31,197
2950 DATA 31,20,20,4C,44,41,20,52,1B4
2960 DATA 45,54,4E,0D,00,82,18,20,1AE
2970 DATA 20,20,20,20,20,43,4D,50,18D
2980 DATA 00,0F,41,00,00,05,00,00,01E
2990 DATA 00,0F,0A,00,3C,29,3C,2B,0E2
3000 DATA 14,29,3C,00,00,29,28,00,0CA
3010 DATA 00,03,02,00,00,03,02,00,00A
3020 DATA 00,11,00,00,00,11,00,00,022
3030 DATA 11,00,00,57,20,50,4F,122
3040 DATA 4B,45,42,41,52,0D,00,96,208
3050 DATA 12,2E,4F,31,32,20,20,4C,17E
3060 DATA 44,41,20,52,45,54,4E,0D,1EB
3070 DATA 00,40,18,20,20,20,20,20,138
3080 DATA 42,4E,45,20,4F,31,33,0D,185
3100 DATA 00,05,00,00,00,05,00,00,00A
3110 DATA 00,03,02,00,01,03,03,00,00C
3120 DATA 02,30,20,02,02,30,20,02,0AB
3130 DATA 00,30,20,00,00,30,28,3C,0F8
3140 DATA 14,2B,3C,00,3C,00,14,2B,0F0
3150 DATA 3C,00,14,2B,3C,00,14,2B,0F0
3160 DATA 2B,00,00,2B,44,41,20,52,147
3170 DATA 45,54,4E,0D,00,8E,18,20,1EA
3180 DATA 20,20,20,20,20,43,4D,50,18D
3190 DATA 20,23,33,3A,42,4E,45,20,1A5
3200 DATA 4F,31,34,0D,00,C8,2A,20,1D3
3210 DATA 20,20,20,20,20,4A,53,52,1BF
3220 DATA 20,50,4F,4B,45,42,41,52,224
3230 DATA 3A,4A,53,52,20,4E,42,41,21A
3240 DATA 52,3A,44,53,52,20,50,4F,23A
3250 DATA 4B,45,42,41,52,0D,00,D2,244
3260 DATA 1C,2E,4F,31,34,20,20,4A,188
3270 DATA 53,52,20,54,45,53,54,5F,264
3280 DATA 4F,4D,5F,46,45,52,44,49,265
3290 DATA 47,0D,00,DC,12,20,20,20,1A2
3300 DATA D5,A0,E6,63,82,1E,0D,C8,503
3310 DATA 1C,DB,CA,15,BE,85,71,AE,405
3320 DATA DE,D6,A9,F3,13,DA,84,D6,597
3330 DATA F5,CA,01,31,93,97,28,31,529
3340 DATA D3,C0,88,39,74,FF,5A,C0,4E1
3350 DATA E1,1D,7E,14,A4,6F,4F,8E,380
3360 DATA 16,24,06,EF,14,9D,94,D9,34D
3370 DATA 42,7D,1C,54,A9,E4,E6,36,3DB
3380 DATA 77,3D,F5,2C,1F,C5,BC,7C,3DB
3390 DATA 4D,74,AF,4D,FF,F2,1E,7F,448
3400 DATA F9,1F,51,99,0C,B6,55,7D,396
3410 DATA C6,B2,A2,1C,BC,B1,9E,D4,515
3420 DATA 2D,22,23,2B,2B,23,26,22,130
3430 DATA 23,23,21,26,2D,23,21,2B,137
3440 DATA 25,27,2C,2A,2D,29,24,2D,149
3450 DATA 22,21,24,26,2C,2C,2E,26,139
3460 DATA 2E,27,23,25,2B,26,2D,27,142
3470 DATA 2E,2D,27,2B,21,21,2D,2B,144
3480 DATA 27,23,25,2B,21,2B,2C,21,13B
3490 DATA 23,2D,2A,23,26,26,2D,2E,144
3500 DATA 29,2A,29,29,24,2B,21,23,138
3510 DATA 26,24,29,26,2C,27,22,22,130
3520 DATA 28,23,2A,2D,2D,29,2D,21,146
3530 DATA 2D,26,2C,2D,27,2C,27,24,2EC
3540 DATA 30,3A,53,54,41,20,52,45,209
3550 DATA 54,4E,20,5C,56,45,4E,53,25A
3560 DATA 54,52,45,0D,01,40,11,2E,178
3570 DATA 50,41,53,53,20,4C,44,41,228
3580 DATA 20,26,43,4D,20,23,31,0D,11B
3590 DATA 20,20,20,20,20,20,43,4D,150
3600 DATA 50,20,23,31,39,34,0D,01,13F
3610 DATA 54,12,20,20,20,20,20,126
3620 DATA 01,04,01,04,01,04,01,04,014
3630 DATA 01,04,01,04,01,04,01,04,014
3640 DATA 04,02,04,02,04,02,04,02,018
3650 DATA 04,02,04,02,04,02,04,02,018
3660 DATA 04,02,04,02,04,02,04,02,018
3670 DATA 04,02,03,02,03,02,03,02,015
3680 DATA 03,02,03,02,03,02,03,02,014
3690 DATA 03,03,01,03,01,03,01,03,012
3700 DATA 01,03,01,03,01,03,01,03,010
3710 DATA 01,03,01,03,01,03,01,04,011
3720 DATA 01,04,04,04,04,04,04,01,03F
3730 DATA 04,04,01,04,01,04,01,04,017
3740 DATA 01,04,01,04,01,04,01,04,015
3750 DATA 02,04,02,04,02,04,02,04,018
3760 DATA 02,04,02,04,02,04,02,04,018
3770 DATA 04,01,04,01,04,01,04,01,014
3780 DATA 04,01,04,01,04,01,04,01,014
3790 DATA 04,01,04,01,04,01,04,01,014
3800 DATA 04,01,04,01,04,01,04,01,014
3810 DATA 04,01,04,01,03,04,01,03,015
3820 DATA 04,01,03,01,03,01,03,01,011
3830 DATA 03,01,03,01,01,03,02,03,011
3840 DATA 02,03,02,03,02,03,02,03,014
3850 DATA 02,03,02,03,02,03,02,03,014
3860 DATA 02,03,02,03,02,03,02,03,014
3870 DATA 03,03,03,04,03,04,02,03,016
3880 DATA 04,04,04,04,04,01,04,01D
3890 DATA 04,04,04,04,04,04,01,04,01D
3900 DATA 04,04,04,04,04,04,04,020
3910 DATA 04,04,04,04,04,04,04,020
3920 DATA 04,04,04,04,04,04,04,020
3930 DATA 04,04,04,04,04,04,04,020
3940 DATA C1,5F,E2,82,84,FF,FC,96,599
3950 DATA 51,77,13,DD,88,30,9A,5C,366
3960 DATA 36,E9,19,D4,07,BC,04,52,325
3970 DATA 3C,A4,49,EF,6D,21,B9,4F
3980 DATA BA,32,41,12,67,7A,AC,2BD
3990 DATA 47,1A,CA,46,68,AC,F0,5B,3D0
4000 DATA 0B,2A,09,2A,57,45,51,4B,19D
4010 DATA A9,20,49,9B,D2,6C,2C,3D4
4020 DATA 60,04,E2,4E,F9,04,ED,81,479
4030 DATA 23,41,36,9B,C0,DE,01,8D,361
4040 DATA D3,A0,7F,D0,5D,4B,64,A1,46F
4050 DATA 8E,9A,87,67,F4,03,17,EC,410
4060 DATA 52,45,54,4E,0D,02,0B,23,173
4070 DATA 2E,52,45,54,55,52,20,4C,220
4080 DATA 4A,41,20,23,31,35,3A,4C,1B4
4090 DATA 44,58,20,23,30,3A,4A,53,1E6
4100 DATA 52,20,26,46,46,46,34,0D,1A8
4110 DATA 02,12,0D,20,20,20,01,0C,1D1
4120 DATA 20,52,54,53,0D,0C,1C,8C,150
4130 DATA 2E,50,4F,4B,45,42,41,52,232
4140 DATA 0D,02,26,1A,20,20,20,20,0CF
4150 DATA 20,20,4C,44,41,20,23,36,18A
4160 DATA 3A,53,54,41,20,26,32,39,1D3
4170 DATA 46,46,0D,02,30,20,20,20,124
4180 DATA 20,20,20,4C,44,41,20,71
4190 DATA 4C,42,42,41,52,3A,53,54,244
4200 DATA 41,20,50,0D,02,3A,1B,20,135
4210 DATA 20,20,20,20,20,4C,44,41,171
4220 DATA 20,4A,53,52,20,4C,44,41,20C
4230 DATA 54,41,20,50,2B,31,0D,02,170
4240 DATA 44,10,2E,4C,4C,4C,4C,20,1D2
4250 DATA 4C,44,59,20,23,30,0D,02,1E8
4260 DATA D1,EB,67,A3,1E,2B,7E,0B,395
4270 DATA 0A,B7,7D,A2,42,F5,1A,57,3A
4280 DATA 93,3C,43,10,D7,2E,E9,C7,3D7
4290 DATA BC,AE,A1,B8,2C,B8,2A,84,458
4300 DATA B8,71,89,99,31,22,6A,71,37C
4310 DATA D1,F2,9E,72,2A,7C,02,D9,454
4320 DATA 9E,6F,A9,45,15,F9,C9,45A
4330 DATA F6,9E,C5,0D,6A,D9,27,59,4EC
4340 DATA AA,C1,70,50,4D,1B,35,A9,371
4350 DATA C4,77,57,EF,87,B4,BF,D1,54C
4360 DATA B3,0E,0D,4E,68,75,D8,F4,3CB
4370 DATA 9E,EC,A9,45,15,F9,C9,45A
4380 DATA DF,1F,7E,A2,E3,42,17,79,3D3
4390 DATA C4,B0,A1,A3,D3,6C,1E,D3,4EB
4400 DATA C5,AF,83,C6,92,75,0B,76,445
4410 DATA 17,7D,FA,0D,B0,A4,BD,2D,49C
4420 DATA 5E,BC,7D,A2,42,F5,1A,57,45D
4430 DATA EB,B7,BA,D7,B6,AE,92,CD,5F6
4440 DATA 7D,62,13,AF,DE,27,77,A7,3C4
4450 DATA 13,5C,0D,2A,3C,19,1F,6B,238
4460 DATA 99,B5,26,CE,D1,B6,5F,6D,3E5
4470 DATA 0B,2D,A3,41,72,5D,37,7C,2C2
4480 DATA F6,66,7F,79,37,6C,04,B8,3B3
4490 DATA 76,18,06,D3,25,F6,D9,04,35F
4500 DATA B0,77,A4,9D,39,B4,7B,27,3F7
4510 DATA 5C,67,CF,79,6C,D3,EB,C2,4F7
4520 DATA 2E,B5,BC,7D,A2,42,F5,1A,45D
4530 DATA B0,C2,6D,24,89,43,39,A2,37A
4540 DATA 69,7D,9E,67,02,38,09,07,235
4550 DATA F1,1B,A9,50,F8,A9,BF,C8,52D
4560 DATA 4A,DE,39,1E,15,AA,DC,A9,3C3
4570 DATA 0B,2D,A3,41,72,5D,37,7C,2C2
4580 DATA 46,62,57,51,6A,47,52,75,2CB
4590 DATA 4C,43,5C,53,6A,7E,67,4D,2DA
4600 DATA 6A,44,44,5F,61,4B,6F,7C,2E5
4610 DATA 55,3F,35,63,76,43,7C,6B,2CC
4620 DATA 0B,2D,A3,41,72,5D,37,7C,2C2
4630 DATA 4B,39,7D,59,3C,5F,7E,39,2A9
4640 DATA 68,5B,70,5C,6F,50,55,76,319
4650 DATA 42,7D,42,7C,77,7B,6F,5C,33A
4660 DATA 64,6E,46,46,61,4C,47,5A,2AC
4670 DATA 0B,2D,A3,41,72,5D,37,7C,2C2
4680 DATA 7B,4B,4B,4A,42,35,52,4B,269
4690 DATA 5B,59,6B,66,6F,7E,5F,72,340
4700 DATA 73,47,57,43,73,73,3D,3B,2AF
4710 DATA 67,47,59,42,51,42,4E,39,263
4720 DATA 6D,6A,71,62,62,54,57,4E,2D5
4730 DATA 62,63,51,69,35,7C,5A,6C,2F6
4740 DATA 68,7D,3C,52,7A,6D,37,5B,2EC
4750 DATA 60,6D,6A,40,69,6C,4B,79,2F0
4760 DATA 3A,45,60,54,41,52,57,3A,257
4770 DATA 65,4E,65,75,3E,6C,6B,65,307
4780 DATA 37,55,69,7C,57,6E,4E,52,2D6
4790 DATA 67,7B,69,4F,5E,79,53,66,32A
4800 DATA 70,71,50,46,52,50,71,5A,2F1
4810 DATA 52,51,39,70,4C,72,57,77,2D8
4820 DATA 40,77,3C,3C,45,64,4B,54,277
4830 DATA 35,7A,3F,44,46,7A,75,65,2CC
4840 DATA 76,3D,64,54,3C,5A,48,6F,28B
4850 DATA 68,6C,42,52,71,6C,7A,48,30A
4860 DATA 73,6F,37,6B,7D,3F,35,3E,2B3
4870 DATA 55,5A,69,78,5E,7E,6D,5B,334
4880 DATA 53,50,79,77,69,71,5C,7D,346
4890 DATA 43,63,6D,3B,3B,4B,3B,3C,245
4900 DATA 0B,0A,0B,01,00,01,0B,0A,024
4910 DATA 0B,20,20,04,01,0A,01,20,0FB
4920 DATA 01,04,0B,04,0A,01,01,0B,0A5
4930 DATA 0A,20,0B,01,0B,0B,0A,0A,157
4940 DATA 01,0A,20,01,0B,0B,0B,20,15E
4950 DATA 0B,20,23,32,0D,03,7A,13,19A
4960 DATA 20,20,20,20,20,20,53,54,167
4970 DATA 41,20,48,42,42,41,52,0D,1CD
4980 DATA 03,84,0D,2E,4F,56,52,32,1EB
4990 DATA 20,49,4E,5B,0D,03,8E,11,1BE
5000 DATA 20,20,20,20,20,20,20,20,153
5010 DATA 58,20,23,3A,3B,0D,03,90,1AF
5020 DATA 10,20,20,20,20,20,42,112
5030 DATA 4E,45,20,4C,32,0D,03,A2,1E3
5040 DATA 1A,20,20,20,20,20,4C,126
5050 DATA 44,41,20,54,45,53,54,3A,21F
5060 DATA 42,45,54,4F,31,35,0D,1BA
5070 DATA 03,AC,19,20,20,20,20,168
5080 DATA 20,4C,44,41,20,4C,42,1E1
5090 DATA 41,52,3A,53,54,41,20,50,225
5100 DATA 0D,03,B6,1B,20,20,20,161
5110 DATA 20,20,4C,44,41,20,4B,1B8
5120 DATA 42,41,52,3A,53,54,41,20,217
5130 DATA 50,2B,31,0D,03,C0,19,20,185
5140 DATA 20,20,20,20,20,4C,44,59,189
5150 DATA 23,30,3A,4C,44,41,20,2B,1A6
5160 DATA 54,59,0D,03,CA,19,4E,1E9
5170 DATA 20,20,20,20,20,20,43,4D,150
5180 DATA 50,20,23,34,3B,0D,03,D4,1E3
5190 DATA 11,20,20,20,20,20,20,42,113
5200 DATA 4E,45,20,4F,31,35,0D,03,179
5210 DATA 1A,20,20,20,20,20,20,1B0
5220 DATA 01,01,FF,00,00,FF,00,00,200
5230 DATA 00,FF,00,FF,78,6E,02,01,2E7
5240 DATA 00,00,00,00,00,00,20,20,040
5250 DATA 00,FF,7E,7E,42,41,52,20,2F8
5260 DATA 50,45,52,4D,49,54,20,231
5270 DATA 3A,42,45,51,20,4F,56,33,20A
5280 DATA 11,05,20,53,43,4F,52,45,1B2
5290 DATA 20,20,20,20,20,20,4C,12C
5300 DATA 49,56,45,53,20,0D,43,20,1C7
5310 DATA 4F,46,53,0D,03,FC,0B,11
5320 DATA 20,20,20,20,20,52,54,30,176
5330 DATA 30,30,30,30,30,30,30,180
5340 DATA 30,20,4C,44,58,20,23,30,1AB
5350 DATA 0D,04,10,0D,2E,4C,33,20,8FB
5360 DATA 4C,44,59,20,23,30,0D,15D
5370 DATA 13,20,20,20,20,20,4C,11F
5380 DATA 44,41,20,4C,42,42,41,52,200
5390 DATA 0D,04,24,10,20,20,20,0C5
5400 DATA 20,20,20,20,50,52,45,53,1BA
5410 DATA 45,54,0D,04,43,20,20,1EC
5420 DATA 20,20,53,54,41,20,4C,42,1D6
5430 DATA 42,41,52,0D,04,38,12,20,150
5440 DATA 20,20,20,20,20,53,54,41,188
5450 DATA 20,72,65,73,74,0D,04,42,231
5460 DATA 12,20,20,20,20,20,4C,11F
5470 DATA 44,41,20,48,42,42,41,52,204
5480 DATA 0D,04,4C,10,20,20,20,20,0ED
5490 DATA 20,20,41,44,43,20,23,30,178
5500 DATA 0D,04,36,13,20,20,20,20,0FA
5510 DATA 44,41,20,59,4A,53,52,20,1D2
5520 DATA 42,41,52,0D,04,68,11,20,177
5530 DATA 20,20,20,20,20,4A,53,52,1BF
5540 DATA 16,07,1F,0B,00,0D,83,9D,1F4
5550 DATA 84,41,54,54,41,43,4B,09,245
5560 DATA 4E,9C,0D,0A,11,20,20,174
5570 DATA 83,9D,84,41,54,54,41,43,311
5580 DATA 4B,09,09,9C,0D,0A,1F,06,135
5590 DATA 03,86,42,79,09,42,6A,6F,268
5600 DATA 65,72,6E,09,4F,2E,09,54,228
5610 DATA 65,73,74,09,09,09,09,09,1E5
5620 DATA 0D,0A,1F,06,87,81,59,6F,18C
5630 DATA 75,72,09,6A,6F,62,09,69,29D
5640 DATA 73,09,74,6F,09,73,6B,6F,2B2
5650 DATA 6F,74,09,64,6F,77,6E,0D,281
5660 DATA 0A,1F,06,88,84,74,65,73,1F9
5670 DATA 09,65,6E,65,6D,69,65,73,2EF
5680 DATA 09,62,65,66,6F,72,65,09,2B5
5690 DATA 74,68,65,79,0D,0A,1F,06,1F6
5700 DATA 09,81,73,68,6F,6F,74,09,2C0
5710 DATA 79,6F,75,2E,0D,0A,1F,07,1C7
5720 DATA 0B,85,59,6F,75,09,68,61,29F
5730 DATA 76,65,09,33,09,6C,69,76,26B
5740 DATA 65,73,2E,0D,0A,1F,06,11,153
5750 DATA 83,5A,2D,4C,45,46,54,09,23E
5760 DATA 09,09,09,09,09,09,09,048
5770 DATA 38,2D,52,49,47,48,54,0D,210
5780 DATA 0A,1F,0C,13,52,45,54,55,188
5790 DATA 52,4E,2D,46,49,52,45,0D,200
5800 DATA 0A,1F,0B,18,88,86,90,84,278
5810 DATA 50,53,53,53,09,52,45,22B
5820 DATA 54,55,52,4E,0D,09,0C,2C,223
5830 DATA 30,30,2C,31,42,2C,34,41,1A0
```

COMMUNICATIONS

Bulletin board buddies should send details of new operations and products to Tony Dennis, *PCN*, 62 Oxford Street, London W1A 2HG.

Bulletin boards are taking to the airwaves

Bulletin boards have become so popular in the UK that one ardent fan, John Wallbridge, claims to have accessed no less than 50. However, the equipment to run a bulletin board can be very expensive and many budding sysops (system operators) have resorted to acquiring secondhand ex-British Telecom modems from Display Electronics. They then have to invest considerable time and effort getting the things to auto-answer properly.

Wouldn't it be better for modem manufacturers to sponsor or at least offer hefty discounts to such worthy cases? That way they could expect to sell more modems. Existing bulletin boards are already massively oversubscribed and callers are becoming frustrated.

Perhaps Paul Beamont had bitten off more than he could chew. His previously very popular multi-micro board Metro is now dedicated entirely to the Apple Mac and going under the name Mactel. The board is back in Nottingham and access is by recommendation only. It appears he got tired of all the VTX owners who could previously access his board because it was set to the standard Prestel/Telecom Gold protocols, not the usual bulletin board ones.

Those who thought that Dave Coles had given up his System CBB would be wrong. He's now on a new number — 01-301 4110. No time wasters will be tolerated though. Also, for those who are feeling cosmopolitan, why not try this board in Paris — 010-33 12503928.

Once on-line addicts see their quarterly phone bills, however, it won't be long before there is a massive rise of interest in packet radio. This technique makes it possible to abandon telephone lines altogether and make use of radios instead, For this you will need another modem and a radio transceiver (and a licence).

The modems are already available from Vomek Software of 50 Mayridge, Fareham, Hants PO14 4QP for just under £300. An added beauty with Vomek's unit is that the requisite software is already built in. It uses AX.25 protocols for error checking — a version of the X.25 protocol employed in packet switching (PSS). Hence the term 'packet radio' which is usually applied to this activity.

What can you do with it? Aside from contacting other packet radio freaks via satellites, you could also access radio bulletin boards which allow a number of users to chat to each other with their keyboards. Operating at 1200 half duplex it would be reasonably fast too. Fortunately there is already public domain software that could turn any TBBS host into a packet radio board.

What's the hold-up? Well it isn't exactly very legal in the UK. If you have the appropriate amateur radio licence there's nothing to stop you sending and receiving packets. What is of doubtful legality is leaving a bulletin board unattended while it is automatically sending and receiving over the airwaves.

In the States they are way ahead of us. Certain frequencies were de-regulated, allowing packet radio boards to spring up. In Vermont, for instance, someone had the idea of relaying tourist information over the airwaves using a bunch of Commodore 64s. Elsewhere financial information is being transmitted in 36 major US cities to subscribers.

VNU's bulletin board, CABB, hopes to stir things up a little by stimulating interest in 1200/1200 baud full duplex communications. By offering an occasional 1200 baud service, perhaps the price of these modems will drop to something more resembling the $200 dollars they cost in the USA?

Current gossip is that the American modem giant Hayes will soon have products available in the UK. BABT approval is blamed for the delay. Their first product? A 1200 baud modem of course.

Tony Dennis

MICROTIME INTERNATIONAL LIMITED

106A BEDFORD RD, WOOTTON, BEDS MK43 9JB
Telephone (0234) 767758/766351

NEC PC-8201A

From Tokai Create
PASOCALC — ROM based spreadsheet (NEC) £80

From A.M.P. Incorporated
Forth £90
The Journalist – Unique text formatter with graphic layout display £65

From Travelling Software Inc.
Travelling Writer – acclaimed word processor £50
Time Manager – time costing for professionals £55
Appointment Manager – calendars & appointments £50
Sales Manager – sales activity/customer notes £55
Expense Manager – full expense accounting £55
Project Manager – budgets/actuals/costs/activities £60
T-Base – the ultimate relational database system £90
T-Backup – advanced tape filing utility £25
IDEA! — the revolutionary outline processor £75

From Chattanooga Systems
Autopen – full featured word processor £30
Autopen N&A – as above with name/address options £40
Autopad — a small memory (5K) spreadsheet £40
Trip – expense account details and trip log £30
ChequeBook – personal cheque book record £25
Book – single entry accounts package £30
Tfile – tape filing utility £20

From Datacount Inc. (NEC only)
Data-Dex – automated desktop card index system £35
Data-Text – text formatting and word processor £40
Data-Code – bar code generation package £30
Data-Max – database, any record in 0.5 seconds £50

From Silicon Crafts/Micro Time
PUFS our best cassette based spreadsheet under 7K £50
MPLAN – spreadsheet with templates £50
MSOLVE – equation solver with templates £50
MBRAIN – full RPN calculator with stacks/memories £20
MLABEL – general purpose labelling program £30

From Custom Software
80C85 Assembler — (in 3K machine code) £40
CBUG 80C85 Assembler De-Bugging tool £35
(all prices ex-VAT, 50p per item UK p&p, 2nd class post)

SEND OR RING FOR DETAILS TODAY FROM MICROTIME

Approved NEC PC-8201A dealers

PHILIPS

In your job, business or profession

GET THINGS GOING

. . . with the Philips portable computer P2000 C. In 16 bit and 8.

With all the RAM you want – 64K to 512K with 32K separate for the video. And disk capacity – up to 2x 640K floppies and a hard disk, built-in if you prefer.

CP/M, p-System and in the 16-bit version MS-DOS provide software for every business task and for many lines of business. And practically all the interfaces you need: serial printer, external floppy drives, slave monitor, data communication, hard disk, IEC/IEEE.

The 9″ screen is glare-free. You have high-resolution graphics. The keyboard is low-profile.

A range of models available – all with free software – at very reasonable prices. For example a P2010 with CP/M and software costs £ 995 plus VAT and for just £ 2995 plus VAT you get a P2009 with CP/M and built-in hard disk. Ask your dealer for details or post the coupon today.

For instant information phone Kingsway Data Systems (09328) 68911.

Personal Computer Div.
P.O.Box 4PD, London W1A 4PD.

PRICES DO NOT INCLUDE VAT

For a demonstration post coupon now!
Personal Computer Division
30, Guildford Street, Chertsey, Surrey.
(or phone 09328-68911)

Name:

Address:

Tel.:

PCN**1/5**

P2000 C

Philips Portable Computer

The affordable portable.

ADAPTABLE ADVENTURES

Ever fancied yourself as an adventure writer? The daring duo of adventures, Mike and Pete Gerrard, explain how to plan an adaptation.

It's said that everyone has a book in them, and the advent of utilities such as *The Quill* suggests that every adventure player has an adventure inside them too. But not everyone is blessed with a fertile imagination. Fortunately, the one trick that's open to everyone to try is to adapt someone else's story into a computer adventure.

Professional adaptations have been made of *Macbeth*, *Sherlock*, *The Inferno*, *Rendezvous with Rama* and many more, so why shouldn't you raid the bookshelves too?

It raises different problems from devising your own storyline, but it can give you a much needed push to start off with.

Copyright laws

The first thing you must consider is whether something is in or out of copyright, which is fairly simple. The copyright in any written work remains with the author until they die (unless they assign it to someone else) and then with the author's estate for another 50 years.

Take Melbourne House's *The Hobbit* and *Sherlock*, for example. To adapt the former, the publishers had to enter into copyright negotiations with Tolkein's estate, as the author died only a few years ago, whereas Sir Arthur Conan Doyle died in 1930, so his works and the characters he created were out of copyright in 1980. Melbourne House was free to contrive an adventure around the characters of Holmes, Watson and others, along with as much or as little of Conan Doyle's works as it wanted, without infringing anyone's copyright.

This is why we have also chosen to use a Sherlock Holmes story as an example of how to adapt a book into an adventure. As there weren't five of us working full-time for 18 months to create the adventure, it's probably slightly less impressive than Melbourne House's effort.

Of course, if something is still in copyright, there's nothing to stop you having a go at it for your own amusement. But if you want to publish it, you must have the author's permission, or the publisher's, depending on who holds the copyright. By 'publishing', the law means not only selling an adaptation to a software house or a magazine, but even *giving* a few copies to your friends, so it's safer to stick with works out of copyright. It's also cheaper: permission must be paid for.

One other advantage is that you can change the stories to make them work as adventures. Naturally, you want to be as faithful to the original as possible, but you can rest easy about making necessary alterations without antagonising anyone.

Adventure stories

Selection of a text should be the least of your worries as there are plenty of writers whose work would be suited to adventure games, and which is safely out of copyright. Conan Doyle and Rider Haggard spring immediately to mind; in fact, the idea for this article came about because we recently raided the Greek classics to adapt Homer's *Odyssey* into a two-part adventure for the Commodore 64 for Ducksoft. Rattling good yarns are prime candidates but don't be afraid to dabble in the classics too, as Peter Cooke did. He turned Dante's *Inferno* into an enjoyable adventure for Richard Shepherd Software — a surprising follow-up to his *Urban Upstart*.

We went for a Sherlock Holmes story after reading through several until we came across *The Sign of Four*. This lesser-known story involves a hunt for fabulous Indian treasure.

'This is the one'

Once you've settled upon a particular story the next stage is to read it again. The more you know the ins and outs, the easier it is to adapt. You'll be flipping back and forth, looking for specific passages or checking facts, a great deal. Naturally, you should make notes as you go; our copy of *The Sign of Four* is now rather tattered, full of underlined sections and notes in the margins, where ideas occurred for mazes, tasks or whatever. If the book is borrowed from the library or a friend, buy a decent sized notebook for jotting down the various verbs, nouns, messages and so on that you'll be needing.

The hardest part of adapting *The Sign*

of Four was deciding where to start. Much of the early part is simply setting the plot. In adventure terms, Holmes would have been sitting around in Baker Street waiting for his client to arrive, then listening to her rather lengthy tale, which is fine in the pages of a book but not on the screen. The bare-bones of a story is enough to get going on. We therefore eliminated a lot of background information, and concentrated instead on getting on with the actual hunt for the treasure on the Thames and through the streets of Victorian London.

An adventure game is a challenge, and it isn't very exciting to ask the player to type WAIT, SPEAK WOMAN, SPEAK HOUSEKEEPER for the first few minutes. Don't be afraid to cut things out; you are, after all, working in a different medium, and even a very short work like *The Sign of Four* contains something like 200K of information, so you'll have to get used to trimming at some stage.

The next step is a map. Some books might lend themselves to mapping straight away. For instance, *The Odyssey* did, being a series of encounters in logical progression.

With *The Sign of Four*, we initially broke the story down into different sections, ending up with six, and then decided how we would approach each one. Two were obvious mazes, giving us a chance to cover the programming of those, while another covered the search for several objects, and another asked the player to do certain things within a set number of moves.

We then mapped each section, using a blank A4-size student's notepad. It might be a temptation to start on a large sheet of paper; the largest you can find, but it's a temptation best resisted. You'll probably go through several versions of the map, making changes as you go, so stick to smaller sheets which can be stuck together as the adventure grows. For the same reason, don't attempt to number the locations yet. You invariably find that you want to add one or two, and while it's okay on a rough sheet to refer to locations as 13(a), 13(b) and so on, you need to keep the same location references in the program itself, so initially use a brief description of each location and leave the numbering for later when you're certain you won't be changing them.

Shot on location

Once the map is reasonably settled (it will continue to change), take a separate sheet of A4 typing paper for each location and start to enter the text which will appear on the screen when the player arrives at that location. This is trickier than it might seem, whether you're a good a descriptive writer or not. For one thing, don't assume the player will go through the adventure the same way that you do. Don't begin a location description with, for example: 'You reach the bottom of the valley floor' if you can then move off to explore other parts of the valley floor. The player can return to that location, so always use descriptions such as 'You are on . . .' rather than 'You arrive at . . .'

Is the description likely to change during the game? It's much easier to make sure your opening sentences are fixed, and add any removable ones at the end of the description. It's very easy to forget how a description might alter, and put, as a very simple example: 'You are in a cave and can hear the noise of rustling in the dark,' instead of 'You are in a cave. You can hear the noise of rustling in the dark.' Once the player has sorted out what the noise is, and got it or killed it or whatever, you still want to put up the initial five words without fiddling around adding full stops or writing a separate similar description. It saves memory, too.

For each location, imagine all the inputs a player may come up with. Some adventures are slightly spoiled when you're told, for instance, that you're standing by a wall, but when you try to climb the wall the response is 'I can't see a wall.' Cater for everything that's in the description, and allow for a few humorous and bizarre responses too. And on each location sheet, make a note of how it connects to other locations, so it's easier to enter the necessary movements when you come to write the program. A little bit of extra planning here saves much wasted work later. You might be keen to get on with the programming, but you'll finish the project sooner if you have a clear plan to start with.

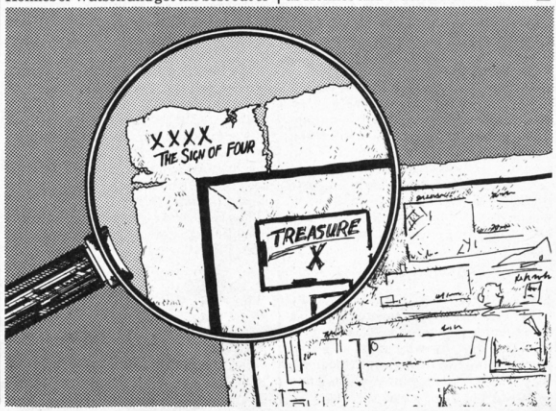
But back to the problems specific to adaptation. Have respect for the original text, bearing in mind that it's probably been around a lot longer than you have, and time has proved that it works as a story. You will need, however, to make alterations. In our adventure, there was no way that a player could have gone through the whole story as either Holmes or Watson and got the best out of it. So why not make the player Holmes for part of the game and Watson for part of the game? It's easy to do and adds a little variety. If there are stretches that would be boring for the adventure player, cut them out, condense the story, or jazz them up.

At one stage in *The Sign of Four* Holmes tries to find a particular boat, moored somewhere along the Thames. In the book he sends out his famous Baker Street irregulars, a gang of street urchins, knowing they will return with the information he needs. In the adventure we sent Holmes himself off on the task, giving him a little maze of would-be boatyards.

Other changes are naturally to do with the tasks you set. It's no great challenge if the player can simply read the book to get all the clues to getting past certain obstacles or the whereabouts of certain objects. Hide the items, as long as they remain in the same vicinity. Add the occasional obstacle not in the book, but try to stay within the spirit of it, Holmes wouldn't get lost in a maze in Baker Street, but Watson might easily mislay the keys to his desk drawer.

How to think up the tasks to be set, and how to design mazes, are aspects of adventure planning generally, rather than specifically to do with adaptations. One final piece of advice, which certainly works for us, is to consider collaborating with someone else. Although we have done this and other projects together, we actually work independently of each other; one does the planning and the other the programming, which is the aspect we'll be considering next week in part two.

Many adventures are jointly written, so if you find the task of doing both the preparation and writing the program rather daunting, why not look round for someone to share the burden? They do say that two heads are better than one, as Holmes and Watson found.



MEMORY MANIPULATION

Do you find the memory on your 64 restrictive? If so, David Bolton shows you how to get more out of what's already there.

The maximum amount of useable RAM on the Commodore 64 is a trifle under 40K from Basic. If you advance into machine code, however, you can program with all 64K of RAM.

Pages 263 to 267 of the Programmers Reference Guide show some of the different memory configurations which can be selected by software and hardware. Bear in mind that almost 90K of memory is available; 64K of ROM, 4K of character ROM and 4K of I/O devices, including 1K of nybble (4 bit) RAM. The main configurations are shown in the tables here.

Memory configurations

8K Kernal ROM
4K I/O
4K RAM
8K Basic ROM
40K RAM

Table 1 Normal 64, Value = 55

8K Kernal ROM
4K I/O
52K RAM

Table 2 No Basic, Value = 54

8K RAM
4K I/O
52K RAM

Table 3 60K RAM, Value = 53

64K RAM

Table 4 64K RAM, Value = 52

If the value is put into location 1, the 64 will be switched into the appropriate configuration. Other configurations are possible but can only be selected by plugging in expander or game cartridges.

Programming with Tables 1 and 2 is straightforward but Tables 3 and 4 require housekeeping routines to look after interrupts and keyboard handling. Configuration 4 is unusual, as all of the I/O devices are no longer part of the memory. They still function — you just can't read, write or change them. The solution is to change from 4 to 3 whenever you need to access an I/O chip and then change back again, as I'll explain later on.

Handling interrupts

All 6502 chips, including the 6510 (in the 64) and the 7510 (Commodore 16) have a three word vector table at the top of memory. This is why most of these machines have ROM high up in memory. By contrast, Z80 machines tend to have their ROM at the low end of memory.

The three vectors are:

			ROM VALUES
1	$FFFA	NMI	$FE43
2	$FFFC	RESET	$FCE2
3	$FFFE	IRQ/BRK	$FF48

The value stored at $FFFC for the reset vector is $FCE2, or 64738 in decimal — the value to SYS to clear the 64. This is only needed at power on, however. NMI stands for Non Maskable Interrupt, which occurs when you hit Restore. The following short program illustrates this:

```
10  FOR I = 0 TO 14
20  READ A : POKE 24576 + I,A
30  NEXT
40  SYS24576
50  DATA 169, 11, 141, 24, 3, 169, 96, 141, 25
60  DATA 3, 96, 238, 32, 208, 64
```

Once run, hitting the Restore key (without touching Run/Stop) will change the border colour.

IRQ is short for Interrupt ReQuest. Whenever any of the I/O chips causes an interrupt, the 6502 checks if interrupts are allowed. If they are, then the code at SFF48 is executed and in turn examines a processor flag to see if a BRK instruction has occurred. As these share the vector with IRQs, the two should be kept separate.

The following short bit of code saves all of the registers and splits interrupts from BRKs.

```
IRQ     PHA
        TXA
        PHA
        TYA
        PHA
        TSX
        LDA $0104, X      Picks up processor
                          flags saved on
                          stack
        AND $10           checks BRK flag
        BEQ INT           interrupt
        JMP BREAK         BRK
```

Handling an NMI is straightforward. A simple RTI instruction prevents it from interfering with your programs and will not let anyone break into them.

The following code will give your 64 60K of RAM:

```
        LDX 5             Copies 3 vectors to
                          top of RAM
MOVE    LDA TABLE, X
        STA $FFFA, X
        DEX
        BPL MOVE
        LDA 53            52 for 64K
        STA 1
        .
        .Your code
TABLE   WORNMI,O,IRQ      Three vectors
        IRQ
        nmi rti           Ignore Restore
                          key
        IRQ PHA
```

Handling the keyboard

As the operating system Kernal ROM is not present, code must be written to look after the keyboard and printing characters on screen. Printing is easy enough, but the keyboard is a little trickier.

The keyboard on a Commodore 64 is made up of 64 keys (plus Restore) which makes up an 8 by 8 matrix.

All keys can be read separately and you can distinguish between the shift keys. It is only the Kernal ROM that treats them as one. But there is a small flaw if you read the three keys that make up corners of a rectangle. If, for instance, C, M and I are pressed then R will also register. The effect is cumulative — if you press Z, then W will also appear.

The keyboard is physically attached to both ports of the CIA chip at $DC00. To scan it, write out the values 127, 191, 223, 239, 247, 251 and 254 one by one to port A at location $DC00 and read back the values from Port B at location $DC01. These eight bytes read back represent the 64 keys, and if a key has been pressed then the corresponding bit will be 0.

The following code will do this:

```
        LDA  $FF
        STA $DC02         set up port A as
                          Output
        LDA  0
        STA $DC03         set up port B as
                          Input
        LDX  7
KLOOP   LDA ROW TAB,      pick up a row mask
        X
        STA $DC00
STEADY  LDA $DC01         wait until value
                          settled
        CMP $DC01
        BNE STEADY
        STA  COLTAB, X
        DEX               loop 8 times
        BPL KLOOP
        RTS
ROWTAB  BYT 127, 191, 223, 239, 247, 251,
        253, 254
COLTAB  BYT 0, 0, 0, 0, 0, 0, 0, 0
```

Using all 64K

When configuration 4 is chosen the 64 can't access its I/O chips — all writes or reads to this area are straight through to the RAM.

I prefer to use the 4K of RAM under the I/O chips for storing data and stay in configuration 3 until I need to get at it.

Two very short subroutines that switch the I/O page in or out are:

```
IO-IN    LDA 53
         STA 1
IO-OUT   LDA 52
         STA 1
         RTS
```

So any section of code needing the data has a JSR IOOUT at the start and a JSR IOIN at the end.

Finally, we have to deal with the problem of interrupts, which can occur when in configuration 4. This is because the IRQ pins on the I/O chips are connected to the processor IRQ pin directly, so an interrupt can be triggered with no I/O chips present. As interrupts must be turned off, the answer is for the interrupt routine to save the current configuration, then switch in the I/O chips, turn off the interrupt and carry on. The following skeleton shows this:

```
INT   PHA
      TXA
      PHA
      TYA
      PHA
      LDA 1    Save configuration state
      PHA
      JSR IOIN Switch in I/O
               Body of interrupt
               routine
      JSR      turn off the inter rupt
      PLA
      STA 1    Restore state
      PLA      Restore register
      TAY
      PLA
      TAX
      PLA
      RTI
```

Accessing RAM from Basic

The program given here is a machine code plus Basic loader, which allows access from Basic to the top 24K of RAM from $A000 to $FFFF. Normally only $C000 to $CFFF is accessible from Basic.

When the program has run it will patch itself into the top of RAM and drop the top of RAM pointer by 82 bytes.

To use it in your Basic routines, make the first line a DIM A%, B%. These two variables must be the first declared in the program.

If you want to store a byte value, output the address in A% the value in B% and SYS 680. To retrieve a value at address A% do a SYS 683 and the value will be in B%.

Addresses should be given from 0 to 24575 which corresponds with $A000 to $FFFF. The free RAM from $C000 to $CFFF corresponds to addresses 8192 to 12287.

For example, to store the value 56 out at location 53280 — the register in the I/O chips holding the colour of the border — use:

```
10 DIM A%, B%
20 A% = 53280 - 40960
30 B% = 56
40 SYS 680
50 B% = 0
60 SYS 683
70 PRINT "VALUE STORED AT"; A%, "IS"; B%
```

Line 20 subtracts 40960 to bring the address into the range 0 — 24575. Line 50 clears B% to show that the value really has been stored out and got back at line 60.

Loader listing

```
5 REM MACHINE CODE LOADER FOR UNDER ROM
READS
10 PRINTCHR$(147);"SETTING UP";
20 T=0:FOR I=680 TO 765:READ A:POKE I,A:T=T+A
:PRINT".";:NEXT
25 IF T<>10684 THEN PRINT "DATA ERROR"
30 END
1000 DATA 76,174,2,76,211,2,160,2,177,45
,133,248,200,177,45
1010 DATA 133,247,24,165,248,105,160,133
,248,160,10,177,45,120,162
1020 DATA 52,134,1,160,0,145,247,162,58,
134,1,88,96,160,2
1030 DATA 177,45,133,248,200,177,45,133,
247,24,165,248,105,160,133
1040 DATA 248,120,162,52,134,1,160,0,177
,247,234,234,234,160,10
1050 DATA 145,45,169,0,136,145,45,76,205
,2,1
```


SPECIAL INTRODUCTORY OFFER . . . ONLY £10!

PERSONAL Computer NEWS

. . . get one month's supply of Personal Computer News absolutely free when you take advantage of our special 6-month introductory offer.

You pay for 26 issues and get 30 sent to you.

This way they'll cost you less than you pay in the shops — only 33p each instead of 40p. Post and packing is *free*.

So, try our 6-month special now . . .

Please send me one month's free supply of Personal Computer News with my special introductory six-month subscription for £10.

☐ six months UK £10
☐ six months Europe £17.50
☐ six months airmail £32.50
☐ I enclose my cheque made payable to Personal Computer News
☐ Please charge my Access/Visa/Diners/American Express card (delete where not applicable)

Account No. _____ Expiry date: _____

Signed _____

What type of computer do you use? _____

Do you use it for home/work/education? _____

Name
Address

108

Please use block capitals

Send to: Subscriptions Dept, 53-55 Frith Street, London W1

LMT

LOOK SPECTRUM OWNERS

L.M.T. 68FXI KEYBOARD

Featuring **A full size space bar** with dedicated numeric and cursor keypad. The LMT 68FXI increases the number of keys from **40 to 65.** The full-travel sculptured keys with **high quality printed characters** ensures ease of use. To fit your **Spectrum** computer board into the LMT 68FXI is **simplicity itself**. Full fitting instructions are included with every LMT 68FXI.

ONLY £39.95 (INC VAT & CARRIAGE)

LMT COMPUTERS, UNIT 2,
274 BAKER ST., ENFIELD, MIDDX.
EN1 3LS. Tel: 01-367 0035

COMING SOON combined disk and printer interface for Spectrum only **£79.95 inc VAT.**

TIMATIC SYSTEMS LTD

Registered Office:
NEWGATE LANE
FAREHAM, HANTS PO14 1AN
Tel: FAREHAM (0329) 239953

Sales and Repairs
FAREHAM MARKET
FAREHAM, HANTS
Tel: FAREHAM (0329) 236727

DEALER ENQUIRIES WELCOME

AMSTRAD
EXPANDABLE RS232

3 Options

- **RS232** (Runs printer, modems, etc)
- **Parrallel** (BBC user port compatible)
- **Sideways ROM** (Graphics, modem, utilities)

Any mix or all on same board. Software available to drive modems, cumana, touch pad, Marconi trackball, Eprom programmer

- **CPM software**

to enable file transfer from Apricot, IBM, Mainframes etc . . .

- **Sideways ROM**

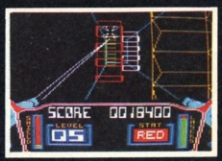
Fully buffered, accept 12 sideways ROMs of your choice ie Modem Driver, Printer, Driver, graphics etc.

Both systems fully cased and supplied with operating software and manuals.

Mail order welcome. Please send SAE for full list.

AMSTRAD

£6.95
SPECTRUM 48K
£5.95
The ultimate space shoot-em-up



C+VG GAME OF THE MONTH
CRASH SMASH 93%

Please rush me:
☐ Starstrike (Amstrad) £6.95
☐ Starstrike (Spectrum) £5.95
☐ Tank Duel (Spectrum) £5.50
☐ Both Spectrum Games £9.00

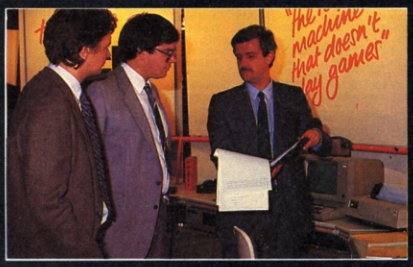
Name .....

Address .....

.....

Cheques/P.O.'s Payable to REALTIME SOFTWARE, PROSPECT HOUSE, 32 SOVEREIGN STREET, LEEDS LS1 4BJ

Britain's no.1 microcomputing show



Britain's no. 1 microcomputing show is back at Olympia in September. More than 45,000 people visited the Personal Computer World Show in 1984 and this year's event will be even bigger.

For the first time, alongside all the household names you expect at the PCW Show, there's a separate hall for business computer buyers only.

That's where you can be sure to find help in solving your business problems. A wide selection of hardware, software and peripherals — from industry majors as well as smaller specialist suppliers — in every price bracket. Plus special features such as these:

- The advice centre and workshop sessions organised by the National Computing Centre.
- Our new applications software advisory service where you can find out exactly which software meets your specific business needs.
- The consultancy area with experts offering advice both on system selection and operational problems.
- And of course the PCW Show product locator service to help you find specific products at the show.

So whether you're a retailer or a builder, an accountant or a doctor — in fact, whatever your business or profession — you can be sure to profit from the Personal Computer World Show. Start planning your visit now.

Put the dates 4-8 September in your diary.

Tickets and further details from:
PCW Show 85, 11 Manchester Square, London W1M 5AB
or phone 01-486 1951 today.

The 8th Personal Computer World Show

4-8 SEPTEMBER 1985
OLYMPIA, LONDON

Sponsored by Personal Computer World

Put it in your diary now!

MILES BETTER SOFTWARE

221 Cannock Road, Chadsmoor, Cannock, Staffs WA11 2DD.
Tel: 05435 3577

U.S. GOLD SOFTWARE

Title & Machine	Cass	Disk
Beach-head (A)	N/A	£12.95
Beach-head (64)	£8.95	£11.95
Beach-head (Amstrad)	£8.95	N/A
Beach-head (ZX)	£8.95	N/A
Conan (A)	£8.95	N/A
Conan (64)	£8.95	N/A
Pole Position (A)	£8.95	£12.95
Pole Position (64)	£8.95	£12.95
Mr Do (A)	£8.95	£12.95
Mr Do (64)	£8.95	£12.95
Pacman (A)	£8.95	£12.95
Pacman (64)	£8.95	£12.95
Digdug (A)	£8.95	£12.95
Digdug (64)	£8.95	£12.95
Dropzone (64)	£8.95	£11.95
Raid over Moscow (64)	£8.95	£11.95
Raid over Moscow (ZX)	£6.95	N/A
Strip Poker (64)	£8.95	£11.95
Aztec Challenge (A)	£7.95	N/A
Forbidden Forest (A)	£7.95	N/A
Slinky (A)	£7.95	N/A
Caverns of Khaska (A)	£7.95	N/A
Super Huey (64)	£8.95	£11.95
Talladega (64)	£8.95	£11.95
Bruce Lee (64)	£9.95	£12.95
Bruce Lee (A)	£12.95	£12.95
Dallas Quest (A)	N/A	£12.95
Dallas Quest (64)	N/A	£12.95
Stellar 7 (64)	£8.95	£11.95
Solo Flight (A)	£12.95	£12.95
Solo Flight (64)	£12.95	£12.95
F15 Strike Eagle (A)	£12.95	£12.95
F15 Strike Eagle (64)	£12.95	£12.95
Ghostbusters (A)	N/A	£14.95
Bounty Bob Strikes Back (A)	£8.95	£12.95
Nato Commander (64)	£8.95	£12.95
Indiana Jones (64)	£8.95	N/A
Tapper (64)	£8.95	£11.95
Tapper (ZX)	£6.95	N/A
Congo Bongo (64)	£8.95	£11.95
Congo Bongo (ZX)	£6.95	N/A
Spy Hunter (64)	£8.95	£11.95
Spy Hunter (ZX)	£6.95	N/A
Up and Down (64)	£8.95	£11.95
Up and Down (ZX)	£6.95	N/A
Buck Rogers (64)	£8.95	£11.95
Buck Rogers (ZX)	£6.95	N/A
Wizard and the Princess (64)	N/A	£11.95
Mission Astroid (64)	N/A	£11.95
Exodus: Ultima III (64)	N/A	£17.95
Dough Boy (64)	£8.95	£12.95
Quasimodo (64)	£8.95	£12.95
Sentimal (64)	£8.95	£12.95
Ulysses and the Golden Fleece (64)	N/A	£11.95
Combat Leader (64)	£12.95	£12.95
Battle for Normandy (64)	£12.95	£12.95
Crogs Revenge (64)	£8.95	£11.95
Fort Apocalypse (64)	£8.95	£12.95
Fort Apocalypse (A)	£8.95	£12.95
Drelbs (A)	£8.95	£12.95
Drelbs (64)	£8.95	£12.95
Blue Max (A)	£8.95	£12.95
Blue Max (64)	£8.95	£12.95
Blue Max (ZX)	£6.95	N/A
Zaxxon (A)	£12.95	N/A
Zaxxon (64)	£8.95	£12.95
Zaxxon (ZX)	£6.95	N/A
Bounty Bob Strikes Back (64)	£8.95	£12.95

Please phone or write for software list regarding Atari and 64
Please phone for stocks availability on all items. Add £1 per item for overseas orders. Access and Visa welcome.

MoveMead Discount Software Co

SPECTRUM

GAME	RRP	OUR PRICE
Raid over Moscow	7.95	6.45
Bruce Lee	7.95	6.95
Everyone's A Wally	9.95	7.45
Daley Thompson	6.90	4.90
Beachhead	7.95	5.90
Knights Lore	9.95	6.90
Underworlde	9.95	6.90
Full Throttle	6.95	2.99
Valhalla	14.95	3.99
Great Space Race	14.95	3.99
Potty Pigeon	6.95	2.99
Match Point	7.95	4.99
Gift of the Gods	9.95	7.45
Allen 8	9.95	7.45
Ghostbusters	9.95	7.45
The Hobbit	14.95	7.95
Hampstead	9.95	3.95
World Series baseball	6.95	5.25
Brian Jacks	7.95	6.25
Kosmi Kanga	6.95	2.99
Dragon Torc	7.95	5.95
Psytron	7.95	4.45
Psytraxx	7.95	4.25
Frankenstein	5.95	3.45
Shadow Fire	9.95	7.95
Death Star Interceptor	9.95	7.45

COMMODORE 64

GAME	RRP	OUR PRICE
Bruce Lee	9.95	8.45
Summer Games	14.95	10.30
Raid over Moscow	9.95	7.45
Bristles	9.95	3.99
Boulder Dash	8.95	4.95
Hobbit	14.95	7.99
Daley Thompson Decath	7.90	5.25
Fighter Pilot	9.95	6.95
Flip & Flop	9.95	3.99
Impossible Mission	8.95	6.95
Astor Chase	9.95	3.99
Kong Strikes Back	7.90	4.99
Valhalla	14.95	6.95
Colossus Chess	9.95	4.95
Gyro Pod	6.90	2.99
Poster Paster	6.90	2.99
World Series Baseball	7.95	5.45
Gremlins	9.95	7.45
Brian Jacks	7.95	6.25
Slap Shot	9.95	7.45
Moon Cresta	6.95	5.45
Hampstead	9.95	5.95
Fire Quest	9.95	5.95
World Cup	7.95	3.95
Hunchback II	7.90	4.99
Shadow Fire	9.95	7.95

All prices include VAT. Postage and packing is **FREE** on orders in excess of £15.00. All orders of less than this amount are charged 0.75p towards the cost. 1,000s of more titles available for all machines. Send a S.A.E. for full list. Send your cheque/P.O. for the full amount (plus postage, if required), to:—

MOVEMEAD (MARKETING) LIMITED,
55 AYLESBURY STREET, BLETCHLEY,
BUCKS, MK2 2BH Telephone: (0908) 79232/3

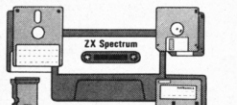
Orders despatched within 3 days of reciept of your order and cheque/P.O. All tapes are offered subject to availability. E&OE.

ROMANTIC ROBOT present

New! TRANS-EXPRESS 85.2

The only fully automatic and professional utility for transferring Spectrum programs from:

① CARTRIDGE to CARTRIDGE or DISC to DISC or WAFER to WAFER
② TAPE to CARTRIDGE or DISC or WAFER
③ TAPE to TAPE
④ CARTRIDGE to TAPE



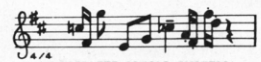
"An ingenious piece of software." PCN
★★★★★ Features ★★★★★ Performance"
"A valuable utility for microdrive users." Sinclair User
"HIGHLY RECOMMENDED." PCN

NEW! Part ② now fully automatic - you just START/STOP the tape transfers, modifies, relocates re structures & helps to RUN also hyper turbo headerless extra long (including 48K) parts, etc.
The best possible success ratio, the easiest & fastest in use.

Wriggler

A novelty maze arcade game. Superb graphics and action. An extensive map, over 250 locations, full of features and creatures unseen as yet. New, funny, addictive, compelling.
Plus a bonus on side B: **THE BOOKS OF ISPITER**
'A WINNER.' PCWeekly

New! MUSIC TYPEWRITER 85



COMPLETE MUSIC SYSTEM FOR THE ZX SPECTRUM

"A very professional piece of programming, easy to use, excellent screen presentation, error trapping and helpful prompts" ZX Computing
"Extremely user friendly, lets you get started within minutes." Crash
"The notation has to be seen to be believed."
"Puts many expensive professional systems to shame." Your Spectrum
"Excellent aid to teaching the basics of music" Which Micro? "Great fun" The Listener
"If you are interested in music and own a computer then get it." ZX Computing

NEW! Sheet music quality printout on dot matrix printers - NEW
Microdrive compatible
NEW SUPPLEMENT for £4.95 DATA CONVERTER to use music in your own programs - MICRODRIVER puts MT onto microdrive NEW

Please send SAE for details. **Trade enquiries welcome.** **Deliveries normally by return.**

I enclose a cheque/PO for £..... (European orders please add £1 overseas £2)
or debit my ☐ ☐ No ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
Name ..... Card expiry.....
Address .....
.....
Signature ..... Date.....

Please send me (tick as applicable)

WRIGGLER	£5.95 ☐		
MUSIC TYPEWRITER	£9.95 ☐	MT Supplement	£4.95 ☐
TRANS-EXPRESS:	part ② £7.50 ☐	or part ③ only	£5.50 ☐
all parts on tape	£9.95 ☐	or cartridge	£14.95 ☐
①+② on tape	£7.50 ☐	or Rotronics wafer	£12.95 ☐
Updates of TRANS-EXPRESS or MUSIC TYPEWRITER			£3.50 ☐
TRANS-EXPRESS upgrades from tape to cartridge			£6.95 ☐

ROMANTIC ROBOT 77 Dyne Road London NW6 7DR ☎ 24 hrs orders 01-625 9463 ☎ YC

DUNGEON

DEADLY TRIO

Concentrating on the BBC this week, Mike Gerrard finds himself locked in a dismal cell, exploring a haunted house and finally chased by horrible nasties in one of the trickiest adventures published to date.

The adventure score this week reads BBC: 3; The Rest: 0, with three rather different adventures—all of them worth a look.

The most traditional is *Island of Xaan* (Robico Software, £7.95), where the aim is to escape from the island by finding a suitable disguise and enough treasure to buy yourself a passage on a sailing ship. This is one author who doesn't need graphics to paint a vivid picture and you begin in less than salubrious surroundings: 'You are in a small, dimly lit prison cell, filled with the stench of death and decay.' The only exit is a huge iron door to the north, locked of course, although you also see an alcove in which is lying a seemingly immovable chain. You are carrying nothing and wearing some sacking which is rough, ragged and filthy.

Escape from here isn't too difficult but in the heady excitement of your bid for freedom don't leave anything behind in the cell as the door slams shut when you exit, showing you now to be in a long east-west corridor. There's also a warning that the cold chills you to the bone, so better do something about that fairly quick.

It isn't long before you step into 'a twisting maze of echoing corridors' where each sound you make is amplified as it bounces between the cold rock walls (echoes of the loud room in *Zork I*?). This maze turns out to have few locations and even fewer ways to get through it although plotting a path isn't the only method of dealing with the eight visible exits in each location.

No sooner had I got out of the maze than I walked slap into a guard who seemed to be snoozing but alert enough to any move I made. And there I'm ashamed to say I'm stuck unable to creep past the guard, get him out of the way, or attack him with anything more deadly than a cloak. I've tried smothering him and wearing the cloak round my feet to sneak past, but every time I find my head rolling lifelessly along the floor after a short back and sides from the guard's sword. Rats! Despite that, the adventure looks promising, with quick responses and all the necessary features.

Unusual features are in *Spooky Manor* one of Acornsoft's recent titles which allows up to four people to play at one time. This is done by splitting the screen into four windows and the position of each player is displayed in his or her window. The object of the game is to explore the haunted manor, gather treasures and escape unharmed.

One person can play alone, but that might lead to slight problems where two people are needed to solve some of the tasks. Each player must enter their number before the actual command and you can play either as rivals or by cooperating. You could have two teams of two seeing who can get to the goodies first and each player can address the other players by using their names. If player one decides to summon help from player two the message will appear in player two's window.

The game, at £9.95 on cassette, is well presented and comes with a booklet that includes maps of the manor indicating that it's meant perhaps for younger players rather than the lone adventurer burning the midnight oil. The four-player facility does mean that the adventure itself is a little more restricted but it's an ingenious idea that's being published under the Acornsoft Home Education banner and deserves your attention if your household has several rival adventure players.

Even several players might find it tricky to deal with *Quondam* the latest adventure from the nasty devious mind of Peter Killworth author of earlier Acornsoft classics *Philosopher's Quest* and *Castle of Riddles*.

This time he's joined forces with Rod Underwood and they should both be chucked into the Goblin's Dungeon with no means of escape for coming up with this dastardly effort. You can't even SAVE the game without threats of violence and there's a thorny problem every way you move as soon as you start the game.

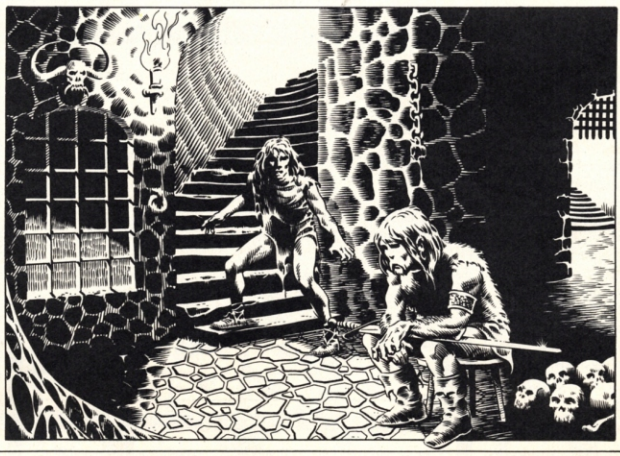
The idea just for a change is to accumulate as much treasure as you can find. Before that, though, you have to get out of the spider's web near where you begin, this being a nasty maze with nasty inhabitants constantly snapping at your heels. Then there's a pretty merciless knight and even our old friend the lamp isn't what it was. Try turning this on and it's curtains. A sort of deadly lampshade, I suppose.

There's no logical storyline to *Quondam* as you leap about all over the place . . . or, more likely, crawl agonisingly slowly from one mind-boggling problem to another. How long the sealed envelope of clues remains sealed is up to you. One for the adventure masochist at a cost of £9.95 on cassette and £11.50 on disk.

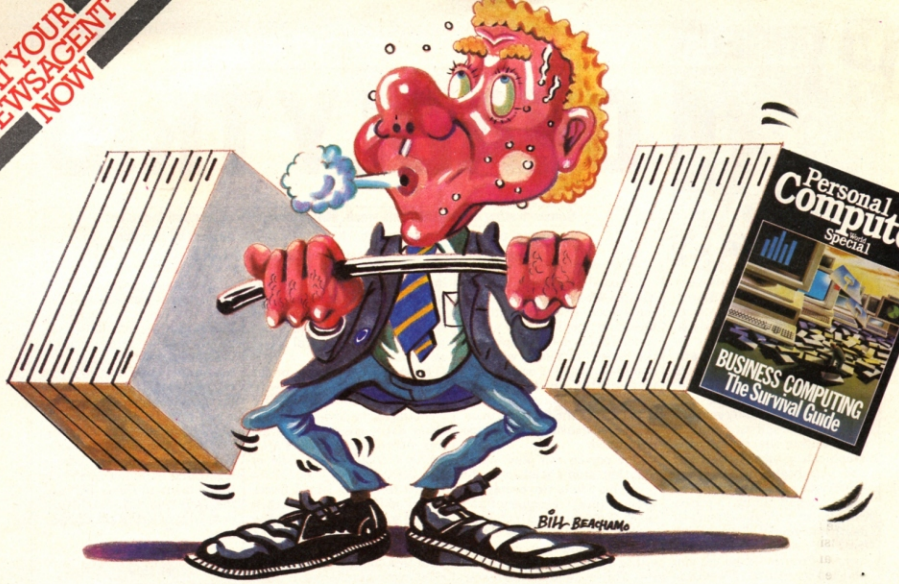
Finally, a mention for Rachel Knox of Abergele who was so frustrated at being unable to find a drink in *Denis Through the Drinking Glass* that she penned a lengthy plea beginning:

O woe is me, this
desperate plight,
Commodore bashing
day and night.
At last reduced to
pen this letter,
Chained to *Denis*
please un-fetter!!
For this adventure I
can't start.
Where's that drink —
please have a heart!

Unfortunately the answer doesn't lend itself to rhyme, not even backwards. For those seeking a snifter: MOOR DEBN ITOPE NIMA XE. Cheers!



AT YOUR NEWSAGENT NOW



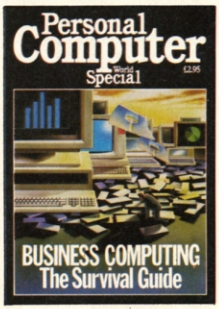
SURVIVAL OF THE FITTEST...

PCWorkout

Personal Computer World announces a special Business Computing Survival Guide – a guide that explains, entertains and educates everyone who has bought – or is about to buy – micro computer hardware, software and peripherals, to further their professional needs.

Read it an discover how to prepare a shortlist. Find out what software can really help – or even hinder – your efficiency. Understand the implications of communications. Learn how to get the best deals – and the best service – from dealers.

Written by a team of impartial experts, carefully selected by PCW, the Business Computing Survival Guide costs an incredibly low £2.95. Order your copy now – you may not survive without it.



PRIORITY ORDER FORM

Yes, I want the real facts about business computing today. Send me immediately the PCW Survival Guide for only £2.95 plus 55p postage and packing, total £3.50.

☐ I enclose a cheque payable to Personal Computer World for £_____

☐ Please charge my ☐ Visa ☐ Access ☐ AmEx ☐ Card No: _____

Expiry Date: _____ **Signed** _____

Name _____

Position _____

Company _____

Address _____

Please send this order form with your remittance to Personal Computer World, Subscription Department, Freepost 38, London W1E 6QZ. No stamp required.

HARDWARE PRO-TEST: MSX DISK DRIVE

DISK JOCKEY

Storage is no longer a problem on MSX machines, thanks to the Sony MSX disk system, says Kenn Garroch.

MSX computers come with cassette storage as standard. This means the loading, saving, and file handling programs are slow and sometimes unreliable. Another option is now available with the HBD-50 disk system from Sony. Included in the system is a set of new commands including such goodies as random access filing and auto execution programs plus the facility to save screens.

Setting up

The Sony HBD-50 floppy disk unit comes in a grey cardboard box which opens to reveal a rather business-like machine, an interface cable, a manual, a blank disk and a piece of wire.

The last item on the list caused some confusion at first since there didn't seem to be an obvious use for it. After wiring up the mains plug and discovering that there was not earth lead in the mains cable, the light began to dawn. There is an earth screw on the back of the case, just like most hi-fi amplifiers. It would appear that the piece of wire is attached to this and then presumably to a cold water pipe somewhere in the house, giving an earth connection.

Connecting up the system to my computer was easy. The interface cable has a plug on one end that attaches to the back of the disk drive and a large cartridge shaped affair on the other that plugs into the cartridge slot on the MSX. Some MSX computers have two slots so that the drive can be plugged in unobtrusively underneath. Others, however, have only one, on the top the machine. In this case the interface sticks out rather untidily but it doesn't get in the way. The cable could have been a little longer.

In use

Once everything had been plugged in and switched on, the system booted itself up. The disk whirred briefly, and then the MSX went away for its usual mandatory meditation period (10 seconds or so) before the drive whirred again. Since no AUTOEXEC.BAS file was found, the system asked for the date.

At this point experience told me that pressing return usually gets around this silly exercise, and it did — full marks for that one.

Typing the FILES command revealed that Sony doesn't provide any demo software with the system, the disk was blank. So the next trick was to format it. This took about 30 seconds via the CALL FORMAT command. One thing that became noticable here is that two drives are allowed for, referred to as A and B in FORMAT, but at other times as 1 and 2. They are equivalent but it can sometimes be confusing.

After formatting the disk, entering ?DSKF(1) revealed that there were 351 blocks free. Since the stated capacity is 360K and there are 9 sectors per track, it appears that each block is 1K with 1 track for system use. This is fair enough, I suppose, but it does seem a waste of 9K of storage.

All of the commands for disk handling are virtually standard Microsoft as found on many other systems. If you're not acquainted with this standard you'll need to get at least a summary. The best thing to do is obtain an IBM PC manual that includes a section on disk handling — the systems are virtually identical.

Loading and saving programs was very straightforward and vast improvement over using cassettes. The filing facilities are also quite neat. Setting up random access files was a little more difficult than sequential files, especially as there were no instructions in the manual.

Eventually I sorted it out and it became obvious that this is a pretty flexible system. The added commands mean that using cassettes for anything besides saving and loading (CSAVE and CLOAD) is a little more complex since the device CAS: has to be specified.

A very useful feature, not available to the cassette Basic, is being able to load and save the video RAM. On MSX machines this is a separate section of memory normally unavailable to BLOAD and BSAVE. The new S option makes saving and loading screens, sprite data and so on very easy, and surprisingly fast. The autoexec facility, a file that runs at switch on, is also very useful.

One thing I did try was to see how big a file I could create. Theoretically this should have been about 350K, but in practice was only 120,000 characters. Unless each character takes up three bytes (unlikely) there is not quite as much disk space as there should be.

Documentation

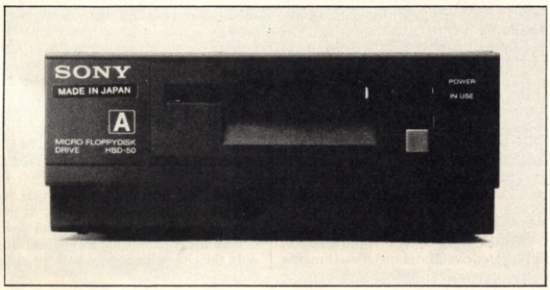
The major problem with the Sony MSX disk system is the pathetic manual. It tells you how to set up the system and takes you as far as formatting a disk. By this time you've reached the page 12 of a 15 page manual and there are no details on any of the commands.

Fortunately, the review drive was used with the Canon MSX machine and the MSX Basic manual includes an appendix that summarises the disk Basic commands.

Verdict

Overall, the Sony MSX disk system is quite good but expensive. It runs like a dream in comparison to cassettes. There should have been a lot more documentation on disk Basic but this is probably the only drawback. The 3.5in disks are expensive at just under £5 each, but they do have the advantage that they are tough and reliable.

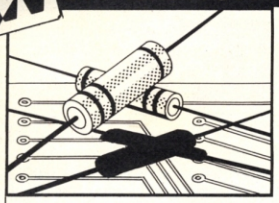
The HBD-50 is an add-on that makes the MSX machine very useable. The only drawback is that the Hitachi MSX version will, no doubt, use Hitachi disks and so be incompatible with the Sony MSX standard. It remains to be seen which one will scoop the market.



REPORT CARD: 1 TO 5

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

Name HBD-50 Sony disk drive **System** MSX **Price** £349.95 **Availability** Retail



COMPONENT CODE

Although you may know how capacitors, resistors and integrated circuits work, how sure are you of identifying their values or even which way to position them? Brendan Lewis explains away the problems.

When we started the Workbench series, we promised you a smooth introduction to the hardware contained within a micro.

Before a project of any size can be undertaken, it is probably a good idea to lay down some of the ground rules needed when dealing with electronic components. This week we will discuss the identification of some commonly used components. This subject is most important, especially to the beginner, as the use of incorrect components will normally prevent the circuit from working and may also damage it.

Probably the two most common types of component are resistors and capacitors; they will appear in almost every circuit you build. Although the various types come in many shapes and sizes, they almost always identify themselves in one of two ways. The value is either printed on the component itself or is indicated using a colour code system arranged as bars on the body of the component.

Colour coding

The colours shown in figure 1 are a standard set used for both resistors and some capacitors, though they are used in slightly different ways for the various types.

The most common type of resistor has a series of coloured rings around the body. Other types are available but are seen much less often. Some of these use dotted colours and a mixture of dots and rings.

When reading the value, make sure the resistor is in the same position as shown in figure 2, with the three rings to the left. When reading the colours, read the first two from left to right and write down the corresponding number (in this case 56). Then the third ring is the multiplier ring or the number of zeros to follow the 56. As our example is yellow this means a value of 560000 ohms or 560K ohms.

The final loop denotes the tolerance of the resistor. This will normally be gold, meaning a tolerance of plus or minus 5%. This means that the actual value of the resistor could be anywhere between 532K and 588K ohms. Other values are 1% (brown), 10% (silver) and 20% (none).

You will find after reading the values of a few resistors that they all seem to use a small combination of numbers plus the multiplier. These numbers are 1.0, 1.2, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8 and 8.2, and are known as the E12 series.

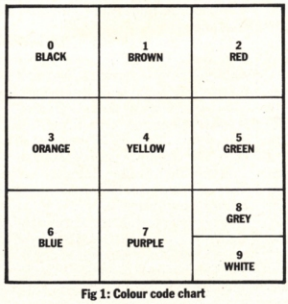


Fig 1: Colour code chart

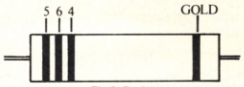


Fig 2: Resistor

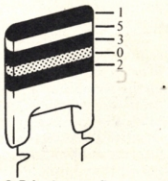


Fig 3: Polyester capacitor

Fig 4: Tantalum capacitor

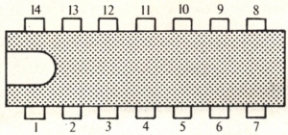


Fig 5: 14-pin chip

They have been chosen because with a 10% tolerance the values should be able to cover the full range from 1.0 to 9.9.

Capacitors use exactly the same colour code as resistors. From figures 3 and 4 you will see that the familiar series crops up here as well. The three most common types of capacitor are: polyester which normally use the colour code; tantalum which sometimes use the colour code; and electrolytic which never use the colour code.

The question of polarity is relevant only when using the tantalum and electrolytic types. They must be inserted into the circuit the right way round or they will be damaged — sometimes with a bang, so be careful. One other thing to remember is the voltage rating; this must exceed the power supply voltage.

Chips

We also want to look at the basics of integrated circuits (chips). Two things to remember with all standard chips is the way in which the pins are numbered and how to orientate the chip. Figure 5 shows both these things.

As you can see, the chip has a notch indented at one end which we will call the top. Always go by this mark and never by the direction of the printed numbers on the chip. Once the correct orientation is found, the pin numbers read as shown. Note that pin 8 is on the bottom right hand corner, not top right.

Chips come in seven basic sizes which have either 8, 14, 16, 20, 24, 28 or 40 pins. All types use the notch and the same numbering system, *ie* count down the left hand side and up the right. This means that pin 1 is always top left and the highest pin number is always top right.

Whenever we use chips in a project, we will nearly always advise you to put them in an IC socket. The socket itself can be mounted either way round, it's only the chip which must be positioned correctly.

QL BANK ACCOUNT

Fed up with infrequent Bank statements? Avoid Bank charges and keep up to date with QL BANK ACCOUNT. Check your mortgage HP, standing orders! Budget your bills.

- ★ Automatic posting of Standing Orders & other regular payments or credits. 80 column display.
- ★ Delete, amend and even backdate entries. Scroll through accounts.
- ★ Six different entry search routines!
- ★ Post items to account headings chosen by YOU to suit your circumstances. Print out individual accounts & summary, eg all payments to Building Society or Motoring expenses.
- ★ Output of Bank statement & accounts to most Epson compatible printers. Makes automatic use of memory expansions. Full instructions and bank account included.

Cartridge & Manual £19.95 + 50p P & P. Cheques & POs to:

cenprime software
10 Castle Street, RUGBY. CV21 2TP
Coventry (0203) 686162

RESOURCE FACILITIES

Official Acorn dealer. Northern Distributor for Viglen

★★ LOOK AT THESE OFFERS AND PRICES ★★

BBC SOFTWARE

DISKIT: STAT: a detailed report on the program size and status of each surface of your discs. Clear single screen display. Print option. EZICOPY: Single copying of all programs from catalogue — menu driven. RENAME extensions (including Wild Card)
Disc £5.00 (£6.90)

VIEW: Printer-driver: Juki 6100, Sanple 2000, Quendata DWP, Epson FX/RX/MX3/DX Canon PW, KAGA Taxan KP, Brother HR15. Disc £5.00 (£6.90)

DISKS IN BOXES OF 10

PROMAG: SS/48 £10.95 (£13.74); DS/48 £13.95 (£17.19); DS/96 £16.95 (£20.64)

DYSAN: 104/1D £15.95 (£19.49); 104/2D £21.95 (£26.39); 204/2D £26.95 (£32.14)

Plastic lockable boxes to hold 100 disks £15.95 (£19.49)

Acorn DFS Upgrades £79.00 (£91.98); DNFS ROM £19.95 (£22.95)

Prices in brackets () include packing, carriage and VAT at 15%

RESOURCE FACILITIES,
Masters Lane, Halifax, HX2 7DX

Telephone (0422) 65935 for best prices on quality HARDWARE, FIRMWARE, SOFTWARE, MEDIA & ACCESSORIES.
Education Authority Orders welcome.

PREVIEW SOFTWARE CLUB

Commodore (all), Spectrum, BBC, Atari, Electron, MSX, Oric, Dragon, Sharp
Receive regular lists of software and peripherals, often including bankrupt stocks at unbelieveable prices and new releases at substantial savings. These special offers are taken from our current list, order now!

Daley Thompsons Decathlon — Commodore 64	~~£7.95~~	**£4.95**
Back Packers Guide to the Universe Spectrum 48K	~~£7.50~~	**£2.95**
The Hobbit — Commodore 64	~~£14.95~~	**£5.95**
Cad Cam Warrior — Commodore 64	~~£9.95~~	**£4.95**
The Hulk — Commodore 64, Spectrum, BBC and Electron	~~£7.95~~	**£4.95**
International Soccer — Commodore 64 cartridge	~~£14.95~~	**£7.95**
American Football — Commodore 64, Spectrum 48K and Amstrad	~~£9.95~~	**£4.95**
Eureka — Commodore 64 and Spectrum 48K	~~£14.95~~	**£4.95**
Alien — Commodore 64	~~£8.95~~	**£3.95**
Quickshot II — Joystick	~~£11.95~~	**£8.99**

MEMBERSHIP (Refund voucher enclosed with first order) **£1.00**
Join THE Software Club now and receive our latest newsletter and comprehensive lists by return and regularly thereafter.
PREVIEW SOFTWARE CLUB, the sensible way to buy your software.
*All stock genuine and fully guaranteed **Orders receive immediate attention ***Software evaluation service.

NAME _____ ADDRESS _____

COMPUTER _____

Cheques/PO's payable to **Preview Software Club.** All orders subject to availability. Prices inclusive of VAT, POSTING AND PACKING (overseas add £1.50)

Send now to:-
Preview Software Club, PO Box 87, Solihull, West Midlands, B91 3UJ.

SPECTRUM LIGHT PEN ONLY £10.00

WORKS WITH ALL SPECTRUMS, CREATE PICTURES, SKETCHES, ANIMATIONS AND GRAPHS. PICK FROM MENU OF 16 ROUTINES. COMPLETE WITH INTERFACE CIRCUIT (PLUGS DIRECT IN TO USER PORT) AND SOFTWARE PROGRAM WITH COMPREHENSIVE INSTRUCTIONS, NO NEED TO KNOW ANYTHING ABOUT MACHINE CODE OR EVEN BASIC PROGRAMMING.

LIGHT PEN £10 inclusive VAT & PP

I enclose Cheque/Postal Order for £10 or Debit my Access/Barclay card/Visa
No.....Expiry Date.....

Name.....

Address.....

Signature.....

CUSTOM CABLES INTERNATIONAL LTD., Units 3 & 4 Shire Hill Ind. Estate, Saffron Walden, ESSEX. CB11 3AQ.

PCN 1

New Concepts

BBC

Computer aided learning template system for teachers. Enables any teacher to quickly acquire a library of personalized teaching software. **Price £25.00**

CBM64

Dr. John and the Battle of the Entropy; The Energy Race. Educational fun game for O and A level/ Technician courses. Teaches fundamental concepts of engineering and heat. A revolutionary new approach to teaching with an emphasis on learning through play with full back up material. **Price £9.95**

SPECTRUM

O and A level Physics packages
NEWTONS LAWS.....**£6.95**
WORK AND ENERGY.....**£6.95**

Atomic Structure — A complete view. Award winning 48K Spectrum programme. Illustrates 13 important Physics experiments with high res graphics and text. Suitable for A level **£5.50**

Super BASIC EDITOR. RESERVES space for code in REMs, FIND AND REPLACE everything, variable speed TRACE, DELETE blocks of BASIC, and much more. 48K only. **£6.50**

Send to:
NEW CONCEPTS,
Rosenython, St. Keverne, Helston,
Cornwall TR12 6QR

HISOFT

ULTRAKIT £9·45

The most powerful toolkit yet for ZX BASIC. All the features you will ever need; AUTO insert, full RENUMBER, block DELETE, CLOCK, ALARM, error trapping, break trapping. Full TRACE with single-step and much, much more. Makes ZX BASIC easy-to-use and powerful.

DEVPAC £14

An excellent assembler, an advanced line-editor, a comprehensive disassembler and a superb 'front panel' debugger all in one package. Used by many leading software houses to write their games. "Buy it!" Adam Denning 1984.

PASCAL £25

A powerful and almost full implementation of Pascal - not a Tiny Pascal. A valuable educational and development tool, programs typically run 40 times faster than a BASIC equivalent. Spectrum version includes Turtle Graphics package. " I haven't seen any other compiler that could match Hisoft's Pascal"

HISOFT
180 High Street North
Dunstable, Beds. LU6 1AT
Tel: (0582) 696421

HISOFT

MONQL

A powerful disassembler/debugger for your QL

MONQL – the latest program development tool from Hisoft.
MONQL – a versatile and easy-to-use disassembler and debugger for your Sinclair QL computer.
MONQL – debug your programs, discover the secrets of the QL's operating system.
MONQL – just look at all these features:
- front panel display showing registers, memory and disassembly.
- modify memory and registers.
- search for bytes, words, strings or even mnemonics!
- intelligent copy of memory contents.
- full disassembly to screen, printer or microdrive.
- single step your programs, ROM or RAM
- set/reset dynamic breakpoints and much, much more.

MONQL – supplied on microdrive cartridge with an extensive manual
MONQL – written by Andrew Pennell, MONQL is a *must* if you want to ge the *most* out of your QL.

MONQL — ONLY £19.95 inclusive

Export and dealer enquiries please write to us:

HISOFT
180 High Street North
Dunstable, Beds. LU6 1AT
Tel: (0582) 696421

SOFTWARE PRE-VIEW

We check out the latest contenders on the software market. Don't forget, if you want your company's package to be included on this page, send your latest releases to Bryan Skinner, *PCN*, 62 Oxford Street, London W1A 2HG, along with prices and 'phone numbers.

AMSTRAD

Forth is here at last. Locomotive Basic may be pretty fast, but I've a penchant for the unusual nature and speed of Moore's language. This version offers ROM call access with parameter passing, so you can use the jump block, as in Basic. Sound and graphics words are provided as part of the vocabulary and there's a 120 page booket which introduces the language and explains command functions.

Unfortunately, it's not very well error trapped. For example it tried to read a file from tape immediately after telling me of an error in a word definition. It could do with polishing, and at just under 20 quid it's overpriced, but it's the only one around. If you're interested in learning a new language you don't have much choice.

I haven't seen *Archon* yet, but if it's a faithful conversion you must buy it, and Ariolasoft's other releases are probably all worth looking at too.

Death Pit follows Durell's excellent *Combat Lynx*, but it's a disappointment. It's a tunnels affair, where you collect as much gold as possible, bop the monsters on the head with your shovel and avoid the green slime and rapidly descending spiders. It's a fair attempt and in some ways the graphics aren't too bad. But the gameplay is terribly limited.

I don't know who Ocean uses for its Spectrum/C64 conversions, but they are very good. *Decathlon* features a very large software sprite that's nicely animated.

FIG Forth	**£19.95**	**Kuma Computers 07357-4335**
Archon	**£10.95**	**Ariolasoft 01-222 0833**
One-On-One	**£8.95**	**Ariolasoft 01-222 0833**
Hard Hat Mack	**£8.95**	**Ariolasoft 01-222 0833**
Deathpit	**£6.95**	**Durell 0823-54489**
Hunchback II	**£8.95**	**Ocean 061-832 6633**
Kong Strikes Back	**£8.95**	**Ocean 061-832 6633**
Daley Thompson's Decathlon	**£8.95**	**Ocean 061-832 6633**
The House That Jack Built	**£8.95**	**Knightsoft 0282-414151**
Colossal Cave Adventure	**£7.95**	**Duckworth 01-485 3484**
Castle Dracula	**£7.95**	**Duckworth 01-485 3484**
Mountain Palace	**£7.95**	**Duckworth 01-485 3484**

ATARI

Ariolasoft has now converted some of its best-sellers on the 64 for the Atari. Given the amount of Atari software being released, the launch of the XEs and the imminence of the STs, you can look forward to a slugging match between Atari, Commodore and Amstrad.

Mule is a multi-player, science fiction Monopoly. It's one of those strategy games which fall in the grey area between board games and computer-moderated games. You can play against up to three other players, or the computer. Your task is to acquire land and develop it with your MULE (Multiple Use Labor Element).

Archon	**£11.95**	**Ariolasoft 01-222 0833**
One-On-One	**£9.95**	**Ariolasoft 01-222 0833**
Hard Hat Mack	**£9.95**	**Ariolasoft 01-222 0833**
Mule	**£14.95**	**Ariolasoft 01-222 0833**
Murder On The Zinderneuf	**£14.95**	**Ariolasoft 01-222 0833**

COMMODORE 64

Bounty Bob Strikes Back is the follow-up to *Miner 2049er*. It's a difficult, complex multiscreen platforms game. If you're into that type of game it's very good, otherwise it's frustrating.

In *Super Pipeline II* there's a tank of liquid at the top of the screen, containers at the foot. A convoluted pipe system links the two, draining the liquid. Your task is to ensure the uninterrupted flow. Self-propelled and hostile drills etc leap about damaging the network. To repair the system you must contact one of the itinerant workers, take him to the breach and stand guard. Fun for a bit, but it lacks long-term appeal.

Peace Women is one of the naffest games I've had the misfortune to be sent. But as Knightsoft produced a strip poker game, I shouldn't be too surprised. The cassette cover shows a peace woman in a C5 with front laser mounting, pursued by a savage soldier firing a pistol from the saddle of a motorcycle. To the left is a bomb, nose deep in mud, labelled 'crude', which aptly describes the game, the graphics and the concept.

Strangeloop was one of the first arcade-adventures, and the conversion from the Spectrum is good. The game's been improved, there are 250 rooms, new puzzles and, of course, the graphics are better.

Bounty Bob Strikes Back	**£9.95**	**US God 021-359 3020**
Jonah Barrington's Squash	**£7.95**	**New Generation 0225-316924**
Strangeloop	**£8.95**	**Virgin Games 01-727 8090**
Super Pipeline II	**£8.90**	**Taskset 0262-673798**
High Bouncer	**£6.95**	**Mirrorsoft 01-822 3800**
Peace Women	**£5.50**	**Knightsoft 0282-414151**

SPECTRUM

Jonah Barrington's Squash is a little like *Match Point*, but I find it infinitely more playable and it's more realistic. The game features 'Reprosound', a technique that reproduces the dulcet tones of squash racquet's star pro. Jonah keeps score. You have to play the sound through your tape deck. Unfortunately the Spectrum just isn't up to that sort of fancy programming. By contrast, the voice on the Commodore 64 version is superb.

Falcon Patrol II is a conversion from the 64 game. It's a sort of *Defender*, but there's a lot less to do. You fly over a desert scenery of towns, pyramids and crashed helicopters etc. There's a sort of long-range radar which shows enemy choppers which you must blast down to protect your installations. It's colourful and playable, but lacks interest and variation. It's a million miles away from being 'the best shoot-em-up for any computer', as claimed by Virgin.

As mentioned elsewhere on this page, *Archon* is a conversion from the C64 game from Electronic Arts. It's a sort of chess — two sides battle on a chequer board — but when it comes to capturing an occupied square the game switches to a real time shoot-out.

The pieces on each side don't correspond as they do in chess, so you'll find that different strategies will be needed if you swap from black to white.

Archon	**£10.95**	**Ariolasoft 01-222 0833**
One-On-One	**£8.95**	**Ariolasoft 01-222 0833**
Hard Hat Mack	**£8.95**	**Ariolasoft 01-222 0833**
Falcon Patrol II	**£6.95**	**Virgin Games 01-727 8070**
Star Seeker	**£9.95**	**Mirrorsoft 01-822 3800**
Jonah Barrington's Squash	**£7.95**	**New Generation 0225-316924**

QL

One reason for the lack of QL software is the trouble publishers have getting decent, cheap and reliable Microdrive duplication. One of the biggest surprises is that Sinclair hasn't made a few deals with software houses. After all if there's one thing that guarantees poor sales of a new micro it's a lack of decent software.

Blackjack is a computer version of the casino card game. It features detailed graphics of the cards and betting chips. *Quest* was originally one of the few graphics adventures for ACT's Apricot, and its conversion has included improvements.

There aren't many sprite designers for the QL, so *Zappit* is a welcome utility. Up to 99 sprites of a maximum of 80×40 pixels can be defined and given one of eight colours. Direction and speed are specified from Basic and collision detection 'machine code routines are included.

This batch of programs may mark a watershed for the QL, but their price will surely prove prohibitive for many users.

Blackjack	**£19.95**	**Quest 04215-66321**
Quest	**£14.95**	**Quest 04215-66321**
Zappit	**£14.95**	**Quest 04215-66321**

GAMEPLAY

SPECTRUM

STARION

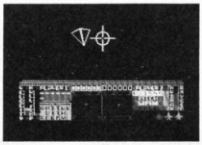
While you're waiting for someone to convert *Elite*, you could get in some practice, playing *Starion*.

Starion features the best wire frame graphics and perspective transformations since *Elite* — they have to be seen to be believed. It lacks *Elite's* detail, but it's fast, difficult and varied.

The aim is to correct faults in time zones: sort them all out and you become 'Creator' — I suppose it's a cut above merely 'Elite'. Aliens have disrupted various years in Earth's history by shifting key events to other time zones.

You choose a sector from a 3×3 grid. Then you're shown another grid. The sectors in these have 'AD' or 'BC' at the top with a year below. Select one of these and it's time to 'Battle with Enemy', so your computer prompts.

The upper part of the screen is the view forward into deep space. Below is a colourful instrument panel. Gauges and meters show your velocity, yaw, hydrox, oxygen, and hulls remaining. But of most interest are the twin 'biplanar scanners' whose circular screens map your immediate vicinity. On the left the axes are X-Z, the right radar shows Y-Z. This is dreadfully confusing at first but



you soon adapt. To get an enemy dead ahead you must get it above you on the left radar, and due east on the right. Then it's in view and you can fly by direct sight.

Apart from the radar you probably won't have time even to glance at the rest of the instruments. Flying SS Stardate by reflex, you bank and turn, accelerate, stop short, spin and rake fighters with twin lasers. All against a sickeningly spinning, star-riddled backdrop.

Naturally the aliens résent your attacks and retaliate by firing at you. They're not as mobile as *Elite* ships, and the SS Stardate is very manoeuverable, so they're quite easy to handle. But I suspect their aim improves as you progress further in the game.

It's the enemy fighters and their rockets that make games like this so compulsive. Fighters come in a variety of 3D white frameworks. Some resemble paper darts, others are pretty complex, and they're all hostile. It's quite a shock when what resembles an elongated brick whistles past your left ear and vanishes into the middle distance. And once you've got a fighter dead centre, it's almost a pity to blast it.

But you have to, because immediately after it explodes, its various parts reassemble to form a letter which you must collect as cargo. The letters in each time zone form an anagram of the displaced time-event in another zone. So, once you've gathered all the letters, your on-board computer asks you to identify the cargo. Most of the anagrams are quite easy, but matching them to the zone dates is harder.

Once you've got a zone's word it's back to the master space map. Select the zone showing the year which corresponds to the word you hold, and you're in deep space, searching for Earth. On arrival your computer assesses if you have the correct cargo for the year, if so you're off again, blasting enemies and collecting letters.

The rules are more complex still — the initial letters of the words from a set of zones form an anagram whose solution is the password to the next set of zones. There are nine sets of zones in a 'time-block', and their initial letters provide the password to the next block. All in all there are 243 bottom-level zones to correct, but it'll take you months to do that.

Starion has nearly everything you could wish for in computer game: speed, variation and superb graphics. My only reservations are that the sound's very limited and the plot and rules are too contrived. It's very good, and if more thought had gone into the game design it would be an instant success.

Bryan Skinner

Price £7.95

Publisher Melbourne House 01-940 6064

COMMODORE 64

AIRWOLF

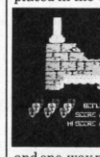
Familiar title? *Airwolf* is based on the television series with Stringfellow Hawk and a hyper-super chopper. The graphics are superb, but the game's almost impossible.

The first screen shows your blue copter on a landing pad in a beautifully drawn cavern. *Airwolf* has a strong caverns element, but there's also a lot of *Fort Apocalypse* in it.

Moving the chopper isn't easy. It takes a steady hand and delicate control to avoid bouncing off the walls and depleting your shield strength. What's worse, the helicopter doesn't hover on its own; you have to keep nudging it up. There's no way you can stay at the same level, turning on the spot to blast forward and back.

Getting past the various obstacles isn't easy either. In the first location you have to shoot a button under a mushroom to get rid of an impenetrable aquamarine column. Later there are brick walls to be demolished, trains to be avoided, lifts to take and so on. Because of the tricky movement control and the tight placing of the obstructions, just getting about relatively unscathed is challenge enough.

But there's a mission involved — rescue kidnapped scientists. Naturally, they're placed in the worst blind alleys



and one-way passages, so clocking a high score takes hours of practice. There are also nasties like magnetic pads which grab your copter and hold it down while rocks tumble on it — very friendly.

The graphics are excellent. The detail, shading and colour make each screen a delight and the animation and scrolling are as as smooth as you could wish for. There are plenty of sound effects and the music's well-done, though you can turn it off during play. The action is one of the hardest I've seen this year. But, difficult as it may be, *Airwolf* is absolutely addictive.

Kenn Garroch

Rating 8/10
Price £7.95
Publisher Elite Systems 0922-611215

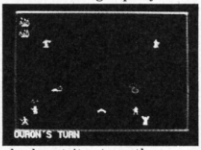
SPECTRUM

CHAOS

Chaos is a poor man's *Archon* — it's the nearest Spectrum owners can get. With strong board game connections it's clever, addictive — and up to eight can play.

The theme is battles between wizards. Having decided how many you want, you give each a name, choose between computer or human control, and select its icon and colour (each from eight possibilities). This works well: you can watch the computer pitch up to eight wizards against each other (good for learning strategy) and masochists can try their hand against seven top-notch wizards under computer control.

The playing arena is black. After each move, the player can select and cast a spell. Each wizard begins with a different list of spells; there may be overlaps but the range is wide. Before selecting a spell you can



check out its strength, range, etc from the main menu.

Some spells summon creations which can be used to attack other wizards or their creations. Some creations are animal: manticore, king cobra or lion, and, I suppose, spectre, zombie or ghost. Others, like lightning, magic bolt and raise dead speak for themselves.

A few of the spells are great fun: magic fire puts a flickering yellow fire in the arena, and at the beginning of every phase more fires spring from it.

The graphics are limited, but colourful and lively. Characters are single animated UDGs. Wings of bat and gryphon flap in irritation as you ponder strategy, while bears shake their fist and the undead march in the night.

The detailed rules may put some players off — you have to learn whether a spell needs a line of sight, weigh up the chances of a law spell succeeding given the current state of chaos of the universe (and there are spells for altering the prevailing entropy level) and so on. Every time you play you're given a different set of spells so it takes quite a while before you don't have to reach for the manual every turn.

Where *Chaos* loses to *Archon* is in the latter's hand-to-hand player combat over strategic squares.

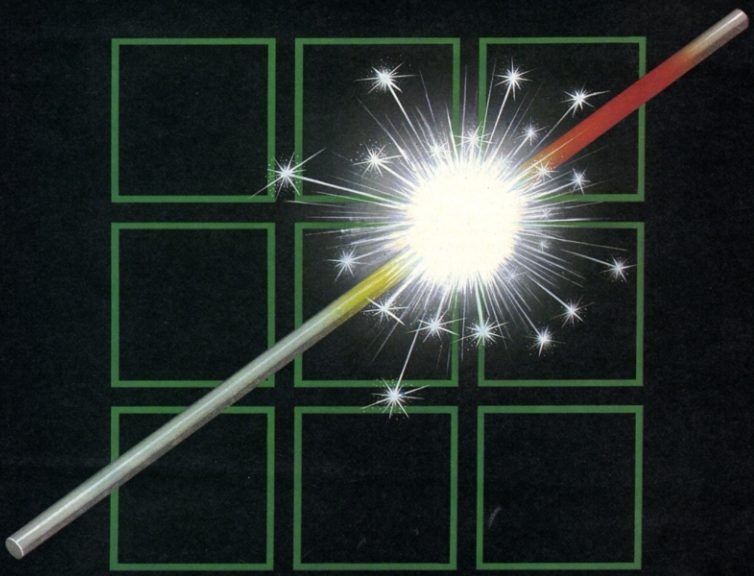
However, *Chaos* is great fun to play. It's hampered by its board game feel, but the graphic detail and its addictive qualities will keep you coming back for months to come.

Bryan Skinner

Rating 8/10
Price £7.95
Publisher Games Workshop 01-965 3713

INCENTIVE

CONFUZION



THE FUZION OF MIND AND MACHINE

★ AMSTRAD ★ SPECTRUM ★ COMMODORE 64 ★ BBC B ★ ELECTRON ★

Price £6.95 Trade and Credit Card orders: Telephone (0734) 591678

INCENTIVE, 54 London Street, Reading RG1 4SQ

GAMEPLAY

SPECTRUM

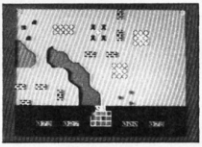
OVERLORDS

M C Lothlorien has carved a niche for itself in the two-player, strategic war games field. Its latest, *Overlords*, has an interesting innovation – there's an option to play over a local area network.

Each player controls an army consisting of a large number of troops, several generals and one overlord. The objective is to overwhelm the opposition and kill the enemy overlord.

The game switches between two main displays. The first is a master map of 12 sectors, showing the relative positions over the entire battlefield.

The second screen concentrates on an individual sector and this is where troop movement takes place. It displays the various forces set against a



background of trees, rivers and castles. There's no waiting to take your turn. Each player can move troops, independently or simultaneously, using the same computer or a separate one if the network option has been chosen.

The computer resolves any conflicts every thirty seconds. Forces attack only when they are immediately adjacent to the opposition; generals are roughly three times more powerful in attack than in defence. If a surrounding force outweighs a piece, then the latter is destroyed and removed from the screen.

An algorithm determines an army's experience and the computer automatically recruits further generals and troops to that side as it develops in experience.

A snapshot of the master map is taken every few minutes allowing a broad replay of progress once the game is over. Options allow for a long or short campaign; the short game is played over half the usual number of sectors.

Graphics are simple but clear and effective. The game is very easy to get into but seemed to lack depth once under way.

Although comparatively simple as strategy games go, *Overlords* is enjoyable enough, and the network option is a fine idea.

Bob Chappell

Rating 8/10
Price £6.95
Publisher M C Lothlorien 0625-876642.

MACINTOSH

GROUND ZERO

It may be odd that a state-of-the-art computer should be offering one of the oldest arcade games but that's the situation with the first action game for the Macintosh — a version of Missile Command, called *Ground Zero*.

In a sense it's a bit of a cop-out since it's hard to conceive of a game that would be easier to implement under the Mac's superb graphics. To compensate, publishers Mindsports have dressed it up immensely.

You can begin on any of six levels of difficulty with corresponding increases in scores. Each attack wave comes in four stages — three waves of the familiar missile tracks criss-crossing your screen, followed by a wave of intelligent bombs.

If you survive each group of attacks your rank increases with an accompanying high-resolution badge of merit, then it's back to the fray with more and faster missiles matched by larger bonuses.

Control corresponds well with the arcade version with the mouse replacing the tracker ball, and the z, x and c keys allowing experts to fire from the left, middle or right missile bases.

Your cities are works of art,

and the graphics are fast and smooth, as might be expected given the machine. The sound, however, is only adequate and there is no facility for controlling the volume — it's either very loud or off.

All in all it's not a bad debut for the Macintosh as arcade machine and since it's all there is for the moment, we can be grateful that someone is at least trying. However, Mac owners can look forward to better than this once publishers come to terms with the machine's lack of colour.

Peter Worlock

Rating 7/10
Price £36.55
Distributor Softsel Computer Products, 01-844 2040.

1541 FLASH!

Do you get bored waiting for your disk drive to load your favourite programs?

Thinking of reverting to 'turbo' tape routines because they're quicker?

WAIT!!!

From SUPERSOFT comes a great NEW product which you can fit in minutes to upgrade your Commodore 64 and 1541 Disk Drive. All disk operations are speeded up as much as THREE times (for example, programs which normally take a minute to load will load in twenty seconds or less using FLASH!)

1541 FLASH! is 100% compatible with Commodore BASIC. However, if you really want to you can easily revert to the normal slow mode at any time — but we don't think you will!

If you take your programming seriously you can speed DATA transfers by up to 10 times normal speed (in your own programs), and can also make use of 11 screen editing functions, as well as 17 disk commands.

Pressing SHIFT and RUN/STOP becomes the same as LOAD"*",8,1 so you can start work about five seconds earlier each day!

Supersoft have 1541 FLASH! in stock NOW, so send your cheque for £89.95 or 'phone 01-861 1166 to order by Access.

P.S. Unlike some add-ons we could mention, 1541 FLASH! leaves you all your memory and the cartridge port available!

SUPERSOFT

Winchester House, Canning Road, Wealdstone, Harrow, HA3 7SJ

Tel: 01-861 1166 for further details and our free catalogue

ADVANCED INPUT DEVICES (UK) LTD

BUSINESS SERVICES DIVISION

SAVE ON PRINTERS!

Quen-Date Daisy Wheel & Dot Matrix Printers (Epson compatible)
"New" Dot Matrix Printer – IBM PC compatible
Send for Price List & Literature. (Dealer enquiries invited)

SAVE ON SOFTWARE!

Save up to 40% on most popular business packages
PC.DOS, MS.DOS, CPM/86, CPM/80. Most formats available.
Special offers on: Easy Junior Integrated Accounts, UIS "RAP" Communications Software and Telecom Gold Mailbox
Send for details and Price List.

SAVE ON POWER PRODUCTS!

Solve all your mains power supply problems – Uninteruptable Power Supply (UPS) Units, Constant Voltage Line Conditioners (CVT), Surge and Spike protectors for individual and multiple equipment situations.
All UK manufactured by Rayman Electronics. Send for details.

ELECTRONIC SHOP! SHOP BY MODEM!

Use your computer to shop from the comfort of your home – our Data Base will shortly be available on-line for instant shopping. Browse through our extensive range of products including business software, games, printers, listing paper, accessories, sundries, etc.
No modem yet? No problem – direct connect low cost modems through to full auto-answer/dial versions available. Send for application form to join the Discount Shopping Club and Access details for Electronic Shopping.
(Starts early May 1985 and includes Electronic Mail facilities for Members)

Write for details to:

ADVANCED INPUT DEVICES (UK) LTD
Freepost, Pinner, Middx. HA5 2BR
(no stamp required)

or phone our 24 hour answerphone service
01-429 2675

A LIGHT TOUCH

Artistically minded Spectrum owners have gained another tool for their paintbox. Bryan Skinner took a shine to this package, a static display designer for the Spectrum.

If you're looking for a package to help with backdrops for games, title screens, etc, *Lightmagic* deserves a close look. It isn't just a good graphics program: there are UDG designer, image compressor and sample files, too.

Presentation

The packaging is unnecessarily large, considering there's only one cassette, and the 38-page instruction booklet contains a lot of white space. The loading screen is clever, but don't expect to produce moving images with *Lightmagic* as it's a static display designer.

Documentation

The documentation explains the functions quite well though there are spelling and punctuation errors and only two illustrations. On the plus side, there's an index, pictures of the ZX and Spectrum Plus keyboards showing *Lightmagic*'s control keys, and a unique 'system map' indicating which functions work under which modes, and the keys involved.

Features

There are four basic modes — pen, brush, block and text/UDG. Pen and brush share features such as set reference point, circle and fill.

Pen mode is used for freehand line drawing, rubber banding and so on. You can set a reference point to which you can return the cursor at any time, making it easy to draw shapes where many lines converge.

Brush mode lets you select from ten types, which range from solid stroke to airbrush effect, with lines and dotted patterns in between. And the brush width may be set from 0 to 20 pixels.

Block mode allows block movement by cut and paste, or you can drag a copy of a box to another area of the screen. To copy or move a block you select block mode, move the cursor to the bottom right of the rectangle and press Q. Then move the cursor to the top left of the block, and press M (cut) or V (copy).

You move the image by its top left corner to where you want it, then press Z or M again to drop it. The only drawback is that this loses the marked area; to make multiple copies you must mark, copy and move over and over again.

However, the block function can be useful — you can sketch something in rough to one side of the main work, then drag it to its correct position.

Text mode allows you to add text, normal or double height, to your image. Each character cell may be rotated, mirrored or inverted and there are eight sets of predefined UDGs. These aren't just ASCII characters but include a wide variety of shapes and patterns, many of which can be joined together to create space invaders or rockets, for example.

The UDG program allows you to define files of characters for use in your own programs. Its facilities include double height characters, rotate, mirror and invert character cells.

In use

The worst thing about *Lightmagic* is the lack of a keyboard overlay. The manual suggests using the illustrations for making your own, but for £14.95 New Generation really ought to have included one.

The package is difficult to use at first, but with practise you can operate it quickly and efficiently. There are so many controls it's difficult to remember what does what. The system map is invaluable because it lists the keys used and the functions available in each mode.

Sound is used to good effect: a note is sounded when you change the cursor speed, rising for faster; if you try to mark too large a block to copy or move, there's a warning buzz. What a pity this information is omitted from the documentation — at first I thought it signalled okay. It took several minutes to discover that I'd tried to mark a block bigger than maximum 8 × 8 character grid.

This limitation restricts the usefulness of the block mode. Also, the top left-hand area of the screen must be left blank (or filled last) since it's here that block operations such as mirror and rotate are peformed.

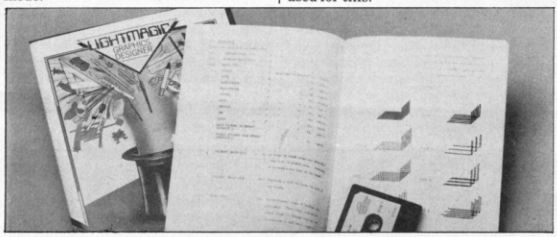
Lightmagic recognises and copes with the fact that colours are bound to be a headache on the Spectrum. The grid function superimposes a matrix of grey and white character squares on the screen. This is handy for checking where colour attribute problems may occur, as well as being a guide to block size for block operations.

The 'over' function is common to all modes. It allows you to superimpose characters on a drawing, and the cursor becomes non-destructive.

Enlarge is really neat, at first. It magnifies the current quarter of the screen to full-screen size so you can take out small errors, smooth out curves, or add fiddly detail. The problem is that it tends to distort your work when you switch back to the main picture.

While you can do detailed colour work in enlarged mode, this reverts to character cell colour resolution in the main picture. Lines have to be drawn in double thickness or they're lost. Although it's not all that useful in the end it still deserves applause.

If you make a mistake you can't 'undo' the last action. However, there are commands for saving the screen to memory and recalling it, so they can be used for this.



Verdict

This excellent product has more features than most comparably priced graphics products. Once you've got the hang of the controls, it's powerful and easy to use. Perseverance pays off and *Lightmagic* goes to the top of my list for this type of software.

REPORT CARD: 1 TO 5

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

Name Lightmagic **Application** Graphics **Price** £14.95 **System** 48K Sinclair Spectrum **Other versions** None **Publisher** New Generation 0225-316924.

KITTED UP

Gavin Monk examines a budget disassembler/debugger for the budget 'business' micro and finds that the quality of the package has not been compromised.

HiSoft's packages have proved invaluable tools for Spectrum owners, and now the company has launched a disassembler/debugger for the QL. Written by Andrew Pennell, *MonQL* comes on a Microdrive cartridge complete with a manual that even a beginner should find easy to understand.

In use

The program can be loaded into the Resident Procedure Space at the top of memory, or onto the Common Heap at the bottom. It should normally be loaded into the top of memory; the other option is to avoid memory conflicts.

After it has loaded you are returned to Basic so the code you wish to examine can be loaded. Entry into *MonQL* is achieved by the new Basic command 'Mon QL'. There is an option to follow it by a memory address and register values, whereby the memory pointer and the initial register values will be set to the address entered.

On entry a 'front panel' window is displayed. This shows all the 68008 register values in hex, including the Program Counter, Supervisor Stack Pointer, and the Status Register. The register values are followed by a table of 24 bytes around the memory pointer.

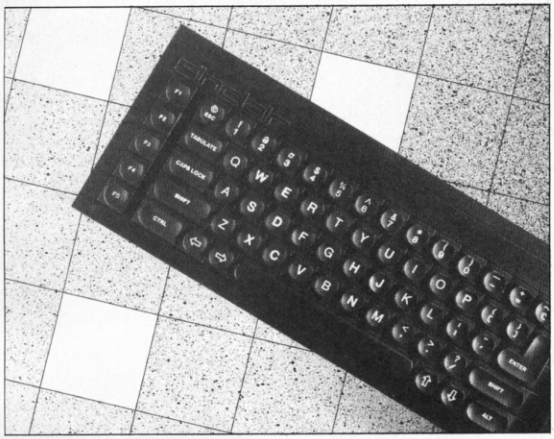
These are divided into word boundaries so that the even memory locations can easily be spotted – a nice touch. (Remember that all 68000 instructions are an even number of bytes long). This is followed by a disassembly of four instructions, one before the Memory Pointer and three after it.

Finally, there is an area reserved for the entry of commands and parameters. The format can be changed by the control key and F1, F2, or F3 which toggles the register, memory, and disassembly displays between long and short forms.

Commands

Commands are entered by a single key press and can be in upper or lower case. Certain commands, such as those used in single stepping, require the control key to be held down as well. A large number of commands can be entered, including incrementing and decrementing the memory pointer by bytes, words, or long words; an intelligent memory copy; quick and short disassemblies; change register values, set break points and single stepping; and an extremely powerful memory search.

The search sequence, which uses the G (Get) command, can look for bytes, words, long words, text, 68000 instructions, or even parts of instructions, making it a powerful tool for both professional programmers and beginners. In addition, values can be entered into *MonQL* as hex or decimal without the need to flip back and forth between the two bases.



Disassembly can be performed in full form with labels to the screen, printer, Microdrive, or disk drives. This disassembly can then be loaded into a standard 68000 assembler for editing and reassembly. A short form of disassembly is also available, without labels and output to the screen. A memory dump in both hex and ASCII can also be performed and sent to any output device.

MonQL can be made to single step memory. A control key ensures that commands are not entered by mistake. Break points can be set or reset at the memory pointer or after the current instruction.

Two new Basic commands, which aid the examination of multi-tasking programs, are included. MONEXEC and MONEXEC_w work in the same way as their Basic equivalents except that when you start a break point will be put at its first location, so that *MonQL* is called as its first instruction.

All jobs currently running can be displayed by the J command from within *MonQL*, and they can be suspended for a period of ten seconds, preventing problems while single stepping through multi-tasking jobs.

Main features

Increment/decrement memory pointer by byte, word, or long word. Change and move display window.

Full and short disassemblies. Hex and ASCII Dumps.

Values entered in hex or decimal. Hex/decimal conversions.

Powerful search for bytes, words, long words, text, instructions, or even parts of instructions. Register updates and update of the memory pointer to a register value.

Full single stepping and control over multi-tasking.

Verdict

MonQL is a powerful development tool. Its excellent manual and ease of use make it equally suitable for experienced and novice users. The only drawback is the lack of a worked example — HiSoft take note.

Another feature I would like to see is greater use of windows, so different disassemblies can be displayed on the screen together for comparison.

But, at £19.95, *MonQL* can only be described as excellent value.

REPORT CARD: 1 TO 5

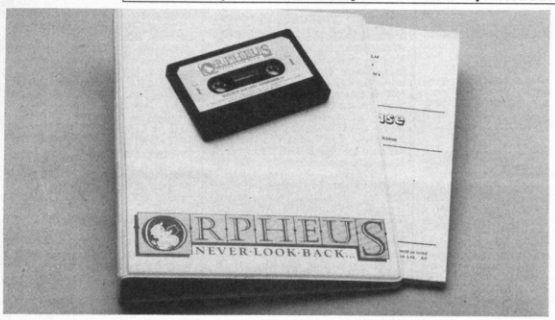
Features	●●●●
Documentation	●●●●
Performance	●●●●
Overall value	●●●●●

Name *MonQL* **Application** Machine code Monitor/Toolkit **Price** £19.95 **Availability** HiSoft 0582-696421

SOFTWARE PRO-TEST: COMMODORE/ORIC

POWER BASE

Orpheus' database for the Oric/Atmos and Commodore 64 is surprisingly powerful and its easy access to data impressed David Janda.



Home computer databases don't, as a rule, have powerful features and easy access to stored data. *Megabase*, however, breaks the mould by offering some facilities normally associated with high-level products such as *dBase II* — an interactive query language, for instance, which allows you to interrogate the data file using simple commands.

Megabase is available for the Oric/Atmos and the Commodore 64 on tape or disk. I used the Commodore 64 tape version.

Documentation

The tape, documentation and registration form are supplied in a white ring-binder. The 35 pages of instructions (index included), are written for both the Atmos and Commodore user: unfortunately, the text is confusing in places.

That aside, the documentation is good. The manual divides into three sections, covering general use, advanced use and the macro facility.

Features

The program can be used several ways. Single commands such as DUMP can be entered and immediately executed. For operations on the whole file, a sentence of commands can be entered (see box) this is the most powerful way of using *Megabase*.

Minimal screen formatting is included. The screen scrolls after each command or sentence is executed. SELECT followed by field names selects fields which can then be DUMPED, *ie* displayed. If fancier displays are required, use the PRINT command, followed by names of fields, literals such as 'age is' with CR for carriage return and FF for form feed. Enabling and disabling a printer is via PON and POFF.

A limited number of mathematical operations can be performed on numerical data. Add, subtract, and multiply are used in the form:

operation a TO/BY b

where 'a' and 'b' can be numeric fields, numeric literals or registers. There are 19 registers which can be used for temporary storage of numbers.

In use

Once loaded, a main menu is displayed which offers choices of loading a data file from tape or disk. A third option allows you to create a new file.

Starting up a new file is easy enough. The total number of fields required is entered, and *Megabase* prompts for the name and type (alpha or numeric) of each one. The ENTER command is used to add records to the file and prompts the user with the name of each field in turn. A nice feature is that the amount of free memory remaining is displayed after a record is entered.

Unfortunately, if you want to add or delete a field or even change the name you must start from scratch as there are no appropriate options. At this point I noticed a bug: entering FIELD should have displayed the names of the fields, but alas this was not the case.

I was impressed by the speed of the sort command. It is followed by a field name together with A or D which indicates whether the field is to be sorted in ascending or descending order. If secondary fields are specified, *Megabase* sorts them if there is more than one match on the primary field.

The only grumbles I have concerning the package are the slowness of the screen output, and that the PRINT command sometimes ignored literals.

Verdict

Apart from the few buggettes I was very impressed. I didn't feel restricted, as I have done with other packages and the free-format in searching/sorting and displaying of data is most welcome — its IQL is particularly useful.

The IQL and Macros

Megabase offers numerous commands which can be used on their own. But the real power of the package is demonstrated by using a number of them together — *ie* in a 'sentence'.

A sentence can begin with ATR which means 'at each record'. An example of this could be:

ATR PRINT "Name" name "Age" age CR.

To specify what records you want, FIND can precede ATR and is followed by selective criteria. An example of this could be:

FIND name = Fred ATR PRINT "Yet another" name CR

In printing reports and so on, one-shot commands may be useful for printing headers etc. This is done in *Megabase* with BEGIN..ATR..END. An example could be:

FIND amount > O BEGIN PRINT "Total income summary" CR ATR PRINT "Weekly income" total END PRINT "End of report"

FIND is usually good enough to select records, yet further selection can be made by using IF..ENDIF An example of this is:

FIND gross > O ATR SUBTRACT tax FROM gross IF gross < O PRINT "Panic!"
ENDIF

Sentences can be edited, and saved to disk or tape as Macros. Further features allow the user to INPUT a value when a Macro is run. Once a Macro has been named it is possible to pass parameters to it:

MACRUN select David"

In this example, the Macro called 'select' is run and the value 'David' is passed to it. Wherever '&' is found in the sentence, David is inserted.

REPORT CARD: 1 TO 5

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

Name Megabase **System** Commodore 64, Oric 1/Atmos **Price** £24.95 **Manufacturer** Orpheus, Unit 1, The Smithy, Church Farm, Hatley St George, Nr Sandy, Beds. 0767-51481 **Availability** Mail order and retail.

PCN Billboard

Atari

Atari 800 48K, with games, £95. Tel: 01-570-3690.

Atari 600XL £50. 1064 64K memory expansion £60. Tel: Tunbridge Wells 20694.

Atari 600XL plus cassette plus joystick cartridges and cassette software, books, magazines etc. Excellent introduction to computing £100 ono. Tel: Southport 0704-214839 evenings.

Atari Software, disks: Reston's Paint £12, Datasoft's Basic Compiler £25. Wanted: DiskBank or Floppy Manager disk boxes. Tel: Keith, 021-328-6853.

Atari 1050 disk drive wanted; also games on disk wanted. Tel: 0904-791067 after 6pm.

Atari 800XL 1010 recorder, hardware cartridge backup utility, 3 cartridges, books, manuals, lots of software, 3 months old. Unwanted Christmas gift £160 ono. Tel: Dave 021-743-5203 after 6pm weekdays.

Atari original software for sale, over 140 programs, tapes £3, disks £4, ROMs £5. Tel: Colin, 05806-3830 after 6pm or at weekends.

Amstrad

Amstrad CPC 464 + colour monitor, software, joystick, firmware manuals. Books, + 100 blank data cassettes. £300 ono. Tel: Romford 60360.

Amstrad Software laserprint 464 The Style-Writer £5.50. Database (Kuma) £8. S. Law, 36 Church St, Littleborough, Manchester.

Amstrad Games Hunter Killer, Roland On The Ropes, Roland In The Caves, Spannerman, Snooker. All £4.50. S. Law, 36 Church St, Littleborough, Manchester.

For sale. Amstrad GT64 Green screen monitor. Only used for three months, excellent condition. (Owner has obtained colour monitor) Offers?. Tel: Slough 72208.

Amstrad printer, DMP1, nearly new, still 11 months warranty left. A real bargain at £150 for quick sale. Anyone willing to swap/buy Amstrad software. Tel: 0203-316599.

Wanted Amstrad Interface to connect to ZX printer. Tel: Scunthorpe 854849.

Wanted ZX81. Must be in working order. Up to £10 paid. Tel: 0481-26168 with price wanted after 6pm.

Amstrad software Quickshot II, joystick £6.50, software, Star, Roland On The Run, Steve Davis, Snooker etc. All £4.50. Tel: 061-795-8025 after 5.30pm.

Amstrad for sale. Blagger, Roland In Caves, Ghouls, Snooker. All originals. Also various Amstrad books. Tel: Tyneside 091-2665184 after 5.30pm.

Amstrad Originals: Sultan's Maze, Message/ Andromeda, Jewels/Babylon, Country Cottages, Forest/Worlds End, Gems/Stradus. Send swap list to D Nale, 116 McDonald Road, Edinburgh.

Newbrain

Newbrain AD, monitor, Tandy Printer, cables, programs and books £200 the lot. Also Intellivision game and voice module +26, carts £50. Tel: Wishaw 350027.

Newbrain AD. Kaga amber monitor, all manuals, cassette recorder, spare PSU, some games software. All mounted as one unit. £180. Tel: Brighton 556184.

Newbrain Peripherals wanted. Expansion board, leads, tapes, books, printer if cheap. Tel: 0423-69567 (5-6pm).

Oric

Oric 1 48K and 41 games including Hobbit, Zenon-1, Zorgons Revenge, Franklins Tom B. £250 ono. Cash only. Tel: Adlington 480-921. Contact after 6.30pm.

Wanted Oric Forth Xchange Ghost Gobbler plus Oric Munch. Also required Issue Two of Your Spectrum. Tel: 0908-310134.

Oric Forth cassette and Forth manual, unused. £8. Tel: 0943-74367 (Ilkley, Yorks).

Oric to Epson printer lead. As new £10. Tel: Leeds 871492 after 6pm.

Oric 1 software, sell or swap for Atmos software, 18 titles inc Skramble, Chess, Oric-Mon, Galaxians, Aster-

Sinclair

Wanted broken Spectrum 16K or 48K. Must be cheap. Keyboard not important. Please phone after 6pm with price. Tel: 0481-26168.

48K Spectrum, Kempston interface, tape recorder, software including Daley Thompsons Decathlon, Dangermouse, Jet Set Willy and many others £95 the lot. Tel: Todmorden 3846.

Keyboard for Spectrum. Metal cased, plugs into Spectrum P.C.B. £20. Tel: 041-959 6125.

Sinclair software to swap or sell. Over 150 top titles eg Cyclone Airwolf Backpackers Guide etc. Write, Andy Webster, 30 Westbourne Gdns, Glasgow G12.

Spectrum software Tape #1 10 quality programs incl. Skiier and Wall £3.99. Clone: copies full size files (41.5K) £1.99. Tel: Leicester 710519 ask for Nick.

Pen-pal wanted with Spectrum, who has games, programs and tips to offer. Write Richard Sharp, 1 Hall Ave, Fenham, Newcastle Upon Tyne NE4 9HX.

48K Spectrum includes ZX Printer, Interface 2, Fox programmable joystick interface, Sharp cassette recorder, £100 original games, worth £345, sell for £165 o.n.o. Tel: 0582-660433 (Dunstable).

Spectrum software Hobbit, Valhalla, Psytron, Ant-Attack, Penetrator, Time-Gate, Kong, Alchemist, Trans-Am, Zoom, Maziacs, Horace Scuba-Dive, Penpy, Planetoids, Atic-Atac, Quest. Reasonable offers. Tel: (Glasgow) 041-881 6881.

Spectrum keyboard. £20. No soldering. Unwanted gift. Extra shift, space bar, joystick port. Power pack, add-ons fit inside. Tel: 01-661 1032 after 4.30.

48K Spectrum, leads, tape recorder, £30 worth of magazines and £500 worth of software. £220 ono. Tel: Pete (0594) 24920 Glos.

Wanted: Spectrum 48K + leads and manual. Pay £60 ono. Tel: Simon 061-485 3098.

Sinclair QL, as new, with games, sprite designer, machine code tutor, only £320 ono. Tel: 0325-312417 after 4pm.

Spectrum software sale Sherlock £4, Lomidnight £4; Doomdarks £4; White Lightning £7.50. All originals also Lo-profile keyboard £30. Tel: Melvyn 0977-511205 (after 6pm).

Spectrum Plus, cassette recorder, Kempston pro joystick interface, Kempston pro joystick, software and manuals. All new. £150 ono. Tel: Neil on 01-886 3052 after 6pm.

Spectrum programmable joystick interface, easy operation, with *all* games. Brand new, including top software. Bargain £25, joystick not sold. Tel: 01-903 4930 anytime. Poleposition wanted.

48K Spectrum in good condition. Still boxed with some games. £75. Tel: Byfleet 45386 (eves).

Spectrum 48K and tape recorder + Fuller keyboard + Micro Power sound board and Analog joystick + six games £95 ono. Tel: (03744) 5006 Essex.

Spectrum 48K software, Pimania, Jokers Wild, Spectrum monitor, all £4 – from Tony Stiles, 20 Montfort Road, Romsey, Hants SO5 8SS.

48K Spectrum Plus VTX 5000 cassette recorder books and software (Fighter Pilot) (Football Manager) etc. Quick sale £150. Phone Kirk 01-555 2776 after 6pm.

Spectrum 5.25in disk drive + Datafax interface fully compatible with all 48K Spectrums. Bargain at £100 inc del. Ring after 6pm and ask for Mark. Tel: 051-339 9605.

SUPPORT YOUR NEWSAGENT...

...and guarantee your weekly copy of

PERSONAL COMPUTER NEWS

NEWSAGENT ORDER FORM

If you would like to make sure your newsagent keeps you a copy of Personal Computer News every week, then just complete this form and pass it to your local newsagent today.

Please reserve me a weekly copy of Personal Computer News until further notice.

☐ I'll collect it

☐ Please deliver it to the address below

Name.....

Address.....

.....

.....

MICROSHOP

Rates: £12 per single column cm. Minimum size 3cm. Series discount available. Also spot colour available. **Mechanical Data:** Column width, 1 column 57mm. 2 columns 118mm. 3 columns 179mm. **Copy Dates:** 10 days prior to publication.
Contact: Jacqui Edmiston on 636 6890

FLOPPY DISCS

5¼" bulk packed by MEMOREX and OTHER MAJOR MANUFACTURERS from 89p each + VAT. Please phone for minimum quantities and other details

BOLTON WELLS LTD 01-435 2411

WHY PAY MORE
CUMANA DS/QD DISCS IN THEIR OWN LIBRARY BOX

Cumana discs are top quality DS/QD 96TPI discs in Cumana's own packaging. This includes a plastic flip-top library box. These discs are suitable for all makes of disc drive including single sided ones.

Prices include delivery.
1-5 boxes DS/QD 96TPI £17.50 + VAT
6-10 boxes DS/QD 96TPI £17.00 + VAT
10 boxes DS/QD 96TPI £16.50 + VAT
48 hour delivery service

Please send payment or phone to use credit card. Large quantity education discounts given.

Micro Resources Limited
Southfield House, 11 Liverpool Gardens, Worthing, Sussex BN11 1RY
Telephone: Worthing (0903) 213174

PRINTER PROBLEMS? SERIAL — CENTRONICS CONVERTER £59.95

If you own an EPSON HX20, PX8, NEWBRAIN, SINCLAIR SPECTRUM with INTERFACE 1, Q.L, APPLE IIC OR COMMODORE 64* and wish to save money on printers call us now. No special software required, needs no external power.

TYEPRO LTD, 30 CAMPKIN ROAD CAMBRIDGE CB4 2NG
Tel: 0255 422087 (Day)
0223 322 394 (Eve)

DEALER ENQUIRIES WELCOME

Computer Repair Centre

Have you got problems with your computer? Then call us for:

BBC, Commodore, Spectrum, Dragon

MASTERCARD VISA

Mail order or call in

Enfield Communications
135 High Street, Ponders End, Middx.
Tel: 01-805 7772

COMPUTER REPAIRS IN SOUTHEND

SPECTRUM. BBC. ELECTRON
CBM64. VIC 20

MINNIE MICRO ELECTRONICS
12 Eastern Esplanade. Southend
Tel: 0702 62033 615809
Open 7 days a Week

BASIC COMPILER

Now supports around 90 key words. Turns Basic Programs into really fast Machine Codes. Its very easy to use and comes complete with full instructions. **Suitable for the BBC Model B or Model A.**

Enquire at your local computer store or order direct (post free) from:

Cassette	Cheque/P.O. or SAE for details to	**£26.95**
Disk (40/80 TRACK)	**ACK Data**	**£28.95**

DEPT PCN
21 Saicombe Drive, Redhill, Nottingham, NG5 8JF
Tel: (0602) 262498
DEALER ENQUIRIES WELCOME

WANTED PERSONAL COMPUTERS

all models bought for cash

Morgan Camera Company
160 Tottenham Court Road, London W1. Tel: 01-388 2562

BBC 27128/250ns EPROM

Hitachi prime stock. Fast delivery

1-2 pieces £8.26 + VAT = £9.50
3-49 pcs £7.39 + VAT = £8.50

Send UK cheques, Money Orders to:
Dept. PCN, SILICON CITY, 1 Milton Road Cambridge CB4 1UY.
Access/Visa orders, phone 0223 312453

BINARY BANANA

AMSTRAD 464

MAGIC PEN: By itself, probably the ultimate ART utility. Save to tape — supplied with loader sketch, or filed. **£4.95. SYMBOL 464:** Design your own lettering, copy pictures from anywhere or original. Save to tape plus decimal print-out. **£3.95. BIG LETTERS:** By itself it's good, with the above, fantastic. Big lettering to 224 pixels. Save to tape. **£2.95. PAINT 464:** Add the fill function. Full or alternative line, plus program subroutine supplied. **£3.50. MOVE IT:** Move the files produced around with this handy utility. **£2.50. THE ARTISTS EASEL:** Now with airbrush + screen dump facility. A collection of integrated graphic functions and subroutines, "25" options plus MAGIC PEN, plus SYMBOL 464, plus BIG LETTERS, plus PAINT 464, plus MOVE IT with handbook. The complete collection: **£9.95**

All price inc. p&p. Export enquiries welcome.
Binary Banana c/o Pitec Ltd, Park Crescent, Peterborough PE1 4BG.

CHILTERN COMPUTER CENTRE

★ Fast, reliable repair service ★

Spectrum £18.00

We also repair BBC, CBM64, Vic 20, Amstrad, Oric Dragon and others, plus printers and disk drives.

PLEASE RING FOR DETAILS.

3 month warranty on all repairs. Send computer with details of fault and cheque to:

NEWCROWN COMPUTERS LTD (PCN)
76B Dallow Road, Luton, Beds. LU1 1LY
Tel: (0582) 455684
Overseas enquiries welcome

MASTERCARD VISA

DATA MANAGEMENT
— Leading the way in QL software —

are at: **12, Larch Way**
Haxby, York Y03 8RU. ***Tel:*** **(0904) 760351**
Our April list now available. Please send or call for details.

AMSTRAD CPC 464
UTILITY PROGRAMS FROM PRIDE

Always the first and the best software. Offering more features and better value for money than other similar programs available. We also offer a fast reliable and friendly mail order service.

SYCLONE Convert your programs to load in up to four times faster
★ Commands available from Basic
★ Choice of four loading speeds, 1000 to 4000 baud
★ Comprehensive header reader
★ Load and list protected basic programs
List your "Welcome" tape. Cassette £6.95 inc P&P

★★ NEW ★★

TRANSMAT Transfer your programs onto Amstrad Disc System.
★ Faithfully transfer cassette based software to disk
★ Add relocator if necessary
★ Auto or non auto modes
★ Erase or rename programs
★ Comprehensive header reader
Cassette £7.95 inc P&P

SPECIAL OFFER WORTH £3.95
Buy both and get a cassette containing a real time digital alarm clock **FREE** including its P&P (While stock last!)

Europe — add £1.00 per title,
rest of world — add £1.50 per title.

PRIDE UTILITIES LTD (PCN)
7 CHALTON HEIGHTS,
CHALTON, LUTON, BEDS LU4 9UF
Customer enquiries. Tel: 0582-411686 (9-10am)

Now you can drive an EPSON printer direct from your 64!

Comprint for your 64

"Excellent value for money... it beats its rivals on several counts" (Personal Computer News, 12.1.85)

£61.99
incl. VAT & carriage

Yes! Comprint/E gives you EPSON printing quality and special printing modes PLUS emulation of Commodore printer features * Simply plugs into any Epson FX/MX/RX printer * Links to the 64 or Vic 20 serial-IEEE port with the cable provided * Why not buy your Epson printer direct from us at the same time?

A>Line
☎ (053 758) 486

A Line Computer Systems
1 Church Farm Lane
Willoughby Waterleys
Leicestershire. LE8 3UD

• Bridge Players •

Improve your play with this easy to understand program. At present available for BBC Model B, your program will remove any worries about bidding — at the end of each hand the computer tells you how many mistakes you have made and sums up your hand for you. Please write for further details or send cheques/PO to:

V. Milburn: 61 Hainault Road, Chigwell, Essex IG7 5DH.

Cassette £7.95 including P&P
Disc £9.95 (state 40/80 track)
Program: No. 1, for intermediate players, 2 for not quite beginners — please state which is required.

• Enquiries from other micro owners welcome •

CURE ALL YOUR CAR ILLS!

Car owners! Let your home computer start saving you money, use this revolutionary new tool **"Car Cure"** to help you find faults on your car. **Trace 300** symptoms and **Locate 900** faults with the support of your own expert mechanic then **determine** the cure. **48K Spectrum version available now only £9.95.**
Available direct or send s. a. e. for detailed guide to the program to:

4 CLARENCE DRIVE, (DEPT. PCN), EAST GRINSTEAD, W. SUSSEX RH19 4HZ. TEL: (0342) 28388.

SIMTRON
PROGRAMS TO HELP YOU

MICROSHOP

SPECIAL OFFER
Datalife
disks at unbelievable prices!!!
15% OFF already LOW prices until 30th June 1985
Write or phone NOW for Offer details and Special Order form.
CONWAY COMPUTER SERVICES LTD
39 CONWAY RD · LONDON · N15 3BB
Tel: (01) 800-1796 (01) 802-1007
Data Processing Supplies & Peripherals

SINCLAIR COMPUTER REPAIRS
Fast, reliable repairs by experienced engineers, having serviced Sinclair computers since the introduction of the ZX80. Our price is inclusive of all parts, labour, postage and VAT irrespective of fault. *No hidden charges. *While-you-wait service available. Spectrum £18.75. ZX81 £11.50. 16K Ram £9.95. Call or send with cheque or P.O. to: T V Services of Cambridge Ltd, French's Road, Cambridge CB4 3NP. Tel (0223) 311371.
Now available
SPECTRUM 'XK' MEMORY EXPANSION SYSTEM
XK System Kit £15.95 inc. VAT
XK System Factory fitted £20.95 inc. VAT

SITUATIONS VACANT

At last, the chance to use your micro knowledge for profit, instead of just for pleasure (in Windsor or Manchester).

If you weren't someone with a serious interest in microcomputers, you wouldn't be reading this magazine.

And if we didn't have a serious proposition to put to you, we wouldn't be running this advertisement.

We want to talk to you about a professional career in an area of our business that's really starting to go places.

The career is lecturing; the business area is Office Systems.

With products such as the DRS range of business micros, the One-Per-Desk electronic office terminal, and some very smart applications, communications and operating software, we can give organisations' offices the massive boost in efficiency that's already happening in other parts of their business.

We believe that with your knowledge of professional micros, and particularly their operating systems, you could be just the right man or woman to explain to our customers exactly how to get the best from their ICL Office Systems.

It's a career which certainly has a lot of variety.

One day, you could be teaching clerical staff how to feel at home with unfamiliar technology.

The next, you could be starting on a week of lectures to help senior management understand and make the best use of our networking systems and communications protocols.

We are interested in your understanding of micros, your ability to communicate technical facts to non-technical audiences, and your highly infectious enthusiasm for your subject.

Equipped with qualities such as these, and supported by our own training in lecturing techniques, you'll be well placed for a long-term career with Europe's leading provider of computer-based business solutions.

It that's a prospect that appeals to you, we'd like the opportunity to answer all the questions you'll certainly have about such a fundamental change in direction in your career.

Please write enclosing cv to Melody Hermon, Personnel Officer Training, ICL, Beaumont, Old Windsor, Windsor, Berks SL4 2JP.

We should be talking to each other. ICL

ICL IS A MEMBER OF THE STANDARD TELEPHONES AND CABLES PLC GROUP OF COMPANIES

THE NEW 'FOREST' RANGE OF CABINETS

A new range of computer cabinets, made by our own craftsmen, designed especially for your Home Computer System. Send S.A.E. for leaflet and price list to:

NEW FOREST CABINET MAKERS LTD
85 DERBY ROAD, EASTLEIGH
HANTS SO5 5GW

BBC SPECTRUM REPAIRS

★ Spectrum repairs £18.50 inc. parts insurance and p.p.
★ BBC B repairs £18.50 + parts, insurance and p+p.
Send your computer with cheque or P.O. for £18.50 and description of fault to:

SUREDATA (PCN)
Computer Service
45 Wychwood Avenue, Edgware, Middx.
Tel: 01-951 0124

PROGRAMMERS

Urgently required for CONVERSION WORK from CBM64 onto AMSTRAD. Must be HIGH QUALITY and conversant with MACHINE CODE. Write, giving full details, plus any samples of your work to:—

SEVERN SOFTWARE
15, HIGH STREET
LYDNEY
GLOS
GL15 5DP

We are also very interested in evaluating software for **SPECTRUM/CBM64/AMSTRAD**

WD Software

FOR THE QL

WD Utilities (3rd ed) **(base £5.50)**
PRINT 60-file DIRectory or view it on one screen, one-key LOAD, COPY or PRINT 60 files with one key (allows for namesakes). Multiple FORMATting to prevent corruption by stretching of tape. TOOLkit to give dated, numbered modules in program development. PRUNE old files to release space (one key DELETEs a file). Full instructions in QUILL file. Use up to 6 EXTRA MICRODRIVES (add on your Spectrum ones)!

WD Utilities for CST Discs **(base £8)**
100-file capacity, for CST/Computamate disc system WITH all microdrive facilities.

WD Morse Tutor **(base £4)**
Specification as for Spectrum but no speech (hurry up, Currah!)

Ref QL (1st ed) **(base £1)**
100+ useful QL references in an ARCHIVE file.

For the 48K Spectrum

WD Morse Tutor **(base £4)**
From absolute beginner to beyond RYA and Amateur Radio receiving. Adjust pitch. Set speed to your test level (4-19 wpm). Learn from single characters, via groups with wide spaces to random sentences; decrease spacing to normal. Write down what you hear, then CHECK on Screen or Printer or LISTEN to phonetic TALKBACK from Currah MicroSpeech if fitted. Also own message, random figures, letters or mixed.

Tradewind **(base £4)**
Sailing/trading strategy game with graphic surprises.

Jersey Quest **(base £4)**
Text adventure with Bergerac and the Dragon.

Prices
Spectrum Cassettes — base price only
QL or Spectrum Microdrives — £2 cartridge plus base price
5.25" floppies £2 plus base (SPDOS for Spectrum)
Two or more programs on one medium — pay medium + base. E.G. WD Utilities and RefQL for £8.50, but IMPOSSIBLE to mix QL and Spectrum programs on one medium. Send OUR cartridge and 25p to update earlier editions.

WDSoftware, Hilltop, St Mary, Jersey
Tel: (0534) 81392

SOFTWARE UP FOR GRABS

100's of TITLES

UP TO 50% OFF!

Manufacturers' Recommended Retail Prices

Many of the top cassette based titles for all the popular makes of computers are on offer- with a full money back guarantee if not highly delighted.

Send for FREE descriptive catalogue

Please rush me your FREE descriptive software catalogue
Make of Computer _____
Name _____
Address _____

PHILIPS & PHILIPS CO LTD
Scriptomatic House, Torrington Park,
Finchley, London N12 9QU
Telephone 01 446 5648

NEW PSION SOFTWARE

Sinclair QL with version 2 Psion packages	£389.99
Simplex Data 256K Ram expansion	£198.00

	single	dual
3.5" or 5.25" 360K system	£308	£475
3.5" or 5.25" 720K system	£349	£529

QDISC 'systems' include, disc interface, power supply typeset manual, VAT + delivery

Telephone for prices of MEDIC DATASYSTEMS QL disc drives

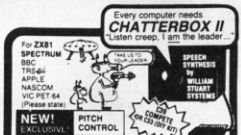
QDISC disc interface alone	£149
Microvitec CUB with cable	£265
Microdrive '4 packs' (as with QL)	£9.99
ZKul or West (adventures)	£19.00
Psion Chess	£19.00
QL Art (Eidersoft)	£15.95
QL Serial cable	£15.95
QL Centronics Interface	£38.00
Computer One PASCAL	£39.95
Computer One FORTH	£39.95
Computer One Assembler	£29.95
Computer One Monitor	£24.95
Computer One Typing Tutor	£24.95
Metacomco Assembler	£34.95
Compware Toolkit	£14.95
Box of 10 5.25" discs	£29.95

All prices include VAT and delivery

57 Repton Drive Haslington, Crewe CW1 1SA
Tel: (0270) 582301

COMPWARE

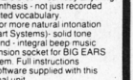
Every computer needs
CHATTERBOX II
"Listen creep, I am the leader"



Genuine phoneme synthesis - not just recorded speech - hence unlimited vocabulary.
Programmable pitch for more natural intonation (exclusive to Wm Stuart Systems)- solid tone cabinet for quality sound - integral beep music amplifier. **PLUS** expansion socket for BIG EARS voice recognition system. Full instructions technical notes and software supplied with this outstanding educational unit.
DEALER ENQUIRIES WELCOME

As seen on BBC TV "Computer Programme"

BIG EARS



SPEECH INPUT FOR ANY COMPUTER

Hugely successful Speech Recognition System complete with microphone software and full instructions.

ONLY £49

BUILT TESTED & GUARANTEED
PLEASE STATE COMPUTER. UK101 SPECTRUM ATOM NASCOM2 Vic 20 Micron. ZX80 81 PET TRS80 MZ80K APPLE II BBC MICRO. CBM 64

ZX81/SPECTRUM **NEW!**

MUSIC SYNTHESISER (Stereo)
- 16 LINE CONTROL PORT

Play 3-part music, sound effects, drums etc. Full control of attack, decay and frequency. Input/Output lines provide control and monitor facility for Home Security, Robot Control, Model Railway etc. etc. Works with or without 16K RAM

Full instructions software included
Add keyboard to make a live performance polyphonic synthesiser!
Note: up to 3 units can be used simultaneously giving 9 music channels & 48 I/O lines

AMAZING VALUE AT ONLY £19.50 (kit) **£25.50** (BUILT)

Please add VAT at 15% to prices.
Barclay Access orders accepted by telephone

All enquiries S.A.E. please

WILLIAM STUART SYSTEMS Ltd
Quarley Down House
Chadonton
Nr. Salisbury
Wiltshire SP4 0DZ
Tel 098 064 235

HEMEL COMPUTER CENTRE LTD.

For fast reliable repair service, send your 16/48K Spectrum computer to us. We will repair and return for £20 + £1.60 p&p.
Also BBC, Commodore, Atari and Dragon service.

Three months warranty on all repairs.

Hemel Computer Centre Ltd.
52 High Street,
Hemel Hempstead,
Herts HP1 3AF.
Tel: 0442 212436

MODEM LINE TERMINAL UNIT VM 65001

This unit is the line interface for a processor-controlled modem with auto-dial designed to work at 1200/75 or 1200/1200. Fitted with new plan plug supplied with full CC7 diagram and connections.

★ £12.00 ★

SENDZ COMPONENTS

63 Bishop Steignton, Shoeburyness, Essex SS3 8AF. Tel: 332992

You've read the feature, now for the components you need, and all your computer components, read on!
We will try and track down ANY special components you need for no extra cost, see our SPECIAL OFFERS

Logic Probe Kit	£6.50
Sideways RAM 6264	£21.39
Eproms 2764	£8.21
27128	£15.00

*VAT INCLUDED *ADD 50p p&p*
Don't delay, order today or send for more details to:

L & E MICRO PERIPHERALS
5 Quarrington Close,
Kennet Lea Estate,
Thatcham, Berks RG13 4YE

QUIT

Mikro-Gen has come up with a new twist on pre-annoucing products. The company has recently published an advertisement that says 'We're sorry'.

The ad is allegedly an apology for not having Everyone's a Wally ready, and burbles on about the difficulties involved in programming five different characters in a multi-role arcade aventure, and about how Mikro-Gen wasn't prepared to release a programme of less than the highest possible standard.

After you've read it you're left with a warm feeling, thinking something on the lines of 'Coo, aren't the people at Mikro-Gen clever, being on the point of finishing something that difficult . . .'

That is if you don't remember the earlier ads, which refer to versions of the game as 'Spectrum 48K £9.95, Commodore 64 £9.95. Available shortly on Amstrad CPC464.' If it's available shortly on the Amstrad, the clear implication is that the Spectrum and 64 versions are already out, which means Mikro-Gen should really apologise for telling pork pies.

The white heat of technology has also struck at Telecom Gold. The electronic mail service has recently discovered the electronic equivalent of the telephone directory, and has introduced an experimental file that catalogues the system's users. There are, however, a few teething problems. The main one is the fact that the users appear to input their own entries, and if the complete directory is anything to go on, a right bunch of wallies they must be.

Problem one is that the entries seem to go through some alphabetical sort routine, so if you type in John Smith rather than Smith John you'll find yourself filed under J, and if you call yourself Mr or Mrs you'll find yourself filed under M.

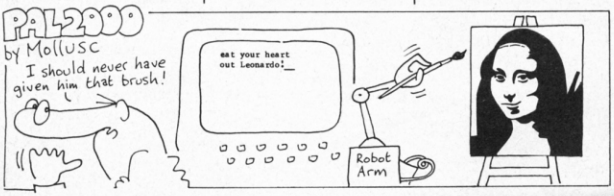
Over at Sinclair we have interesting intelligence on the future of the QL. Sinclair has started producing a technical newsletter to aid people writing software for the beast, and this comes up with: 'software should not assume the use of Microdrives as a medium'. What could this mean?

We're inclined to check this by running the QL's date of birth through Super Teams, a stunning new biorythms program from Gilvale Software. Although Super Teams may sound like some kind of pools program, it's actually 'an essential tool for everyone interested in day-to-day interpretations and applications of biorhythms.' What, both of them?

But Super Teams is much more versatile than that. It uses the Gregorian Calendar, which goes back as far as 14th September 1752 (handy if you're 233 years old). Gilvale recommends it for historians checking to see if Napoleon was on a downer at Waterloo, as a tool for industry, or even in the home. 'Find out why your mother-in-law is so difficult to get along with. Or why your family is the way it is.' Because you're the sort of person who blows £10 on this sort of program, we suppose.

Ordinary people might have a few mates round for a drink every now and again, but not Sir Clive. Our picture shows the scene at Sir Clive's Cambridge home last month when Sinclair Research played host to educationalists from 14 countries, including China and the USSR. Here we see the Yugoslav Ambassador (centre) demonstrating the Spectrum's capabilities to the throng assembled in Sir Clive's study.

But if you look closely, at the top right of the picture, you can see something interesting. It's a QL, and it's still in the box. Come on Sir Clive, open the box and get stuck in, it's a nice machine once you've got the hang of it.



PCN DATELINES

Event	Dates	Venue	Organisers
TI99/4a Exchange (UK TI User Group)	April 28	Royal Pavilion, Brighton	Clive Scally, 0273-503968 after 7.30pm
Computer Aided Production Management Exhibition	April 30-May 2	Wembley Conference Centre	David Houchin, 01-579 9411
COMDEX Spring	May 6-9	Atlanta, USA	Interface Group, 300 First Avenue, Needham MA 02194, USA
Apple 85	May 9-11	Novatel Complex, Hammersmith, London	Pamela Goodwin, 061-480 7863
Electron and BBC Micro User Show	May 9-12	New Horticultural Hall, London	Database Publications, 061-456 8383
Micro City 85	May 14-16	Bristol Exhibition Complex	Argus Specialist Exhbns 04427-73291
Hong Kong Comp Conf & Exhbn	May 21-24	Hong Kong	Trend Exhbn, 1203 Wah Kwong Building, 60 Hennessy Road, Hong Kong
DEXPO South	May 26-29	New Orleans, USA	Reed Exhbns 01-643 8040
Compec Europe	May 7-9	Brussels	CGP 01-528 9256
Nat Software & Comp Exhbn	May 29-31	Brisbane, Australia	Riddell Exhbn Promotions, Riddell House, 137/141 Burnley Street, Richmond, Victoria 3121, Australia
Business Computer Show	June 4-6	Earls Court, London	Reed Exhbns 01-643 8040
Computer Peripherals & Equipment Trade Exhbn (COMPETA)	June 4-6	Kensington Exhbn Centre, London	Network Events 0280-815226

EDITORIAL: Editor Peter Worlock **Deputy editor** David Guest **Production editor** Lauraine Turner **Editor's assistant** Karen Isaac **Features editor** John Lettice **Software editor** Bryan Skinner **Peripherals editor** Kenn Garroch **Hardware editor** Stuart Cooke **Art editor** Dave Alexander
PUBLISHER Tony Harris **Publishing manager** Peter Goldstein
ADVERTISING: Advertisement manager Sarah Barron **Assistant advertisement manager** Laura Cade **Sales executives** Phil Benson, Mike Blackman, Jacqui Edmiston, Andrew Flint, Sarah Musgrave, Tony O'Reilly **Production** Richard Gaffrey **Advertisement assistant** Andrea Laurence **Subscription enquiries** Gill Stevens **Subscription address** 53 Frith Street London W1A 2HG 01-439 4242 **Editorial address** 62 Oxford Street London W1A 2HG, 01-636 6890 **Advertising address** 62 Oxford Street London W1A 2HG 01-323 3211 **Published by** VNU Business Publications, Evelyn House, 62 Oxford Street London W1A 2HG © VNU 1983. No material may be reproduced in whole or in part without written consent from the copyright holders. Photoset by Quickset, 184-186 Old Street, London EC1. Printed by Chase Web Offset, St Austell, Cornwall. Distributed by Seymour Press, 334 Brixton Road, London SW9, 01-733 4444. Registered at the PO as a newspaper

WIN A
PORSCHE 924
(or cash equivalent)
see pack for details

·TAKE THE CHALLENGE·

GYRON

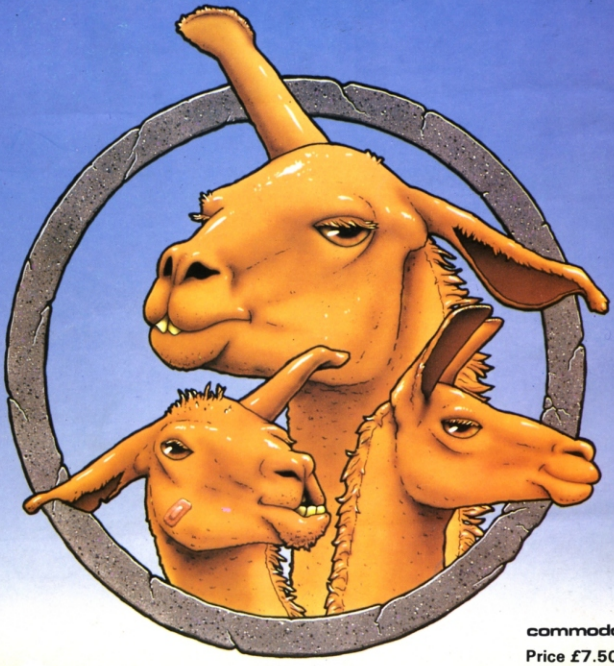
firebird

FIREBIRD SOFTWARE · WELLINGTON HOUSE
UPPER ST MARTIN'S LANE · LONDON WC2H 9DL

FIREBIRD IS A TRADEMARK OF BRITISH TELECOMMUNICATIONS PLC.

GOLD EDITION
48K SPECTRUM £9.95

MAMA LLAMA



commodore 64

Price £7.50

LlamaSoft

ORIGINAL SOFTWARE DESIGN

AVAILABLE FROM W.H. SMITHS, BOOTS, WOOLWORTHS AND MOST COMPUTER RETAILERS OR FROM LLAMASOFT 49 MOUNT PLEASANT, TADLEY, HANTS (TEL. 07356 4478) SAE FOR CATALOGUE & NEWSLETTER

'THE NATURE OF THE BEAST!