

**Independent  
guide to the  
BBC MICRO!**

**Three full-length games**  
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crosses, trap the mutant flies

# **THE MICRO USER**

Volume 3  
Number 5  
July 1985  
£1.25



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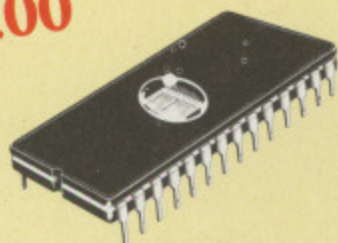


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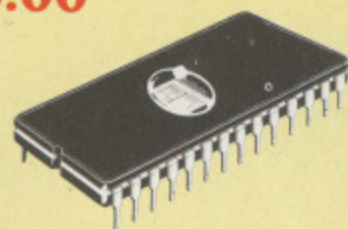
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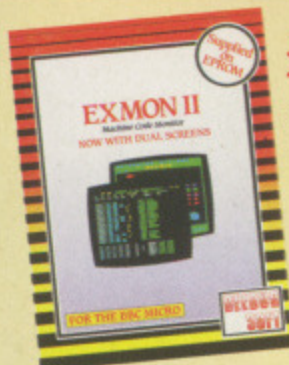
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AUTO DISC MENU  
AUG 1984



FAST FILL ROUTINE  
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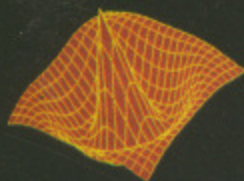


DOMINOES  
MAY 1984

BEEBUG Function Key Editor

- 1) - List keys
- 2) - Edit key
- 3) - Delete key(s)
- 4) - Connect to tab(s)
- 5) - Print key buffer space left
- 6) - Expand keys
- 7) - Update definitions
- 8) - Exit

FUNCTION KEY EDITOR  
MAY 1984



3D SURFACES  
JAN 1985

STEWAYS ROM INDEX

ROM NUMBER    ROM TITLE

BASIC  
PROLOG  
ECHO  
WORDWISE-PLUS

TOOLKIT  
HELP  
OF V. 1.10  
EXROM II

IPS

ROM READER  
MARCH 1984



BODY POPPING  
MARCH 1985



GRAND PRIX  
JUNE 1984

Press the key to select the program of your choice

1) KITCHEN  
2) SHOPPING  
3) BAKING  
4) CLEANING  
5) REPAIRS  
6) GARDENING  
7) SPORTS  
8) MUSIC  
9) ARTS  
10) OTHER

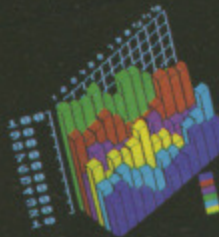
AUTO DISC MENU  
AUG 1984

ANALYSIS RESULTS  
Line Time Percent

BEEBUG CAD PROGRAM  
DEC 1983



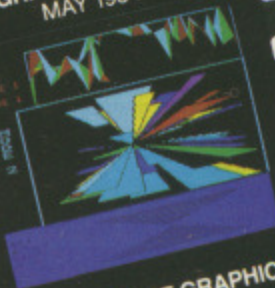
HOME ACCOUNTS PROGRAM  
NOV 1984



3D BAR CHART GENERATOR  
APRIL 1984



GRAPH PLOTTER  
MAY 1984



MULTI-MODE GRAPHICS  
APRIL 1985



DETONATOR DAN  
MAY 1984



MUSIC SYNTHESISER  
AUG 1984



SPITFIRE  
MAY 1984

COMPUTER  
AIDED  
DESIGN

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**ABC 63,388**  
July-December 1984

The Micro User welcomes program listings and articles for publication. Material should be typed or computer-printed, and preferably double-spaced. Program listings should be accompanied by cassette tape or disc. Please enclose a stamped, self-addressed envelope, otherwise the return of material cannot be guaranteed. Contributions accepted for publication will be on an all-rights basis.

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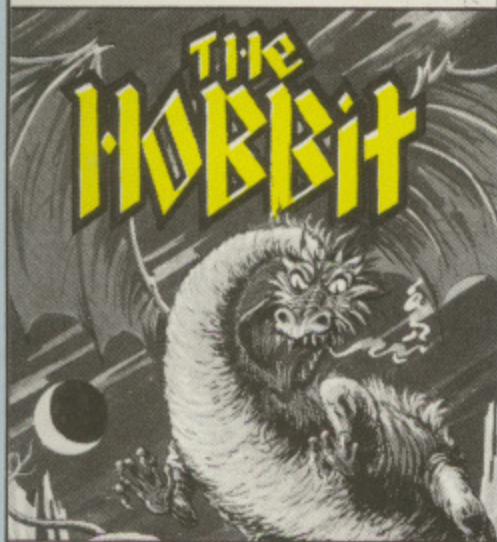
**185 MICROMAIL**

The part of the magazine you write yourself – your news, views, ideas, praise and moans.

**199 ORDER FORM**

From back issues to binders, cassettes to cases, discs to dust covers – they're all here.

**Free contest!**



**50 prizes to be won!**

Already a classic among adventure games, the new disc-based version of **The Hobbit** features superb colour graphics, making it more enjoyable than ever.

To celebrate, we're giving away 50 of them. All you have to do is find the hidden characters in a word square and **The Hobbit** could be yours.

– See Page 31



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# Your BBC would not be without it

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SOLIDISK's SIDEWAYS RAM is an almost indispensable add-on for the BBC user.

It is available in either 32k, 64k or 128k byte capacity and is compatible with all issues of BBC microcomputers along with most of the add-ons and ROMs obtainable for it.

To date, more than 37,000 units have been sold.

The Sideways RAM occupies the right most ROM socket of the BBC and sits in the same position in the micro's memory map as the paged ROMs.

This means that the Sideways RAM can run almost all ROM type software including languages, utilities and filing systems.

The difference between Sideways RAM and Sideways ROM is that RAM can be written to meaning that only the presently required software has to be loaded into the machine, thus making redundant the multitude of high current consumption and often unsightly ROM extension boards.

Sideways RAM is also an invaluable tool for writing ROM type software to run on the BBC since software may be assembled straight into the area in which the final version will run. This will save a lot of time over using offset assembly and eprom programming/erasing on a non Sideways RAM equipped BBC.

For the user who is not interested in writing ROM type software but is in need of the utilities provided by the use of the Sideways RAM, we supply free software to make maximum use of the Sideways RAM facilities.

These are included in the Sideways RAM Software package, a collection of no less than 5 diskettes containing nearly 100 programs, from database, word processor, music system, sprite graphic, printer buffer, virtual memory, spelling checker, RAM disk, RAM filing system, VDU replay, disassembler, machine code monitor, macro basic, video digitised pictures etc. and Solidisk Most Advanced Disk Filing System version 2.0.

Another extremely useful feature is the ability to configure the Sideways RAM as a 'SILICON DISC' as in our STLDISC program. It makes use of available Sideways RAM as an extra disc drive.

Once the STLDISC program is loaded it acts exactly like a normal DFS with the exception that one drive is now allocated to the Sideways RAM. All operations on this drive are much faster than a physical disc drive and, of course, impart no mechanical wear to them. This means that programs may be repetitively loaded, saved, spooled or exec'd many times and only the final version need actually be saved to disc.

The extensive use of the facilities offered in the STLDISC program will allow the physical disc drives to go longer between services and the discs themselves to last longer and could in fact pay back for itself in a fairly short while.

The STLDISC program will operate on any size of Sideways RAM and will configure itself to the available space. Therefore a 16k board will give 4k bytes of storage, whereas the 32k will give 20k bytes and the 128k up to 116k bytes of 'Silicon disc' storage space.

### PRICES

The listed price (effective from the 15 April onwards) comprises the Sideways RAM fully guaranteed for 1 year, comprehensive manual and a software package consisting of 5 diskettes formatted either in 40 or 80 track. Please specify when ordering.

- SWR32 (32k unit, by far the most popular): £58.95
- SWR64 (64k unit, new introduction model): £85.00
- SWR128 (128k unit, the second most popular): £149.00

As Solidisk Software Support Service has to produce in excess of 16,000 diskettes every month, we regret that we can no longer provide personalised service for disk copying. In extreme cases, when you need to update your software diskette, either reorder a new software package (which is always sold to you at nominal media cost (plus post and packing) or return the old package with £2.00 to cover post and packing. You may avoid post and packing costs if you call at Solidisk's stand at any BBC micro exhibition or at the Solidisk office.

### UPGRADING

Upgrading from a smaller model is very simple: you return the old RAM board to us with your payment.

The listed prices include the full software package and new manual.

### THE SOFTWARE PACKAGE

The Software package comprises of 5 diskettes, formatted either in 40 or 80 track. Please specify when ordering.

#### Volume 1:

Volume 1 contains all the general applications of Sideways RAM such as load and save ROMs (the Menu program), printer buffer (the Printer program), Improved Disk Filing System with unlimited catalog or PAGE at &E00 (STL0E00 and 2.0 ROM), Silicon Disc (the STLDISC program), the Quickcopy and the Fast Backup programs which use Sideways RAM to save you time and disk swapping effort.

#### Volume 2:

Volume 2 contains the Wordprocessor, Spelling Checker and the English Dictionary.

#### Volume 3:

Volume 3 contains the Macro Basic (a program generator), a Linker-Editor and the Virtual Memory Program, which lets you use Sideways RAM to store Basic programs thus allowing otherwise too large programs to run.

#### Volume 4:

Volume 4 contains a suite of programs, all part of the Solidisk Database system. This Database allows you to retrieve any record of up to 6500 records quicker than you can remove your finger; each record can have up to 15 fields of up to 60 characters long. 15 utilities are included allowing printing of forms, tabulation, mailmerge, maths etc.

#### Volume 5:

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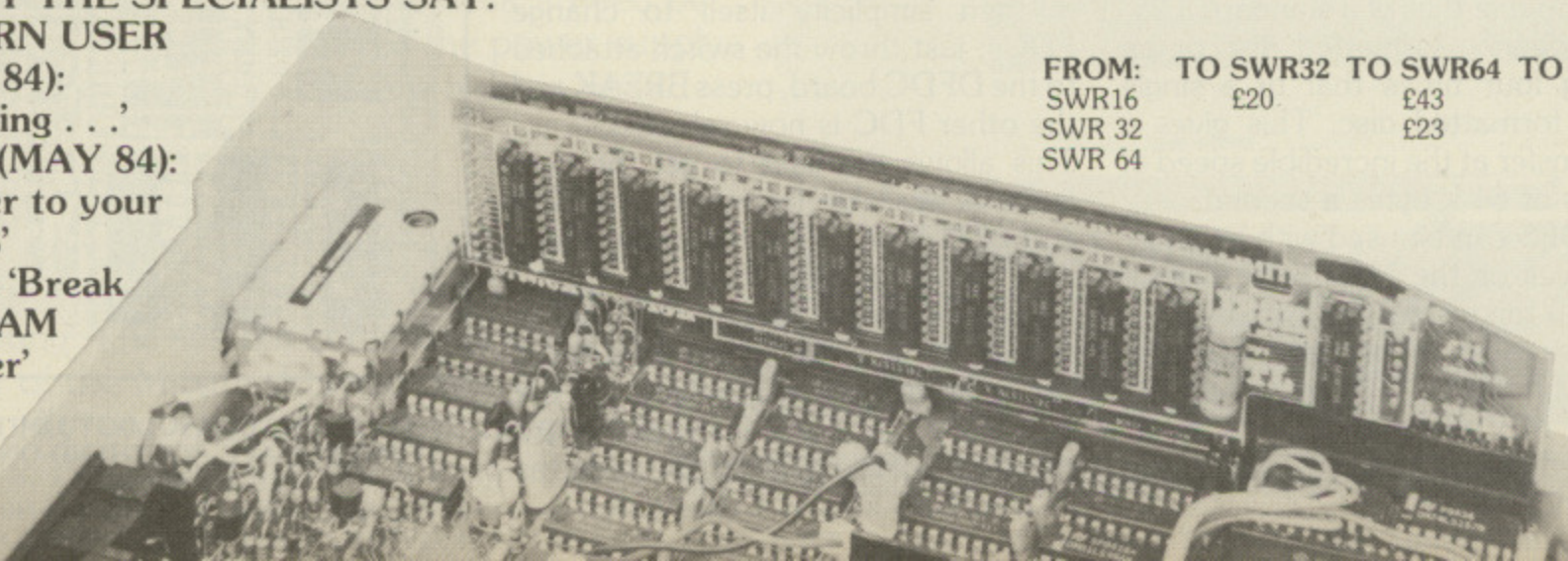
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FROM:	TO SWR32	TO SWR64	TO SWR128
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## THE HARDWARE:

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## THE SOFTWARE:

The software comprises 5 diskettes, formatted in 80 tracks. Volume 1 contains the Word Processor, Volume 2 the Database, Volume 3 the new Spreadsheet 1.1, Volume 4 the disc, tape utilities and a blank dictionary.

It would take several pages to describe them all. In general, they are of the highest standard as our hardware products. Only the first 2 volumes will be described below.

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Solidisk Word Processor and Spelling Checker with English dictionary. Easier than View, Wordwise or

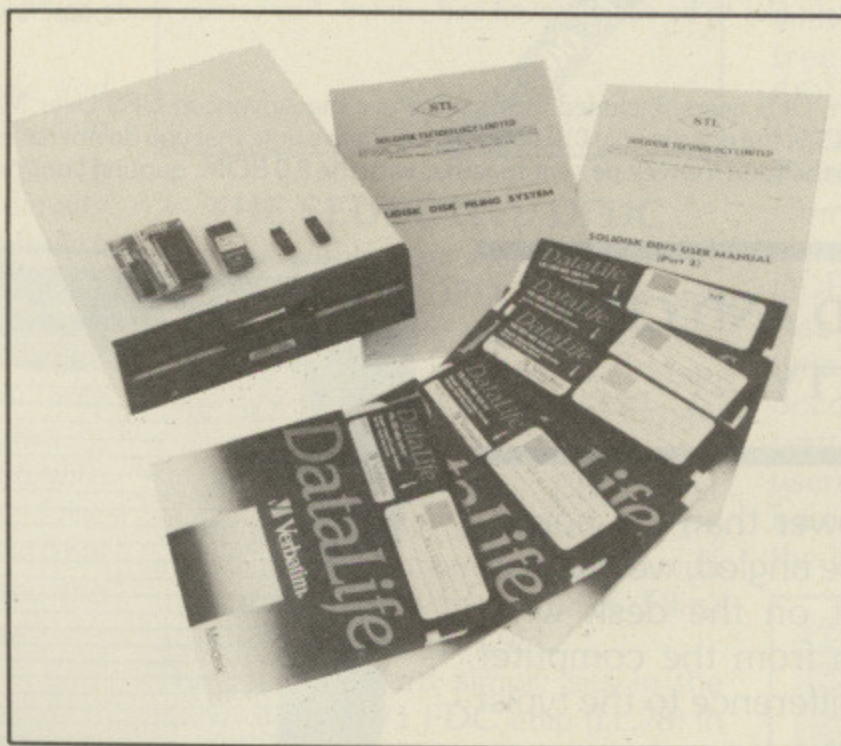
Scribe, you enter the WP by \*WP (filename), then start typing. What you see on the screen will be exactly printed on paper.

You don't even need to read the manual twice, the most useful commands are all displayed on the top part of the screen.

This Word Processor features 80 column screen throughout, direct on screen justification, automatic margins, page numbering, printer special commands, Wordstar like editing commands for block move, block delete, block copy, print, save, load text to cursor, insert and overwrite, search and replace, total word count, word frequency count, free space, \* commands etc, etc.

Solidisk WP loads and saves texts under 1 second flat and also you may save the edited version as many times and under any filename you like.

And also better than any other wordprocessor, you can spell check your document without leaving it, simply type in Control-U.



It has self dictionary generating capability too. You may create any dictionary you like simply by entering the words. Solidisk WP is also excellent as a training tutor for Wordstar, as used on most 16 bit computers.

### Volume 2:

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You can design a new database, list all records, edit them, merge them, split them, making mailshot with Solidisk WP etc. For instance, Solidisk telephone enquiries are dealt with by an ordinary BBC with twin Mitsubishi holding the last 4000 sales records. Typing in the name you retrieve the complete record quicker than you can remove your finger. It of course runs Solidisk Datafile.



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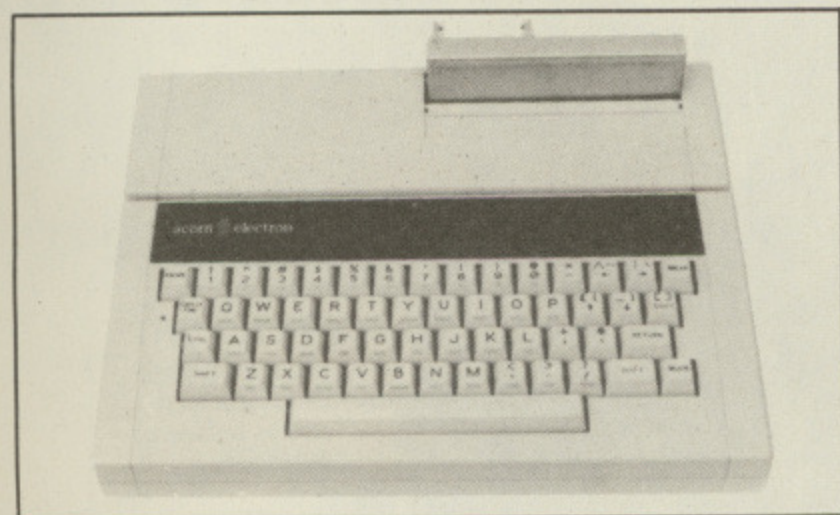
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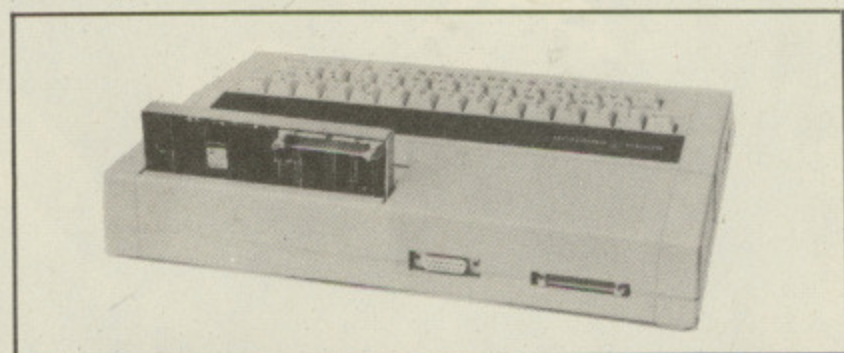
It Plugs into the PLUS-1 and allows direct attachment of disk drive and software compatibility with BBC disks.

PRICE: £39.95 inclusive, P&P: £1.00.

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Short form price list. Full price list on request.

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SWR64	£85.00	£1.00
SWR128	£149.95	£1.00
CPU & Keyboard		
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MU7



# SOLIDISK + MITSUBISHI BIG DEAL:

## THE MITSUBISHI 640K DISK OUTFIT:

This offer comprises:

- One Double Sided, 80 track Mitsubishi M4853 disk drive, cased in beige.
- One Solidisk DDFS Single and Double Density Disc Upgrade.
- All leads and manuals (2).
- One Software package comprising 5 program diskettes as detailed below.
- Full one year guarantee.
- All for £209.95 inclusive of VAT and carriage.

## IMPORTANT

If you upgrade (now or later) to twin Mitsubishi M4853 disk system, Solidisk will offer you, subject to stock availability, absolutely free a CPU and keyboard case as shown earlier.

For that, you have the choice of ordering a 640k Mitsubishi disk outfit now and then later on, of returning your disk drive, enclosing payment of £160 to cover the second disk drive and carriage. Alternatively, save by ordering right now a complete twin Mitsubishi (2MB unformatted, 1.3 MB formatted) Fantastic Offer at only £359.95 inclusive.

## THE HARDWARE:

As described earlier as shown opposite.

## THE SOFTWARE:

The software comprises 5 diskettes, formatted in 80 tracks. Volume 1 contains the Word Processor, Volume 2 the Database, Volume 3 the new Spreadsheet 1.1, Volume 4 the disc, tape utilities and a blank dictionary.

It would take several pages to describe them all. In general, they are of the highest standard as our hardware products. Only the first 2 volumes will be described below.

### Volume 1:

Solidisk Word Processor and Spelling Checker with English dictionary. Easier than View, Wordwise or

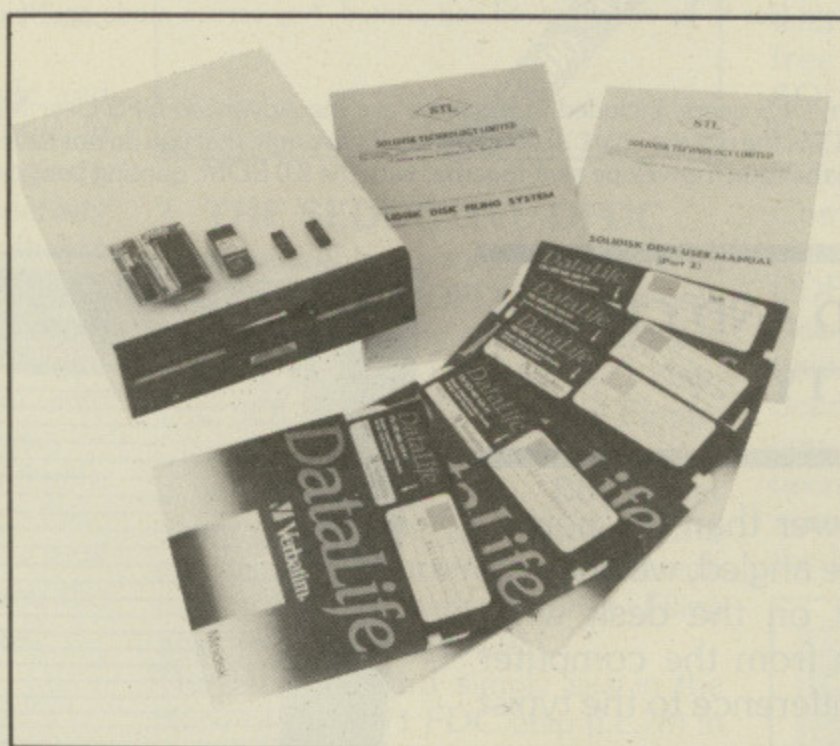
Scribe, you enter the WP by \*WP (filename), then start typing. What you see on the screen will be exactly printed on paper.

You don't even need to read the manual twice, the most useful commands are all displayed on the top part of the screen.

This Word Processor features 80 column screen throughout, direct on screen justification, automatic margins, page numbering, printer special commands, Wordstar like editing commands for block move, block delete, block copy, print, save, load text to cursor, insert and overwrite, search and replace, total word count, word frequency count, free space, \* commands etc, etc.

Solidisk WP loads and saves texts under 1 second flat and also you may save the edited version as many times and under any filename you like.

And also better than any other wordprocessor, you can spell check your document without leaving it, simply type in Control-U.



It has self dictionary generating capability too. You may create any dictionary you like simply by entering the words. Solidisk WP is also excellent as a training tutor for Wordstar, as used on most 16 bit computers.

### Volume 2:

Solidisk Database. Solidisk Database is a random access system, completely menu driven and more importantly, very easily customised to suit any particular need.

Important features include unlimited filesize and number of records, all maths functions and 80 column screen throughout. Solidisk Database is particularly simple to understand and easy to use. You are first presented with an option menu, which comprises 15 different options. Each option will then lead to a new menu and so on. Mostly you only have to enter an appropriate data or hit the RETURN key.

You can design a new database, list all records, edit them, merge them, split them, making mailshot with Solidisk WP etc. For instance, Solidisk telephone enquiries are dealt with by an ordinary BBC with twin Mitsubishi holding the last 4000 sales records. Typing in the name you retrieve the complete record quicker than you can remove your finger. It of course runs Solidisk Datafile.



# NEW PRODUCT ANNOUNCEMENTS

## Solidisk MODEM.

Single chip FSK, Multistandard internal MODEM, requires no soldering, no adjustment.

Supplied with Menu Driven SoliComms 16k ROM, ready to be connected to any information provider such as Prestel or Gold. Auto dialling, auto answer, auto baud rate, auto error correction.

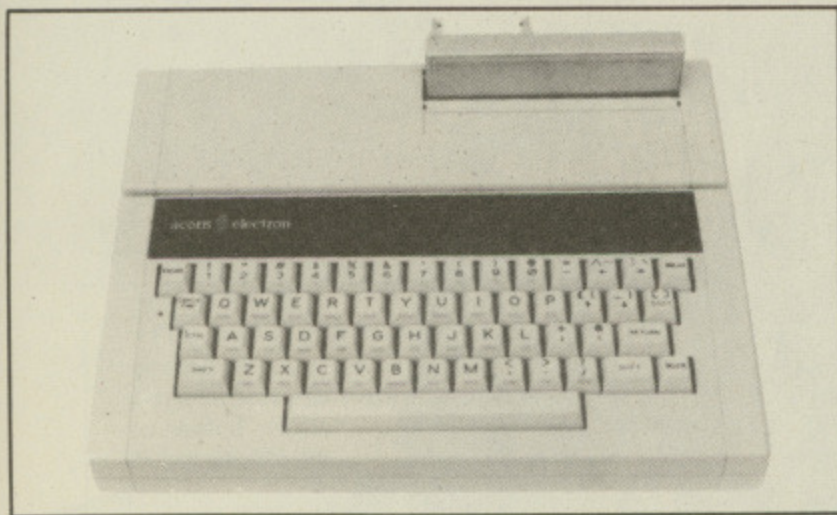
Available soon. Price: £39.95 inclusive.

## Solidisk Third Processor

Internally fitted 6502 compatible with Acorn Second Processor, 128k as standard, upgradable to 256k, 4 Sideways ROM sockets, software supplied in ROM allowing unused RAM to be loaded with Sideways Software or used as Silicon Disk. Available soon.

128k 6502 TP: £179.00 inclusive.

256k 6502 TP: £229.00 inclusive.



## IN STOCK:

### 1) NEW LOW PRICE EPROMS.

2764s and 27128s are going down in price.

5 x 2764s now cost you only 24.95 per pack.

3 x 27128 now only 25.95 per pack.

### 2) PLENTY OF UVIPROMS AND UVIPACS.

### 3) ELECTRON DISK INTERFACE.

This interface is BBC compatible and includes 3 Sideways ROM sockets.

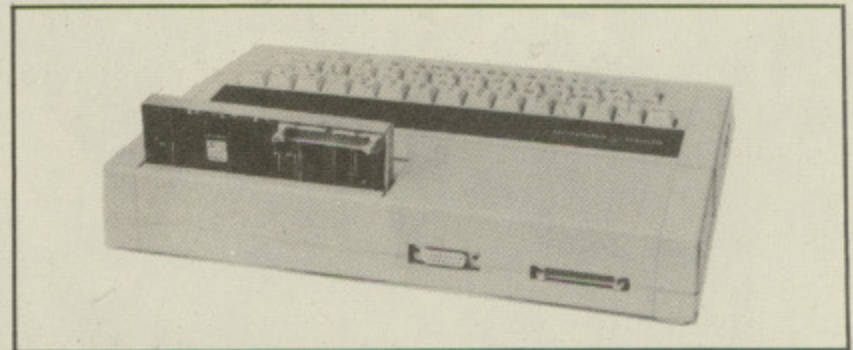
It Plugs into the PLUS-1 and allows direct attachment of disk drive and software compatibility with BBC disks.

PRICE: £39.95 inclusive, P&P: £1.00.

# SOLIDISK LOCAL EXPERTS

We have people able to fit your equipment free of charge in all the following towns. If your area is not mentioned, ring the office!

Dunstable, Leighton Buzzard, Reading, Peterborough, Wimslow, Penzance, Torquay, Wimborne, Basildon, Stroud, Southampton, Hoddesdon, Watford, Bexley, Margate, Rochdale, Boston, London (all areas), Oldham, Hunts Cross, East Dereham, Rushden, West Bridgford, Wantage, Bambery, Grimsby, Kingston, New Malden, Woking, Taunton, King Norton, Sutton Coldfield, Halesowen, Leamington Spa, Hassocks, Salisbury, Swallowne, Leeds, Huddersfield, Treowen Newtown, Newtownards, Co Fermanagh, Co Londonderry, Le Mesnil St Denis (France), Kalgoolie (Australia), Paramatta (New Sth Wales), Manawatu (New Zealand).



Short form price list. Full price list on request.

Qty Items	Prices	P&P
Sideways RAMs:		
SWR32	£58.95	£1.00
SWR64	£85.00	£1.00
SWR128	£149.95	£1.00
CPU & Keyboard		
Case (both)	£30.00	£3.00
Solidisk DDFS.		
DDFS (with 1.9 ROM)	£38.95	£1.00
DDFS (with 2.0 ROM)	£48.95	£1.00
DFDC (with 2.0 ROM)	£54.95	£1.00
8" Controller	£69.95	£1.00
Special Offers.		
640k Disc Offer	£206.95	£3.00
1.3MB Fantastic Offer	£356.95	£3.00
Eprom Equipment.		
Programmer	£19.95	£1.00
Eraser	£19.95	£1.00
2764 x 5 new low price	£24.95	£1.00
27128 x 3 new low price	£25.95	£1.00
Datalife Diskettes.		
MD525 SS/DD	£17.00	£1.00
MD550 DS/DD	£22.00	£1.00
MD557 2S/4D	£28.00	£1.00
65C02 with Software	£13.00	£1.00
Solimon-2 16k ROM	£13.00	£1.00
2.0 DFS 16k ROM	£20.00	£1.00

Total =

Name: \_\_\_\_\_

Address: \_\_\_\_\_

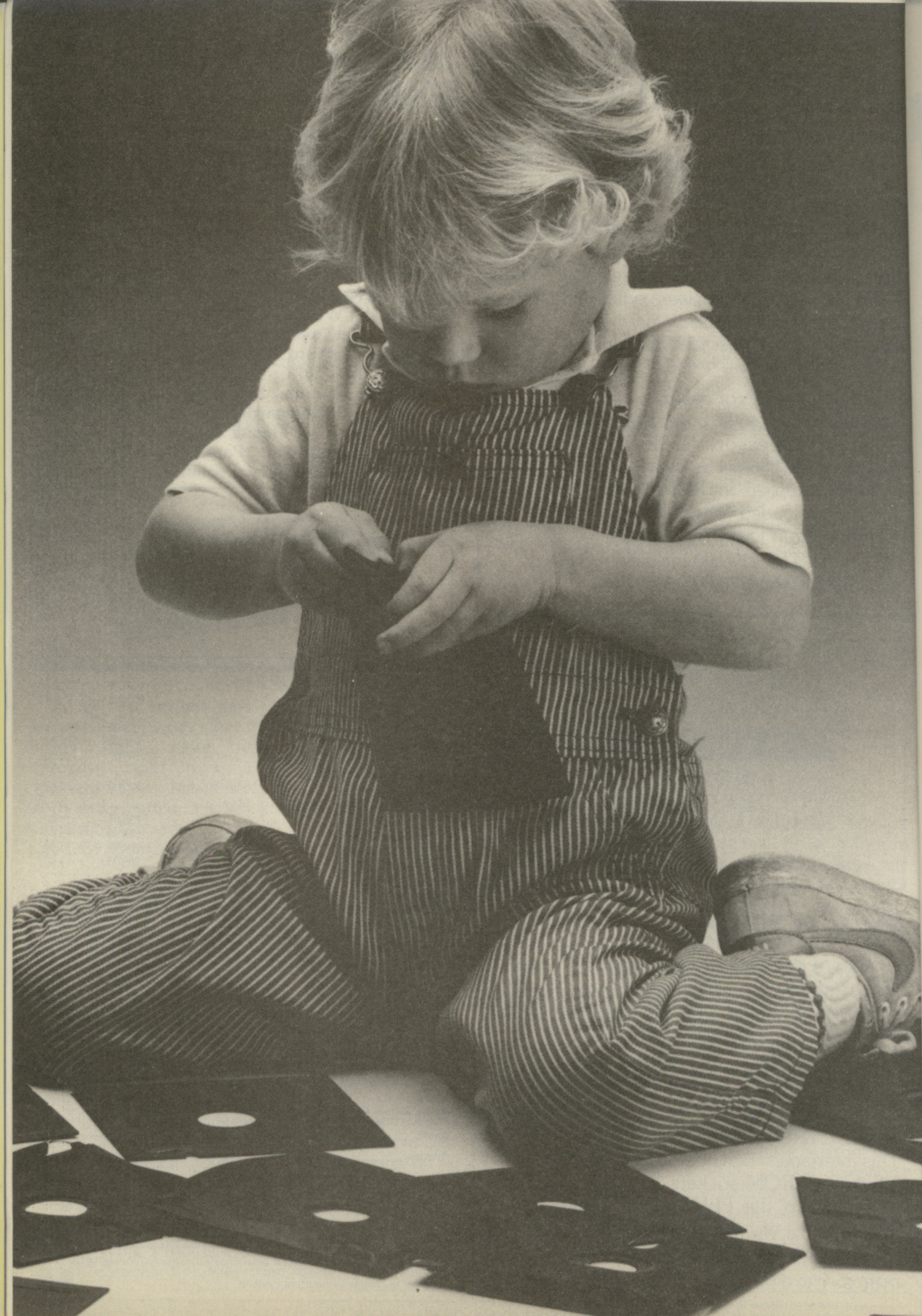
Barclay/Access:

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Prices and specifications correct at time of going to press: we do reserve the right however to change without prior notice.

MU7







# Herbie Briggs has just destroyed the myth that all floppy discs are created equal.

They seem equal. Until you look at the seams.

That's where equality ends.

Most companies seal their discs with a spot here, a spot there. Leaving most of each seam not sealed at all.

Sooner or later, the seams might do what comes naturally: they bulge. Warp. Pucker. Open up.

Pens, pencils, fingernails—even a four-year-old's, like Herbie—can catch and snag in those wide open spaces.

That's sloppy. And dangerous. Because if you put a sloppy floppy into your disc drive, it can jam your drive. Ruin your drive head. Lose your data.

So much for their seams. Ours are different.

## THE SLOPPY FLOPPY:

Sealed with a spot here, a spot there. Leaving unsealed seams everywhere.



Memorex uses a process we developed, called Solid-Seam Bonding.

Solid-Seam Bonding seals shut every inch of every seam of every Memorex® floppy disc. Tight as a drum. That makes the Memorex

floppy stiffer. Stronger. And your data safer.

To resist bulging, warping, puckering, or opening up.

## MEMOREX SOLID-SEAM BONDING:

Every inch of every seam is sealed shut. Tight as a drum.



To resist all the things that can jam your drive, ruin your drive head, or lose your data.

Which proves that a Memorex floppy disc isn't equal to all the others. It's better.

Solid-Seam Bonding is just one example of the extra care that goes into every Memorex floppy disc. Be it 8", 5¼" or the new 3½" Extra care that lets us guarantee every Memorex disc to be 100% error-free.

The next time you're buying a floppy disc—or a few hundred of them—just remember this:

It's always better to be safe than sloppy.

For more information on the full line of Memorex quality computer media products, including computer tape, call Memorex U.K. Ltd., 96-104 Church Street, Staines, Middlesex. Tel: 0784 51488



Your Data. When it matters, make it Memorex.™

# MEMOREX



# GREAT NEWS!

## REVOLUTIONARY NEW PRODUCT.

### Fileaid extends BASIC data handling

FILEAID is a database system which is accessed via BASIC. It provides all the facilities required for complex data handling. FILEAID extends the capabilities of BASIC by providing fourteen new commands which allow you to create and access indexed files on diskette.

FILEAID gives you the ability to write sophisticated applications without worrying about the format data actually takes on the diskette. No matter what the application is, FILEAID will handle it.

One advantage of FILEAID is that you write your programs in BASIC, the language you already know, unlike other database systems.

What good is a database if you can't write your own programs to access it? BASIC is more flexible than any of the database languages.

The BASIC program may operate in any MODE and access as many files as required.

FILEAID is supplied as a EPROM, a diskette and a 77 page manual.

The EPROM contains the extra BASIC commands for accessing indexed files. The diskette contains five utilities for creating and maintaining your database system. The manual is a comprehensive guide to using FILEAID and contains an example of a telephone directory.

The program required for the telephone directory system is supplied on the utilities disc.

FILEAID is extremely easy to use yet very powerful. First tell FILEAID about the file using the file definition utility. Simply give it the names of the BASIC variables, their length and the maximum number of records that you want the file to hold. FILEAID then creates a file large enough for the definition you have described.

To write a record give the relevant command and FILEAID takes the contents of the appropriate variables and writes them to disc. When you read that record it returns the values to their BASIC variables. You can access the file randomly or sequentially and FILEAID takes care of the problem of keeping the index up-to-date.

FILEAID has been written so that it uses every bit of storage you can spare. The more storage available for FILEAID the faster it will work. It dynamically manages the available storage to optimize performance.

To give FILEAID more storage just set PAGE to a higher value. An EPROM command is available to help you do this.

- Record Fields may be Integer/Real/String
- Random Access Functions:- READ/

INSERT/REPLACE/  
DELETE/REVERSE -  
DELETE

- Sequential Access Functions:- TOP/  
BOTTOM/  
READNEXT/  
READPREV

- Multiple Volume Support - Maximum 4 Drives

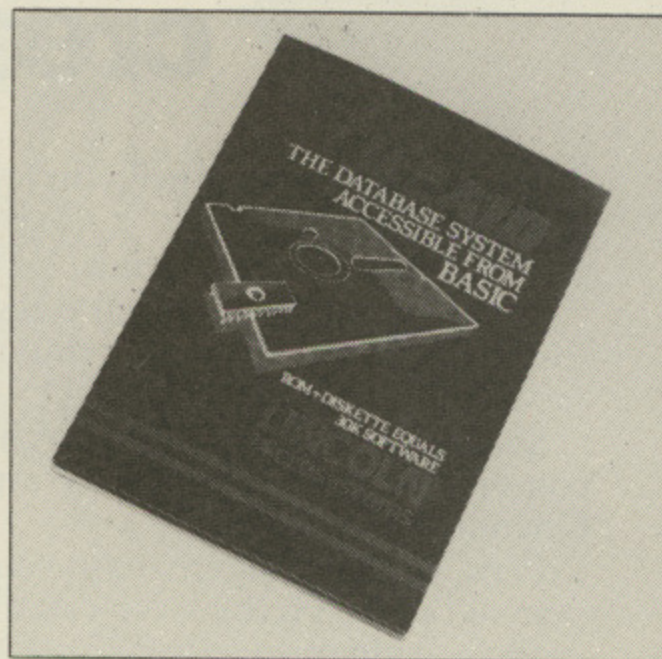
- Unlimited Number of Files per Program

- BACKUP/  
RESTORE Utilities

- Maximum Records per File 65,000 (depending on Disc Space)

- Maximum Record Size 4096 Bytes

- Maximum of 196 Fields (BASIC Vari-



YOU'LL LOVE THE CONCEPT!

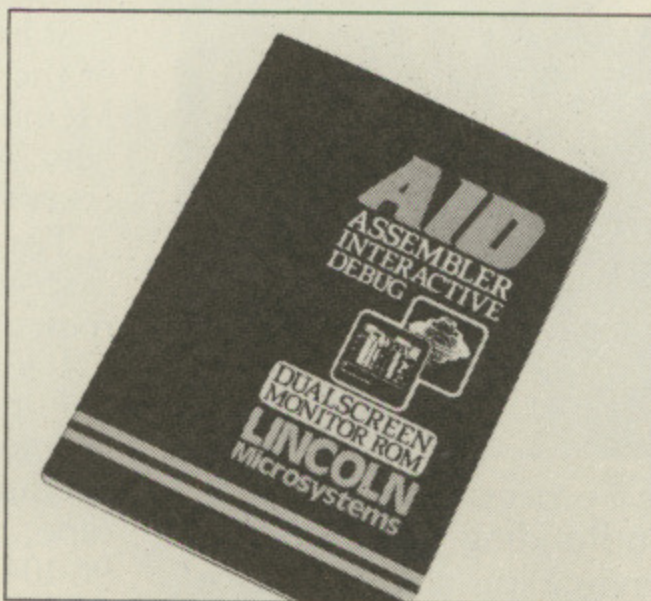
- ables) per Record
- File AUDIT/  
INFORMATION Functions
- Comprehensive 77 page Manual detailing Concepts/Facilities/Examples

- Free telephone/  
address directory system

**£35.00**

PRICE INCLUDES P & P OVERSEAS ADD £3.00 P & P (AIR)

### Machine code graphics...NO PROBLEM!



This is not just another m/c monitor. AID offers features far in advance of other monitors.

One unique facility is it's ability to leave the program screen display unaffected when displaying AID information. Using this original DUALSCREEN concept m/c graphics programming becomes fun.

**£28.00**

PRICE INCLUDES P & P OVERSEAS ADD £3.00 P & P (AIR)

"This dual screen feature is a cracker" Acorn User, March 1985.

**LINCOLN P.O. BOX 74,  
Bradford,  
Microsystems West Yorkshire. BD6 3RN**





# Before you go mad at Silverstone, let David Hunt drive you round the bends.



David Hunt, brother of ex-World Champion James, began racing 100cc go-karts at 16. Now aged 24 and with two successful Formula Ford seasons behind him, David is currently racing in International Formula Three.



**7. CHICANE.**  
Throw out the anchors. Change down to 4th. Flick left then right. Come out, at around 117mph. Get the first bend wrong and you lose a lot of time correcting later on.



**1. COPSE CORNER.**  
Brake and drop into 4th. Turn in, then accelerate. On a good lap you can hit the exit kerb at 5,400rpm.



**2. MAGGOTS.**  
Easily taken flat-out. That's around 5,600rpm in 5th. The power in an F3 car peaks between 5000 and 5,600rpm. If you put your foot down at less, you'll blow your engine up.



**3. BECKETTS.**  
Approach at 5,800rpm in 5th (132mph). Keep left, 60 yards out, hit brake and drop down through 5th and 4th to 3rd.



**4. HANGER STRAIGHT.**  
Drive diagonally across the straight. Clock 5,800rpm in 5th as you approach Stowe Corner. That's around 139mph.



**6. CLUB.**  
Arrive with 5,700rpm up, to get through in 5th gear. Avoid the apex kerb. It'll flick you into the catch-fencing.



**5. STOWE.**  
Supreme test of courage to keep your foot on the loud pedal through this critical bend.

REVS is far and away the most realistic simulation of motor racing ever devised.

Technically, of course, it's a computer game for the BBC Micro. But somewhere in the middle of your first practice lap you'll realise that 'game' has nothing to do with it.

Instead, you'll experience how it feels to drive every bend, straight and gradient of the world's fastest Grand Prix circuit. In a machine that accelerates from 0 to 100mph in just 7 seconds.

Gear ratios, engine tuning and handling - they're all accurate in their finest detail and faithfully programmed into REVS.

You can even pre-set the aerodynamic profile of the car to suit your driving style.

So take our advice: before you try for the lap record at Silverstone, study David Hunt's circuit diagram.

After all, when was the last time you had a free driving lesson from a professional?

For the address of your nearest Acornsoft stockist, or to order REVS on credit card, call 0933 79300 during office hours.

Or send the coupon below to: Acornsoft, c/o Vector Marketing, London Road, Wellingborough, Northants NN8 2RL. Please allow 28 days for delivery.

To: Acornsoft, c/o Vector Marketing, London Road, Wellingborough, Northants NN8 2RL.

Please send me REVS for The BBC Microcomputer.

No. of Discs at £17.65 inc VAT \_\_\_\_\_

No. of Cassettes at £14.95 inc VAT \_\_\_\_\_

I enclose PO/Cheque payable to Acornsoft Ltd. Or charge my credit card

Card Number: Barclaycard/Access (delete) \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

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Postcode \_\_\_\_\_

Signature \_\_\_\_\_



MU7



## AMX MOUSE

Catch an incredible AMX MOUSE! The advanced opto-mechanical device that brings to your BBC micro facilities once only available on more expensive computers. Now you can use ICONS, WINDOWS AND POINTERS in your own programs.

## AMX PACKAGE

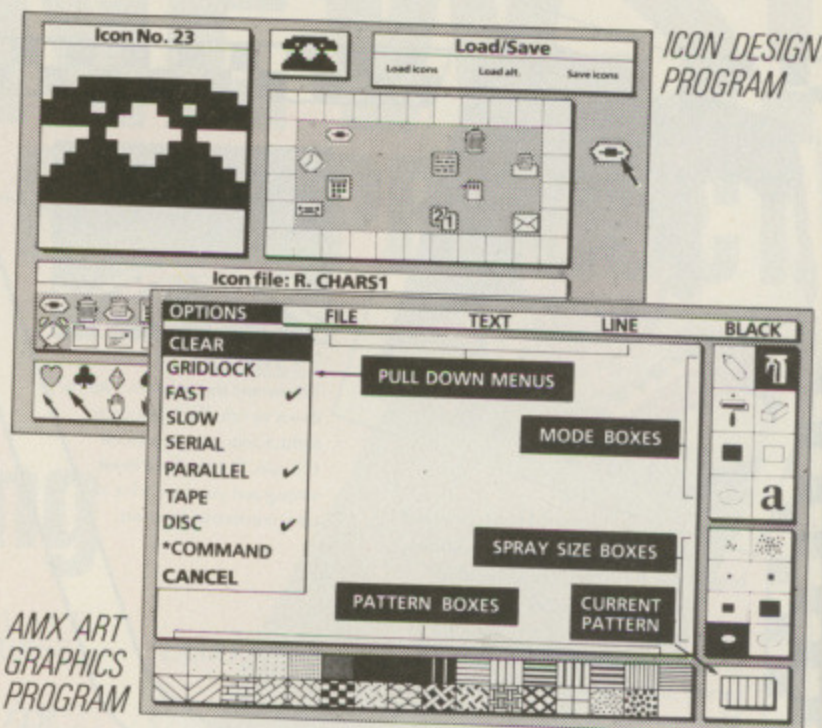
Plug the MOUSE into the user port, and the EPROM into your board. The latter contains fast machine code routines for creating on-screen windows, icons and pointers. And means that the MOUSE buttons can be programmed for use with commercial software such as Wordwise and View. There are two manuals included, explaining how to operate the MOUSE and the ROM routines, which are available in both basic and machine code programs.

Included in the package are two superb programs:

AMX ART has to be seen to be believed! It's a computer-aided drawing program that's just as good for serious applications—such as the preparation of detailed architectural and engineering drawings or teachers' worksheets—as it is for having lots of family fun! And if you're artistically inclined, you'll be astonished at the quality of work you can produce and save. It makes full use of on-screen menus, pull-down menus and icons: the ideal, easy way for novices to learn and gain in confidence.

ICON DESIGNER is an invaluable program for creating and storing icons for use in your OWN programs.

The AMX MOUSE may be used with any BBC Model B fitted with the Operating System 1.2; and it's compatible with the 6502 second processor and disc or tape filing systems.



AMX ART  
GRAPHICS  
PROGRAM

ICON DESIGN  
PROGRAM

## New! AMX DESK

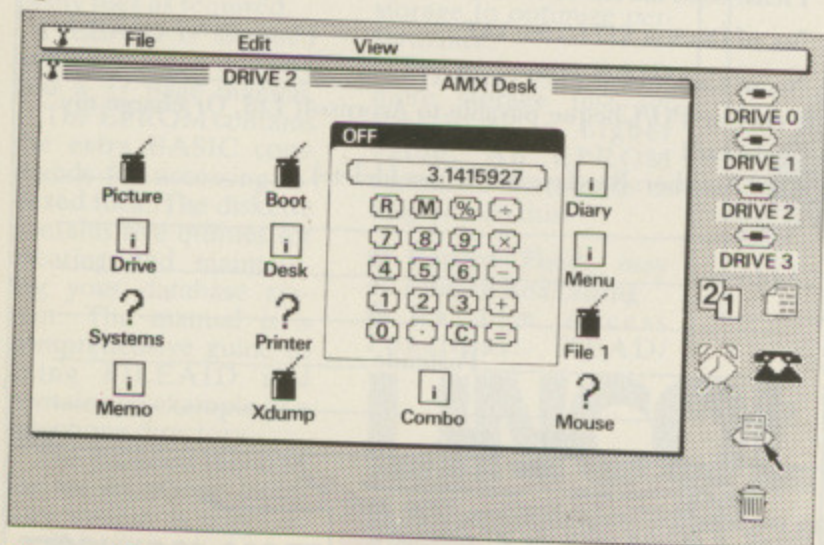
DISC ONLY  
£24.95 INC  
VAT

A terrific new program designed for the AMX MOUSE. If you want to get properly organised—at home or at work—DESK is for you!

The main screen contains a desktop with header offering SYSTEM, FILE and EDIT menus—plus an additional menu for extra features; and there's a constant time display.

Down the right-hand side are icons displaying Disc Drives, Memo Pad, Telephone Book, Diary, Alarm Clock, Printer and Trash Can. Simply by using your MOUSE you can select any service you require.

- MEMO PAD—Up to three pages of text may be stored. With printing at the touch of a button.
- TELEPHONE/ADDRESS BOOK—Up to 200 or 400 entries (depending on disc drive capacity) with handy scrolling search.
- DIARY—Displays a calendar for three months, centred on the current month, with scrolling backwards and forwards. Dates with entries are highlighted; select a date and view the entries.
- ALARM—Sounds at the time you've pre-set, whichever DESK service you're using.
- CALCULATOR—A full-function calculator can be brought on-screen at any time, and results can be stored for use in Memo Pad, etc.



See us on Mouse Links on Viewfax tube link on Prestel: Page No. \*258216#

Any window showing Telephone/Address Book, Diary or Memo Pad may be dumped to the printer by simply selecting the printer icon. An interface program for Wordwise+ and View means pictures created with AMX ART can be merged with text upon printing out.

## New! AMX UTILITIES

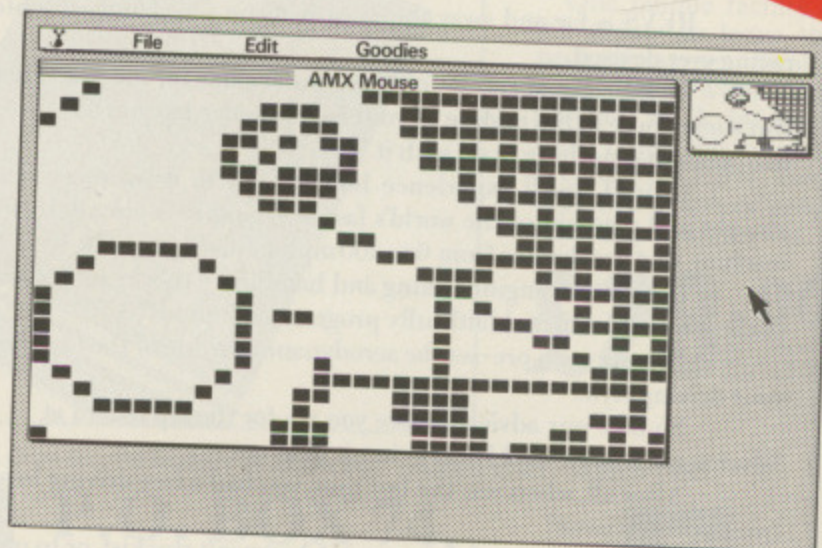
DISC ONLY  
£14.95 INC  
VAT

Another remarkable new program for the AMX MOUSE. Now you can enjoy many drawing features you'd never expect to find at this price!

The Zoom facility means easy and accurate amendments to your drawings: one dot becomes a character. You can copy, rotate and reflect; enhance circles; draw ellipses and arcs; and print icons, too. Borders can be added, and pictures can be stripped and centred ready for saving and printing.

There's colour sketch, too...  
Great for budding artists!

All disc software is available on 40 or 80 Track and 3" disc. Please state which you require when ordering.



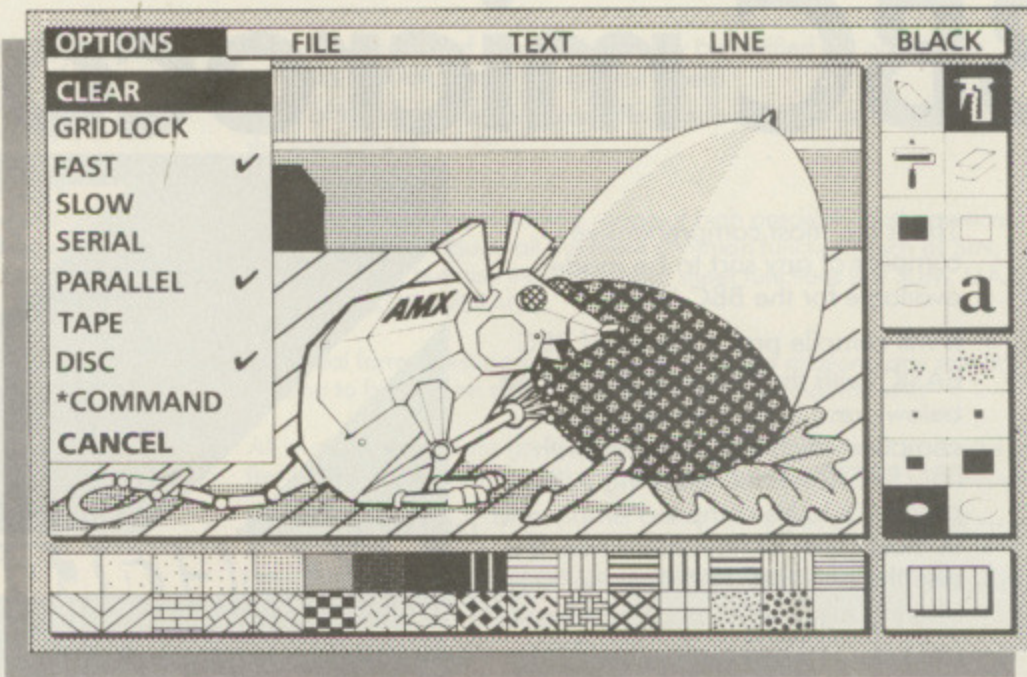
These exciting AMX products are available from top computer dealers. Or you can order direct from us. Send cheque/PO to Advanced Memory Systems Ltd, Green Lane, Appleton, Warrington WA4 5NG. Ring (0925) 62907/602690 for instant ACCESS and VISA orders.



# AMX MOUSE

**POINTS THE WAY**

**FOR THE  
BBC MICRO  
MODEL B**



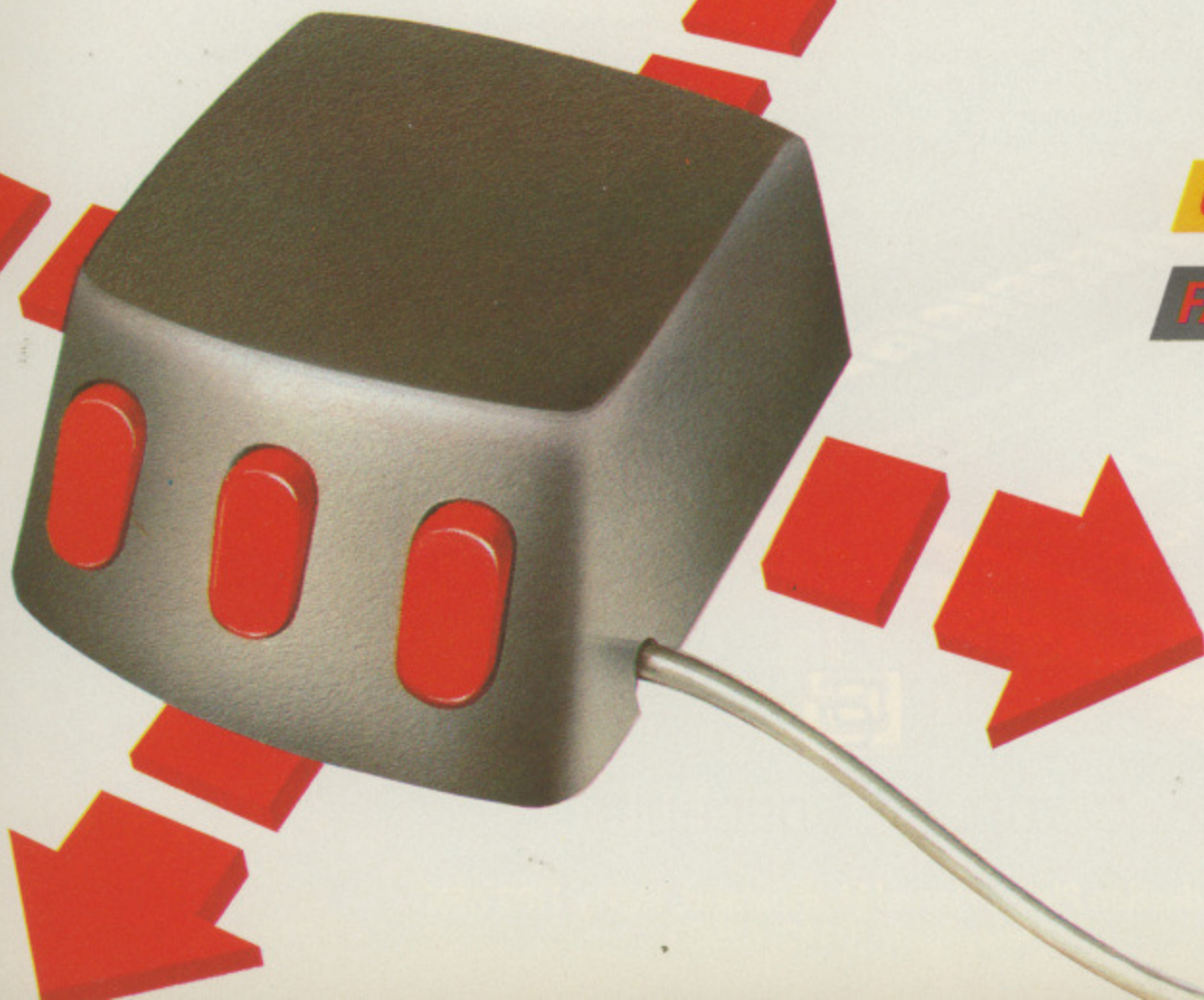
**with AMX ART GRAPHICS PROGRAM**

**EDUCATIONAL QUANTITY DISCOUNTS**

**ICON SOFTWARE**

**CREATIVE GRAPHICS**

**FASTER INTERACTION**



**£89.95**  
inc. VAT and P & P



# The BBC BASIC compiler for the BBC microcomputer

This is the most comprehensive compiler of any sort to be made available for the BBC Micro.

It will compile practically all of BBC BASIC (with the few exceptions listed below), and is the only available compiler which is compatible with BBC BASIC syntax, allowing existing programs to be compiled simply and in most cases without alteration. It is also the only BBC BASIC compiler offering full floating point arithmetic.

Like many PASCAL compilers, ACCELERATOR achieves compact compiled programs by using an intermediate code (G-code) rather than 6502 machine code. This G-code is executed by another part of the compiler.

Other compilers produce machine code up to 5 times longer than the original program especially when catering for floating point arithmetic. By using G-code, ACCELERATOR ensures that the object program is compact; in some cases actually smaller than the original program.

Machine code programs produced directly by some compilers are sometimes faster than intermediate code but, as explained above, they are usually larger. ACCELERATOR normally compiles to the intermediate G-code but a variety of utilities are supplied with the ROM that allow the G-code to be converted into machine code. Machine code programs can only use integer numbers.



Other utilities are also supplied that allow the user to create his own sideways language ROMs.

ACCELERATOR therefore offers the user the choice between efficient G-code compiled programs, or larger but faster machine code.

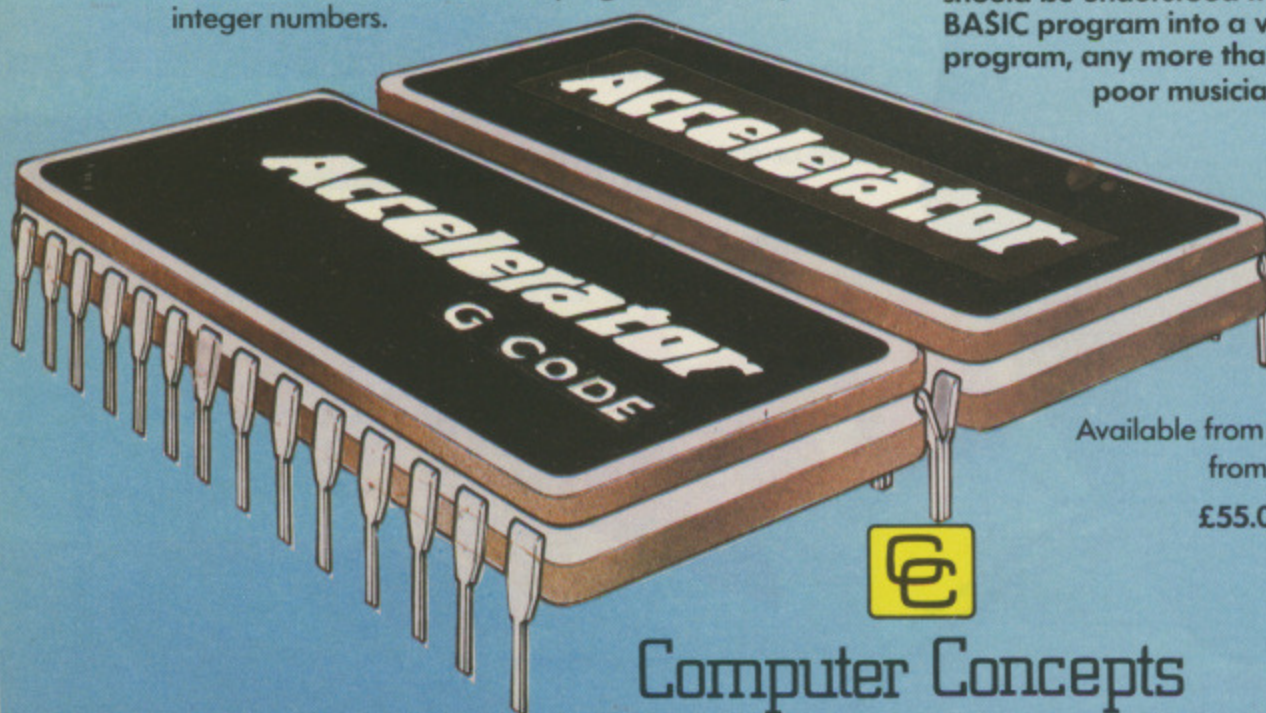
ACCELERATOR is a complete compiler package including 2 ROMs, comprehensive spiral bound manual, disc with utility programs and quick reference card.

Note the machine code converter utility programs are supplied on a 40/80 track disc. These require a disc drive to work.

**EXCEPTIONS:** The EVAL statement cannot be compiled because this must be interpreted at run-time, and in-line assembly language is not permitted as this is not appropriate to an intermediate code compiler. LOMEM, PAGE, TOP and TRACE are not relevant. VAL, RND, FN have been rationalised for predictable type conversion, but can be used as described in the manual.

When converting to machine code no floating point arithmetic is allowed, only integers (16 bit). The ESCAPE key is handled in a slightly different manner.

Although ACCELERATOR is a very powerful tool it should be understood that it cannot turn a bad BASIC program into a well written machine code program, any more than a Stradivarius can make a poor musician sound brilliant.



Available from all good BBC dealers or directly from ourselves at the address below.

£55.00 + £1.00 p&p + VAT (£64.40)



Computer Concepts

Gaddesden Place, Hemel Hempstead, Herts. HP2 6EX  
Telephone (0442) 63933



# INTER-SHEET

## The electronic spreadsheet program

Spreadsheet programs have become one of the most popular micro-computer applications in recent years. They can be thought of as a totally general purpose numeric tool, of use to anyone who has to handle figures, calculate costings, keep control of running costs, or just simple budgeting.

This package contains the ROM itself, a quick reference card, an introductory manual to spreadsheets and a comprehensive reference manual. Chip fitting instructions and a function key strip are also included.

The program has many quite unique features.

- 1) 40, 80 or 105 column screen display. The special 105 character screen mode displays more than any other spreadsheet.
- 2) Up to 16 spreadsheets may be stored in memory at once.
- 3) Data can be transferred from one spreadsheet to another.
- 4) Spreadsheet data can be transferred to and from popular wordprocessors such as WORDWISE and VIEW.
- 5) This package will integrate directly with other ROM-LINK compatible products, such as INTER-CHART, which can produce charts and graphs of data from the sheet.
- 6) Formulae in boxes are tokenised to save space. This means larger than normal spreadsheets can be accommodated.
- 7) Main menu enables even the inexperienced user to operate the more complex functions. There is no need to remember long command names.

These are in addition to many other powerful features such as: Variable column widths. Flexible replication facilities. Insert and delete rows and columns. Numbers may be printed in three formats. The number of decimal places is variable from 0 (integer) to 9.

Locking/unlocking of boxes. Boxes may be justified left or right for numbers and left, centre or right for labels.

Most of the above features can affect individual boxes, rows, columns or the entire sheet.

INTER-SHEET supports a large range of high precision mathematical functions. These include all the more common functions such as SIN, SQR, TAN etc. but also include special sheet functions like SUM, MAX, MIN, LOOKUP, AVERAGE.

A special form of windowing has been included allowing any row or column to be held on screen as the sheet scrolls underneath.

All in all these features go to make INTER-SHEET the most powerful and flexible ROM based spreadsheet available for the BBC Micro-computer.

24K (Two ROMs)

£49.00 + VAT (£56.35)



### ROM-LINK

INTER-SHEET is the first of a fully integrated suite of ROMs for the BBC MICRO to be known as the ROM-LINK series. Any ROM-LINK compatible product can run in memory with other ROM-LINK programs, and data can be transferred directly from one to another.



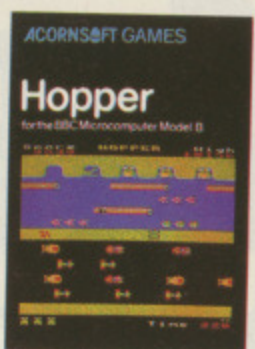
Computer Concepts

Gaddesden Place, Hemel Hempstead, Herts. HP2 6EX (0442) 63933





**MAZE**  
 Electron Cass SLG11 £6.99  
 BBC Cass SBG11 £9.95  
 BBC Disc SNG11 £11.50



**HOPPER**  
 Electron Cass SLG23 £6.99  
 Electron ROM SCG23 £14.95  
 BBC Cass SBG23 £9.95  
 BBC Disc SNG23 £11.50



**MAGIC SHOW**  
 Electron Cass SLX11 £6.99  
 BBC Cass SBX11 £9.95  
 BBC Disc SNX11 £11.50



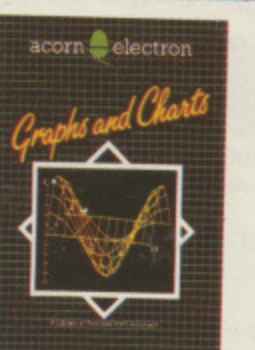
**ACHETON**  
 BBC Disc SNG37 £17.65



**STARSHIP COMMAND**  
 Electron Cass SLG22 £6.99  
 Electron ROM SCG22 £14.95  
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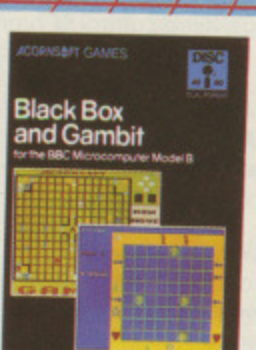
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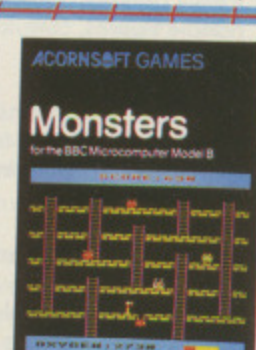
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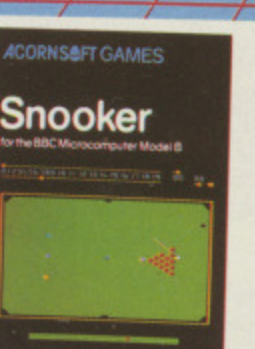
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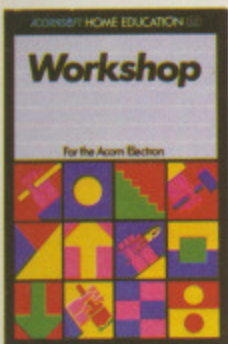
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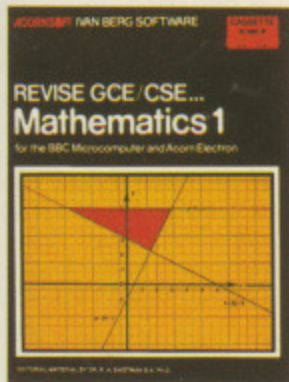
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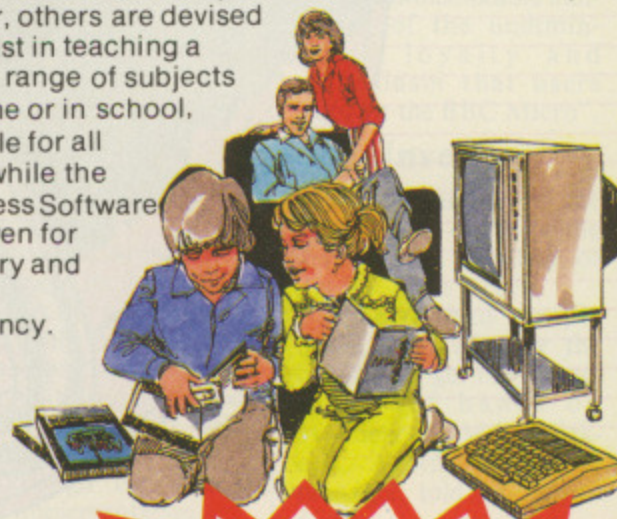
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# Show breaks all records

AS if to answer all the critics who have hounded Acorn in recent times, all previous attendance records were smashed at the latest Electron & BBC Micro User Show.

Well over 20,000 visitors went through the turnstiles in the New Horticultural Hall, London, during the four day event.

At peak times on Saturday and Sunday, queues more than a mile long formed as enthusiasts braved unseasonal icy winds to wait their turn to get inside.

"This response from the public was the perfect answer to those who have been saying that the BBC Micro was long in the tooth and had no future", said Derek Meakin, head of Database Publications, the show organisers.

"The crowds that poured in were proof for everyone that, from the point of view of users, Acorn is far from finished.

"What we saw here was an unmistakable indication of the undiminished loyalty and enthusiasm that users have for the BBC Micro".

## Unveiling

Star attraction of the show turned out to be the first public unveiling of the B+ from Acorn.

"We've had people travel from all over the country to get the opportunity of hands on experience", Mike Bicknell, Acorn's consumer manager, told *The Micro User*.

However if the B+ was the initial draw, it was the latest developments in the communications field which eventually eclipsed it in pulling power.

MicroLink, the revolutionary new service which brings Telecom Gold within the budget of every home computer owner, proved a highlight for the crowd.

Over the course of the show no fewer than 5,000 enquiries were received on this stand alone.

Pace Micro Technology also made its bid for centre stage with its coloured bulletin board software for the BBC and the auto-dial, auto-answer

**Turn to Page 24**

# SECRET TALKS ON B+ UPGRADE KITS

ACORN is holding secret talks with at least one third party supplier on an upgrade kit to convert the standard BBC Micro into the B+.

## Major Irish order

LENDAC, Acorn's distributor in the Republic of Ireland, has won contracts worth £250,000 to supply BBC Micro systems to vocational educational centres.

And Acorn believes it could be the first of many.

The equipment is to be used for the development of EEC funded information technology courses, which are now in the pilot stage.

## Colleges

Technical and commercial colleges will run the courses, which cover both data processing and electronics.

Before winning the contract Acorn claimed it had already built up a strong following in Ireland.

Currently, the BBC Micro is installed in all tertiary colleges and universities. Acorn is the market leader in educational networks at secondary level, and a primary school sample revealed that two-thirds used Acorn computers for curriculum development.

However company officials are refusing to reveal any details at this stage because of the "sensitive nature" of the current talks.

Marketing manager John Caswell admitted to *The Micro User* that discussions were being held but ruled out any possibility of Acorn launching an upgrade kit itself.

"As a manufacturer we are not geared up to do this", he said, "but we would encourage a third party".

Although the company official refused to name a third party interested in launching an upgrade, *The Micro User* has learned that the front runner is likely to be Watford Electronics.

Nazzir Jessa, Watford's managing director, admitted that his com-

pany has "something under wraps" - but balked at providing further details.

"At present we have not got anything concrete planned", he said. "You cannot just go and make a kit. It needs a lot of research. We are working on it".

Back at Acorn, John Caswell was maintaining that he did not consider such a conversion kit was required for the normal home user.

Pointing out that a whole new board needed to upgrade the standard model would be "a bit expensive", he indicated that he felt it wasn't really necessary in any case.

"The model B is the machine for the home user anyway", he said. "It can be upgraded to a disc version, and lots of options are open using second processors.

"But the B+ is aimed at a different section of the

community, in particular education and business".

As for fears that some existing software packages would not run on the new machine, Caswell dismissed these as groundless.

However he agreed there had been problems with the early disc versions of Elite, but said this had resulted from the way it had been protected.

"These problems have now been solved", he insisted.

Meanwhile Aries Computers says its Aries-B20 20k RAM expansion board will provide the required path for model B owners who want to upgrade to Acorn's new specifications.

"Although the details of the implementation are not identical, any software written to Acorn guidelines for the B+ will run on the model B with Aries B20 upgrade", claims the company.

## ACORNSOFT OFFERS

ACORNSOFT is hoping its latest offer will provide the incentive for financially hard-pressed schools to expand their software libraries.

Schools and parents who buy five Acorn-

soft/ASK education titles for the BBC Micro are being given a 50 per cent cut in price, while smaller purchases merit savings of 30 per cent.

Meanwhile, people who have just started

up in business are also being given a helping hand. If they buy all seven software modules in the Acornsoft Small Business suite they will get 34 per cent off the normal price of £151.90.



## Super, says trade

EXHIBITORS at the latest in the series of Electron & BBC Micro User Shows gave it an overwhelming vote of confidence at the end of the four day event.

In all cases, they reported record takings and are now eagerly lining up to take part in the forthcoming Manchester show.

This is what some had to say.



"Absolutely fantastic. We have never seen such interest at any previous show. It has more than renewed our confidence in the Acorn market" - Barry Rubery, Pace Micro Technology.



"An extremely successful show. It was a real surprise to see how intense the continued interest in the BBC Micro really is. It proved to be particularly valuable for ongoing business. I can't wait for Manchester", Dale Hubbard, Gemini.



"We chose the show to launch two new pieces of software for our mouse which is in line to be the peripheral of the year. And we couldn't have been more pleased with the response" - Nick Pearson, AMS.

# David collects his golden micro

ARCHITECT David McLeod bought a BBC Micro to help him while away the time he is forced to spend at home on a kidney dialysis machine.

This led him to subscribe to *The Micro User* and unwittingly the opportunity to go for gold.

In this case it was the fabulous gold micro, valued at £5,000, being given away in a competition to celebrate the magazine's second birthday.

And it was the 29-year-old Londoner who eventually carried off the world's most expensive home computer.

## Imaginative

David McLeod's entry was judged to be the most imaginative of thousands submitted by readers of *The Micro User* who were asked to predict the contents of the March, 1988, issue.

His vision of the future included networked video games, flat screen monitors, fibre optics and satellite listening stations - all available to BBC Micro users.

The young architect received his prize during the Electron & BBC Micro User Show in the New Horticultural Hall.

Created by the



David McLeod receives the gold micro from Derek Meakin, head of Database Publications

Universal Communications Company of Bradford, the gold micro took one month to make.

Within the gold plated streamlined processor and keyboard casings, the birthday micro contained a BBC keyboard and motherboard, a disc interface, two 1mbyte disc drives and an 85 watt power supply unit.

For more than a month before its presentation the gold micro had been on a

national tour of major branches of W.H. Smith.

"It certainly makes my standard BBC Micro look a bit down market now in comparison", observed a delighted David. "There couldn't have been a more fabulous prize.

"But what else could you expect from *The Micro User* which is undoubtedly the most readable, comprehensible, technical publication available".

## Record show

From Page 24

board for the Nightingale modem.

However the Bradford company did not have the modem field to itself.

Miracle Technology also got into the act with its WS 2000 and pre-production versions of the WS 3000, soon to be unveiled with a price tag of £295.

Also UCC, best known for customised casings for the BBC, had its own modem on display for the first time.

Yet the show's attractions were not restricted to the communications field, although there was a marked shift away from games and into more serious applications.

The youthful team behind Computer Concepts was just one standholder who reported a bonanza, in this case with the Wordwise Plus package.

"We feel that this renewal of faith in Acorn among the people whose support is so essential quite clearly shows that the company and its products will continue to play a leading role in the micro marketplace", said Derek Meakin.

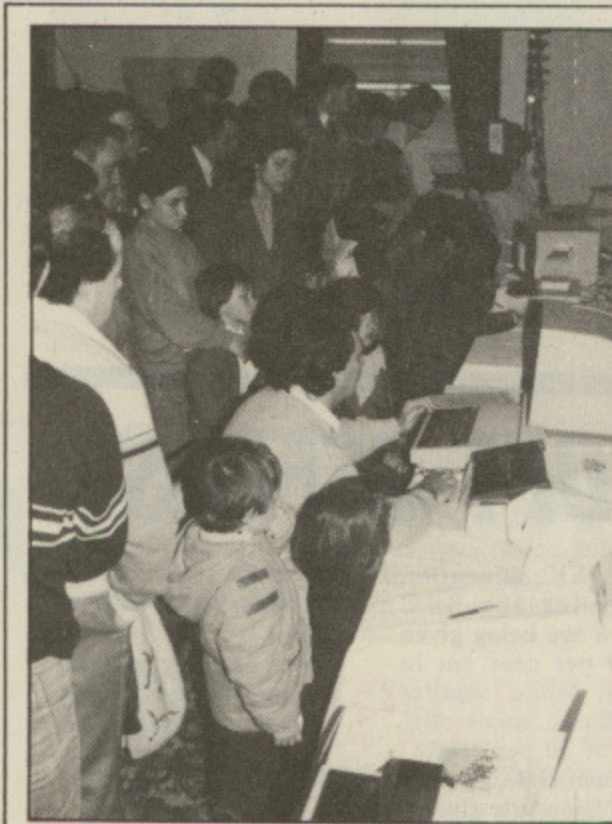
## MALTA MICROS

THE BBC Micro has taken off in a big way in Malta. So much so a BBC user group, Malbeeb, set up in September 1983, has already increased its membership to 145.

The club not only organises regular product demonstrations and lecture sessions for users but also publishes an informative newsletter.

Recently the club pulled off its most ambitious project to date, a one-day exhibition for the islanders on microcomputing as a hobby.

It enticed 800 visitors in six hours.





# School helps fight crime

THE winners of a police computer program competition organised by Nottingham Constabulary - and backed by Acorn distributors LVL - have now been announced.

Burford Primary School, Nottingham, won

the schools prize of a computer graphics system. Mr Grahame Handley of LVL is pictured (far left) presenting it to the school's head Mr Gerry Mills. With them is Acorn's sales manager, Mr Chris Hall.

Chief Inspector Derek Wass, former deputy head of community affairs, is pictured on the right with the two individual winners.

## Prizes

Paul Walker, aged 12, of Ruddington Lane, and Christopher Whiteman, aged 16, of Wain Grove, both Wilford, received certificates from him to go with their respective prizes of a £35 LVL voucher and a £15 voucher.

Based on the BBC Micro, the aim of the competition was to submit a program reflecting aspects of safety training, fighting crime, robotics and monitoring property.

It was planned as part of the Link-up '84 Police and Community Day in Nottingham.



# Pupils run viewdata service

WHEN pupils at John Birkbeck High School, Lincolnshire, started a Prestel-type information system recently, they had plenty of experience to draw upon.

For the school, at North Somercotes, Louth, had already been running an in-house viewdata service for 18 months.

So setting up the LincTel database - believed to be the first of its kind operated by a school - posed few problems for the youngsters and their teachers.

The school's interest in viewdata originally came about as an offshoot of the Council for Education Technology's pilot scheme for testing software transmission via Prestel.

John Birkbeck was one of the trial schools and its first system was set up by teacher Vic Robins in the library.

It was interrogated remotely via a keypad linked to an RML computer on the floor below.

With the introduction of BBC Micros into the school, and the advent of colour, came the opportunity to enhance the system.

The first editing package used was Edfax, but the lack of page routing made this unsuitable for the school's particular application.

Other systems like Communitel and Schoolfax were looked at before it was decided to purchase Rotavision - "the best software package I have ever seen for the BBC



Micro", says assistant head Michael Alger.

Assistant head Michael Alger and pupils at John Birkbeck High School design a frame for their LincTel system

"The editor is superb and it is extremely easy for children to produce professional results after a very short period of instruction".

The system, which has as its theme conservation, with particular emphasis on wildlife and pollution, runs from 1pm until 9am on 050785352.

The difficulty of maintaining the system has been partly overcome by inviting other schools in the area to contribute frames.

Says Michael Alger: "The most impressive spin-off has been the increased motivation that has emerged. Here at last we have found something that the girls as well as the boys enjoy.

"Writing poetry and short stories and then illustrating them has proved to be a popular option, and there is an air of excitement each morning when the log file is examined for details of callers".

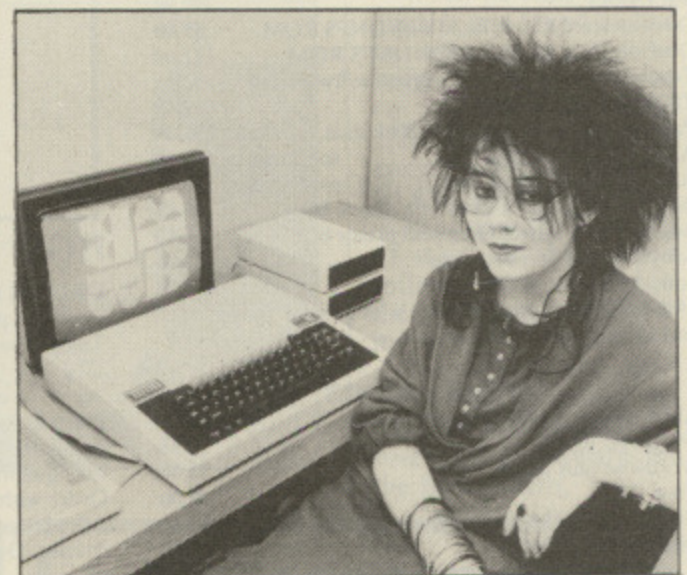
## Musical notes

STEP-by-step instructions on how to exploit the BBC Micro's three-channel sound generator are given in Acornsoft's recently published book and program suite, Creative Sound.

It teaches the user how to turn the keyboard into an instrument, emulate studio techniques and use the micro for teaching the rudiments of music, says Acornsoft.

The package's authors are musician, composer and programmer David Ellis and the designer of the micro's sound and envelope commands and Acorn Music 500 digital synthesiser, Chris Jordan.

Creative Sounds costs £17.95 for the cassette version and £19.95 for the twin dual-format disc. The book alone is £9.95.



## Rotavision editor

ONE of the new generation of youngsters making a career for themselves in the fast-growing field of viewdata is Sara Scott from Southport.

Sara got her training on a Manpower Services Commission project in Liverpool. Now she's off to the bright lights of London where she will be employed as a viewdata editor for the Rotavision system recently installed in the massive Barbican entertainment and conference centre.



# MICROWORLD

## COMPUTER GROUP

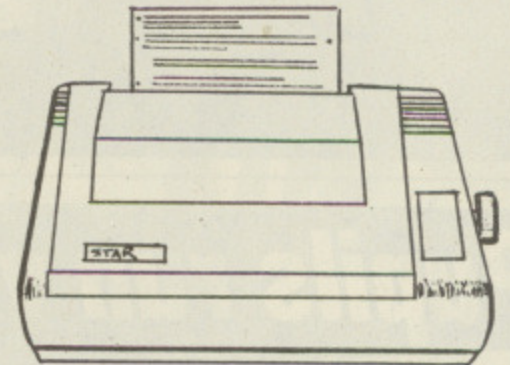
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# LEUKEMIA MAN'S MARATHON BATTLE

BY taking the footslog out of sponsorship, a BBC Micro has helped a former leukaemia victim raise over £30,000 for medical research.

Following the diagnosis of the "killer" disease in March, 1983, Chris Dobbs, a 27-year-old biology teacher from Oakington, Cambridge, started a battle against it.

He won three months later — with the help of a bone-marrow transplant from his brother Geoffrey.

While watching the 1983 London marathon from his sickbed, a still-desperately-ill Chris pledged he would make the run himself ... to prove that leukaemia could be beaten and raise thousands of pounds for research.

Chris went into training and then made that run in April.

He finished in four hours and ten minutes.

When Chris first started planning his run, he

## BBC Micro helps raise £30,000

was faced with the daunting task of coordinating large-scale sponsorship.

A number of computer firms came to his rescue — Acorn, Epsom and Juki — and supplied him with BBC Micro, printer, monitor, disc drive and other accessories.

These took the pain out of producing hundreds of similar-worded letters, replies, acknowledgements and sponsor forms.

The BBC Micro monitored cheques and calculated how much money had been raised. The computer's database helped with addressing.

By the time of the marathon, Chris had corresponded with more than 800 people, who



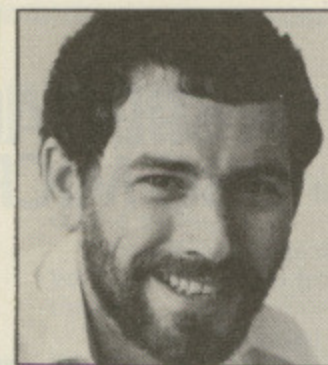
The marathon complete ... Chris and his wife Chrissie

brought in thousands of sponsors, among them staff of Database Publications.

Most illustrious of all his sponsors was Prince Charles, whom Chris had met while working as an

archaeologist and diver on the four-year project to raise the wreck of the Mary Rose.

Said Chris: "The BBC Micro speeded up the whole process of sponsorship".



Andy Hood

## Comms author moves

ANDY Hood, author of the Commstar communications package for the BBC Micro, is to join Pace as senior software engineer.

For Birmingham-born Hood, 30, it will be his first full-time position in the computer industry.

Hood is currently a project engineer in charge of the computer at a Birmingham firm of consulting engineers specialising in civil and structural engineering.

### Popular

He began writing structural engineering programs in the late 1970s and later became interested in communications.

When he built his own modem and found he had no software to run it he began work on what was to become Commstar, the first popular comms program for Prestel and general use.

Pace saw the potential of the ROM-based software and undertook the marketing of Commstar.

Since it went into production a year ago, the package has become the best selling software for the BBC Micro.

## IT'S A WIN FOR BOBBY!

FAMILY-run software house DACC has scored three winning goals with its newly released Bobby Charlton Soccer Game for the BBC Micro.

Not only was the ex-England and Manchester United player involved in its creation but the game's timely release on FA Cup Final day ensured maximum press coverage.

The BBC's Look North West news used it to highlight the region's current supremacy in football.

DACC is also having talks with W.H. Smith, who are interested in using the game for a nationwide in-store competition.

The object of the game is for the user, the manager, to form a winning team using variable

skills, accuracy and stamina factors, then pit it against another user's team or a computer side. The computer can also play itself.

The cassette contains a voice introduction and play hints by Bobby and details of the Bobby Charlton Computer Soccer Club.

Charlton became in-

involved with the game when DACC took on audio and video firm Holiday Bros to do its marketing. The player was already on their books as an adviser.

Priced at £11.95 the BCSG requires two analogue joysticks. World Cup and Canon League modules are scheduled.



Bobby Charlton supervises a game

## Easier assessments

An answer to the teacher's age-old problem of how to easily compile, mark and update student assessments is now available for the BBC Micro.

The time-saving solution, produced by G.A. Herdmon Educational Software, is a range of six science assessment programs on disc.

Programs, price £12.95 each, provide various options around a bank of more than 200 questions and have the capacity for more to be added. A free catalogue is available on request.



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**MU7**

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## From ITV to BBC

THE first of a computer game series modelled on the popular quiz show 3-2-1 will soon be available to BBC Micro users.

Manufacturer Micro Computers has worked with Yorkshire Television to make the computer version as true to the series as possible. It has a question and answer section, skill game and pot luck section.

Players will be able to send in their taped game and scores and the top three will be invited to take part in a grand final.

## Light on cartography

A LIGHTPEN with applications which include cell counting, cartography and microscopy, has been released for the BBC Micro.

Digithurst have produced the pen to go along with its MicroSight Camera System and MicroScale image analysis package.

The pen can be used to define windows within the MicroScale image which it wants analysed further.

MicroSight I costs £900 and the MicroScale image processing package with light pen £495.

## Disc toolkit

ADVANCED Computer Products has brought out what it claims is the most versatile advanced disc toolkit ever for the BBC Micro and other Acorn legal compatibles.

The 16k eeprom contains more than 30 commands, works in any screen mode, and enables the user to view over 2k of memory at a glance. Price is £29.

## Maths for the minis

TO get away from the question-and-answer type computer maths programs, Hilditch Software has released a Creative Mathematics three-part series for the BBC Micro.

The first in the package, How Does Your Garden Grow? is for three-to-seven-year-olds.

Progressing from the numbers one to nine, then

A MYSTERIOUS mail order operation offering top-selling BBC Micro games at rock bottom prices has apparently stopped – just as leading software publishers including Acornsoft were urgently investigating its activities.

Money has been returned to people who ordered software packs from a firm calling itself A1 Software Services of

Hornchurch, Essex.

Famous titles like Elite, Castle Quest, Micro Olympics, Football Manager and Combat Lynx – all BBC favourites – were mentioned in the promotion, which offered as many as 50 games for £30.

Acornsoft's head of technical services, John Collins, was among the first to react to the mail shot after hearing about it

from readers of *The Micro User*.

Collins sent a postal order for £19 to A1 Software Services for a pack of 15 games.

An Acornsoft colleague sent 25p postage and packing for a "free" game chosen from a list of 20 well-known titles.

Collins told *The Micro User*: "My money was refunded along with a slip of paper saying 'A1

Software Services has ceased trading'.

"My colleague has not yet received a reply from the firm.

"I shall be pleased if this mail order operation has stopped. We were most concerned that our titles had been mentioned in it and our legal department was ready to act should any infringement of copyright have been involved".



Elite line-up... Philip Carson, Joseph Buchdahl, Darren Rowley, winner Paul Shonk, Dave Brunner, Mike Keeting and David Duckworth

## £1000 prize for Paul

A 17-year-old Croydon schoolboy took time off from studying for his A levels recently to become the world champion Elite player.

Paul Shonk, son of a sales executive, snatched the title in the face of fierce competition during the Electron & BBC Micro User Show.

The youngster who had

practised the cult space game for seven hours a week prior to the build-up to his exams, carried off the £1,000 prize.

In all, some 12 finalists converged on the New Horticultural Hall to display their skills during the marathon two-day play-off.

Each of them had previously won elimina-

ting heats organised by Acornsoft since the company launched Elite in September, 1984.

The finalists were:

**Dave Brunner**, a computer studies teacher from Romford, Essex.

**Joseph Buchdahl**, a 14-year-old from Hovingsea, Cambridge, who much prefers history and biology to computing.

**Philip Carson**, aged 18 and studying physics, maths and electronic engineering at Surbiton School, Surrey.

**David Duckworth**, a 19-year-old who sells cleaners on a market stall in his home town of Preston, Lancashire.

**Mathew Huddleston**, a 14-year-old student at Kings Manor, Shoreham, who can be found playing the theatre organ – or Elite – when not studying for his O levels.

**Mike Keeting**, a bio-

logy teacher from Leeds who ran foul of domestic problems for playing Elite seven hours a day when it first came out.

**Brett Keys**, a 30-year-old electronics technician who writes accounts software packages in his spare time.

**Andrew Myers**, a 16-year-old rugby enthusiast who is about to take O levels at Testbourne School, Whitchurch.

**Darren Rowley**, aged 19 and an employee of a food processing company in Rugby.

**Kemal Sangrar**, 15, a student at Our Lady's High School, Cumbernauld, Glasgow.

**Andrew Vickery**, a 17-year-old British Telecom apprentice engineer and self-confessed Eliteaholic who plays up to four hours a night.



## Card games

MAKING a bid for part of the BBC Micro software market is Livewire Software with its first games for the machine – Bridge and Whist Challenge.

A contract bridge game, Bridge Challenge, provides the player with a partner and opponents, makes bids for the opposition based on an analysis of their cards alone, and displays the cards and table on screen.

It also features full rubber bridge scoring, ACOL based bidding system, single bid auto help and Blackwood Sam convention.

Whist Challenge is a partner whist game and features full scoring during play and screen display of cards and table.

Both include auto and cheat-proof play and are provided with playing instructions or manual. Price £9.95 on cassette, £11.95 on disc.

## Break breaker

THE solution to all problems relating to the BBC Micro's Break key is simple, claims Elm Systems – switch off the key using its intercept circuit board.

The board is plugged into the keyboard and a switch, mounted on the rear of the micro, is flicked to inhibit the Break key. No soldering or wiring is needed.

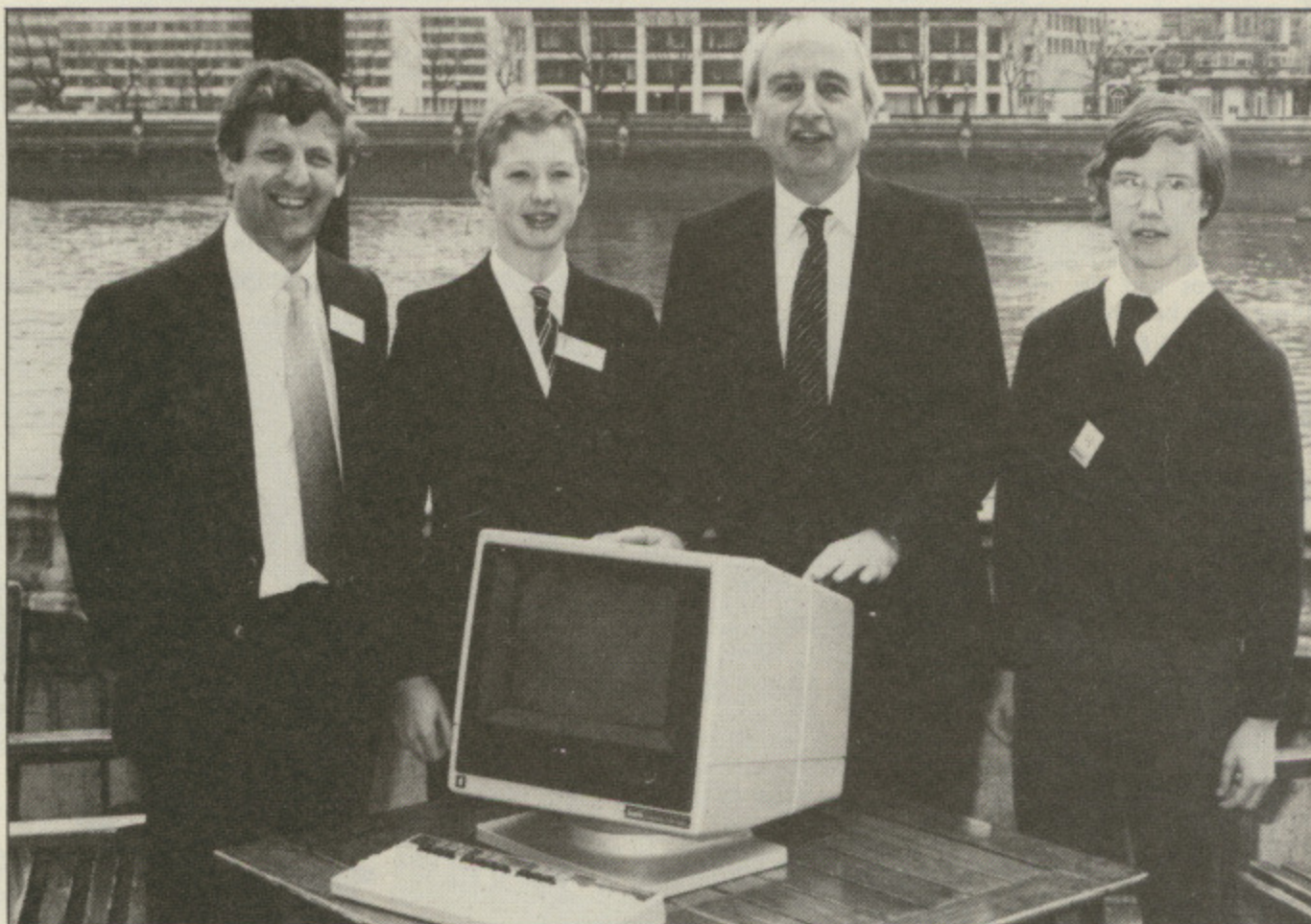
## Utilities modules

GEMINI Marketing claims its latest software suite offers total integration and datafile compatibility between database, spreadsheet and graphics – the three major utility packages for the BBC Micro disc system.

Called Triple-D, the suite has the three modules and they can be bought, and used, singly or together.

Each module is formatted for both 40 and 80 track systems and is clearly documented. Its indexed manual also has training sections

# Software pool plan wins two micros



● Lord Young of Graffham with prizewinners of The Times Network for Schools Communicate Competition (left to right): Gordon Jones, chief executive of TTNS, Stephen Perugi, Bedford Modern School and Martin Maidment, Linden Lodge School.

STEPHEN Perugi, aged 13, of Bedford, has won a unique Acorn micro for his school, Bedford Modern, in the first competition organised by The Times Network for Schools.

Entrants were asked to devise a project for TTNS that would make full use of the network's communications and database features, and be of social value.

Stephen suggested developing a pool of software for schools for the mentally handicapped, pointing out that the cost of buying specialist packages is beyond most school budgets.

His idea was for special schools needing software to put descriptions of their requirements on the database, for programmers in other schools to work from.

Once programs were developed, they would be added to a TTNS software library and downloaded free of charge by any school needing them.

Stephen's idea will be implemented by TTNS over the next few months,

and special schools will be encouraged to take part.

The unique Acorn micro won by Bedford Modern School is a 32 bit machine based on the NS 32016 processor, with a 10mbyte hard disc and a high-resolution colour monitor.

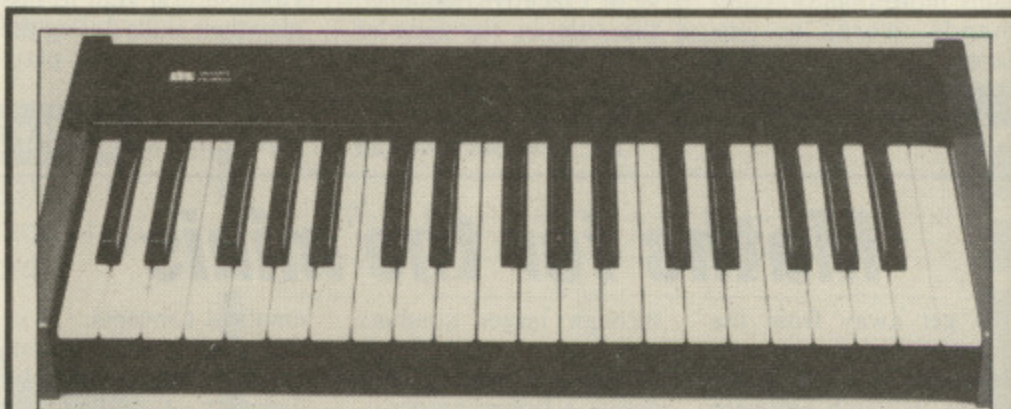
Acorn decided to

donate a special prize of a BBC Micro with voice synthesiser to Linden Lodge School for the visually handicapped.

Pupils of the weekly boarding school submitted a collective entry proposing that TTNS should help integrate handicapped children with

those in ordinary schools through the use of speech synthesisers and Braille-link add-ons for micros.

News of local and national events would then be readily available from the database, and students could swap ideas and information with other schools.



SOUNDING off about its recent software developments for the Echo three-octave musical keyboard is LVL. It has introduced new ROM-based software for the system, which was launched last year for the BBC Micro.

The new version has additional

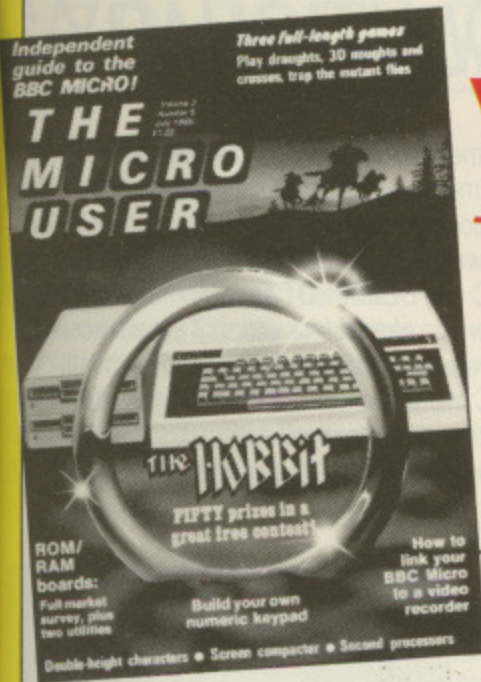
features which include making the recording and playback of music possible, as well as adjusting the pitch or changing the voice while playing.

Its ROM chip also makes it faster than using tape or disc, the firm claims. Price: £29.95 with manual.



**FREE CONTEST!**

# Your chance to WIN the fabulous disc-based version of The Hobbit!



*"Well Mr Baggins, all is ready for adventure and I must say, things are looking very hopeful. Shall we be off then?"*

SO begins what has become one of the all-time classic games for micros – The Hobbit. What follows is a superb recreation of a quest through Tolkien's fantasy world of Middle Earth – a world peopled by trolls, elves, dwarves and many other mysterious creatures.

Based on the plot of Tolkien's famous book, The Hobbit, the task is to steal treasure from the evil dragon Smaug, with you in the role of Bilbo Baggins, gentleman hobbit.

Your journey through Middle Earth will be anything but easy, though. The characters you meet aren't always friendly, to say the least – and there's no guarantee your faithful companions are!

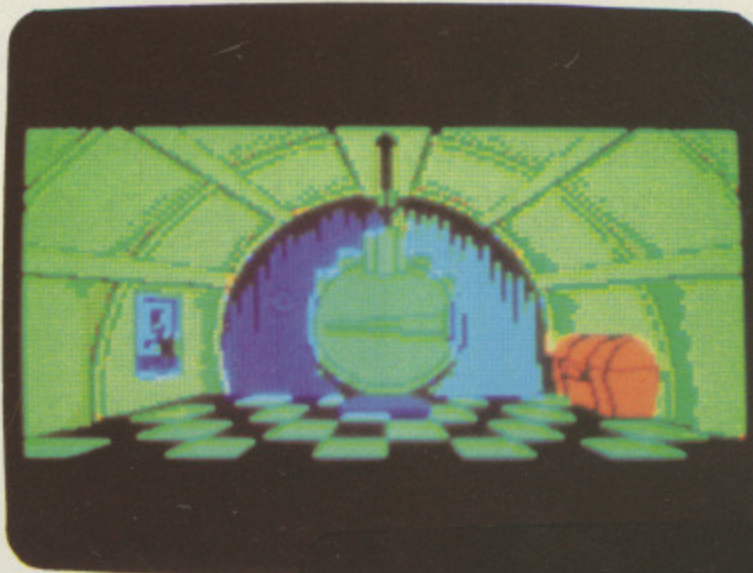
In this unique adventure each character makes his own decisions, so that the game is slightly different every time it is played.

The exciting news is that The Hobbit is now available from Melbourne House on disc. So for the first time your BBC Micro can take advantage of the stunning Hobbit graphics that have been available on versions for other micros.

In fact it's the best implementation of The Hobbit yet – and to celebrate the fact, we are giving away 50 disc-based copies of The Hobbit as prizes for this month's contest.

The competition shouldn't give you any problems at all – it's simply a word square. Hidden in it are the names of 18 characters, creatures and locations mentioned in the book. All you have to do is to ring them on the coupon below, and send them to us not later than July 31, 1985.

The first 50 correct solutions out of the bag will be the winners.



**50 prizes!**

*The new disc-based version features these and many more stunning graphic displays*



## Entry form

Name \_\_\_\_\_

Address \_\_\_\_\_  
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Post to: Hobbit Contest, The Micro User, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.

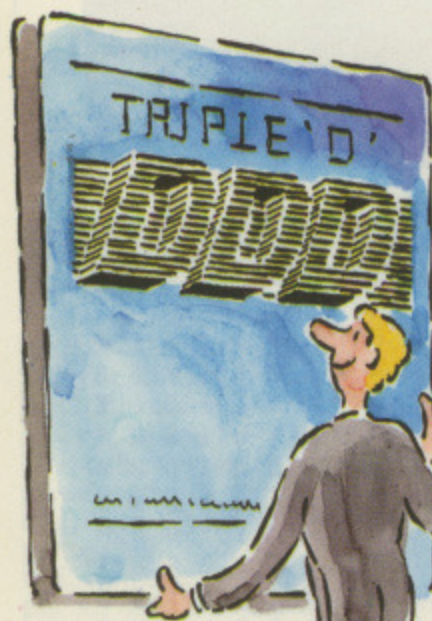
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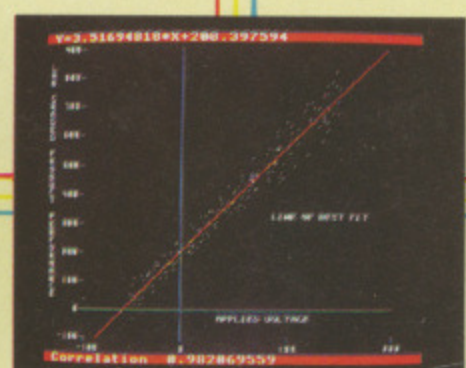
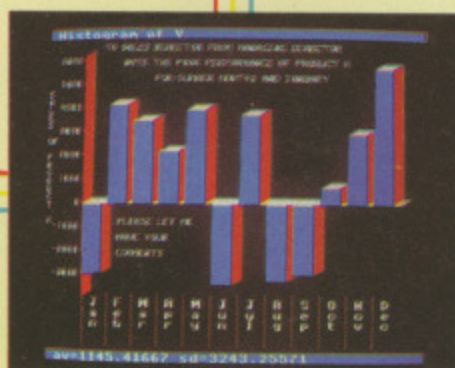
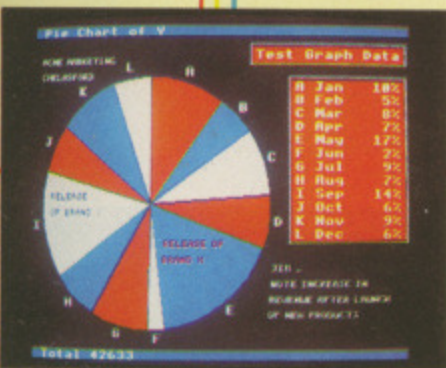
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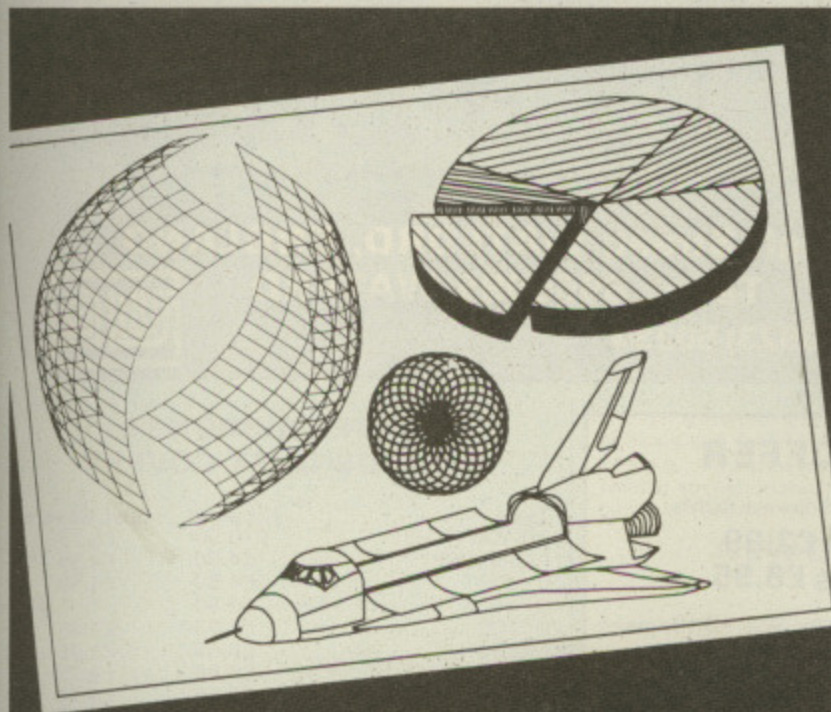


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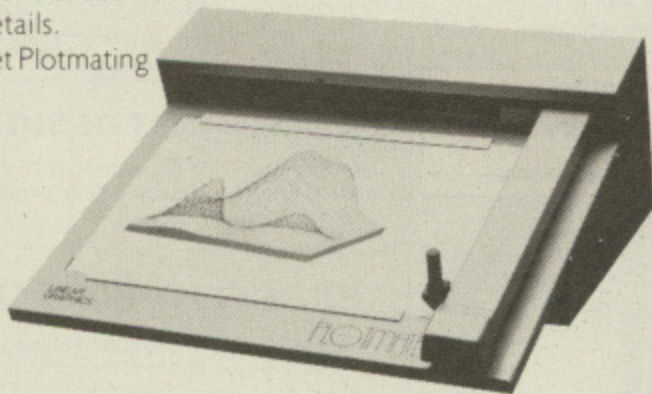
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Only: £65

### BROTHER HR-15

Brother HR15 is a high-quality daisy-wheel ideal  
for a budget printer for serious use. Notable  
features of this printer include a 3k buffer, 18cps  
(max), bi-directional proportional spacing,  
Centronics or RS232 interfaces as standard,  
optional Sheet Feeder and Keyboard.

ONLY £325 (carr. £7)

Single Sheet Feeder	£185
Electronic KEYBOARD	£135
TRACTOR FEED Attachment	£84

### RIBBON CARTRIDGES:

Fabric £3.75; Carbon £3.75;  
Multistrike £6

DAISYWHEELS (various typefaces)	£18
---------------------------------	-----

With immediate effect, we are offering at  
no extra cost ON-SITE 12 months  
Maintenance on all HR15 Printers purchased  
from us.

W.E. GIVES YOU A GREAT DEAL

### Listing Paper (Perforated)

1,000 Sheets 9½" Fanfold Paper	£7
2,000 Sheets 9½" Fanfold Paper	£13
1,000 Sheets 15" Fanfold Paper	£9
Teleprinter Roll (Econo paper)	£4

Carriage on 1,000 Sheets £1.50

### PRINTER LABELS

(On continuous fanfold backing  
sheet)

1,000 90x36mm	£5.00
1,000 90x49mm	£7.75
1,000 102x36mm	£6.25

Carriage on 1,000 Labels £1.00

All prices exclude VAT

### PRINTER RIBBONS & VARIOUS DUST COVERS

Type	Ribbons	Dust Covers
MX100/FX100	£10.00	£5.25
FX80/MX80	£4.50	£4.95
RX80	£4.50	£4.50
GP80	£4.50	-
GP100	£4.95	£3.95
GP250	£5.95	£3.95
KAGA KP810	£5.95	£4.75
CANON PW1080	£5.95	£4.75
MICROVITEC MONITORS	-	£5.50

### KAGA KP810 NLQ PRINTER

This Dot matrix printer has EPSON FX/RX  
compatible control codes and is functionally  
equivalent to an FX80 with the added advantage  
of its 'Near Letter Quality' mode. It is solidly built  
and features include: Normal, Italic, Enlarged,  
super/subscript, proportional spacing and  
user-defined character set. Extras over the FX80  
included in the price are Near Letter Quality  
(NLQ) print ideal for correspondence, Proper  
adjustable tractor feed, half speed quiet mode  
and 3K buffer. The printer is bi-directional and  
logic seeking to give a speed of 140CPS for high  
throughput in conjunction with the standard 3K  
buffer. 8K RAM may be added to give more  
user-defined character sets. Centronics parallel  
interface + Watford's 12 month NO QUIBBLE  
WARRANTY.

Special Offer: ONLY £252 (£7 carr.)

RS232 interface + 2K buffer to connect to other  
micros. £89

### KAGA KP910 Printer

Similar to the KP810 but with 17" carriage for  
wide print. Gives 156 columns of normal print or  
256 columns in condensed mode. Ideal for  
printing out spreadsheets.

ONLY £339 (£7 carr.)

### NLQ FONT DESIGNER

For this NEW ROM (latest in NLQ Technology  
from Watford) please see later pages of this  
advert.

### EPSON HI-80 PLOTTER

The latest addition to the popular range of  
EPSON Printers/Plotters. Prints in upto 10  
colours. Has many more features. Please write in  
for spec sheet.

Price: Only £399 (£7 carr.)

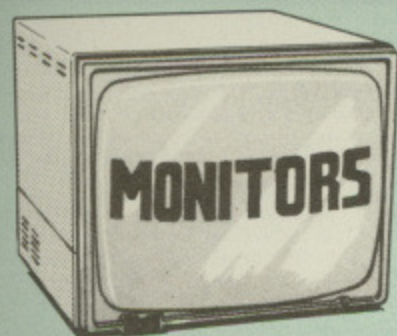
### PRINTER LEAD

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

Standard length (4 feet long)	£6
Extra long (6 feet long)	£9

We can supply leads to any required length.





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

#### MICROVITEC

- 1431 - Medium resolution as used on the BBC television computer programme ..... **£175**
- 1451 - High resolution, suitable for word processing in mode 0 ..... **£237**
- 1441 - High res, exceeds the capabilities of the BBC micro ..... **£385**
- 1431AP RGB + PAL and AUDIO ..... **£199**
- 1451AP RGB + PAL and AUDIO ..... **£285**
- Dust Cover for Microvitecs ..... **£5.50**

All Microvitec Monitors are 14" RGB in their distinctive right angle sturdy metal case or the new beige plastic case. They are supplied complete with connecting lead to the BBC and a 3pin mains plug.

#### KAGA

- KAGA KX1201G Hi-res Green Monitor ..... **£90**
- KAGA KX1202G Ultra-Hi-Res Green Monitor ..... **£105**
- KAGA KX1203A Ultra-Hi-Res Amber Monitor ..... **£105**
- KAGA Vision 2, Hi-Res, RGB Colour Monitor ..... **£225**
- KAGA Vision 3, Ultra Hi-Res, RGB Monitor ..... **£310**

All KAGA monitors are 12" units housed in a professionally finished beige plastic cabinet. They all have as standard, a genuine etched anti-glare screen.

#### ZENITH

12" high resolution monochrome monitor. Ideal for word processing as its green or amber screen is very restful to read. The high resolution makes it good for games too - you can really see the detail that has been put into the graphics ..... **£66**

#### LEADS

- BNC Lead for Zenith or Phillips ..... **£3**
  - RGB lead for KAGA ..... **£5**
- N.B. Carriage on Monitors **£7** (securicor)



#### ROM-SPELL



ROMSPELL is the new fast Spelling Checker ROM from Watford. Packed with excellent features, ROMSPELL is probably the most advanced spelling checker available for the BBC micro.

Features include:

- 30,000 word dictionary
- One pass check
- Two pass check
- Ambiguous word check
- Basic access to ROMSPELL
- Immediate entry check

ROMSPELL is fantastic value at **£25**

(Please specify 40 or 80 tracks when ordering)

## BBC MICRO WORD-PROCESSING PACKAGE

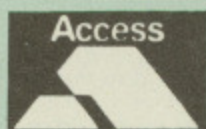
A complete word-processing package (which can be heavily modified to your requirements, maintaining the large discount). We supply everything you need to get a BBC micro running as a word-processor. Please call in for a demonstration.

#### EXAMPLE PACKAGE

BBC Model B, Watford Electronics' DFS upgrade, WORDWISE ROM, Twin 400k Epson drives in beige, Zenith 12" Hi-resolution monitor (Green or Amber), Brother HR15 daisywheel printer, Gemini software: BEEBCALC spreadsheet, analysis and DATABASE software on disc, 10 x 3M disc, 500 sheets fan-fold paper, 4 way mains trailing socket, manuals, all leads and BBC carrying case.

#### NEW LOW PRICE

Only **£999**



**ACCESS  
HOT LINE  
(0923 50234)  
24 Hours**

## THE EPSON RX/FX/KAGA PRINTER COMMANDS REVEALED

So you bought yourself a new printer, because the salesman in the shop showed you how clever it is and impressed you with all sorts of printouts to show its capabilities - he may even have offered you a special price.

However, now that you have got it home and connected it to your BBC microcomputer, you are wondering how to make it perform these magical tasks. The manual seems to give no clues, and when you type in the example programs, the computer throws the LPRINT statements back in your face.

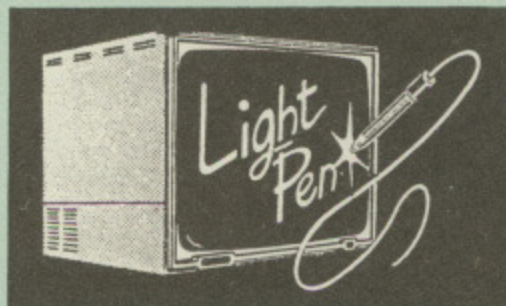
Now what do you do, when this £400 piece of high technology refuses even to move its head, and you have stayed up until 2 in the morning with copious supplies of coffee, desperately trying to print something out. Once again, Watford Electronics comes to your help with our new book entitled 'THE EPSON RX/FX/KAGA PRINTER COMMANDS REVEALED'.

This book describes in plain, easy to understand English how to use your printer (Kaga KP810, Canon PW1080A, or any other Epson FX-80 compatible printer) with the BBC micro, both from Basic and your Wordwise wordprocessor.

It describes in detail how to obtain the maximum in graphics capability from your printer and includes full indexes allowing you to cross index the numerous commands. Every command is explained in detail, with an accompanying BBC Basic program and an example of its use from Wordwise.

This book is superb value at only **£5.95** (Book - No VAT)

#### LIGHT PEN

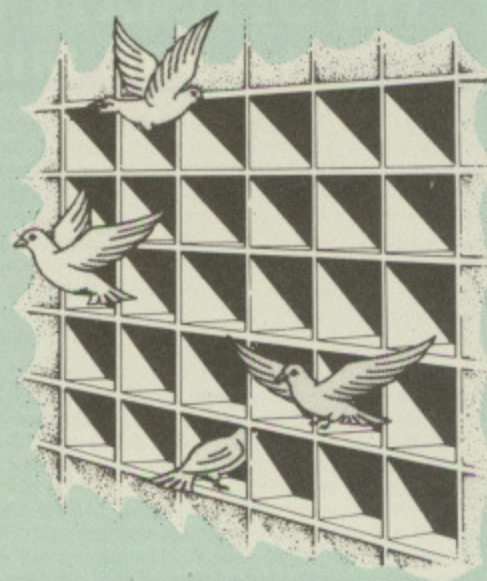


This Light Pen for the BBC micro is packaged in a neat pen shape with built in switch. Supplied complete with our sophisticated Pen-Pal software on cassette (see elsewhere in this ad).

Only **£23**

(For software on disc please add £2)

## DATABASE MANAGEMENT SYSTEMS



#### DISCDATA

Discdata is an entirely disc based database handling system. It is extremely easy to use through its comprehensive menu system. The simplicity is such that we do not feel the need to provide explanation on use in the written guidance supplied with the program. The first-time database user will rapidly become familiar with this package designed throughout to be simple and obvious.

On disc at **Only £17**  
(Please specify 40 or 80 track when ordering)  
(Please write in for technical specifications)

#### FILE-PLUS

The File-Plus package is even more powerful and flexible than Disc-Data. It is also largely menu driven but has its own command language for file searching. The 16K ROM contains all the normally required routines, with lesser used options supplied on the utilities disc. All input and output formatting is controlled through screen forms. A full screen editing system is used to define a form which allows tremendous flexibility in the format in which your data is displayed. It is very easy to change from form to form so that you can type in your data with one form, and examine it with others. You will typically design several forms before starting to access the database so that you can quickly and easily see the fields of each record that you want to appear in the layout you decide on. The form system is also used for output to your printer. File Plus has a unique file linking system that allows the entire on-line storage of your system to be used for one database. This can give around 1.5 Megabyte databases using dual drives and double density.

The built in FQL (File-Plus Query Language) can be used for searching the database. Presented in the form of a powerful command language with looping facilities etc. this allows the most flexible access to your data possible. Full arithmetic operations are provided to allow the system to be used for statistical analysis.

Operations supported are -, +, \*, /, + - 999999 9999.9999 and compare facilities =, >, <, >=, <=, &.

Many keywords are supported by the language: assign, compare, display, and, goto, iff, ift, print, read, search, spool and update.

Supplied with a very detailed 70 page manual to explain all the facilities with many examples.

**Only £43**

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

#### DATAGEM

Gemini's 24K ROM based  
DATABASE Management System  
Special Offer: **£99**

Continued



## The ULTIMATE DFSs for the BBC MICRO

Adding disc drives to your BBC is probably one of the best ways of improving the power of your microcomputer system. Watford, with their reputation for providing quality products at an affordable price, have available a full range of disc drives and associated products, including:

- Disc Filing Systems
- Disc drives
- Disc covers
- Floppy discs
- Disc boxes
- Disc cases
- DFS manuals
- Disc books
- Disc cleaning kits
- Disc based software

Watford Electronics supply two highly sophisticated Disc Filing Systems specially designed to be fully entry point compatible with Acorn's standard DFS. As well as this, these two DFSs provide significant and powerful enhancements to allow the user greater ease in accomplishing a given task.

Many people who are about to buy a DFS find themselves wondering which one to opt for: should they buy the standard Acorn one and restrict their available features, or should they buy one of the other DFSs and find themselves running into compatibility problems if they opt for the wrong one? Before you look below to see the vast range of extra features that our DFSs provide, may we just point out that our DFSs are fully Acorn compatible; not just partially, like some of the "competition". We have been supplying DFSs for two years now with many thousands of satisfied users. Also, please note that the Watford DFS is supplied by a reputable firm via proper mail order and shop premises.

Just compare the features:

Features	Acorn 1.20	Watford	
		Single Density	Double Density
Max nos. of files per disc side	31	62	62
Max disc capacity	800k	800k	1440k
Tube compatible	Yes	Yes	Yes
Built-in Editor	No	Yes	Yes
Built-in Formatter	No	Yes	Yes
Built-in Verifier	No	Yes	Yes
MRUN a file	No	Yes	Yes
MLOAD a file	No	Yes	Yes
Extended RENAME	No	Yes	Yes
Selective COPY	No	Yes	Yes
Default file name	No	Yes	Yes
Disc space distribution	No	Yes	Yes
40/80 Software Switchable	No	Yes	Yes
Wide catalogue	No	Yes	Yes
Close open files	No	Yes	Yes
Improved OPENOUT	No	Yes	Yes
Copy between densities	N/A	N/A	Yes
OSWORD & 7F	Yes	Yes	Yes
Full entry point compatibility	Yes	Yes	Yes
Retain information over a break	1.20 partial	1.42 Yes	1.52 Yes
Games compatibility	Yes	Yes	Most
Econet file server	Yes	Yes	Yes
Econet station	Yes	Yes	Yes
Full wildcard facilities	No	Yes	Yes

Note that whilst BOTH of our DFSs are compatible with the 6502 and Z80 Second Processors, the Acorn DNFS ROM (supplied by Acorn with the processors) should be present within the machine for the Tube transfer protocol. Our single density DFS is compatible with the Torch Z80 system. With the current versions of our DFS and DDFS, "PAGE" will remain unaltered by the presence of a DNFS ROM; i.e. the normal value of &1900 is retained.

## THE WATFORD DFSs

Designed to offer power and flexibility, the two versions of our DFS are packed with features such as:

- Acorn's slightly antiquated DFS allows a maximum of only 31 files per side of a disc. OUR DFSs cater for either 31 or 62 files per side of a disc. In 62 catalogue mode, all these files are available and displayed as one continuous catalogue; not a collection of small catalogues that require extra effort on the part of the user to swap between. We have found that 62 files is adequate in normal use (more would require altering "PAGE", which is undesirable - again this is due to the way in which the BBC micro is organised).
- Built into each Watford DFSs are the disc Formatter, Verifier and Sector Editor that are so useful and essential for the operation of a DFS. We do not ask you to pay extra for these features with our DFSs - they should always be present within a perfect DFS and therefore included in the price.

- One of the excellent features of the BBC is its 80 column mode of operation. Acorn's DFS, unfortunately, only displays in 40 columns even in these 80 column modes; ours displays the catalogue correctly in 4 columns. This feature has now been extended to include the 80 column display of the filing system information at the top of the catalogue as well.

- When working on a program, most "load and save" operations to the disc will use the same filename (ie that of the current program). To save typing, and minimise errors, our DFS has a novel feature whereby a "default" filename can be entered. Once this is done, the usage of a null filename will cause this previously entered filename to be used.

- Catalogues produced on the screen by our "Ultimate" DFS include extra information to say how many files are present within the catalogue, whether the catalogue is 31 or 62 files in size, how many tracks are on the disc, and whether the double stepping mode is active, etc.

- Due to the way that Acorn decided files should be stored, there is occasionally a need to "compact" the available spaces on the disc. As this can alter the contents of memory, we decided that it would be useful to implement a command that informs the user whether compaction is necessary, and if it will actually result in any significant gains.

- One standard requirement of a filing system is to be able to rename files. Acorn's simple DFS only allows for one named file to be changed to another named file. Our "Ultimate" DFS allows for groups of files to be renamed. For instance:

\*RENAME \*BERT\* \*FRED\*

will take all the files that have BERT in their name, and change the BERT to FRED.

- The OPENOUT command on both versions of the Watford DFS has been improved so that it automatically selects the largest available space on the disc; thus minimising the frequency of the Can't extend error messages.

- Both of our DFSs feature, as standard, the ability to make a normal 80 track disc drive read and write 40 track discs. This is normally accomplished by an expensive manual switching unit on the drives; our DFS does this as standard.

- The software switching aspect of our DFS and DDFS is far more flexible than a standard switchable drive. The reason for this is quite simple: a switchable drive means that both sides of the disc are either 40 OR 80; you cannot have 40 track on one side and 80 track on the other side with a standard switchable disc drive. The Watford DFSs are fully independent, and thus far more powerful. With the DDFS, both the density and the 40/80 aspect are independent; thus offering incredible flexibility.

There are many other features of the Watford DFS too numerous to mention, but all well documented in the excellent DFS manual sold separately.

## WATFORD'S & ACORN'S SINGLE DENSITY DFS

Watford's popular and widely acclaimed DFS has now been available for two years, and has gained a large following amongst serious users of the BBC Micro. Owners of Acorn's standard DFS can upgrade to our "Ultimate" DFS merely by replacing their DFS ROM. See below for the price of this upgrade.

### PRICES

- Complete Disc Interface Kit incl. DFS ROM & fitting instructions **£75**
- Acorn's DFS Kit complete **£73**
- DFS Manual (Comprehensive) (no VAT) **£6.95**
- (P.S. Our comprehensive DFS Manual covers both Acorn & Watford DFSs)
- Watford's sophisticated DFS ROM only **£16**
- We will exchange your existing DFS ROM for Watford's Ultimate DFS ROM for only **£12**
- Watford's DFS is exclusively available from Watford Electronics. Every ROM carries a special label with our LOGO and serial number.

## WATFORD'S DOUBLE DENSITY DFS INTERFACE

The DDFS from Watford Electronics represents a new standard in DFSs for the BBC micro. This is a double density version of our popular single density DFS, and combines all the features of this powerful DFS with the advantages of a system that gives 80% more storage per disc in double density mode. P.S. - Please note that not all DDFSs are capable of providing either the full 80% storage increase, or of allowing a file the full size of the disc - Ours allows both of these!

The Watford Electronics DDFS will operate with discs formatted in either single or double density: the density is automatically sensed on an access to the disc and this is then remembered for future accesses. The built-in formatter prompts for the density when a disc is formatted, allowing the user to select the density of his own discs.

The typical piece of games software these days is provided upon a protected disc. In order to work on any double density system (including the others on the market) a protected piece of software needs to make calls through the OSWORD & 7F routines. To ensure compatibility, the Watford DDFS features probably the most comprehensive and powerful 8271 emulation ever written for a double density system.

### PRICES

- Complete DDFS Kit incl. fitting instructions **£85**
- DDFS Manual (no VAT) **£6.95**
- We will exchange your existing Single Density for our DDFS Unit at **£40**



## Quality Disc Drives from Watford Electronics

To help you decide which drive is the most suitable for your needs (and your pocket!), we have produced the table below.

The first capacity given in the first column indicates the single density capacity. The double density storage capacity is second one, (that within the brackets). All disc Drive type numbers start with the prefix "C".

The tinting on some of the boxes is used to indicate which Drives are 40 track and which are 80 track. The 40 track ones are manufactured by EPSON, the world famous Japanese company, (non-tinted boxes). The 80 track drives are famous MITSUBISHI drives (tinted boxes).

With two prices in a box (e.g. £295/£299), the first price is for the standard drive and the second for the same unit in switchable type. Users of either of the two Watford DFSs will not need switchable drives as their DFS will provide software switching for them. Users of Acorn's DFS will find that they need to pay the extra for switchable drives if they wish to use 40 track discs in an 80 track drive.

The drives we supply are fast (3ms track to track, 15ms settle), quiet and have a low power consumption (average well under 1 amp). Extensive experience of the usage of disc drives suggests that the MITSUBISHI and EPSON drives currently represent about the best in terms of speed, reliability and overall "elegance" available for the BBC Micro.

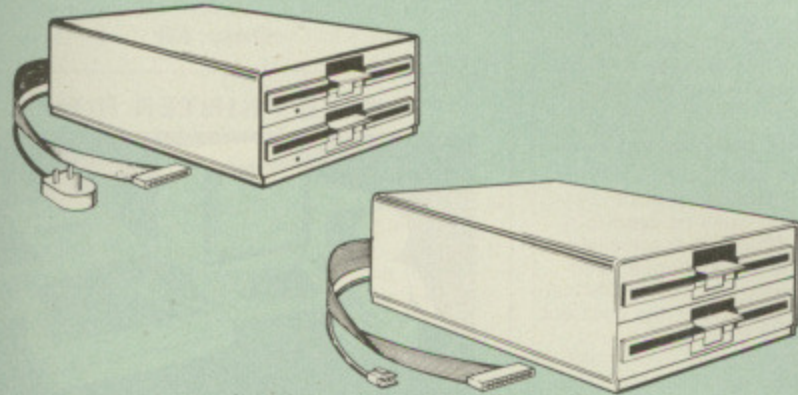
Various other "manufacturers" of disc drives for the BBC micro (more accurately, "packagers" label other manufacturers drives with their own name). We buy the high quality Epson and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public.

### Names you can trust, at prices you can afford!

If you look around the popular BBC micro press, you will find that the prices we quote are, virtually without exception, some of the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.

Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate: extensive tests within our workshops have confirmed this. All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. (Ideal for Schools & Colleges. All single disc drives with power supply, (i.e. CS100, CS200 & CS400S) are supplied in a twin case with twin data cable for later inclusion of a second drive). At Watford we anticipate your needs of tomorrow not just today!

All disc drives advertised here will operate in double density mode with the appropriate interface and software.



Capacity	Drives without P.S.U.		Drives with P.S.U.	
	Single	Twin	Single	Twin
100K (180K)	CLS100 £85		CS100 £115	
200K (360K)	CLS 200 £89	CLD200 £165	CS 200 £120	CD200 £185
400K (720K)	CLS 400 £120 CLS400S £122	CLD 400 £170	CS 400S £140	CD400 £189
800K (1.44M)		CLD800 £232 CLD 800S £242		£265 CD 800S

- TWIN drive CASE, with Power Supply & Cables £40  
Securicor carriage on Disc Drives £5

Prefix C = Cased Drive      Suffix S = 40/80 Switchable  
L = Less PSU  
S = Single  
D = Double

e.g. CLS400S = Cased drive, Less power supply unit, Single 400K, Switchable (40/80 track).

## MYSTERIES OF DISC DRIVES & DFS REVEALED

Are you tired of faulty cassettes, and lengthy loading times? Do you want to upgrade your BBC micro to take discs but you get tied up in the plethora of jargon surrounding the choice and use of these systems.

For instance, what is the difference between single and double density formats, how can you use a 40 track disc on an 80 track disc drive? What is the difference between a DFS and disc interface kit? Should you acquire a single Disc drive or twin? What does 48 TPI and 96 TPI discs mean? These are just a few of the questions you may have asked yourself and never found the answer or maybe you have yet to encounter these questions.

Now the mystery of buying a suitable interface and disc drive for your BBC micro is revealed in Watford Electronic's new book entitled 'MYSTERIES OF DISC DRIVES & DFS REVEALED'. It describes in fine detail, yet remaining very readable to the beginner, how disc drives operate, the type of interfaces available, which type of discs to use on a disc drive and how data is stored on the discs.

There is even a handy section describing the phrases you are likely to encounter, and how to interpret them. This book must be an essential purchase at £5.95, especially if you own or are thinking of buying a disc system.

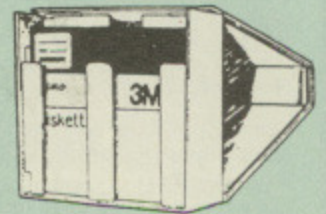
£5.95 (Book No VAT)

## 3M - 5 1/4" DISKETTES

Top quality 3M - SCOTCH Diskettes from Watford Electronics (Your 3M Appointed Distributors). All our discs carry a lifetime warranty. These discs are quiet in operation and insert positively with their reinforced hub rings. Boxes of 10 supplied complete with self stick disc labels and write protect tabs.

FREE FREE FREE

Watford Electronics are now the biggest single distributor of 3M's 5 1/4" floppy discs throughout the UK. As a gesture of thanks, we are this month giving away absolutely FREE this Disc library case with every box of 10 discs purchased from us.



### DON'T SETTLE FOR LESS, BUY THE BEST

- 10 x S/S D/D 40 Track Diskettes £13
- 10 x D/S D/D 40 Track Diskettes £18
- 10 x S/S D/D 80 Track Diskettes £22
- 10 x D/S D/D 80 Track Diskettes £24

## DISC ALBUMS

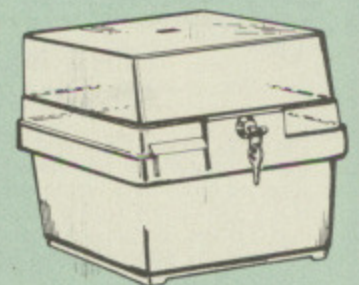
Attractively finished in beige leather-look vinyl, these conveniently store upto 20 Discs. Each Disc can easily be seen through the clear view pockets.

£4.25

## LOCKABLE DISC STORAGE UNITS

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

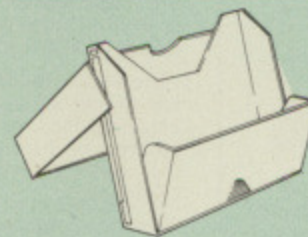
- M35 - holds upto 40 discs £12
- M85 - holds upto 95 discs £15



## PLASTIC LIBRARY CASES

FOR 5 1/4" DISC STORAGE  
holds 10 Discs.

£1.80



## FLOPPY HEAD CLEANER KIT

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

£9

## DUST COVERS (For our Disc Drives)

- Single (without PSU) £3.20      Twin (without PSU) £3.85
- Single (with PSU) £3.25      Twin (with PSU) £3.90

Continued



## EPSON NLQ ROM for the BBC Micro



Impress your friends and business colleagues with the quality of your letters and printed material with Watford's very simple to use EPSON NLQ! (Near Letter Quality) ROM. Suitable for FX80, RX80, RX80F/T, FX100.

Look at the features:

- Simply type \*NLQ80/100 and a single VDU code to use NLQ print.
- NLQ is then available without any modifications from BASIC, WORDWISE, VIEW (with NLQ DRIVER) or virtually any other program or language.
- Single codes select PROPORTIONAL type (yes even on the RX80); ENLARGED type; UNDERLINED type. These features can be used separately or in any combination.
- Full UK character set; Standard 'pica size'; Proportional spacing; Enlarged; Underlined; Normal type.

The NLQ ROM is supplied complete with comprehensive manual.

P.S. NLQ ROM is compatible with the Torch Z80 system and can be used from within the Perfect Writer software.

Only: £22

## VIEW PRINTER DRIVER for NLQ ROM

This specially written printer driver has been designed to allow View access to the full features of our NLQ ROM. A must for all VIEW and NLQ ROM users.

£7.00

NEW  
LAUNCH

## THE NLQ DESIGNER

The Kaga Taxan KP810 and KP910 are two superb printers, as our many thousands of satisfied customers would surely attest to. One of its particularly strong points is the NLQ option that it offers; perhaps one of the more weaker points is the effort required to design your own custom NLQ font.

Well the solution is here NOW in the shape of Watford's NLQ DESIGNER ROM! This powerful piece of software allows easy design and entry of a full NLQ font, with further fonts recallable from disc. Once a font has been programmed with the versatile NLQ DESIGNER, it can be saved to disc, downloaded to your Kaga (or Canon) printer, or even programmed into an EPROM (given the appropriate hardware) and then plugged directly into your printer so that it is available immediately when you turn it on.

A 40/80 track format disc containing 3 example fonts is included in the package.

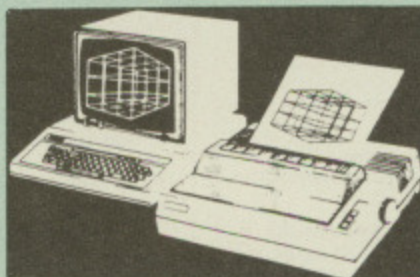
(P.S. This ROM is not suitable for Epson printers as they don't normally have NLQ ability. Keep reading our adverts though - work is in development!)

NLQ DESIGNER & FONT DISC £25

INDIVIDUAL Preprogrammed FONT ROMS  
£15

(Please write in for further details on both the NLQ DESIGNER and the individual font ROMs available.)

## DUMPOUT 3



A highly sophisticated screen dump ROM. This has to be the most flexible and powerful screen dump ROM yet produced for the BBC micro. It will put on paper anything you see on the screen, including all Mode 7 facilities etc. We have to admit that there is one facility that we cannot replicate - if anyone can supply flashing ink we would like to know! The ROM also provides window setting utilities and two new OSWORD calls that allow mode 7 graphics pixels to be read and plotted using the standard graphic co-ordinate system. The latest version includes a graphic dump trigger for dumping screens from games whilst they are running.

Two commands are used to operate the dump routines:  
\*GIMAGE - This provides a full graphics dump of any graphics mode, plus modes 7 and '8'. There are many optional parameters but you need only specify the parameters you wish to change.

Features available include:

- Vertical and horizontal scaling through all the graphic modes and mode 7
- Rotation of the image produced through 90, 180 and 270 degrees
- Left hand indentation setting
- Screen dump window definition
- Colour grey scaling
- Two tone fast dump
- Special colour mask
- Mode 7 contrast expansion
- Mode 7 contiguous dump
- Key triggered dumps
- User port switched dumps

What does the independent press say!

*Practical Electronics, May 1985*

"The Dump Out 3 ROM from Watford Electronics represents one of the most sophisticated types of printer dump utilities available for the BBC Micro . . ."

"an extremely sophisticated and powerful dump utility".

"VERDICT - Dump Out 3 ROM has all the facilities which you are ever likely to need for producing printer dumps. The facilities available work extremely well and if printer dumps are something which you require, then this ROM can be recommended to help you to get the best out of your dot matrix printer".

*The Micro User Feb. 1985.*

"Well, here is that winner"!

"provide(s) some rather sophisticated screen dumps. Producing high resolution paper copies of graphic screens in any (graphics) mode will be the major reason for buying this ROM, and this is where Dump Out 3 performs PAR EXCELLENCE". (Our capitals for their italics.)

"The versatility of \*GIMAGE (the graphics dump command) when using these parameters is amazing. Pictures of almost any size, shape, contrast or distortion may be produced without the need for a reducing photocopier or trick photography".

"Without reservation I wholeheartedly recommend the Dump Out 3 ROM as the ultimate screen dump facility for the BBC micro. It is easy to use yet highly versatile, and caters for all BBC screen modes in multitone high resolution printing. Whole, partial, rotated and scaled screens may be dumped to almost any BBC compatible dot matrix printer (see our list at the end of this advert). At £24 it must represent excellent value for money and surely cannot be beaten".

Designed for use with the following printers: CP80, GP80/100/250, CANNON, STAR, KAGA/TAXAN, NEC, SHINWA CP80, GEMINI, EPSON MX/RX/FX, LPVII, NEC PC8023, DMP100/120/200/400, etc. etc.

Price including comprehensive manual

£24

## ADE

'Systems' complete program development package in a 16K ROM. We are now supplying the new 6502 2nd processor compatible version.

SPECIAL OFFER ONLY £43

## VIEW

### VIEW WORDPROCESSOR

We are supplying the new VIEW version 2.1 allowing printing of memory contents etc ..... £46

## HI-VIEW

A special version of VIEW designed for use with 6502 2nd Processor. Available on disc, it offers 47K of text memory.

£49

VIEW SHEET (Acornsoft)

£49

## Watford's own Sophisticated VIEW PRINTER DRIVER for Epson FX80 & KAGA KP

Only £9

## VIEW DRIVERS FOR JUKI & BROTHER PRINTERS

Only £8

## VIEW/VIEW SHEET PRINTER DRIVER for SILVER REED

(Officially approved by Silver Reed)

A range of VIEW Printer drivers to complement the Silver Reed range of printers EXP400/500/550 & 770 EB 50 and converted typewriters EX43/44 & 55.

Only: £8

## BEEB PRINTER ROM



"Makes Printing Childs Play"

This utility ROM is designed to simplify using all the facilities of your printer. It has many facilities:

- ★ Selection of printer modes such as underline, font and size is by 'Single Key' operations.
- ★ From Wordwise, a single number following OC will select a mode rather than a long and incomprehensible string of control codes. This makes using your printer with Wordwise much more convenient.
- ★ When using Basic (or other languages) you can have control over the formatting of the output to the printer in the style of a wordprocessor. You can define page top, bottom and side margins etc. with intelligent page skip for binders an option. All supported printers will now respond to form-feed etc. commands.
- ★ User defined characters are printed as you see them on the screen so that non-standard characters are automatically printed out correctly.
- ★ Commands select the options for the following printers: GP100, STAR, NEC, MX/FX, KAGA, LP/VII/DMP100, DMP200.

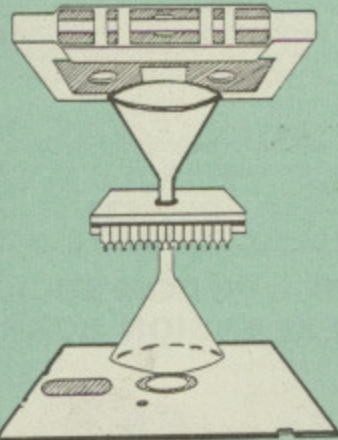
Operates with either parallel or serial interfaces.  
★ Supplied with a 50 page manual that is very comprehensive and easy to follow. Please specify printer type when ordering so that we can send the correct function key strip.

Price: £24





## TRANSFEROM (Tape to Disc Utility)



After months of top secret development, we are now able to supply details of this advanced and sophisticated utility ROM for the BBC micro. Just look at the features:

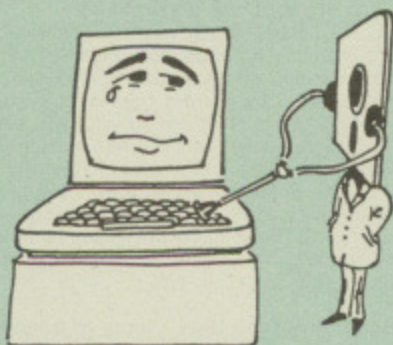
- Fully menu driven for ease of use
- Copes with locked programs
- A very comprehensive built in copying features
- Copies very long adventure games
- Supplied with comprehensive manual

TRANSFEROM is now available in BOTH single and double density versions. The single density version works with both the Acorn and Watford single density DFSs. The double density version works with the Watford DDFS system only.

TRANSFEROM takes your software on tape and saves them onto disc. TRANSFEROM does not stop when one disc is full; you just insert another disc in and carry on with that one! Surely this is the most valuable investment you could make if you have tape software that you wish to transfer to disc! Please specify version required - Single or Double Density.

£22.00

## DIAGNOSTICS DISC



The BBC micro is a very complex machine and thus diagnosing a fault can be very difficult. Until now, the only way to discover the nature of a fault was either to find a competent friend with a large degree of patience or to find your nearest dealer and pay him to find out what is wrong.

At Watford Electronics, we realise how difficult it can be when faced with a problem, finding yourself a long way from your nearest dealer, or even just uncertain about your Beeb's health, but not wanting to waste time and money taking it to be looked at.

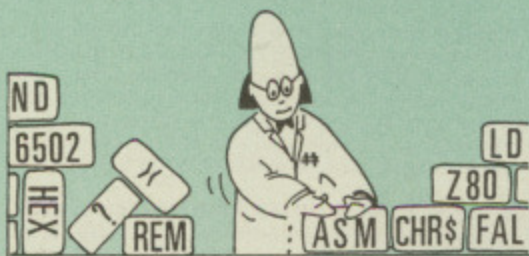
The solution to these problems is here now, in the form of the Watford's Diagnostics Disc. This excellent utility is specially designed to test out the following areas of your Beeb:

RAMs, ROMs, ULAs, Sound, Keyboard, Disc, RS423, ADC, User Port, Printer Port, Cassette, Joysticks, Speech, Disc Drives, 6502 and Z80 2nd Processors.

This utility is an invaluable aid for all those who take the reliability of their system seriously. A comprehensive manual provides full operating details and a list of possible causes and remedies for any faults that you may find along the way. The package also enables a permanent equipment and service record to be maintained.

Trial Price  
Only £15.00

## ROMAS THE CROSS ASSEMBLER AND MACRO EDITOR FOR SERIOUS PROGRAMMERS!



ROMAS is a carefully designed, sophisticated yet simple to use, development system for serious assembly language programmers. Using the BBC as the development system, you can choose your target system from the following processors:

6502, 65C02, Z80, 8085, 8041, 6809 and Z8 P.S. This includes the Acorn 6502 & Z80.

ROMAS features a powerful expression analyser, making complex table easy to generate. To aid in documentation, fully formatted assembly listings may be produced, with full symbol table output at the end.

ROMAS is provided with a powerful cross referencer to produce a listing of all the labels in a given "source" program; this makes it easy to check to see if you are about to duplicate a label.

### The Macro Editor

Features of this powerful editor provided with the ROMAS package include:

- Works in all 40 and 80 column screen modes
- Fast load and save speeds
- Continuous line and column number displays
- Search, replace and move; all available in macros
- Command repetition

The ROMAS package includes a comprehensive manual, providing detailed documentation and plenty of examples.

A give away at ... Only £45

Please specify 40 or 80 track disc when ordering.

### Special Offer

Purchase a copy of ROMAS and our EPROM programmer (retail price £113.00), and we'll give you the very special price of:

£99.00! (£4 p&p)

## ULTRACALC 2

The mark 2 version of the BBC Publications extremely popular electronic spreadsheet ROM.

Only: £66

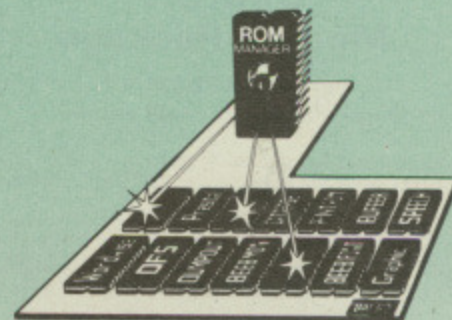
## DELSYS

### Digital Electronic System

The DELSYS project introduces the BBC Micro user through a structured approach to the fundamentals of microcomputer hardware design. For the first time an opportunity to grasp and understand the importance of Digital Electronic Systems in control applications is offered to owners of the BBC Micro. This is achieved by tackling a set of hardware project packs of varying degrees of complexity. Introductory packs will educate users in the fundamentals of digital circuits by using practical experiments. A easy to understand manual explains the constructor, the operations and procedures in a step by step guide to basic design principles.

The first of the DELSYS project packs introduces the user to the concepts of logic gates, fundamental chip selection from technical data sheets, interfacing and bus structure techniques using the construction of a set of "Traffic Lights" as an example.

## ROM MANAGER



'Provides comprehensive management of all your installed ROMs - BEEBUG Nov. '84'. This ROM is unique in its capabilities. It allows you, the user, full control over the BBC Micro's sideways ROM paging system with simple to use commands. This ROM is essential for those with several ROMs. At a simple level ROM MANAGER can be used to remove the problem of clashing command names and allow full use of all the facilities of your ROMs. This is coupled with facilities to completely enable or disable various ROMs in the machine including ROM manager itself.

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

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

Price £20

## DISC EXECUTOR

Disc Executor is a sophisticated disc utility for the transfer of your programs from cassette to disc. It copes with 'locked' files and full length adventures (up to &6E blocks long) and programs that load below &E00. Disc Executor is simple to use and provides menus to prompt the user along the way. Disc Executor will cope with the vast majority of tapes. (Please note that Disc Executor is not compatible with double density disc interfaces - keep reading our adverts though!)

Price only £10

(Please specify whether 40 or 80 track disc when ordering)

Continued



## Nightingale Modem

Now Watford brings you PACE's NIGHTINGALE MODEM PACKAGE including the popular Commstar ROM software for the BBC Micro. Nightingale is considered to be by far the most versatile BT approved modem available at the price for the BBC Micro. It is ideal for home or business use. It offers Prestel/Viewdata baud rates (1200/75 & 75/1200) as well as 300/300 baud full duplex for communication between BBC and other computers, including bulletin boards. A bargain at our

### SPECIAL INTRODUCTORY OFFER

(Price includes  
COMMSTAR ROM &  
comprehensive manuals) **£119**

Nightingale Modem without software  
**Only £99**

COMMSTAR ROM package only **£29**  
(P&P on modem £2.00)

Auto Dial/Auto Answer Board **£48**  
Auto Dial Utilities Disc **£9.50**  
OBBS Bulletin Software **£20.00**

## DEMON Modem Package

### THE MODEM

300/300 baud full duplex Auto answer  
(orig and ans) Auto dial  
1200/75 baud full duplex Auto baud rate detect  
75/1200 baud full duplex CCITT/BELL standards

### THE SOFTWARE

Full baud rate support  
1200/1200 full duplex 4800/4800 full duplex  
2400/2400 full duplex 9600/9600 full duplex  
Auto dial  
Auto answer  
File transmission in 3 protocols  
Prestel terminal  
Mainframe type terminal  
Two window operation

Supplied with a comprehensive manual and all necessary leads.

Price: **£69.95** (Carr. £3)

Auto dial software disc **£4.25**

(Please specify 40 or 80 track)

(Note: Demon is not BT approved)



Watford's own Machine code Monitor ROM written by Andrew Bray (Cambridge), co-author of the BBC Micro Advance User Guide.

BEEBMON is the most powerful and versatile machine code monitor from Watford Electronics. BEEBMON offers some superb features specially designed to make the task of understanding and debugging machine code easier; indeed BEEBMON is probably the only product with sufficient power to aid in the debugging of such complex pieces of software as a DFS. Offering a total emulation mode, BEEBMON can be used to single step through code anywhere in memory. All breakpoints are emulated and the workspace is totally relocatable, allowing for the simulation of all those "awkward" pieces of code.

Superb value for money at only:

**£24**

## DISASSEMBLER ROM

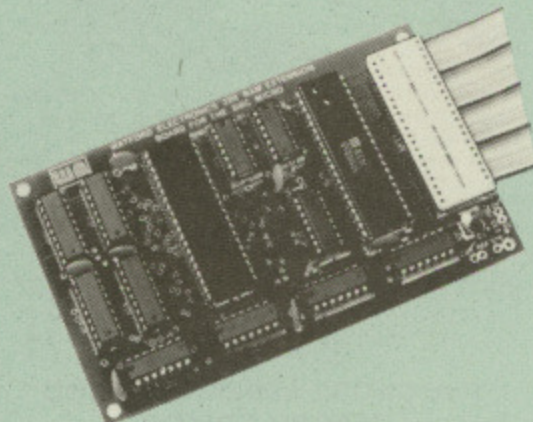
Discover the hidden secrets of BASIC and the OPERATING SYSTEM with this easy to use programmers tool.

**ONLY £18**

Please write in for technical details.

# 32K RAM/

## PRINTER BUFFER EXPANSION BOARD



A MUST FOR WORD PROCESSING

Watford Electronics now brings you the latest state-of-the-art MEMORY EXPANSION BOARD for your BBC microcomputer. Just plug the ribbon cable into the 6502 processor socket, and fit the compact board inside the computer. Immediately you will gain not 16K or even 20K, but a massive 32K of extra RAM!!!

- IMPROVE your WORD PROCESSING system, whether disc or cassette based. Don't wait for a slow printer - type in text while printing. TWO JOBS DONE SIMULTANEOUSLY and £100+ saved on a printer buffer.

- In "VIEW", type in letters in 80 columns and have up to 28,000 bytes free - 5 times as much as normal.

- In WORDWISE (or WORDWISE-PLUS), preview in 80 columns with the full 24K of text in memory - recommended by Computer Concepts.

- Combine GOOD GRAPHICS and LONG PROGRAMS. Use the top 20K of the expansion RAM as the screen display memory, leaving all the standard BBC RAM free for programs. Benefit from MODE 0/1/2 graphics and 28K of program space.

- Use the FULL 32K or the bottom 12K of the expansion RAM as a PRINTER buffer for PARALLEL or SERIAL printers, sound channels, RS423 etc. Print large text files while running long graphics programs and have all your buffer options available as well (\*FX15,21,138,145,ADVAL etc).

- Ensure COMPATIBILITY with a vast range of hardware (including Watford & ATPL ROM boards, double density boards, second processors), and software (including BASIC, TOOLKIT, VIEW, WORDWISE (1.20+), WORDWISE-PLUS). This is because our board, unlike those of our competitors, is connected to the computer by a ribbon cable.

- Achieve EASY OPERATION with ROM based software. A large range of commands is available for machine code and BASIC users, including some useful \*HELP messages.

**Only: £65**

(Price includes a comprehensive manual and the ROM)

## GRAPH PAD

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

**SPECIAL OFFER £86**

## BEEBFONT ROM

BEEBFONT is a remarkable and different concept in BBC software supplied on a 16K ROM. It allows you to display text on the screen in 13 different styles:

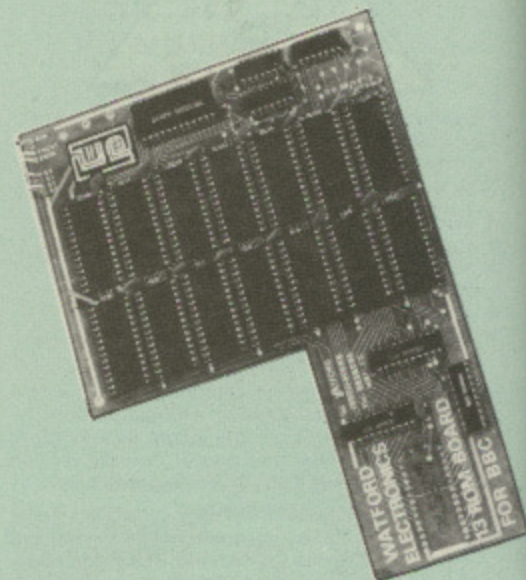
It works in modes 0, 1, 2 and 4 using the full colour capabilities of each mode. Characters are printed in the same way as normal. Selection between the various fonts is very easily achieved with Ctrl-V - press this followed by a font number and the output will continue in the new font. Beebfont ROM is particularly useful in display work with the characters produced at twice the normal size.

You can create your own character fonts with the editor supplied. You can also print-out pre-formatted text files using the special characters with Epson FX, RX and NEC printers. The full range of character styles can be used, controlled from within the text. The editor and spooler program are supplied with the package, on cassette or disc. The spooler allows word processor (Wordwise & View) output to be printed in the new characters.

A twenty page manual is supplied. Please state printer type and media for the editor & spooler when ordering (cassette, 40 or 80 track disc).

**ONLY £32**

## Mk-2 13 ROM SOCKET EXPANSION BOARD



**Now all lines fully buffered - On board battery back-up facility - will now accept EPROMs 2716, 2732, 2764 & 27128 and ROMs 6116 & 6264.**

Simply plugs into one of the four ROM sockets currently available in BBC Micro. There are only 5 solder connections to be made. Full instructions are supplied. Unlike other ROM Boards, this board has been ergonomically designed to enable the user, easy further expansion inside the Micro, e.g. Double Density Board, Torch Board, RAM Card, etc., without any clash. (At Watford, we think ahead). Our Mk2 13 ROM Socket Board enables the User to increase the sideways ROM capacity from the basic 4 sockets upto full 16 capable of being supported by current operating systems. In addition the board is designed with the facility to hold upto 16K RAM, which when switched into operation is automatically selected by any WRITE signal to the Sideways ROM area. This gives the User the ability to write a utility or language and upon pressing break have the utility or language up and running (new ROM software can be developed and tested in situ.)

The Board gives the User, plenty of freedom to explore the possibilities of the new paged ROMs due in the coming months and offers them the chance to develop their own.

All lines are fully buffered and the board meets or exceeds all timings for operation in the BBC Microcomputer.

Supplied ready-built and tested complete with fitting instructions.

**Only £30**

PCB NI-CAD Battery for ROM Boards.

**£2.75**



### COMPUTER CONCEPT'S ROMS

CARETAKER Basic Utility	£28
Graphics ROM	£28
Disc Doctor ROM	£28
INTER-SHEET	£49
TERMI	£27
COMMUNICATOR	£58

## Wordwise

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

SPECIAL OFFER THIS MONTH: **£32**

### WORDWISE PLUS

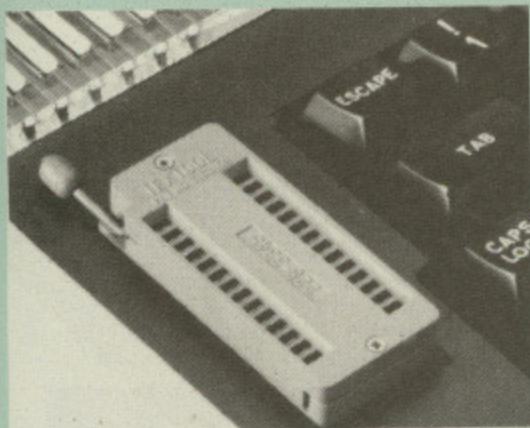
Now available from stock **£47**

### WORDWISE PLUS UPGRADES

Existing users of Wordwise can upgrade to WORDWISE + for £17. Please return the old WORDWISE package complete with Chip and MANUAL with your remittance and we will send you the new WORDWISE + package.

**£19**

### SIDEWAYS ZIF SOCKET



Now Watford Electronics brings you a ROM board for small budgets or for those of you who do not wish to open up your Micro frequently. It allows you to change ROMs quickly and efficiently with the minimum of effort - no screws to loosen or keyboard to remove. The unit consists mainly of a zero insertion force (ZIF) socket on a small circuit board which is located into the position of the 'ROM Cartridge' and is connected to one of the internal ROM sockets via a ribbon cable.

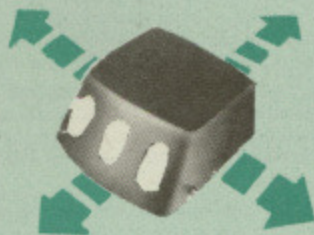
- Very simple to install. **NO SOLDERING REQUIRED.** The ZIF eliminates the possibility of damage to your ROM pins when inserting and extracting them.
- The low profile of the socket allows unrestricted access to the keyboard, unlike other cartridge systems. In addition, there are no costly extras, such as ROM cartridges for every new ROM.
- All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.

● This versatile hardware solves the problem of running out of socket space, simply unplug the ROM and plug in a different one. It is a real must for Professionals and Hobbyists alike.

**ONLY £18**

# THE AMX MOUSE

The AMX Mouse package, of which WE are the largest single distributor in the entire country, is an incredible addition for your BBC Micro. This very popular package is truly brilliant value at only £68.50.



OUR SPECIAL PRICE

**ONLY: £68.50**

**FREE FREE FREE**

This month we are giving away the sophisticated COLOUR ART package absolutely FREE with every purchase of the AMX Mouse from Watford.

AMX Desk package	<b>£19.00</b>
AMX ART package	<b>£11.50</b>

## COLOUR ART!

As seen at the Micro User Show

Watford Electronics has long been a source of innovation in the BBC field; e.g., we were the first to market a ROM board. Well now We've done it again!

The AMX Mouse is, as we are sure you already know, a very easy to use and powerful drawing package. Throughout the country, there is no single bigger distributor of this excellent package than Watford Electronics. To celebrate this fact, we are, during this month only, including FREE with every AMX Mouse package purchased from us the superb piece of software called COLOUR ART.

This novel program allows you to add COLOUR to any drawing produced with your AMX Mouse package, and really bring those pictures alive. Not with just any colours, mind you, but a full range from up to 255 different shades! It's simplicity itself to use this "painting by numbers" painter to create simple, striking and powerful images to please the eye.

Price **£13**

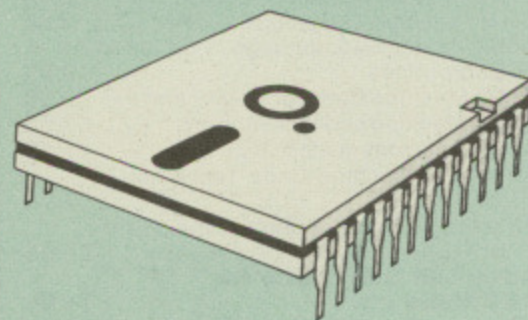
(please specify 40 or 80 track disc when ordering)

## THE INVESTIGATOR

This sophisticated Utility program on disc, enables you to make security back-up copies of most of your valuable Disc Software. Makes full use of all 8271 (will not run with double density DFSS) facilities to discover the precise format of your protected disc so that an exact copy can be produced. Supplied with detailed instructions. Please specify 40 or 80 track disc when ordering.

Only **£20**

## 16K DISC RAM



This is the RAM you've been waiting for!! This battery backed up, write protectable 16K sideways RAM board allows you to run from disk every sideways ROM available. Beware of other sideways RAM boards which are not backed up as certain ROMs will not run in these boards even though the RAM can be write protected. The Battery Backup facility allows retention of DATA after power off. On switch on the Micro will think the WATFORD DISC RAM is a ROM. Features available are:

- No soldering or modifications to BBC micro necessary.
- Plugs into normal ROM socket fitting neatly under the keyboard allowing room for other add-ons.
- Easy to use. Comes with disk based software to SAVE and LOAD ROMs. Allows you to make backup copies of your ROMs.
- Disk software can be copied onto other discs when disc is full.
- All existing ROMs can be stored on disk and used in DISC RAM.
- No messy plugging and unplugging of your ROMs. Simply Load the one you want into DISC RAM.
- Ideal for Professional users to develop ROMs. Backup facility allows testing of final versions without using EPROMs.
- The switch provided allows backup and write protection to be switched off externally.
- Can also be used as 16K printer buffer RAM in conjunction with our Buffer & Backup ROM.

**New Low Price: £35**

P.S. 16K DISC RAM Board is not designed to work in conjunction with a Sideways ROM Board.

## Versatile BEEB SPEECH SYNTHESISER Unit



The Watford Speech Synthesiser is a very flexible speech synthesis unit based upon the powerful phonemes system. This system stores the building blocks of speech (called phonemes) and allows you to combine them quickly and easily to form virtually any word imaginable.

Supplied with an advanced ROM, you are provided with a 500 word dictionary to get you started. These can easily be added to by following the notes given in the comprehensive manual.

**SPECIAL PRICE £35**

**Continued**



## BOOKS (No VAT on Books)

30 Hour BASIC (BBC Micro) .....	£6.95
35 Education Programs for BBC .....	£6.95
40 Educational Programs for BBC .....	£5.95
100 Programs for BBC Micro .....	£6.95
6502 Application Book .....	£12.50
6502 Assembly Language Program ..	£13.95
6502 Assembly Language Subroutines .....	£19.95
6502 Machine Code for Beginners ...	£5.95
6502 Machine code for Humans .....	£7.95
A young persons guide to BBC Basic ...	£4.50
Advanced Machine Code Technique for BBC .....	£7.95
Advanced Programming for the BBC Micro .....	£6.95
<b>Advanced User Guide for BBC Micro</b> .....	£11.95
Advanced Graphics with BBC .....	£9.95
Advanced 6502 Programming .....	£12.45
Assembly Language Programming on BBC Micro .....	£7.95
Advanced Programming Techniques for the BBC Micro .....	£7.95
BBC BASIC for Beginners .....	£7.95
BBC BASIC .....	£5.95
BBC DIY Robotics & Sensors .....	£6.95
BBC Forth .....	£7.50
BBC MICRO add on guide .....	£6.95
BBC Micro An Expert Guide .....	£6.95
BBC Micro Book BASIC Sound & Graphics .....	£7.95
BBC Micro Graphics and Sound .....	£6.95
BBC Micro Programs in Basic .....	£5.95
BBC Micro <b>ROM PAGING</b> System Explained .....	£2.00
BBC Micro Revealed .....	£6.95
BBC Micro Disc Companion .....	£7.95
BBC Micro in Education .....	£6.50
Basic Programming on BBC Micro ...	£5.95
BBC Software Projects .....	£5.95
Brain teasers for BBC micro .....	£5.95
CP/M Handbook with MPM .....	£13.95
CP/M The software BUS .....	£8.95
Creating Adventure Programs on BBC Micros .....	£6.95
Creative Animation & Graphics .....	£7.95
Creative graphics on BBC Micro .....	£7.50
Complete Programmer for BBC .....	£5.95
<b>DISC FILING SYSTEM (DFS)</b> <b>Operating Manual for BBC</b> .....	£6.95
Discover BBC Machine Code .....	£6.95
Discover FORTH .....	£13.95
DIY Robotics & Sensors with BBC ...	£6.95
Easy Programming for the BBC Micro .....	£5.95
Exploring FORTH .....	£6.95
Further Prog. for BBC Micro .....	£5.95
FORTH on the BBC Micro .....	£7.95
Forth Programming .....	£14.40
Functional Forth for the BBC Micro ...	£5.95
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Graphs & Charts on BBC Micro .....	£7.50
Graphic Art for BBC Computer .....	£5.95
Handbook of Procedure & Functions for the BBC Micro .....	£6.95
Introducing the BBC Micro .....	£5.95
Introducing LOGO .....	£5.95
Introduction to PASCAL .....	£14.95
Let your BBC teach u to program .....	£6.45
LISP .....	£9.25
LISP Cassette .....	£15.50
Logo Programming .....	£8.95
<b>Mysteries of DISC DRIVES and DFS REVEALED</b> .....	£5.95
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Programming the BBC micro .....	£6.95
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Programming with Graphics .....	£5.95
Structured Prog. with BBC BASIC ...	£6.50
The Complete FORTH .....	£6.95
The Complete Programmer .....	£5.95
<b>The Epson FX/KAGA PRINTER Commands REVEALED</b> .....	£5.95
Using Floppy Discs with BBC Micro ...	£5.95
Using BBC Basic .....	£6.95
Wordstar & CP/M made easy .....	£6.95

## NEW NEW NEW NEW BEEB VIDEO DIGITISER THE LATEST IN HIGH TECH FROM WATFORD

Using any source of composite video (colour or monochrome) and the Watford Beeb Video Digitiser, you can convert an image from your camera into a graphics screen on the BBC Micro.

This uses the full graphics capacity of the BBC micro in modes 0, 1 or 2. The video source may be a camera, video recorder or television, and is connected via the video output socket.

Images produced can be compressed, stored to disc, printed on an Epson compatible printer, directly used to generate graphics, analysed for scientific and educational use or converted to other formats e.g. Slow Scan TV or receiving a picture from a remote camera using a modem.

The output from the digitiser exactly matches the graphics capability in each mode, with up to 8 levels of grey in mode 2. The unit connects into the User Port and automatically scans a complete picture in 1.6 seconds.

Both the black and white levels can be adjusted manually for the optimum picture, or switched to automatic for unattended use. The image produced can be reversed if necessary.

Full controlling software is supplied on a normal sideways ROM and this is easily accessed via additional \* commands. The package is designed to allow easy input of complex screens and give full access of the data to the user. Once on the screen, the image can be used as a normal graphics screen, allowing any of the usual graphics commands in BASIC or other ROM's to work on it.

A special print dump routine is included with the driver programs. This is specially designed to produce a fast, correctly proportioned picture, with reduced "contouring", resulting in an accurate reproduction of the original image.

Features offered by this package include:

- The adding of pictures or written text to typed documents.
- Unattended recording of scientific data.
- Entry of real images into graphics programs.
- Generation of computer images.
- Slow scan television; sending images via a modem or radio.
- Security.
- Input from any video 1v video source.
- Full resolution in Modes 0,1 or 2.
- 1.6 seconds scan time.
- Up to 8 grey levels
- Manual or Auto level control
- Connects to user port

Detailed examples of driving this unit from BASIC or other languages are all provided in the extensive manual supplied.

Introductory price  
Digitiser Unit & ROM

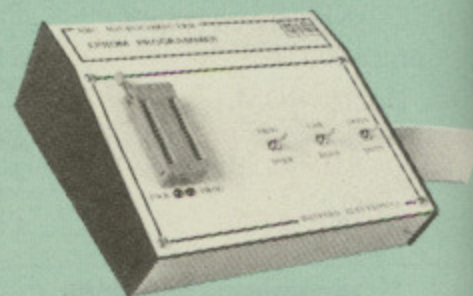
**£89 (Carr. £2)**

## PLINTHS FOR BBC MICRO AND PRINTERS

Protect your computer from the weight and heat of your monitor. The BBC micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and monitor, whilst the double height version provides enough room for our stacked or side-by-side dual disc drives or TORCH Disc pack, to be placed in the centre section. If you use our stacked drives, the remaining space can be used for further peripherals e.g. Speech Synthesizer, EPROM programmer or simply stationery. The computer slides neatly in to the lower section allowing easy access to remove the lid. The printer plinth is equally sturdy but without the cooling slots. It allows for access to the paper from the front as well as from the rear, (a facility not often thought of in similar products) if the paper is located beneath the plinth. This is a very convenient way to work especially if your work area is not deep enough to take the printer and paper separately.

SINGLE BBC PLINTH .....	£11 (carr. £1.50)
DOUBLE BBC PLINTH .....	£19 (carr. £2.00)
PRINTER PLINTH .....	£10 (carr. £1.50)

## EPROM PROGRAMMER



The Watford Electronics EPROM programmer for the BBC micro is a high quality self contained package. Programs all popular EPROMs from 2K to 16K: 2716, 2516, 2532, 2564, 2764 and 27128. All manufacturers' specifications have been followed to program EPROMs at the correct speed - wrong timings could destroy your EPROMs. The unit has its own power supply so does not put heavy loads on the BBC power supply as do some other units. Connects directly to the 1MHz bus following all Acorn recommendations on addressing and bus loadings.

### SOFTWARE PACKAGE

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

### Software facilities include:

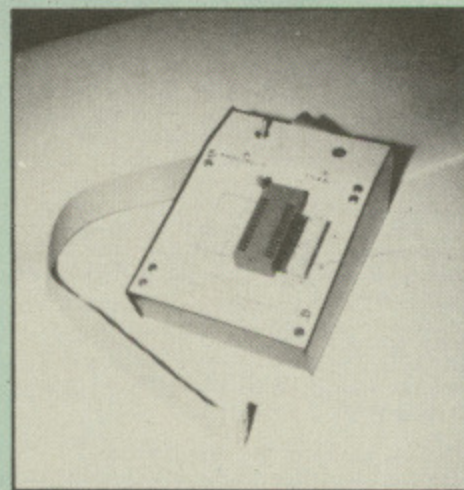
Load File - Save File - Down Load EPROM - Program EPROM - Verify - Blank Check - Editing of memory contents prior to programming.

Also included is an automatic system to allow Basic programs to be put in EPROM and accessed through the \*ROM filing system. More than one program may be put in an EPROM. All these facilities and more are explained in the comprehensive and clear 15 page manual.

**SPECIAL OFFER £69**  
(£3 carr.)

## LOW COST 'DIN' EPROM PROGRAMMER

A high performance, low cost, self contained 'DIN' EPROM PROGRAMMER for the BBC Micro. Plugs into the BBC Micro's user port.



The features are:

- Will program 2716, 2732, 2532, 2764 & 27128 EPROMs.
- Copy Eprom into memory and compute checksum.
- Blank check EPROM.
- Program EPROM from memory.
- Verify programmed EPROM and display checksum.
- All \* commands may be used from menu mode.
- High speed programming on 2764 & 27128.
- Machine code SOFTWARE supplied in ROM.

Only: **£49.50 (carr. £2)**



## ANTI GLARE MONITOR SAFETY SCREEN



HEADACHES? TIRED EYES? Don't take pills - Use a Watford Electronics anti-glare filter!  
 ● Made in Britain by a long established glass maker.  
 Available in 12" & 14" versions - please specify the exact monitor type when ordering.  
 Special Price: **£16.00** (carr. £1)

## SURGE PROTECTOR Plug

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

Protection for only **£9.50**

## FLEXIBLE KEYBOARD CONNECTOR

A 'Keyboard to Micro' replacement jumper lead.

**£4.95**

## ATTACHE CARRYING CASE for BBC Micro

The Attache carrying case is attractively finished in mottled antique brown leatherette. The case is made of tough plywood, providing a very solid and safe way to carry your BBC micro. There is room provided to fit all the leads necessary behind the computer and manuals in the front. Locks supplied with two keys. Price **£11** (£2 carr.)

## DATA RECORDER AND ACCESSORIES

Top quality slimline portable cassette recorder designed specifically for use with home computers. Mains/Battery operated with tape counter.

**£20**

**DATA CABLE** to connect recorder to BBC **£2.50**

### DATA CASSETTES

Top grade tested C12 Data cassettes supplied in library cases **35p** each; 10 for **£3.20**.

## ASSORTED CONNECTING LEADS

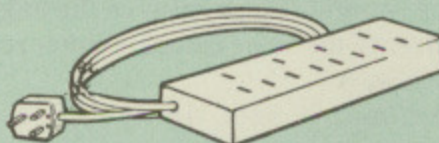
(All ready made and tested)

**CASSETTE LEADS** 7 pin DIN Plug to 5 pin DIN Plug + 1 Jack Plug **£2.00**  
 to 3 pin DIN Plug + 1 Jack Plug **£2.00**  
 to 7 pin DIN Plug **£2.50**  
 to 3 Jack Plugs **£2.00**  
**6 pin DIN to 6 pin DIN Plug (RGB)** **£2.50**  
**MONITOR LEADS**  
 KAGA/SANYO Colour Monitor Leads **£5.00**  
 Monochrome monitor leads BMC to Phono **£3.00**  
**DISC DRIVE POWER LEADS**  
 Supply from BBC power supply to standard Disc Drive connector.  
 Single **£3.00** Dual **£3.75**

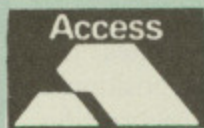
## MISCELLANEOUS CONNECTORS

	Plugs	Sockets
RGB (6 PIN DIN)	30p	45p
RS423 (5 pin Domino)	40p	50p
Cassette (7 pin DIN)	25p	65p
ECONET (5 pin DIN)	20p	30p
Paddles (15 pin 'D')	110p	215p
BBC Power Plug 6 way	80p	-
Disc Drive Plug 4 way	75p	-

## 4 WAY MAINS DISTRIBUTION SOCKET



4 way top quality mains trailing sockets. Supplied wired up with mains plug ready for use. Can be screwed to floor or wall if required. Very useful for tidying up all the mains leads from your peripherals. Allows the whole system to be switched on from one plug. **£9.99**



**ACCESS HOT LINE**  
**0923 50234**  
**24 Hours**

## ROM EXTRACTION TOOL

This extremely useful tool allows trouble free IC removal from your computer. No longer do you have to weld a screwdriver at your valuable ROM software. Instead this IC extractor distributes the removal force over the whole body of any 24 or 28 pin device, thus preventing undue damage to your Chip. Isn't £1.75 a small price to pay to protect your ROMs stature?

**£1.75**

## ADVENTURE GAMES (level 9)

COLOSSAL ADVENTURE	<b>£8.50</b>
ADVENTURE QUEST	<b>£8.50</b>
DUNGEON ADVENTURE	<b>£8.50</b>
SNOWBALL ADVENTURE	<b>£8.50</b>
LORDS OF TIME	<b>£8.50</b>
Please add £2.50 for Discs	

## MISCELLANEOUS

<b>28 pin ZIF SOCKET (Textool)</b>	<b>£6.95</b>
<b>28pin DIL PLUG</b>	
SOLDER type	<b>£2.90</b>
IDC CRIMP type	<b>£3</b>

## RIBBON CABLE

28way **55p/ft**; 34way **60p/ft**.

**8way DIP SWITCH** **£0.85**

## CHIP SHOP

7438	<b>40p</b>	74LS00	<b>30p</b>
74LS04	<b>25p</b>	74LS10	<b>25p</b>
74LS123	<b>£1</b>	74LS163	<b>70p</b>
74LS244	<b>95p</b>	74LS245	<b>£1.60</b>
74LS393	<b>£1.20</b>	4013	<b>60p</b>
4020	<b>£0.90</b>	4816	<b>£1.50</b>
LM324	<b>£0.45</b>	UPD7002	<b>£4.40</b>
6502A CPU	<b>£5.45</b>	65C02 CPU	<b>£9.50</b>
6522	<b>£3.40</b>	6845SP	<b>£7.50</b>
SAA5050	<b>£8.75</b>	SN76489	<b>£5.50</b>
2764-250nS	<b>£4.25</b>	27128-250nS	<b>£9.75</b>
6116LP-2K	<b>£3.25</b>	6264LP-8K	<b>£9.95</b>
8271	<b>£50</b>	ACORN DNFS	<b>£15</b>
ACORN OS 1.2	<b>£6</b>	ACORN BASIC 2	<b>£16</b>
SLEUTH ROM	<b>£25</b>	TOOLKIT ROM	<b>£23</b>
BBC A to B Upgrade Kit	<b>£45</b>		

ISO-Pascal ROM	<b>£56</b>
BCPL ROM	<b>£50</b>
Acorn LISP ROM	<b>£40</b>
Acorn FORTH ROM	<b>£40</b>
Microscope Toolkit ROM	<b>£20</b>

Prices subject to change without notice and available on request.

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**VAT: UK customers please add 15% VAT to the total cost incl. Carriage.**

**SHOP HOURS: 9.00am to 6.00pm. Monday to Saturday. (Ample Free Car Parking Spaces)**



# Watford Electronics

Dept. BBC, JESSA HOUSE, 250, Lower High Street, WATFORD, ENGLAND  
 Tel: Watford (0923) 40588/37774 Telex: 8956095 WAELEC

## TEX EPROM ERASERS

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

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

## VOLTMACE DELTA 14 JOYSTICK SYSTEM

The Voltmace system provides full facilities for connecting the Delta 14 handset.

Delta 14 handset - On its own makes a high quality centre sprung analogue joystick with fire buttons **£12.50**

Adaptor Module allows use of two joysticks and provides hardware to access all the keys on the keypad of the joystick **£12.55**

Transfer program allows use of the keypad keys and joystick to simulate any key on the keyboard. This works by creating a machine code patch that stays in memory while another program is loaded in. Allows any game to be used with joysticks. Supplied on disc or tape.

Tape **£5.10** Disc **£7.95**

## STANDARD JOYSTICKS

These are standard analogue type with a fire button on each joystick. Twin joysticks go to a single moulded plug, long leads provided.

Single Player version **£9.75**

Two Players version **£15.00**

## SPECIAL OFFER

### Fast EPROMs for Sideways ROMs

**2764-250nS £2.99**  
**27128-250nS £6.95**

Low power RAM for ATPL, Watford, etc. Sideways ROM/RAM Boards

**6264LP (8K) £7.25**

## LOGOTRON LOGO

LOGO is a specially developed language carefully designed to teach the basics of both programming and logical, ordered thinking. Until recently, there wasn't a version of LOGO available for the Beeb. Now Watford Electronics are proud to bring the highly acclaimed version of LOGO from LOGOTRON. This version is recommended by most local education authorities.

Supplied on a 16k ROM for easy fitting, the LCSI LOGO is accompanied by a high quality ring bound manual for easy reference. Please note the LCSI Logo is not just the well known graphics section of LOGO, but the FULL implementation. Educational establishment making a quantity order? Contact us for a possible discount.

**ONLY: £55**



**D**

**R**

**A**

**U**

**G**

**H**

**T**

**S**

By **BRIAN** and  
**MARTIN BOND**

**DRAUGHTS** is a superb computer implementation of the well-known board game. Each player has 12 counters of the same colour – either red or yellow.

The micro sets up the pieces automatically and is then ready for the first move, which is always made by the red counter.

The basic move consists of moving one of your counters forward one diagonal square.

The flashing cursor indicates the piece you want to move. You position it over that piece by means of the direction keys or the joystick.

At this point press the spacebar or fire button, then move the cursor to the position where you wish to put it. Once again, "set" this position by pressing either the spacebar or the fire button.

If an opponent's piece is on a square to which you could make a normal diagonal move, and there is a space beyond it in the same diagonal line, you can capture that piece.

You may move by "jumping over" your opponent's counter and landing on the vacant square – you then remove his piece. In all you'll have moved two squares in a diagonal line.

Once you have taken a piece the micro checks to see if another can be taken.

If this condition is confirmed you are asked whether you wish to jump again. To do so place the cursor where you wish to jump to and press the spacebar or fire button again.

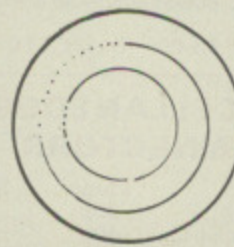
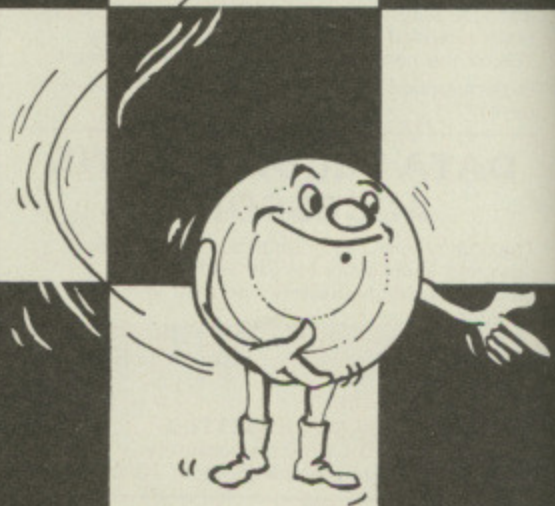
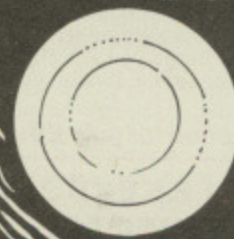
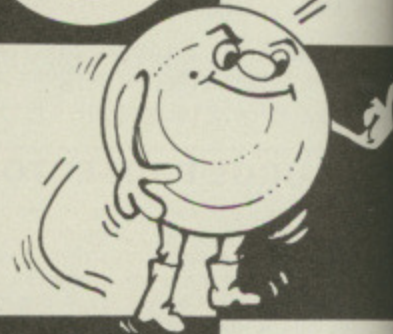
If your opponent fails to capture you when in a position to do so, you have the option of removing (huffing) his counter. You do this by placing the cursor over the offending piece and pressing H at the start of your go. After huffing you continue with your normal move.

When one of your counters has reached your opponent's baseline it is crowned and this allows you to move it in any diagonal direction.

A player is declared the winner if all his opponent's counters are removed from the board. If you wish to concede a game simply press Escape when it is your turn.

While you are typing the program in, you would be well advised to REM lines 40 and 60 until such time as you have removed any typing errors.

For the benefit of disc owners there is a routine that relocates the program to PAGE = &E00 automatically. So, while you're in the debugging phase, save each new "typing error free" version before running it.





## PROCEDURES

**select** Prints game keys and prompts for keyboard or joystick.  
**init** Defines characters and initialises variables.  
**board** Draws board complete with counters.  
**red\_go** } Moves cursor for each player.  
**yellow\_go** }  
**false** Prompts for illegal move.  
**check\_red** } Decides if each move is valid, then execute movement or call PROCfalse.  
**check\_yellow** } Draws the cursor at current X,Y position.  
**sight** Scans keyboard for keypress and increments X,Y coordinates. Checks that cursor stays in playing area.  
**inkey** as PROCinkey.  
**joystick** Scans appropriate joystick and continues as PROCinkey.  
**multi\_jump** Jump again?  
**huff** Checks for huffing.  
**red\_jump** } Checks for a valid move in multi-jump  
**yellow\_jump** } condition.

## VARIABLES

**x%,y%** X and Y coordinates of cursor.  
**X%,Y%** Coordinates of counter's original position.  
**red** Number of red counters left on the board.  
**yellow** Number of yellow counters left on the board.  
**J** Flag for multiple jumps.  
**F** Flag for illegal move.  
**K** Flag for King move.  
**end** Flag for game over.  
**U,D,L,R** INKEY numbers for keyboard control.  
**UD,LR** ADVAL numbers for joysticks.  
**IJ** Illegal move during multi-jump.  
**choice%** Keyboard or joystick.  
**Piece\$** Characters for piece.  
**Box\$** Characters for board.

Full listing starts  
on Page 174



# Twillstar reliability for Home

## COMPUTERS

### BBC

BBC Model B	£345.00
BBC Model B + Disc Interface	£399.00
BBC Model B + Econet Interface	£385.00
BBC Model B + Disc & Econet Interface	£458.00
Z80 Second Processor	£399.00
6502 Second Processor	£199.00
Acorn Bistick	£375.00
Acorn IEE Interface	£325.00
BBC Prestel Receiver	£132.00
BBC Telex Receiver	£225.00
Speech Interface	£54.00
Acorn 10M hard disc	£1495.00
Acorn 30M hard disc	£2299.00
Acorn Fileserver level 3	£345.00
Acorn Music 500	£199.00

### ELECTRON

Electron	£129.00
Electron Me + My Micro Pack	£229.00
Plus 1 Interface	£59.95
Plus 3 Interface (DFS/Drive)	£225.00

### TORCH

Torch Z80 Card + Software	£315.00
Torch Z80 Card + Software + Disc Pack	£745.00
Torch UNICORN Z80 system	£745.00

### BBC FIRMWARE

View Word Processor	£55.00
Word Wise Word Processor	£37.00
Word Wise + ROM	£49.00
Viewsheet	£55.00
Speech Synthesiser	£54.00
Graphics ROM	£32.00
Disc Doctor	£32.00
Print Master	£32.00
Communicator	£65.00
Acorn 1.2 O/S	£11.50
Acorn Basic II	£25.50
Termi Emulator	£32.00
Gremlin Debug ROM	£32.00
Caretaker	£32.00
Toolstar	£33.00
Commstar	£33.00
BCPL ROM	£99.00
System ADE ROM	£60.00
System SPY ROM	£30.00
Edword User Pack	£44.00
Edword Teacher Pack	£25.00
Merlin Scribe	£59.00
ExMon (Beebug)	£27.00
Toolkit (Beebug)	£27.00
Mu-ROM (Beebug)	£27.00
Gemini Datagem database	£115.00
BBC UltraCalc	£69.00
BBC Toolbox	£20.00
BCPL ROM + Discs + Manuals	£95.00
Logo	£69.00
Iso-Pascal	£69.00
Beebug Help ROM	£25.00
Beebug Sleuth	£29.00
Spellcheck II	£31.00
DNFS ROM	£20.00
B ROM	£32.00

## EXPANSION BOARDS

Raven 20 (upgrade BBC to 52K computer)	£69.95
RAM-AMP 6 socket + 16K RAM	£56.00
6 Eprom socket + 32K RAM	£67.00
IX16K RAM Board	£38.00
Eprom Programmer (Blow all your BBC Eproms)	£49.00

## BBC UPGRADES

A-B upgrade	£110.00
DFS Interface	£99.00
Econet Interface	£69.00
Speech Interface	£54.00

## DISC UTILITIES

View Index	£14.95
View Printer Driver generator	£11.50
Hi-View	£59.00
Acornsoft Database	£15.00
Clares Betabase 40/80	£23.00

Clares Graphdisk 40/80	£12.95
Clares Replica II Disc Copier 40/80	£11.95
Clares The Key 40/80	£12.95
Beebugsoft Masterfile	£19.00
Beebugsoft Design	£19.00
Microtext (cassette) (disc)	£49.80
	£59.85
BCPL Calculation Package	£19.00
Masterfile II	£32.00

## MONITORS

Microvitec 1431 Standard Res	£189.00
Microvitec 1451 Medium Res	£289.00
Microvitec 1441 High Res	£399.00
Microvitec 2031 20" Standard Res	£315.00
Microvitec Sinclair QL	£270.00
Philips BM7502 V.H. Res (Green)	£85.00
Normende TV/Monitor + Remote Control	£249.00
Philips CTV + RGB	£229.00
Kaga RGB Vision III 12"	£355.00
Kaga 12" H.R. Green	£118.00
Sanyo SCM 14" VHR	£425.00
Novex 1414 colour Monitor	£215.00
Philips V7001 H.R. (Green) with volume, RGB, Composite Inputs	£75.00

## DISC DRIVES

BBC Single 100K Drive	£99.00
BBC Dual 200K	£189.00
BBC Single 200K 40 Track	£159.00
BBC Dual 400K 40 Track	£299.00
BBC Single 400K 80 Track	£159.00
BBC Dual 800K 80 Track	£318.00
BBC Single Power Supply	£20.00
BBC Dual Power Supply	£29.00

## Cumana Drives

CSX 100 40T/600K single	£109.00
CSX 200 80T/200K single	£149.00
CSX 400 80T/400K single	£179.00
CS 100 40T/100K single (PSU)	£149.00
CS 200 80T/200K single (PSU)	£189.00
CS 400 80T/400K single (PSU)	£199.00
CD 200 40T/200K dual (PSU)	£269.00
CD 400 80T/400K dual (PSU)	£315.00
CD 400/S 40/80T switched dual (PSU)	£399.00

## PRINTERS

Brother EP44	£228.00
Brother HR5	£148.00
Brother M1009	£195.00
Canon PW1080A 160 CPS (NLQ)	£289.00
Canon PW1156A 160 CPS (NLQ)	£399.00
Kaga KP810 (NLQ)	£279.00
Kaga KP910 (NLQ)	£399.00
Kaga RS232 + 2K buffer	£95.00
Ensign 1650 165 CPS	£305.00
Epson RX80T 100 CPS	£212.60
Epson RX80F/T 100 CPS	£240.00
MPO-165 (NLQ)	£299.00
Panasonic KP1091	£325.00
Seikosha GP100A	£189.00
Epson RX100F/T 100 CPS	£396.00
Epson FX80 160 CPS	£365.00
Epson FX100F/T 160 CPS	£494.00
Shinwa CP80A	£199.00
Riteman Compact 120 CPS	£199.00
Star Gemini 10X 120 CPS	£230.00
Star Gemini 15X 120 CPS	£339.00
Epson 814RS232 Interface for FX & RX	£34.00
Epson 814RS232 Interface with 2K Buffer X On/Off	£65.00

## DAISYWHEEL PRINTERS

Brother HR15	£378.00
Brother HR15 Keyboard	£155.00
Brother HR15 Sheet Feeder	£212.00
Brother HR15 Tractor Feed	£95.00
Quen Data 20 CPS	£249.00
Juki 6100 18 CPS	£340.00
Juki 2200 Daisywheel/Typewriter	£280.00
Juki Single Sheet Feeder	£230.00
Juki tractor Unit	£115.00
Juki RS232 Interface	£74.00
Juki Spare Daisywheel	£16.00

## COLOUR PRINTERS

Canon PJ1080A 7 Colour 40 CPS Ink Jet	£440.00
Seikosha GP700A 7 Colour 50 CPS	£399.00

## Plotters

Penman Plotter	£275.00
PIXY Plotter	£399.00
Epson HF-80	£445.00

## Add Ons

AMX Mouse	£79.00
Trackerball	£59.00

## DISKS

Very high quality RAVEN Diskettes, guaranteed for life at only **£24.00** per box (inc. library case) (Double-sided 80 track - using 3M media)

## MODEMS

Pace Nightingale	£135.00
(inc Comstar ROM)	£155.00

## WS2000

A world standard modem switchable between 75, 300/300, 600, 1200/75, 75/1200 baud rate. This is the only modem you would ever likely to need to communication with any computer throughout the world.

Modem	£148.00
Lead	£7.50
Auto-Dial	£34.00
Auto-Dial Cable	£4.50
Auto-Answer Card	£34.00
SK1	£11.50
DS1	£11.50

## Telemod 3

BT approved - switchable between 75, 300/300, 1200/75, 75/1200 and allows you to communicate virtually anywhere in the world. It will allow you to communicate with services like Micronet, Telecom Gold, Prestel, One-to-One, Easylink, Microweb. It comes as a standard with built in board for auto-answer.

Modem	£155.00
Lead	£8.00
Software	£19.95

## BBC BUSINESS SOFTWARE

Microsimplex	£270.00
Gemini Integrated Accounts	£99.00
Sage Accounts	£429.00
Please add £4.00 for Disc Version	

## ACORNSOFT

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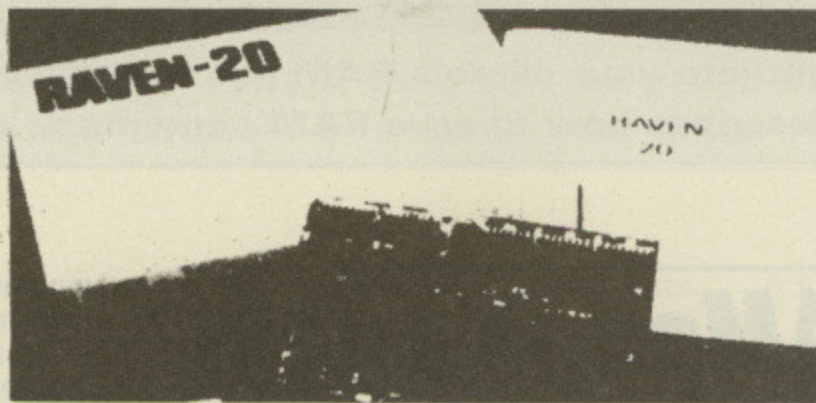
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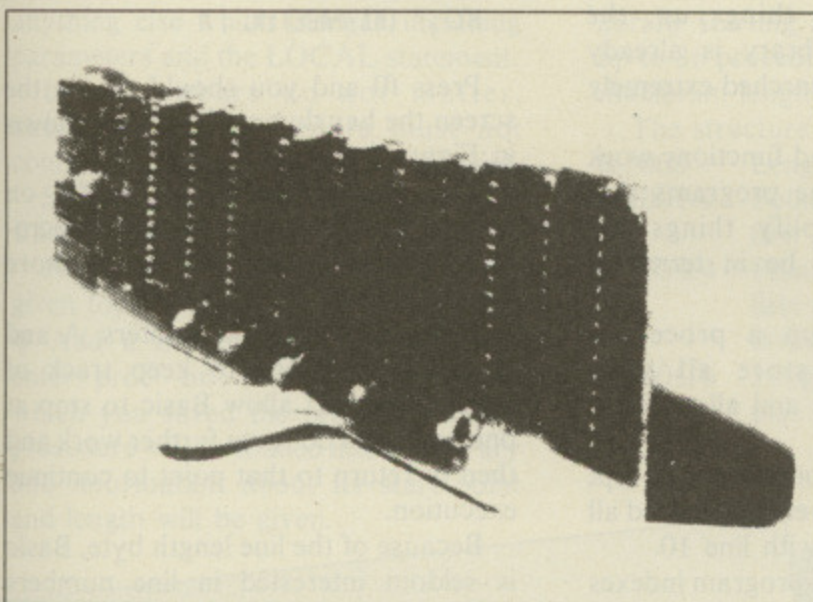
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# RAMification

With an insight into your micro's RAM you can really start to branch out in PETER VASEY describes how to save RAM contents to disc or tape and MIKE

## On the RAMpage again

**YOU can do more with your paged RAM board than you might think. With its help, the effective length of a Basic program in any mode can be increased by at least 16k.**

With further modifications to the programs given here there is virtually no limit to the length of a program. However a 16k increase is a good place to start.

As I discussed in my first RAM page article, in the October, 1984, issue of *The Micro User*, paged RAM is a cheap hardware addition that puts a RAM board, usually with 16 or 32k, into the memory map at &8000 to &BFFF beside your Basic or DFS ROM.

The operating system will switch these ROMs in and out as required, but the RAM is always accessed when bytes are POKEd or written into the ROM/RAM area.

The only difficulty is that Basic cannot directly read paged RAM because they both sit in the same area of memory.

No problem – we shall use a machine code routine outside this area.

The principle used here is called dynamic overlay.

A library of procedures and functions is stored in paged RAM.

When a library procedure, say, is requested from a Basic program, the required procedure is copied down to a lower area of memory and then executed.

When the next library procedure is requested, it is copied down to the same lower area of memory which is therefore used many times.

Dynamic overlay means that if one copied procedure is already active then the next will be copied starting at a point

above the previous copy.

Static overlay always copies to the same starting point.

The only disadvantage is a slight increase in time taken by the Basic program but this really is hardly noticeable because all actions are carried out at machine code speed.

The procedure and function handling program itself permits recursion (where a procedure/function calls itself) and nesting (where procedure A calls procedure B which calls procedure C and so on) in an almost unlimited fashion.

To further speed things up, the procedure/function library is already indexed and can be searched extremely quickly.

Both procedures and functions work equally well in all the programs that follow, but to simplify things the description will only be in terms of procedures.

Program I sets up a procedure library. This will store all your procedures in one file and allows later editing of this file.

Line numbers are not relevant, except for editing and may overlap – indeed all procedures can start with line 10.

The library creation program indexes the library file so as to speed up the action of Program II.

Program II is written in assembly language and, when run, creates the procedure handler which can be separately saved.

The handler occupies nearly two pages (in fact 427 bytes) of memory for itself and requires a second area of memory for the copied procedures.

The size of this second area depends on the size and nesting of the

procedures, but 1k should be more than enough.

In a disc machine, provided that your own DFS does not corrupt this area, the best place for the code is at &1300 with the copy area starting at &1500.

Tape users should increase PAGE to &1900.

In order to understand the way these programs work, you should know how a Basic program is stored in memory and broadly how the Basic interpreter works.

As an example, consider a program which could be listed on the screen as:

```
10 PROCa
```

Enter this function key definition:

```
*KEY 0 FOR M%=0 TO 7: PRINT*(PAGE+M%),*(M%?PAGE):N. | M
```

Press f0 and you should see on the screen the hex dump of memory shown in Figure I.

The Basic interpreter works on similar principles to the 6502 micro-processor although is much more comprehensive.

Basic has two main pointers, A and B, which are used to keep track of interpreting and allow Basic to stop at one point and do some further work and then to return to that point to continue execution.

Because of the line length byte, Basic is seldom interested in line numbers except for editing and executing the GOTO/GOSUB statement.

When Basic comes across the PROC token, a special routine within the Basic ROM is called into action.

The contents of the 6502 stack (from &1FF downwards) are saved on to Basic's own much larger stack at HIMEM downwards.

Basic then puts on to the 6502 stack the information shown in Figure II

Basic then executes the procedure by



# tions . . .

in your programming. Here TONY PHILIP examines the paged RAM board, MAHON looks at available hardware to enhance your micro's memory

a JSR (not a JMP) to the statement interpreter.

On return, pointers A and B are restored from the top of the stack and the 6502 stack is reinstated and control returns to the statement interpreter.

To speed things up, Basic remembers in a table where the DEFPROC definition is and checks the table first to see if the PROC has been called previously. If not, the table is updated.

Now we can look at the procedure library.

Enter and save Program I.

Now write or extract the debugged procedure that you want to add to the library.

The first line should start with the DEFPROC statement (with no spaces in front of DEF) and may contain anything else which is legal, including parameters and the LOCAL statement.

Line numbers do not matter, although your procedure must not contain a GOTO or GOSUB statement.

Save this procedure as you would a Basic program (such as SAVE "proc").

Now run Program I and you are given four options:

- Add a new proc/fn. Press A and enter proc or the filename under which you saved the procedure. Your procedure will be loaded into the library and information about its start point and length will be given.

- Save complete file. Press S enter the filename (for example, LIBRARY) and then the library and index will be saved.

- Load a complete file. Press L, enter filename and this file will be loaded and analysed.

- End - by pressing E.

To see your procedure library, end the program and press Break. Then press f0 holding down Ctrl and Shift to stop the scrolling. Notice that line numbers may be duplicated.

If you want to edit this block, renumber first then edit as you would a Basic program.

SAVE the edited block as a Basic program. This can then be added to an empty library by the add option.

The index is stored at &3000 with the library starting at &3100. This allows up to 36 procedures to be stored with a maximum length of 15.75k.

The structure of the index is:

- &3000 Length of name of first proc
- &3001/2 Pointer to PROC token of first procedure.
- &3003/4 Pointer to first character of first procedure to be copied down.
- &3005/6 Length of first procedure plus one.

&3007/D Ditto for second procedure.

Don't worry about keeping unnecessary procedures in your library as the time penalty is only a few microseconds.

The most suitable procedures for a library are those with reasonably straightforward structures. Nasties such as nested recursive calls should be left in the main program.

Now enter Program II. Basic I owners should change *variable* in line 120 to &951F.

The procedure handler is saved in a file called CODE.

You can check that this code is likely to be correct by running PROCcheck which gives a series of hash totals for each group of 61 bytes.

If one of your totals does not agree, then at least you know where to start.

The first number will be 7185 not 7243 if you have Basic I.

The program's structure is described on the following page.

Now for the nice bit.

In your main program where the full DEFPROC listing would have occurred, delete all lines but the first and insert a new second line CALL &1300.

Add two lines at the beginning of

Memory	Hex	Return code at start of program
1900	D	15 bit line number (A is hex for 10)
1901/2	000A	Line length byte
1903	6	Basic token for PROC (FN is A4)
1904	F2	&61 is the Ascii code for "a"
1905	61	Return code at end of line
1906	D	Program terminator
1907	FF	

Figure I

At	Example	Details
1FF	F2	PROC token
1FE	02	Offset from pointer A to first character of proc name
1FD/C	1903	Pointer A to length byte of line 10
1FB	00	Number of parameters in proc definition, here nil
1FA	03	offset from pointer B to next part of line to be interpreted
1F9/8	1903	Pointer B to length byte of line 10
1F7/6	xxxx	Return address from proc interpreter

Figure II



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## PROGRAM STRUCTURE

Line	
180	Code is assembled to &1300 which is called directly by the procedure.
200	Save pointer to length byte of procedure line in main program.
230	Find first character of procedure name.
340	Use Basic subroutine to get length of procedure name.
360	Switch off Basic, turn on paged RAM (assumed to be number 15).
380	Check namelength with index.
480	A new error message has been added to deal with calls for procedures which are not in the library.
620	If match found check individual name characters.
730	Check for recursive call.
820	When name is found get pointer to start of procedure in library.
870	Copy down procedure.
1160	Alter pointers A and B to point to copied file and alter 6502 stack to point to return handler.
1320	Switch Basic back on.
1370	A further error message has been added and is given when the next copy of a library procedure would overwrite a predetermined page boundary (initially set to &1900).
1450	On return from the procedure recover the

original pointers and return to Basic ignoring any spaces after the return point.

## VARIABLES

<b>nameptr/h</b>	Pointer to procedure name in paged RAM.
<b>startptr/h</b>	Pointer to start of procedure in paged RAM.
<b>Startfile/h</b>	Pointer to storage in lower RAM.
<b>endptr/h</b>	Pointer to first byte for next procedure space.
<b>filelength/h</b>	Length of file to copy down.
<b>romsave</b>	Holds the number of your Basic ROM.
<b>record</b>	Pointers to block of four addresses for copied procedure. 2/3 holds execute address; 4/5 holds return address. If an error occurs in the interpretation of a library procedure you should reset record+0 to 0 and record+1 to 255, or reload CODE.
<b>direct</b>	Direction of proc - holds 1 if within proc, 0 if not.
<b>base</b>	Where proc file is stored.
<b>procspace</b>	Starting point for area of lower memory into which library procedures are copied.
<b>memtop</b>	Page boundary of memory set aside for library procedures.

### From Page 51

your program to load the code and the library although these need only be loaded once.

So now your main program should look like this:

```

10 *LOAD CODE 1300
20 *LOAD LIBRARY 8000
30 PROCa
40 PROCb
50 END
60 DEFPROCa
70 CALL&1300
80 DEFPROCb
90 CALL&1300
    
```

You can use more than one library file by arranging procedures between libraries and loading the next library file part way through the Basic program.

This could give access to many more than 36 procedures.

The programs given here could be modified.

Alter the ROM number loaded into the X register in line 360 and you could search more than one paged RAM bank if present.

Or, store the library on disc to give the advantage of virtually unlimited length Basic programs although with rather slower program execution more than the method proposed here.

Tony Philip

### Program 1

```

10 REM ** Library creation program
20 REM ** By Tony Philip
30 REM ** (C) The Micro User
40 *key0 PAGE=&3100:MOLD:ML:IM
50 HIMEM=&2FFF:VDU26:CLS:DIM A 30
60 ptr%=&3000:load%=&3100:point%#0
70 PRINT TAB(12,0);"LIBRARY CREATI
DN"" L Load complete file A Add
new file"" S Save complete file E
End "
80 PRINT TAB(0,22);"Name of pr/fn
start length"
90 VDU28,0,20,39,5
100 VDU30
110 REPEAT
120 G%=GET$
130 IF G%="L" OR G%="1" PROCload
140 IF G%="A" OR G%="a" PROCadd
150 IF G%="S" OR G%="s" PROCsave
160 UNTIL G%="E" OR G%="e"
170 VDU26
180 END
190 DEFPROCanalyse(point%)
200 REPEAT
210 PROCfind
220 PROCupdate
230 PROCstore
240 PROCinfo
    
```

```

250 UNTILpoint%?1=&FF
260 PRINT"End of file"
270 load%=point%
280 ENDPROC
290 DEFPROCfind
300 startfile%=point%
310 IF point%?4(<)&DD PRINT"DEF byte
in wrong place" :STOP
320 REPEAT
330 lenbyte%=point%+3:IF ?lenbyte%#
0 PRINT"length error":STOP
340 point%=point%+?lenbyte%
350 UNTILpoint%?1=&FF OR point%?4=&
DD
360 endfile%=point%
370 ENDPROC
380 DEFPROCupdate
390 IF startfile%?5=&20 startfile%=
startfile%+1
400 IF startfile%?5=&A4 type%="FN"
410 IF startfile%?5=&F2 type%="PROC
"
420 name%=startfile%+6:C%="":len%#0
430 IF ?name%=&20 name%=name%+1
440 REPEAT
450 C%=C%+CHR$(name%?len%)
460 len%=len%+1
470 UNTILname%?len%#32 OR name%?len
    
```

Turn to Page 171



## Save your RAM to tape or disc

FOLLOWING the interesting article in the October, 1984, issue of *The Micro User* by Tony Philip concerning the programming of sideways RAM, here is a short program which will allow you to save the contents of your RAM directly to disc or tape.

As Tony stated, it is usual to wire up the sideways RAM so that any write operation from addresses &8000 to &BFFF will be directed to this RAM.

In certain cases, it can also be read by ROM based disassemblers, such as Disc Doctor.

But it cannot be read directly by Basic, since it occupies the same space in the Memory Map.

So it is necessary to use machine code routines to gain entry to the sideways RAM.

In the case of the cassette filing system, the RAM can be saved directly since the filing system is resident in the



Operating System ROM, but for discs it is necessary to copy over the contents of the sideways RAM to user RAM before saving, since the DFS occupies the sideways slot when operating.

The program given is for disc systems, and will also work with cassette systems, but may be shortened as follows:

Change line 90 to read:

```
90 NAME$="S. "+NAME$+"8000 "+
length$+" D9CD"
```

Omit lines 200, and 220 to 300 then

add the following lines:

```
200 LDA#F4:STA#80
335 LDA#80:STA#FE30
```

Save your program before running it in case of assembler errors.

When using the program to save your sideways RAM you must set up the RAM details as requested by lines 50 to 70.

The variable *ramnumber* is the number of the slot occupied by your sideways RAM – this may vary for different boards – and the variable *length\$* is the length in hex of the code to be saved.

Obviously if your utility is &1000 (4k) bytes long, it would be pointless to save it as a &4000 (16k) byte file, particularly on cassette.

Once you have saved your RAM, it is reloaded when required by entering \*LOAD filename. Then press Break to activate, or \*RUN filename or \*filename (disc users only).

The working of the program is as follows:

Line 90 sets up the save command string which is later passed on to the command line interpreter.

The execution address &D9CD is given to force the Operating System to re-initialise following the running of the new RAM and thereby recognise its presence.

In the case of the disc system, the RAM has been copied over into user RAM starting at &2000, so the last address &8000 is the new reload address. (This is documented on page 19 of the Advanced User Guide.)

Line 200 stores the current ROM number, then line 210 resets the paged ROM selection latch at address &FE30 (Advanced User Guide page 271).

Lines 220 to 290 copy &4000 bytes from the selected RAM into user RAM.

Line 300 (335 in cassette version) resets the ROM selection latch, and lines 310 to 330 send the save string (stored at text) to the command line interpreter for execution.

Peter Vasey

```
10 REM SIDWAYS RAM SAVER. P. Vasey
20 REM (c) The Micro User
30 MODE 7
40 PRINTTAB(7,5)"SIDWAYS RAM SAVER"
50 PRINTTAB(5,8)"Enter Sidways RAM number";:REPEAT:PRINTTAB(33,8)SPC3:INPUTTAB(33,8)ramnumber:UNTILramnumber>8 AND ramnumber<16
60 INPUT""Enter length of RAM in HEX ? &"length$
70 INPUT""Enter filename for SAVE "NAME$
80 PRINT"Now SAVING"
90 NAME$="SAVE "+NAME$+" 2000"+"length$+" D9CD 8000"
100 PROCAS
110 CALLsaver
120 VDU7:PRINT""Done"
130 END
140 DEFPROCAS
150 DIMR% 100
160 FORI%=0 TO 2 STEP 2
170 P%=R%
180 [OPTI%
190 .saver
200 LDX#F4
210 LDA#ramnumber:STA#FE30
220 LDY#8:STY#70:STY#72
230 LDA#80:STA#71
240 LDA#20:STA#73
250 .loop
260 LDA(&70),Y:STA(&72),Y
270 INY:BNEloop
280 INC#71:INC#73
290 LDA#73:CMP#&60:BNEloop
300 STX#FE30
310 LDX#text MOD 256
320 LDY#text DIV 256
330 JSR#FFF7
340 RTS
350 .text
360 ]
370 $P%=NAME$
380 NEXT
390 ENDPROC
```

Sideways Ram Saver





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# And now for a ROM/RAM roundup

**THERE are now around 35 alternative ROM/RAM expansion boards available for the standard BBC Micro. Why do we need them at all and what facilities do they offer?**

The BBC Micro, built around a 6502 microprocessor, is an 8 bit machine with 16 bit address lines and is therefore limited to directly accessing 64k (or 2<sup>16</sup>) bytes of memory.

A great deal of this memory, however, is already used for the operating system and Basic language ROMs (a total of 32k), for language and filing system workspace (about 6k) and for screen memory (from 1k to 20k).

This often leaves the user with only 6k for program and data storage, which is pitiful in 1985 with all the 16 bit machines around the corner.

However, there are four main ways in which the effective memory of the BBC may be expanded – by adding one or more of the following.

- 1: Sideways ROMs (or RAM).
- 2: Shadow screen RAM.
- 3: Second processor.
- 4: Paged 1MHz bus memory.

Option 4 is rather slow in use as memory banks require paging in, and access to this memory is awkward. Therefore this is not a popular option on the BBC Micro and will not be discussed in detail here. It is, however, worth mentioning that the sophisticated Acacia Diary uses this method with up to 30k of RAM and battery backup.

Option 3 is part of Acorn's initial specification to add a 6502 or Z80

second processor with 64k of extra memory. The BBC then acts as an input-output processor and caters for screen and filing system memory leaving lots of RAM (up to 44k for Basic or 61k for machine code in the 6502 version) on board the second processor for program and data storage.

Other advantages are the facilities to directly load language ROM software from disc and the increased processing speed. The processor add-ons are, however, rather expensive – 6502 £199, Z80 plus software £399 – and many BBC users have chosen options 1 and 2 to increase available memory.

(Needless to say, at least five other second processors are available in addition to Acorn's from other manufacturers.)

The differences between options 1 and 2 are best illustrated by reference to the memory map shown in Figure I.

The hardware available to provide this extra RAM/ROM is listed in Table I.

The BBC Micro has some superb graphics capabilities, but unfortunately the higher-resolution screen modes encroach upon the initially reasonable

	INTERNAL	EXTERNAL
<b>RAM ONLY</b>		
Shadow screen RAM	Aries-B20 board Watford 32k RAM board Twillstar Raven-20	
Sideways RAM	Solidisk 32-256k Twillstar 1x16k RAM board HCR 16/32k RAM board Watford 16k disc RAM Opus RAMbank 32k JP RAM/emulator	
<b>SIDEWAYS ROM ONLY</b>	JP ROM card Technomatics ROM board Midwich ROM board Micro-Z ROM board	National Micro ZIF Watford ZIF ATPL Insideout ZIF Toad ZIF Viglen cartridge Care cartridge Micro-Pulse ROMbox Ramamp ROM extension (Micro-Z ROM board)
<b>SIDEWAYS ROM/RAM</b>	HCR ROM/RAM board Altair Apex Watford Mk2 ROM BOARD ATPL Sidewise Aries B12 Sir ROM/RAM Mk2 Computer Village CVx16 Anderson Exprom Twillstar RAMamp Twillstar RAM-ROM board UDM ROM board	HCR ROM/RAM box GCC RAMROM 15 Watford Apex  (Aries B12)  (Anderson Exprom)

Expansion board	Approx cost (£ a)
Midwich ROM board	27
Technomatics ROM board	29
JP ROM card	25
Micro-Z paged ROM	60
Watford Mk2 ROM board	35
ATPL Sidewise	44
Aries B12	46
Anderson Exprom	62
Altair Apex	57
Twillstar RAM-ROM	27
Twillstar Ramamp	67
GCC RAMROM 15	129
Computer Village CVx16	49
Sir ROM/RAM Mk2	55
UDM ROM board	47
HCR internal ROM/RAM card	37
HCR external ROM/RAM box	120
Watford Apex	-

J Available, X Not available, - Not known/Alternate

Table I: RAM and ROM extensions for the BBC Micro



# RAMifications

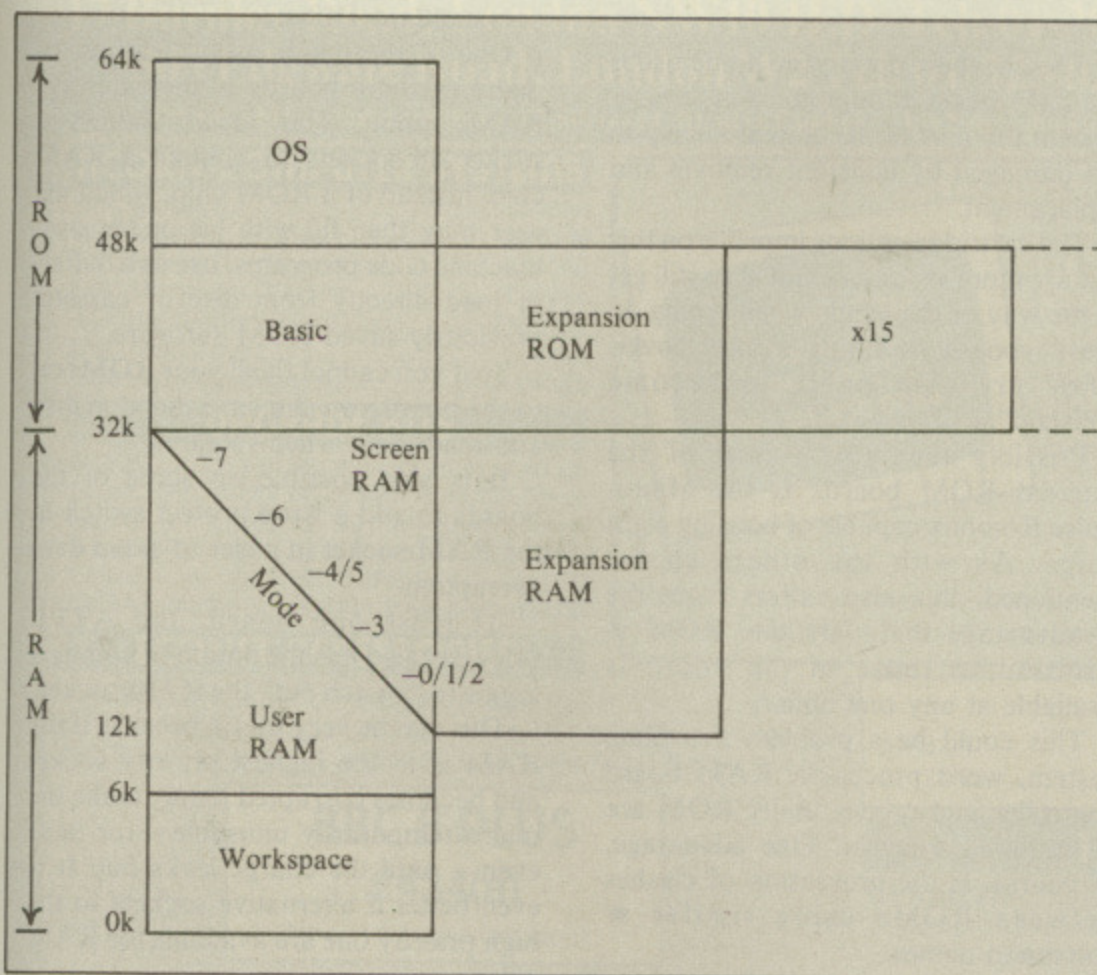


Figure 1: BBC Micro's memory map

amount of user memory available between locations 6400 and 32768.

This means that it is difficult or impossible to have long programs with plenty of data storage together with high-resolution graphics – as receivers of the dreaded “Bad mode” or “No

room” error messages know only too well.

A number of companies – Aries, Raven and Watford Electronics – have produced RAM boards which are designed to house screen memory thus leaving up to 20k extra for the user. It

certainly is a boon to see “BBC Computer 52k” at switch-on.

It must be remembered, however, that if you normally use the teletext Mode 7 screen occupying only 1k of RAM, that is all you will save with these expensive add-ons.

An important advantage of the shadow screen RAM boards is their use with word processor software where the user often needs to display a large amount of text in the high resolution Mode 0 or Mode 3 screens but not enough memory is available.

With the add-on RAM board both requirements may be fulfilled, putting the BBC Micro's word processor in the small business category.

However, care must be taken here as certain programs and word processors address the screen memory directly in order to improve operating speed.

These utilities expect to find screen memory in the usual place aboard the BBC Micro and therefore cannot take advantage of the shadow RAM.

View and newer versions of Wordwise including Wordwise Plus are, however, mostly compatible with these boards, but check first if buying one. The same advantage may be gained with spreadsheet programs which are also greedy in their use of memory.

The three shadow screen RAM

Approx. cost £ inc. VAT	Maximum ROMs available	ROMs on board	RAM option*	RAM Write Protect	RAM Socket off	Battery Backup option	RAM Socket position	Comments
27	16	16	X	X	X	X	X	Plug in socket 15 & IC76, sits under keyboard edge.
29	12	8	X	X	X	X	X	Plug in socket 15, sits under keyboard edge.
25	11	8	X	X	X	X	X	8k or 16k Eproms allowed.
60	16	12	X	X	X	X	X	Plug in 6502 socket, internal or external fit.
35	16	13	16k (2, 4, 8, 16)	✓	X	✓	15	Plug in socket 14, sits above RAM chips.
44	16	12	16k (2, 4, 8, 16)	✓	✓	✓	15	Plug in OS & AD sockets, sits near FDC controller.
46	12	12	16k (8, 16)	–	–	X	0	Plug in 6502 socket, 16 page manual.
62	16	16	16k (2, 8)	–	✓	X	0	Plug in 6502 socket, slow Eprom mode, ROM disable.
57	16	12	16k (8)	✓	–	✓	0	Plug in 6502 & 8271 sockets, 5 page manual.
27	10	7	32k (8, 16)	X	–	X	–	Plug in ROM socket.
67	10	6	32k (8, 16)	–	–	–	–	Plug in OS socket, 10 util. progs., buffer options.
129	15	11	16k (2, 4, 8, 16)	✓	✓	✓	4, 15	Plug in 6502 socket, power supply, 6 util. progs.
49	16	16	16k (2, 8, 16)	✓	–	✓	–	Fits close to RAM, battery backup included.
55	16	12	16k (4, 8)	✓	X	✓	–	Plug in 6502 socket.
47	16	16	16k (4, 8, 16)	✓	–	X	15	Plug in OS & AD sockets.
37	16	16	16k (2, 8)	–	–	✓	–	Plug in socket 15, can use 32k RAM card.
120	28	24	32k (2, 4, 8)	✓	–	–	–	Plug in socket 15, two boards, power supply.
–	142	142	1+ megabyte	–	–	✓	various	Plug in board + 8 external cards, RAM disc option.

known Alternative RAM sizes in brackets

Table II: Major features of 18 multiple ROM/RAM expansion boards



# RAMifications

## From Page 57

boards available – Aries-B20, Raven-20 and Watford RAM board – are similar in price (£70-80), fitting and function.

They are all internal boards fitting into the 6502 socket, which is then mounted on the expansion board, and do not normally require soldering or track cutting. They also require a vacant sideways ROM slot for their controller ROMs. The latter may also claim some workspace by raising PAGE.

Though the spare memory on each board, if not used for screen memory, is available to machine code users the Watford board seems to be the more versatile as it can provide a 32k buffer for the printer, sound, keyboard or RS423, or a 12k buffer simultaneous to the 20k screen buffer.

Furthermore, the ribbon cable attachment of the latter allows for greater compatibility with other internally-fitted boards.

Finally, other boards in this section allow for extra RAM, but for use only in a sideways ROM fashion – thus user memory is not increased. An exception to this is the Solidisk option which gains back the 2½k of workspace normally occupied by the disc filing system.

It must not be forgotten, however, that in some circumstances large programs and large data files can still be efficiently handled by the BBC Micro's disc system continuously using overlays, thus obviating the need for expansion RAM.

In the standard BBC Micro the 16k Basic language ROM occupies memory locations 32768 to 49152. However, the operating system, if version 1.0 or greater, is designed to communicate at any one time with any one of 16 alternative sideways ROMs occupying the same memory addresses.

This is a marvellous feature and has led to a multitude of languages, filing systems and utility software available on ROM so that it may be paged in without occupying user RAM.

Unfortunately, only four sideways ROM sockets are provided on the original BBC Micro, and numerous companies have produced ROM expansion boards, as can be seen from Table I.

The simplest form of expansion is to provide for a zero force insertion (ZIF) socket or replacement cartridge socket external to the micro connected to a sideways ROM socket via a ribbon

cable.

The cheapest option for home use is the ZIF socket, though for a multi-user system the pins of the chip are likely to get damaged by constant removal and replacement.

The cartridge options improve on this but are more expensive and may still get in the way of the hands when typing on the keyboard or fitting a hard cover. They are also liable to become "mislaid".

Possibly the most robust of the external ROM boards is the Micro-Pulse Rombox capable of housing eight chips. As with the others so far mentioned, this also suffers from the disadvantage that only one ROM in addition to those in the micro is available at any one time.

This could be a problem if a filing system, word processor, RAM board controller and printer utility ROM are all required together. One advantage, of course, is the prevention of clashes between ROMs using similar ★ command names.

Multiple ROM boards are therefore a better choice. The majority of these fit inside the micro with the main board plugged into a 28 pin socket or the 6502 microprocessor socket, often with flying leads to connect elsewhere. These generally bring the ROM capacity up to between eight and the maximum possible 16.

A few of the boards are also capable of external mounting which helps avoid overheating or overcrowding problems within the micro.

Two of these, Watford's Apex and HCR's external box, also allow for added ROM cards to be paged in, greatly increasing the number of ROMs available. These, however, require external power supplies.

A useful additional feature, available on the Anderson's Exprom, is the possibility of switching out certain ROMs when necessary.

Furthermore, it is possible on many of these boards, sometimes with the aid of a built-in turned pin DIL socket, to add a ZIF for the easy addition or removal of less-frequently-used or clashing chips.

Some of the main features of these boards are outlined in Table II, though readers would be advised to check reviews or adverts and perhaps to ring manufacturers to check for complete compatibility with other add-ons that you may have in your micro – especially

non-standard DFSs.

One of the major useful features of many of these boards is the sideways RAM option. This facility allows a socket or sockets to contain a RAM chip, instead of a ROM chip, which the user may then fill with his or her own machine code programs, use as a buffer, or load directly from disc or cassette previously-saved ROM software.

So if you cannot fit all your ROMs on to the board you can save them on disc and load them when required.

It is also possible on some of the boards to add a write protect switch to the RAM socket in order to avoid data corruption.

At least one board, the ATPL sidewise, also has the option of adding a toggle to "switch out" the RAM socket.

This can be very useful because if the RAM is in the highest priority socket and becomes corrupted it may make the micro temporarily unusable – for days even – until the charge leaks out. It is even better if alternative sockets to the high priority one are available for RAM chips.

Finally, a number of sideways RAM only boards are available which specialise in storing disc-based ROM software though they may also be used as a temporary on-board disc file.

With all these sideways ROM options a battery backup facility, if available, allows the loaded software to remain in the BBC Micro even after it has been switched off, thus saving constant reloading from disc or cassette.

In conclusion I would say that the addition of a multiple (switchable) sideways ROM board with at least one sideways RAM socket and a ZIF is almost essential to make good use of the capabilities of the BBC Micro.

Furthermore, RAM memory expansion via a shadow RAM board or a second processor is a necessity for business or home users making frequent use of word processors or spreadsheets.

Interestingly, if all these expansion possibilities were fitted at the same time the BBC user would have a 400k BBC Micro at his fingertips!

The importance of these expansions to the BBC Micro has recently been stressed by the launch of the BBC B+ which is enhanced with precisely some of the features.

Perhaps we have now seen the heyday of expansion boards – or is it just the beginning of a new lot?

Mike Mahon



# TECHNOMATIC

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The package also includes a 'carousel' type display, allowing each frame to be displayed for a specified time, before moving on to the next frame.

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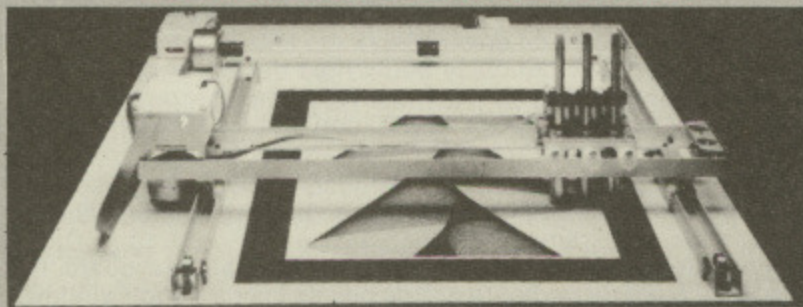
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2 Computers/2 Printers X-over	36V36-X £69(c)	25V25-X £69(c)
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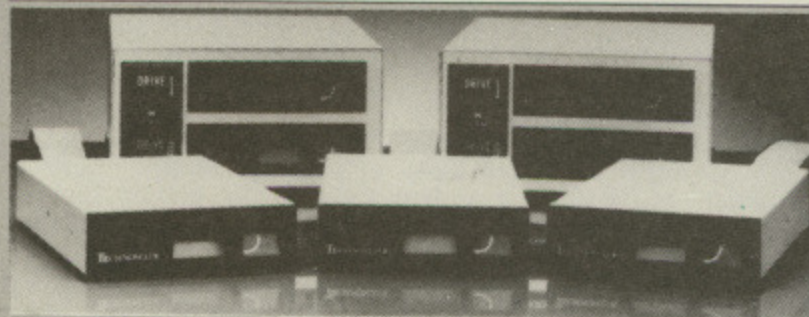
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TECHNOMATIC drives are fitted with high quality slimline Mitsubishi mechanisms and represent the state of the art in drive technology. The drives are built to the highest standards and are tested to their full performance capability before packaging.

All drives are available with or without integral mains power supply. The dual drive power supplies are switch mode type and are generously rated to ensure minimum heat generation even over long periods of operation. All drives with integral power supply are fitted with a mains indicator.

The drives are housed in attractively designed metal casings painted in hard wearing BBC matching paint. The dual drives can be supplied in stacked version or with built-in plinths. The plinth version cases are of sturdy construction to carry any monitor and provide a simple method of having a compact computer installation.

The 80T drives are supplied with the 40/80 track switching modules at no extra charge. The 40/80 track switches are conveniently positioned to enable easy switching between the tracks.

All drives are supplied with all the necessary cables, manual and a formatting disc. The mains powered drives are also fitted with a 13A mains plug suitably fused. The drives are ready to be fitted to the computer. All drives are capable of operating in single or double density modes.

### Single Drives:

1 x 100K 40T SS	TS100	£85(b)	PS100 with psu	£125(b)
1 x 400K 80/40T DS	TS400	£125(b)	PS400 with psu	£149(b)

### Dual Drives:

Stacked Version:		Plinth Version:		
2 x 100K 40T SS	TD200	£175(a)	PD200 with psu	£200(a)
2 x 400K 80/40 DS	TD800	£250(a)	PD800 with psu	£290(a)
2 x 100K 40T SS	TD200P	£195(a)	PD200P with psu	£220(a)
2 x 400K 80T DS	TD800P	£265(a)	PD800P with psu	£305(a)

## DISC DRIVE MULTIPLEXER

A simple device that enables up to four computers to be connected to one single or dual drive. Ideal unit for installing in classrooms where networking is not planned or necessary or the costs have to be kept low or where software information is shared. Several of these units can be installed in series to connect more computers to access the same discs. Units supplied with 5' of cable per outlet as standard. Mains powered.

TDM 4 Quad Unit (upto 4 computers) £135(a)

TDM 2 Dual Unit (2 computers) £75(b)

Note: All computers must be fitted with a DFS

## 3M FLOPPY DISCS

Authorised Distributor  
Data Recording Products



Industry standard high quality discs with guaranteed error free performance for life. Discs in packs of 10:

40T SSDD £13(c)	40T DSDD £18(c)
80T SSDD £22(c)	80T DSDD £24(c)

3 1/2" discs. Pack of ten £38(c)

## FLOPPICLENE DRIVEHEAD CLEANING KIT

The FLOPPICLENE drive head cleaning kit is an ideal way to ensure the optimum performance of your drives. The use of disposable cleaning discs eliminates the risk of contamination and abrasion of sensitive driveheads. These risks are normally inherent in the reusable drivehead cleaning kits. Floppiclene with 20 disposable cleaning kits. £14.50(b)

## DISC ACCESSORIES

Single Disc Cable	£6(d)	Dual Disc Cable	£8.50(d)
10 Disc Library Case	£1.80(d)	30 Disc Case	£6.00(c)
Lockable Storage Boxes 40 Discs	£14(c)	100 Discs	£19(c)

17 Burnley Road, London NW10 1ED

Telephone: 01-208 1177. Telex: 922800



# COMMUNICATIONS

## MODEMS

**ACORN PRESTEL:** The official Acorn add-on — an advanced BT Approved. Auto-Dial, Prestel Terminal ideal for British Telecom Gold. Comprehensive software includes 'tagged' frames, downloading of Telesoftware, saving of frames, printing, sophisticated 'Mailbox' handling c/w editor. A built-in speaker allows line monitoring. A simple !BOOT file allows automatic operation £99(b)

**BUZZ BOX** A full spec, BT approved, pocket size, direct connect modem with both originate & answer modes, full & half duplex, allowing access to many databases, bulletin-boards as well as Intercomputer communications. It conforms to CCITT V21 300/300 Baud Standard. Battery/mains powered £62(c) BBC Lead £6 External PSU £9(c)

**MINOR MIRACLES WS2000** A world standard modem, having BT approval, covering V21, V23, (BELL 103/113/108 outside the UK) and including 75,300,600,1200 Baud ratings. (It even includes



'reverse Prestel!'). This is the modem that will cover 'Prestel' type systems as well as Bulletin Boards both in the UK and abroad. What possibly gives this modem its biggest advantage is its option of computer control. A 25Way RS232 input as well as possible

computer controlled auto-dial/auto-answer makes this modem unique. WS2000 £129(c) BBC Serial Cable £7

**WS2000 Auto-Dial card:** includes an integral loudspeaker for monitoring of the phone line £30(d).

BBC User Port cable (for modem control) £7.

**SKI KIT** (Allowing total control of the modem by your computer) £10.

**DS1 Disc (for Commstar):** When used with the Auto-dial card, SK1 Kit, and a user port cable, this software will dial out to Prestel, enter your password etc. and leave you in Commstar. Will also store many bulletin board telephone numbers for autodialling £10.

**WS2000 Auto-Answer Card** £30(d).

(Please note that the A/D & A/A Cards are still awaiting BABT Approval.)

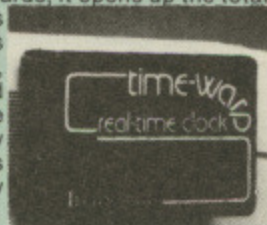
**COMMSTAR** An ideal communications Rom. Extremely easy to use, yet very versatile. It features both a Prestel mode as well as a Terminal mode, thus offering very good value for money. In Prestel mode, all normal Prestel features are available including, downloading of software, saving and retrieving of pages on disc, page tag, revealing of hidden text etc. Its terminal mode is ideal for bulletin boards etc. All input may be copied into a buffer in memory over which full control is available. Controls of protocols are very simple and any type of file, (not just ASCII) may be sent using XModem protocols. Even includes an elapsed time-clock. £29(d)

**TERMI-II** A good general purpose communications package for bulletin boards, electronic mail etc. (Not for PRESTEL) £28(d)

**COMMUNICATOR** This is a full 80 col VT100 terminal emulation program on 16K eprom. It is a more advanced program than TERMI and features easy to follow screen menus. The rate at which data is sent or received is easily set up with rates up to 19200 Baud with 80 column text. Allows files to be transmitted from disc, or a copy of incoming data to be sent to a file or to a printer. (Communicator is not suitable for PRESTEL). £59(d).

## 'TIME-WARP' REAL-TIME CLOCK CALENDER

We have broken the price barrier! A low cost unit, allowing the facilities of units costing far more. Built to professional standards, it opens up the total spectrum of Real-Time applications. Possibilities include desk diary/planner, calendar, continuous display of on-screen time and date information, automatic document dating, precise timing and control in scientific applications — its uses are endless. Simply plugs into the user port — battery backup is supplied as standard. A full manual as well as Extensive software on cassette (easily transferred to disc) — no ROMs needed. £29(c)



## SMARTMOUTH

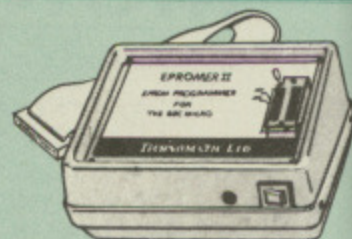
The original 'infinite speech' synthesiser. A ready built, self contained speech synthesiser unit attractively packaged with a built in speaker. Plugs into the user port. £31(c)

# TECHNOMATIC

All prices exclude VAT

## EPROMER II

A sophisticated eprom programmer that handles the full range of single rail eproms (incl 27256) and allows the user full control of the programming process.



Its powerful menu driven software makes the programming of eproms simple, efficient and eliminates the need to have fiddly switches for selecting eprom types, programming voltage or method. The features include:

- \* Integral power supply ensures no power drain from the computer.
- \* Interfaces through 1 MHz bus, fully buffered.
- \* Eproms upto 16K (27128) programmed in single pass.
- \* Selectable programming voltage 25/21/12.5V
- \* Selectable programming method — normal or high speed algorithmic. High speed programming enables 27128 to be programmed in just over 2 mins. Normal programming skips addresses with FF data to increase programming speed. Automatic verification on completion of programming.
- \* User can select any section of the eprom from a single byte to its full address range to Blank Check/Read/Program/Verify enabling program development/changes very simple.
- \* Full screen editor with HEX/ASCII input.
- \* Full tape/disc filing facility. Data input from keyboard/Tape/Disc/Eprom.
- \* Constant display of all options selected.
- \* Several BBC BASIC programs can be entered on a single eprom.

EPROMER II with Manual & Cassette £99(b) Software on disc & ROM based software £10

## UV ERASERS

**UVT1T Eraser** with built-in timer and mains indicator. Built-in safety interlock to avoid accidental exposure to the harmful UV rays. It can handle up to 5 eproms at a time with an average erasing time of about 20 mins. £59(b).

UVT1T as above but without the timer. £47(b).

## ROM/RAM EXPANSION SYSTEMS

**COMPUTER VILLAGE ROM/RAM BOARD:** A beautifully designed expansion board, simply plugs in — no soldering. (Fits into 6502 and Video ULA Skt.). Fully buffered with 16 paged Rom capacity. Option of 16K paged Ram, with software initiated write protect — battery backup is included. It allows nine different ROM/RAM configurations. £43(c)

**ATPL SIDEWAYS ROM EXPANSION BOARD:** This is a well constructed expansion board, that does not require soldering in its installation. All buses are buffered. It allows full sideways ROM expansion to a total of 16 ROMs. One socket has been split into two 8K sockets to allow the use of 8K byte CMOS RAM chips, giving a total of 16K sideways RAM. This is ideal for sideways ROM development, and will also allow downloading of software from cassette or disc. The battery backup option will allow retention of data in the RAM, when power to the computer is removed. Several link-selectable options include the choice of type of Eprom, and a 'write-protect' for the RAM option. £39(d) Back-up Kit £18.

**RAMROM-15:** The advanced sideways ROM/RAM expansion system. This is an external unit, using high quality construction, attractively packaged in a BBC coloured metal case, allowing easy access to all the sockets. (Allows other units to be fitted inside the BBC). Absolutely no soldering is required. Allows 11/12 additional sideways ROMs to be fitted with an option of up to 16K sideways RAM. All commonly available RAM can be used i.e. 4801/6116/6264 or xx128. All the hardware to take the RAM is already fitted e.g. battery backup. For development work and further expansion most of the 6502 processor signals are available. Supplied with utility disc and full instruction manual. £86(b).



**01-208 1177**

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**THE SCROLL**

We are about to launch a revolutionary new concept in Word Processing, that will raise the standard of BBC word processors.

Among its revolutionary features are:

1. A supplied 64K ram card allows a genuine 64K of text storage.
2. 40/80 Column use is easily selectable.
3. A special non-volatile 2K ram, stores (even when the BBC is switched off!) both pre-defined document configurations, and pre-defined printer drivers. This allows you to take full advantage of many and varying printer facilities, such as Italics, Bold, Underline, Shadow etc., with ease and simplicity.
4. A unique facility allows user access to the 64K Ram and 2K Non-volatile RAM.

Not priced for the lower end of the market, this product is aimed primarily at the professional user who spends a considerable period of time using a word processor, and is not satisfied with 'hobby' type products. We feel that we have reached a high standard with this product — that it has achieved the delicate balance between sophisticated features and an elegant ease of use.

Detailed specifications to be released soon.

**ACORN IEEE INTERFACE**

This interfaces enables a BBC computer to control any scientific and technical equipment that conforms to the IEEE488 standard, at a lower price than other systems, but without sacrificing any aspect of the standard. The interface can link up to 14 IEEE compatible devices. Typical applications are in experimental work in academic and industrial laboratories, with the advantage of speed, accuracy and repeatability. The interface is mains powered and comes with cables, IEEEFS ROM, and user guide.

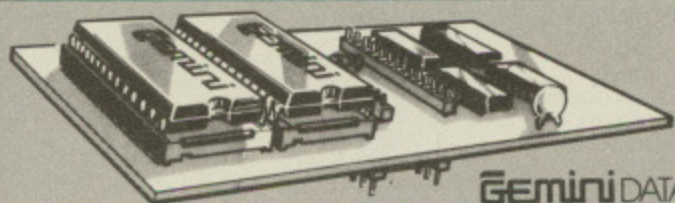
£282(a)

**ACORN MUSIC 500**

Convert your BBC micro into a sophisticated music composition aid and sound effects generator. Custom made software will provide you with the flexibility to compose, experiment, perform and teach music. Stereo output can be connected to a sound system including your home stereo unit. Full specification on request.

£174(a)

**DATABASE MANAGEMENT SYSTEMS**



**Gemini DATAGEM**

**The Definitive Random Access, 24K ROM Based DATABASE MANAGEMENT SYSTEM.**

Datagem is the first truly flexible database for the BBC Micro that can make your system really useful and efficient, saving you money in the long run. The system includes a carrier board containing two Eproms, demonstration applications disc in both 40/80T, professional documentation with quick reference card, and 'Trans' utility program. Features include: \*almost unlimited file size (max 10Mbyte) \*supports up to 4 drives \*Max of 5000 records per file \*max 6K record size \*max of 62 fields \*9 level hierarchical search system with facilities to store results of searches. Searches can be any one of the following: Search, Include, Exclude, Combine, Common or Difference \*user defined variables \*generates form letters from records. Please ask for leaflet. £99(c)

**STARdataBASE:** A fast machine code, true random access database program in a 16K Eprom. Up to 4096 records in a file, up to 69 fields in a record. The record layout is totally user defined. Entirely menu driven — thus very user friendly. Extremely fast searches are possible using the Keysearch facility. Mailmerging from View and Wordwise, and address labelling. Its printer configuration suits any BBC compatible printer. £69(d)



**VIEWSTORE:** An exciting, powerful database with many features: Display can be 'spreadsheet' or 'card-layout' type. Powerful selection and sorting utilities. Any screen mode can be used. Data can be sent to View and ViewSheet. Maximum file size 4096MByte!. Maximum record size 60K. £52(c)

**CP/M SOFTWARE FOR TORCH Z80 ACORN Z80 PROCESSOR**

We can now supply almost any CP/M based software package in a format suitable for the Torch Z80 and Acorn Z80 second processors. The following are generally available from stock

DBASE II £335(a) WORDSTAR PROFESSIONAL £380(a)

WORDSTAR £275(a) DBASE II Tutorial.... £32(c)

PROPASCAL £220(a) Supercalc 2 £200(c)

Phone for your specific requirements

Please specify the type of format (TORCH or ACORN) required.

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**WORDSTAR PROFESSIONAL:** The advanced word processing package comprising of WordStar, MailMerge, StarIndex and SpellStar, a total combination offering substantial savings on individual prices. WordStar is the best selling word processing program on the market. Extensive operator aids include a comprehensive yet friendly manual, step-by-step training guide, command cards, on-screen menus with four levels of help messages etc. etc. SpellStar checks text files against its 20,000 word-plus dictionary. You can both add to the dictionary and create specific supplementary ones. Mailmerge is ideal for mailing applications where lists are selected on a range of criteria. It enables the fast production of personalised form letters, mailing labels, invoices, etc. StarIndex creates alphabetical indexes, tables of contents, paragraph numbering and much more.

WORDSTAR PROFESSIONAL £310(a)  
WORDSTAR £275(a) MAILMERGE £145(a)

**DBase-II:** Undoubtedly 'The Database', can be used for an almost limitless number of business applications, ranging from mailing list preparation and maintenance through to running accounting ledgers and payrolls. In addition to standard database features it provides much more. An on-disc tutorial takes you from setting up a simple file all the way through to setting up custom screens and reports. Automatic calculations may be performed on data, and fields or entire databases may be modified or replaced with single, English-like basic commands; Dbase-II can therefore be used by general personnel having no programming knowledge. It can be tailored to suit a variety of professions and individual needs, with files such as accounting, payroll, time billing, job costing, scheduling and mailing lists. It can access several files at a time. It is fast, flexible and powerful. £335(a)

**SuperCalc-2:** A powerful easily operated financial planning tool. Using a grid of 63 columns by 254 rows each cell can hold up to 127 characters. Many facilities include, split screen, powerful editing, data protection, consolidation, sorting, calendar clock etc. etc. £200(c)

**PRO-PASCAL:** A complete implementation of the International Standard for Pascal, it has been validated by BSI. Compiles translated source code programs into machine code, which is executed directly by the processor, rather than being interpreted. The package includes a compiler, library, link editor, library manager, and cross referencing utility. £220(a)

**BSTAM:** A telecommunication facility used for transmitting any size CP/M file. £165(b)

Other packages available include CIS-COBOL, INFOSTAR, FRIDAY, DMS +, FMS, SAGE, ATI TUTORIALS, MACRO-80 etc. Please telephone with your requirements.

**TORCH GRADUATE SOFTWARE**

We are able to supply most popular software packages including: FRAMEWORK, WORDSTAR, WORD, EASY-WRITER, DBase-II & III, LOTUS-123, VISICALC, SAGE etc. Please telephone with your requirements.

**ROMs/SOFTWARE**

**VIEW** Acorn's new version V2.1 word processor rom. Advantages include printing straight from memory and editing in any mode. £48(c)

**HI VIEW** Disc based version of VIEW word processor for use with the 6502 2nd processor. Allows 47K of user memory. £52(c)

**VIEW INDEX** Disc based program to create an index from VIEW text files. Ideal for anyone concerned with writing extensive reports or books. £13(d)



**WORDWISE:** One of the most popular word processors for general use £34(d). Wordwise SpellCheck Disc — A must for any serious word processor user. Normal price £16.50(d). If bought with Wordwise: No p&p and only £14.

**WORDWISE PLUS:** The new advanced Wordwise on a 16K eprom, for the more specialised users who require added features and flexibility. New facilities include: 2nd Processor compatible allowing 80 column previewing in all cases, a new Basic-like language, new editing features and embedded commands etc etc. Four new programs are also supplied allowing mail-merging, index generating, two-column text printout and continuous processing. A new 56 page introductory manual and a 180 page reference manual complete this rather special package. Finally, it is able to use existing Wordwise files without any modification. £49(d)

**SPELLCHECK II:** A ROM based fast machine code program that works with both VIEW and WORDWISE. Vocabulary disc supplied with 6000 words can be expanded to well over 17,000 words on 100K drive. Fully compatible with 6502 second processor. £26(d)

**ISO-PASCAL:** Acorn's full implementation of International Standard Pascal on two 16K ROMs. Disc Version for use on 6502 2nd Processor also supplied. Comprehensive manual. £60(c)

**OXFORD PASCAL:** A fast, compact P-Code compiler, that fully utilises BBC Graphics and sound, contains a powerful editor, and produces 'stand-alone' software. £43(c)

**ACORN LOGO:** A full implementation of the Logo language from Acornsoft. Supplied as two ROMs with a tutorial course and technical manual. £60(b)

**ULTRACALC 2:** This enhanced version of the original BBC Publications popular spreadsheet ROM includes many new features including full compatibility with the 6502 2nd processor running as HiCalc allowing 44K of user memory, operate in any mode, greater flexibility in printer control, spooling as ASCII file etc. All these features are in addition to the existing powerful features such as handling of labels and numbers as values. Column width control and features normality found in well designed spreadsheets. £69(d)

**INTERSHEET:** The new spreadsheet from Computer Concepts. Many advanced facilities including 105 character display, several spreadsheets may be used at once, may be used with View & Wordwise etc. etc. £49(c)

**VIEWSHEET:** Acorn's spreadsheet provides 255 columns and 255 rows and will operate in any mode. Windows can be created which can then be rearranged to provide any print format required. Function keys provide for easy entry of commands. Printer control codes can be used using the printer driver. Fully compatible with VIEW and the 6502 2nd Processor. £52(d)

**BCPL:** A full implementation of the BCPL compiler language consisting of the language ROM, disc containing the BCPL compiler, a screen editor, a 6502 assembler, other utilities and programming aids and examples of BCPL code and a 450 page manual. BCPL can be used to develop games programs, commercial packages, system software, to write control systems and to produce programs which otherwise would need to be written in assembler. £52(b)

**BCPL STAND ALONE GENERATOR:** Utilities in this package enable the programs developed using the BCPL ROM to be converted so that they can be run on any BBC micro whether it has a BCPL ROM or not. Stand alone programs for other 6502 based systems can also be developed. £43(d)

**BCPL CALCULATIONS PACKAGE:** Supplied on disc, it supports floating point, fixed point and fast integer calculations. It includes the BCPL calculation files, example files and a comprehensive user guide. £17.30(b)

**ACORN LISP Rom £43(d); FORTH £43(d); COMAL £43(d)**

**COMPUTER CONCEPTS COMPILER:** Please phone for availability.

**G:FORTH:** An advanced implementation of FORTH which follows the 79-Standard specification on a 16K ROM and has a full double number extension set. It incorporates an editor, 6502 assembler, very fast turtle graphics and supports extensive string and file handling. It contains 540 predefined words including those for reading joystick ports, produce sounds, set and read the time and produce random numbers. Fully compatible with disc or tape filing systems and works in any mode. Package comes complete with a USER GUIDE, Introduction to FORTH and 16K GFORTH ROM. £43(d)

**DISC DOCTOR:** Computer Concept's popular disc utility ROM which adds 20 commands to the DFS system. £27(d)

**DISCMASTER:** Disc Utility. £16(d)

**EXMON-II:** Advanced M/C Monitor. £24(d)

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**PRINTMASTER:** The ROM that features the most versatile screen dumps for the Epson MX/RX/FX80 and KAGA PRINTERS. Includes mode 7, magnification, character definition, enlarged text, etc. etc — in short — this ROM does it all! £28(d)

**DUMPMASTER:** Disc based dumps for many printers. £10(d)

**MUROM:** Music Development ROM. £24(d)

**BILLBOARD:** A useful program that enables your BBC to produce super-large 'Billboard' type characters i.e. a continuous horizontal scrolling of super-large characters. Supplied in ROM. £16.50(d)

**HELP:** ROM based comprehensive on screen HELP facility to aid and speed up programming. £21(d)

**MICROGUIDE:** Keyboard Key-Plate. £16.50(d)

**MICROTEXT:** The authoring system from the National Physical Laboratory. Disc £53(b) Cassette £43(b)

**REPLICA II:** 40 & 80 Track Versions available. £10.35(d)

**BROM:** The new utility ROM from Clares — a Toolkit ROM that gives you full screen editing. Many extra functions are included. £30(d)

**BEEBUG DESIGN** £16.50(d)

**BEEBUG SUPERPLOT** Cass £8.50(d)

**SPELLCHECK-I** £16.50(d)

**MASTERFILE II:** The new version of the popular general purpose file management system. It allows large amounts of information to be stored and processed. It is extremely powerful yet flexible to use. The disc version allows up to 17 fields per record, and the only limitation as to the number of records is the capacity of the disc. Typically, using 5 fields, about 2000 records may be stored on a 100K disc. This latest version features many new facilities including use with WORDWISE/VIEW £16.50(d) Disc (80 or 40T).

**HERSEY CHARACTER:** Font generator £12.50(d)

When ordering software on disc please specify track format (40/80)

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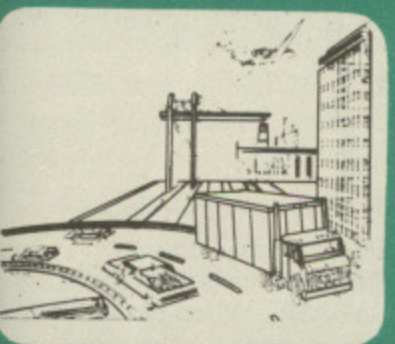
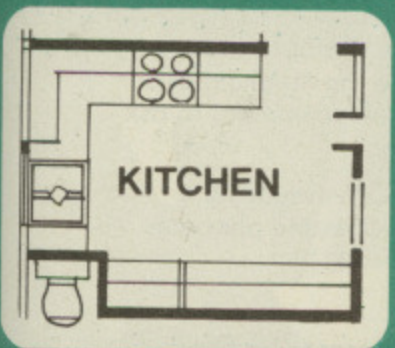
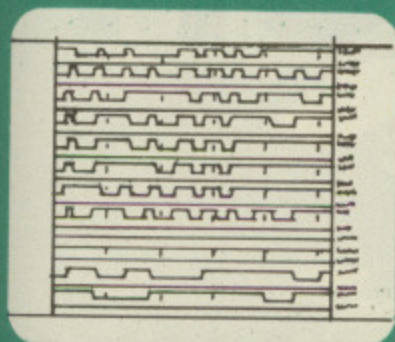
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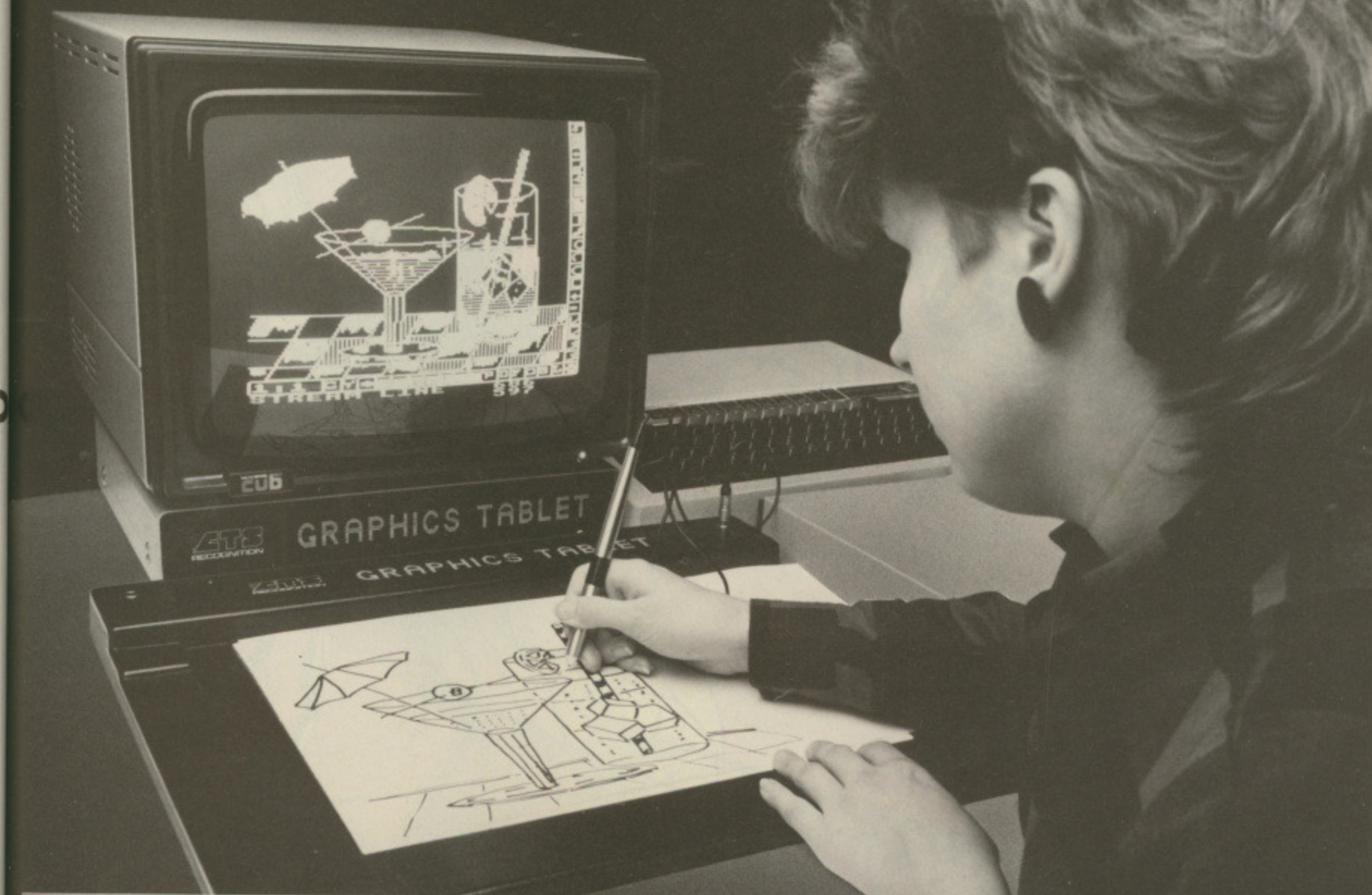
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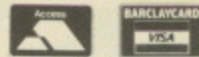
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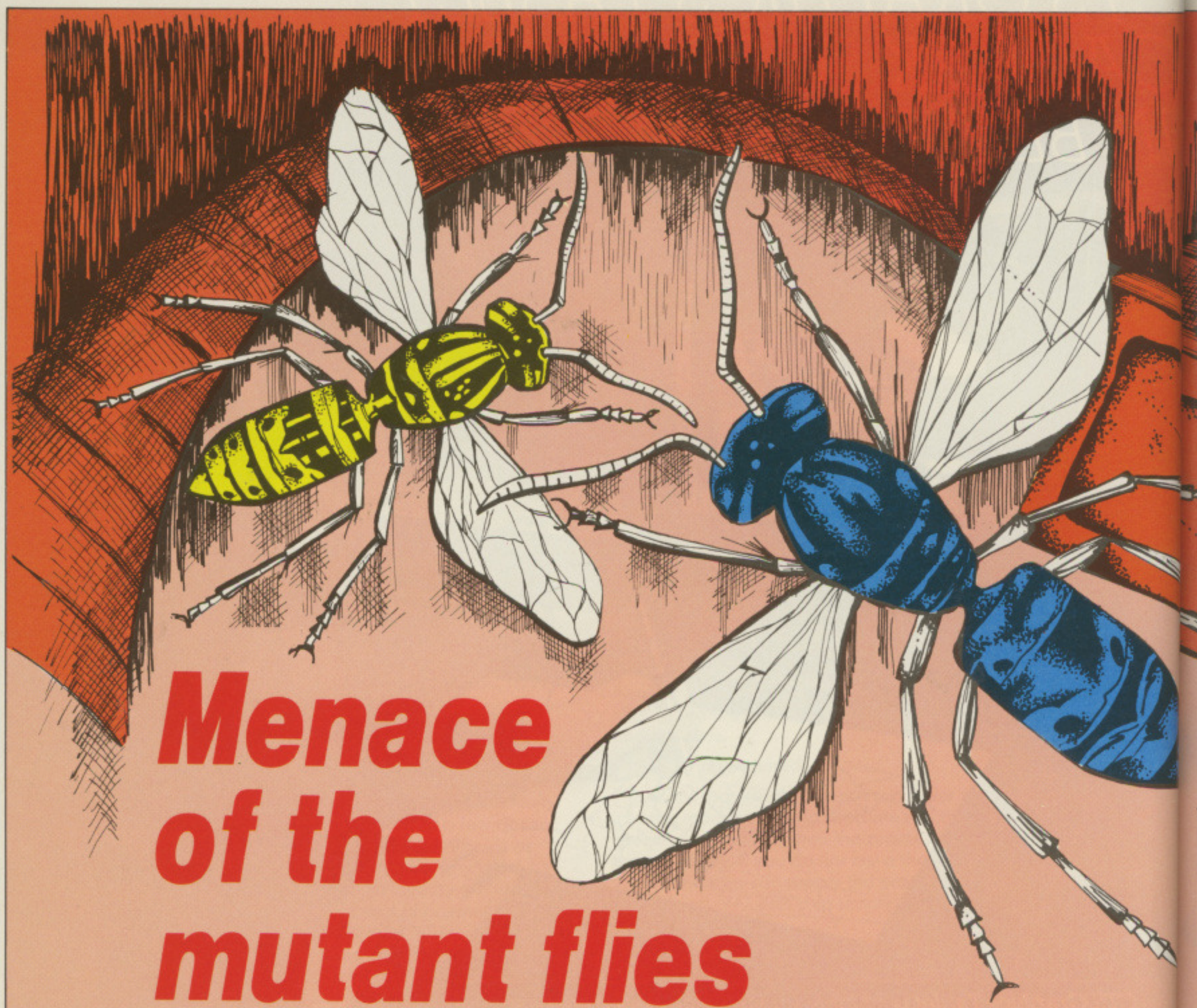
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Suddenly those rumours aren't rumours any more. A giant fly hovers before you, screeching (if that's what giant flies do), blocking the passage and spreading its enormous wings. For a few seconds you freeze in fear. Your only chance of escape now is to build a trap to contain it.

By JOHN  
McCAULEY

The cellar is littered with huge bricks which you can push around using the Z, X, : and / keys. Correctly positioned these will form an impenetrable barrier between you and the monster.

Be careful where you push them though, as any that you move outside the confines of the cellar are irretrievable. And you'll need as many as you can get your hands on.

However that isn't quite as easy as it sounds. Any brick, or number of bricks, pushed directly at the fly will be reduced to powder as the insect crushes them with its huge jaws. Yes, this overgrown maggot cut its teeth on house bricks – it's a house-fly.

To succeed in your task you must strategically position the bricks to surround your foe rather than attempt to crush it.

If you manage to trap the monster

within certain time limits you are awarded a bonus in proportion to the time you took. You then move to the next level where you'll find a similar enemy.

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However in return you are able to amass a greater number of points. In fact there are nine difficulty levels, all selectable at the start of the game for practice purposes if required.

Oh yes, one more little point: just like the real world you die once, so best stay away from the 'winged thing' or else it's curtains.

What a challenge! I don't doubt you've seen big horse-flies, and you've probably seen big dragon-flies. But boy, you ain't seen nothing yet!!

Full listing starts  
on Page 168



## PROCEDURES

instructions Instructions for the game.  
title\_page Displays title screen.  
print\_bricks Puts the bricks on screen.  
move\_bricks Moves bricks when pushed.  
next\_sheet Gives you a new screen.  
bonus Gives a bonus depending on time taken.  
loss Called when the fly catches you.  
win Called when you trap the fly.  
level Decides how many bricks to print and fly's intelligence.

## VARIABLES

HI% High score.  
SC% Score.  
X%,Y% Man's position.  
X1%,Y1% Fly's position.  
OX%,OY% Man's last position.  
OX1%,OY1% Fly's last position.  
CO% Time taken.  
R% Random number for fly movement.  
F% Level of difficulty.  
J%,H% Direction man pushes bricks.  
U% Number of bricks pushed.  
PE% Number of bricks displayed.  
PA% Rate at which fly follows man.





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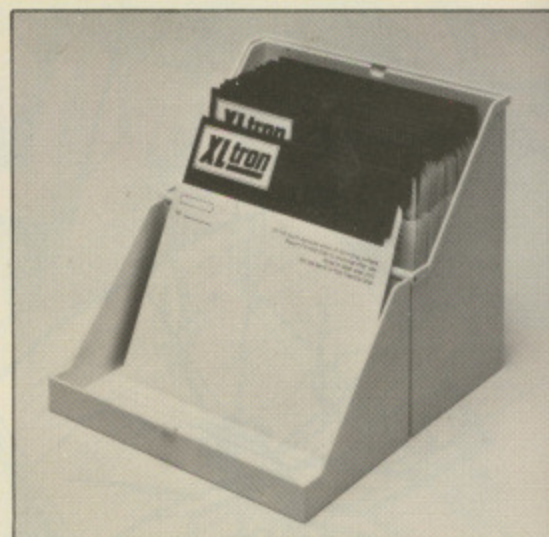
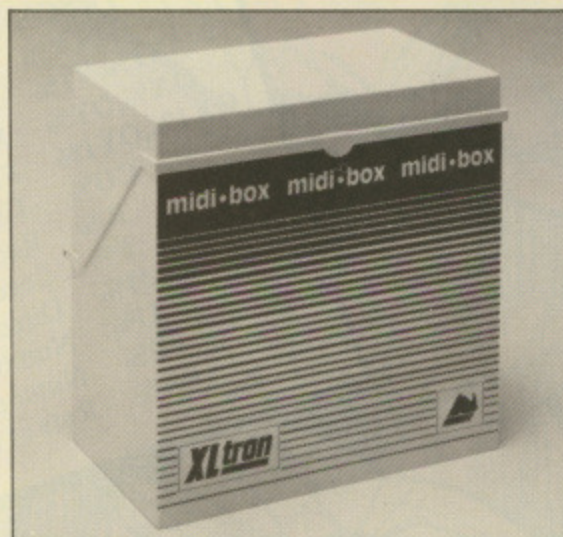
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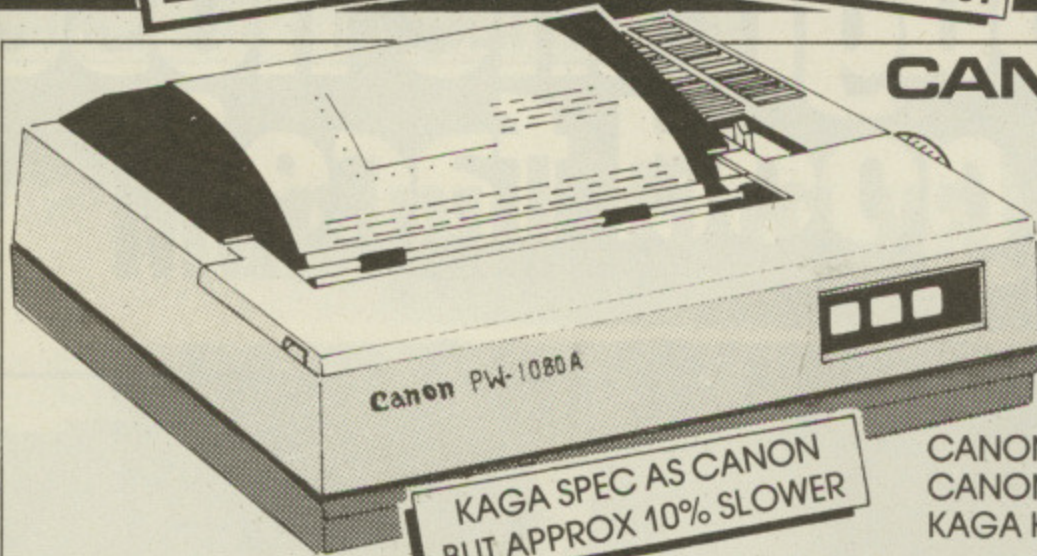


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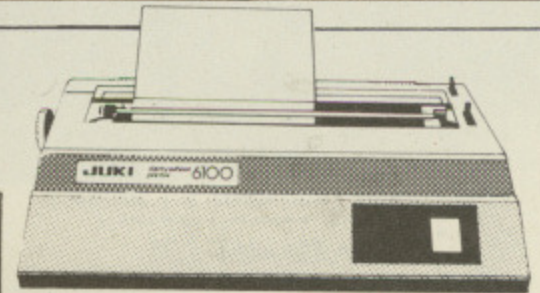
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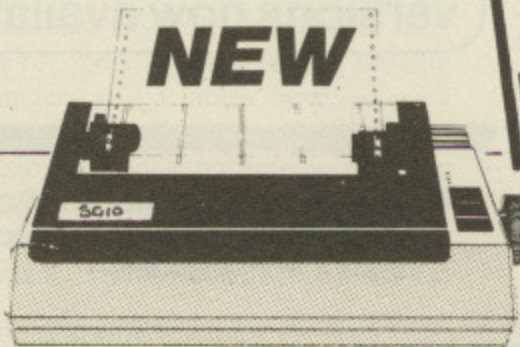
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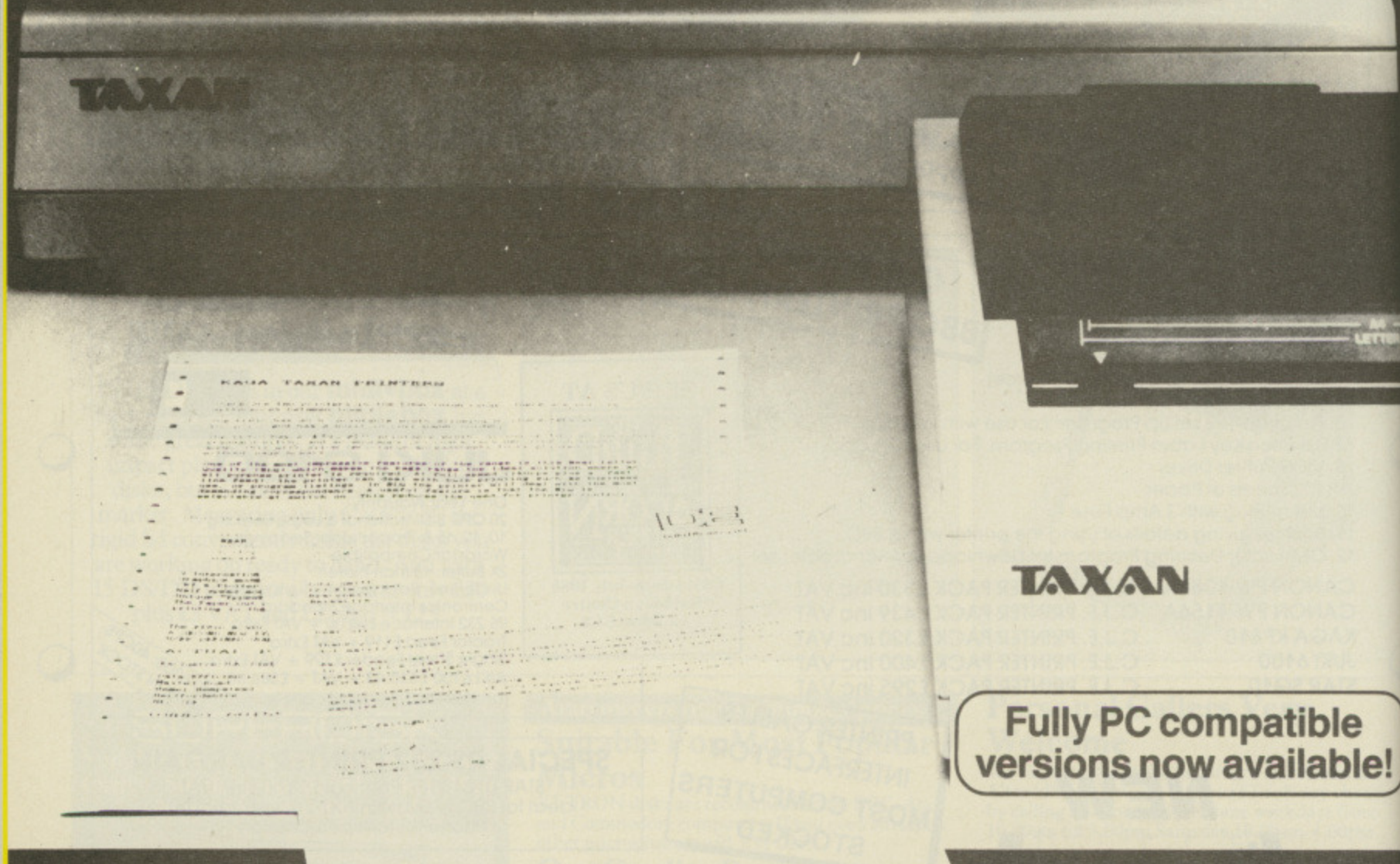
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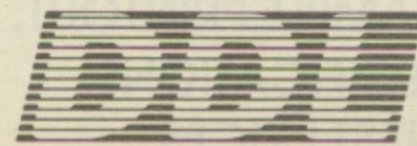
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**PETER JOHNSON**  
 continues his series on  
 machine code programming  
 with Basic's internal routines

# Manipulating values stored in Basic variables

IN last month's article I described how to input and output values from machine code using Basic's internal routines. This month I look at manipulating values stored in Basic variables — that is, performing arithmetic functions on them.

The easiest way to deal with variables is to pass them as parameters to Basic's CALL statement. This has the form:

```
CALL address [,parameters]
```

where *address* is the location of the machine code to call and *parameters* is an optional list of variables whose addresses are passed to the routine.

In addition to the parameters, you can pass values in the A, X and Y registers by loading the A%, X% and Y% variables first.

This is useful for calling MOS routines like OSWORD and OSFILE.

We're more interested in passing parameters in variables here, so we'll concentrate on this method.

Basic sets up a parameter block in page &6 (&600 onwards) corresponding to the parameters in the CALL statement. The format of this block is:

```
&600 Parameter count (0-84)
&601 LSB of address of first
parameter
&602 MSB of address of first
parameter
&603 Type of first parameter
&604 and so on for "count"
parameters
```

There are five values for the variable type byte:

```
&00 — An eight-bit integer (eg ?&70)
&04 — A 32-bit integer (eg A% or !&70)
&05 — A 40-bit real number (eg A)
&80 — An indirection string (eg
S&1456)
&81 — A string variable (eg AS)
```

The exact meaning of the address

depends on the type. The interpretation for each type is as follows:

```
&00 — The address of the byte
&04 — The address of the LSB of the
integer
&05 — The address of the exponent (ie
first byte) of the real
&80 — The address of the first byte of
the string (&0D marks the end)
&81 — The address of the first byte of
the string information block
```

A string information block (SIB) is a four-byte value giving the start address of the string, the length allocated and the current length. We'll be using SIBs a bit later.

This is rather a lot to digest, so I'll give a few examples of CALL statements and the parameter blocks that would be set up for them.

Note that in the cases of all variables except A%-Z% and @%, the address given is just typical, that is it depends on the size of the program, the value of PAGE and so on.

**Example 1:** CALL code

```
&600 — 0 No parameters
```

**Example 2:** CALL myCode,@%,?&70,!ptr

```
&600 — 3 Three parameters
&601 — &00 } &0400 — Address of
&602 — &04 } @% variable
&603 — &04 } Type of @%
&604 — &70 } &0070 — address of
&605 — &00 } ?&70
&606 — &00 Type of ?&70
&607 — &24 } &4324 — Value of ptr,
&608 — &43 } therefore address of !ptr
&609 — &04 Type of !ptr
```

**Example 3:** CALL swap,string1\$,string2\$

```
&600 — 2 Two parameters
&601 — &32 } &2032 — Address of
&602 — &20 } string1$'s SIB
```

```
&603 — &81 Type of string1$
&604 — &73 } &2173 — Address of
&605 — &21 } string2$'s SIB
&606 — &81 Type of string2$
```

Notice that you can't have parameters which are constant values, for example for something like:

```
CALL addr,123,"hello"
```

You would have to use:

```
a% = 123
a$ = "hello"
CALL addr,a%,a$
```

However, there is a way of passing integer constants between 0 and &FFFF.

Instead of saying:

```
CALL addr,1234
```

use:

```
CALL addr,?1234
```

The value 1234 is then passed as the address of the first and only parameter, but there is no reason why the machine code at *addr* could treat it as a value instead of an address.

Enough of the theory — what about some practice? Program I takes a string parameter and converts it into upper case or lower case.

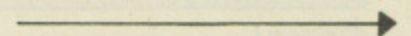
If the value of A on entry is positive, then letters are converted into upper case — if it's negative (&80 or above) then letters are converted to lower case.

Only a\$-type strings are dealt with, not \$a-type ones.

At the end of the program are two Basic functions which provide a more useable interface to the machine code.

The program checks that there is only one parameter and that it is a string variable.

If you are writing machine code





10 REM Program to convert the case of strings	440 lda (strPtr),Y	Get n
20 REM Pete Johnson 1985	450 bit convertType	Get t
30 DIM code 110	460 bmi toLowerCase	
40 parBlk=&600	470 .toUpperCase	
50 sibPtr=&70	480 cmp #ASC"a"	Check
60 strPtr=&72	490 bcc convertLoop	No, n
70 FOR pass=0 TO 2 STEP 2	500 cmp #ASC"z"+1	
80 P%=code	510 bcs convertLoop	
90 [ opt pass	520 and #&DF	Make
100 .convert	530 sta (strPtr),Y	
110 sta convertType	540 bcc convertLoop	Always
120 lda parBlk	550 .toLowerCase	
number of parameters	560 cmp #ASC"A"	Check
130 cmp #1	570 bcc convertLoop	No, n
140 beq oneParam	580 cmp #ASC"Z"+1	
error	590 bcs convertLoop	
150 .badParms	600 ora #&20	Make
160 brk	610 sta (strPtr),Y	
170 opt FNequb(50)	620 bcc convertLoop	Always
180 opt FNequs("Bad parameters")	630 .done	
190 brk	640 rts	Go ho
200 .oneParam	650 .convertType	
210 lda parBlk+3	660 opt FNequb(0)	
the type	670 ]	
220 cmp #&81	680 NEXT	
230 bne badParms	690 END	
240 lda parBlk+1	700 DEF FNtoLower(a\$)	
string info address	710 LOCAL AX	
250 sta sibPtr	720 AX=&FF	
260 lda parBlk+2	730 CALL convert,a\$	
270 sta sibPtr+1	740 =a\$	
280 ldy #0	750 DEF FNtoUpper(a\$)	
290 lda (sibPtr),Y	760 LOCAL AX	
string address	770 AX=&00	
300 sta strPtr	780 CALL convert,a\$	
310 iny	790 =a\$	
320 lda (sibPtr),Y	800 DEF FNequb(byte)	
330 sta strPtr+1	810 ?P%=byte	
340 iny	820 P%=P%+1	
bytes allocated	830 =pass	
350 iny	840 DEF FNequs(string\$)	
360 lda (sibPtr),Y	850 \$P%=string\$	
length	860 P%=P%+LEN(string\$)	
370 tax	870 =pass	
as counter		
380 inx		
increment it to make test easier		
390 ldy #&FF		
pointer into string		
400 .convertLoop		
410 dex		
byte?		
420 beq done		
430 iny		

Program I

### From Page 73

solely for use by your own Basic programs, checking like this can be removed once the program is debugged.

If you are planning to write the routine for other people's use, then it's wise to keep such code in the program.

You can see the action of the routine by typing in things like:

```
PRINT FNtoUpper("Goodbye Cruel
World")
PRINT FNtoLower("I'm Leaving You
Today")
PRINT FNtoUpper(FNtoLower("Goodbye,
Goodbye, Goodbye"))
```

As a last example of using parameter block variables, I present Program II, which swaps any two variables of the same type except for indirection strings.

Two strings are swapped by swapping their information blocks (SIBs): the characters of the strings don't have to be touched.

This makes a call such as:

```
CALL swap,a$,b$
```

always much faster than the equivalent:

```
t$=a$:a$=b$:b$=t$
```

The longer the strings, the bigger the difference.

There is some fairly tricky code to convert the type of the variable into a count for the swap loop (lines 250-290). It is smaller and quicker than using a table of type, count pairs though.

The two programs given so far use only "legal" code. This means that the programs will work with all versions of Basic without alteration.

This disadvantage is that you are limited in what you can do with the variables passed as parameters.

In particular, when a machine code routine is passed a floating point variable, there isn't much that it can do about it, as dealing with real numbers takes so much effort.

A solution is to call Basic routines internally.

This makes programs less portable, in that they will only work on the version of Basic for which they were assembled.

On the other hand, it does make it a lot easier to process floating point numbers (as we saw last month with input and output).

Before a variable can be used, it has to be loaded into one of Basic's



```

10 REM Program to swap two variables
20 REM Pete Johnson 1985
30 DIM code 90
40 parBlk=&600
50 varPtr1=&70
60 varPtr2=&72
70 FOR pass=0 TO 2 STEP 2
80 P%=code
90 [ opt pass
100 .swap
110 lda parBlk      Check for type
120 cmp #2
130 beq okParams
140 .badParams
150 brk
160 opt FNequb(0)
170 opt FNequs("Bad SWAP parameter")
180 opt FNequb(0)
190 .okParams
200 lda parBlk+3    Get type of
first parameter
210 cmp parBlk+6    Check they're
the same type
220 bne badParams
230 cmp #&80        Check it's
not an indirection string
240 beq badParams
250 tay
260 beq gotLen      Type 0 need
s count of 0
270 dey             Types 4 and
5 need 3 and 4 resp.
280 bpl gotLen
290 ldy #3          Type &81 ne
eds 3
300 .gotLen
310 lda parBlk+1    Get pointer
s to variables
320 sta varPtr1
330 lda parBlk+2
340 sta varPtr1+1
350 lda parBlk+4
360 sta varPtr2
370 lda parBlk+5
380 sta varPtr2+1
390 .swapLoop
400 lda (varPtr1),Y Get var1 by
te
410 tax             Save it
420 lda (varPtr2),Y Get var2 by
te
430 sta (varPtr1),Y Save it in
var2
440 txa             Get var1 by
te back
450 sta (varPtr2),Y Save it in
var2
460 dey             Next byte
470 bpl swapLoop   More to go.
..
480 rts             Go home
490 ]
500 NEXT
510 END
520 DEF FNequb(byte)
530 ?P%=byte
540 P%=P%+1
550 =pass
560 DEF FNequs(string$)
570 $P%=string$
580 P%=P%+LEN(string$)
590 =pass

```

**Program II**

equivalent:  
accumulators.

There are three of these: the integer accumulator (iac) at addresses &2A-&2D, the floating point accumulator (fpa1) at &2E-&35, and the string accumulator which occupies all of page &0600. The length of the string is held in location &36.

There is another floating point accumulator (fpa2) at &3B-&42, but fpa1 is used most frequently.

The first thing we need to do is load a value from a variable into the appropriate accumulator. This is achieved by calling &B32C (&B35B). (As in the previous article, Basic II addresses are given first with the equivalent Basic I address in brackets.)

On entry, a variable information block must be set up in the iac.

We've already met a variable information block - it's exactly what Basic sets up in the CALL parameter block for us, an address and a type byte.

Here's an example. Suppose the statement:

CALL routine,A

is executed. Basic will set up this parameter block:

```

&600 1      One parameter
&601 &DF    LSB of address
&602 &1D    MSB of address
&603 &05    Type byte

```

To load the variable into fpa1:

```

ldx #2          Copy three bytes
.loop lda parBlk+1,X from the
parameter block
sta iac,X       to the iac
dex             Next byte
bpl loop
jsr &B32C       Load the var in
fpa1

```

On exit, the flags indicate the type of variable loaded (even though in this case we already know), as explained last month.

The fpa1 is an expanded version of the format used to store floating point variables. It occupies eight bytes instead of five - this enables arithmetic routines to be performed more efficiently and accurately. The format of the fpa is:

```

&2E Sign byte (&00=>positive, -
&80=>negative)
&2F Exponent high byte (overflow if
this is non-zero)
&30 Exponent low byte (in
excess-128 format)
&31 Mantissa MSB
&32 Mantissa second MSB
&33 Mantissa third MSB
&34 Mantissa LSB
&35 Guard byte

```

"excess-128" means that if the mantissa is to be raised by two to the

power n, then the exponent actually contains 128+n.

There is a notional binary point just to the left of the most significant bit of the MSB of the mantissa.

The guard byte is used to maintain accuracy in complex calculations, such as SIN, EXP and so on.

Now that we've got the variable in the fpa1, what can we do with it? There are all sorts of useful routines in the Basic ROM, mostly located between addresses &A000 and &AB00.

Table I lists some of the functions which may be applied to fpa1 (and in some cases, fpa2):

Most of the operations are self-explanatory.

The NORM function normalises the fpa1 after an operation on it (such as LN). The routine should always be called before storing the value back in a variable.

FLOAT converts the integer in iac into a floating point number and stores it in fpa1.

The "flags" call tests the value in fpa1. The N flag is set if it is negative and Z is set if it is zero.

Notice there is no straightforward way of doing ACS. This is because Basic uses ASN to perform it.

However, you can achieve



## From Page 75

fpal=ACS(fpal) in the way shown below. Similarly, LOG takes a bit of effort:

	Basic I	Basic II
.asn	jsr &A8CF	jsr &A8DD
	jmp &A8C9	jmp &A8D7
.log	jsr &A807	jsr &A801
	jmp &A8D0	jmp &A8AB

In addition to the routines shown above, there are some useful floating point constants in the ROM which may be loaded by putting the address in &4B-&4C and calling &A3B5 (&A3A6 in Basic I). The constants are:

	Basic I	Basic II
PI/2	&AA77	&AA63
PI/180	&AA7C	&AA68
180/PI	&AA81	&AA6D
e (EXP(1))	&A807	&AAE4
LOG(e)	&A856	&A869
LN(2)	&A85B	&A86E

After using the routines to perform arithmetic, you will want to assign the result to a variable. This is done in the following way.

Set up the information block for the variable at addresses &37-&39. Thus &37-&38 contain the address of the variable and &38 contains its type (&04 or &05).

Then set the type of the number you want to assign in location &27. This should be &80 if the number is in fpal or &40 if it is in iac.

Finally call &B4B7 (&B4E6).

This automatically converts between types, so you can save a value in fpal into an integer variable.

To assign a string in the string buffer (at &600, length in &36), the variable information block must be set up in the iac (&2A-&2C). The type byte must be either &81 or &80.

Then call the routine at address &8C21 (&8BD3).

This also takes care of allocating a new block of memory if the variables' allocated space isn't big enough for the new string.

To give a concrete example of using some of the routines. Program III, if called with the statement:

```
CALL fpEq,a,b
```

will perform the equivalent of  $a=10*\text{SIN}(\text{RAD}(b))$ .

The program tests itself with  $b=45$ .

Function	Basic I	Basic II	fpal=1	&A6A4	&A699
fpal=fpal*10	&A1E5	&A1F4	fpal=1/fpal	&A6B0	&A6A5
fpal=fpal/10	&A23E	&A24D	fpal=SQR(fpal)	&A7B7	&A7B7
fpal=-fpal	&ADA0	&AD7E	fpal=LN(fpal)	&A807	&A801
fpal=NORM(fpal)	&A2F4	&A303	fpal=EXP(fpal)	&AAB7	&AA94
fpal=fpa2	&A4E4	&A4DC	fpal=ASN(fpal)	&A8CF	&A8DD
fpa2=fpal	&A20F	&A21E	fpal=ATN(fpal)	&A90A	&A90A
fpal=fpal+fpa2	&A513	&A50B	fpal=COS(fpal)	&A98C	&A990
fpal=fpal*fpa2	&A61E	&A613	fpal=SIN(fpal)	&A997	&A99B
fpal=fpal/fpa2	&A6FC	&A6F1	fpal=TAN(fpal)	&A6CC	&A6C1
iac=INT(fpal)	&A3F2	&A3E4	fpal=RAD(fpal)	&ABD9	&ABB4
fpal=FLDAT(iac)	&A2AF	&A2BE	fpal=DEG(fpal)	&ABEA	&ABC5
fpal=0	&A691	&A686	fpal=PI	&ABF0	&ABC8
fpa2=0	&A463	&A543	fpal=RND(1)	-----	&AF69
			flags=fpal-0	&A1CB	&A1DA

Table I

10 REM Example of using FP routines in BASIC	220 sta assignType
20 REM BASIC II addresses used in this program	230 jmp assignNum
30 REM Pete Johnson 1985	240 .pbToZp
40 PROCinitAddr	250 lda parBlk,X
50 DIM code 100	260 sta 0,Y
60 FOR pass=0 TO 2 STEP 2	270 lda parBlk+1,X
70 PX=code	280 sta 1,Y
80 [ opt pass	290 lda parBlk+2,X
90 .fpEg	300 sta 2,Y
100 idx #4	310 rts
1k+4 - parBlk+4 into iac	320 ]
110 ldy #iac	330 NEXT
120 jsr pbToZp	340 a=0 : b=45
130 jsr loadVar	350 CALL fpEg,a,b
140 jsr rad	360 PRINTa" (should be ";10*SINRADb")"
(fpal)	370 END
150 jsr sin	380 DEF PROCinitAddr
(fpal)	390 iac =&2A
160 jsr times10	400 assignType =&27
fpal	410 info =&37
170 jsr normalise	420 parBlk =&600
180 jsr normalise	430 loadVar =&B32C
180 ldx #1	440 rad =&ABB4
1k+1 - parBlk+3 into info	450 normalise =&A303
190 ldy #info	460 sin =&A99B
200 jsr pbToZp	470 times10 =&A1F4
210 lda #&80	480 assignNum =&B4B7
in fpa so -ve type	490 ENDPROC

Program III

The results printed should be identical. They are if @% gives printing to nine places as usual.

If however you set @% to 10, you will see that the results are different in the tenth place.

This is because the multiplication by ten that *times10* does is slightly different (presumably more accurate) from putting 10 in fpa2 and calling the routine to multiply fpal by fpa2. It

doesn't make any practical difference.

Finally, I present Program IV to perform the assignment  $a=\text{sinh}(b)$ , where

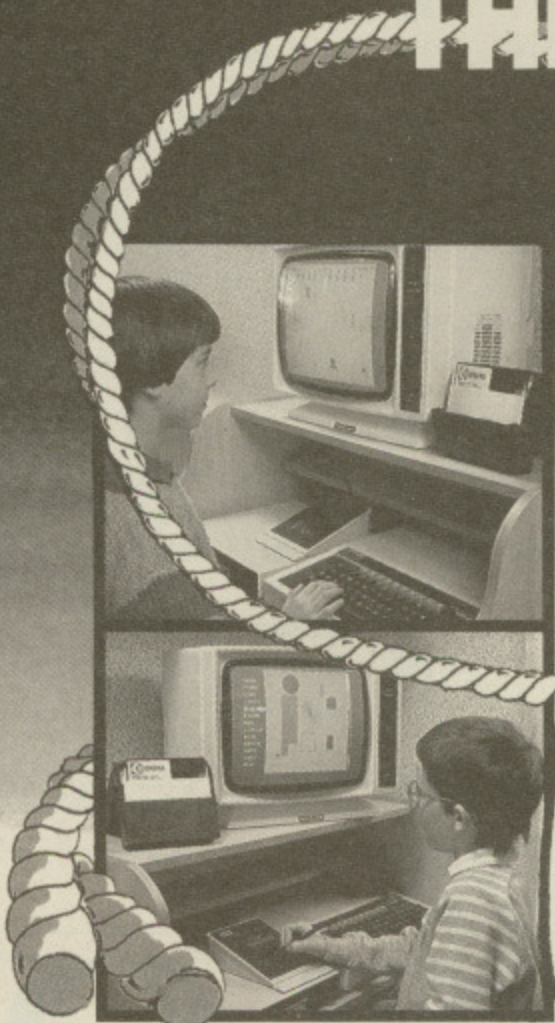
$$\text{sinh}(x)=(\text{EXP}(x)-\text{EXP}(-x))/2$$

The program uses some routines which haven't been mentioned before - those which deal with the floating point variable pointer at &4B.

For example subVar subtracts from



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## From Page 76

fpal the value in the (packed format) variable at locations pointed to by &4B-&4C.

There are several useful functions which operate on the value at the variable pointer.

● Next month I'll look at these, as well as some of the operations which can be performed on integers and strings.

```

10 REM Example of using FP routines
    in BASIC
20 REM BASIC II addresses used in
    this program
30 REM Pete Johnson 1985
40 PROCinitAddr
50 DIM code 100
60 FOR pass=0 TO 2 STEP 2
70 PX=code
80 [ opt pass
90 .sinh
100 jsr getArg          Load arg
    ument into fpal
110 jsr negFpal        Get -b
120 jsr exp            EXP(-b)
130 jsr pushFpal      Save res
    ult for later
140 jsr getArg          Get the
  
```

Program IV

```

argument back again
150 jsr exp            EXP(b)
160 jsr pullVar       Get EXP(
-b) back into (varPtr)
170 jsr subVar        Subtract
    them
180 dec fpal+2        Divide b
y two (pretty quick!)
190 jsr normalise     Normalis
e fpa after operations
200 lda parBlk+1      Copy des
tination var info into
210 sta info          the assi
gnment info block
220 lda parBlk+2
230 sta info+1
240 lda parBlk+3
250 sta info+2
260 lda #&00         Data is
in fpal so -ve type
270 sta assignType
280 jmp assignNum     Make the
assignment and return
290 .getArg
300 lda parBlk+4      Get argu
ment into fpal
310 sta varPtr       First pu
t its address into varPtr
320 lda parBlk+5
330 sta varPtr+1
340 jmp fpalEqVar    Load it
and return
350 ]
360 NEXT
370 a=0 : b=1
380 CALL sinh,a,b
390 PRINTa" (should be "(EXPb-(EXP
-b))/2")"
400 END
410 DEF PROCinitAddr
420 iac =&2A
430 fpal =&2E
440 assignType =&27
450 info =&37
460 varPtr =&4B
470 parBlk =&600
480 exp =&AA94
490 pushFpal =&BD51
500 negFpal =&AD7E
510 pullVar =&BD7E
520 subVar =&A4D0
530 loadVar =&B32C
540 normalise =&A303
550 assignNum =&B4B7
560 fpalEqVar =&A3B5
570 ENDPROC
  
```

# BOBBY CHARLTON SOCCER

Available now for the BBC Model/B.

'Play Bobby Charlton Soccer in your own home. Build and manage a Championship side, see them match their skills and fitness with opposing teams to create the kind of exciting games I played in for Manchester United and England.'

'With the realism of this DACC Soccer Game your team win or lose by the way you instruct them to play. You will be shown a bird's eye view of your half of the pitch. Select and vary the skills of each of your players and then move them individually to whatever position in the field you know will create the best team formation.'

'Each player is shown with three digits below him relating to skill, accuracy and stamina in the range 1-5. To start off with each man has 3-3-3, giving him a total of 9. So the total for your team is 11x9..99. This total of 99 cannot be exceeded, but the object is for you, the manager, to formulate your winning team using the best possible combinations of positions and skills.'

'Of course, as a professional footballer, injuries sustained by myself and team-mates often had a great influence on the outcome of the game. So, to create even more realism, you may add optional 'injuries' to the game, which are allocated randomly to each team by computer...hold your breath as your star forward swivels to shoot or goes in for a hard tackle!'

'Once your team is formulated, you are ready to move on from the Management Module to Module II—Match Play.'

'With realistic 3D view of the pitch from the 'TV Camera' position the game really comes to life. From the kick off every moment of the match unfolds realistically, with throw-ins, goal kicks, corner kicks, passing and shooting.'

'The game can be played by 2 people, 1 person v the computer or computer v computer. If the game is player controlled your joystick will control one man at once. Pressing the fire button enables

you to change player...or, if the opposition are attacking your goal, to the goalkeeper.'

'If a player is in possession of the ball the fire button initiates a pass or a shot. Control the accuracy and strength of the pass or shot by the extent of joystick movement and the height of the kick by the length of time that the fire button is depressed... from a Bobby Charlton cannonball shot, to a carefully flighted Bryan Robson through-ball! Although you have set the skill, accuracy and stamina levels of your players during the *Manager Module*, the more a player is involved in the game, the more energy he uses...his stamina level falls and he runs more slowly! Then, when the player is not under joystick control, his stamina slowly builds up again.'

'If the game is under computer control, one or both teams are played entirely by computer. Under joystick control the player controls one man at a time, whilst the computer provides intelligent action for the other 10.'

'The skill level you have chosen affects the success of tackles, the accuracy level and the direction of the ball when kicked...what could be more realistic than the Bobby Charlton Soccer Game from DACC?'

The Cassette contains a voice introduction and play hints by Bobby Charlton and the *Bobby Charlton Soccer Game* package contains details on the *Bobby Charlton Computer Soccer Club*, with mail order products, services and special offers for members.

BBC Model/B package with *Manager* and *Match Play* Modules **£11.95** inc. VAT (also including p&p for direct orders).

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PAYROLL calculations are a considerable headache for small businesses.

Not only may normal pay and overtime have to be worked out, but there are also tax and National Insurance contributions to contend with.

These calculations are not usually very difficult, but they are repetitive and time-consuming. Also, employees do not like mistakes in their pay, and some care is needed if these are to be avoided.

Micro-Aid's **Payroll** could, I think, be of considerable help to many small businesses.

It will cater for up to 100 employees and with all tax codes (up to a maximum of 480).

As regards National Insur-

## Take the pain out of payrolls

ance, the program deals with non-contracted-out employees only.

There are separate versions for weekly and monthly earners and for disc and cassette users.

I found Payroll easy to use and the manual comprehensive.

It included a partial program listing showing the variables which are used to hold the

Inland Revenue and national insurance data.

The user is free to alter these when required (for example after the Budget) or Micro-Aid offers an update contract.

To calculate the pay of, say an hourly-paid employee, the user would be presented with a number of options such as enter normal hours, overtime hours, bonus pay and so on. The

program will work out all the figures needed and will print a wage-slip.

The use of a printer is, in fact, optional and the calculated figures could be copied manually from the screen.

As cassette versions of the programs are available, the system can therefore be very economical in hardware terms.

At the end of the run, period and cumulative-to-date summaries can be printed out for each employee and company-wide.

There is an enormous variety of payroll calculations and I checked only a few situations. I found all of these to be calculated correctly.

Ken Garrett

## Legal way to try hacking

**THE HACKER** is a new release from Firebird Software and, in line with Firebird's radical marketing approach, is available at the crackdown price of £2.50.

Reading through the concise instructions, we appear to be in control of a little sprite called The Hacker whose job is to hack his way into the computer games library.

To enter the system he must overcome the protection on the terminals, modems, buffers and CPUs in his path before reaching the games store.

Needless to say, this epic pirating operation isn't as easy as it sounds.

Each device in his path takes the form of a Manic Miner-type screen packed with platforms, walkways, conveyor belts and various computer components oscillating to and fro.

Each stage also has several floppy discs in it which must be collected before The Hacker can go through the exit and finish that stage.

The first stage deserves special mention since the ladder to reach the top is cunningly concealed. After hurling myself



on to most stationary objects I discovered that the flashing title at the edge of the screen could be used for such an operation - very subtle!

There are twelve screens of varied arrangement and each introduces new computer components to be avoided.

These include resistors, sparks, silicon chips and system clocks.

The graphics are highly detailed and well animated.

Another nice touch is the wonderful tune that plays during loading, though if tunes aren't your scene it can be cancelled.

The sound effects during play are well thought out, as are the straightforward keyboard controls.

Though clearly in the Manic Miner vein, it's a challenging version of the old favourite and at the price you needn't bother breaking into the computer games library for a copy of it.

David Slater

## Orchids add to the jungle perils

FOLLOWING a fall of unknown distance through steep ravines and unknown hollows, Sabre Man finds himself trapped in a mystical jungle.

A message etched deep in the rock reveals to him that his only chance of escape lies in finding the four quarters of the sacred amulet.

Without this treasure none shall escape the perils of the jungle.

Sabre Man is so named because he is a master swordsman. If he wasn't he soon would be after one or two games of **Sabre Wulf** from Ultimate.

Armed only with his trusty sabre, he must scour every inch of this maze-like jungle in search of the four corners of the amulet.

Being in a jungle, you will encounter the odd animal or two - well, actually the whole place is teeming with wildlife, and most of it is out to get you.

Pressing the Shift key causes Sabre man to leap into action, drawing his sword and fencing with great skill in the direction in which you last travelled.

Most of the animals can be despatched with one blow of your mighty sword.

Rhinos and natives, however, are only frightened and run in the opposite direction. While on

the subject of fighting, I found that the best tactics were to hold down the Shift key all the time.

This way, Sabre man tears through the undergrowth slashing at everything that moves. It may not be subtle but it is effective.

The animals are not the only factor in the game - the jungle contains many wild orchids. The colour of the orchid determines its effect upon our hero should he pass over it.

Orchids can cause Sabre man to become ill, or cure him. They can produce changes in the speed at which he travels, and they can even reverse the direction of movement produced by the keyboard controls.

My only major gripe about the game is the choice of controls. Cursor keys for left and right, A and Z for up and down, and either Shift key to fight.

There is no joystick option and no facility for the user to select his own keys.

Overcoming the poor choice of control keys is the player's main problem when beginning the game.

Had Ultimate paid just a little





## From Page 79

more attention to the control, the game would have lived up to their name.

As it stands, it is still very good, but it takes that little bit longer to master.

Jon Revis

## Fun trip on a runaway tortoise

IF your idea of fun consists of tearing through the prehistoric wilderness standing on the back of a runaway tortoise, then read on.

**Caveman Capers** is a new game from Icon Software which is based on this rather unusual theme.

Press the Spacebar to start the game and the background begins to scroll from right to left.

Balancing precariously on the back of a turbo-charged tortoise, you must leap over the potholes as you career towards almost-certain disaster.

Some well-timed stabs at the Return key are sufficient to get you past these first obstacles.

Having been broken in gently, you will now be buzzed by pterodactyls while still jumping craters.

With the use of the Z and X keys to move our caveman hero short distances to the left and right, you can avoid nutting the birds.

Section three seems quite easy as there are no craters to jump — just a series of purple snakes hanging down from the treetops.

The problem with the snakes is that they are constantly bobbing up and down.

Should they be in the down position as you pass below, then it's PROheadache for our hero and shellshock for his transport.

The next two levels are very similar.

The first involves using

extended jumps to clear some toadstools and in the second you're jumping logs.

The next stage is the one that is giving me great difficulties at the moment. I'm having trouble with crabs.

One minute they are lying nice and quiet on the ground, the next thing you know they're doing flipping star jumps at about waist height.

Icon has really gone to town on the graphics with this game as every character is drawn on a grand scale and in the brightest of colours.

One character who has not yet played a part in the game is a rather large dinosaur who keeps poking his head on to the screen and grinning mischievously. I'm sure he's up to no good.

**Caveman Capers** is an excellent game. It has got fast action, simple controls, and is just brimming with humour.

James Riddell

## Stocks under control

**STOCK Control and Invoicing, Sales and Purchase Ledgers** from Systematics International, offer easy-to-use disc-based business programs.

All printouts produced were

well-designed and the systems were well-documented.

I will deal first with the stock and invoicing system.

Each stock record consists of an item code, description, cost price, a normal and alternative selling price, stock quantity, re-order level and supplier code.

Unlike many stock systems, the user can assign his own item codes to the stock (up to 10 alphanumeric digits) rather than have to number the items consecutively.

The system records receipts, issues and stock adjustments and will print full stock listings, value listings and a reorder report.

The stock system is integrated with the invoicing system so that quantities invoiced for are subtracted from the relevant stock balance and the selling prices and descriptions can be picked up from the stock file for inclusion in the invoice.

The invoicing system is not integrated with the sales ledger system so that customers' names and addresses have to be typed in full each time.

In addition to the invoice header and footer, up to 16 lines can be included in each invoice. This could be 16 different items being sold or eight different items, each taking up two lines of description and so on.

Even if the system is being run in conjunction with the stock system, "free" format can be entered at any time to allow the user to insert tailor-made invoice lines.

This might be useful if, for

example, special delivery charges were needed.

Discounts and up to 10 different rates of VAT can be handled and invoices can be easily amended at any time.

The sales and purchase ledger systems each deal with up to 400 accounts and 750 transactions.

The ledgers work on the balance forward system in that full details are kept of the current period transactions but only totals are kept of the transactions from each of the previous periods.

Posting of invoices, credit notes, receipts (or payments as appropriate) and adjustments can be made.

There is no facility to explicitly match up postings to one another in an account.

Invoices are entered into the current period and all other postings are entered against the oldest outstanding balance.

I think that this may not be satisfactory for many users as it easily leads to confusion as to what has actually been paid.

Even staying with a balance forward system, I can see no reason why this cannot be improved by allowing the user to specify against which period amounts are to be set.

Ledger cards, aged analyses, daybooks, VAT analyses, control reports and statements or remittance summaries and remittance advices are all available for printing.

A competent package in a very competitive market, but not particularly outstanding.

Ken Garrett

## Mugged by a micro!

computer will do it for you.

Play pauses every time a score is made and waits for you to press the Spacebar before proceeding.

This is useful, as I found the screen cluttered and graphically disappointing, but it does allow you to see what's going on.

I very much liked the way the scores were shown broken down into groups of fifteens, pairs, runs, and so on.

It was also a great help to see my cards rearranged numerically from left to right when choosing which two to throw into the crib.

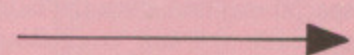
Mind you, it didn't help to see

my cards whisked away just as I realised that I had made a mistake! Perhaps it would have been better to have had to press Return at this point to enter them.

Oh, yes, and while on single-key entry, don't pause too long between entering the 1 and 0 of say 10 scored, otherwise the machine will "mug" you for nine!

There is one serious fault in the program.

The Escape key is not always disabled and, sitting beside







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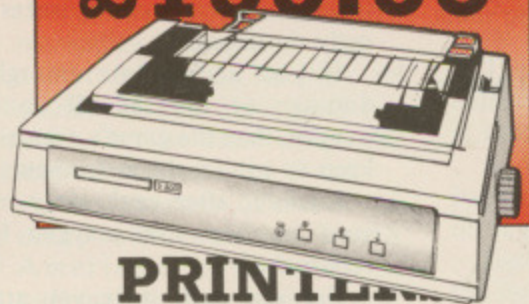
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## From Page 80

number 1 as it does, it should be.

I would also like to see the random generator "seeded" for every game and something done about the sound, which is a joke.

However, I enjoyed playing K.V. Meader's cribbage and felt that for most of the time I was sitting opposite an experienced player.

I am sure this value for money game will give hours of enjoyment and make you think at the same time.

Alan Farman

# Inside Frankie

IN *Frankenstein 2000*, a new release from Icon Software, you must guide a miniature sub-

marine through Frankenstein's body.

The screen is split into two sections showing an X-ray of Frankenstein in one half and an enlarged picture of the sub's immediate vicinity in the other.

Your mission starts by navigating down the throat past green infected-looking nasties, though if subtlety's not your forte then you can always pick them off with your laser.

If you collide with the nasties or brush against the wall of the throat, then you become increasingly damaged.

If you accumulate enough damage or breathe all your oxygen, then the game's over, so keep an eye on the instruments.

Luckily, after each stage of your journey your oxygen is replenished.

Between each stage you are required to shoot down a sphere hurtling towards you before your oxygen runs out.

The next stage is the left lung, where you must avoid cigarette-lighters and plumes of smoke.

After shooting down yet

another hurtling sphere you reach the heart, which consists of several chambers connected by opening and closing valves.

This is awkward to negotiate and is made worse by the small quantity of oxygen allowed for it.

I haven't got past this stage, but Frankie's body shows both lungs, stomach, kidneys and intestines, so I imagine that you must negotiate these as well to complete the game.

Your score increases depending on how many stages you complete.

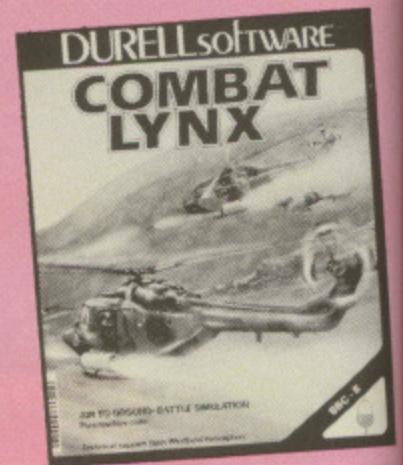
It's great fun as a game because of its easy keyboard controls and the quality of the display.

It's a shame that jerky animation lets it down.

The sound effects are also good, with a background tune playing all the time. Unfortunately, they cannot be turned off if they bother you.

All in all, it's an enjoyable game, but slightly overpriced.

Phil Tudor



## A high flyer!

TAKE an arcade-type shoot-'em-up game, combine it with a strategic wargame, and just for good measure throw in a flight simulator, and you end up with *Combat Lynx* from Durell.

The idea is that you pilot a Lynx helicopter around a battlefield trying to defend bases

# QUICK RUNS

A first look at some of the latest releases

**Market Gardener:** A strategy game in which you inherit a plot of land and in order to succeed must make decisions as to the crops to grow. Your results will depend on outside factors such as fertilisers used, the state of the ground and the weather. (West Wales Electronics)

★ ★ ★

**Speech Tables/Table Tester:** Two separate early learning programs designed for use with the Acorn speech chip. The first is intended to teach children tables from 2 to 12 using large text and numbers. The program cannot be used to its full potential without the chip. The second is also intended to teach tables but is only partly dependent on the speech chip. (Chestnut)

★ ★ ★

**French Tenses:** An educational program designed to aid the pupil to master the four basic tenses. Menu-driven, the program allows selection between Past, Present, Future and Imperfect tenses, with options to use pronouns, and reflexive verbs. (Chestnut)

★ ★ ★

**O-Level Maths:** A series of questions and demonstrations covering the O-level and CSE syllabuses (except geometry). The

computer can be used as a calculator to display your workings, after which the answer will be entered and checked. After two wrong answers have been input the program uses explanations to help you correct your technique. (Topswot)

★ ★ ★

**Microphile:** A disc-based Database with options to Add, Change, Delete, Find and Report records. Additional facilities available under the Report option will allow string-searches under the headings Contains, Begins with, Finishes with, Precedes and Succeeds, as well as numeric searches for Equals, Less than and Greater than. (Ephegy)

★ ★ ★

**Time Trucker:** An educational package aimed at 8 to 14-year-olds designed to turn telling the time into a challenging game. You drive a truck round a map and must watch the clock to establish how many deliveries of fresh produce can be made in eight hours. With three levels of difficulty and three different maps, the program uses an analogue clock for the lower level and a digital version is introduced later. (ASK)

★ ★ ★

**Sheep Dog Trial:** An educational game for two players designed to teach grid

referencing. You must send your dog in the paddock (an alphanumeric grid) in an attempt to split five sheep from a total of 10, and pen them. This requires logical thinking and strategic planning as the original positions are randomly set up allowing many games without repetition. (Jacaranda)

★ ★ ★

**Gold Dust Island:** An adventure-based educational package designed to promote cooperation and strategic planning. Stranded on a desert island, the players have water available in one place, building materials in another, and gold. The object is to escape alive with wealth. Starting with 10 days' water supply, players must make decisions on tools for either boat building or gold digging, trying to balance the desire for wealth with that of survival and escape. (Jacaranda)

★ ★ ★

**Raft-Away River:** An educational adventure for two to six players designed to encourage the skill of communication, cooperative behaviour and problem-solving in groups. The players must use their ingenuity to build a raft from available materials and survive hunger and cold. There are several levels of difficulty, and random elements mean that different



while at the same time attempting to destroy the enemy aircraft and artillery.

Your helicopter is equipped with a variety of weapons, but to obtain these you first have to land at any base. Having landed, you may arm up with a selection of weapons.

Having equipped the Lynx, it's off into combat.

While flying around the skies, you find yourself under constant attack from enemy missiles. This part of the program I found most frustrating.

There seems to be too many missiles being fired, and it is virtually a full-time job just trying to avoid them – which leaves little time to concentrate on other matters like navigation and attacking the enemy.

The program has an excellent screen display, the lower half showing various instruments and gauges to aid flying and navigation, as well as information on the current state of your weaponry.

In the top half of the screen, the helicopter can be seen flying

over the landscape. It's almost a pilot's-eye view, but seen from behind the helicopter.

The view is very colourful and realistic, with houses and trees scattered over the landscape zooming into view as you fly over them – or into them!

The level of the terrain is constantly changing, and your altitude must be carefully adjusted to avoid flying into trees.

An altitude gauge is displayed to the left of the screen, and it is necessary to keep a careful eye on this to avoid hitting the deck.

A scrolling intelligence map can also be displayed, on which the position of your bases and enemy tanks can be seen, thus giving you some idea of which direction you should be travelling.

This is an excellent game, offering far more than the run-of-the-mill shoot-'em-up game. I would have liked to see a practice mode, to allow flying without being constantly attacked. Nevertheless, highly recommended.

Geoff Turner

## Percy in peril

IT'S penguin breeding-time in the Antarctic and it's Percy Penguin's turn to find food for his clan. Hungry and cold, he must make his way to the edge of the sea ice.

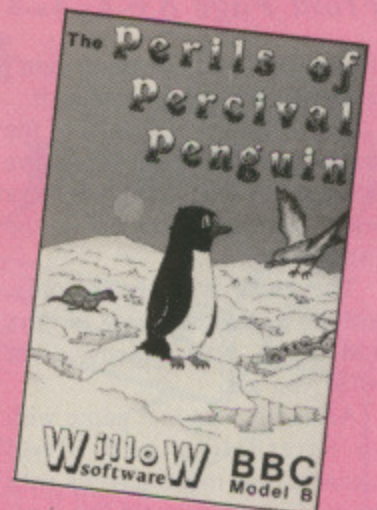
The bad news for Percy is that the place is littered with marauding blighters.

Not only does he have to avoid the crevasses and ice slides, but he must dodge the leopard seals and the skuas.

Also, courtesy of one of the many unscrupulous South American governments, radioactive waste has mutated the microscopic sea life into mega-critters.

Fortunately, there's the odd fish lying around to sustain Percy's energy...

**The Perils of Percival Penguin** has four screens which you must



waddle through until you find a route that gets you to the sea.

These are nicely set out in detailed graphics, and animation is simple but smooth.

A tune chunters in the background, but it can be turned off if things hot up.

Each screen has a time limit in the form of a setting sun. If the sun sets before you finish the screen, it's bye-bye Percy! That's provided your energy doesn't run out beforehand.

I found it difficult to control

strategies must be worked out each time the game is played. (Jacaranda)

★★★

**Super Teams:** A menu-driven suite of programs available on 80 track disc deriving and interpreting Bio-rhythms in a friendly and useful way. Compatibility studies for groups of up to 15 people can be quickly prepared for Physical, Emotional, Intellectual or Averaged Bio-rhythms and the package is aimed at genealogists, and has industrial, commercial and business applications. (Gilvale)

★★★

**Hunt The Treasure:** A set of three simple educational adventure games that involve following trail clues. They provide practice in the use of coordinates and compass bearings and allow the creation of personally tailored new games with scope for using strategy, planning, design and language skills. (Hilditch)

★★★

**How Does Your Garden Grow?** A two-program educational pack based on the principles of number, in which children are invited to plant flowers in a variety of beds. Garden 1 is aimed at children aged over

three to develop their understanding of the numbers 1 to 9, while Garden 2 reinforces this understanding by introducing numbers up to one hundred and simple arithmetic. (Hilditch)

★★★

**Chicane:** A motor car race simulation written with the experience of drivers and based on Formula Ford 2000 single seaters in the British Championship. It features six famous race tracks, and you must use your skill to qualify in practice and then race with intelligent cars as opposition. (Kempston Micro)

★★★

**Mosaic:** A design program suitable for all ages based on the creation of patterns and pictures from repeated small elements. Its applications range from being used for simple shape recognition in the reception class, to designing sophisticated repeating patterns and tessellations. (Hilditch)

★★★

**Magic Mushrooms:** An exciting levels and ladders game in which you guide Murphy around the screen leaping from brick to brick, bouncing on trampolines, sliding down slides and gliding up escalators in his quest for mushrooms. The game includes

nine different screens and the package contains a complete games constructor allowing unlimited scope for designing your own screens. (Acornsoft)

★★★

**Cars – Maths in Motion:** A simulation program for children aged nine and upwards, in which small groups compete in a series of motor races. The program augments the understanding of percentages, multiplication, division, simple geometry, scale drawing, straight-line graphs, strategy and the use of planning and logical thinking. Each group must adjust their car to suit the circuit, and devise race strategies based on measurement and calculation. (Cambridgeshire)

★★★

**Making Connections:** A suite of ten educational programs aimed at lower secondary school. Units 1-4, aimed at developing thinking skills, are offered as "common core" programs capable of being introduced by any member of staff having passing computer interest. Units 7-10 fit into the more-traditional disciplines of history, geography, science and English where pupils can use the programs to demonstrate understanding of major concepts. (Medusa)



## From Page 83

the penguin and the game didn't really inspire me to master it.

However, the standard of the graphics is high – with attractive title pages and comprehensive instructions available before the game starts.

The game is keyboard only, with an awkward layout of keys and it's a little expensive for what you get.

All in all, this is a game with an interesting and novel scenario, but more screens with fewer hazards would be welcome.

Phil Tudor

# Happy landings

JUST as you thought it was safe to go back to the keyboard, Willow Software start "The

Search for Spark" in the form of **Landing Party**.

It's a Star Trek program, but, changing with the times, we have to find Spark, the First Officer.

Poor old Spark has been caught by the Zingons and they're either hiding him on a planet or on one of their spaceships.

The USS Endeavour has been assigned to find him.

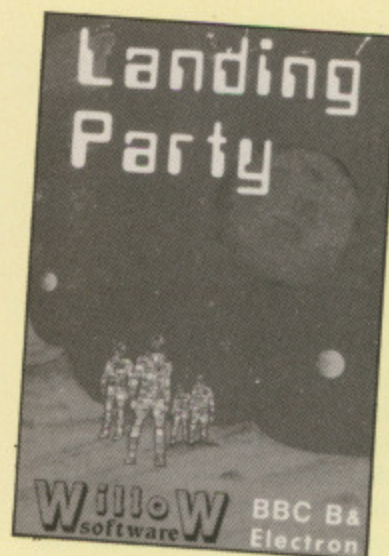
The universe is divided into 10 sectors. Each sector is a grid of 10 by 10 locations. Your forward scan shows your current sector and its neighbours.

Dotted about the universe are various planets, Zingons (Boo!), Space stations and Space HQ (Hooray!) plus the occasional asteroid and black hole.

Each planet, when visited, must be scanned by the Science Computer, an orbit achieved using Impulse engines and a landing party beamed down.

They report the nature of the planet, though often get themselves killed in the process.

The Zingons are destroyed



using either your needle lasers or Fulton torpedoes.

Lasers take quite a time to do their job and you might find yourself badly damaged before the Zingon is dead.

A more certain outcome is provided by using the Fulton torpedoes.

When fired, the torpedoes tracks left to right, lower and lower across the forward scan-

ner. When the torpedo reaches the Zingon, it should be detonated.

In docking, left and right control is available to align the spaceship, while the speed of approach is fixed.

You must continue trekking until you recover Spark.

The graphic sequences won't set the world on fire, but the game isn't claiming to be graphical.

The screen layout is, however, quite good.

All responses from the computer are printed out in a teleprinter style which is imaginative but slow.

Sound effects are limited but effective.

Frankly, this is a game for those who dislike Space Invaders and its ilk.

Reflexes don't count for much, since only docking and firing are in real-time.

However, this is a well-explained, novel variation on the Star Trek theme.

David Slater

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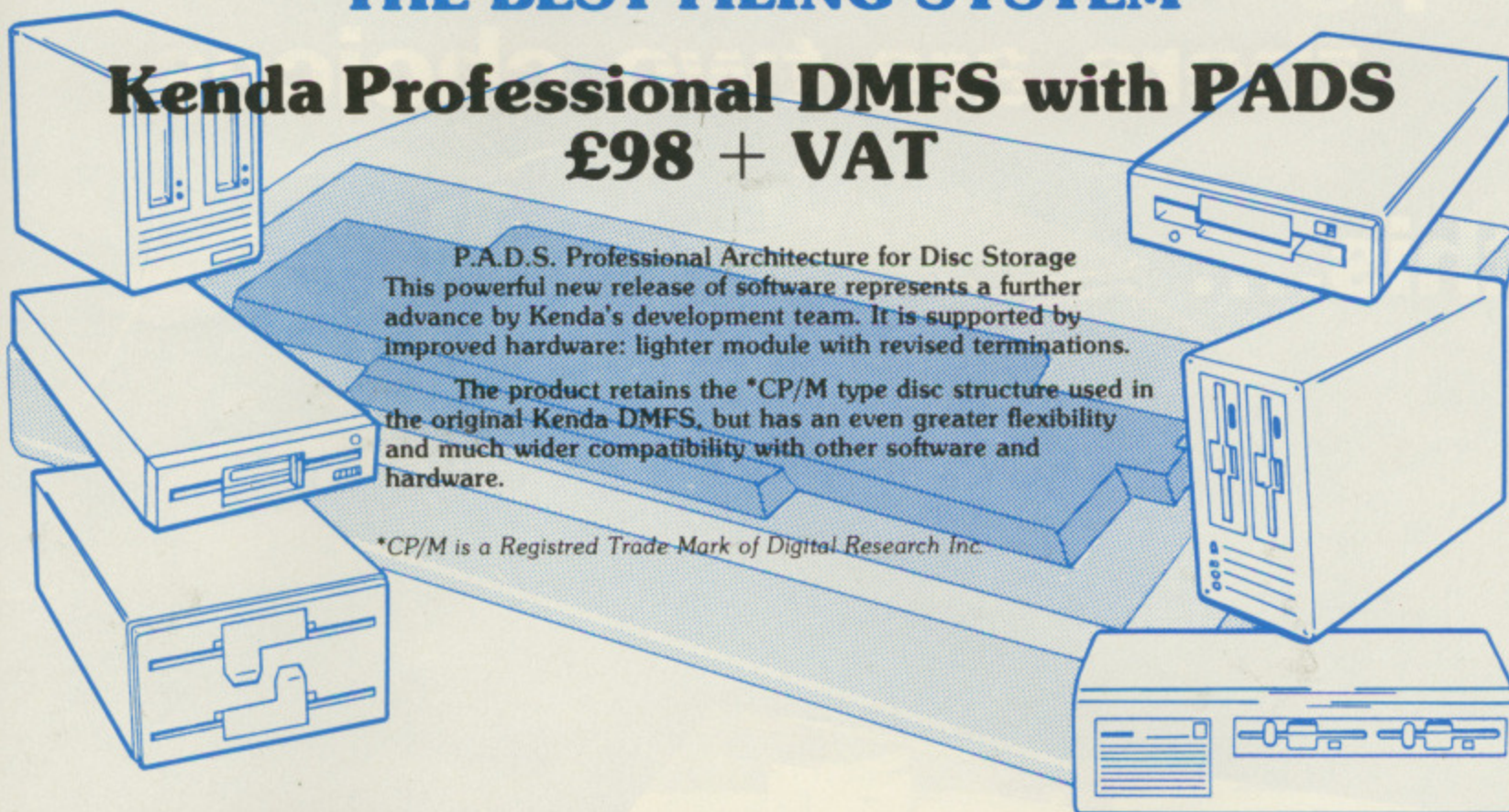
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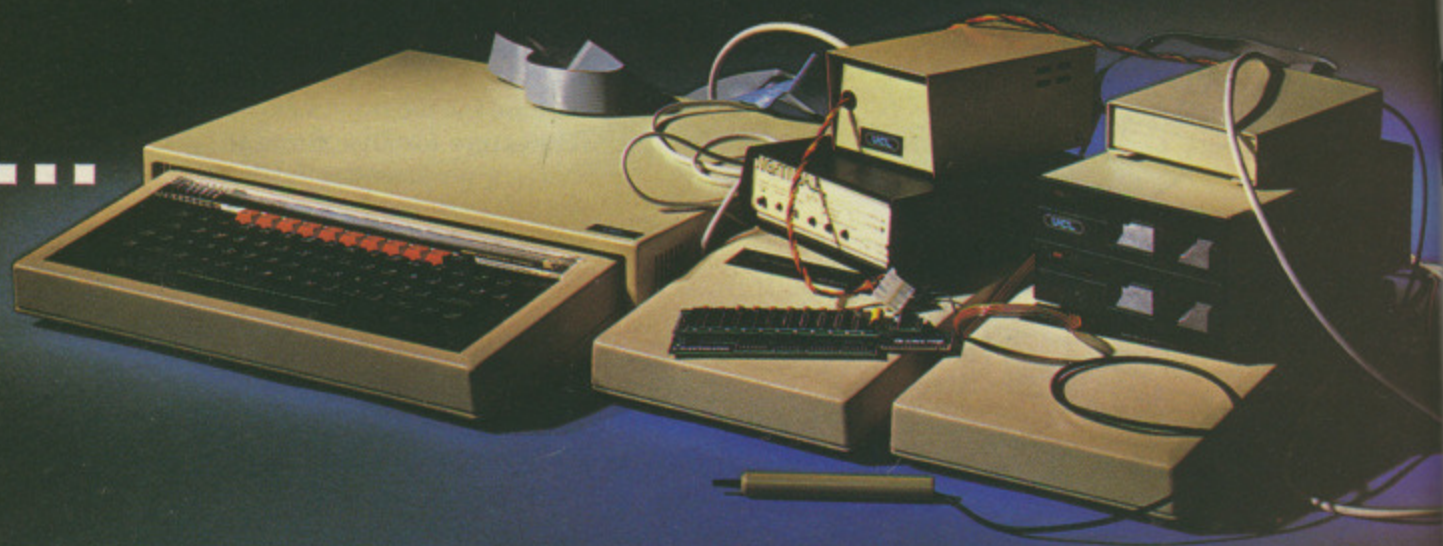
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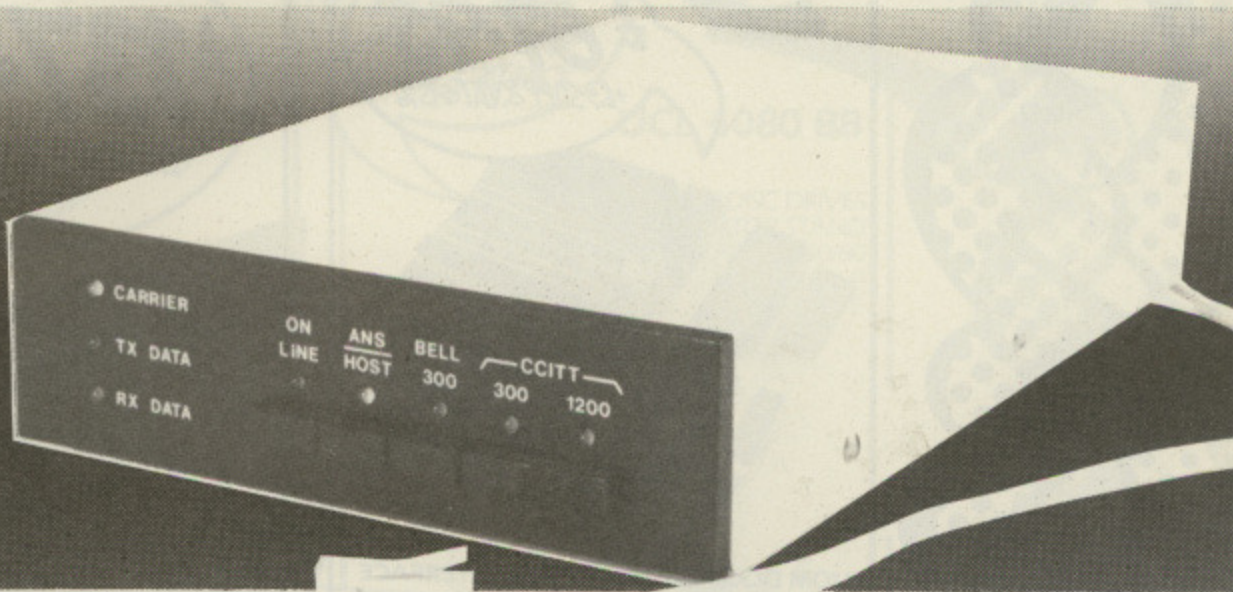


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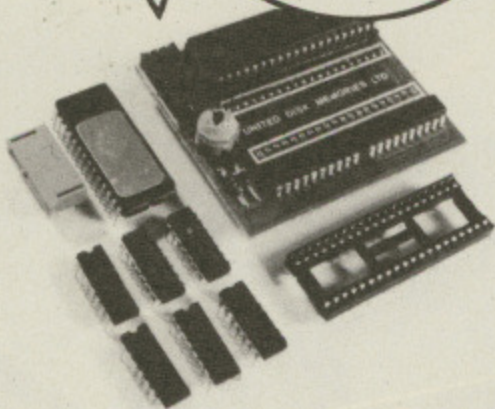




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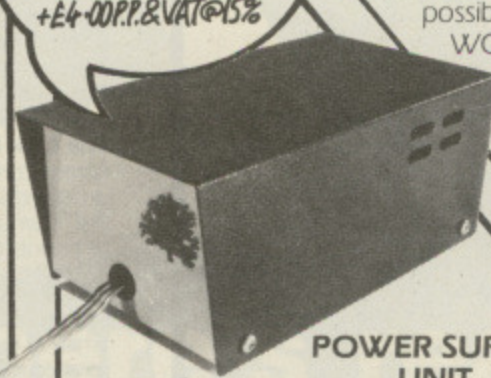
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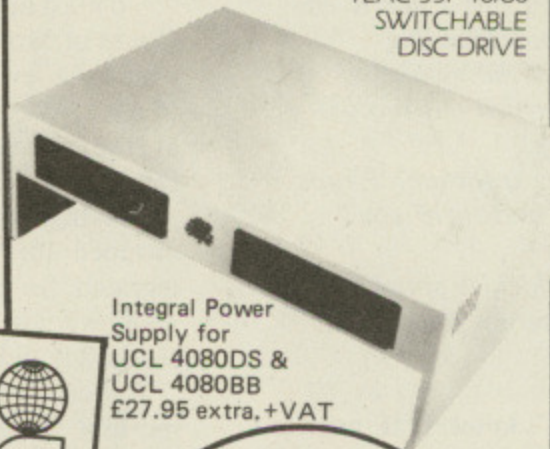
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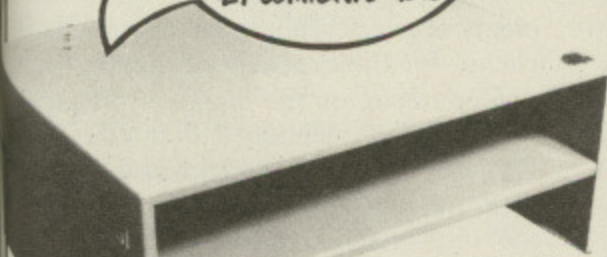
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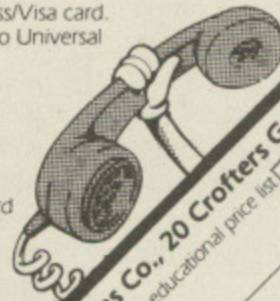


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*I have to tell you that I am (be  
under no illusion)  
A simple soul who lives in  
mathematical confusion.  
When faced with perfect  
numbers I feel absolutely lost  
while  
As for amicable ones my  
feelings verge on hostile.  
The thought of cube or prime  
has no appeal – in fact  
displeases  
So Diaphantos' name is mud  
and Eratosthenes's.  
As for that eucky Euclid he's no  
better than Pythagoras –  
To me they're just a pain in  
sadly neck or sadder a\*\*.  
Thus neither I nor J nor K can  
aid my understanding  
And I confess the monkey  
puzzle's turned out too  
demanding.  
So may I beg a favour? P'raps  
(just now and then) you  
might  
Give for us thickies simpler  
ones. Sincerely, Gabriel  
White.*

**FACT is, I don't know THE answer to half the puzzles either (although the monkeys and the coconuts was "my own invention"). Also the editor has told me to stop using smarta\*\* quotes as hints and give more full-frontal Page 3 clues.**

*Vox populi – vox dei* (the voice of the people is the voice of God) so here is a simple problem.

It is a quote from a book that has been read by millions of people – who said it and what does it mean?

*"Let me see: 4 times 5 is 12, and 4 times 6 is 13, and 4 times 7 is – Oh dear! I shall never get to 20 at that rate!"*

Actually the puzzles are partly my revenge on Adventure writers who expect me to realise that SING LULLABY or EXAMINE GRAVE is THE only answer and then complain when I "solve" such puzzles from a listing.

Others give a massive set of hints which don't tell me where to find the CORPSE that I usually expect to exhume.

The problem of how to give hints to puzzles is a fascinating one.

Adventures are rather like cross-words – after a while you get used to the "style" of the author and his ideas.

Change the author, however, and I am often stuck at the very beginning.

This happened in Island of Xaan by Robico Software. In this, you start in a

# In a quandary concerning cryptic clues

prison cell with just a dirty sackcloth and a chain.

To me it appeared to be based on The Count of Monte Cristo, so should I just wait for a few years for the Abbe Faria to ask: "Who talks of God and despair at the same time?" followed by a four-year course in psychology...?

Having waited a few minutes, I dropped the chain, which then disintegrated. So I tried to restart. "Do you really want to quit?" says it. "Yes", says I – and it did.

Robert O'Leary of Robico assures me that the game now restarts after a QUIT. He sent me a review copy on disc, plus hints, plus an Adventurer's Note Book, plus a card (so only genuine buyers can get hints), plus a translation

of the O'Leary Heraldic Arms. Other software houses take note.

The hint sheet explains how to escape from the prison. To do that, you have to attract the attention of the first guard and vice versa with the second.

Once outside, you are almost overwhelmed with agoraphobia, since you can then explore a valley, forest, plain, graveyard, mountains, caves, and a hut containing an unfriendly, starving beggar.

The object is to obtain a disguise, plus enough treasure to pay for a voyage on the ship you can see from the clifftops at the north of the island.

I think this game will appeal to those who have the time and patience to investigate and map systematically.

## Backwards march!

THE latest offering from an established company is The Seventh Star (Acornsoft). It seems obligatory for adventurers to crash-land on planets. As usual you survive and can grab some useful items (a bucket, a crowbar and a microcomputer) before popping out to visit the Persian market next door. Responses are quick for a change.

The author, David Hampton, has a similar style to Peter Killworth so there are lots of mazes, strained jokes and weird connections, an old lady and a robot called Fun Boy One but really Marvin's second cousin.

An unusual feature is that, no matter where you are, you can type \*HELP and the program gives a number to look up in a set of hints.

The number MUST be the room number, which means that all the mazes are quite easy to map without opening up the usual sealed envelope.

In fact it's quicker to solve them this way than read clues like "Try dropping

something in each room to find your way around" or "All the tunnels have different descriptions – so it's not really a maze" – how true.

I now expect to get letters complaining that this hint has ruined the game – c'est la vie.

The game is quite amusing, with plenty of puzzles, but I think it too full of cliches for the experienced player.

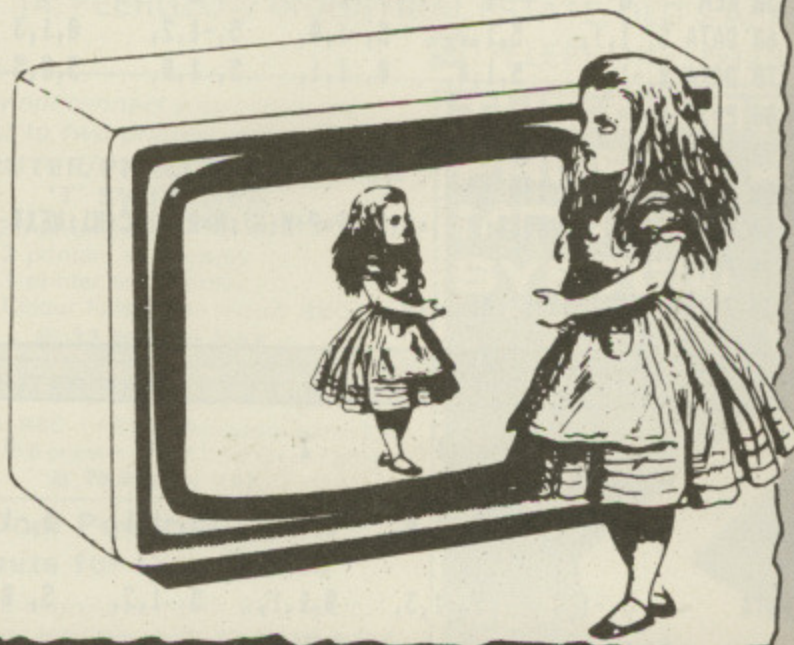
Continuing on the theme of hints, a while back I mentioned that you can play Level 9 games "backwards" from their massive hint sheets. An analysis of the cross-references can while away many an hour.

For example, Adventure Quest, the second (and sadly neglected) of their Middle Earth trilogy, requires you to chain TABLE – ORCHID – PIPES – RUBY – EYE in order to obtain the vital SWORD without losing a life.

This sequence is further complicated by having to obtain other chains of objects in order to get to where you can



## Alice through the VDU



Our monthly foray into Adventure games

swap the eye for the sword.

Such complex interweaving is a hallmark of Level 9 design, and I've never found a significant error despite the fact that the game can be solved in a variety of ways – the real hallmark of the top-class adventure.

Adventure Quest takes place many years after Colossal Cave (the grating has rusted up) and the action is now to the north.

It is essentially a picaresque game taking you on a long journey through forest, desert, mountains, a lake, caves, a volcano, a moor and a swamp to the Dark Tower of the Demon Lord Ageliarapt (?). Never heard of him, so he must be some character in Lord of the Rings – I'll look him up in my palantir.

Even though I had analysed the game before starting to play, it still took me longer to solve than other games without clues.

The first time through, I got 5,106 points out of 6,000, but by then I could move around blindfold and worked out a chain of objects that meant I need never go back for anything (you should arrive on the moor with just the Sun stone and sword).

The result then was 6,261 points, but I'm sure that even that can be beaten – no comment from Level 9 however.

The final game in the Middle Earth Trilogy is Dungeon Adventure.

Having defeated Agalierept (?) the Dark Tower is now open to sightseers and looters – that's you, sunshine.

Armed with 586 cross-referenced clues, I entered confident that I need not roll a dice (die?) with the Rakshasa to

increase my luck, only to be engulfed by the quivering Blob of Jelly with no mention in the hints of such an Object or Creature.

This dessert is a real blocker to further progress, so I asked Bob Redrup (who rarely uses hints) how he tackled it.

The answer is to leave no stone unturned. You must TAKE, WAVE, WEAR, EAT, DROP, SNIFF, BLOW and EXAMINE every new object you find.

De rigeur you always SAVE before doing anything potentially dangerous, then press every button in sight and try all 10 directions.

This systematic approach (plus a classical education and four years studying Philosophy at Leeds) is the simple secret of his success, so he had no trouble discovering that the packing case was a portable Tardis – a puzzle that floored me and my literal knapsack mentality.

Unlike Adventure Quest, The Dungeon is a cyclic search – there are umpteen ways of moving from A to E and back again.

The central dungeon is very confusing and needs careful mapping in almost three dimensions.

Finally I emerged from the caves with 600 points, gritted my teeth to win the battle of Orcsbridge and exited east to get my degree.

These two games, although about two years old, are still streets ahead of the majority I get to review.

The attention to detail gives a unique atmosphere (it affects even quibblers

like me), so, despite his degree from Cambridge in psychology, I'm not surprised to hear that Pete Austin has now come up with an explanation of how Eridani "E" got moved to Eridani "A".

Ectually, Peter – coming from Orcsford myself I don't give a demn if you mix your vowels – I still give the Snowball trilogy straight E's but 30 parsecs is pushing it a bit and I still can't find the Red Giant.

## SOLUTION

THE dropping bricks problem we featured in our January, 1985 issue created a lot of interest.

You start in an array of empty rooms stretching away to the East and the West. You have only a knapsack full of Lego bricks and a set of cards which, depending on whether the present room is empty or not, give you three instructions –

- (1) Drop or remove a brick;
- (2) Move East or West and get the ...
- (3) Next three instructions from the card specified.

Believe it or not, this is ALL that sequential computers do.

It is called a Turing machine after the British mathematician Alan Mathieson Turing who invented it in the 1930s.

It was a pure "thought" machine and yet it revealed certain fundamental limitations on what any computer (or human) can calculate. Certain problems, although they must have an answer, are non-computable.

Probably the most famous of these problems is to decide whether or not a given Turing machine (or program) will stop.

A subset of this problem is to find, for a given number of cards, the stopping program that leaves the most bricks in the rooms.

This is called the Busy Beaver problem and, although studied for more than 20 years, the answer for five or more cards is still unknown.

In order to explain and clarify the problem, I have written a bog Basic program which should run on any machine and accept any five card set of instructions. (See Listing I). It incorporates the amendments I made to the problem in the March issue.

The rooms are in the array  $R$  with  $P$  as the pointer to the current room. Note that there are a generous 700 rooms and



## From Page 91

P starts in room 20.

Line 100 does all the work. From the data it gets the next three instructions which tell it to:

- (1) Drop a brick or clear the room (drop 5 or 0 in RCP).
- (2) Move East or West (add 1 or -1 to P).
- (3) Get the next three data items and count moves until ON ERROR.

Compare the data with the original cards in January to see the equivalence.

If you run this program you should find that it takes about 12 minutes to make 134,467 moves, which leave 501 "bricks" or 5s in the array R.

The fastest program received was by Steven Chmiel. It took 477 seconds and was almost unreadable. He also included an assembler program that took only 4.97 seconds.

Many readers did the test set only. If they think they can do better than Steven they could try changing the data statements to those shown in Figure 1.

You also need to increase the array R (make it 4000) and reset the pointer P (make it 3990). This Busy Beaver makes 2,133,492 moves before stopping.

Alice

```

10 DIM R(700),D(9),M(9),C(9)
20 FOR I= 0 TO 9
30 READ D(I),M(I),C(I)
40 NEXT
50 REM      0      1      2      3      4
60 DATA 5, 1,1, 5,1,2, 5,-1,0, 5,-1,2, 0,1,3
70 DATA 0,-1,2, 5,1,4, 0, 1,1, 5, 1,0, 5,0,5
80 P=20:N=0
90 TIME = 0
100 ON ERROR GOTO 120
110 FOR I=0 TO 3000000:R(P)=D(N):P=P+M(N):N=R(P)+C(N):NEXT
120 PRINT I
130 PRINT TIME/6000;" Minutes"
    
```

Listing 1: The 5-card Busy Beaver

	0	1	2	3	4
60 DATA	5, 1,1,	0,-1,0,	0,1,3,	5,-1,1,	5,-1,0
70 DATA	5,-1,4	0,-1,3,	0,1,1,	5, 1,2,	5, 0,5
<i>which corresponds to the following cards:</i>					
CARD	0	1	2	3	4
IF EMPTY	DROP,E,1	W,0	E,3	DROP,W,1,	DROP,W,0
ELSE	W,4,	GET,W,3,	GET,E,1,	E,2,	STOP

Figure 1: The data statements explained

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# CARE ELECTRONICS

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*Why not connect your computer direct to two printers using our -*  
**COMPUTER/PRINTER SELECTOR 'T' SWITCHER**

- \* 26 pin as BBC
  - \* 2 printers to 1 micro
  - \* 1 printer to 2 micros
  - \* Colour finished to match BBC
- @ 32.20d inc VAT

**COMPUTER/PRINTER SELECTOR**

- \* 26 pin as BBC
  - \* Colour finished to match BBC
  - \* 1 micro to 6 printers
  - \* 6 micros to 1 printer
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- ★ Colour finished to match BBC Micro.
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- ★ 6 pin BBC outlet or Dual power leads for disc drives. (Please specify when ordering).

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- ★ **Standard version:** Suitable for use with TEAC and TEC drives.
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**MAKE YOUR TEAC AND TEC DRIVES SWITCHABLE (40/80 conversion assembly)**

200K and 400K Drives only  
 Teac version @ 5.75c inc VAT  
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**READYMADE LEADS:**

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Disc drive single	@ 6.67c Inc VAT
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Printer	@ 7.82c Inc VAT
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RGB 6 pin DIN	@ 2.99c Inc VAT
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RGB 6 pin to SCART	@ 7.82c Inc VAT
BBC to single disc	@ 3.45c Inc VAT
BBC to Dual disc	@ 4.60c Inc VAT
Serial 25 pin "D"	@ 12.88c Inc VAT

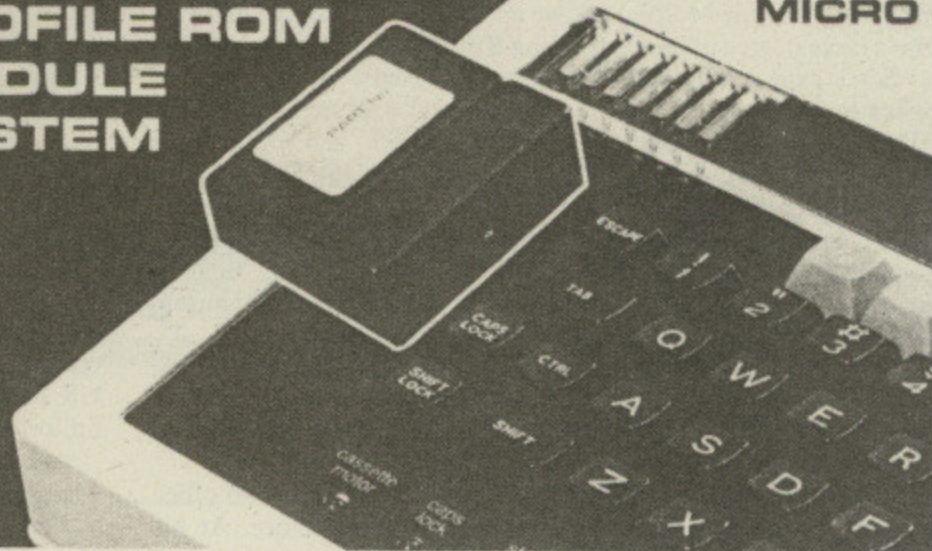
We can make up any combination of cable assy. Please contact our Factory for details.

**FLOPPY DISCS: (Boxed in 10's)**

3M's Single sided Double Density	@ 16.10c
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**THE CARE LOW PROFILE ROM MODULE SYSTEM**

**FOR THE BBC MICRO**



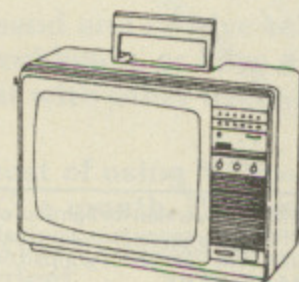
Don't run the risk of damaging your ROMS/EPROMS or your BBC Micro. Whenever you want to remove ROMS/EPROMS from your BBC. Fit our Low Profile Rom Module System and save your collection of ROMS/EPROMS in our specially designed cartridges. The CARE LOW PROFILE MODULE SYSTEM has been designed not to take any power from your BBC Micro and allows you unlimited ROMS/EPROMS.

- ★ **The Low Profile system** is a sideways mounting flush fitting unit.
- ★ **Unlike other systems:**
  - ★ Won't get in the way when using the Keyboard.
  - ★ Stops damage caused by shortcircuit due to metal objects e.g. paperclips falling inside.
  - ★ Prevents damage caused by dust.
- ★ **Edge Card Socket** which takes all the wear, Gold Plated for extended life.
- ★ **Manufactured entirely in the UK.**
- ★ **Each System Contains:**
  - ★ 1 Low Profile Assy.
  - ★ 1 ROM Cartridge.
  - ★ 1 Library Rack 6 way.
  - ★ 5 Blank Labels.
- ★ **Prices including VAT.**
  - ★ Complete Module System @ £15.87d
  - ★ Spare Cartridge @ £2.99c
  - ★ Library Rack to store 6 Cartridges @ £1.84c
  - ★ 5 Cartridges @ £14.95c
  - ★ 10 Cartridges @ £28.75c

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- ★ Resolution better than 585 x 450 pixels.
- ★ Image clarity comparable to leading monitors.
- ★ Includes RGB lead for connecting with BBC.
- ★ Conversions carried out at our workshops within 2/3 days.
- ★ Please write or telephone for other makes.



**HOW TO ORDER:**

By Post. Enclose your Cheque/P.O. made payable to **CARE Electronics**. Or use your ACCESS. Allow 7 days for delivery. Please add carriage.

OPEN  
 9am-5pm MON-THUR a) @ 8.00 c) @ 1.00  
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**CARE ELECTRONICS**  
 TEL: 0923 777155

SEE US AT THE ACORN USER SHOW





# The great adventure has begun...

WHEN we launched MicroLink we naturally expected it to generate quite a large degree of interest among BBC Micro enthusiasts. What we didn't expect was what actually happened – a stampede of applications to join.

They poured in from all parts of Britain, and even more surprisingly from places as far away as Tasmania.

*What has attracted them to MicroLink?*

**For the computer buff** it's the thought of joining one big family of like-minded enthusiasts. Through the Chat facility he can "talk" in real time to people who are using the same micro as himself, discussing common problems and sharing hints and tips.

And as MicroLink is part of Telecom Gold and Dialcom – the largest electronic mail service in the world – he can also communicate speedily and cheaply with other enthusiasts in many other countries.

**For the businessman**, MicroLink immediately provides an office tool that he might not have been able to afford before. At his fingertips are the same facilities that are enjoyed by every leading British business – all of whom are subscribers to Telecom Gold.

For a once-only payment of £10 he can turn his micro into a telex machine – which normally would cost him £2,000. He can send a telex message for as little as 5.5p, and even that is reduced by 10 per cent if he defers transmission until after 8pm!

His micro can also become a terminal to the Telecom Gold computer, able to tap its tremendous power and versatility and to use

giant number-crunching programs that can only be run on a mainframe.

No longer need he be tied to his office. He can use his micro from home – or golf club. And if he's not too confident about his spelling he can run his letter or telex message through the sophisticated Spell program before sending it off.

One of the many advantages of an online service like MicroLink is its flexibility – its ability to cope quickly with growing and changing needs.

Although it is only a few weeks old, new sections are being continually introduced to provide users with an even more comprehensive service. Among the latest are a definitive guide to all UK bulletin boards, which can be updated daily as new boards open up, or phone numbers or hours of access change.

And there's a review of the computer magazines, so you can see what subjects are being covered in their current issues.

Finally, why should the Tasmanians, of all people, want to join MicroLink? As they live right on the other side of the world, won't it cost a fortune to communicate with the UK?

Not so. Because Tasmania is part of the international PSS network, instead of paying the normal telephone call rate of 96p a minute, they can call MicroLink over PSS for just 10p a minute.

For callers in Europe it's even cheaper – just 2.2p a minute. With incentives like this, we expect MicroLink to grow into a truly international service.

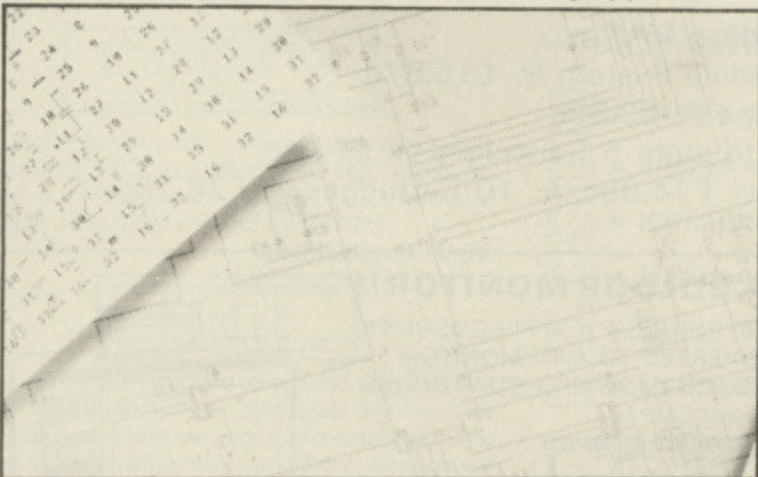
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**CIRKWIK**

**Datapen**

## SCHEMATIC DRAWING ON THE BBC MICRO

A CAD package orientated to the production of schematic drawings, such as circuit diagrams, flow charts, pipework diagrams, fluid logic diagrams and many similar professional and engineering applications.



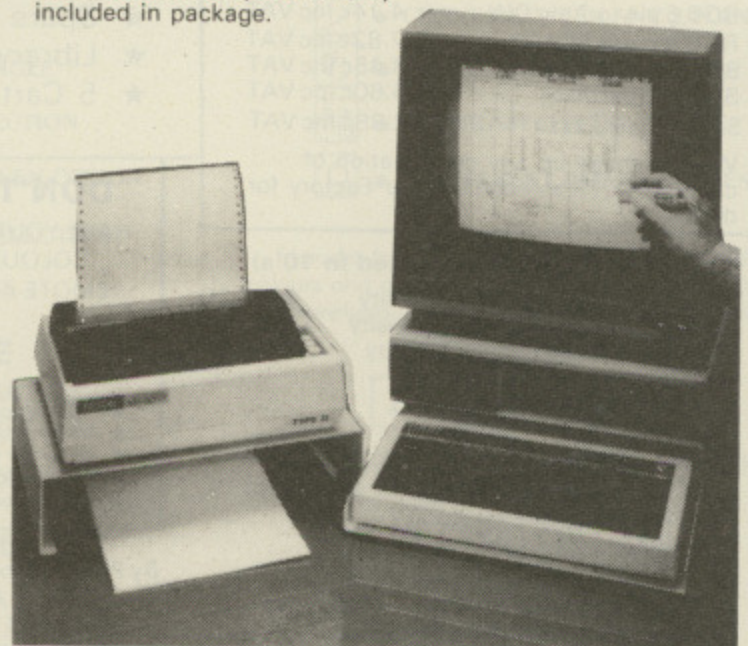
CIRKWIK Version for lightpen only ..... £19.95  
 CIRKWIK Version for trackball or lightpen ..... £24.95  
 CIRKWIK Version for grafpad or lightpen ..... £24.95

**HARDWARE:**

DATAPEN Lightpen (introductory programs included) ..... £25.00  
 MARCONI Trackball (Micro-Draw program included) ..... £59.50  
 or with new icon based program included ..... £69.50  
 ATARI Trak-Ball c/w with user port interface ..... £33.00  
 User port/Atari Track-Ball interface only ..... £13.00

*Our prices already include VAT & Delivery  
 S.A.E. for details of lightpen, CIRKWIK and other programs.*

- ★ Lightpen or trackball driven.
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- ★ Uses standard dot matrix printer in dual-density graphics mode to produce excellent quality diagrams.
- ★ Automatic parts list generation.
- ★ Up to 640 different symbols may be in use in any one diagram.
- ★ Total symbol library unlimited in size.
- ★ Create your own symbols on a highly magnified scale.
- ★ Many electronic symbols already included in package.



**DATAPEN MICROTECHNOLOGY LTD. Dept MU3, Kingsclere Road, Overton, Hants RG25 3JB Telephone: (0256) 770488**



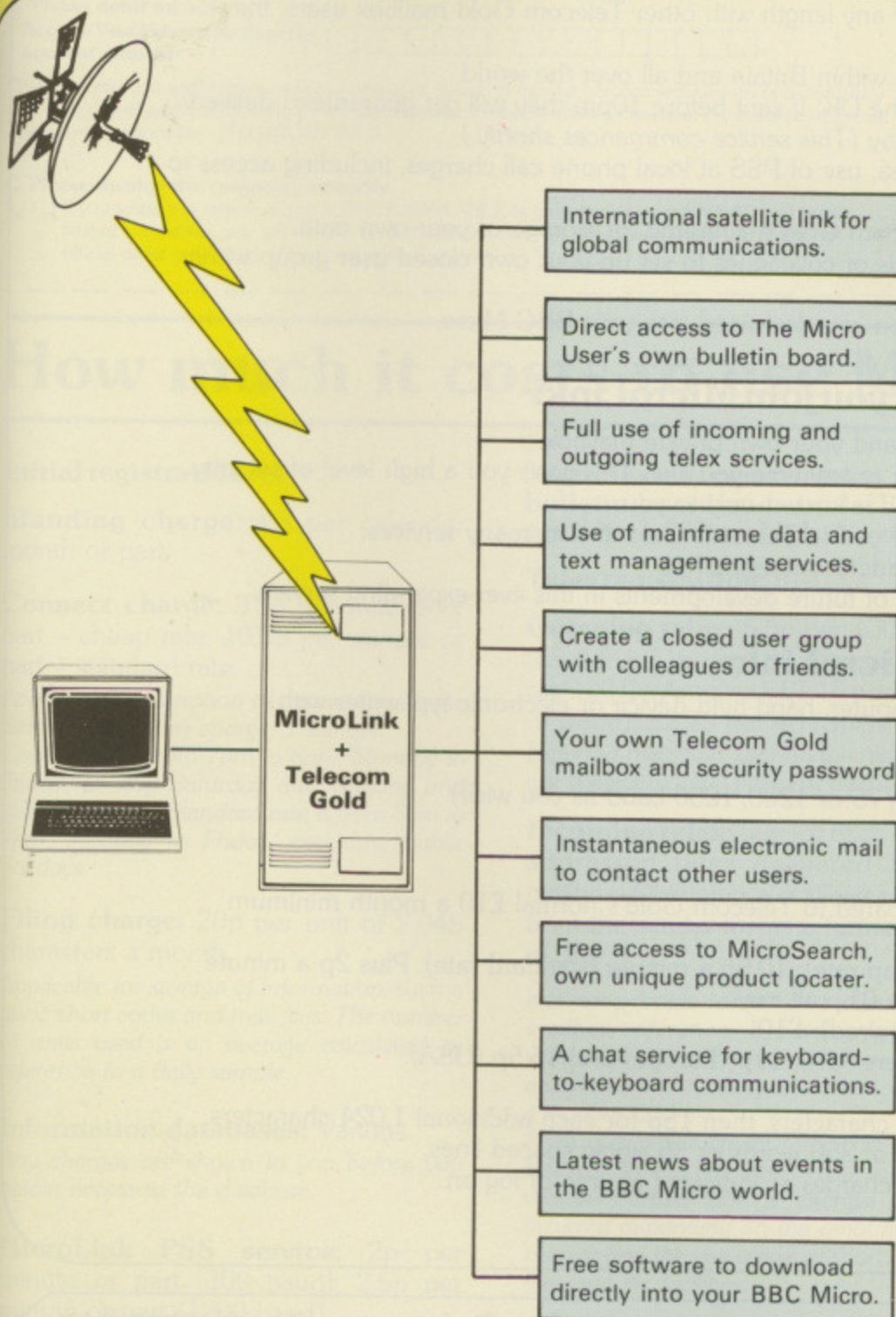
**THE  
MICRO  
USER**

invites you to join . . .

# MicroLink

in association with

**TELECOM GOLD**\*



MicroLink is this year's most exciting - as well as most ambitious - development in the rapidly-expanding world of telecomputing.

For the first time, it combines the enthusiasm of many thousands of computer users with the power and versatility of Britain's national database, Telecom Gold.

The result is an international communications link that is your passport to new realms waiting to be explored, new experiences to be shared with kindred spirits who enjoy telecomputing just as much as you do yourself.

Communicating the MicroLink way is ultra-fast - and much cheaper than you might expect. Wherever you live, you get direct access to the Telecom Gold computer at local call rates.

With your own electronic mailbox you can send a message to one destination - or to 500! - for less than you would pay for a first class stamp.

You can send and receive telex messages worldwide, or have a two-way chat with other users in real time.

And the cost of using MicroLink? Just £3 a month. Plus small additional access charges as detailed overleaf.

Join MicroLink now - and let you and your BBC Micro be in the forefront of the new revolution in communications!



These are some of the innovative features  
you'll be able to use when you join . . .

# MicroLink

## What facilities you can use – directly from your micro:

- Access at any hour of the day or night to Microsearch, our exclusive product locator, which is constantly updated by Britain's major distributors. Powerful, easy-to-use keyword searching means you should find what you want within seconds.
- Direct contact, via electronic mail, with other users throughout the world. And because you're connected via PSS, and not the normal phone links, it's usually much, much cheaper.
- Full use of the closed user group bulletin board – with a special section for BBC Micro users.
- Full service of news about new products and events. All presented in easy-to-read form to keep you right up to date with what is happening in the world of microcomputing and communications.
- Send and receive mailbox messages of any length with other Telecom Gold mailbox users, the number of which is rapidly growing.
- Send and receive telex messages, both within Britain and all over the world.
- Send telemessages to any address in the UK. If sent before 10pm they will get guaranteed delivery the next working day, including Saturday (*This service commences shortly.*)
- If you live outside the 01- local call area, use of PSS at local phone call charges, including access to the international Dialcom system.
- Use, should you require it, of the Telecom Gold mainframe for storage of your own data.
- Encouragement to combine with friends or colleagues to set up your own closed user group within MicroLink.
- Provision of free telesoftware, which you can download into your BBC Micro.

## What you will receive when you join MicroLink:

- Free registration on Telecom Gold – and your own private mailbox.
- Free password, which you can change at any time you like. This gives you a high level of security in order to preserve confidentiality, and is known only to you.
- Free instructional manual to introduce you to Telecom Gold and its many services.
- Free Help facility should you require additional assistance.
- Free newsletter to keep you informed of future developments in this ever-expanding service.

## What you need to access MicroLink:

- Any personal computer, portable computer, hand-held device or electronic typewriter with communications facilities.
- Appropriate communications software.
- Modem (you can use 300/300, 1200/75 or 1200/1200 baud as you wish).

## What will it cost?

- Monthly standing charge of £3 (compared to Telecom Gold's normal £10 a month minimum charge).
- Connect charges: 3.5p a minute (cheap rate); 10.5p a minute (standard rate). Plus 2p a minute PSS charge if calling from outside the 01- call area.
- Once-only telex registration fee (if required): £10.
- Outgoing telex: 5.5p per 100 characters (UK), 11p (Europe) and 16.5p (USA).
- Incoming telex: 50p.
- International mail: 30p for first 2,048 characters, then 15p for each additional 1,024 characters.
- Telemessages: £1.25 for a maximum of 350 words or 35 single spaced lines.
- On-line databases on Telecom Gold: charges as indicated at time of log-on.

To secure your immediate registration, complete the form opposite and return it to:  
MicroLink, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.



Name

Position

Company

Address

Postcode  Daytime telephone

**Commencement of Service**

Please indicate month of commencement  19

Please allow 10 days for validation of mailbox

**Payment**

Whilst Database Publications Ltd is the supplier of all the services to you, the commission and billing thereof will be handled by Telecom Gold as agents for Database Publications Ltd. Date of first payment to be on 15th of month following commencement. Please complete billing authorisation form A, B or C below.

**A. Direct Debiting Mandate** (Enter full postal address of Bank Branch)

To

I/We authorise you until further notice in writing to charge to my/our account with you on or immediately after 15th day of each month unspecified amounts which may be debited thereto at the instance of British Telecommunications plc - TELECOM GOLD by Direct Debit.

Name of Account to be debited

Account Number

**B. Please debit my/our**

**Access/Visa/American Express**

**account number**

I/We authorise you until further notice in writing to charge to my/our account with you on or immediately after 15th day of each month unspecified amounts which may be debited thereto at the instance of British Telecommunications plc - TELECOM GOLD.

**C. Please invoice the company/authority.**

If you select this option, which is ONLY AVAILABLE to government establishments and public limited companies, you will be sent an authorisation form for completion which will require an official order number to accept unspecified amounts.

**MicroLink**

in association with

**TELECOM GOLD**\*

**Application Form**

**Terms and conditions:** I/We have read and accepted the terms and conditions as set out on this document and hereby apply to join MicroLink.

- I wish to use Telex. I authorise you to charge an additional £10 to my initial bill.
- I confirm that I am over 18 years of age.

Signature

Date

I enclose my cheque for £5 payable to Database Publications as registration fee to MicroLink.

I intend to use the following computer

**SEND TO:**  
**MicroLink**  
**Database Publications**  
**Europa House**  
**68 Chester Road**  
**Hazel Grove**  
**Stockport SK7 5NY.**

**FOR OFFICE USE ONLY:**

Mailbox assigned

Start date

Password

\* Telecom Gold is a trademark of British Telecommunications plc.

MU7

**How much it costs to use MicroLink**

**Initial registration fee:** £5.

**Standing charge:** £3 per calendar month or part.

**Connect charge:** 3.5p per minute or part - cheap rate; 10.5p per minute or part - standard rate.

*Applicable for duration of connection to the Service. Minimum charge: 1 minute.*

*Cheap rate is from 7pm to 8am, Monday to Friday, all day Saturday and Sunday and public holidays; Standard rate is from 8am to 7pm, Monday to Friday, excluding public holidays.*

**Filing charge:** 20p per unit of 2,048 characters a month.

*Applicable for storage of information, such a telex, short codes and mail files. The number of units used is an average calculated by reference to a daily sample.*

**Information databases:** Various.

*Any charges are shown to you before you obtain access to the database.*

**MicroLink PSS service:** 2p per minute or part (300 baud); 2.5p per minute or part (1200 baud).

*Only applies to users outside the 01-London call area.*

**MicroSearch, news service, bulletin board and similar sections of MicroLink:** No charge.

**Telex registration:** £10.

**Outgoing telex:** 5.5p per 100 characters (UK); 11p per 100 (Europe); 16.5p per 100 (N. America); £1.15 per 40 (Rest of world); £2.75 per 40 (Ships at sea).

*Deferred messages sent on the night service are subject to a 10 per cent discount.*

**Incoming telex:** 50p for each correctly addressed telex delivered to your mailbox. Obtaining a mailbox reference from the sender incurs a further charge of 50p.

*It is not possible to deliver a telex without a mailbox reference. If a telex is received without a mailbox reference the sender will be advised of non-delivery and asked to provide a mailbox address.*

*Each user validated for telex and using the facility will incur a charge of 6 storage units a month. Further storage charges could be incurred depending on the amount of telex storage and the use made of short code and message file facilities.*

**Telemessages:** £1.25 for up to 350 words.

**Radiopaging:** No charge.

*If you have a BT Radiopager you can be paged automatically whenever a message is waiting in your mailbox.*

**International Mail:** For the first 2,048 characters - 20p to Germany and Denmark; 30p to USA, Australia, Canada, Singapore, Hong Kong and Israel. For additional 1,024 characters - 10p; 15p.

*These charges relate to the transmission of information by the Dialcom service to other Dialcom services outside the UK and the Isle of Man. Multiple copies to addresses on the same system host incur only one transmission charge.*

**Billing and Payment:** All charges quoted are exclusive of VAT. Currently all bills are rendered monthly.

**On receipt of this application form you will be sent:**

- Your personal mailbox number and initial password
- A Quick Guide to Mail manual
- Customer Helpline telephone number



This contract is made between Database Publications Ltd, of Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY (DPL) and the subscriber whose name and address appears overleaf.

Whereas DPL has agreed with British Telecommunications plc (BT) through its agent Telecom Gold Limited to sell and distribute the MicroLink Service (the Service) and BT through Telecom Gold Limited has agreed to supply the Service to customers of DPL.

It is agreed as follows:

1. Access  
DPL shall issue to the subscriber such user codes (called mailbox numbers) as it thinks fit in order to allow the Subscriber and persons associated with the subscriber, access to use the Service.
2. The Service  
The Service shall be BT's Telecom Gold Dialcom Service, and shall comprise such services and facilities as DPL shall in its discretion from time to time consider appropriate, subject to the supply by BT of such services and facilities.
3. Charges
  - a) The subscriber shall pay for all charges arising under this contract from his subscription to and/or use of the Service, and/or from the issue to him of any mailbox number issued by DPL to the Subscriber. All charges are payable on demand.
  - b) DPL shall give to the Subscriber not less than fourteen days written notice of any alteration in the applicable charges for the Service. The charges applicable at the date of this Subscription are set out overleaf.
  - c) Subject to any provision of this contract, liability for charges for service shall commence, unless BT notifies the customer to the contrary, with effect from the first day of the month in which BT first makes service available to the customer.
4. Limitations on use
  - a) The Subscriber shall not use, or permit any person to use the Service otherwise than according to instructions given by DPL or BT, existing for the time being and in particular, shall not use the Service for the purpose of sending abusive, offensive, indecent or menacing communications, or for sending communications which cause annoyance, inconvenience, or needless anxiety.
  - b) The Subscriber shall not permit any person to use the Service by means of a mailbox number issued by DPL unless the name and relationship of that person to the Subscriber has been disclosed to DPL.
5. Termination
  - a) This contract may be terminated by either party giving not less than one month's written notice, such notice to expire on the last day of any calendar month.
  - b) DPL may terminate this contract forthwith without notice if the Subscriber shall
    - i) fail to pay any sum payable under this contract or payable under any other contract with DPL to which the Subscriber is a party.
    - ii) be adjudicated bankrupt, enter into liquidation or any arrangement or composition with his creditors, or if a receiver is appointed of any part of the Subscriber's assets and not discharged within seven days, or if any judgment against the Subscriber remains unsatisfied for more than seven days.
    - iii) fail to comply with any term of this contract, or any instruction given by DPL or BT under clause 4 of this contract.
  - c) DPL may terminate this contract without notice in the event that BT and/or its agent Telecom Gold shall cease to supply the Service.
  - d) If the customer fails to comply with any provision of this contract he shall nevertheless continue to be liable for all charges due and to become due for service provided during any period of such failure.
6. Assignment  
The subscriber shall not, without the written consent of DPL assign this contract, or any rights or obligations arising under this contract.
7. Limitation of liability
  - a) For the avoidance of doubt neither DPL nor BT has an obligation duty or liability in contract, tort, for breach of statutory duty or otherwise beyond that of a duty to exercise reasonable skill and care.
  - b) In any event in no circumstances shall either DPL or BT be liable in contract, tort (including negligence or breach of statutory duty) or otherwise for loss (whether direct or indirect) of profits, business, or anticipated savings or for any indirect consequential loss whatever.
  - c) In any event DPL's liability in contract, tort (including negligence or breach of statutory duty) or otherwise arising by reason of or in connection with this contract or howsoever otherwise shall be limited to £500,000 for any one incident or series of incidents and £1m for any series of incidents related or unrelated in any period of 12 months.
  - d) DPL does not exclude or restrict its liability for death or personal injury, where such arises as a result of the negligence of DPL or its employees.
  - e) The Subscriber shall indemnify DPL against all loss, actions, proceedings, costs, claims and damages arising from
    - i) any breach by the Subscriber of his obligations hereunder;
    - ii) the use of the Service by third parties by means of any mailbox number issued to the Subscriber.
  - f) DPL shall not be liable for any loss or damage occurring through any act or omission of BT or its agent Telecom Gold Limited, in the supply or failure to supply, the Service to DPL. Notwithstanding anything to the contrary contained hereby, the supply of the Dialcom service shall be upon and subject to the standard terms and conditions of BT from time to time and of which the subscriber shall be deemed to be aware.
  - g) Neither party shall be liable for failure to perform its obligations if the failure results from Act of God, Act of Government or other Authority or Statutory undertaking, fire, explosion, accident, power failure, industrial dispute, inability to obtain materials or anything beyond such party's reasonable control.
  - h) DPL accept liability hereunder for direct loss caused to the subscriber where such loss arises solely due to acts or omissions of DPL or its employees in the provision of access to the service up to an aggregate maximum of £1,000 or a sum equal to one month's average service charges to the subscriber over the previous 12 months' period, whichever is smaller. Save as otherwise provided herein, DPL shall be under no liability for any loss suffered by the subscriber or by any other person arising from negligence or otherwise.
8. Any notice, consent or other communication required to be given hereunder by either party to the other, shall be made in writing and may be served by first class post to the address of the other as set out herein, and shall be deemed to have been received 48 hours from the time of posting.
9. This agreement constitutes the entire agreement between the Subscriber and DPL in respect of the Service, and no representation, statement, warranty or condition not expressly contained in this agreement or incorporated herein by reference, shall be binding upon DPL as a warranty or otherwise.
10. This agreement shall be governed and construed in accordance with the laws of England, and the English Courts shall have exclusive jurisdiction to determine any disputes arising hereunder.



# QUALITY NEVER LOOKED SO GOOD—

Now everyone with a BBC or IBM PC will want to get their paws on CUB's sleek new D series plastic cabinet — a triumph of ergonomics and up to the minute design. Within it is the CUB 653 MEDIUM RESOLUTION colour monitor — the perfect mate for computer users who wish to combine the advantages of brilliant, low cost colour graphics with 80 column processing software.

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



MICROVITEC 653  
**CUB**  
COLOUR DISPLAYS

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Tel: (0274) 390011 Telex: 517717



Available from High Street Computer Retailers and selected branches of W. H. Smith, Harrods, John Lewis Partnership, John Menzies with selected models available from larger branches of Boots.



# Never before

has there been such a  
helpful, easy-to-understand  
guide to BBC Basic

There has been an enthusiastic welcome from users of the BBC Micro and Electron to "Getting Started on BBC Basic". And with good reason. For its author, Mike Bibby, is acknowledged to be one of Britain's leading experts on BBC Basic, and in it he achieves new standards in simplifying the teaching of Basic programming.

The book, which is based on his highly-praised series for beginners in *The Micro User*, takes the reader step by step through the fundamentals of writing programs.

Its hands-on approach has been specifically designed to teach the

absolute novice not only the formal rules of Basic but also that elusive quality - good programming style.

By working through its many examples, the reader will gain a clear insight into structured programming, and will quickly acquire the ability to use structured techniques in creating his own programs.

### The chapters include:

- ★ Basic ideas - printing strings and numeric expressions
- ★ RUNning your first programs
- ★ Strings and simple editing
- ★ Getting data from your keyboard with INPUT
- ★ REPEAT ... UNTIL, the building blocks of loops
- ★ Controlling loops with FOR ... NEXT statements
- ★ Modes and colour
- ★ Introducing procedures - a taste of structured programming
- ★ How to use subscripted variables
- ★ Nested loops
- ★ Into the second dimension with arrays
- ★ String manipulation
- ★ Simple data structures

Please send me a copy of Getting Started in BBC Basic.  
2289 £5.95 (including p&p)

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Cheque/PO made payable to Database Publications Ltd.

Name \_\_\_\_\_ Signed \_\_\_\_\_

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68 Chester Road, Hazel Grove, Stockport SK7 5NY.  
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Mike  
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Getting started in  
**BBC Basic**  
on the BBC Micro & Electron

DATABASE PUBLICATIONS



you  
can  
fit a  
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into a  
pint  
pot...

... or to be more exact,  
you can squeeze more  
Mode 2 screens onto  
disc or tape with  
this clever utility by  
KEVIN EDWARDS

COMPACT is a clever utility that will save and load a complete Mode 2 screen which has been compressed in a special way.

The only limitation is that eight of the 16 colours available cannot be used. This is not a great disadvantage because the eight un-usable colours are the flashing ones.

COMPACT will be especially useful for Computer Aided Design (CAD) programs which need to save and load many different screens.

The Mode 2 screen uses 20k of RAM to store the display – this is known as the video RAM.

Normally, to SAVE the Mode 2 screen display we would use:

```
*SAVE SCREEN 3000 8000
```

The 3000 and 8000 in the statement corresponds to the hexadecimal start and end address of the video RAM for Mode 2. In fact the end of the video RAM is &7FFF, but the \*SAVE command expects the next location in memory, which is &8000.

The screen could then be reloaded with:

```
*LOAD SCREEN 3000
```

The problem with saving and loading 20k of memory is that it takes up a large amount of tape or disc space. Tape users will also have to wait a long time while the file loads or saves.

In fact a 100k disc can hold only four whole screens – not five as you would expect (5\*20k=100k). The other screen doesn't quite fit because the directory takes up 512bytes of the disc.

So you can see that screens consume a lot of space.

But help is on its way, because COMPACT will save a typical Mode 2 screen in approximately 5k, thus allowing four times as many screen dumps on each disc or tape. Once a compressed screen has been saved it can be loaded back onto the screen in its original expanded form with one simple CALL.

The Mode 2 video RAM consists of 32 lines of 640 bytes. Each line has 80 columns of 8bytes. And each byte corresponds to two coloured pixels.

Diagram 1 shows the layout of the first few lines of the Mode 2 screen – assuming the screen hasn't scrolled. If it has, the start address will be different, but the screen will still be organised in much the same way.

So by storing different numbers in the video RAM we get different coloured pixels on the screen. The relationship between the byte stored in a location and the pixels displayed is quite unusual.

What happens is the binary digits of the left and right pixels colours are interweaved – left pixels colour bit first.

All sixteen colours in Mode 2 can be represented by a four bit binary number (COLOUR 0-15, %0000-%1111). So when four bits are interweaved with another four we get eight bits – a byte. And it is this byte which we store in the video RAM to display the two pixels in the colours chosen.

See Page 74 of the February 1985 issue of *The Micro User* for a more detailed explanation of the video RAM.

The highest non-flashing colour number is 7 (white). Therefore the highest number stored in the video RAM to produce a pair of non-flashing colours is 63 – when both pixels are

```
10 REM Screen Compact
20 REM By Kevin Edwards
30 MODE 2
40 screen=&70:fileopen=&72
50 ytemp=&73:counter=&74:endflag=&
75
60 FOR pass=0 TO 2 STEP 2
70 PZ=&B00
80 [OPT pass
90 LDA#&80:JSRopenit
100 .open_is_ok JSRinit
110 .newbyte LDA#1:STAcouter
120 LDA(screen),Y:STAsearch+1
130 .nextlocation JSRincscreen:BM11
asttwo
140 LDA(screen),Y
150 .search CMP#&FF:BNEnotsame
160 INCcounter:LDAcounter:CMP#&7F:B
EQoutput
170 BNEnextlocation
180 .lasttwo JSRcntplusbyt
190 .closefile LDYfileopen:LDA#0:JM
P&FFCE
200 .output JSRcntplusbyt
210 LDAscreen+1:BM1closefile
220 JSRincscreen:BM1closefile
230 JMPnewbyte
240 .notsame JSRcntplusbyt
250 JMPnewbyte
260 .savebyte STYytemp
270 LDYfileopen:JSR&FFD4
280 LDYytemp:RTS
```

Program 1: The Compact program



white (63=%00111111).

From this you can see the two most significant bits are unused when dealing with non-flashing colours. These two bits are very useful, as you will see.

Here's a rough outline of how COMPACT works:

1. Read a new screen byte.
2. Read the next screen byte.
3. If the byte is the same as the first screen byte increase a counter and goto step 2.
4. If the screen byte is different save the counter and the byte to disc/tape.
5. Goto step 1.

COMPACT relies on the fact that many adjacent screen locations contain the same byte. By keeping a count of the number of adjacent matching bytes we can represent them using only two numbers – the counter and the repeated byte.

This method is very efficient. But if the screen has a large section of differing bytes the data will end up being twice as long as necessary – the counter byte (always 1) followed by the screen byte.

This problem is solved by using bit 7 of the byte as a flag. If it is set, the screen byte is held in bits 0 to 5 of the same byte. Otherwise the byte corresponds to the counter.

This means that the counter can only be in the range 0 to &7F – &80 or greater would indicate that the screen data byte is held in the same byte. In which case the screen byte must be extracted.

If the byte read is a counter another byte (the screen byte) must be read.

COMPACT goes one stage further by using bit 6. If bit 7 is set bit 6 indicates the number of bytes to be

	COLUMN					
	0	1	2	...	78	79
HIMEM	&3000	&3008	&3010 ...	&3270	&3278	
	&3001	&3009	&3011 ...	&3271	&3279	
	&3002	&300A	&3012 ...	&3272	&327A	
ROW 0	&3003	&300B	&3013 ...	&3273	&327B	
	&3004	&300C	&3014 ...	&3274	&327C	
	&3005	&300D	&3015 ...	&3275	&327D	
	&3006	&300E	&3016 ...	&3276	&327E	
	&3007	&300F	&3017 ...	&3277	&327F	
	&3280	&3288	&3290 ...	&34F0	&34F8	
	&3281	&3289	&3291 ...	&34F1	&34F9	
	&3282	&328A	&3292 ...	&34F2	&34FA	
ROW 1	&3283	&328B	&3293 ...	&34F3	&34FB	
	&3284	&328C	&3294 ...	&34F4	&34FC	
	&3285	&328D	&3295 ...	&34F5	&34FD	
	&3286	&328E	&3296 ...	&34F6	&34FE	
	&3287	&328F	&3297 ...	&34F7	&34FF	
	&3500	&3508	&3510 ...	&3770	&3778	
	&3501	&3509	&3511 ...	&3771	&3779	
	&3502	&350A	&3512 ...	&3772	&377A	
ROW 2	&3503	&350B	&3513 ...	&3773	&377B	
	&3504	&350C	&3514 ...	&3774	&377C	
	&3505	&350D	&3515 ...	&3775	&377D	
	&3506	&350E	&3516 ...	&3776	&377E	
	&3507	&350F	&3517 ...	&3777	&377F	

Diagram 1

displayed – another simple counter.

If bit 6 is 0 only one byte will be displayed, otherwise, if it is set two bytes are displayed. This means that we need only one byte to represent one or two bytes – if you see what I mean.

This is all rather complex so if you are lost in the maze of twisty little passages

type in Program I and save it.

The program assembles the screen load and save routine into page &B – the soft key buffer. This will be responsible for random characters when Break is pressed. Programming the

```

290 .cntplusbyt LDAcounter:CMF#3:BC
Sbothout
300 LDX#&80:CMF#1:BEQitstone
310 LDX#&C0
320 .itstone TXA:ORAsearch+1:JMPsave
byte
330 .bothout JSRsavebyte
340 LDAsearch+1:JMPsavebyte
350 .incscreen INY:BNEexit
360 INCscreen+1
370 .exit LDAscreen+1:RTS
380 .displayscreen LDA#&40:JSRopenit
390 JSRinit
400 .first STYytemp:LDYfileopen:JSR
&FFD7:TAX:BPLmultiple
410 .singl AND#&3F:TAY:TXA:LDX#1:AN

```

```

D#&40:BEQonlyone:INX
420 .onlyone TYA:LDYytemp:JMPsaveit
430 .multiple JSR&FFD7:LDYytemp
440 .saveit STA(screen),Y:INY:BNEig
nore:INCscreen+1:BMieoscreen
450 .ignore DEX:BNEsaveit
460 BEQfirst
470 .eoscreen LDYfileopen:LDA#0:JMP
&FFCE
480 .openit LDX#filename MOD 256:LD
Y#filename DIV 256
490 JSR&FFCE
500 STAfileopen:TAX:BEQfileerror:RT
S
510 .fileerror OPT FNequb(0)
520 OPT FNequb(0)

```

```

530 OPT FNequs("File error")
540 OPT FNequb(0)
550 .init LDA#0:STAendflag:TAY:STAs
creen
560 LDA#&30:STAscreen+1:RTS
570 .filename OPT FNequs("SCREEN")
580 JNEXT
590 END
600 DEFFNequs(string$)
610 $P%=string$
620 P%=P%+LEN($P%)+1
630 =pass
640 DEFFNequb(byte)
650 ?P%=byte
660 P%=P%+1
670 =pass

```



### From Page 103

function keys or pressing Ctrl+Break will erase the object code – so be warned.

The next stage is to \*SAVE the object code. This is done by:

```
*SAVE "COMPACT"800 B00
```

COMPACT can be \*LOADed whenever it is needed by the command:

```
*LOAD COMPACT
```

All you need to do now is put the appropriate commands into your program to save or load the screen.

The filename of the screen data can be changed by using the following command – where NAME is the new filename:

```
$&BD9="NAME"
```

The default filename is SCREEN. Disc users should note that the file name must contain valid characters and must

```
10 REM Random triangles
20 REM By Kevin Edwards
30 MODE 2
40 *OPT 1,0
50 FOR LX=1 TO 30
60 GCOL 3,RND(8)-1
70 PLOT 85,RND(1280)-1,RND(1024)-1
80 NEXT
90 CALL&B00
```

Program II: Random Triangles

not be greater than seven characters in length.

To save a screen all you do is insert a line with the command:

```
CALL&B00
```

Loading a screen is very similar. All you do is execute the statement:

```
CALL&B75
```

Tape users must turn all cassette messages off or the screen will be corrupted when the filename and block number are printed during saving and loading. Cassette message can be turned off by putting the command \*OPT 1,0

at the start of your program.

To show you how a screen can be saved type in Program II.

All it does is draw randomly coloured triangles on the screen before saving the screen. To load the picture back make sure you're in Mode 2 then CALL&B75.

If at any time you get the message:

#### File error

it means that the file specified couldn't be opened. One cause of this is trying to load a non-existent file – disc users only.

Knowing that the Mode 2 screen is 20480 (&5000) bytes in length you will notice that the compressed file will be much shorter – approximately a quarter of the size.

Anyway, that's it. I hope you find it useful. If you have a utility or program that others would find useful why not send it in for our experts to evaluate?

You never know, we might use it in a future issue of *The Micro User*.



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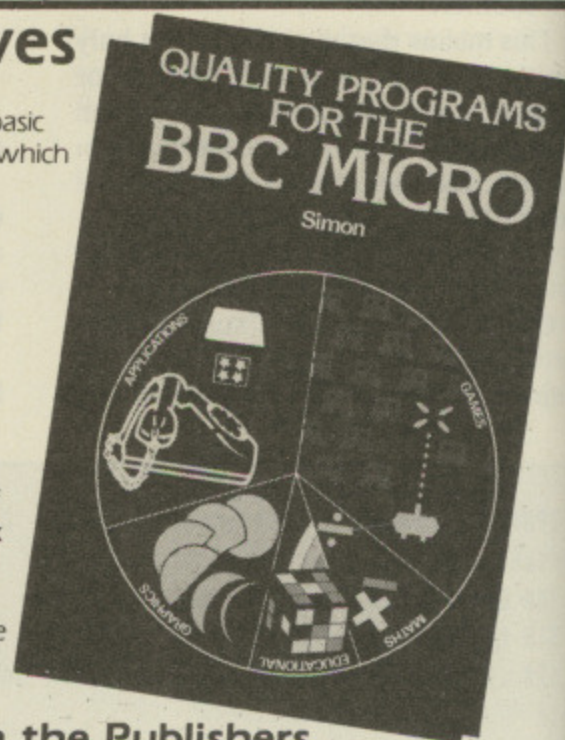
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MANY newcomers to microcomputing are puzzled by the fact that seemingly straightforward words and phrases take on a completely different meaning when used in a computing context. In an earlier issue of *The Micro User* we presented an innocent's guide to Computerspeak. And here are some more expressions to complete the set.

# An innocent's guide to Computerspeak

**"Business machine"**: The price is £1,000 to £3,000 more than it should be and the specification is so boring that no one has written any games for it.

**"User friendly"**: Just like all friendly people at parties, they range from boring to a pain in the neck.

**"But to explain that would be outside the scope of this article/book"**: I don't understand it, so neither would you!

**"Design feature"**: Design error described by the sales team.

**"99% compatible"**: Totally incompatible. Only trivial programs will run.

**"Software compatible"**: The hardware is different and although the commands will be accepted without an error message they will not do what you want.

**"Transparent changes"**: Transparent only to those with X-ray vision.

**"Tube"**: Mythical device forcing software writers to use slow cumbersome indirection methods to access the operating system. Its real function is to allow many attempts to get the operating system right and still be able to sell the duff ones.

**"Second processor"**: See Tube. Also see Second Coming.

**"Acorn approved product"**: One or more of the design team went to the correct Cambridge college.

**"Wally"**: AbUser friendly.

**"Improved version"**: This one works.

**"New improved version"**: This one really works.

**"Basic II"**: A privilege, rather like an OBE or knighthood.

**"Electron"**: A very clever computer that thinks it's a turkey and so did not appear until after Christmas.

**"Demonstrated at the Splige Computer Show"**: We got the prototype working the night before.

**"Provisional"**: A word scribbled on manuals of equipment sent for review in the hope that it will prevent criticism.

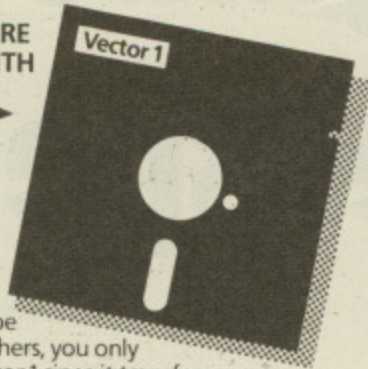
**"A Sinclair"**: A device for turning silicon technology into silly con technology.

**"Word processor"**: A program that always takes a whole page to print the last two words of a document.



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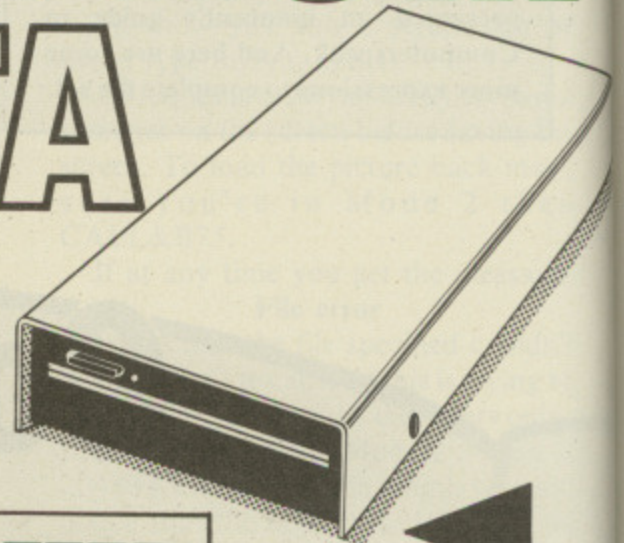
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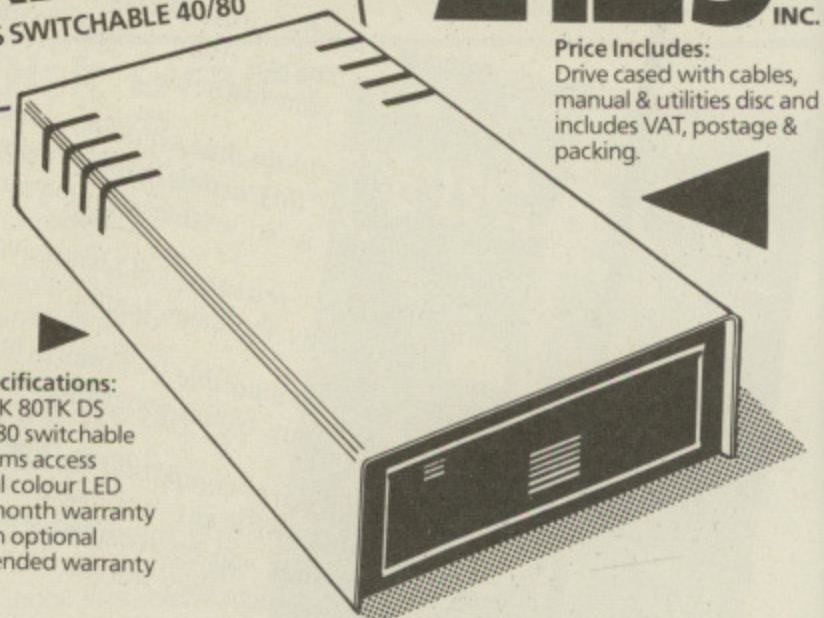
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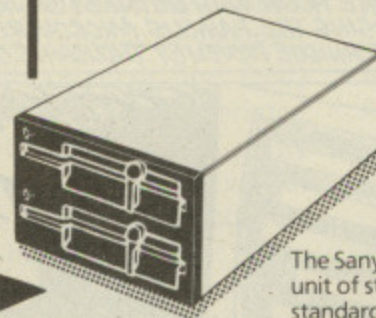
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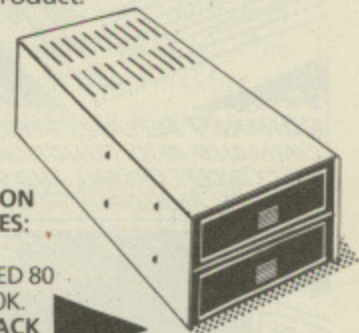
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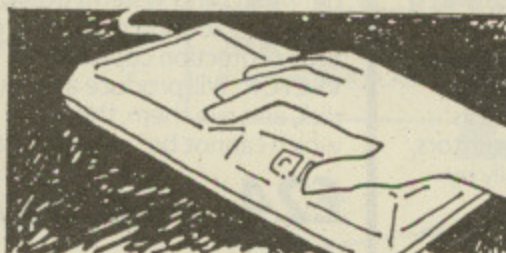
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TESTED COMPATIBILITY — BBC model "B" OS E.I BASIC I or BASIC II (except when using INKEY with negative argument), DFS 0.90. View A1.4, Wordwise 1.17, Edword.

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MU7



# WALK TALL!

HERE's a program to print characters in double height on the BBC – and Electron – “soft” display modes. That is, all Electron modes, and all modes except Mode 7 on the BBC Micro.

Several programs have been published already for printing double height, so why print yet another? Well, most of the existing routines are in the form of Basic procedures which are called from a program with statements such as:

```
1120 PROCdouble("Hello there")
```

This would cause the string “Hello there” to be printed in twice the normal height. However, wouldn't it be far more useful if the large characters were available at all times, in Basic or not?

That's what the routine presented here does. It intercepts the operating system routine OSWRCH and converts each character into a double height one before printing. All you have to do is assemble the program and run it. From then on, all output is printed at twice its normal height.

The routine checks that the VDU queue is empty before mucking around with characters. This is a small but important point. If it didn't do this, your PLOT commands (and other VDU-type commands) would start to go badly wrong.

It also checks that the display isn't in

## MICHAEL MITCHELL tells how you can double your height – all the time...

Mode 7. If it is, it doesn't attempt to make characters double height.

The reason that it can't do it in Mode 7 is that the double height characters are made by redefining the character set. This is only possible in the soft modes, as Mode 7 characters are “hardwired” into the chip that generates the display.

The program also checks for line feed and vertical tab (inverse line feed) characters. If either of these are printed they are doubled, so that print formatting using line feeds works properly. Delete characters are converted into double height Deletes.

Finally, the VDU 31,x,y sequence – which Basic uses for PRINT TAB(x,y) – is changed so that the y coordinate is doubled.

The effect of all this fiddling with the VDU drivers is that whereas normally you have a 20, 40 and 80 by 32 character screen, you now have a 20, 40 or 80 by 16 screen. In Modes 3 and 6, which are 25 lines high, you now have a

12½ line screen, the extra half line being at the top after the screen has scrolled.

The usual way of printing double height is to get the character definition to be printed, using OSWORD 10. This gives a pattern of eight bytes making up the character, as shown in Figure I, for the letter A.

Then redefine two convenient characters (using VDU 23) – say CHR\$(224) and CHR\$(225) – so that each of those characters contains half the definition as shown in Figure II.

Now to print A in double height you want CHR\$(224) on top of CHR\$(225). You get this by the VDU sequence:

```
VDU 225,bs,vt,224,lf
```

where bs is backspace, vt is vertical tab (cursor up one line) and lf is line feed (codes 8, 11 and 10 respectively).

The trouble with this method is that

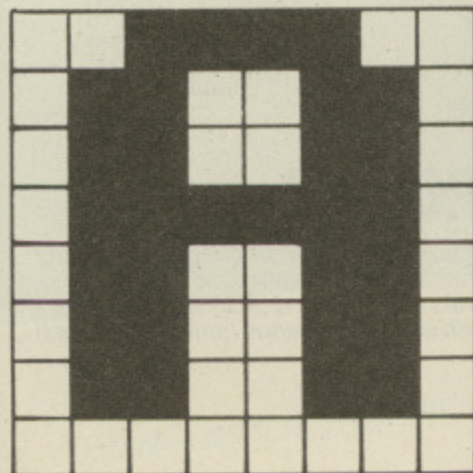


Figure I

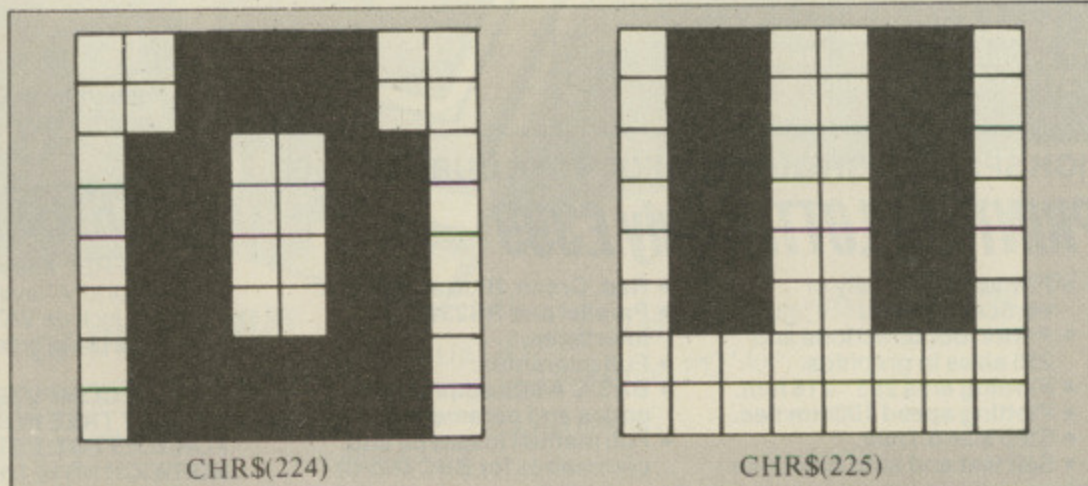


Figure II



## From Page 109

for each character printed a total of 25 calls to OSWRCH and one call to OSWORD have to be made. This makes it rather slow – or slower than you'd expect from a machine code program anyway.

To get round this, my program does a lot of work in advance. First it redefines the whole character set so that the codes 32-126 – the usual Ascii characters – become just the bottom half of the character, like CHR\$(225) in Figure II, and the same range plus 128 – that is, 160 to 254 – are defined to be the top half, like CHR\$(224).

This has the advantage of speed. You don't need to call OSWRCH 20 times and OSWORD once for each character printed. The disadvantages are that you lose 1½k of memory in the definitions. Also redefinable characters are no longer available.

The listing is commented well enough for those who want to find out exactly how it works, so I won't bore you with details here. A couple of general points

though. The program must go in the I/O processor even when a Tube is fitted. This is so that characters generated in the I/O processor, like the output of star commands and the characters echoed by the OSWORD 0 input routine, are printed in double height.

I've taken advantage of this fact by accessing things like VDU variables directly. This makes it faster and lets it fit in one page. At the moment the program goes in the serial input buffer at &A00, but could be moved somewhere else if necessary.

To use the routine, type it in (without the comments if you're sensible) and run it. The object code is saved automatically under the name X.DblHite. If you're using ADFS you'll have to make sure directory X exists.

It then redefines \*KEY9 to do a quick demo. Tape users will have to rewind the tape when the "Searching" message appears on the screen. After the demo has run you will see that you can use the machine exactly as before, except that everything is double height.

Before executing the object code for

the double height text, once Break has been pressed or the Micro has been turned on, you must increase PAGE by &600. This must be done to reserve space for the user-defined characters.

To do this type in:

```
PAGE=PAGE+&600
NEW
*RUN X.DblHite
```

Finally, a word about cursor editing when using the program. You can copy from the bottom half of the character, and usually it will be read correctly.

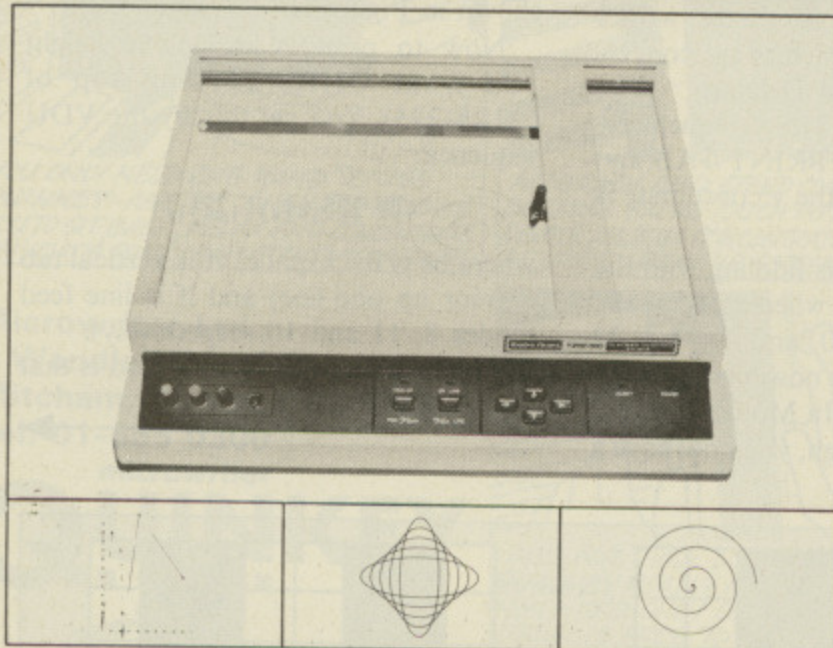
However some characters have identical lower halves and only one will be copied OK. A and H are examples. They both copy as A.

Don't try to copy from the upper half of the character or you'll get the code you want plus 128. This results in a tokenised Basic keyword being inserted into the line.

Michael Mitchell

**Full listing starts  
on Page 180**

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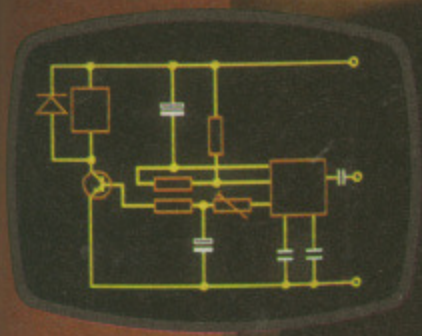
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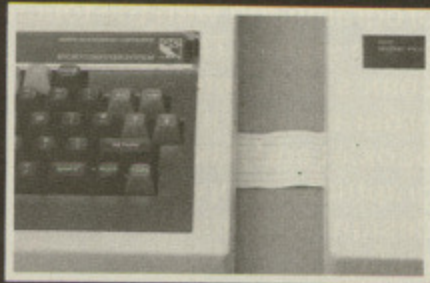


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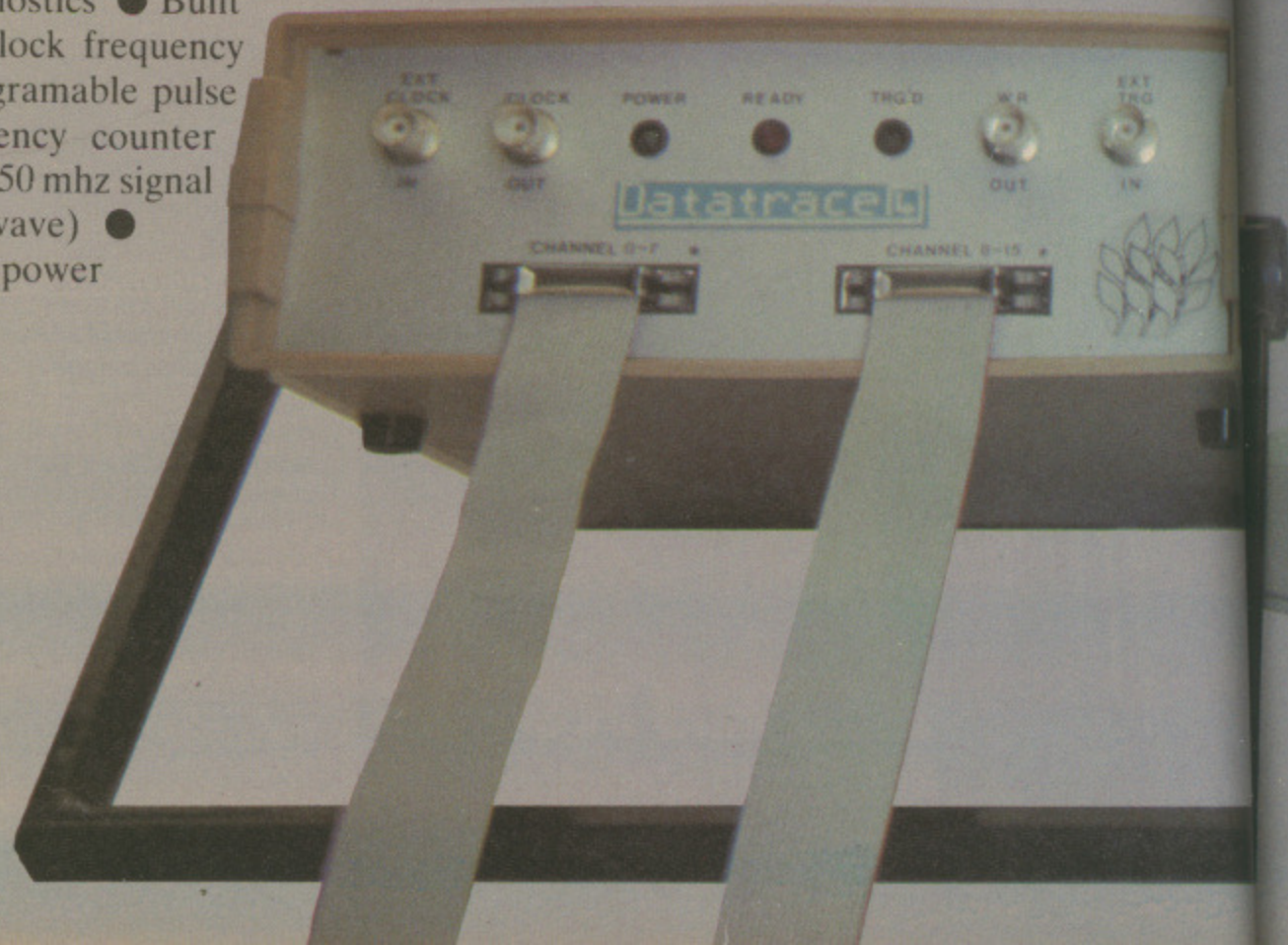


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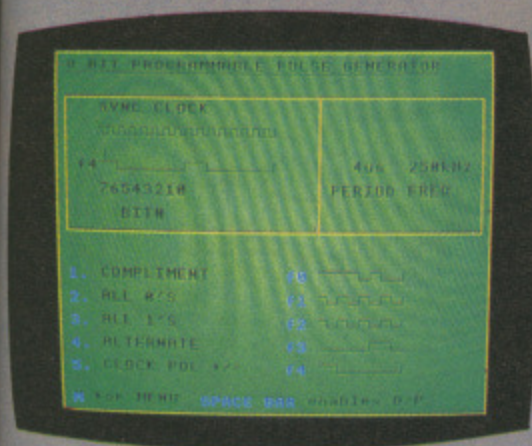
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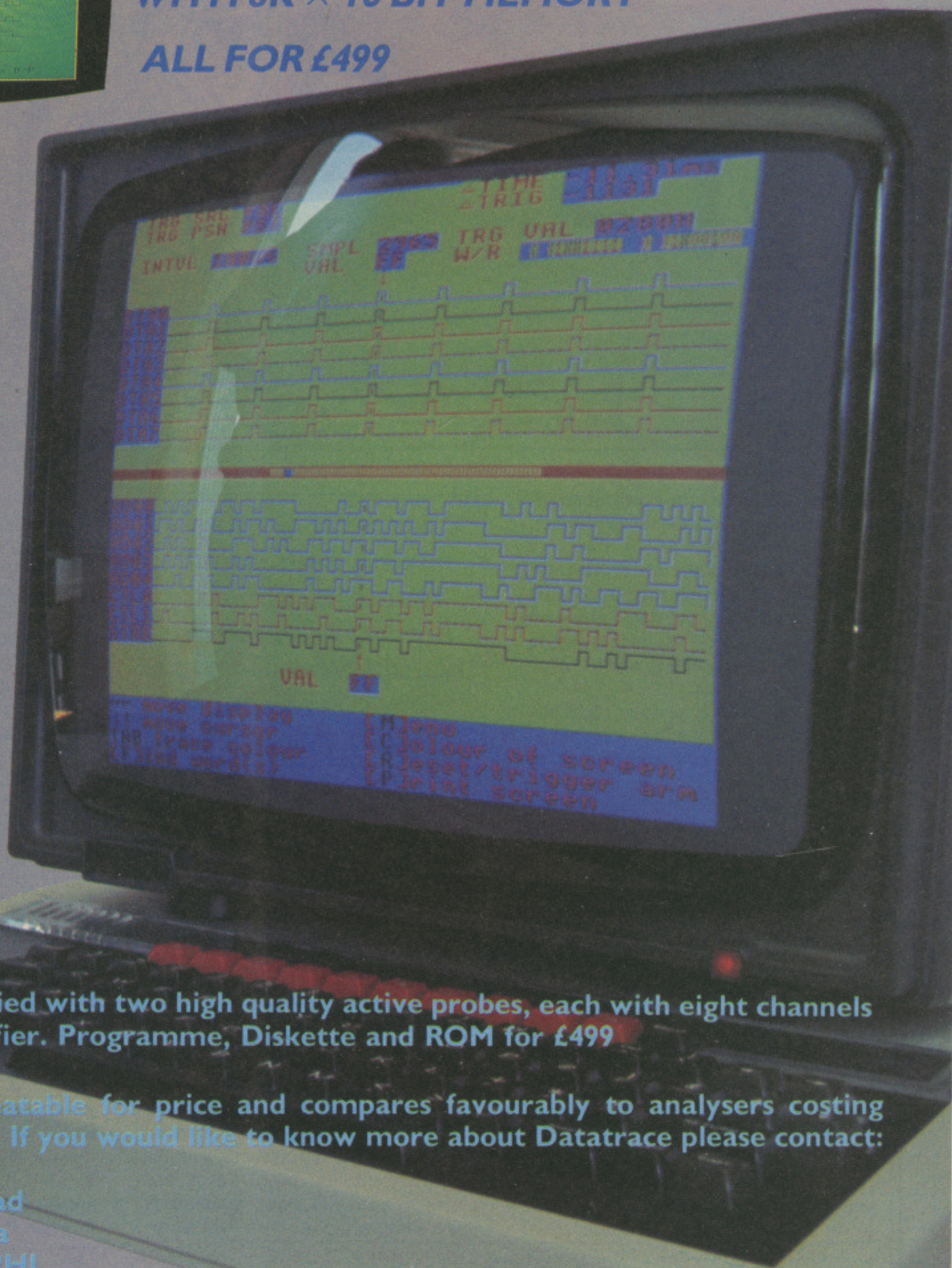
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STIMULATED by the excellent article on tiling home videos in the September, 1984 issue of *The Micro User*, we decided to extend the ideas presented there by simultaneously recording computer graphics and stereo music on to the video tape – the idea being to record computer graphics which “fit” in time with the music.

The end result is a video recording which gives you something original to watch as well as being able to listen to the music.

The only additional equipment required is a stereo system – which a large percentage of people will already have – and suitable connecting leads.

So far we have managed to create some fairly interesting results using electronic music, which seems to fit very well with computer graphics.

Using slow-moving graphics patterns for very slow pieces of music, flashing colours for more up-tempo music, and speeded-up flashing colours for fast music, the finished product can be quite impressive.

As the flash rate can be altered very accurately – from once every five seconds to fifty times a second – you can usually manage to get the graphics to fit almost any piece of music.

Using a very fast flash rate produces a strange effect with the colours which is

**Computer graphics swing with your favourite stereo music thanks to this up-beat program by JULIA and JULIAN AIZPURVS**

almost hypnotic as you watch it. Please note that this can be dangerous to epileptics!

Try watching the recordings in a darkened room with the brightness and colour turned up slightly on your TV.

These recordings could be useful at a party.

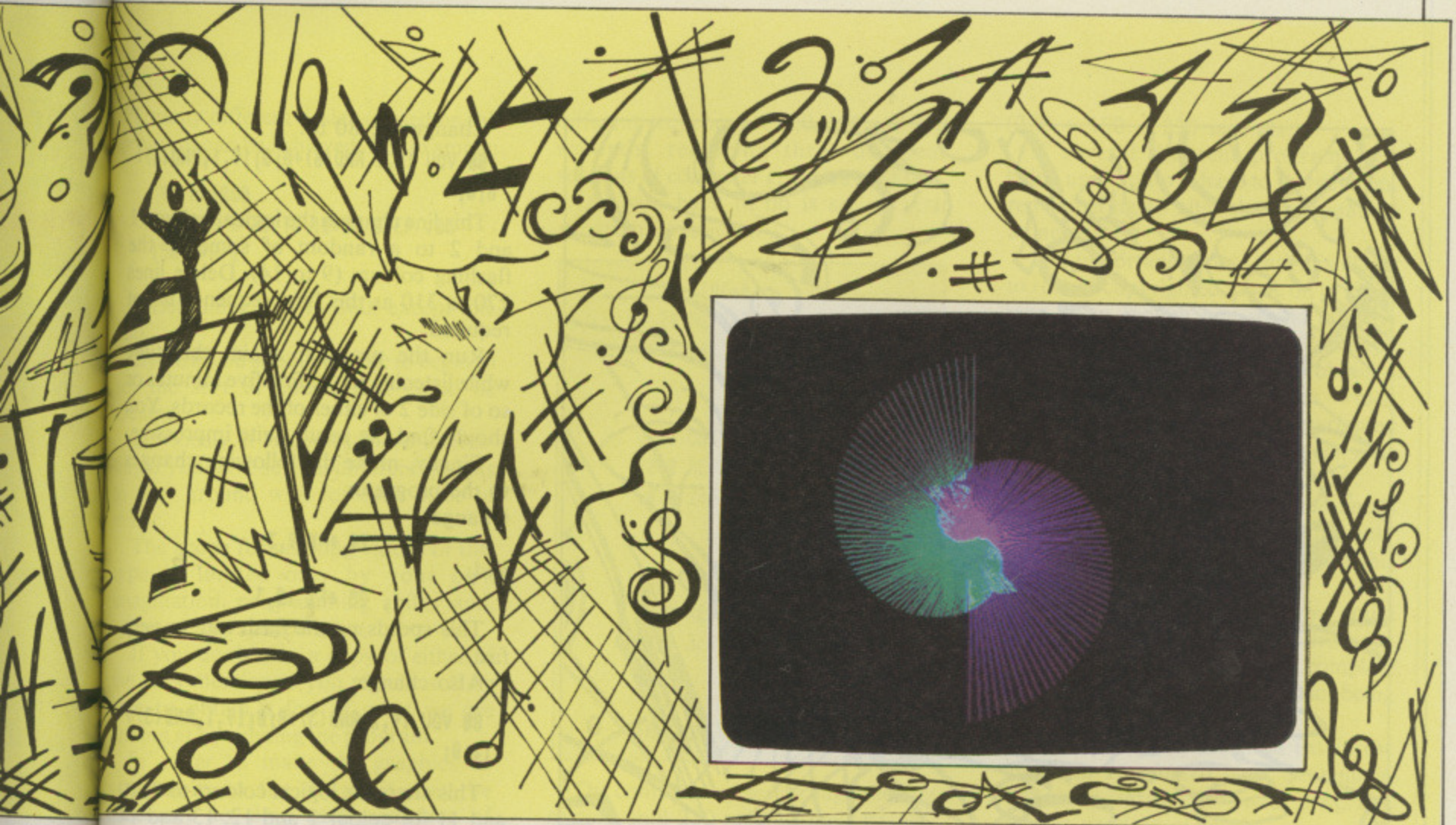
After creating a video recording with some suitable music and computer graphics, place the TV in a fairly high position in one corner of the room.

Play the video tape with the sound through your stereo system, and the lights in the room turned down, and hopefully you will have your party music along with your own light show.

Here's a step-by-step guide of how to go about it:

- First of all the modification to obtain colour from the video out socket on the computer will have to be made. This will differ depending on which issue of printed circuit board you have.
- Purchase the necessary connecting leads – computer to video recorder and amplifier to video recorder. These will vary in type depending on your video and amplifier. You may require non-standard leads which will have to be made up.
- Plug all units into the mains. Connect leads correctly (see Figure I).
- Switch video “source” button to “Aux” (this just means the video will accept its input from an alternative source, that is the computer, instead of the TV transmissions.)
- Load a program into the computer.
- Place a record on the turntable (assuming you wish to record sound from a record).
- Set amplifier source switch to the usual position for listening to a record.
- Switch all the units on – amplifier, video, TV and Turntable.
- Switch TV to the video channel. Place a blank tape in the video recorder.
- Type RUN on the computer but do not press Return.
- Press Pause and Record/Play on the video recorder (or whichever buttons are appropriate for recording on your





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- video, but pausing for a few seconds).
- Start the record playing the appropriate piece of music and *at the same time* press Play on the video (to start recording) and Return on the computer to start the program. (This is not as difficult as it sounds if you have a remote control unit for the video!)
  - When the desired piece of music has finished press Stop on the video recorder and rewind the tape. (You can now take the record off and stop the program running.)
  - Switch the amplifier source button to "Aux". Press Play on the video recorder. The program should appear on your TV and the sound should come through the loudspeakers of your stereo system.
  - If you turn the amplifier off the sound can still be heard through your TV.
  - If it has not worked as expected, go through the procedure again, checking each step very carefully.
  - If you don't have a stereo video recorder or if you find it too difficult to synchronise the music with the program, the following method is much easier:  
Record the program only on to the

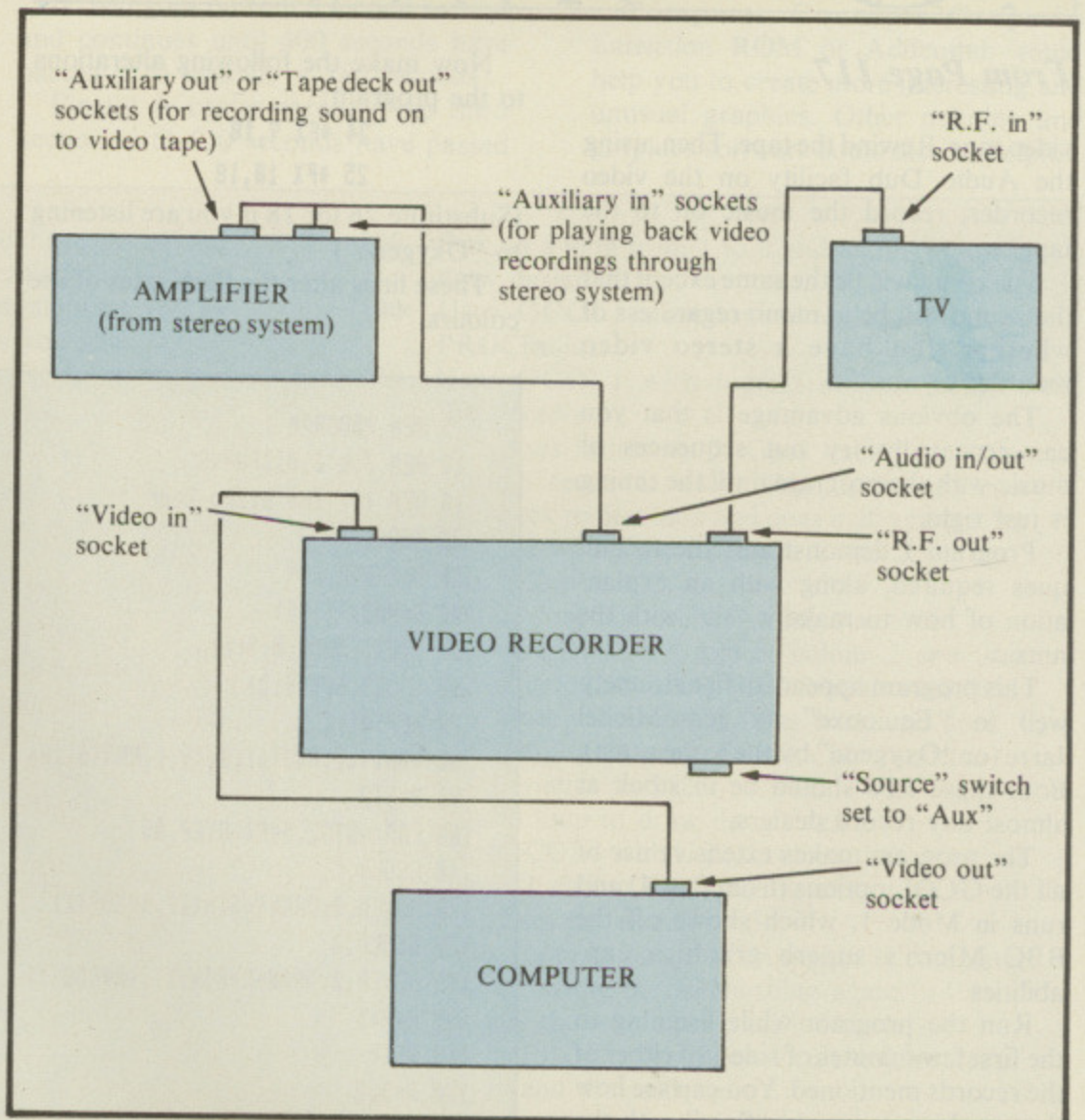


Figure 1: The set-up that enables you to simultaneously record computer output and music on to video tape





### From Page 117

video tape. Rewind the tape. Then, using the Audio Dub facility on the video recorder, record the music on to the tape.

The result will be the same except that the sound will be in mono regardless of whether you have a stereo video recorder or not.

The obvious advantage is that you can repeatedly try out sequences of music with the program until the timing is just right.

Program I demonstrates the techniques required, along with an explanation of how to make it "fit" with the music.

This program appears to fit extremely well to "Equinoxe" by Jean-Michel Jarre (or "Oxygene" by the same artist). Both these LPs should be in stock at almost any record dealers.

The program makes extensive use of all the GCOL options (from 0 to 4) and runs in Mode 1, which shows off the BBC Micro's superb graphics capabilities.

Run the program while listening to the first few minutes of side 1 of either of the records mentioned. You can see how the graphics appear to "flow" with the music.

Now make the following alterations to the program:

```
24 *FX 9,18
```

```
25 *FX 10,18
```

(Substitute 26 for 18 if you are listening to "Oxygene")

These lines alter the flash rates of the colours.

Change line 80 to:

```
80 VDU 19,2,RND(6)+8;0;19,1,RND(6)+8;0;
```

This line changes the logical colours 1 and 2 to a random of some of the flashing colours (9 to 14). Delete lines 270 to 310 as this final sequence is not required.

Run the program again, this time while listening to the first five minutes or so of side 2 of either of the records. You should find the result quite impressive.

Finally, make the following changes to the program:

Change:

```
24 *FX 9,3
```

and:

```
25 *FX 10,3
```

This speeds up the flash rate to very fast.

Also change:

```
80 VDU 19,2,RND(3)+8;0;19,1,RND(3)+11;0;
```

This alters the logical colours to 9, 10 and 11 for colour 2 and 12, 13 and 14 for colour 1.

About two-thirds of the way through side one of either of the records the music develops into a very fast rhythmic section. Listen to this section while running this version of the program.

Try experimenting further with the program. By changing the value of *R* to a larger number or by altering the step value, or altering the value multiplied by

```

5 REM PROGRAM I
10 REM J.& J.AIZPURVS
15 REM (C) The Micro User
20 MODE1
30 ONERROR RUN
40 D=RND(-TIME)
50 VDU23;8202;0;0;0;
60 VDU29,640;512;
70 REPEAT:CLS
80 VDU19,2,RND(6);0;19,1,RND(6);0;
90 R=512
100 FORX=0TO2.5*PI STEP.05
110 GCOL0,1
120 MOVE0,0:DRAWR*SIN(X),R*COS(X)
130 GCOL0,2
140 MOVE0,0:DRAW-R*SIN(X),-R*COS(X)
150 R=R-5
160 NEXT
170 R=512
180 FORG=1TO2:FORX=0TO2.5*PI STEP.0
190 GCOLG,1:PROCRADIUS(R)
200 GCOLG,2:PROCRADIUS(-R)
210 R=R-5:NEXT:NEXT
220 R=512
230 FORX=0TO2.5*PI STEP.05
240 GCOL3,2:PROCRADIUS(R)
250 GCOL3,1:PROCRADIUS(-R)
260 R=R-5:NEXT
270 R=512
280 FORX=0TO3.5*PI STEP.03
290 GCOL4,2:PROCRADIUS(R)
300 GCOL4,1:PROCRADIUS(-R)
310 R=R-5:NEXT
320 FORQ=1TO5000:NEXT
330 UNTIL FALSE
340 DEFPROCRADIUS(R)
350 MOVE0,0:DRAWR*COS(X),R*SIN(X)
360 ENDPROC

```

Program I



PI, many different designs based on this program can be achieved. For example:

```

90 R=1000
100 FOR X= 0 TO 10*PI STEP .05
150 R=R-2

```

Delete lines 170 to 360, except line 330.

By now you should be able to begin to see the sort of effects that could be created.

Obviously it becomes more interesting if you have several different designs to play around with for each piece of music.

The scope for creating videos of this type is limited only by your own imagination, programming ability and, as usual, the time it takes.

If you don't own a copy of either of the LPs mentioned you should still be able to obtain a feel of what we are aiming at by running the program.

In order to make the graphics fit accurately to the music it may be necessary to time each sequence of music first, then use the Basic variable TIME in your program.

For example, suppose a piece of music is 10 minutes 30 seconds long (630 seconds) and is made up of three

different sequences of 220, 180 and 230 seconds, requiring three different sections of computer graphics to fit to it.

All you have to do is set up your program as follows:

```

10 TIME=0
20 REPEAT
1000 1st section
.
.
2000 UNTIL TIME>=2200
2010 REPEAT
2020 2nd section
.
.
3000 UNTIL TIME>=4000
3010 REPEAT
3020 3rd section
.
.
4000 UNTIL TIME>=6300

```

The computer cycles through the first section until 220 seconds have passed.

It then goes on to the second section and continues until 400 seconds have passed (220 seconds + 180 seconds).

Finally it cycles through the third section until 630 seconds have passed

(220 + 180 + 230 seconds).

If several different programs are being used you will have to merge them, remembering to alter the line numbers as necessary.

It is important to note that it is illegal to record copyrighted music on to video tape (even though you would actually have to purchase the records initially).

However, I believe you can obtain a yearly licence for a small fee, which allows you to record most copyrighted music on to video tape of film *for your own personal use*.

You should in no circumstances attempt to sell, hire or publicly broadcast any video recordings of this nature.

For the more ambitious, you could try creating moving pictures, drawings and simulations or even a complete animated film with the music being generated by the computer.

You could also use titles (as in the article in *The Micro User*, September, 1984) to introduce each program, section or piece of music.

Computer Concepts Graphics Extension ROM or Addcomm could help you to create more interesting and unusual graphics. Other painting and graphics software could also be helpful.

- 30 Leave this line out until you have typed the program in correctly. By pressing the Escape key it will restart the program, allowing you to find a combination of colours you like.
- 40 Seeds the random number generator so that the same combination of colours will not appear each time you run the program.
- 50 Turns the cursor off.
- 60 Sets the graphics origin to the centre of the screen.
- 70 Starts the REPEAT . . . UNTIL loop, clearing the screen each time the loop restarts.
- 100 Sets up the loop for drawing the design.
- 110 Uses GCOL0 with logical colour 1.
- 80 Changes logical colours 1 and 2 to a random of 1 to 6.
- 90 Sets the initial length of the radius (R) of the design.
- 120 Moves to the centre and draws the first part of the design.
- 130 Uses GCOL0 with logical colour 2.
- 140 Moves to the centre of the screen and draws the second part of the design.
- 150 Decreases the radius by 5.
- 170 Resets radius to 512.

- 180 Sets up a loop from 1 to 2 and another loop to draw design.
- 190 Uses GCOL1 with logical colour 1. Calls PROCradius.
- 200 Uses GCOL1 with logical colour 2. Calls PROCradius.
- 210 Decreases radius by 5. Goes back and cycles through sequence until design is drawn, then goes back to first loop and does it all again using GCOL2 with logical colours 1 and 2.
- 220 Sets radius to 512.
- 230 Sets up loop for drawing design again.
- 240-250 Uses GCOL3 with logical colour 2 and then logical colour 1 calling PROCradius each time.
- 260 Decreases radius by 5. Goes back and does it again until next part of design is complete.
- 270 Resets radius to 512.
- 280 Sets up loop to draw design again.
- 290-300 Uses GCOL4 with logical colour 2 then logical colour 1 calling PROCradius each time.
- 310 Decreases the radius by 5.
- 320 Delay loop, to pause when design is complete, before starting the whole thing again.
- 330 Repeats the whole program indefinitely.
- 340-360 Define PROCradius. Moves cursor to centre of screen and draws design.

Description of Program I



NO doubt you will have seen the omnipresent clock while watching Breakfast Television. Wouldn't it be good if you also had such a clock while programming on your BBC Micro? It would be even better if it had an alarm.

I decided to develop such a program but immediately came across several problems.

- It would have to use interrupts.
- Which interrupt could I use?
- What to do in different screen modes?
- Where to put the clock?

I decided on a digital display in the top right-hand corner on a blue background. The clock would only be displayed in Mode 7 and not any other mode, as the program accesses the screen directly (for speed). It would, of course, continue to "tick" even when it is not displayed.

What is needed for this application is an interrupt generated once a second. Since with interrupts we are dealing with milliseconds we must also use a secondary counter (*count* in the program).

If an interrupt is generated 20 times a second, *count* must be loaded with 20,

**Locations in SHEILA associated with Timer 1**

- &FE64 - Timer1 counter (low byte).
- &FE65 - Timer1 counter (high byte).
- &FE66 - Timer1 latch (low byte).
- &FE67 - Timer1 latch (high byte).
- &FE6B - Auxiliary control register.
- &FE6D - Interrupt flag register.
- &FE6E - Interrupt enable register.

# Time you had an alarm clock on your micro

**RICHARD GRAVES** shows how to set it up

then decremented once every interrupt, and the clock updated when *count* reaches zero.

Many interrupts are placed at the user's disposal. One of the least publicised is that generated by Timer1 on Port B of the User VIA. This is a rather special interrupt as you can choose how often you want an interruption.

The value in the counter (&FE64,&FE65) is decremented every millionth of a second, and when it reaches zero an interrupt is generated.

Two things can happen then - either no further interrupts will occur (single interval mode) or the contents of the latch (&FE66,&FE67) will be loaded into the counter and the countdown will start again (free-running mode).

To select the first, Bit 6 of &FE6B must be set to 0 (AND &DF), else set to 1 (OR &40) for the second. In the clock program we obviously need free-running mode.

When you set the counter to a certain value it is also stored in the latch. The

value in the latch however can be altered later to change the frequency of the interrupt. Writing a value to the counter high byte (&FE65) will start the countdown.

Interrupts will only be generated if you have enabled them. This is done by writing &C0 to &FE6E (interrupt enable register). Writing &40 to &FE6E will disable Timer1 interrupts.

&FE6D (interrupt flag register) contains &C0 (bits 6 and 7 = 1) if Timer1 has caused an interrupt. It is necessary to check this if you are using other interrupts simultaneously.

In your interrupt routine you must also ensure that you have cleared &FE6D, or else the computer will literally get stuck. To do this simply write &C0 to &FE6D. However reading &FE64 or writing &FE65 will also do the job.

The contents of &206, &207 must point to your interrupt routine. This routine should, as usual, preserve all registers and return to the address previously held in &206, &207 - JMP

```

10 REM 24 Hour Clock
20 REM By R. Graves
30 REM (c) The Micro User
40 REM
50 *FX250,255
60 FORNZ=1TO2000:NEXT
70 zp=&F8
80 FORNZ=0 TO 2STEP2
90 PZ=&900
100 [OPTNZ
110 .enable_int
120 SEI:LDA&206:STAoldv:LDA&207:STAoldv+1
130 LDA#interrupt MOD256:STA&206:LDA#interrupt DIV256:STA&207:CLI
140 LDA&40:ORA&FE6B:STA&FE6B
150 LDA&C0:STA&FE6D:STA&FE6E
160 LDA#1:STAcount:LDA#0:STAmode7
170 LDA&26:STA&FE64:LDA&C3:STA&FE65:RTS
180 .disable_int

```

```

190 SEI:LDAoldv:STA&206:LDAoldv+1:STA&207
200 LDA&40:STA&FE6E:CLI:JMPexit
210
220 .interrupt
230 LDA&FC:PHA:TXA:PHA:TYA:PHA
240 LDA&40:AND&FE6D:BNEtimer1_interrupt:JMPexit
250 .timer1_interrupt
260 LDA&FE64
270 LDA&355:LDX&28A:CMP#7:BEQstore_mode:LDX#0
280 .store_mode STXmode7
290 LDA&28A:CMP#255:BEQdisable_int
300
310 DECcount:BEQprint_time:JMPexit
320 .print_time CLI:LDA#20:STAcount
330 LDA#0:STAaltemp
340 LDA&350:STAZp:LDA&351:STAZp+1:L
DY#39:LDX#12
350 LDY#39:LDX#12

```

```

360 LDAmode7:BNEdisplay:LDA#&C0:STAZp+1
370 .display LDAttab,X:STA(zp),Y:CHPaldat,X:BNEnext_display:INCaltemp
380 .next_display DEY:DEX:BPLdisplay
390 .update_time LDY#10
400 .increment_loop LDA#58:STAtemp:JSRchange:CMP#48:BNEcheck_hour
410 DEY:LDA#54:STAtemp:JSRchange:CMP#48:BNEcheck_hour
420 DEY:DEY:BNEincrement_loop
430 .check_hour LDY#3:LDAttab,Y:CMP#50:BNEcheck_alarm
440 LDAttab+1,Y:CMP#52:BNEcheck_alarm
450 LDA#48:STAttab,Y:STAttab+1,Y
460 .check_alarm LDAaltemp:CMP#13:BNEexit:JSRsound
470 .exit \end of interrupt routine
480 PLA:TAY:PLA:TAX:PLA:STA&FC:JMP

```



(OLDY) is used in the program.

When run the program will ask you for a time in hours, minutes and seconds. The clock works in 24 hour time, so for 10 past 7 in the evening you must type 19, 10, 0. You will then be asked for the alarm time - that is, when you want the alarm to sound. When the alarm does go off press Escape to stop it or it will continue indefinitely.

The machine code is about &16F bytes long. Changing P% in line 90 will allow you to place the code elsewhere. Probably the best place to store it is at &900 onwards, as long as you don't use this space for any other purpose or use file handling on the cassette filing system.

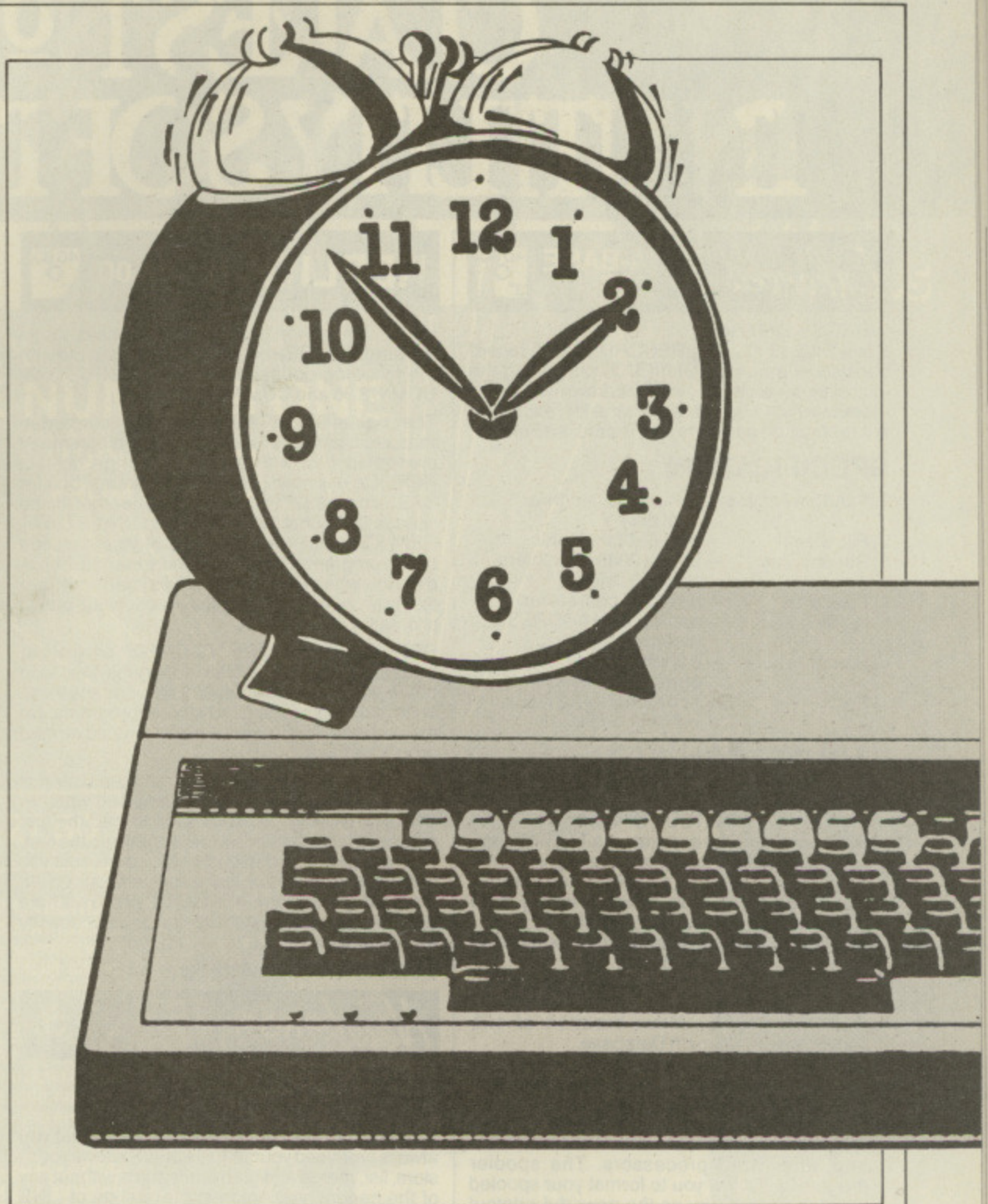
The program uses two consecutive bytes in zero page. These are selected by "zp" in line 70. One of the best places is at &F8, &F9, as these locations are not used by the operating system.

If you type \*FX 250,0 while the clock is running, it will stop being displayed. Typing \*FX 250,1 will turn the display back on. If you want to stop the clock completely use \*FX 250,255.

The clock uses interrupts generated 20 times a second. To work out the value to store in the counter you must take the time interval and multiply it by a million, in this case  $1/20 * 1000000 = 50000$ .

50000 in hex is &C350 so enter &50 into &FE64 and &C3 into &FE65. The largest interval you can have is just less than 1/15 of a second.

The VIA clock is not extremely accurate so it is best to lower the value stored in the counter slightly, especially if you are using a disc.



```

oldv)
490 .change LDAttab,Y:CLC:ADC#1:CM
temp:BNEP%+4:LDA#48:STAttab,Y:RTS
500 .sound LDA#89:JSRplay
510 LDA#101:JSRplay
520 LDA#117:JSRplay
530 LDA&FF:BPLsound:RTS
540 .play STAmusdat+4:LDX#musdat MO
D256:LDY#musdat DIV256:LDA#7:JSR&FFF1
:RTS
550 .oldv BRK:BRK \old contents of
(&206)
560 .mode7 BRK \If this contains 0,
do not display time
570 .count BRK \decremented 20 time
s a second
580 .altemp BRK \temporary alarm wo
rkspac
590 .temp BRK \temporary time works
pace
600 .ttab \data for time

```

```

610 JPX=PX+13:(OPTNX:.aldat \data f
or alarm time
620 JPX=PX+13:(OPTNX:.musdat \data
for alarm sound
630 JNEXT:PX=PX+8
640 FORNX=@T033
650 READttab?NX
660 NEXT
670 DATA132,157,131,48,48,58,48,48,
58,48,48,32,32,132,157,131,58,58,58,5
8,58,58,58,58,32,32,1,0,243,255,89,0,
3,0
680 MODE7
690 INPUT" Input Time in hours, minu
tes,seconds" 'HZ,MZ,SZ
700 PROCenter(HZ,ttab+3)
710 PROCenter(MZ,ttab+6)
720 PROCenter(SZ,ttab+9)
730 INPUT" Input alarm Time" 'HZ,MZ
,SZ
740 PROCenter(HZ,aldat+3):PROCenter

```

```


(MZ,aldat+6):PROCenter(SZ,aldat+9)
750 PRINT"" Press any key to start
clock...."
760 *FX15,1
770 A=GET
780 *FX250,1
790 CALLenable_int:CLS:END
800 DEFPROCenter(VX,AZ)
810 S$=STR$VX
820 IFLENS$=1 S$="0"+S$
830 ?AZ=ASCID$(S$,1,1)
840 AZ?1=ASCID$(S$,2,1)
850 ENDPROC

```

*This listing is included in this month's cassette tape offer. See order form on Page 205.*



# CLARES NO1 IN UTILITY SOFTWARE!

*Enhanced* BETA-BASE £25 

## WHAT IS A DATABASE?

It is a FILE containing RECORDS, each record consists of a number of FIELDS containing the information—an analogy can be drawn with a card index in which a box of cards is the file, each card is a record and each line on the card is a field.

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- 5) Holds—approx 1200 ADDRESS records per 100k.
- 6) Search—5 search fields using powerful options.
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- ★ SPOOLER—enables you to create spooled files that are compatible with Wordwise, View and other word processors. The spooler program will allow you to format your spooled file in the same way as the powerful printout option. You can therefore have headings, columns, titles, numbers etc.
- ★ INPUT—is a routine included on the disc which will allow you to write your own utilities for accessing your data. Many of the programs on the coming utilities disc were written using this procedure.
- ★ TUBE—compatible with the 6502 second processor.
- ★ Comprehensive manual and tutorial.

**Beta-Base Utilities disc** containing many advanced features such as full disc sort, AND/OR search on 10 fields, wildcards, mail merge + many other features.

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
"Beta-Base is a joy to use"

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REPLICA II £12.00 

In addition to working with the standard single density DFS's REPLICA II is now compatible with the following double density DFS: OPUS 3.45, UDM v. 2.00 and CUMANA QFS.

The original REPLICA set a very high standard so the specification that we set our chief programmer presented him with a real challenge. In fact REPLICA II is now 2 separate programs, one for DFS using the 8271 controller and the other for the various DDFS that fully implement OSWORD & 7F. REPLICA II will transfer many of your cassette based programs to disc, even more than REPLICA did. Now when you buy disc drives you do not have to throw away your expensive cassette based programs.

REPLICA II transfers 'LOCKED' programs, programs loading as files, programs that load below & EOO, those with up to 9 sections and those up to & 6E in length e.g. adventure programs. No more waiting for 6 minutes whilst your adventure programs load.

REPLICA II is very easy to use and the user just enters a name, how many sections and whether CHAIN, \*RUN or \*LOAD is used to load the first section. Press play and let the program do the rest, even a menu. Just think how much it will cost you to buy a disc version of your favourite program—it is probably more than REPLICA II, which will hold up to 16 programs, limited only by the disc capacity and catalogue.

STATE DFS & 40 or 80 tracks

*New!* PROFILE £12.00 

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Now you can start the procedure library that you always promised yourself. PROFILE allows you to store, list, merge and grab procedures without any of the headaches. Automatic alteration of LINE NUMBERS and resident variables such as TOP, LOMEM etc release you from the tedious chore of setting and resetting, checking and rechecking. PROFILE leaves you free to create your programs without disturbing your chain of thoughts.

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- ★ NESTED Procedures can also be grabbed automatically


A Procedure can be a FUNCTION, a BASIC program or part of it or a PROCEDURE.

With PROFILE you will quickly amass a wealth of procedures which will enable you to write programs quickly and easily. Simply write the controlling program containing the procedure calls and PROFILE will merge the procedures for you.

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*New!* BETA-ACCOUNTS INVOICE & DELIVERY NOTE MODULE £25.00 

This is the first module in an integrated accounting suite of programs written to be used and not simply to please an accountant. This module contains an INVOICE and DELIVERY NOTE program with 80 column input and screen editing, you see what will be printed before committing yourself. Account customer details are inserted automatically and delivery notes generated automatically when required. Customer details without account numbers can be automatically placed in a Beta-Base compatible file for use as a mailing list.

A sales ledger sheet is printed automatically when there is enough data to fill a page, alternatively the user can print the ledger sheet before a full page to suit his needs. VAT details are generated at the end of the VAT period and the year to date figures can be viewed at any time. Provision is made for multiple VAT rates including standard, zero, export and exempt.


A transaction file is generated for account customers for use with the STATEMENTS and ACCOUNTS RECEIVABLE module.

Future modules will be STATEMENT and ACCOUNTS RECEIVABLE, STOCK CONTROL, ACCOUNTS PAYABLE and NOMINAL LEDGER. All relative files are compatible with CLARES Beta-Base which can be used to manipulate the files as required. A Beta-Base Utilities Disc will soon be available and will provide Mail-Merge facilities and links into ULTRACALC plus many other features.

- ★ INTEGRATED ACCOUNTS and DATABASE
- ★ MULTIPLE VAT rates
- ★ SCREEN EDITING with insert & overwrite
- ★ AUTOMATIC DELIVERY NOTES
- ★ INVOICE COMMENTS
- ★ ACCOUNT HOLDERS details inserted automatically
- ★ MAILING LIST generated automatically
- ★ LEDGER SHEET printed automatically
- ★ VAT sales returns prepared
- ★ TRANSACTION FILE generated
- ★ Beta-Base compatible

This program was written for our own use and is used to prepare hundreds of invoices per week. It has no unnecessary questions or keys to press and extensive but easy edit options, we have made life as easy as possible for ourselves so why not take advantage of our efforts.

Requires double sided single or twin single sided drives for minimum configuration—no stock control or customer database. Double sided twin drives will enable a full integrated system to be used.

FUN HOUSE £10.00 

FUN HOUSE is a highly original suite of educational programs suitable for ages 3 to 13. The program is designed to encourage children to spell words which relate to objects found around the home. Animation and music are used to good effect and some highly original ideas are incorporated. Each room exercise is terminated with a warning item e.g. the lounge finishes with 'FIRE' which goes on to engulf the whole lounge. Tests with a newly hired 4 year old resulted in us having to prise him away from the keyboard after 2 hours. In that time he had gone from never having used a keyboard to finding the location of all the keys very quickly and entering the correct answer. He had thus started on the path to learning spelling and familiarised himself with the keyboard including the use of DELETE to correct his mistakes. Can you afford not to give your children the same start?

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NO EXTRAS! Please state 40 or 80 track disc  
and state which D.F.S. you use




# BROM

**21**  
EXTRA  
COMMANDS

**THE NUMBER ONE**

TOOLKIT ROM  
FROM CLARES

**BROM**  **£34.50**  **£27.50**

BROM is the first toolkit ROM to provide a FULL SCREEN EDITOR, which means that you can scroll your program up and down just like WORDWISE does with text, do not confuse this powerful editor with the line editor used in other toolkit ROMs. The EDITOR allows insertion and deletion of lines and insert and overwrite within a line. This is the editor that the BBC micro should have had.

Closely related to the EDITOR is the EXTENDED ERROR HANDLING which will trap errors in a program and enter the EDITOR at the line generating the error, not only that but it will also position the cursor as near to the statement causing the error as possible, no more wading through multi statement lines trying to identify the error.

Commands unique to BROM are:

ROMON & ROMOFF which enable you to turn on/off sideways ROMs so that they stay off even after CTRL/BREAK, very useful for avoiding clashes especially for users with second processors. This also works with the DFS and reverts to PAGE & EOO automatically.

CASE which forces input into upper or lower case irrespective of caps/shift lock.

FLIST which lists a program one statement to a line but more importantly it will even list 'BAD PROGRAMS.'

ONEKEY is a single key entry option but you can also define your own strings to any ASCII key, just like an extra 48 function keys.

Another group of commands provide FIND and selective or global SEARCH and REPLACE facilities. These commands work with strings and keywords or a mixture of both e.g. "FIND PROChelp T", will list the full line containing PROChelp, the 'T' simply tokenizes any keywords.

Yet another group of commands allow lines to be moved or copied to a new location.

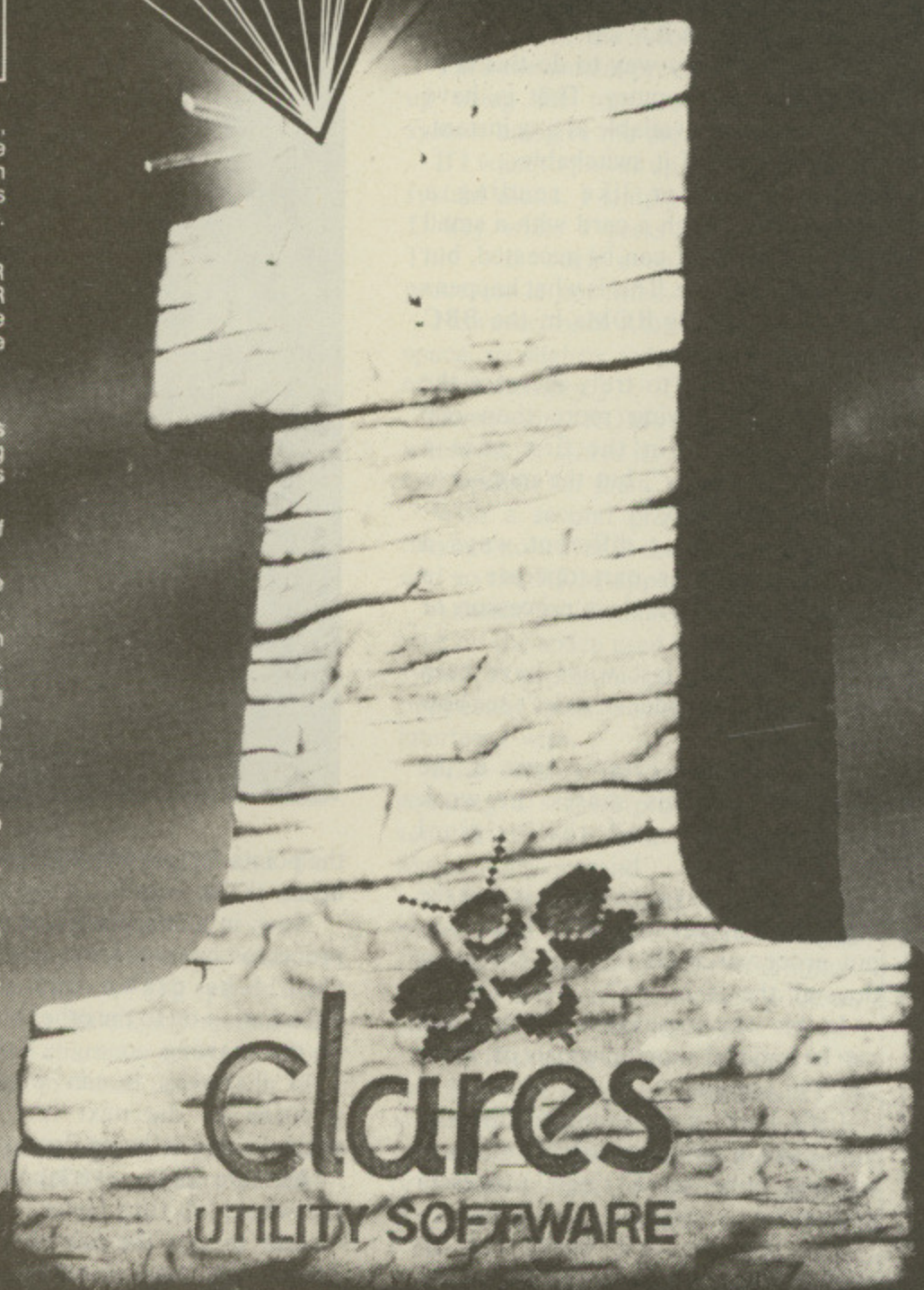
The other commands provide function key editor, 'BAD PROGRAM' cure, variable lister, integer variable flush, program compacter etc.

This is a genuinely useful ROM that no user should be without. Be warned, once used you will not be able to live without it!



"...this is the best On-Screen BASIC Editor I have ever used; it is far superior to BEEBUG softs Toolkit."

Viewfax Tubelink

The Brom disc is suitable for use with SOLIDISK SIDEWAYS RAM.



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UTILITY SOFTWARE

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UNLESS STATED ALL DISCS COMPATIBLE WITH ACORN, WATFORD 1.3, AMCOM, UDM 2.0, OPUS 3.45 AND CUMANA QFS. PLEASE RING FOR COMPATIBILITY WITH OTHER



**THE idea of a second processor is by no means new, but Acorn has done more than anybody to bring the concept to reality at an affordable price. Let's explore the increased power this brings and how you can benefit from it.**

When 8 bit microprocessors were first introduced, the addressing range of 64k seemed so huge that many people thought it was a little over the top.

Those were the days when mini computers like the PDP8 ran quite happily on 8k of memory.

It took 512 chips to make up 64k of memory and the power supply requirements made it very difficult to get that many chips working on one system.

As time passed it became possible to fill up the 64k of address space, but only on the more expensive machines.

Nowadays most microcomputers have the 64k of memory space full and the designers are scratching around for tricks to increase it.

In fact the only way to do this is to "bank switch" memory. That is, have 64k of memory available at any instant, but make part of it switchable.

This is rather like reading a newspaper through a card with a small hole. All the print can be accessed, but only a bit at a time. This is what happens with the sideways ROMs in the BBC computer.

The only way to truly increase the power is by having more than one microprocessor, in the first case a "second processor", but the number is not limited to two.

There are three different ways a second processor can operate — a master processor, a slave processor, or a co-processor.

The first and last ways have been converted into products, so let's see how they work.

The only co-processor type is the Acorn 6502. This shares the work between itself and the original processor.

The way the system works is that the original computer acts as an input/output processor while the new processor does all the "thinking".

In this way some parts of a program can be handled simultaneously or, as we say, "in parallel".

Let's look at an example. Suppose you have a program which draws a rotating cube on a single processor system.

The program first works out the position of a line to draw and then draws the line by calculating the position of all

## MIKE COOK says

# Think...



the points on that line and lighting them up on the screen.

Now, in a two-processor set-up, one processor can work out where the line should be drawn and pass that information on to the other processor to do the drawing.

In that way it can work out the position of the next line while the previous one is being drawn.

As there is some overlapping of tasks, the whole job runs faster.

Add to this the fact that the 6502 second processor itself is working at 3MHz as opposed to the BBC's speed of

2MHz and you will see there is going to be a speed-up even if little of this parallel sharing, as it's known, takes place.

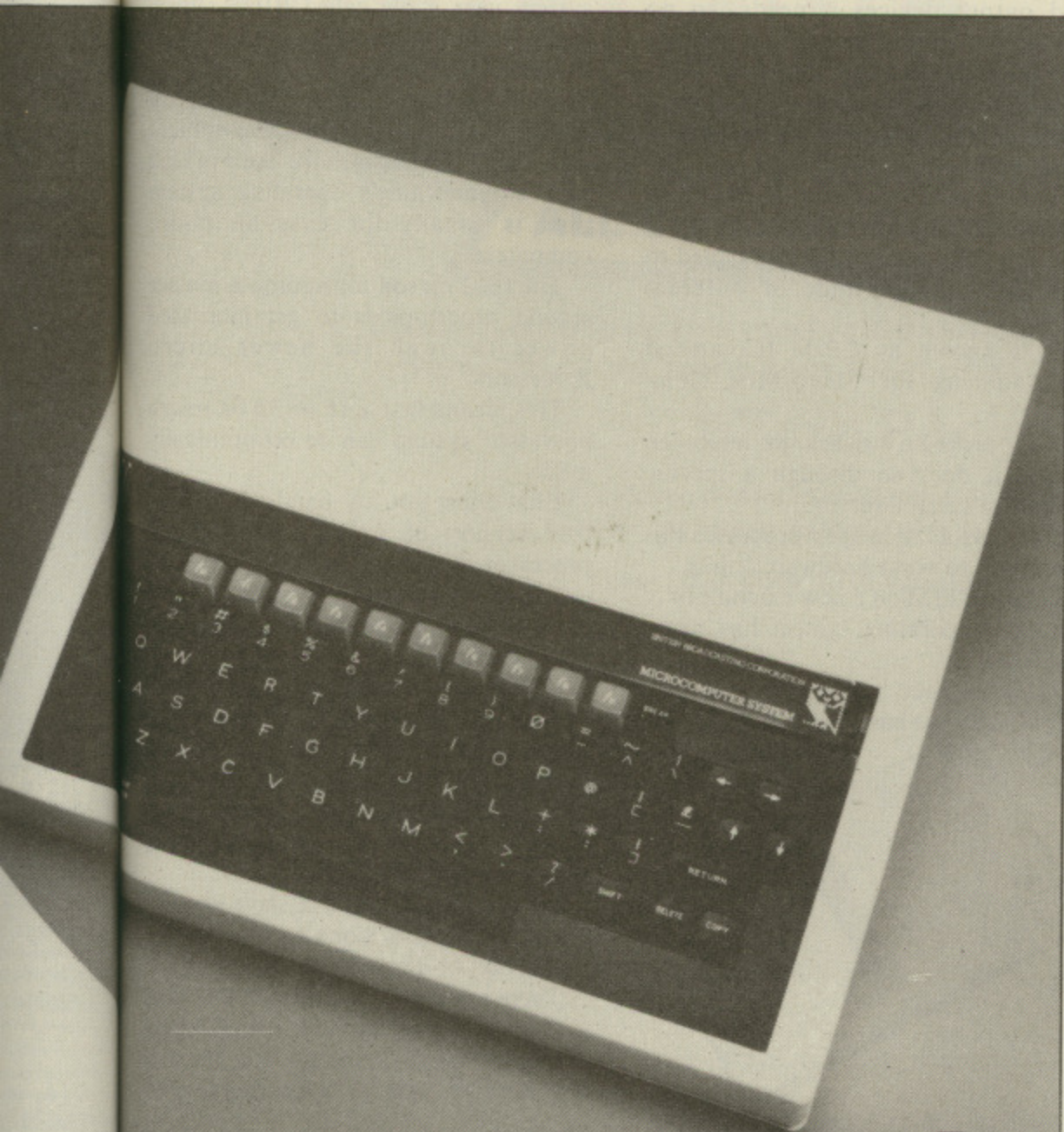
When you add the 6502 second processor, you gain quite a bit of extra speed — up to 50 per cent more.

However, that's not all you gain. As each processor can address 64k of memory, you now have a system with 128k plus any extra from sideways ROMs.

Of course you can't use all of that for Basic programs, but you do have more room to move.

Using one processor, memory space





# ...second processor!

...going to must be allocated to the operating system, the input/output devices, the screen display and your program.

...2 second But with a second processor, one looks after the language and the other looks after the input/output and display.

...gain. As Therefore there is more room for your programs.

...s 64k of The 6502 second processor sets the PAGE variable which determines the start of your program at &800 and the HIMEM variable that determines the end of your program at &B800, thus giving you 44k of programming space.

...ry space The rest of the memory (20k) is used

to hold the Basic language and the routines needed to communicate with the input/output processor.

As your original computer now copes only with the display, filing system and input/outputs, a little slack memory is left over so the character set is exploded allowing you to "user define" all the characters.

This set-up is especially good when you need to write a program with large arrays.

I found it invaluable when I wrote Mornington Crescent (for the April 1985 issue of *The Micro User*).

Although the game was designed to be run on a single BBC computer system, it took five programs to generate and edit the linked database, and most of those would only run with the extra room the second processor gave me.

It also allowed me to work with a Mode 0 display without losing any memory.

There is a price to pay for all this, besides counting the money. This lies in the ability to use some commercial software, mostly in sideways ROMs.

There is a lot of misconception surrounding this. Some people think you lose all sideways ROMs including disc filing systems.

In my set-up I run a Watford DFS, but in order for the second processor to run, the Acorn DNFS must be fitted.

I simply have the two systems fitted, making sure that the Watford system is to the right of the Acorn system.

Then the second processor will power up using the routines in the Acorn system but give me the Watford DFS.

If I want to power up using the Acorn system alone, I simply hold down the D key while I press Control+Break. This will work even if the second processor is not fitted.

However, both ROMs take up work space, so slightly reducing the amount of free memory.

Some utility ROMs think they know where Basic stores its integer variables and operate on them.

With a second processor attached, they are now over in the other processor and so the ROM appears not to work.

Another problem is that some ROMs take up the space used by the operating system to communicate with the second processor and so their action is interfered with.

This is due to software houses equating a second processor with the second coming and building their foundations on sand.

Far be it from me to say they were greedy and ignorant – let he who is without indirection cast the first stone.

Which brings me to the next point of incompatibility – indirection.

This is the use of the operators ? , ! and \$ (before a variable, not after it). It is still possible to use these operators to operate on data structures on the second processor. In fact you can construct a very rich set of data structures using this.

However, in a lot of programs



## From Page 125

(especially my Body Build ones) these are used directly to access the input/output devices.

These need to be changed to OSBYTE calls which write to the input/output processor.

In some cases, however, it is not as simple as this.

Suppose you have an interrupt driven task like my Real Time clock (*Micro User*, February, 1984). This generates an interrupt every half second to update a time display on the screen.

If you simply run this program on a second processor, the interrupt service routine code will be in the second processor.

It needs to be moved across into the input/output processor before it can run.

This is because all interrupts are handled by this processor and not the "thinking one".

Fortunately there is a simple answer to all this incompatibility. It's an OFF switch on the second processor.

When it is off, it pretends that it is not even connected so everything that used to work still works.

So, using the 6502 second processor requires you to think a little more deeply about what-is-happening-where when controlling the inputs and outputs.

If you're a pure Basic programmer, you just forget about it and everything works as before but faster and with more room. The co-processor shares the work.

Now with a master second processor things are quite different. Your machine takes on a Jekyll and Hyde personality.

These are normally processors of a different type to the 6502 found in the BBC computer.

A typical one is the Acorn Z80. What this does is allow you to have the capability of running other software at a reduced cost.

You see, you already have half the computer system in your original system, so this need not be duplicated.

This approach will only work if the other software can be tricked into sharing its input/output tasks with another processor.

Many people have asked if they can use their Spectrum or Dragon as a second processor. This is not only impossible, but quite pointless.

These systems were designed to run on a single processor and cannot be made to separate their tasks.

The code operates directly on the hardware which contains all the input

and output devices it needs, so no advantage will be gained from running two machines like this together.

It is possible to write routines to swap files, but this is best done through a serial port.

The reason why the Acorn Z80 system can operate other software is that the software has been designed to run under a multitude of different systems.

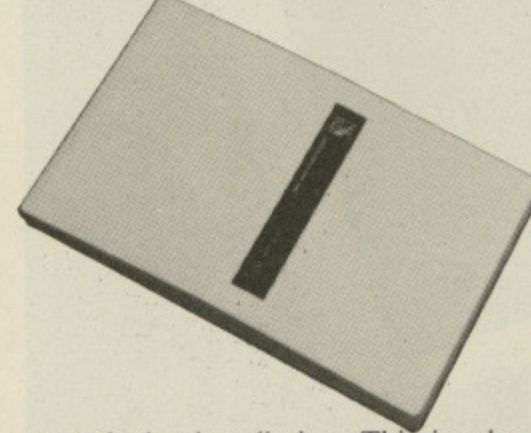
It is known as CP/M (Command Programming for Micro/Mini Computers).

If a program wishes to make an output it does so through a specific operating system vector.

Each installation then processes this according to what hardware it has.

To run CP/M on a new machine only the basic operating system has to be changed.

What in fact happens is that new CP/M software has to be configured for



a particular installation. This involves changing control codes and disc formats, among other things.

This process is, however, semi-automatic, so the person doing the configuration need have no actual knowledge of the code being translated.

This is why there is such a lot of software available for this system and why it is a sensible way of operating a second processor.

The Acorn Z80 system, by the way, needs twin double-sided 80-track drives to work, a fact not emphasised in the advertising.

This "universal" approach can also be found now on the 6502 second processor with the introduction of the UCSD P system.

In the P system all programs are compiled down to a pseudo code called P code. This is like machine language but is not specific to any machine.

When the program is run, an interpreter turns the P code into instructions. Therefore, on each new processor, only the P interpreter has to be rewritten.

This is relatively straightforward. To handle different hardware, the P

system uses a file called BIOS (Basic Input Output System). This handles all character translation.

This system is fast growing in popularity, but program development under the P system is more like working with a mainframe's operating system than is usually the case on micro computers.

The final reason for adding a master second processor is to get increased power through the newer micro processors.

This means that a 16 or 32 bit micro processor system can be economically made.

I have just got my hands on a field trial version of Acorn's new 32 bit processor, but more of that later.

With a bigger processor you can have more memory space than the 64k of the 8 bit machines.

In fact we are at the stage where the addressing space of a 16 bit processor seems so large it is a little silly. For example, 24Mbytes is a common value.

Most machines make do with about 1mbyte, with Acorn's large business system handling 4Mbytes.

Finally you can add a slave second processor. This is done to handle one particular job and report back.

There are many examples of this that you might not have noticed. For example, most printers are micro-processor systems, as is Acorn's speech chip.

The Pluto graphics board from Io Research has a processor just to look after the drawing of graphics.

I have connected one of these to the 1MHz bus and written a routine to pass the graphics commands directly to it.

This speeds up large graphics programs and also frees some memory.

When my 6502 second processor system is attached, I have in effect a three processor system - four or five if you count the speech chip and the printer.

There is scope for adding many more slave processors for doing jobs like signal processing and communications.

One of the reasons I first became involved with the BBC Micro was the way it could be expanded.

A second processor is certainly one of the better ways to expand your computer's power.

But remember that with this increased power comes the added responsibility of looking after it.

Once you have used a second processor system, you will never want to be without it, even if it is switched off for some of the time.



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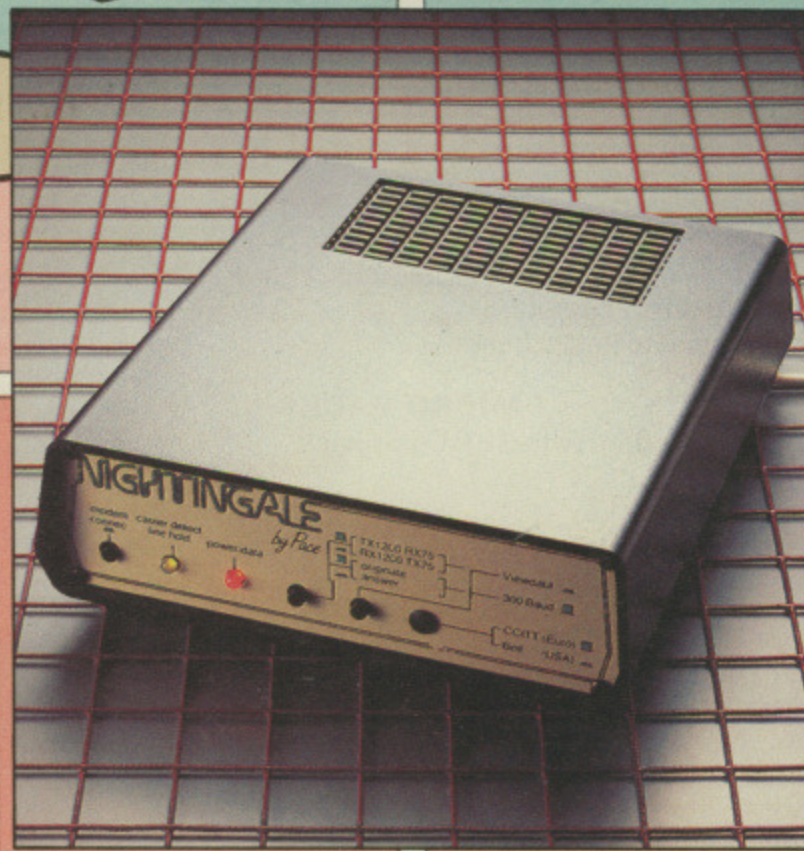
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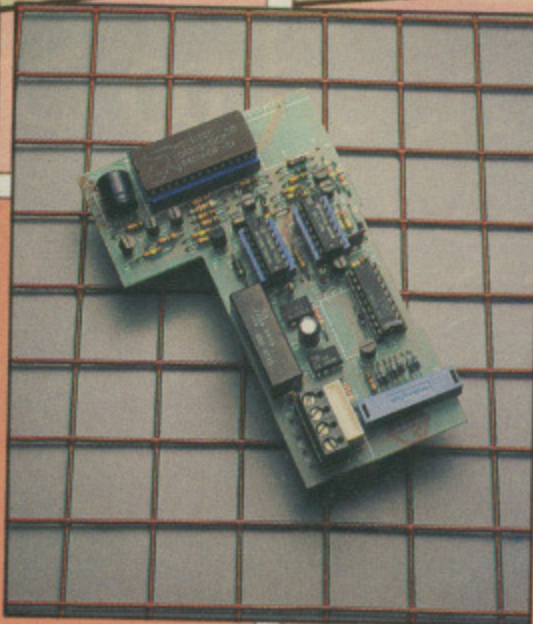


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# 16k EPROM

**\*HEX**, Is a full HEX dump, displaying 8 bytes of HEX and ASCII equivalent per line. A status line shows the current address and the byte at this address in: HEX, ASCII, Decimal and either the binary, basic token or assembler mnemonic. Forward and reverse scrolling of the display at normal and

high speeds is a feature, as is a full on screen memory editing facility which allows inputs in either hexadecimal, ASCII characters or assembler mnemonics.

**\*MON**, Serves the same function as \*HEX, but the display is in disassembled opcodes, rather than \*HEX. The editing and scrolling facilities are the same as for \*HEX. An additional feature of \*MON is the ability to directly follow JSR's, branch's etc.

**\*DEBUG**, A full featured program debugging aid, allowing the programmer to see the most intimate details of the program under examination. Features, variable speed, single stepping, breakpoints, continuously updated disassembler, selective HEX dumps (up to 6) plus current stack, all continuously displayed on screen, plus many other features.

**\*DISCED**, A comprehensive disc sector editor enabling any sector of a disc to be read, inspected, edited and written back. It will work with any 40, 80 or dual formatted single density disc.

**\*DGET**, Searches a disc for all occurrences of a string or group of bytes.

**\*REL**, Enables machine code to be easily moved around in memory, automatically adjusting JSR's, JMP's etc.

**\*SLOW**, This command causes the entire computer to slow down to any variable speed between 1 and 255. This can allow the in depth study of graphic's methods etc.

**\*EDIT**, A dynamic basic screen editor, cursor controlled with full forward/reverse scrolling of listing, incorporating insert/delete lines, insert/overwrite characters, enter line from any position after editing.

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**\*REF**, Produces a cross-reference listing of the current basic program. All variable names are listed (WITHOUT HAVING TO RUN THE PROGRAM!) in alphabetical order followed by the line numbers on which they are referenced. Numeric items can also be crossed referenced if desired.

**\*SORT**, A built in sort routine allowing any single dimension array, be it integer, real or string, to be sorted.

**BASIC COMMAND LIST:**  
\*PROG, \*BAD, \*EXTEND,  
\*PACK, \*SORT, \*PAGE,  
\*ENVELOPE, \*FIND,  
\*REPLACE, \*XREF,  
\*TRON, \*TROFF, \*CHAR,  
\*EDIT, \*EDKEY.

**MACHINE CODE  
COMMAND LIST:**  
\*MCODE, \*MOVE,  
\*CROM, \*SLOW, \*GET,  
\*PHEX, \*GO, \*MON,  
\*HEX, \*SPACE, \*DGET,  
\*DISCED, \*DIS, \*DEBUG,  
\*CRC, \*REL.

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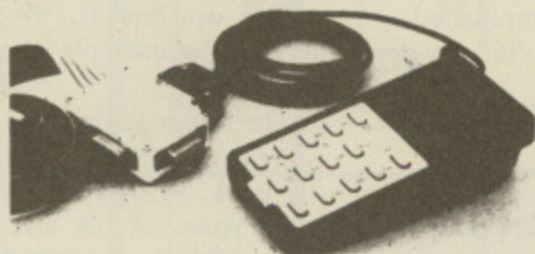
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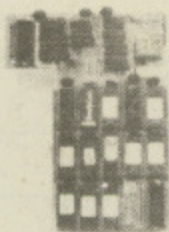
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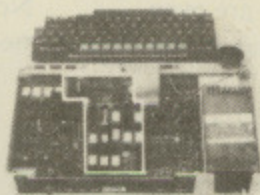


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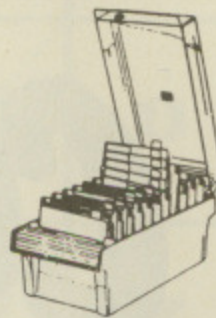
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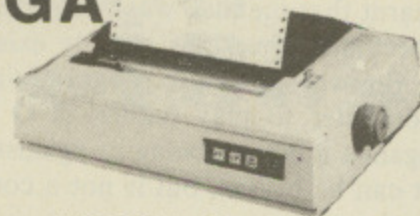
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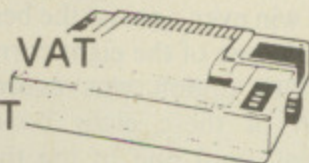
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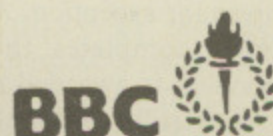
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## You've seen Star Trek's 3D chess, now try this earthbound version of noughts and crosses . . .

EVERYONE knows the conventional game of Noughts and Crosses. This is where a O or a X is placed by alternate players in a 3 x 3 grid, the winner being the first player to complete a straight line of three.

Most people also know that it is possible to secure at least a draw either as first or second player, although the first player has a definite advantage.

In this game, O is always the first player and X always second.

We thought it would be interesting to produce a three dimensional version using a cube of 27 boxes (3 x 3 x 3). Having written most of the program, we learnt that the idea was not original, as mechanical versions already exist.

So we set about programming the computer to play (either as O or X) against a human being or against itself. It can be beaten, but is not a complete pushover.

When this idea had been developed it was quickly found that O could hardly fail to win if he immediately took position in the central box. An option was therefore introduced to overcome this by making this central box illegal.

However O by correct play would still win even against the best defence by taking one of the eight corner boxes. So a third option was evolved whereby each of these eight boxes was also illegal, until one of the three adjacent edge boxes was occupied, either by the player wanting the corner or the opponent.

The three options can be selected as skill levels E, M or D (easy, moderate or difficult).

The obvious game to play is where the first to make a straight line wins, and that is indeed the only possibility in the original two dimensional game on nine squares. So games 1 and 2 (in two and three dimensions respectively) are won by achievement of a straight line, in any direction.

To add interest, game 3 was introduced (3D only, of course), in which the winner is the first to complete two straight lines.

For the tacticians we then devised game 4. It is identical to game 3 with one important exception. As soon as either player completes the first line, the opponent is awarded an extra turn.

The trick, of course, is to delay finishing a line until you have at least a

# COMPOX

second lined up and your opponent has none which you can't block.

If you have perhaps hitherto had difficulty in beating the computer this is where you have your best chance. The programming got rather complicated, and ended up less cunning than we would have liked.

Game 5 is for the masochist. You

**By PAMELA and  
DENIS SMITH**

simply go on until every box is filled, the winner being the one with the most lines.

Except in game 1, all skill levels are allowed, which gives 13 different versions to choose from. There are even more if you count the handicapping described below.

*It may be worth mentioning a few*

*pitfalls for the unwary:*

If your name is Charlie, Chris or Camilla, don't type in just your initial. If you do the computer will think you mean him, and play the game for you.

The options E, M or D can be different for each player within the same game.

The boxes are in three planes – white is the nearest, then green, then yellow at the back. Within each plane there are three rows, A, B and C, and three columns 1, 2 and 3.

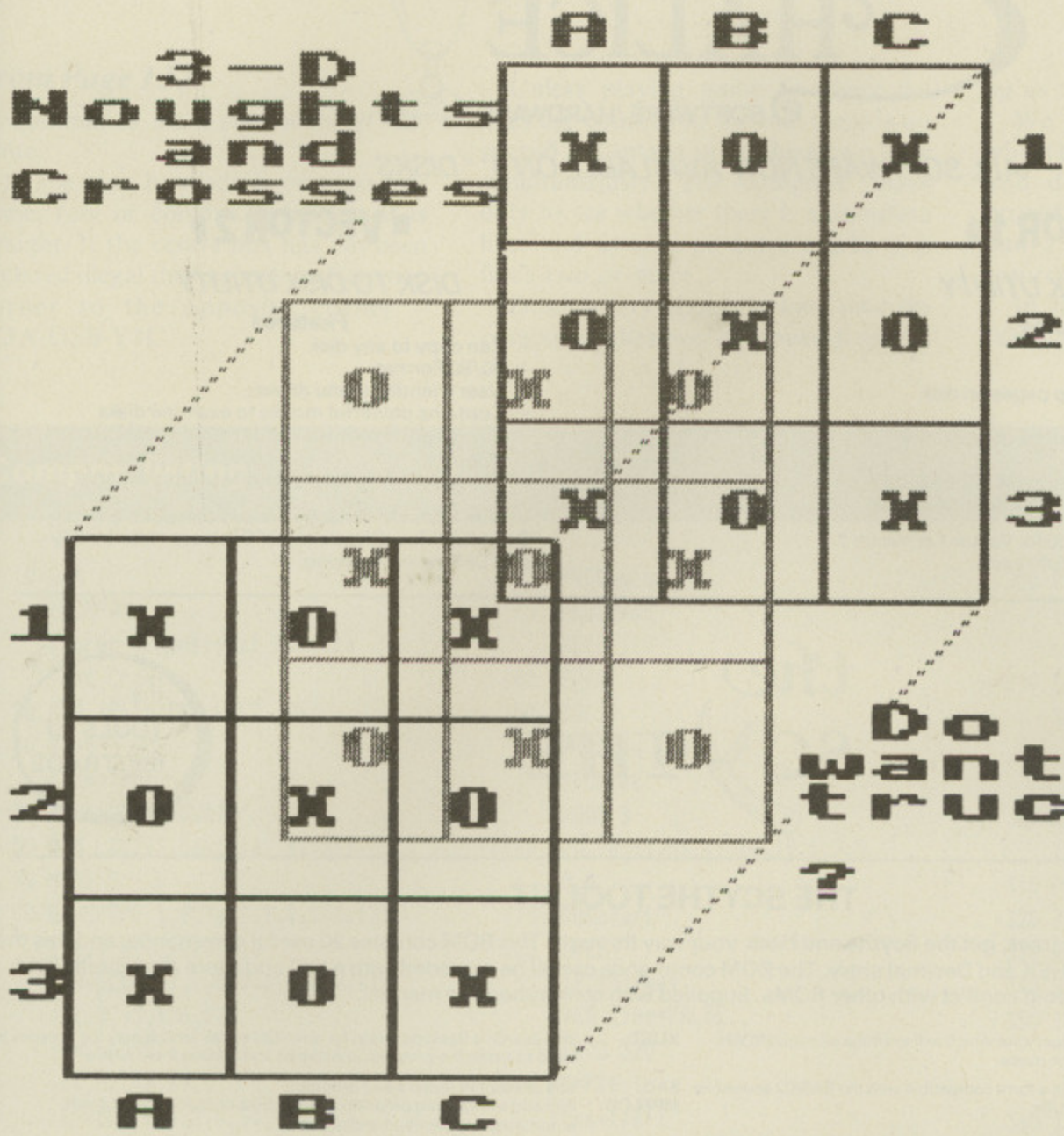
To move to a certain box, the computer understands only these commands – initial of colour, column, row. For example box 'Y3A' is at the bottom left corner of the rearmost plane (yellow).

Note that the format is the same in game 1. Although it is on one plane only.

### VARIABLES

<b>FNV(B%)</b>	Assigns a value to each box according to its location, and whether it has a O, an X or is empty.	<b>H%</b>	Number of possible boxes, 9 or 27.
<b>test%(B)</b>	Used to test characters typed in for moves.	<b>status</b>	Used by PROChowmany to see if game finished. Depends on game option and lines completed so far.
<b>L%(B%)</b>	Value given permanently by FNV(B%), to each box.	<b>line</b>	True if a full line (as tested by PROCtry) exists.
<b>A%(B%)</b>	Temporary value used by PROCbeebgo.	<b>G%</b>	The box being tested by PROCbeebgo.
<b>law</b>	Is true or false according to legality of proposed move.	<b>d%, e%</b>	Adjacent boxes examined by PROCbeebgo and PROCtry.
<b>loc%</b>	The current box.	<b>s%</b>	Box number given by PROCcalc
<b>CH%</b>	Either X or O, to be printed.	<b>game</b>	1 to 5 as chosen.
<b>t%</b>	Colour of CH%	<b>end</b>	True or false as decided by PROChowmany.
<b>@\$</b>	Gives full instructions if asked.	<b>n1\$, n2\$</b>	Names of players, 'C' if the computer is playing.
<b>P%</b>	Player 0 or 1.		
<b>tns</b>	Total number of boxes occupied.		





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want  
instructions  
?**

### PROCEDURES

<b>PROtable</b>	Draws a grid of 9 squares.	<b>PROCvalid</b>	Assisted by PROCinvalid, checks that only correct letters and numbers are submitted for moves. It also converts any lower case character to upper.	<b>PROCdraw</b>	Prints "draw" if the cube is complete without anyone getting a line.
<b>PROCchair</b>	Draws diagonals to connect three 3x3 grids to form the cube.	<b>PROCcalc</b>	Converts the string input to the appropriate box number before FNV.	<b>PROCwin</b> <b>PROCfivend</b>	Shows the winner. Counts up the lines for each player. (Only for game 5.)
<b>PROCsay</b>	Writes messages outside the text window - say, top left.	<b>PROClegal</b>	Checks that the chosen box is both legal and vacant.	<i>The following are called only when the computer is playing:</i>	
<b>PROCshow</b>	Deletes existing CH% and draws new.	<b>PROCtune2 etc.</b>	Makes various noises.	<b>PROCbeebgo</b>	Looks at each box and considers the prospect of each adjacent box being filled with O or X.
<b>PROCinstruct</b>	Does so if required by...	<b>PROCtry</b>	Tests for a straight line of three similar characters.	<b>PROCaward</b>	Gives marks for finishing line, blocking opponent, etc, according to level of game.
<b>PROCquery</b> <b>PROCdemo</b>	PROCquery... Prints an O and an X to show how to give the right commands.	<b>PROCrow</b>	Draws a dotted line where found by PROCtry.	<b>PROCbestmove</b>	Looks at marks awarded to each box, and makes the best move.
<b>PROCwho</b>	Asks whether the player is the computer or a HB. If the latter, your name!	<b>PROCchowmany</b>	Decides if sufficient lines are complete for game to end.		
<b>PROCask</b>	Determines skill levels E, M or D, and game option (1 to 5).				
<b>PROCstart</b>	Redraws cube and resets variables.				



# HALICE

SOFTWARE/HARDWARE



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#### Features

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- + 40/80 Format
- + User friendly, menu driven
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<b>MEDIT:</b>	Memory editor with hex/ascii display. Up/Down scrolling with paged ROM/RAM access. Will work in any 40 or 80 column mode.	<b>MRELOC:</b>	Will add a relocating program to a machine code file so that it will automatically download and run.
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<b>BASE:</b>	Will accept a number and display its Hex, Decimal & Binary equivalents.	<b>TDISK:</b>	Comprehensive file transfer utility allowing you to transfer files between filing systems (i.e. ROM, Net, Disk, Tape & Tape 3). Many features including: locking/ unloading programs, any length of file, plus most forms of tape protection coped with.
<b>ROMLIST:</b>	Displays what ROMs are present in your machine and the ROM size.	<b>VECTOR:</b>	Will produce a menu of the programs on a Vector 1 program disk, and run them. This utility will cope with some forms of protection which cannot be handled by any disk based product.
<b>ROMSAVE:</b>	Will save any sideways ROM to the current filing system.	<b>ROFF:</b>	Will switch off a particular ROM so that it cannot be accessed. Even Scythe can be switched off!
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<b>VERIFY:</b>	Verifies a disk shows up bad tracks, and displays an error count.		
<b>FREE:</b>	Displays an analysis of the free space available on a disk.		
<b>SFIND:</b>	Search memory for the occurrence of a specified string.		
<b>BFIND:</b>	Search memory for the occurrence of any sequence of bytes.		

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## From Page 132

all commands must start with 'W' for white.

A line may be made in or cross any plane, row or column so long as it is straight. If the centre box has not been declared illegal the line may go from one corner to the opposite corner - W3A-G2B-Y1C.

Unless playing game 5, where the lines are counted at the end, there is no special advantage in finishing two lines simultaneously. The computer looks only to see whether there is a complete line, and awards no extra marks if it finds two or more.

Don't worry about the long time the computer takes over its moves. It speeds

up as fewer boxes are vacant.

We heard about the chess program which took three hours to decide 'P-K4', and decided not to use recursive procedures (thus converting a weakness into a virtue, as we don't understand recursion anyway!).

In fact, the computer should never take more than two minutes on a move.

## CompoX listing

```
10 REM                                     :PROCsetup
   :COMPOX                                 :PROCdemo
   :Three-dimensional Noughts            :GOTO 120
   and Crosses
20 REM (C) MICRO USER 1984
30 @%=4
   :law=TRUE
40 *KEY10"O.:MRUN:M"
50 DIM LX(27),testX(4),AX(27)
60 MODE 5
70 ENVELOPE 1,8,1,-1,1,1,1,1,121
   ,-10,-5,-2,120,120
   :ENVELOPE 2,1,0,0,0,0,0,0,126
   ,-1,0,-3,126,126
   :ENVELOPE 3,3,1,1,1,1,1,1,70
   ,-1,-1,-1,69,0
   :ENVELOPE 4,2,0,50,-30,2,1
   ,2,127,-4,-2,-1,126,0
80 VDU 28,11,31,19,17,19,1,2,0
   ,0,0,23,231,112,216,216,216
   ,216,216,216,112,23,233,216
   ,216,112,112,112,112,216,216
   ,23,242,0,168,80,168,80,168
   ,80,168
90 VDU 23,230,0,0,0,32,32,0,0
   ,0,23,240,248,248,248,248,248
   ,248,248,248,23,241,248,216
   ,136,168,168,136,216,248,23
   ,243,248,0,136,216,216,136
   ,0,248
100 *FX15,0
110 PROCboard
   :PROCquery
   :SOUND 2,2,150,10
   :IF Q$="N" OR Q$="n"
   THEN 140
   ELSE 120
120 MODE 7
   :PROCinstruct
   :SOUND 2,2,85,5
   :IF Q$="Q" OR Q$="q"
   THEN 140
130 MODE 5
   :VDU 28,11,31,19,17,19,1,2
   ,0,0,0
   :PROCstart
140 REPEAT
150 MODE 4
   :PROCwho
   :PROCask
   :MODE 5
160 VDU 28,11,31,19,17,19,1,2,0
   ,0,0
170 PROCstart
180 REPEAT
   :IF tns=max
   THEN line=FALSE
   :GOTO 320
190 P%=P%*-1
   :tns=tns+1
200 PROCsay(1,2,CHR$(232+P%))
210 IF n1$="C" AND P%=-1
   THEN PROCbeebgo
   :GOTO 280
220 IF n2$="C" AND P%=1
   THEN PROCbeebgo
   :GOTO 280
230 PRINT
   :INPUT ,6$
240 testX=TRUE
   :PROCvalid
   :PRINT
250 IF testX=FALSE
   THEN PRINT "Are you sure ?!?"
   :PROCTune3(25)
   :GOTO 210
260 PROCcalc
   :PROClegal(s%)
   :IF ABS(LX(s%))>27
   THEN PRINT "Already taken!"
   :PROCTune1(4,s%)
   :PROCTune3(60)
   :GOTO 210
270 IF law=FALSE
   THEN PRINT " Not allowed"
   :PROCTune1(4,s%)
   :PROCTune2
   :GOTO 210
280 PROCshow(s%,232+P%)
   :PROCTune1(P%+2,s%)
   :LX(s%)=FNV(s%)*P%
290 IF tns>22
   THEN PRINT ";tns;" boxes""are
   now""taken.""max;" total"
   "allowed!"
300 IF game=5
   THEN 340
310 PROCtry
320 UNTIL line=TRUE OR tns=max
330 GOTO 360
340 UNTIL tns=max
350 IF game=5
   THEN PROCfivend
   :GOTO 390
360 IF line=TRUE
   THEN PROCrow
   :GOTO 380
370 IF tns=max
   THEN PROCdraw
   :GOTO 390
380 PROCchowmany
   :IF end=FALSE
   THEN 180
390 PRINT ""Another game ?"
400 UNTIL GET$ ="N"
410 CLS
   :CLG
   :VDU 19,0,1,0,0,0
420 GCOL 0,3
430 MOVE 200,500
   :VDU 5
440 PRINT "Goodbye, then!"
   :VDU 4,26
450 END
460 DATA 1,108,528,2,108,384,3
   ,108,240,4,252,528,5,252,384
   ,6,252,240,7,396,528,8,396
   ,384,9,396,240,10,300,720,11
   ,300,576,12,300,432,13,444
   ,720,14,444,576
470 DATA 15,444,432,16,588,720
```



## Compo listing

From Page 135

```

,17,588,576,18,588,432,19,492
,912,20,492,768,21,492,624
,22,636,912,23,636,768,24,636
,624,25,780,912,26,780,768
,27,780,624
480 DEF PROCshow(loc%,sign%)
490 RESTORE 460
:REPEAT
:READ n%,x%,y%
:UNTIL n%=loc%
500 LOCAL t%
:t%=3
510 IF loc%>9
THEN t%=1
520 IF loc%>18
THEN t%=2
530 VDU 25,4,x%+8;y%-8;18,0,0,5
,240,25,4,x%+8;y%-8;18,0,t%
,(sign%),4
540 SOUND 1,2,loc%+8+16,1
550 ENDPROC
560 DEF PROCsetup
570 PROCtable(444,960,2)
580 PROCtable(252,768,1)
590 PROCtable(60,576,3)
600 PROCchair
610 ENDPROC
620 DEF PROCboard
630 PROCsetup
640 COLOUR 3
:COLOUR 128
650 PROCSAY(1," 3-D")
:PROCSAY(2,"Noughts")
:PROCSAY(3," and")
:PROCSAY(4,"Crosses")
660 FOR loc%=1TO 27
670 CH%=231+loc%*2
680 IF CH%>233
THEN CH%=CH%-4
:GOTO 680
690 PROCshow(loc%,CH%)
700 NEXT
710 ENDPROC
720 DEF PROCtable(X%,Y%,colour)
730 BCOL 0,colour
740 FOR Z%=X%TO (X%+432)STEP 144
750 MOVE Z%,Y%
:DRAW Z%,Y%-432
760 NEXT Z%
770 FOR Z%=Y%TO (Y%-432)STEP -144
780 MOVE X%,Z%
:DRAW (X%+432),Z%
790 NEXT Z%
800 ENDPROC
810 DEF PROCchair
820 BCOL 0,1
830 VDU 25,4,60;576;25,21,444;960;25
,4,492;576;25,21,876;960;25
,4,492;144;25,21,876;528;
840 VDU 5,18,0,2
850 VDU 25,4,484;1000;65,25,4,628;10
00;66,25,4,772;1000;67,25,4
,892;904;49,25,4,892;760;50
,25,4,892;616;51
860 BCOL 0,3
870 VDU 25,4,100;128;65,25,4,244;128
;66,25,4,388;128;67,25,4,0;232;5
1,25,4,0;376;50,25,4,0;520;49
,4
880 ENDPROC
890 DEF PROCSAY(line%,word%)
900 PROCsay(line%,0,word%)
910 ENDPROC
920 DEF PROCsay(line%,start,word%)
930 LOCAL Y%
:Y%=(1000-line%*32)
940 VDU 25,4,0;Y%;25,3,432;0;25
,83,0;-32;25,3,-432;0;25,83
,0;32;
950 VDU 5,18,0,2,25,4,start*64;Y%;
960 PRINT ;word%
970 VDU 4
980 ENDPROC
990 DEF PROCinstruct
1000 PRINT "" You have just seen
a cube of 27 box- es. In case
you have never played, the
idea is for one player to
try to get three noughts
in a row first, and for the
other three crosses."
1010 PRINT "" The row can be horizo
ntal, vertical, or diagonal.
The cube is, of course,
three-dimensional, and your
row can be in any direction!"
1020 PRINT "" In this version, 0
always goes first, and you
can choose various skill levels
,some positions being illegal
as you get more difficult."
1030 PRINT "" To move, give the
colour, row number and coluan
letter of the required box."
1040 PRINT "" In the demonstration
which follows, there is a
nought on W2C and a cross on
83B !. Press any key for the
demon- stration and key
'Q' when you under- stand."
1050 Q%=GET$
1060 ENDPROC
1070 DEF PROCdemo
1080 PROCdisplay
:PROCshow(8,231)
:PROCshow(15,233)
1090 PRINT "There's anought onW2C
and across on 83B !"
1100 PRINT
1110 PRINT "Do not move on until
youare sure that you understand
!"
1120 PROCWAIT(2)
:PROCSAY(1," Press")
:PROCSAY(2,"any key")
:PROCSAY(3,"to con-")
:PROCSAY(4,"tinue.")
1130 *FX15,0
1140 REPEAT UNTIL GET
1150 ENDPROC
1160 DEF PROCstart
1170 PROCsetup
1180 FOR loc%=1TO 27
:L%(loc%)=loc%
:PROCshow(loc%,230)
:NEXT
1190 FOR loc%=1TO 27
:AX(loc%)=0
:NEXT
:FOR loc%=1TO 4
:test%(loc%)=0
:NEXT
1200 CLS
:PRINT CHR$(231);" to go first
."
1210 IF O$="E" OR X$="E"
THEN 1230
1220 PROCshow(14,242)
1230 P%=1
:tns=0
:status=0
1240 IF game<>1
THEN 1280
1250 FOR sq%=10TO 27
1260 PROCshow(sq%,242)
1270 NEXT
1280 PROCSAY(1," ")
:PROCSAY(4,"to go.")
:PROCSAY(3," ")
:PROCSAY(2," ")
:PRINT
1290 PRINT "Type in your square:
- colour, number, letter."
1300 ENDPROC
1310 DEF PROCWAIT(W)
1320 FOR w=1 TO W*1800
1330 NEXT w
1340 ENDPROC
1350 DEF FNV(B%)=511+(B%-1)DIV 9*100+
(B%-1)MOD 9DIV 3*10+(B%-1)

```



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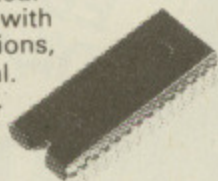
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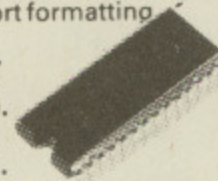
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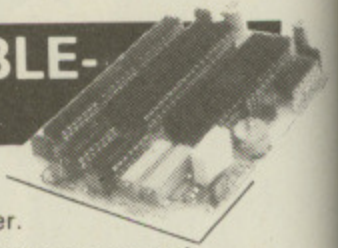
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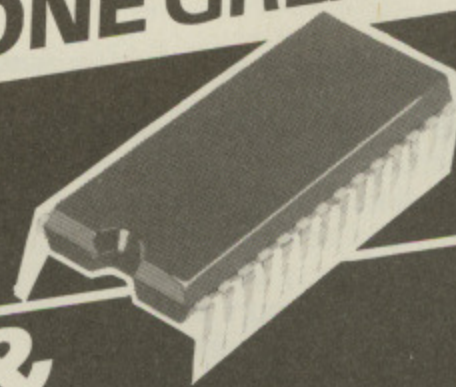
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### IMPORTANT NOTE:

Please check with us if you decide to use any other disc interface than Acorn or Double-Dos with Scribe or Database.



## Compo listing

From Page 136

```

MOD 9MOD 3
1360 DATA W,0,6,9,Y,18,1,1,2,2,3
      ,3,A,0,B,3,C,6
1370 DEF PROCcalc
1380 LOCAL AX,BX
1390 sZ=0
      :vZ=0
1400 RESTORE 1360
1410 FOR AX=1TO 3
1420 REPEAT
1430 READ A$,BX
1440 UNTIL A$=MID$(G$,AX,1)
1450 sZ=sZ+BX
1460 NEXT
1470 ENDPROC
1480 DEF PROCdisplay
1490 FOR locZ=1TO 27
1500 PROCshow(locZ,230)
1510 NEXT
1520 ENDPROC
1530 DEF PROCvalid
1540 LOCAL XZ,YZ,P$,Q$,R$
      :g$=""
1550 FOR XZ=1TO 3
1560 YZ=ASC (MID$(G$,XZ,1))
1570 IF YZ>90
      THEN YZ=YZ-32
1580 g$=g$+CHR$(YZ)
1590 NEXT
      :G$=g$
1600 FOR XZ=1TO 3
1610 Y$=MID$(G$,XZ,1)
1620 IF XZ=1
      THEN PROCinvalid("B","W","Y")
1630 IF XZ=2
      THEN PROCinvalid("1","2","3")
1640 IF XZ=3
      THEN PROCinvalid("A","B","C")
1650 NEXT
1660 testZ=testZ(1)AND testZ(2)
      AND testZ(3)
1670 ENDPROC
1680 DEF PROCinvalid(P$,Q$,R$)
1690 IF Y$=P$ OR Y$=Q$ OR Y$=R$

      THEN testZ(XZ)=TRUE
      ELSE testZ(XZ)=FALSE
1700 ENDPROC
1710 DEF PROCtry
1720 line=FALSE
1730 LOCAL DX,EX,dZ,eZ
1740 FOR dZ=1TO 27
1750 IF ABS (LZ(dZ))<28
      THEN 1890
1760 IF dZ=sZ
      THEN 1890
1770 DX=LZ(sZ)-LZ(dZ)

```

```

1780 IF DX>300
      THEN 1890
1790 FOR eZ=1TO 27
1800 IF ABS (LZ(eZ))<28
      THEN 1880
1810 IF eZ=sZ
      THEN 1880
1820 IF eZ=dZ
      THEN 1880
1830 EZ=LZ(sZ)-LZ(eZ)
1840 IF EZ>300
      THEN 1880
1850 IF ABS (EZ)=ABS (DX)
      THEN line=TRUE
      :pZ=eZ
      :rZ=dZ
      :qZ=sZ
1860 IF DX=2*EZ
      THEN line=TRUE
      :pZ=dZ
      :rZ=sZ
      :qZ=eZ
1870 IF DX=EZ/2
      THEN line=TRUE
      :pZ=eZ
      :rZ=sZ
      :qZ=dZ
1880 NEXT
1890 NEXT
1900 ENDPROC
1910 DEF PROCrow
1920 RESTORE 460
1930 REPEAT
      :READ LZ,XZ,YZ
      :UNTIL pZ=LZ
1940 RESTORE 460
1950 REPEAT
      :READ MZ,xZ,yZ
      :UNTIL rZ=MZ
1960 GCOL 0,2
      :MOVE xZ+8,yZ-8
      :PLOT 21,xZ+8,yZ-8
      :GCOL 0,3
      :MOVE XZ+24,YZ-24
      :PLOT 21,xZ+24,yZ-24
1970 SOUND 1,4,pZ*8+16,1
      :PROCWAIT(.5)
      :SOUND 1,4,rZ*8+16,1
      :PROCWAIT(.5)
      :SOUND 1,4,qZ*8+16,1
1980 ENDPROC
1990 DEF PROCwin
2000 PRINT "STRING$(18,CHR$(232+PZ)
      +" ");" is the winner !"
      :PROCTune3(150)
2010 ENDPROC
2020 DEF PROClegal(tZ)
2030 law=TRUE
2040 IF game=1AND tZ>9

```

```

      THEN law=FALSE
      :ENDPROC
2050 IF game=1AND tZ<10
      THEN ENDPROC
2060 IF PZ<0
      THEN L$=0$
      ELSE L$=X$
2070 IF L$="E"
      THEN ENDPROC
2080 IF tZ=14
      THEN law=FALSE
2090 IF L$="M"
      THEN ENDPROC
2100 RESTORE 2200
2110 FOR zZ=1TO 8
2120 READ ZZ,hZ,jZ,kZ
2130 IF tZ<>ZZ
      THEN 2180
2140 law=FALSE
2150 IF ABS (LZ(hZ))>27
      THEN law=TRUE
2160 IF ABS (LZ(jZ))>27
      THEN law=TRUE
2170 IF ABS (LZ(kZ))>27
      THEN law=TRUE
2180 NEXT
2190 ENDPROC
2200 DATA 1,2,4,10,3,2,6,12,7,4
      ,8,16,9,6,8,18,19,20,22,10
      ,21,20,24,12,25,22,26,16,27
      ,24,26,18
2210 DEF PROCdraw
2220 FOR count=0TO 4
      :PROCTune2
      :NEXT
      :PROCTune3(200)
2230 PRINT "STRING$(18,CHR$(232+PZ)
      +" "+CHR$(232-PZ)+" ");" DRAW
      !"
2240 ENDPROC
2250 DEF PROCquery
2260 PRINT
2270 PRINT " Do you want ins-tructio
      ns"
2280 PRINT "?"
      :Q$=GET$
2290 ENDPROC
2300 DEF PROCask
2310 VDU 19,0,4,0,0,0,19,1,3,0,0
      ,0
2320 PRINT "'''' You have a choice
      of five different games, which
      we shall number 1 to 5."
2330 PRINT "' 1 This is the novic
      e's game, played on the
      white squares only, and in
      two dimensions."

```



## Compo listing

### From Page 139

```

2340 PRINT " 2 In three dimension
      s; the first      player
      to get a row wins."
2350 PRINT " 3 In three dimension
      s; the first      player
      to get TWO rows wins."
2360 PRINT " 4 Similar to '3',
      but the player    who
      makes the SECOND row has an
      extra turn."
2370 PRINT " 5 Each player takes
      turns until      the cube
      is full. The winner
      is the one with most rows."
2380 PRINT "" Choose your game!"
      ....
2390 INPUT TAB(23,27),game
      :IF game>5 OR game<1
      THEN 2320
2400 SOUND 1,4,game*45,2
2410 IF game=1
      THEN HZ=9
      ELSE HZ=27
2420 IF game=1
      THEN Q$="E"
      :O$=Q$
      :X$=Q$
      :max=9
      :ENDPROC
2430 CLS
      :VDU 19,1,0,0,0,0,19,0,5,0
      ,0,0
2440 PRINT ""
2450 IF game<3
      THEN 2480
2460 PRINT " By the way, unless
      you are play- ing game
      5, there is no point in
      finishing two (or more)
      rows in the same go, as
      only one of them will
      count!"
2470 PROCWAIT(3)
2480 VDU 19,0,6,0,0,0
2490 PRINT "" There are three
      levels of skill to choose
      from:-"
      :PRINT " E = Easy: All boxes
      are valid;"
2500 PRINT " M = Medium: The centr
      e box, G2B,
      is out of bounds;"
2510 PRINT " D = Difficult: Not
      only is the cen-
      tre box out of bounds,
      but so also is
      each of the"
2520 PRINT " eight corner
      boxes until
      one of the three adjacent
      EDGE boxes is
      occupied!"
2530 PRINT ""
      :INPUT "Skill level for first
      player",Q$
2540 O$="E"
2550 IF Q$="M" OR Q$="m"
      THEN O$="M"
2560 IF Q$="D" OR Q$="d"
      THEN O$="D"
2570 PRINT ""
      :INPUT "Skill level for second
      player",Q$
2580 X$="E"
2590 IF Q$="M" OR Q$="m"
      THEN X$="M"
2600 IF Q$="D" OR Q$="d"
      THEN X$="D"
2610 IF X$="E" AND O$="E"
      THEN max=27
      ELSE max=26
2620 ENDPROC
2630 DEF PROCHowmany
2640 status=status+P%+4
      :end=FALSE
2650 IF status=30R status=5
      THEN 2660
      ELSE 2670
2660 IF game<3
      THEN PROCwin
      :end=TRUE
      :ENDPROC
2670 IF status=8 AND game=4
      THEN P%=P%*-1
2680 IF status=6 OR status>9
      THEN PROCwin
      :end=TRUE
      :ENDPROC
2690 ENDPROC
2700 DEF PROCtune1(en%,u%)
2710 SOUND 3,en%,u%*8+16,4
      :SOUND 2,en%,u%*8,4
2720 PROCWAIT(0.4)
2730 *FX15,0
2740 ENDPROC
2750 DEF PROCtune2
2760 SOUND &10,2,6,60
2770 PROCWAIT(0.4)
2780 *FX15,0
2790 ENDPROC
2800 DEF PROCtune3(count)
2810 FOR c%=1TO count
2820 SOUND &11,RND(4),RND(150)+50
      ,RND(3)
2830 NEXT
2840 PROCWAIT(0.4)
2850 *FX15,0
2860 ENDPROC
2870 DEF PROCwho
2880 VDU 19,0,2,0,0,0,19,1,0,0,0
      ,0
2890 PRINT "" The game can be
      played by people or compute
      rs!"
2900 PRINT "" Please enter the
      players' names."
      :PRINT " (C = COMPUTER!)"
2910 PRINT ""
      :INPUT " First player",n1$
2920 PRINT ""
      :INPUT " Second player",n2$
2930 PROCWAIT(1)
2940 ENDPROC
2950 DATA 1,7,2,4,3,7,4,4,5,5,6
      ,4,7,7,8,4,9,7,10,4,11,5,12
      ,4,13,5,14,13,15,5,16,4,17
      ,5,18,4,19,7,20,4,21,7,22,4
      ,23,5,24,4,25,7,26,4,27,7
2960 DEF PROCbeebgo
2970 COLOUR 1
      :PRINT "Thinking!"
      :VDU 17,3,11,11,19,0,4,0,0
      ,0
2980 FOR G%=1TO HZ
      :AZ(G%)=0
2990 IF ABS (LZ(G%))>27
      THEN 3360
3000 PROClegal(G%)
      :IF G%=14AND law=FALSE
      THEN 3360
3010 IF law=FALSE
      THEN 3350
3020 PROCshow(G%,242+P%)
      :IF G%MOD 2=0
      THEN F%=2
      ELSE F%=1
3030 RESTORE 2950
3040 REPEAT
      :READ squ%,mk%
      :UNTIL squ%=G%
3050 AZ(G%)=mk%+400
      :IF game=1 AND G%=5
      THEN AZ(5)=418
3060 FOR d%=FX TO G%-2 STEP 2
3070 IF d%=G%
      THEN 3140
3080 IF d%<>14
      THEN 3100
3090 IF NOT (X$="E" OR O$="E")
      THEN 3140
3100 e%=(G%+d%)/2
3110 IF e%<>14
      THEN 3130

```



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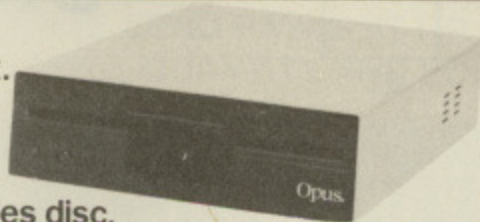
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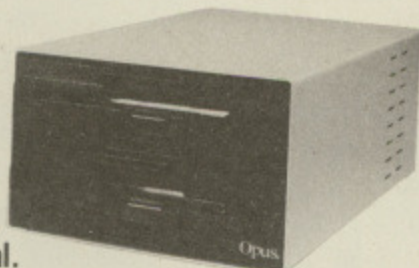
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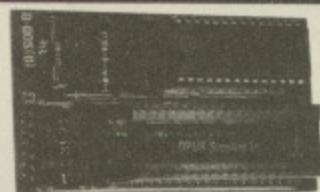
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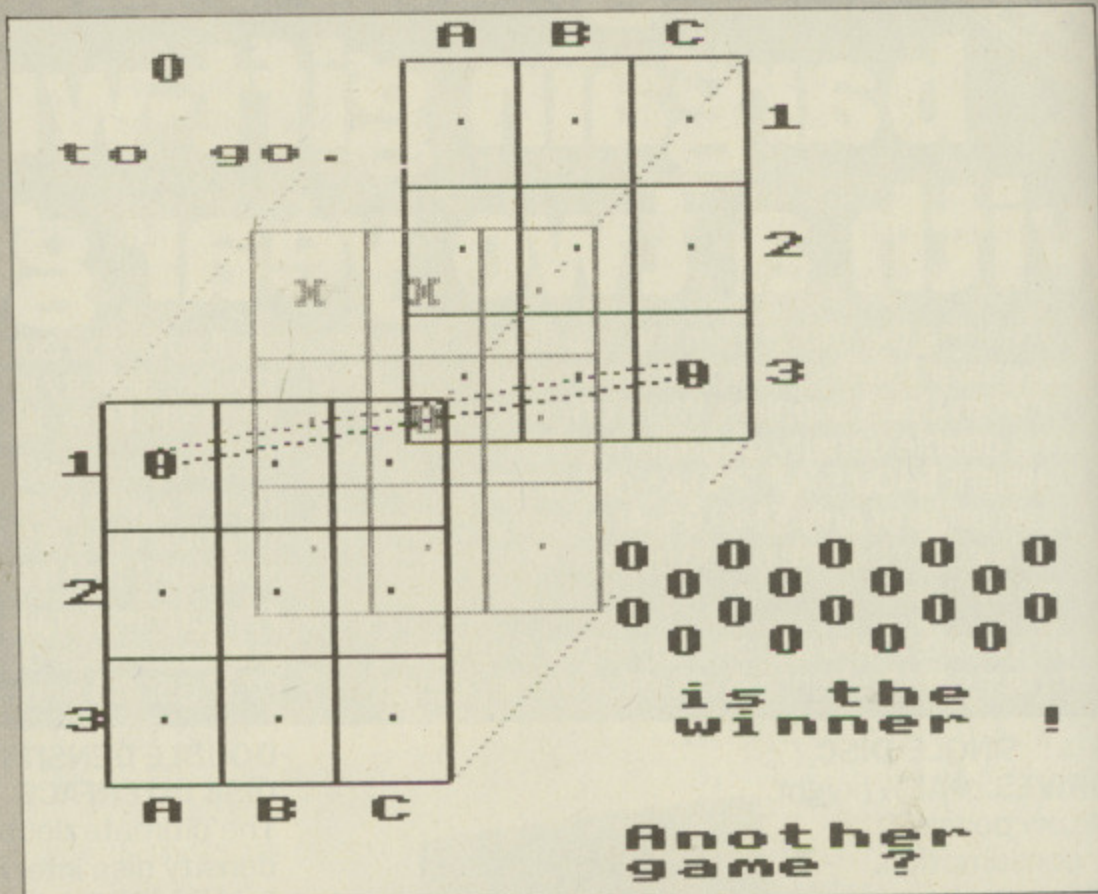
# CompoX listing

From Page 140

```

3120 IF NOT (X$="E" OR O$="E")
    THEN 3140
3130 IF FNV(eZ)-FNV(dZ)=FNV(BZ)-
    FNV(eZ)
    THEN PROCaward
3140 NEXT
3150 FOR dZ=1 TO BZ-1
3160 IF dZ=BZ
    THEN 3240
3170 IF dZ<>14
    THEN 3190
3180 IF NOT (X$="E" OR O$="E")
    THEN 3240
3190 eZ=2*BZ-dZ
3200 IF eZ>HZ
    THEN 3240
3210 IF eZ<>14
    THEN 3230
3220 IF NOT (X$="E" OR O$="E")
    THEN 3240
3230 IF FNV(GZ)-FNV(dZ)=FNV(eZ)-
    FNV(BZ)
    THEN PROCaward
3240 NEXT
3250 FOR dZ=BZ+1 TO HZ
3260 IF dZ>=HZ
    THEN 3340
3270 IF dZ<>14
    THEN 3290
3280 IF NOT (X$="E" OR O$="E")
    THEN 3340
3290 eZ=2*dZ-BZ
3300 IF eZ>HZ
    THEN 3340
3310 IF eZ<>14
    THEN 3330
3320 IF NOT (X$="E" OR O$="E")
    THEN 3340
3330 IF FNV(eZ)-FNV(dZ)=FNV(dZ)-
    FNV(BZ)
    THEN PROCaward
3340 NEXT
3350 PROCshow(BZ,230)
3360 NEXT
3370 VDU 19,0,0,0,0,0
3380 startZ=2+RND(HZ-4)
    :bZ=0
    :sZ=0
3390 FOR gZ=startZ TO HZ
    :PROCbestmove
    :NEXT
3400 FOR gZ=1 TO (startZ-1)
    :PROCbestmove
    :NEXT
3410 ENDPROC
3420 DEF PROCbestmove
    :IF AZ(gZ)>bZ
    THEN sZ=gZ

```



```

    :bZ=AZ(gZ)
3430 ENDPROC
3440 DEF PROCaward
3450 JZ=LX(eZ)DIV 400+4+LX(dZ)
    DIV 400+4+PZ
3460 IF ABS(JZ)=9 AND game=4
    AND status=0
    THEN JZ=1
3470 RESTORE 3550
3480 IF ABS(JZ)=7 AND game=5
    THEN AZ(BZ)=AZ(BZ)+65
    :ENDPROC
3490 REPEAT
    :READ KZ,MZ
    :UNTIL KZ=ABS(JZ)
3500 AZ(BZ)=AZ(BZ)+MZ
3510 SOUND 1,-(JZ+3)/2,BZ*8,1
3520 *FX15,1
3530 IF ABS(JZ)=1 AND ABS(LX(dZ))>2
    B
    THEN AZ(BZ)=AZ(BZ)-50
3540 ENDPROC
3550 DATA 1,10,3,20,5,40,7,400,9
    ,4000
3560 DEF PROCfivend
3570 LOCAL JZ,KZ,MZ
3580 CLS
    :VDU 19,0,1,0,0,0
3590 nt=0
    :cr=0
3600 PROCprint
3610 FOR JZ=1 TO HZ-2
3620 FOR KZ=JZ+1 TO HZ-1
3630 MZ=2*KZ-JZ
3640 IF MZ>HZ
    THEN 3710

```

```

3650 IF LX(KZ)-LX(JZ)<>LX(MZ)-LX(KZ)
    THEN 3710
3660 PROCshow(JZ,230)
    :PROCshow(KZ,230)
    :PROCshow(MZ,230)
3670 PROCWAIT(.5)
3680 IF LX(KZ)<0
    THEN nt=nt+1
    :PROCprint
    :PROCshow(KZ,231)
    :PROCshow(JZ,231)
    :PROCshow(MZ,231)
3690 IF LX(KZ)>28
    THEN cr=cr+1
    :PROCprint
    :PROCshow(JZ,233)
    :PROCshow(KZ,233)
    :PROCshow(MZ,233)
3700 PROCWAIT(.5)
3710 NEXT
3720 NEXT
3730 VDU 19,0,0,0,0,0
3740 ENDPROC
3750 DEF PROCprint
3760 CLS
3770 PRINT ;"Counting"
3780 VDU 31,1,4,231,31,1,6,233
3790 PRINT TAB(4,4);nt;TAB(4,6);cr
3800 ENDPROC

```

This listing is included in this month's cassette tape offer. See order form on Page 205.





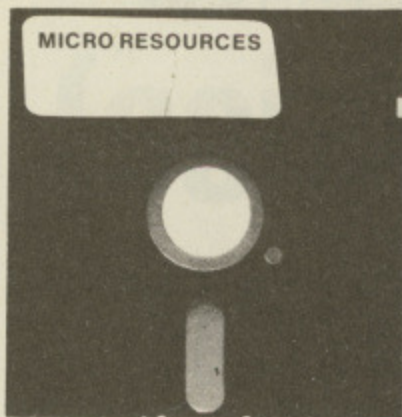
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# How to keep (and raise) your score

NEARLY all games have a score of some kind, and wherever there's a score there's a high score table. These are two of the subjects we'll be looking at this month.

First we'll consider how to keep and increase a score.

The easiest way to store the score is as a sequence of numeric Ascii characters – 0 to 9. This makes it easier to output, as we shall see.

One very useful routine in the operating system is OSWRCH (&FFEE). Calling this routine will print the character whose Ascii code is held in the accumulator – just what we need to print out the score.

For example, if the accumulator contains 65 and OSWRCH is called, the letter A is printed on the screen – 65 being the Ascii code for A. You see, OSWRCH is the machine code equivalent of VDU.

Take a look at the following example:

```
LDA#31
JSR &FFEE
LDA#8
JSR &FFEE
LDA#6
JSR &FFEE
```

This is exactly the same as VDU 31.0,6 – move the text cursor to coordinate 0,6.

OSWRCH allows you to perform many operations from drawing triangles to turning printers on and off. See page 378 of the User Guide for a list of the VDU codes.

Program I uses OSWRCH to position the text cursor (line 170) and print out the score digits (line 190).

The score is held in eight consecutive locations. This means that the largest number that can be represented is 99999999! The base location of the score is pointed to by the variable *thescore*.

Program I contains two routines. One increases the score by 10 points (lines 90-160) and the other prints the score on the screen (lines 170-210).

These have been separated so that the *add 10* subroutine can be called several times to make it into an *add 10\*n* subroutine – *n* being the number of times the routine is called.

In other words we can call the *add 10*

routine 5 times to add 50 to the score before we print it on the screen.

Some games use score routines which print leading zeros. For example, one game might print the score as "000150" and another would print it as "150". I'm sure that you'll agree that the latter looks the tidier.

So to make the score output neat and tidy leading zeros will be replaced by spaces. This must be taken into account by the score routine.

Try Program I, pressing a key to add 10 to the score.

Line 230 is very important. This initialises the score to 0. The length of the string should always be eight characters in total with a zero at the end.

The score is increased by incrementing the Ascii character in the tens position of the score – remember Hundreds Tens and Units. If the digit in the tens position is a nine it must be replaced by a zero and 1 must be added to the hundreds column.

In fact the same routine which increased the tens is used to add one to the hundreds. This is achieved by decrementing the score offset register so that it points to the hundreds column instead of the tens column – the most significant digits of the score are stored first.

Again, if the digit is a 9 the routine puts a zero in the score, decrements the offset register and branches back on itself. You'll be able to understand this

Part six

## HOW TO WRITE MACHINE CODE GAMES

By KEVIN  
EDWARDS

better by following Program I through in your head.

One of the features that has been added to more and more games is the high score table. This allows a person who has accumulated a good score to enter their name into a table of other scores.

Most high score tables keep a record of the top ten scores. The higher the score the higher its position is in the table.

When a new high score is recorded space must be provided to accommodate the new score. This is done by moving all the scores less than the new one down the table one place. This means that the lowest score must be lost.

The name of the person who achieved the new score is requested and entered into the table.

It gives players great satisfaction when they see their name and score above all of the others. It's also very useful when several players are having a competition.

Achieving this in machine code is quite tricky. Several problems must be solved first:

- *Storing the high scores and names in memory.*
- *Accepting the name of the person who achieved the high score.*

The obvious way to store the names and scores is in Ascii. This makes it easier for us to print the table – using OSWRCH – and to use the Ascii characters, corresponding to new scores from Program I.

Program II is the high score table routine which keeps a record of the top



```

10 REM Score routine
20 REM By Kevin Edwards
30 MODE 7
40 HIMEM=&2800
50 thescore=&2AA0
60 FOR pass=0 TO 2 STEP 2
70 PX=HIMEM
80 [OPT pass
90 .add10 LDX#6
100 .examedigit LDAtscore,X
110 CMP#ASC" ":BEQmake_it_a_1
120 CMP#ASC"9":BNEincdigit
130 LDA#ASC"0":STAtscore,X
140 DEX:BPLexamedigit
150 .make_it_a_1 LDA#ASC"1":STAtscore,X:RTS
160 .incdigit INCthescore,X:RTS
170 .scoreout LDA#31:JSR&FFEE:LDA#1
5:JSR&FFEE:LDA#12:JSR&FFEE
180 LDY#0
190 .nextdig LDAtscore,Y:JSR&FFEE
200 INY:CPY#8:BNEnextdig
210 RTS
220 JNEXT
230 $thescore=" 0"
240 REPEAT
250 CALLscoreout
260 CALLadd10
270 A%=GET
280 UNTIL 1=2

```

Program 1

```

40-80 Enter assembler.
90 Sets score offset register to 6.
100 Reads digit.
110 checks if it's a space. If it is make it a one. Spaces
are used instead of leading zeros.
120 Is the digit a 9? Branch if it isn't.
130-140 If it's a space make it a zero and repeat the
process for the next digit along.
150 Makes the score digit 1.
160 Increments the score digit by one to add 10 to the
score and then exit.
170 Positions the text cursor - VDU 31,15,12.
180-200 Output the score digits.
210 Exits the routine.

```

Description of Program 1

Line 860 specifies the new score. Try changing it, but make sure that the score string is eight characters in total.

The high score routine execution address is pointed to by the variable *start*. Make sure you've set the score up in memory before you call the routine - the score address is given by the variable *newscore*.

The names of the high scores are stored sequentially in nine groups of 16 characters. Only 15 characters of each hold the name, the other holds CHR\$(13) - carriage return. The variable *names* points to the first name.

The scores are stored sequentially in nine groups of eight characters. The first character in each group is the most significant digit of the score.

The names and scores were limited to 16 and eight characters to simplify calculations needed to locate a specific score by multiplication. For example, the start of the text for the third score can be found by multiplying 8 (number

of characters per score) by the position, 1, the result being 16 (8\*(3-1)).

A number can be multiplied by 8 by shifting it left three times using the command ASL - see line 220. Shifting it left once more, again using ASL, is the same as multiplying the original number by 16 - see line 230.

Of course this only works if the original number is less than 16 - which it will be in our case. If it is greater or equal to 16 the result will overflow because the maximum number that a register or location can hold is 255.

The second problem was how to accept an input from the user when his name is requested for the high score table. This is a lot easier than it sounds. Another operating system call allows us to do this.

The call required is to OSWORD (&FFF1) with the accumulator set to 0 - OSWORD 0 for short. The X and Y registers hold the low and high byte, respectively, of a control block which

gives further information about the operation to be performed.

For example, if the control block is at location &A60 the following routine would execute OSWORD 0 correctly.

```

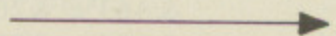
LDX#&60
LDY#&A
LDA#0
JSR &FFF1

```

But before this can be executed the control block must be set up. This specifies the following information:

- The address in memory where the input string is to be stored - low byte then high byte.
- The maximum number of characters to be accepted.
- The minimum acceptable Ascii character.
- The maximum acceptable Ascii character.

For example, we'll set up the control





```

10 REM High Score Table
20 REM By Kevin Edwards
30 MODE 7
40 HIMEM=&2800
50 names=&2A00
60 newscore=&2AA0:workspace=&2AB0
70 scores=&2B00
80 FOR pass=0 TO 2 STEP 2
90 P%=HIMEM
100 [OPT pass
110 .start LDA#22:JSR&FFEE:LDA#7:JSR&FFEE
120 LDX#0:TXA:PHA
130 .checkanother ASLA:ASLA:ASLA:TXA:LDY#0
140 .char1 LDAnewscore,Y:CMPScores,X:BCCnotgreater:BNEinsert
150 INX:INY:CPY#8:BCCchar1
160 BCSinsert
170 .notgreater PLA:TAX:INX:TXA:PHA:CPX#9:BCCcheckanother
180 LDA#255:STAspace+2:JMPfinish
190 .insert LDY#0
200 .messageout LDAmessage,Y:BEQexit:JSR&FFEE:INY:BNEmessageout
210 .exit PLA:PHA:STAspace+2
220 ASLA:ASLA:ASLA:STAspace
230 ASLA:STAspace+1
240 CMP#128:BEQmovenewscore
250 LDX#127
260 .copynames LDAnames,X:STAnames+16,X:DEX:CPXworkspace+1:BNEcopynames
270 LDAnames,X:STAnames+16,X
280 LDX#63
290 .copyscores LDAscores,X:STAscores+8,X:DEX:CPXworkspace:BNEcopyscores
300 LDAscores,X:STAscores+8,X
310 .movenewscore LDXworkspace:LDY#0
320 .copynewscore LDAnewscore,Y:STAscores,X:INX:INY:CPY#8:BCCcopynewscore
330 .deleteoldname LDXworkspace+1:LDY#15:LDA#32
340 .delete STAnames,X:INX:DEY:BPLdelete
350 LDAworkspace+1:STAswordblock:LDA#0:LDX#oswordblock MOD 256:LDY#oswordblock DIV 256:JSR&FFF1
360 .finish PLA:JSRdisplay
370 LDY#0
380 .messageout2 LDAmessage2,Y:BEQexit2:JSR&FFEE:INY:BNEmessageout2
390 .exit2 JSR&FFEE:LDA#7E:JMP&FFF4
400 .display LDA#12:JSR&FFEE
410 .displayscores LDX#0
420 .nextscore LDA#31:JSR&FFEE:LDA#1:JSR&FFEE:TXA:ASLA:ADC#3:JSR&FFEE
430 TXA:AND#7:CMP#7:BNEcolourok:LDA#2
440 .colourok CLC:ADC#129:JSR&FFEE
450 LDA#32:CPXworkspace+2:BNEposition:LDA#136
460 .position JSR&FFEE
470 TXA:CLC:ADC#49:JSR&FFEE
480 LDY#3:JSRdots
490 TXA:PHA:ASLA:ASLA:ASLA:TAX:LDY#7
500 .nextdigit LDAscores,X:JSR&FFEE:INX:DEY:BPLnextdigit
510 LDY#4:JSRdots
520 PLA:PHA
530 ASLA:ASLA:ASLA:ASLA:TAX:LDY#15
540 .nextletter LDAnames,X:CMP#13:BEQskip:JSR&FFEE:INX:DEY:BPLnextletter
550 .skip PLA:TAX
560 INX:CPX#9:BCCnextscore
570 RTS
580 .dots LDA#46:.dot1 JSR&FFEE:DEY:BPLdot1:RTS
590 .oswordblock OPT FNequb(0)
600 OPT FNequb(names DIV 256)
610 OPT FNequb(15)
620 OPT FNequb(&20)
630 OPT FNequb(&7E)
640 .message OPT FNequb(31)
650 OPT FNequb(3)
660 OPT FNequb(9)
670 OPT FNequb(133)
680 OPT FNequb("You're score is in the top nine")
690 OPT FNequb(31)
700 OPT FNequb(7)
710 OPT FNequb(11)
720 OPT FNequb(134)
730 OPT FNequb("Please enter your name")
740 OPT FNequb(31)
750 OPT FNequb(11)
760 OPT FNequb(13)
770 OPT FNequb(130)
780 OPT FNequb(8)
790 .message2 OPT FNequb(31)
800 OPT FNequb(6)
810 OPT FNequb(23)
820 OPT FNequb(133)
830 OPT FNequb("Press a key to continue")
840 OPT FNequb(0)
850 JNEXT
860 $newscore=" 4560"
870 $scores=" 9000 8000 7000 6000 5000 4000 3000 2000 1000"
880 $names="HISSING SID "+"FRED DY FLUKE "+"KEYBOARD BASHER "+"SQU IDGY BOD "+"KONG BASHER "+"TRICKY DICKY "+"SPARROW MAN "+"HAVE A NICE DAY "+"DENIM DENNY "
890 CALL start
900 END
910 DEFFNequb(byte)
920 ?P%=byte
930 P%=P%+1
940 =pass
950 DEFFNequb(string$)
960 $P%=string$
970 P%=P%+LEN($P%)
980 =pass

```

#### Program 11

### From Page 145

block at location &A60 with the following information:

**Input buffer address = &920**

**Line length = &20 (32 characters)**

**Minimum Ascii = &20 (32 decimal)**

**Maximum Ascii = &7E (126 decimal)**

Therefore the corresponding control block would be:

&A60 = &20

&A61 = &9

&A62 = &20

&A63 = &20

&A64 = &7E

At this point the OSWORD routine can be called.

The micro will now accept an input. Pressing Return or Escape will terminate the routine. Ctrl+U will delete the whole line, Delete will erase the previous character and Copy will copy the character at the editing cursor. On exit the carry flag will be 1 if Escape terminated the input.

Any attempt to enter more characters than specified in the control block will result in a beep - VDU 7.

Characters which are outside the Ascii range are printed but not entered into the string buffer.

For those of you who are interested, Basic uses OSWORD 0 for its INPUT statements.

Another input routine, used in line 390, is OSRDCH (&FFE0). This waits until a key is pressed and returns the key's Ascii value in the accumulator - just like Basic's GET command.

If Escape is pressed the accumulator will contain &1B. This must be acknowledged by issuing OSBYTE &7E (126) - also on line 390.

● *That's it for this month. Next month we'll look at random numbers and other useful techniques used in machine code games.*



- 50-70 Define work space area for the high scores.  
 80-100 Enter assembler.  
 110 Changes to Mode 7 - VDU 22,7.  
 120-180 Check if the new score is greater or equal to the other high scores.  
 190-200 Print out a message indicating that the new score is in the top 9.  
 210 Retrieves the position in the table where the new score is to be inserted.  
 220 Multiplies the position by 8 to get the offset for the corresponding score.  
 230 Multiplies again by 2 to get the offset for the corresponding name.  
 240 If the new score is at the bottom of the high score table skip the insert routine - it's not necessary.  
 250-300 Move all of the names and scores down one place in the table.  
 310-320 Copy the new score into the score table.  
 330-340 Clear the existing name from the table.  
 350 Accepts a name for the new score.  
 360 Calls the subroutine which displays the high score table.  
 370-380 Output the message "Press a key to continue".  
 390 Calls the read character routine and clears the Escape condition.  
 400-570 High score display routine.  
 400 Clears the screen - VDU 12.  
 410 Loads the X register with 0 - this is used to keep count of the score being displayed.
- 420 Positions the cursor - VDU31,1,Y\*3+2, where Y is the position in the table of the score.  
 430-440 Output a colour control character.  
 450-460 Output a flashing control character if the score being displayed is the new score.  
 470 Prints the position of the score 1,2..9.  
 480 Prints four dots.  
 490 Finds the offset of the score's start position and places it in X.  
 500 Prints the score.  
 510 Prints five dots.  
 520-530 Find the offset of the name's start position and place it in X.  
 540 Prints the names out.  
 550-560 Test if all nine scores have been displayed.  
 570 Exit routine.  
 580 Prints out dots. The number is determined by the Y register.  
 590-630 OSWORD 0 control block.  
 640-780 Text for new high score message.  
 790-840 Text for "Press a key to continue".  
 850 Exits assembler.  
 860 Places " 4560" into the "newscore" work space - the spaces are very important.  
 870 Sets up the high scores.  
 880 Sets up the high score names.  
 890 Calls the routine.  
 900 Exits program.  
 910-940 Macro for Equate byte (EQUB).  
 950-980 Macro for Equate string (EQU S).

Description of Program II

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# PROBLEM PAGE

Your technical queries answered by MIKE COOK

## Help for the poor struggler!

I AM one of the poorer members of the Beeb fraternity, since I do not have a disc drive or printer.

However, I have recently acquired a secondhand Ricoh Nexos 3300 word processor with a printer and two 8in disc drives.

Having read your Beeb Body Building Course article of January, 1984, about disc drives and your plea for information from 8in disc users, I hope you can help me connect up my 8-inch drives and printer.

I understand from the manual that the discs are single-sided, also the second drive is read only. These drives are connected via 50 way ribbon cables. The disc units are powered from the main unit.

Please could you advise on a disc interface kit and connections and modifications if and where necessary to use with the BBC Micro.

The daisywheel printer (Qume I think) is uni-directional and is connected via a 50 way ribbon cable and another multicore power cable.

Since I can power up the printer from the main unit, is it possible to tap into the 50 way cable, via a switch if necessary, to use the printer with the BBC? — Peter Downes, Merthyr Tydfil, Mid-Glamorgan.

● You can fit an 8in drive to the

BBC, but you need a different DFS chip and there are also some modifications to the tracks on the computer's PCB.

This information can be obtained from Vogan Products, The White House, 21 Grove Road, Hazlemere, Bucks. HP15 7QY.

The instructions they give are not for the complete beginner, but there is sufficient to do the job if you are competent.

I have never heard of a read-only disc drive, so I am not sure whether that one will work.

As to the printer, it is in theory possible to connect it up, but you will need to write a printer driver to convert from the Ascii used by the computer into the code used by your printer (do you know what it is?).

Then all the wires need sorting out. This is not a simple job, but is possible. I estimate it would take me about three weeks full-time to do if I had all the information.

As my consultancy rate is £80 a day, it is perhaps not very economic!

## Cash calls the tune

I AM teaching electric guitar — which I play — and electronic keyboard — which I don't — to teens and subteens who don't quite make the grade with the entrenched classical music mob.

Funds are low, but various parents, are rallying round with contributions to a common

music fund. I don't charge for lessons but I spend the fund on second hand name equipment, to date with reasonable results.

My mate at work is quite sure, and so am I after seeing very high priced equipment (Synthaxe, Roland guitar synthesiser, Korg ditto etc) that it could be possible to connect up as in Figure 1, the object being to cut costs and provide more effects. Also Tomorrow's World have shown various systems, but not explained them.

Can you throw some light on this? — Kevin O'Hara, Bury St Edmunds, Suffolk.

● Yes, it is possible to do what you want but like all things it is a matter of cost and time. Also you need the experience to do it.

A simple A/D converter will allow you to input a waveform and a D/A converter will allow it to be outputted from the computer. It is then a matter of mangling up the number in the computer to give you the desired effects.

This mangling has to be done in machine code as you need to run at about 8,000 samples per second.

First you have to decide what effect you want and then work out what is happening to the signal — then write the machine code to do it.

For example, an echo could be obtained by placing successive samples in a buffer and extracting them at one or two points offset from the input position. These would then be added together and sent to the D/A converter.

The input and output pointers would then be moved to the next part of the buffer and the whole process repeated.

I hope to cover this type of manipulation in a book I am writing. However you can have a go yourself if you see the Body Build articles March 1984 (A/D), October 1984 (D/A) and August 1984 (user port expansion).

You could do without the latter by driving the D/A converter through the printer port instead of the user port.

I did not see the Tomorrow's World programmes but I think they involved controlling of synthesisers via computers and is not really what you want.

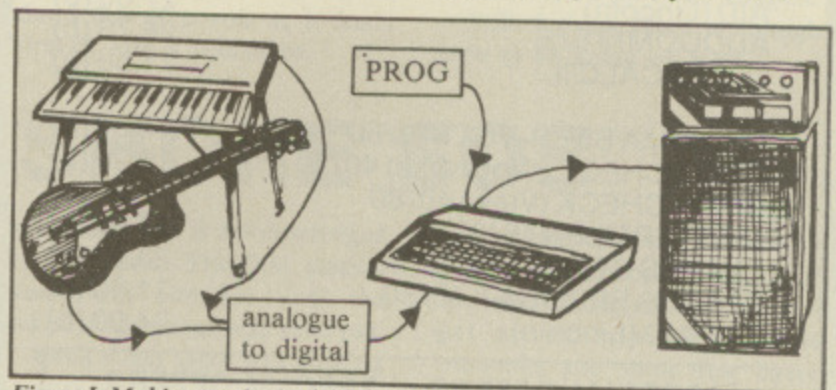
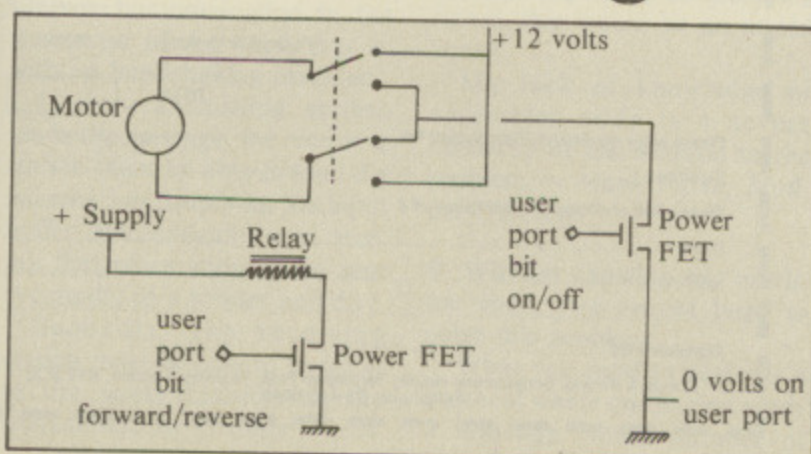


Figure 1: Making music via the BBC Micro

## How to get motoring . . .



I have read your article on stepping motors from the May 1984 issue of *The Micro User* and found it very interesting.

I wondered whether it was possible to use normal rotary arm motors found in Meccano and Lego sets?

As the user port only provides a 5 volt power supply, a 5 volt motor would have to be used.

If it is possible to use rotary arm motors would it be possible to make the motor spin in

reverse as well as forwards? If it is possible, how? — John Scott, Wellingborough, Northants.

● Yes, it is possible to control a normal motor using the user port if you use a power FET to switch it. As to changing the direction — this can be done by changing the polarity of the voltage going through the motor.

While this can be done electronically the simplest way is to use a double pole relay. See the circuit alongside.





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MY problem is: My BBC Micro will not operate a printer.

I bought a Model A machine and using your upgrade article proceeded to transform it into a Model B.

Everything appeared to be satisfactory.

I then added an Acorn disc drive interface which again appears to work satisfactorily.

However, when trying to use a printer in conjunction with my kit it appears that no signal was getting through to activate the printer.

I made sure that Ctrl+B was pressed. There was no response. I then typed in \*FX5,1 and this did nothing.

Other tests I did were to substitute the Basic chip, then the DFS chip and the operating chip, all separately.

Sorry, I should have mentioned earlier that I have also fitted a 1.2 operating chip. I subsequently checked most of the soldered joints that I had done originally, but to no avail.

The printer would work with another machine that I borrowed. This is the machine I borrowed the chips from; so there was nothing wrong there.

The only other thing which may have caused a problem was the connection from the leg of IC27 to the east of S9.

I did this underneath the board, cutting the existing connection, and without cutting the leg of the IC.

I carefully checked to make sure no track came to that leg

# A MARRIAGE OF INCONVENIENCE..

before doing this. The track was cut above the board, as instructed.

I have checked and rechecked the settings of all removable links, shifted some of the ICs to ensure contact of the legs. I have an Issue 2 board.

There is another problem which may be connected with the printer problem. I have a disc which holds a program and some data.

It is basically a sorting program which has to access the data, sort it and then print it.

This disc works fine on the borrowed machine. On mine it enters the program but will not access the data file. It comes up with: "No variable at line...".

When using this disc the disc drive usually runs twice when things are operating normally. My machine only activates the drive once.

The machine I borrowed is a 1982 model with an Issue 4 board.

I can operate a joystick and a light pen successfully on my machine, but I have not tried the RS423 or RGB ports. — *A.E. Fillingham, Huntingdon, Cambs.*

● It's always difficult trying to fault find at a distance as you

always want to know one more fact. In this case I am assuming that your non-working printer is a parallel one.

If it has an on-line/off-line switch on it, try this experiment. Type Ctrl+B and type in rubbish until the screen jams, then type in some more.

Then rapidly press the on-line switch repeatedly.

If you see extra characters of your typed-in rubbish appearing, you know that the acknowledge signal (ACK) is getting to the computer. Then the problem is most likely the strobe pulse is not getting out.

I seem to remember there was a change in the strobe pulse circuits from issue 2 to 3, but I am not sure what it was as I have never worked on an issue 2 board.

However, if you have access to an oscilloscope try to see the narrow strobe pulses that will be produced on pin 39 of IC69.

If you can see them, trace them through to pin 5 of IC27. These should emerge at pin 6 (if you have not damaged the track underneath when cutting the link for the disc mod). However the signal at this pin will only be about 0.7 of a volt as it feeds directly into a transistor.

Finally, look at the strobe output to the printer — pin 1 of the printer connector. Most printers need this to be high, and to pulse low check what your printer needs and make sure it matches. It can be changed by putting a logic zero on pin 4 of IC27.

Also check the soldered joints. Last week I found resistor R6 (the one connected to the strobe line) had not been soldered in on a friend's computer. The printer worked at first and then packed in.

I think you have successfully carried out the modifications you have done and this is an example of a latent bug in your original computer.

As to your disc problem, this is something different. I am not sure that the mod to IC27 can be done without cutting the leg as the offending track is on the component side under the IC. However, this is true on issue 3 boards and could be different on others.

It might, however, explain why data files are not being accessed. But I am afraid without examining the computer there is not a lot I can suggest.

Still, I think there is enough here to be going on with.

## MY SHIP-TO-SHORE SOS

I AM undertaking a project requiring the communication via radio link of two BBC Micros, for a degree in nautical studies.

The project concerns using micros for ship-to-shore communication and assessing the economics of such a system.

However, I have come up with a number of problems.

Firstly I require a means of simplex communication in the true sense of the word, that is, with no handshaking involved.

If the transmitting station sends the message, the receiving station must be able to load the information, emptying the input buffer automatically, and storing the information to be sent eventually to a printer and disc.

Secondly, the receiving station must be able to transmit in the same fashion as the transmitter, so in other words,

two-way communication can be set up between ship and shore.

Thirdly, if the cassette port can be used for transmission and reception then this will alleviate the need for modulators and demodulators outside the micro.

Lastly, if the micro could be used for purposes other than for transmission and reception until it is interrupted by an incoming signal, this would be an added bonus.

My lack of knowledge of assembler code is a severe handicap in the solution to the problem. — *Mark Paine, Modbury, Devon.*

● Without knowing any machine code, you cannot hope to solve this problem.

What you need to devise is a protocol where one station sends a message (small number of

bytes) and this is acknowledged by the other. The first station would not continue until the acknowledgement was received.

Even when there was nothing to pass this null exchange would have to still be going on.

The computer could turn on or off the TX as required as it would be told by the other computer to do so. A sort of automatic version of it saying "over to you".

The only way to do this is by means of a background task and this has to be written in machine code. There is a similar

system that has been devised by radio amateurs called Amtor. If the transmitting station does not get an acknowledgement it transmits the same few bytes over again until it does.

You can use the cassette port to read and send data. For an example of this, see the Advanced User Guide.

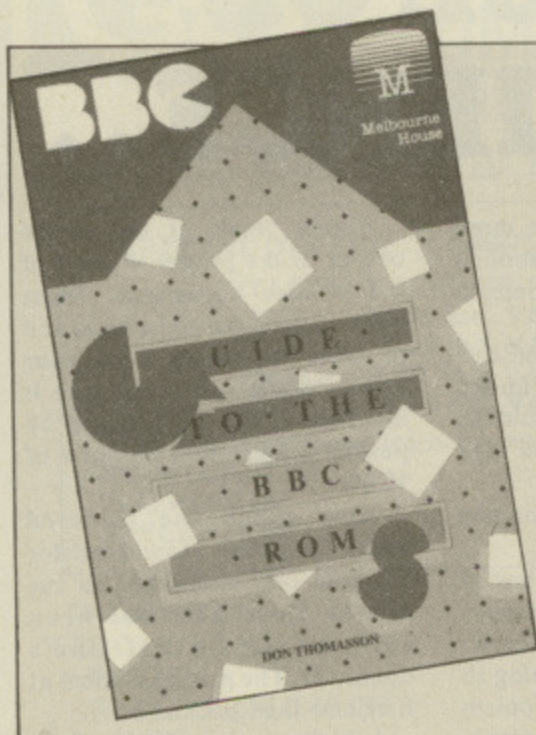
This is a much larger degree project than I would give my own students if you are required to both devise and implement it.

Sorry I could not be more helpful, but this is a very large problem.

IF you have a technical query for this page, send it to Mike Cook, *The Micro User*, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.

Letters on other subjects should be sent, as usual, to Micromail, which this month starts on Page 185.





IF, like the Micro User staff, you enjoy peeking about your ROMs and trying to work out what's going on, you'll be glad to know that this month we've managed to come up with something rather special – a guide to what happens to your BBC Micro at switch-on.

Melbourne House have just published the Guide to the BBC ROMs, by Don Thomasson, a fascinating exposition of how the BBC Micro's operating system works, together with details of the Basic Interpreter.

The guide covers each ROM

routine clearly and intelligibly, giving its entry addresses and parameters, details of its function and an explanation of how it works.

We were so impressed we contacted Melbourne House and got permission to reproduce extracts from the fascinating second chapter, which covers OS initialisation. So now you can see for just how good the book is.

Incidentally, you might find a disassembly of the ROM useful to read in conjunction with the article. If so, try Jim Notman's program in last February's issue of *The Micro User*.

# Initialising the Operating System

**SOME of the more complex components of a computer need to be set up to a given state when power is first applied.**

This is usually achieved by means of a reset line, which remains in its "off" state for a few tens of milliseconds after the various power rails have stabilised. The BBC Micro has two reset lines.

RSTA is controlled by a simple charging circuit, and is only effective when the computer is first switched on. RST is generated by a timer chip, and is effective both at switch-on and when the Break key is pressed. RSTA resets the internal VIA chip and RST resets everything else. The distinction will be seen to be important.

When reset is removed from the 6502 CPU it reads an address stored at FFFC/D and jumps to the location specified. Check the address, remembering that the upper byte is in the higher location, and you know where to find the initialisation routine.

It may not be at the address used here, but don't worry about that.

**D9CD** The first action is to set (0D00) = &40, which is an RTI instruction. This comes into play in the event of a non-maskable interrupt,

which is 'vectored' to 0D00 by the contents of locations FFFA/B. The interrupt is normally associated with the Econet system, and the RTI instruction is a precaution only if Econet is not fitted.

Set I then bars maskable interrupts, Clear D sets binary mode in case the processor chose to come up in decimal mode, and the stack pointer is set to &FF, this being its home position in page 1.

A = (FE4E) then reads the interrupt enable register of the internal VIA. ASL

## By DON THOMASSON

moves the most significant bit into carry, and if that leaves A = 0 a jump to D9E7 is taken.

Remember, the internal VIA is not reset by RST, so it is not cleared down by pressing Break. If this is a Break and not initial switch-on, one or more of the enable bits will be set.

A is pushed before the jump, to retain an indication of whether this was a switch-on or Break start.

If the jump is not taken A = (0258),

which determines the action taken in response to depression of the Break and Escape keys. Bit 1 is examined, and if it is 0 the routine jumps to DA03, skipping the store clearance routine.

Bit 1 was brought into the bit 0 position by an LSRA before the check, and if the jump is not taken another LSRA zeroes A (unless someone has put a value greater than 3 in (0258), which would mess things up somewhat).

**D9E7** Whether reaches by a jump or directly, this point finds A = 0. (0000/1) = 0400, the base address for store clearance, X = 4 and Y = 0.

**D9EE** ((0000) + Y) = A = 0. If (0001) then equals 0, the routine jumps to D9FD, because the RAM clearance is complete and the clearance routine has wrapped round to clear locations 0000 and 0001. The RAM address system is arranged so that this happens as soon as all available RAM has been cleared, whether it extends to 16k or 32k. Otherwise Y is incremented, and if Y is then non-zero the routine loops to D9EE. If Y = 0, Y and X are



incremented, (0001) is incremented to select a new page, and if (0001) is positive the routine loops to D9EE. Look closely, and you will see that clearance of a fresh page begins with Y = 1. Location 0 is not cleared. Why? Well, it would be more difficult to arrange to skip location 0D00, which holds that RTI instruction, so all location 0s are left alone.

**D9FD** This point is reached when clearance is complete, and X holds the number of the last page to be cleared, plus 1, &80 for 32k RAM, &40 for 16k RAM. This value is copied into (0284), the soft key consistency flag, and (028E), which signals the size of available RAM.

**DA03** Attention is now turned to the peripheral devices (FE42) = &0F sets Port B of VIA 1 to output on bits 0-3, input on bits 4-7. Then a loop outputs values &0E to &09 on Port B.

**DA11** A further loop is now entered in which X takes values 9 to 1. The keyboard interrogate subroutine F02A is called for each value. This subroutine locks the keyboard by disabling auto-scan, and sets bit 7 of X high if the key defined by X on entry to the subroutine is pressed.

In this case, wire links rather than keys are involved, except for the Ctrl key. The meaning of the X values output by the interrogate subroutine are as follows:

- X=1: Ctrl key pressed.
- X=2,3: Links 7,8: Not used.
- X=4,5: Links 5,6: Disc Drive Data.
- X=6: Link 4: Shift/Break action.
- X=7-9: Links 1-3: Initial screen mode.

As each X value is output by the interrogation routine, bit 7 is shifted into the msb of (00FC). The last shift puts the lsb of (00FC) into carry, and the msb of (00FC) is 1 if Ctrl was pressed.

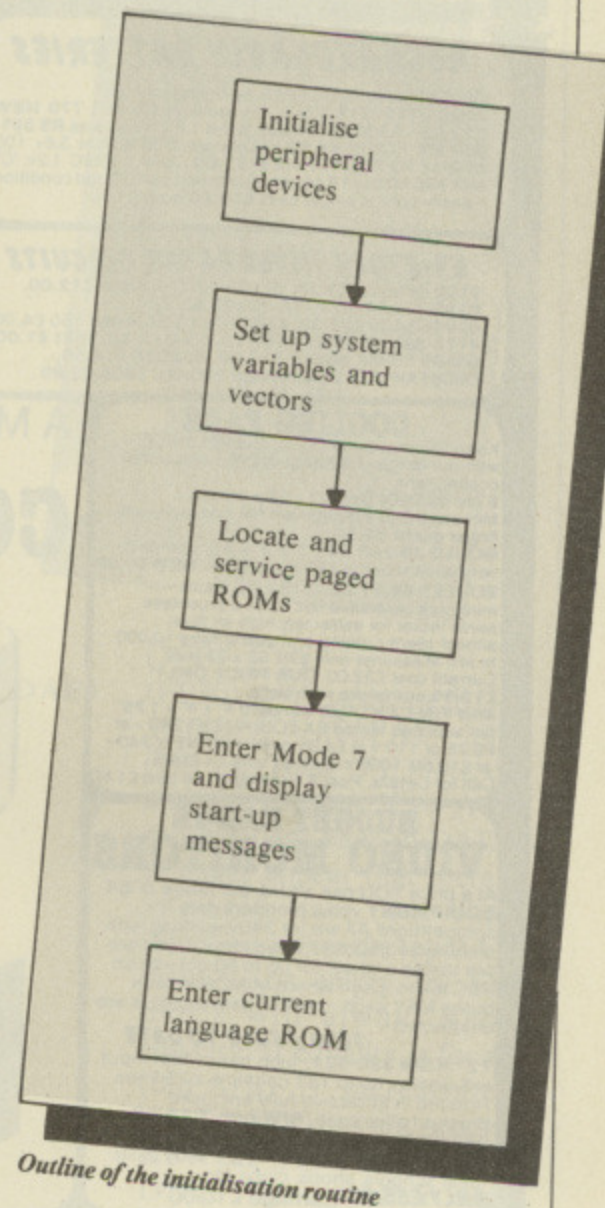
An option to use Shift with Break is mentioned in the manuals, but as the state of Shift would be checked by X = 0, a value not used here, the option is not immediately relevant.

**DA20** (00FC) is rotated left to put

the carry into the lsb and put the msb into carry. The LED-setting routine at EEEB is then called. This transfers the CPU status byte on entry to A on exit, so a rotate right is needed to restore the carry bit to its rightful place. It is now time to deal with the initialisation of page 2, which holds the indirect links and many system variables. There are three situations to be considered -

- (a) A is pulled, restoring the value pushed early in the initialisation routine. If A = 0, an initial start is being performed. X = &90, Y = &9C, (028D) = 1, and (028F) = (00FC) inverted.
- (b) If carry is set, Ctrl was pressed, calling for a cold restart. X = &90, Y = &87, (028D) = 2, and (028F) = (00FC) inverted.
- (c) If carry is clear, Ctrl was not pressed with Break, and a warm restart is required. Y = &7E, X = &9C, (082D) = 0, and (028F) is unaffected, being set already.

The values in X and Y determine



VIA location System/User	Register Desig.	Description Write/read
&FE40/&FE60	ORB/IRB	Output Register B/Input Reg. B
&FE41/&FE61	ORA/IRA	Output Register A/Input Reg. A
&FE42/&FE62	DDRB	Data Direction Reg. B
&FE43/&FE63	DDRA	Data Direction Reg. A
&FE44/&FE64	TIC-L	T1 Low Order Latch/Counter
&FE45/&FE65	TIC-H	T1 High Order Counter
&FE46/&FE66	T1L-L	T1 Low Order Latch
&FE47/&FE67	T1L-H	T1 High Order Latch
&FE48/&FE68	T2C-L	T2 Low Order Latch/Counter
&FE49/&FE69	T2C-H	T2 High Order Counter
&FE4A/&FE6A	SR	Shift Register
&FE4B/&FE6B	ACR	Auxiliary Control Register
&FE4C/&FE6C	PCR	Peripheral Control Register
&FE4D/&FE6D	IFR	Interrupt Flag Register
&FE4E/&FE6E	IER	Interrupt Enable Register
&FE4F/&FE6F	ORA/IRA	Reg. 1 Without Handshake

Table 1 - 6522 VIE registers



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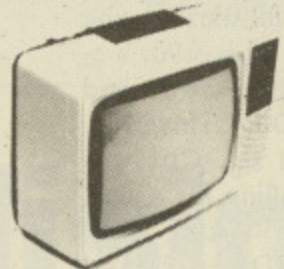
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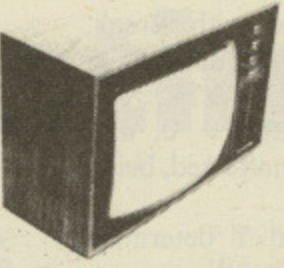
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**From Page 153**

which parts of page 2 are cleared and which are initialised.

(028D) is used to indicate which type of initialisation was last performed, and (028F) provides an indication of the keyboard links which are set.

**DA44** Page 2 can now be set up, partly by reference to a source table holding standard values. First, (0200 + X) to (02CD) are zeroed, then (02CF - 02FF) = &FF.

Rather out of context, (FE63) = &FF, setting Port A of the external VIA (printer interface) to output on all bits. Then again, rather out of context, (00E2 - 00FF) = 0. Finally, the lower part of page 2, up to (01FF + Y), is set from the source table.

**DA64** (00ED) = A = &62, and subroutine FB0A is called to set up the asynchronous communications interface adapter, or serial I/O chip. Note the sub-routine address. We will return to it in due course.

**DA6E** A positive orgy of peripheral initialisations comes next. (FE4D), (FE4E), (FE6D) and (FE6E) are all set to &7F, clearing the interrupt flag and enable registers of both VIAs. Interrupts are allowed briefly, to clear the air. With all significant interrupts disabled, nothing is affected.

If bit 6 of (00FC) = 1, subroutine F055 is called. This is a dead end if the disc system is not implemented. (FE4E) = &F2: Enable interrupts 1,4,5,6 of the internal VIA.

(FE4C) = 4: Set internal VIA PCR.

(FE4B) = &60: Set internal VIA ACR.

(FE46) = &0E: Set internal Via T1 counter (L).

(FE6C) = &0E: Set external VIA PCR.

(FEC0) = &0E: Set up A/D converter.

If (FE6C) ≠ &0E increment (0277). (External VIA bit mask).

(FE47) = &27: Set internal VIA T1 counter latch (H).

(FE45) = &27: Set internal VIA T1 counter (H).

The T1 counter being set to 270E (9998 decimal), it generates an interrupt every 9998 clock pulses, that is, every 10mS.

Setting the external VIA PCR to &0E gives:

CA1: Interrupt on negative edge. (Printer Acknowledge).

CA2: High output. (Printer strobe).

CB1: Interrupt on negative edge. (User port).

CB2: Negative edge. (User port).

If reading the external VIA PCR does not give the value just set in it, the chip is missing or defective. (0277) is incremented from &FF to 0 to bar all external VIA interrupts.

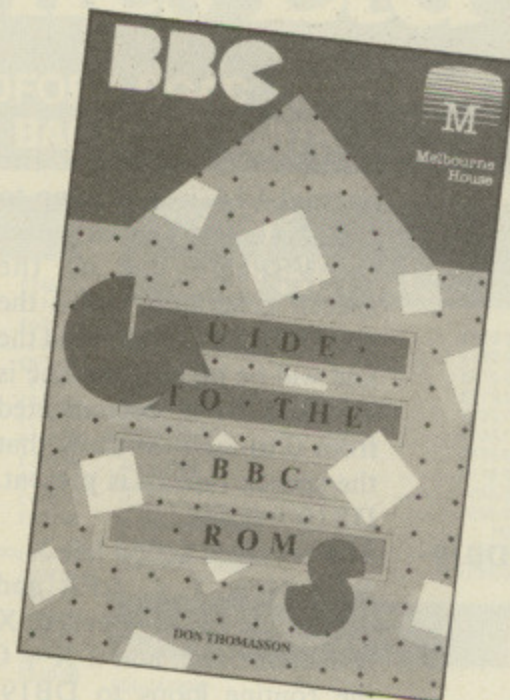
Setting (FEC0) = &0E gives input channel 1 selected, and the ten-bit mode of the converter chip.

**DAAA** Subroutine EC60 is called to clear the sound channels. This is another address worth noting. The actions which follow depend on the kind of initialisation being carried out, reference being made to page 2 locations unaltered in a warm start but reset during initial or cold start. Subroutine E6A7 is called with A = (0282) AND &7F to set up the Serial ULA. Then, if (0284) ≠ 0 subroutine E9C8 is called to rest the function keys, this call being executed only for a cold or initial start.

**DABD** Attention now turns to the paged ROMs. First, subroutine DC 16 sets (00F4) = (FE30) = X = 0. This sets the ROM select chip and its RAM copy. X = 3, Y = (8007). Y now holds the displacement of the start of the ROM heading text relative to 8000.

**DAC5** A loop checks that the heading text begins with '(C)', the copyright symbol. If the check fails, a jump to DAFB is taken. Otherwise, X = Y = (00F4).

**DAD5** Y is incremented, and if the result exceeds &0F a jump to DAAF is taken. Otherwise, (00FA) = Y inverted, and (00FB) = &7F. (00FA/B) form an address equal to



(7FFF - Y).

**DAE3** (FE30) = Y, selecting ROM Y, then A = ((00FA) + Y) = (7FFF). Then (FE30) = X, and if ((00FA) + Y) ≠ A the routine loops back to DAD5. It might appear that there is an error here, but since (7FFF) is either the top RAM location or empty the first check will always show equality. If equality is found, (00FA/B) is incremented, and if (00FB) has not reached &84 the routine loops to DAE3 for a further comparison. As two different ROMs are being compared, it is to be expected that a difference will soon be found. If the ROMs are identical, up to &83FF, DAFB follows.

**DAFB** X = (00F4), and if X is positive a jump to DBOC is taken.

**DAFF** A = (8006), which is the type number for the selected ROM. This is stored in (02A1 + X), setting up a dictionary of the ROM types available. If the type number AND &8F is zero, (024B) = X. This identifies the Basic ROM, which should be the only one which returns a type number with bit 7 = 0. (However, it is stated that bit 1 should always be set, which from this code appears to be an error.)

**DBOC** X is incremented, and if the result is less than &10 a jump back to DABD repeats the process. Otherwise, if bit 7 of



**From Page 155**

the Port B input on the internal VIA is 1, a jump to DB27 is taken. This bit senses the VSPINT line on the speech generator, and if the speech facility is not fitted the line will be high. If the line is low, (027B) is decremented from 0 to &FF to show that the speech facility is present. DB19 follows.

**DB19** The previous action left X = &10. Now Y = &FF and subroutine EE7F is called. X is decremented, and if X ≠ 0 the routine loops to DB19. This initialises the speech generator system. Then the internal VIA T2 counter, used with speech, is zeroed by (FE48) = 0, (FE49) = 0.

**DB27** A = (028F), which holds the inversion of (00FC), and C300 is called. This is a jump to the screen initialisation routine. Bits 0 - 3 of (028F) determine the mode which is set up. The routine continues by calling E4F1 with Y = &CA. This enters the value in the keyboard buffer. It is perhaps no coincidence that &CA is the Basic token for NEW. Subroutine EAD9 is then called. This is a check to see whether a boot address is set up, in which case the address follows. F140 is called to set up the cassette options, and (FEE0) = &81, A = (FEE0). If bit 0 of A = 0, DB4D follows. There is no second processor. Otherwise, F168 is called with X = &FF to perform a ROM select function. If the return is zero, (027A) is decremented from 0 to &FF to show that the Tube is in use and that the appropriate ROM is available.

**DB4D** Y = &0E, X = 1, and ROM select (F168) is again called. X is changed to 2, and F168 is called again. (0243) = (0244) = Y = &0E. This is the PAGE variable.

X = &FE, Y = (027A), and F168 is again called. If A AND (0267) gives a positive result, a jump to DB87 is taken. Bit 7 of (0267) bars the

startup message if true. It may be set up by a ROM during initialisation.

DEA9 is called with Y = 2. This outputs a string starting at C300 + Y + 1; "BBC Computer".

If (028D) = 0 a jump to DB82 is taken. This will be remembered as having been set to 0, 1 or 2 according to the type of initialisation being executed.

Otherwise DEA9 is called again with Y = &11 or &16 according to the contents of (028E), which indicate the size of RAM.

**DB82** DEA9 is called with Y = &1B, which gives two newlines.

**DB87** C is set, and EAD9 is called to look for a "booting jump", which may have been set up during ROM initialisation.

Then E9D9 is called, this being OSBYTE 118, which sets up the LEDs in accordance with keyboard status. (Whereas EEEB set them according to data supplied.)

P is now pushed and A pulled. Then LSRA is called four times. This will zero bits 4-7, and bits 0-2.

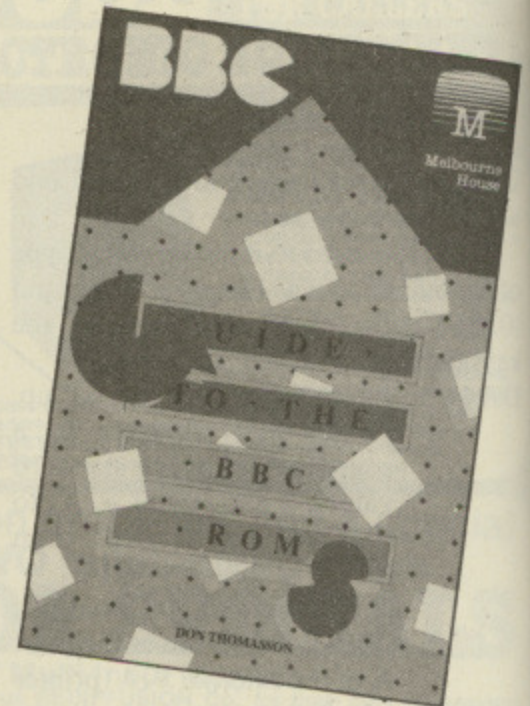
Bit 4, which was the sign flag, may be set. A = A EOR (028F) AND 8. Bits 0-3 and 5-7 will now be zero, and bit 4 will be 1 if bit 4 of (028F) = 1. This is disc drive data, and may or may not be 1.

Y = A, X = 3, and F168 (ROM select) is called. If it returns with the equal condition set, DBBE follows.

It must be assumed that this is a check for disc facilities, in view of what follows:

If Y ≠ 0, a jump to DBB8 is taken. Otherwise F135 is called with A = &8D to set up standard cassette baud rates. X/Y are then set to EAD2, which is the address of a text string BOOT, and the Command Line Interpreter is called at FFF7.

During the call, (0267) is decremented, this being the start-up suppression flag, which is mainly concerned



with the disc system.

If (0267), incremented again after return from the call, is ≠ 0, DBBE follows.

**DBB8** F137 is called with A = 0, X = 0, to set tape speed.

**DBBE** If (028D) ≠ 0 (not warm restart), DBC8 follows. Otherwise, if (028C) is positive (current ROM number), a jump is taken to DBE6.

**DBC8** X = &0F.

**DBCA** A loop is entered which checks the ROM directory from (02A1) upwards. If bit 6 of the directory entry is 1 (ROM has a language entry), the routine jumps to DBE6. The ROMs are checked in descending order.

If none of the ROMs has a language entry, A = 0, and if bit 7 of (027A) is true, DC08 follows, otherwise the report Language is displayed. ((027A) is the Tube flag, set to &FF if the Tube is in use.)

**DBE6** Carry is cleared, whereas the OSBYTE call enters with carry set.

**OSBYTE 142: Enter language ROM:**

**DBE7** P is pushed, and the language ROM number is set in (028C) from X. DC16 is called to select that ROM.

Then DEAB is called with A = &80 and Y = 8 to display a text string held in the ROM at 8009. Y = &FD, and newline is called twice at FFE7. P is pulled, and A = 1.

If (027A) is negative (second processor fitted), a



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**From Page 156**

jump to 400 follows, else the language ROM is entered at 8000.

This completes the initialisation routine. Understanding of it will grow as other parts of the program are studied. Some of the functions will only be relevant to particular system configurations.

We are left with a small problem. Most of the subroutines called by initialisation will crop up in other contexts, where they can be examined more effectively, but there are some exceptions, which, for convenience, are described below. The first performs ROM selection:

**DCOB** X = (00F4), the currently selected ROM number, and (00F4) = Y, (FE30) = Y, selecting ROM Y. Y = 0, and A = ((00F6) + Y). Then -  
**DC16** (00F4) = X, (FE30) = X. The routine returns.

The string output routine has three possible entry points:

**DEA9** A = &C3, this being the high

byte of string start.

**DEAB** (00FE) = A, (00FD) = 0. This sets up a base address, to which Y + 1 is added to give the string start.

**DEB1** Y is incremented, and A = ((00FD) + Y). OSASCI (FFE3) is called to output the character in A. If A ≠ 0, the routine loops back to DEB1, else returns.

E6A7 is the tail end of a routine beginning at E689. It sets the serial ULA:

**E6A7** (0282) = A, this being the RAM copy of the last output to the ULA, which is then set by (FE10) = A. A = Y, X = A, the routine returns.

EAD9 looks for a link in ROM:

**EAD9** If (0287) ≠ &4C (jump op-code), return, else go to 0287.

At F055 there is an indirect jump to (FDFF), which is an address associated with the disc controller.

To sum up, the Break key can be very useful on occasion, but some of the consequences of its use can be annoying. Some significant chips in the

be particularly annoying in the case of the User Interface, which may need several bytes of data to set it up in the required working mode.

It would be useful if a user-defined routine could be called up to rectify matters. The jump checked by EAD9 looks hopeful, but the jump is cleared to zeroes in both initial start and warm restart.

It is therefore necessary to incorporate any resetting process in the main program.

One thing we have learned about the initialisation routine is that it is authoritarian. It will brook no interference, and will deliver you into the hands of either the language ROM or the Tube.

Incidentally, if you are wondering whether you might fool the routine by setting (027A) = &FF, and then putting your set-up routine at 400, you should note that (027A) is zeroed in all initialisation modes.

Nevertheless, our study of the initialisation procedure has brought to light a number of useful facts, though some of the facts are not, perhaps, quite as we would wish them to be.

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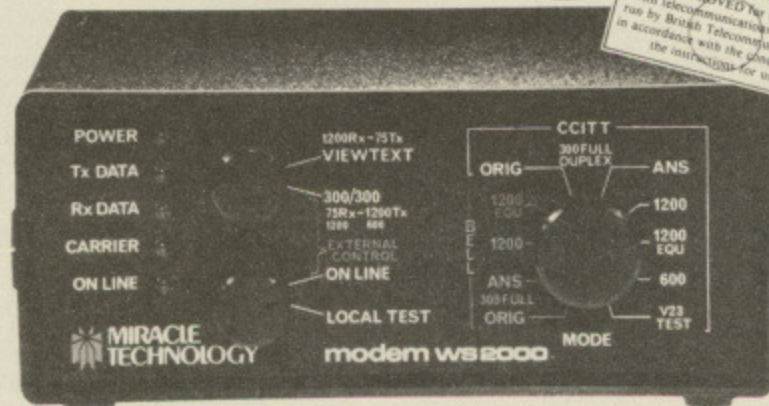
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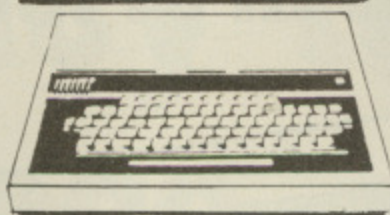
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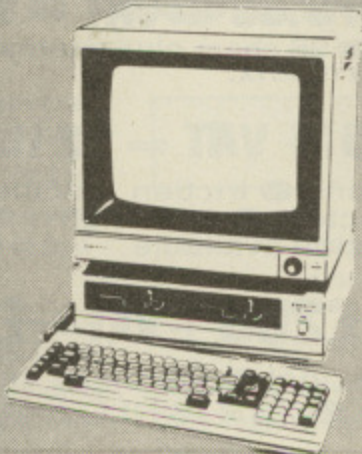
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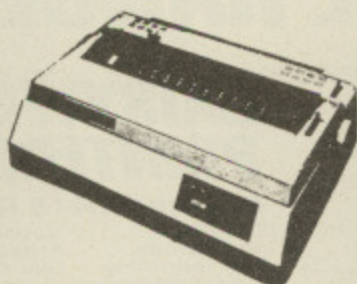
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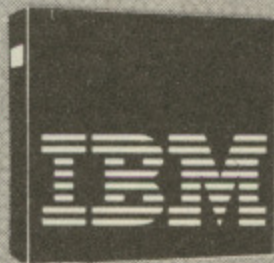


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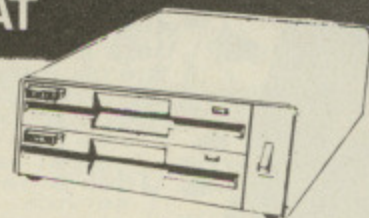
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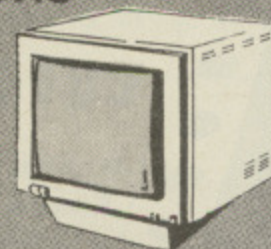
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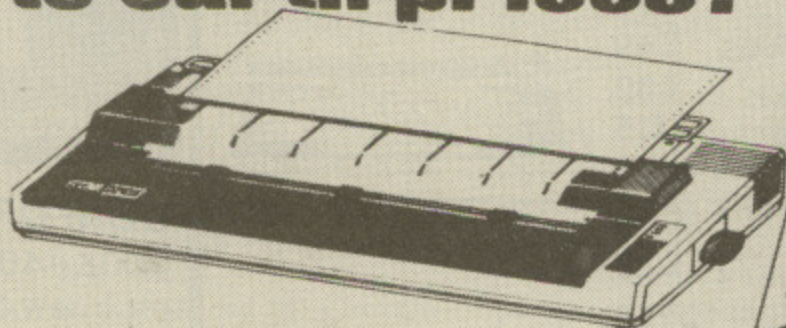
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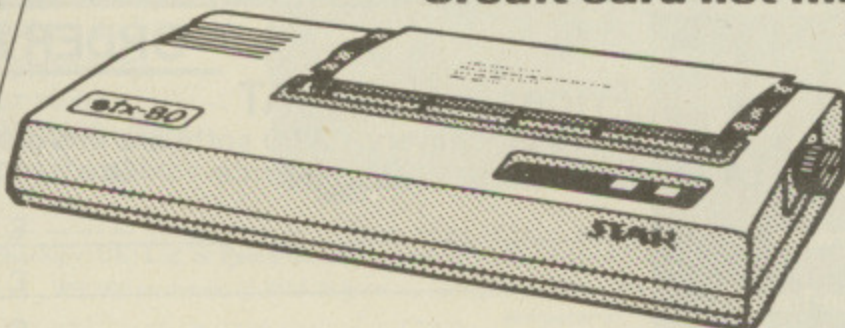
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# The key to success – numerical style

## THE BEEB BODY BUILDING COURSE

Part 28

SOME time ago I received several letters from readers wanting to know how they would fit a numeric key pad to the BBC Micro. At that time there wasn't one on the market, so I set to and designed one.

For one reason or another different projects took precedence and in time commercial keypads appeared on the scene. However I still think it is worth looking at the principle of keyboards, and we might save ourselves a bit of money into the bargain.

So, it's back to the aptly named user port. This has eight data lines that can be used as inputs. However, a decent keypad needs 16 keys. So how do we squeeze 16 signals into eight inputs? The answer is time division multiplexing using a scanning matrix.

Sounds impressive, doesn't it? But fortunately it's quite simple. It's based on the same principle used on virtually all computers from the highest main-frame to the lowest Spectrum.

Time division multiplexing means that at different times there are different signals on the same line. The line acts like a multitude of lines by allowing each signal its own slice of time, hence the name.

It's rather like a railway – different trains (signals) can use the same line, hence Clapham Junction. Provided they don't all try to use the same line at the same time, everything works smoothly.

Let's delve into the circuit and see how it works. The full circuit of the keypad is shown in Figure 1. You will see a 4 by 4 line matrix with push switches at the intersection of each matrix line. We can conveniently split this up into row lines and column lines.

You can see that all the row lines come from the user port. These are set to be outputs. The column lines are set to be inputs and there is a resistor

By MIKE COOK

pulling each input to the +5 volt line so that these inputs will normally read as logic ones.

Suppose we make the first row line a logic zero and all the other row lines logic ones. Any key pressed in the first row will cause a logic zero to be fed into the user port. None of the keys in any other row will have an effect on the normal (logic one) state of the inputs.

We can then tell which key in the first

row has been pressed by seeing on which input the logic zero appears.

We can zoom in on the pressed key by placing a zero on the first row and seeing if any input is zero. If it is not, we place a logic one on the first row and try the second row by placing a logic zero on that, and so on.

In this way we can identify the matrix intersection that is connected together.

However there is a snag with this method. The computer must take the time to scan the matrix in order to see if a key is being pressed, so a lot of time will be wasted looking at the keypad

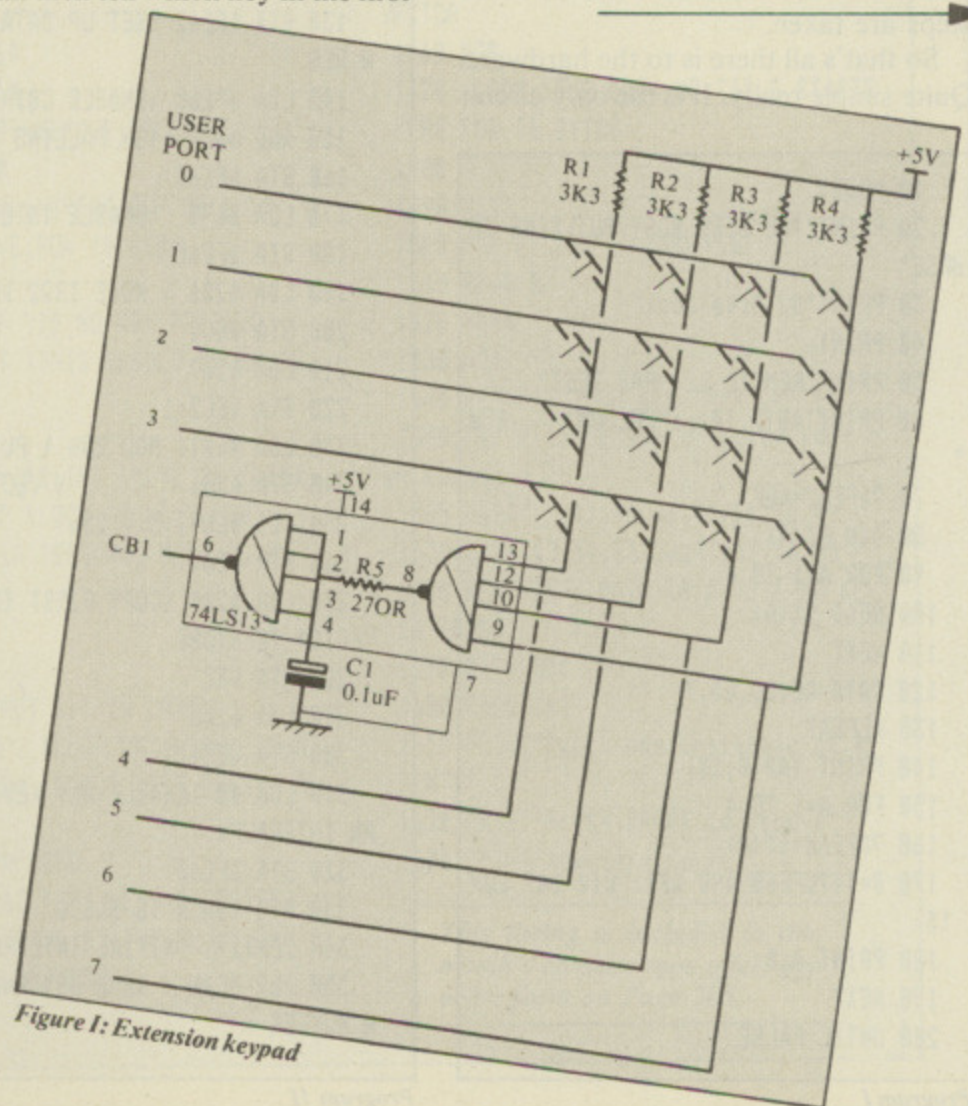


Figure 1: Extension keypad



## From Page 161

when there is no need to.

This is where IC1 comes in. It is two four input NAND gates, each input connected to a column line. Therefore if any column lines go low the output of the gate goes high (this is the action of a NAND gate).

The second gate in the package is used to invert the signal so that the control line input CBI goes low when any key is pressed. This is arranged to generate an interrupt and so summon the computer to come and look at the keypad.

All key switches are subject to key bounce caused by the two contacting surfaces bouncing off each other before coming to rest. We mortals are not quick enough to notice this, but electronic logic circuits are. They think there have been several rapid key presses.

We must take steps to de-bounce the keys in very much the same way that Tigger was de-bounced. We tackle this in both software and hardware.

On the hardware side you can see that C1 and R5 together act as a little delay circuit slowing down any response from a key press and allowing it to settle down before summoning the computer.

We will see later on what software steps are taken.

So that's all there is to the hardware. Quite simple really. It is the only circuit

```
10 MODE7
20 PRINT"THE BEEB BODY BUILDING CO
URSE"
30 PRINT"By Mike Cook"
40 PRINT
50 PRINT"REMOTE KEY-PAD TEST"
60 PRINTTAB(7,10);;"COLOUM  ROW
"
70 ?&FE62=&0F
80 DIM S%(4)
90 FOR A=1 TO 4
100 READ S%(A)
110 NEXT
120 DATA &E,&D,&B,7
130 REPEAT
140 PRINT TAB(0,10)
150 FOR A=1 TO 4
160 ?&FE60=S%(A)
170 B=((?&FE60 AND &F0) DIV 16) EOR
15
180 PRINT A,B
190 NEXT
200 UNTIL FALSE
```

Program I

# 'The construction is quite straightforward'

I have made a printed circuit board for before making a prototype.

The PCB is available along with all the other components as Body Build Pack No. 25. See Page 164 for the ordering details. Note that you will also need a cable to connect it to the user port. Body Build Pack No. 2 is suitable.

The keys have clear plastic tops allowing you to place your own legends

on each. This means you can have a group of the keys you want, not the ones I think you need. There is, however, a printed sheet of the ones I used included in the pack.

Construction is quite straightforward. Simply slot the components in and solder up. However, for that professional finish take a little care in soldering in the keys. Due to the size of

```
10 PRINT"THE BEEB BODY BUILDING CO
URSE"
20 PRINT"By Mike Cook"
30 PRINT
40 PRINT"REMOTE KEY-PAD PATCH"
50 OSBYTE=&FFF4
60 FOR PASS%=0 TO 2 STEP 2
70 P%=&9C6
80 [
90 OPT PASS%
100 .INIT
110 \ INITIALISE PATCH
120 LDA #&0F
130 STA &FE62 \SET UP DATA DIRECTIO
N REG
140 LDA &FE6C \ENABLE CBI
150 AND #&EF \ON FALLING EDGE
160 STA &FE6C
170 LDA #&90 \ENABLE INTERRUPT
180 STA &FE6E
190 LDA &206 \ MOVE IRQ2 VECTOR
200 STA VEC2
210 LDA &207
220 STA VEC2+1
230 LDA #ENT1 MOD 256 \ PUT IN IRQ2
240 STA &206 \ VECTOR PATCH
250 LDA #ENT1 DIV 256
260 STA &207
270 LDA &204 \COPY FIRST INTERRUPT
VECTOR TO STORE
280 STA VEC
290 LDA &205
300 STA VEC+1
310 LDA #0 \ENABLE ANY KEY TO GIVE
AN INTERRUPT
320 STA &FE60
330 RTS \BACK TO BASIC
340 .ENT1 \ INITIAL INTERRUPT ENTRY
350 JSR SCAN \ READ KEY AND PLACE I
N BUFFER
```

Program II

```
360 JSR K_INSERT \ INSERT TO BUFFER
370 LDA #196 \GET AUTO REPEAT DELAY
380 LDY #&FF
390 LDX #0
400 JSR OSBYTE
410 STX DR1 \ STORE FOR LATER
420 LDA #197 \GET REPEAT RATE
430 LDY #&FF
440 LDX #0
450 JSR OSBYTE
460 STX RR1 \STORE FOR LATER
470 LDA #1
480 STA RR2 \PRIME REPEAT RATE TEMP
STORAGE
490 STA PD \PRIME PRE DELAY
500 LDA VEC2 \PUT BACK INTERRUPT VE
CTOR 2
510 STA &206
520 LDA VEC2+1
530 STA &207
540 LDA #KDOWN MOD 256
550 STA &204 \REDIRECT FIRST INTERRUPT VECTOR
560 LDA #KDOWN DIV 256
570 STA &205
580 JMP (VEC2) \ ON YOUR WAY
590 LDA #&7F \ CLEAR ANY BOUNCE INT
ERRUPTS
600 STA &FE60
610 .KDOWN \ ENTRY POINT WHILE THE
KEY IS DOWN
620 DEC PD \DECREMENT PRE DELAY
630 BNE SEE_END \SEE IF KEY IS UP
640 LDA #3 \RE-PRIME PRE DELAY
650 STA PD
660 LDA DR1 \GET DELAY TIME
670 BEQ AR \TO SEE IF WE NEED TO AU
TO REPEAT
680 DEC DR1 \DECREMENT DELAY TIME
690 JMP SEE_END \SEE IF KEY IS UP
```



# THE BEEB BODY BUILDING COURSE

as it copes with two key rollover and auto repeats. If you just want a simple non-repeating key pad this can be simplified considerably.

As the program is complex, several words of explanation will not go amiss.

The overall strategy of the program is

the hole there is a little play in the key position. If all the keys do not line up square it can detract from the appearance of the key pad. To avoid this, place all the tops on the keys before soldering them in place. This will allow you to find the correct position more easily.

We are only talking about fractions of a millimetre play, but over 16 keys that can add up.

The lower left-hand key can be placed in the board in two positions. The first is in line with the other keys and the second is offset. This is to allow you to use a double-size keytop here if you wish. This can be useful if you make this

the Return key.

To test the keypad use Program I. It continuously scans the keyboard and displays which key is being pressed in terms of rows and columns.

You will see that each key in a column returns its own value represented by one bit in the number being set high. If more than one key is held down these values add up.

This is written entirely in Basic and so will not test to see if CBI is being driven correctly.

Integrating the keypad into the computer's operating system is a little more tricky, as shown in Program II. This program is an all-bells-and-whistles one

```

700 .AR
710 DEC RR2 \DECREMENT REPEAT RATE
720 BNE SEE_END
730 JSR K_INSERT \INSERT CHAR TO BU
FFER
740 LDA RR1 \SET NEW DELAY TIME
750 STA RR2
760 .SEE_END \SEE IF WE NEED TO END
THIS
770 LDA &FE60 \GET CURRENT KEY PAD
BYTES
780 CMP SS \COMPARE TO SAVED STATUS
790 BNE PUT_BACK
800 CMP #&FF \SEE IF NO KEY IS PRE
SSED
810 BEQ PUT_BACK
820 JMP (VEC) \TO DEAL WITH INTERR
UPT
830 .PUT_BACK \REPLACE VECTOR IRQ1
840 LDA VEC
850 STA &204
860 LDA VEC+1
870 STA &205
880 LDA #ENT1 MOD 256 \RESTORE ENTR
Y FOR INTERRUPT VECTOR 2
890 STA &206
900 LDA #ENT1 DIV 256
910 STA &207
920 LDA #&FF \REMOVE ANY INTERRUPT
930 STA &FE60
940 LDY #40 \DELAY LOOP FOR CONTACT
BOUNCE
950 .DE1 LDX #&FF
960 .DL NOP
970 DEX
980 BNE DL
990 DEY
1000 BNE DE1
1010 LDA #0 \ENABLE ANY KEY TO BE AN
INTERRUPT

```

```

1020 STA &FE60
1030 JMP (VEC) \ON YOUR WAY
1040 .K_INSERT \INSERT CHAR TO BUFFE
R
1050 LDA #&99
1060 LDX #0 \KEYBOARD BUFFER
1070 LDY K_PRESSED \THE KEY THAT IS
PRESSED
1080 JSR OSBYTE
1090 RTS
1100 .SCAN \READ KEYPAD
1110 LDY #&F7 \ROW TO READ
1120 LDX #0 \INDEX OF KEY
1130 .LOOP
1140 STY &FE60
1150 LDA &FE60
1160 AND #&F0 \REMOVE COLUMN BITS
1170 CMP #&F0
1180 BNE FOUND \BREAK OUT OF LOOP
1190 TYA \MOVE ROW TO READ
1200 LSR A
1210 CMP #&0F \IS NO KEY PRESSED
1220 BEQ WHAT \THIS SHOULD NEVER BE
EXECUTED
1230 TAY
1240 INX:INX:INX:INX \MOVE ON INDEX
1250 JMP LOOP \LOOK AT NEXT ROW
1260 .FOUND \A ZERO HAS BEEN FOUND
1270 DEX
1280 .LOOP2
1290 INX
1300 ASL A \PUT BIT IN CARRY
1310 BCS LOOP2 \LOOP UNTIL BIT FOUND
1320 .WHAT LDA LOOK,X \GET ASCII VAL
UE
1330 STA K_PRESSED
1340 LDA &FE60 \GET KEYPAD STATUS
1350 STA SS \SAVE STATUS SO WE CAN S
EE WHEN IT IS UNPRESSED
1360 RTS

```

```

1370 .SS NOP \SAVED KEYPAD STATUS
1380 .K_PRESSED NOP \ASCII VALUE OF
KEY PRESSED
1390 .PD NOP \STORE FOR PRE DELAY
1400 .DR1 NOP \AUTO REPEAT DELAY
1410 .RR1 NOP \AUTO REPEAT RATE MAST
ER STORE
1420 .RR2 NOP \AUTO REPEAT RATE TEMP
STORE
1430 .VEC NOP \TEMP STORE FOR INTERR
UPT VECTOR
1440 NOP
1450 .VEC2 NOP \TEMP STORE FOR IRQ2
VECTOR
1460 NOP
1470 .LOOK \THE LOOK UP TABLE STARTS
HERE FOR 16 BYTES
1480 J
1490 NEXT
1500 FOR A=LOOK TO LOOK+16
1510 READ B
1520 ?A=B
1530 NEXT
1540 REM DATA FOR KEY TRANSLATION
1550 REM Alter these to suite your o
wn keyboard
1560 DATA 13,43,46,48,45,51,50,49
1570 DATA 42,54,53,52,47,57,56,55
1580 REM FINAL DATA IS A ? IF NO KEY
IS FOUND
1590 DATA &3F
1600 CALL INIT
1610 PRINT"Patch now installed at &
;^ENT1
1620 PRINT"Press BREAK to remove"
1630 PRINT"Now type in NEW"

```

*This listing is included in this month's cassette tape offer. See order form on Page 205.*



# THE BEEB BODY BUILDING COURSE

## From Page 163

to detect a key press by the interrupt generated from the control lines on the user port.

Once a key is down, the computer's main interrupt vectors are then redirected to look and see if it is still down and sufficient time has elapsed for a new character to be generated. When the key is finally up the main computer's vector is restored and the secondary interrupt vector set to detect the next key down.

By swapping the vectors in this way the system looks after the auto repeat by using the stream of interrupts the computer normally generates.

This is a tricky procedure to fault-find and you are strongly recommended to save the program before you run it as mistakes often cause the system to crash.

Due to the complexity of the program it takes up nearly a page of memory.

As usual, I have used the serial buffer in &A00 but there is a short initialisation section that will be needed only when the patch is installed. This sits just above the buffer and is free to be used by the system after the program is run.

The program is heavily commented and you should be able to follow it through with a little care.

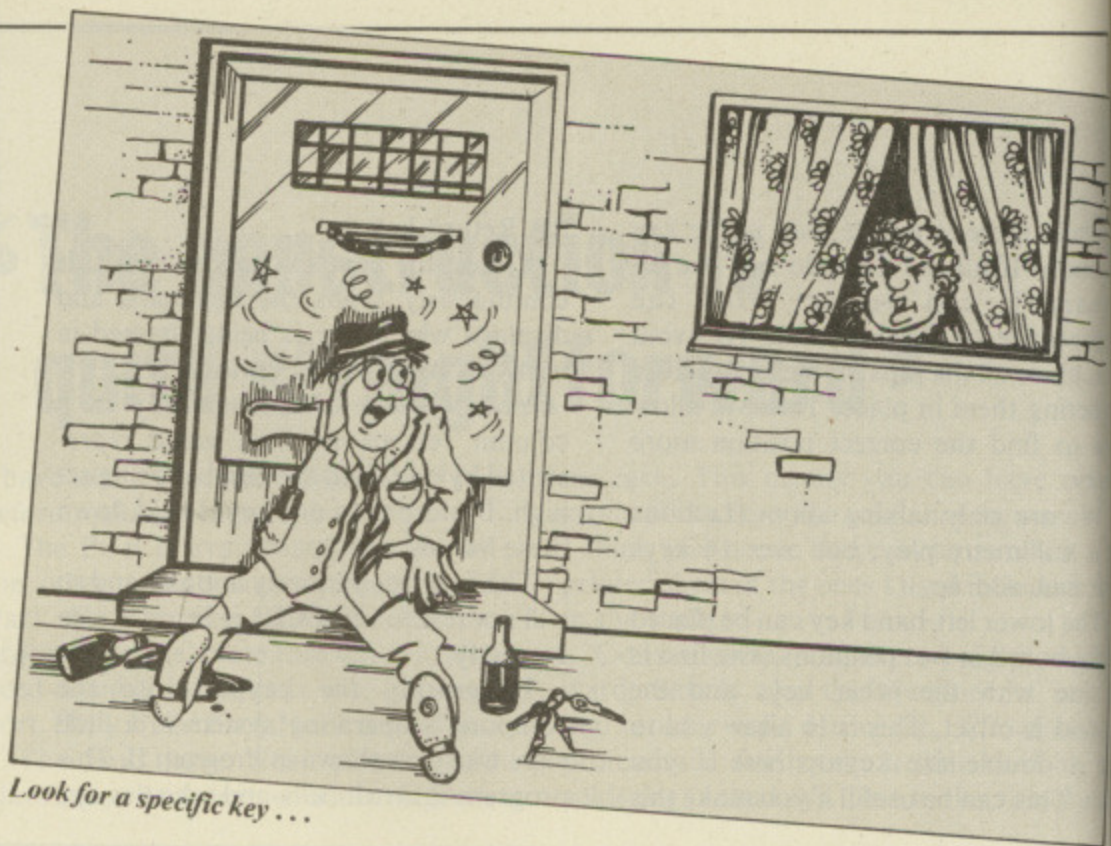
The auto repeat rates are derived from those set by the system, although using this patch they run slightly slower than the keyboard.

When the "delay-before-repeats" has expired, it is replaced by a very short delay as this was slightly easier to program than removing the delay altogether.

When a key is released there is a short delay to cover any contact bounce before the program is sent on its way.

As the program scans the keypad and places any key press found into the keyboard buffer, it will work with all the input commands from Basic with the exception of an INKEY command with a negative number.

This causes the keyboard to be



## 'You could graft on another keyboard...'

scanned to look for a specific key. This command could also be trapped and redirected to look at our keypad.

This is a technique that is used mainly in games and has been covered in past articles, so we will not go over it again here.

The values returned by the keypad are entirely dependent on the software. Lines 1560 and 1570 hold the Ascii codes of the keys' values.

The values start at the bottom right-hand corner and go from right to left, down to up. I am sorry about that,

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but I have been programming a lot in Forth lately and it gets you like that!

Well what can you do if you want a larger matrix? Having four input lines is rather wasteful, so you could have a data selector to channel this down to one input.

Likewise you could have a multiplexer circuit to place one row at logic zero when the row's binary value is placed into it. The logic gate would have to have a lot more inputs, of course, but the principle would be the same.

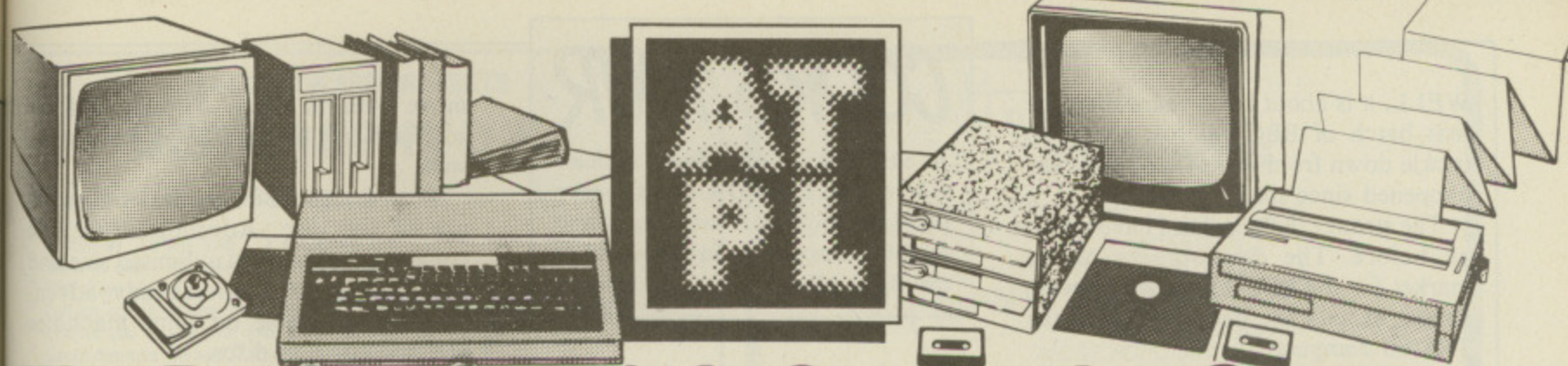
All these additions are made on the computer's main keyboard. The circuit diagram for this is on page 490 of the Advanced User Guide. With what we have learnt here you should be able to follow it.

You will see that the whole of the keyboard is controlled by the signals available on the User Port, so with the appropriate software patch you should be able to graft another full keyboard on if you want.

Well that's the principle of a scanning matrix keyboard. It can be adapted to many needs. For example the keys can be made larger and spaced out for the disabled. You can even make your own "concept keyboard" with symbols or pictures on the keys for the pre-school child.

As usual, the best part of a Body Build project is what you make of it. See you next month.





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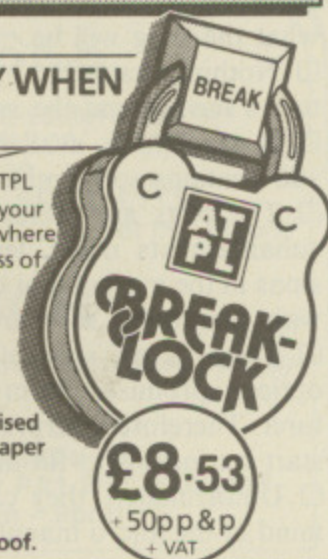
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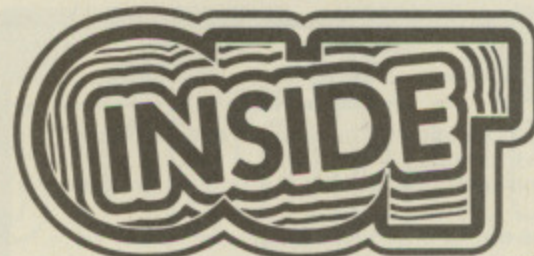


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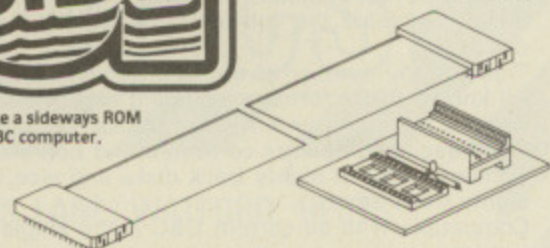
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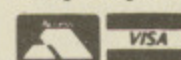
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WELL, it is about three years since the first batch of BBC Micros started to trickle down from Acorn, and a lot has happened since then.

The strange thing is that I have seen it all before. The development of the market for the BBC Micro is following almost exactly the development of the TRS-80 computer.

Other popular machines have set out on this road, but most have stopped short, killed off by models with a lower price tag and higher specification.

The development life cycle of a successful micro is usually like this:

- The micro is announced and everyone is impressed and wonders what the snag will be.
- Nothing happens – the manufacturers have found the snags.
- A machine is available, although it still contains some minor bugs.
- The bugs are corrected and a few enhancements made, leaving two versions in the market that cause problems with compatible software.
- There is no sign of the up-grade options promised from the manufacturer. Therefore enterprising individuals start businesses to fill the gap.
- Unfortunately they cannot read the mind of the micro manufacturer and so

## COOK'S TOUR

A SERIES of occasional articles where MIKE COOK takes a very personal look at what has, is and might be happening in the world of the BBC Micro.

when his products appear they are not compatible with what most people have.

- Newer machines are announced and the market stabilises. People neglect their cassette recorders and go for discs.
- Software producers finally realise this and produce software that will only run from disc.
- Quality software starts to appear on the market.
- Existing owners start looking at newer, better or faster machines.
- The trusty old workhorse has some very useful software and sits beside the newer machines on the desk.
- Relegated to use by the children, given away to a worthy cause or sits gathering dust. The owner finds out there is no secondhand market for it.

Currently with the BBC Micro I think we are at the stage where the market has stabilised and people are starting to

move over to discs. Virtually all the software is still available on cassette as well.

I can foresee software that makes full use of the disc. Adventures on disc could have a virtually unlimited size and full graphic facilities. Already adventures are available on some machines that run to eight discs.

Also, given the graphic capabilities of the BBC Micro, the animated graphics produced so far have been a little disappointing. This no doubt will improve in the future.

The further stages of this life cycle will be extended by the increasing use of second processors and more software should be available to run on it.

Unfortunately, most software producers will shy away from this for the fear of limiting their market. Look at how many have catered for Acorn's speech synthesiser.

Given the number of BBC Micros that have found their way into educational establishments, the later death throes of our micro may be delayed for many years to come.

All in all there is a lot of computing left in this machine – it is just starting to reach maturity and like a good wine, it will improve with age.

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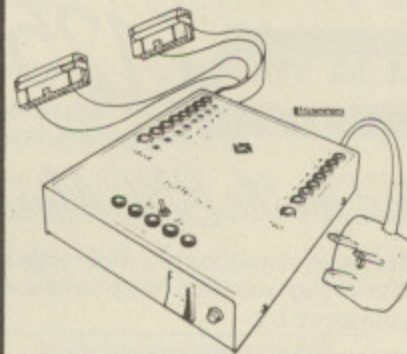
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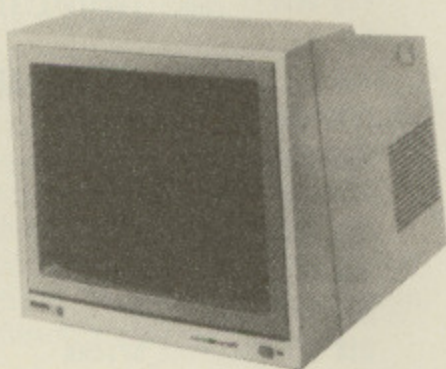
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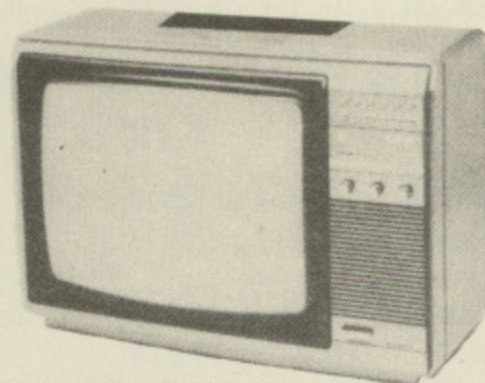
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## Mutant Fly listing

### From Page 69

```

10 REM FLY BY John Mc Cauley
20 REM (C) The Micro User
30 ON ERROR MODE7:REPORT:PRINT" at
line ";ERL:END
40 ENVELOPE1,1,-10,20,-10,33,33,33
,25,-1,-1,-2,100,80
50 ENVELOPE2,1,4,-3,5,40,20,30,127
,-1,0,0,126,0
60 ENVELOPE3,6,-8,-10,7,2,14,0,0,0
,0,0,0,0
70 ENVELOPE4,0,0,0,0,0,0,67,-3,0,-
4,126,126,0
80 VDU23,255,255,255,255,255,255,2
55,255,255
90 MODE7:VDU23;8202;0;0;0;0;:PROCi
nstructions:DIM PAX(30)
100 DX=128:FOR SX=1 TO 30:OZ=OZ+32:PAX
(SX)=OZ:NEXT
110 MODE1:VDU23;8202;0;0;0;0;:SCZ=0
120 HIZ=0:VDU4:COLOUR129:CLS:VDU5
130 XZ=608:YZ=576:X1Z=576:Y1Z=512:O
X1Z=0:OY1Z=0:VZ=0
140 COZ=0:VDU5
150 VDU19,0,3,0,0,0,19,3,0,0,0,23
,224,255,255,255,255,255,255,255,
23,225,28,28,0,127,8,20,34,65,23,226,
36,24,60,90,153,153,165,195:VDU5
160 VDU23,227,0,0,0,36,102,102,66,0
,23,228,255,8,8,8,255,64,64,64
170 VDU19,2,7,0,0,0:VDU24,100;100;1
184;928;:6COL0,132:CL6:VDU24,0;0;1024
;1279;
175 PROCtitle_page
180 6COL0,3:MOVE 600,576:VDU225
190 DATA 1,192,480,896,1,224,480,89
6,0,896,224,684,0,768,224,320,1,440,4
80,768,0,480,440,608,1,896,440,704,0,
704,704,1088,1,704,704,896,1,1088,704
,896,-1,-1,-1,-1
200 REPEAT
210 OX=XZ:OY=YZ:JZ=0:SOUND0,-10,2
3,1
220 KEYZ=TRUE
230 IF INKEY-98 AND XZ>96 XZ=XZ-32:
KEYZ=FALSE:IF POINT(XZ,YZ)=2 REPEAT
JZ=JZ+32:UNTIL POINT(XZ-JZ,YZ)<>2:PRO
Cmove_bricks(1,JZ)
240 IF INKEY-67 AND KEYZ AND XZ<115
2 XZ=XZ+32:KEYZ=FALSE:IF POINT(XZ,YZ)
=2 REPEAT JZ=JZ+32:UNTIL POINT(XZ+JZ,
YZ)<>2:PROCmove_bricks(2,JZ)
250 IF INKEY-73 AND YZ<928 AND KEYZ
YZ=YZ+32:KEYZ=FALSE:IF POINT(XZ,YZ)
=2 REPEAT JZ=JZ+32:UNTIL POINT(XZ,YZ+
JZ)<>2:PROCmove_bricks(3,JZ)

```

```

260 IF INKEY-105 AND KEYZ AND YZ>12
8 YZ=YZ-32:IF POINT(XZ,YZ)=2 REPEAT
JZ=JZ+32:UNTIL POINT(XZ,YZ-JZ)<>2:PRO
Cmove_bricks(4,JZ)
270 6COL 0,0:MOVEOXZ,OYZ:VDU224
280 6COL 0,3:MOVEXZ,YZ:VDU225
290 OX1Z=X1Z:OY1Z=Y1Z
300 RZ=RND(4)
310 IF RZ=1 AND X1Z>100 AND X1Z>XZ-
PAX AND POINT(X1Z-32,Y1Z)<>2 X1Z=X1Z-
32
320 IF RZ=2 AND X1Z<1152 AND X1Z<XZ
+PAX AND POINT(X1Z+32,Y1Z)<>2 X1Z=X1Z
+32
330 IF RZ=3 AND Y1Z>128 AND Y1Z>YZ-
PAX AND POINT(X1Z,Y1Z-32)<>2 Y1Z=Y1Z-
32
340 IF RZ=4 AND Y1Z<928 AND Y1Z<YZ+
PAX AND POINT(X1Z,Y1Z+32)<>2 Y1Z=Y1Z+
32
350 MOVEOX1Z,OY1Z:6COL0,0:VDU224
360 MOVEX1Z,Y1Z:6COL0,3:VDU226:6COL
0,2:MOVEX1Z,Y1Z:VDU227
370 COZ=COZ+1:VDU4:COLOUR3:COLOUR13
0:PRINTTAB(32,1);COZ:VDU5
380 UNTIL (XZ=X1Z AND YZ=Y1Z) OR (P
OINT(X1Z+32,Y1Z)=2 AND POINT(X1Z-32,Y
1Z)=2 AND POINT(X1Z,Y1Z+32)=2 AND POI
NT(X1Z,Y1Z-32)=2)
390 IF XZ=X1Z AND YZ=Y1Z PROCloss E
LSE PROCwin
400 GOTO 130
410 DEFPROCmove_bricks(HZ,UZ)
420 VZ=VZ+32:SOUND1,1,3,1
430 IF HZ=1 FORKZ=0 TO UZ STEP 32:M
OVE XZ-KZ,YZ:6COL0,1:VDU224:MOVE XZ-K
Z,YZ:6COL0,2:VDU228:NEXT:MOVEXZ,YZ:6C
OL0,0:VDU224
440 IF HZ=2 FORKZ=0 TO UZ STEP 32:M
OVE XZ+KZ,YZ:6COL0,1:VDU224:MOVE XZ+K
Z,YZ:6COL0,2:VDU228:NEXT:MOVEXZ,YZ:6C
OL0,0:VDU224
450 IF HZ=4 FORKZ=0 TO UZ STEP 32:M
OVE XZ,YZ-KZ:6COL0,1:VDU224:MOVE XZ,Y
Z-KZ:6COL0,2:VDU228:NEXT:MOVEXZ,YZ:6C
OL0,0:VDU224
460 IF HZ=3 FORKZ=0 TO UZ STEP 32:M
OVE XZ,YZ+KZ:6COL0,1:VDU224:MOVE XZ,Y
Z+KZ:6COL0,2:VDU228:NEXT:MOVEXZ,YZ:6C
OL0,0:VDU224
470 ENDPROC
480 DEFPROCloss:SCZ=0:SOUND&111,3,2
0,12:SOUND&110,4,7,12
490 SOUND1,1,3,0:FOR TX=0 TO 20:VDU19,
0,TX,0,0,0:FOR WZ=1 TO 50:NEXT:NEXT
500 VDU4:COLOUR3:COLOUR130:PRINTTAB
(14,15);"GAME OVER":VDU5

```

```

510 RESTORE 190
520 FOR X=1 TO 4000:NEXT
530 ENDPROC
540 DEFPROCwin
550 S=0:REPEAT S=S+10:SOUND1,1,5,1:
UNTIL S=300
560 VDU4:COLOUR3:COLOUR130:PRINTTAB
(14,15);"YOU WIN":VDU5
570 IF COZ<800 VDU4:COLOUR3:COLOUR1
32:PRINTTAB(14,20);"BONUS":VDU5:SOUN
D1,2,30,5:PROCbonus
580 SCZ=SCZ+(FX*50)
590 RESTORE 190
600 FOR X=1 TO 4000:NEXT
610 PROCnext_sheet
620 GOTO 200
630 DEFPROCtitle_page:VDU5:VDU19,1,
1,0,0,0
640 REPEAT READ CX,DZ,AZ,BZ
650 FOR GZ=AZ TO BZ STEP 32
660 IF CZ=1 MOVE DZ,GZ:6COL0,1:VDU2
24:MOVE DZ,GZ:6COL0,2:VDU228 ELSE MOV
E GZ,DZ:6COL0,1:VDU224:MOVE GZ,DZ:6CO
L0,2:VDU228
670 NEXT
680 UNTIL AZ=-1
690 *FX15,1
700 VDU4:COLOUR3:COLOUR128:PRINTTAB
(10,20);"LEVEL (1/9) (1 easiest)":RE
PEAT GZ=INKEY$(0):PROCFL:UNTIL VALG$(
GZ)>0:PRINTG$:PRINTTAB(16,23);"Z = LEFT"
;TAB(16,24);"X = RIGHT";TAB(16,25);"
= UP";TAB(16,26);"/ = DOWN"
710 PRINTTAB(8,30);"Press any key t
o continue"
720 FX=VALG$
730 PROCset_level
740 REPEAT PROCFL:GZ=INKEY$(0):UNTI
L GZ<>"
750 COLOUR1:PRINTTAB(8,30)STRING$(2
5,CHR$(255))
760 VDU5
770 CL6
780 X1Z=576:Y1Z=512
790 PROCprint_bricks
800 ENDPROC
810 DEFPROCprint_bricks
820 FOR UZ=1 TO PEX
830 REPEAT E1Z=PAX(RND(30)):E2Z=PAX
(RND(23)):UNTIL POINT(E1Z,E2Z)<>2:6CO
L0,1:MOVE E1Z,E2Z:VDU224:6COL0,2:MOVE
E1Z,E2Z:VDU228
840 NEXT
850 ENDPROC
860 DEFPROCnext_sheet
870 FX=FX+1:CL6:COZ=0:PROCset_level
:PROCprint_bricks:SOUND1,1,3,1

```



```

880 ENDPROC
890 DEFPROCset_level
900 IF FX=1 PEZ=200:PAZ=400
910 IF FX=2 PEZ=175:PAZ=300
920 IF FX=3 PEZ=150:PAZ=200
930 IF FX=4 PEZ=125:PAZ=150
940 IF FX=5 PEZ=100:PAZ=100
950 IF FX=6 PEZ=75:PAZ=75
960 IF FX=7 PEZ=50:PAZ=50
970 IF FX=8 PEZ=40:PAZ=40
980 IF FX=9 PEZ=30:PAZ=30
990 IF FX=10 PEZ=20:PAZ=0
1000 IF FX>=3:VDU19,0,5,0,0,0
1010 IF FX>=6:VDU19,0,6,0,0,0,19,1,4
0,0,0
1020 IF FX>=8:VDU19,0,5,0,0,0
1030 IF SCX>HIX HIX=SCX
1040 VDU4:COLOUR128:COLOUR3:PRINTTAB
(3,1);"LEV:";FX;" ";TAB(10,1);"HI-SC:
";HIX;TAB(22,1);"SC:";SCX;" ";TAB(3
,1);" "
1050 VDU5
1060ENDPROC

```

```

1070 DEFPROCFL:VDU5:RX=RND(4)
1080 IF RX=1 AND X1X>100 AND POINT(X
1X-32,Y1X)=0 X1X=X1X-32 ELSE IF RX=2
AND X1X<1152 AND POINT(X1X+32,Y1X)=0
X1X=X1X+32
1090 IF RX=3 AND Y1X>416 AND POINT(X
1X,Y1X-32)=0 Y1X=Y1X-32 ELSE IF RX=4
AND Y1X<950 AND POINT(X1X,Y1X+32)=0 Y
1X=Y1X+32
1100 MOVEOX1X,OY1X:GCOL0,0:VDU224:MO
VEX1X,Y1X:GCOL0,3:VDU226:GCOL0,2:MOVE
X1X,Y1X:VDU227:OX1X=X1X:OY1X=Y1X:VDU4
:ENDPROC
1110 DEFPROCbonus
1120 IF COX<=100 SCX=SCX+300 ELSE IF
COX<400 SCX=SCX+200 ELSE IF COX<500
SCX=SCX+150 ELSE IF COX<600 SCX=SCX+1
00 ELSE IF COX<700 SCX=SCX+50 ELSE SC
X=SCX+10
1130 ENDPROC
1140 DEFPROCinstructions
1150 FOR N=3 TO 4:PRINTTAB(0,N+1);V
DU141,129,157,135:PRINTTAB(10,N+1);"F

```

```

LY":NEXT
1160 PRINT:PRINT
1170 PRINTTAB(9,8)CHR$134"You must t
rap the fly"
1180 PRINTTAB(5,9)CHR$134"by surroun
ding it with bricks"
1190 PRINTTAB(5,10)CHR$(134)"using t
he Z, X, : and / keys."
1200 PRINTTAB(2,12)CHR$(129)"The fly
can only destroy the bricks"
1210 PRINTTAB(2,13)CHR$(129)"when yo
u drive them straight at him."
1220 PRINT'CHR$131" Do not move the
bricks to close to the ";CHR$131;"edg
e, and don't get caught or else!!"
1230 PRINTTAB(5,23);CHR$135"Press an
y key to continue..":6$=GET$
1240 ENDPROC

```

*This listing is included in this month's cassette tape offer. See order form on Page 205.*

# Get more out of your BBC Micro with the New Marconi RB2 Tracker Ball

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## RAMification listing

From Page 53

```

% = 13 OR name%?len% = 40 OR name%?len% = 5
8
480 copystart% = name% + len% - 1
490 REPEAT
500 copystart% = copystart% + 1
510 UNTIL?copystart% = 13
520 filelength% = endfile% - copystart%
530 ENDPROC
540 DEFPROC store
550 ?ptr% = len%
560 ptr%?1 = (name% - 1) MOD 256; ptr%?2 = (
name% - 1) DIV 256 + &50
570 ptr%?3 = copystart% MOD 256; ptr%?4 =
copystart% DIV 256 + &50
580 ptr%?5 = (filelength% + 1) MOD 256; pt
r%?6 = (filelength% + 1) DIV 256
590 ptr%?7 = 0
600 ptr% = ptr% + 7
610 ENDPROC
620 DEFPROC info
630 PRINT type%; C%; TAB(16) ~ startfile
%; TAB(23) ~ (endfile% - startfile% - 1)
640 ENDPROC
650 DEFPROC add
660 INPUT "Name of program to be add
ed " name$
670 $A = "LOAD "+ name$ + " "+ STR$(load
%)
680 X% = A MOD 256; Y% = A DIV 256; CALL
&FFF7
690 PROC analyse(load%)
700 ENDPROC
710 DEFPROC load
720 INPUT "Name of file to load
" name$
730 $A = "LOAD "+ name$ + " 3000"
740 X% = A MOD 256; Y% = A DIV 256; CALL
&FFF7
750 ptr% = &3000
760 PROC analyse(&3100)
770 ENDPROC
780 DEFPROC save
790 INPUT "Name of file to save " nam
e$
800 $A = "SAVE "+ name$ + " 3000 "+ STR$(
load% + 2)
810 X% = A MOD 256; Y% = A DIV 256; CALL
&FFF7
820 ENDPROC

```

### Program II

```

10 REM ** Procedure/function handl
er
20 REM ** By Tony Philip
30 REM ** (C) The Micro User
40 PROC assemble
50 PROC check

```

```

60 END
70 DEFPROC assemble
80 error1$ = "PROC/FN not in library
90 error2$ = "No room for PROC/FN"
100 base = &8000; procspc = &1500
110 memtop = &19
120 varname = &9559; REM Basic 1 &951F
130 endptr1 = &80; endptrh = &81
140 startptr1 = &82; startptrh = &83
150 startfile1 = &84; startfileh = &85
160 nameptr1 = &37; nameptrh = &38
170 FOR opt% = 0 TO 3 STEP 3
180 P% = &1300
190 [OPT] opt%
200 LDA &1F9: sta nameptr1
210 LDA &1F8: sta nameptrh
220 ldy #0: lda &1FF
230 .namest
240 INY
250 cmp (nameptr1), Y
260 bne namest
270 clc
280 tya
290 adc nameptr1
300 sta nameptr1
310 lda #0
320 adc nameptrh
330 sta nameptrh
340 ldx #0: jsr varname: stx nameleng
th
350 ldx &F4: stx romsave
360 ldx #15: stx &F4: stx &FE30
370 ldx #0
380 .checklength ldy base, X
390 beq error
400 cpy namelength
410 beq lengthok
420 .nolenmatch
430 clc: txa: adc #7: tax
440 jmp checklength
450 .error
460 jsr basic
470 brk
480 ]: ?P% = 29: P% = P% + 1: $P% = error1$: P%
= P% + LEN(error1$): [OPT] opt%
490 brk
500 .stack
510 lda record+2, Y: sta &B
520 lda record+3, Y: sta &C
530 lda #0: sta &1FA: sta &1FE
540 lda #rtnaddr MOD 256: sta &1FD: s
ta &1F9
550 lda #rtnaddr DIV 256: sta &1F8: s
ta &1FC
560 rts
570 .recursion
580 ldy record
590 dey: dey: dey: dey
600 jsr stack
610 jmp end
620 .lengthok \matched length
630 lda base+1, X: sta endptr1
640 lda base+2, X: sta endptrh
650 .comname
660 lda (nameptr1), Y
670 cmp (endptr1), Y
680 bne nolenmatch
690 dey
700 bne comname
710 .nameok \matched name
720 ldy direct: beq norecursion
730 cpx record+1: beq recursion
740 .norecursion
750 ldy record
760 bne copyexec
770 lda #procspc MOD 256: sta reco
rd+2
780 lda #procspc DIV 256: sta reco
rd+3
790 .copyexec
800 lda record+2, Y: sta startfile1
810 lda record+3, Y: sta startfileh
820 lda base+3, X: sta startptr1
830 lda base+4, X: sta startptrh
840 lda base+5, X: sta filelength1
850 lda base+6, X: sta filelengthh
860 stx record+1
870 .copy
880 clc
890 lda startfile1: adc filelength1:
sta endptr1
900 lda startfileh: adc filelengthh:
sta endptrh
910 cmp #memtop
920 bcs noroom
930 lda filelengthh
940 beq nolengthh
950 .page \copy down file
960 ldy #0
970 .round
980 lda (startptr1), Y
990 sta (startfile1), Y
1000 iny
1010 bne round
1020 inc startptrh
1030 inc startfileh
1040 dec filelengthh
1050 bne page
1060 .nolengthh \copied whole pages
1070 ldy #0
1080 .nextchar
1090 lda (startptr1), Y
1100 sta (startfile1), Y
1110 iny: cpy filelength1
1120 bne nextchar
1130 .nowin
1140 ldy record: clc: lda &1FA: adc &1F

```



## RAMification listing

### From Page 171

```

9:sta record+4,Y
1150 lda #0:adc &1F8:sta record+5,Y
1160 jsr stack
1170 iny:iny:iny:iny
1180 lda endptrl:sta record+2,Y
1190 lda endptrh:sta record+3,Y
1200 sty record
1210 .end
1220 jsr basic
1230 ldx #1:stx direct
1240 rts
1250 .rtnaddr
1260 ):rtn$=CHR$(&0D)+CHR$(&0)+CHR$(&
A)+CHR$(&B)+CHR$(&D6)+CHR$(&20)+CHR$(&
&26)+"147F"+CHR$(&D)+CHR$(&FF)
1270 $P%=rtn$:P%=P%+LEN(rtn$):[OPT o
pt%
1310 .basic
1320 ldx romsave:stx &F4:stx &FE30
1330 rts
1340 .norum
1350 jsr basic
1360 brk
1370 ):?P%=0:P%=P%+1:$P%=error2$:P%=
P%+LEN(error2$):[OPT opt%
1380 brk
1390 .romsave nop
1400 .direct nop
1410 .filelengthl nop
1420 .filelengthh nop
1430 .namelength nop
1440 ]
1450 P%=&147F
1460 [OPTopt%
1470 ldy record
1480 dey:dey:dey:dey
1490 sty record
1500 lda record+4,Y:sta &B
1510 lda record+5,Y:sta &C
1520 ldy #0
1530 .inagain
1540 lda (&B),Y
1550 cmp #&20:bne nospace
1560 inc &B:bne over3
1570 inc &C
1580 .over3
1590 jmp inagain
1600 .nospace
1610 ldx #0:stx direct
1620 RTS
1630 .record
1640 ]
1650 NEXT
1660 ?record=0:record?1=&FF
1670 ENDPROC
1710 REM $P%=rtn$:P%=P%+LEN(rtn$):[
PT opt%
1730 DEFPROCcheck
1740 FORMX=&1300 TO record STEP 60
1750 total%=0
1760 FORMX=0 TO 60
1770 total%=total%+MX*NX
1780 NEXT
1790 PRINT*MX,total%
1800 NEXT
1810 REM When debugged *SAVE CODE I
00 1500
1820 ENDPROC
1830 REM Results of PROCcheck
1840 REM 1300      7243
1850 REM 1330      5653
1860 REM 137A      7554
1870 REM 13B7      6735
1880 REM 13F4      8069
1890 REM 1431      5976
1900 REM 146E      6595

```

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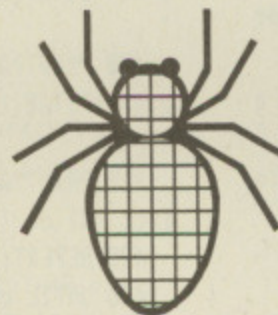
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Programs on drive 1 are

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Press bracketed letter to run a program  
TD Rom Utilities (?) Help page  
(1) Transfer program (2) Change options  
(3) Change drive (4) Recatalogue disc  
<ESC> to exit Please select\_

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TAPE/DISC ROM from Vine Micros  
(c) 1985 Written by R.P.D. Mallett

Disc prog filename

Last block loaded

Load address  
Run address  
Block length  
Block byte

ACIO error File locked  
Bad header Last block  
Bad data 2400 Hz  
Wrong block Data found  
Rewind cassette Empty block

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## Draughts listing

From Page 47

```

c
10 REM *****
15 REM *      DRAUGHTS      *
20 REM * by Brian & Martin Bond *
25 REM *   (C) The Micro User   *
30 REM *****
40 VDU6:*KEY0 OLD:MRUN:IM
50 IF PAGE<>&E00 THEN1910
60 ONERRORGOTO1740
70 MODE7:VDU23;8202;0;0;0;
80 PROCselect:PROCinit:*TV0,1
90 MODE1:VDU23;8202;0;0;0;:PROCboa
rd
100 REPEAT
110 VDU4:COLOUR3:PRINTTAB(34,17)SPC
(5);TAB(1,17)"Moves"
120 x%=256:y%=220;q=1:C=1:PROCCred_g
o
130 IFPOINT(x%+48,y%-15)<>1PROCFals
e:GOTO120
140 SOUND1,-14,150,1:PROCdelay
150 X%=x%:Y%=y%:C=2
160 PROCCred_go:PROCcheck_red
170 IFyellow=0end=1:GOTO310
180 IFIJ=1THENIJ=0:x%=X%:y%=Y%:GOTO
160
190 IFJ=1THEN150
200 IFF=1PROCFalse:F=0:GOTO120
210 VDU4:COLOUR3:PRINTTAB(1,17)SPC(
5);TAB(34,17)"Moves"
220 x%=928:y%=892;q=2:C=1:PROCYello
w_go
230 IFPOINT(x%+48,y%-15)<>2PROCFals
e:GOTO220
240 SOUND1,-14,150,1:PROCdelay
250 X%=x%:Y%=y%:C=2
260 PROCYellow_go:PROCcheck_yellow
270 IFred=0end=1:GOTO310
280 IFIJ=1THENIJ=0:x%=X%:y%=Y%:GOTO
260
290 IFJ=1THEN250
300 IFF=1PROCFalse:F=0:GOTO220
310 UNTIL end=1
320 VDU4:PRINTTAB(1,17)SPC(5);TAB(3
4,17)SPC(5)
330 VDU5:6COL0,2:IFyellow=0MOVE372,
973:PRINT"RED is the winner"ELSEMOVE3
20,973:PRINT"YELLOW is the winner"
340 VDU4:COLOUR3:PRINTTAB(4,30)"Do
You Want Another Game? (Y/N)"
350 Q%=GET$
360 IFQ%="Y"ORQ%="y"RUN
370 IFQ%="N"ORQ%="n"THENTIME=0:REPE
ATUNTILTIME>100:CALL!&FFFC ELSE350
380 END
390 DEFPROCselect
400 FORY%=3TO4:PRINTTAB(7,Y%)CHR$14

```

```

1CHR$129CHR$157CHR$131" D R A U G H T
S "CHR$156:NEXT
410 PRINTTAB(17,8)CHR$131"Red Y
ellow"
420 PRINTTAB(6,10)CHR$131"Up";TAB(6
,11)CHR$131"Down";TAB(6,12)CHR$131"Le
ft";TAB(6,13)CHR$131"Right";TAB(6,14)
CHR$131"Huff!";TAB(6,15)CHR$131"Conce
de";TAB(6,16)CHR$131"Fix"
430 PRINTTAB(18,10)CHR$134"A"SPC(8)
"*";TAB(18,11)CHR$134"Z"SPC(8)"?";TAB
(18,12)CHR$134"X"SPC(8)"<";TAB(18,13)
CHR$134"C"SPC(8)">"
440 PRINTTAB(18,14)CHR$134"H"SPC(8)
"H";TAB(17,15)CHR$134"ESC"SPC(6)"ESC"
;TAB(16,16)CHR$134"SPACE"SPC(4)"SPACE
"
450 PRINTTAB(12,19)CHR$129"Or Do Yo
u Want";TAB(11,20)CHR$129"Joystick Co
ntrol"
460 PRINTTAB(7,22)CHR$129"Please Se
lect (K) or (J)"
470 REPEAT:choice%=GET
480 UNTIL choice%>73ANDchoice%<76
490 ENDPROC
500 DEFPROCinit
510 *FX4,1
520 *FX11,0
530 F=0:K=0:J=0:IJ=0:red=12:yellow=
12:end=0
540 VDU23,224,0,0,0,1,7,15,15,31,23
,225,0,0,126,255,255,255,255,255,23,2
26,0,0,0,128,224,240,240,240,23,227,3
1,63,63,63,63,63,31,31,23,228,255,255
,255,255,255,255,255,255
550 VDU23,229,248,252,252,252,252,2
52,248,248,23,230,15,15,7,1,0,0,0,0,2
3,231,255,255,255,255,126,0,0,0,23,23
2,240,240,224,128,0,0,0,0
560 Block$=CHR$228+CHR$228+CHR$228+
CHR$10+CHR$8+CHR$8+CHR$8+CHR$228+CHR$
228+CHR$228
570 Box$=CHR$228+CHR$228+CHR$228+CH
R$10+CHR$8+CHR$8+CHR$8+CHR$228+CHR$22
8+CHR$228+CHR$10+CHR$8+CHR$8+CHR$8+CH
R$228+CHR$228+CHR$228
580 Piece$=CHR$224+CHR$225+CHR$226+
CHR$10+CHR$8+CHR$8+CHR$8+CHR$227+CHR$
228+CHR$229+CHR$10+CHR$8+CHR$8+CHR$8+
CHR$230+CHR$231+CHR$232
590 ENDPROC
600 DEFPROCboard
610 VDU19,3,6;0;:COLOUR3
620 FORX%=0TO18STEP6:FORY%=0TO18STE
P6
630 PRINTTAB(X%+8,Y%+4)Box$;TAB(X%+
11,Y%+7)Box$:NEXT,
640 6COL0,1:MOVE252,124:DRAW1024,12
4:DRAW1024,896:DRAW252,896:DRAW252,12

```

```

4:MOVE240,112:DRAW1036,112:DRAW1036,
88:DRAW240,908:DRAW240,112
650 COLOUR2:FORX%=0TO18STEP6
660 PRINTTAB(X%+11,4)Piece$;TAB(X%+
8,7)Piece$;TAB(X%+11,10)Piece$:NEXT:P
RINTTAB(35,14)Block$
670 COLOUR1:FORX%=0TO18STEP6
680 PRINTTAB(X%+8,19)Piece$;TAB(X%+
11,22)Piece$;TAB(X%+8,25)Piece$:NEXT
PRINTTAB(2,14)Block$
690 ENDPROC
700 DEFPROC$ight:6COL3,3
710 FORI%=1TO2:*FX19
720 MOVEx%,y%:DRAWx%+92,y%:DRAWx%+
2,y%-92:DRAWx%,y%-92:DRAWx%,y%
730 NEXT:ENDPROC
740 DEFPROCinkey(U,D,L,R)
750 TIME=0:REPEATUNTILTIME>3
760 IFINKEY-U y%=y%+96
770 IFINKEY-D y%=y%-96
780 IFINKEY-L x%=x%-96
790 IFINKEY-R x%=x%+96
800 IFINKEY-85ANDC=1PROChuff:ENDPR
C
810 IFx%>928x%=928ELSEIFx%<256x%=25
6
820 IFy%>892y%=892ELSEIFy%<220y%=22
0
830 ENDPROC
840 DEFPROCjoystick(UD,LR)
850 TIME=0:REPEATUNTILTIME>3
860 IFADVAL(UD)>45000 y%=y%+96
870 IFADVAL(UD)<20000 y%=y%-96
880 IFADVAL(LR)>45000 x%=x%+96
890 IFADVAL(LR)<20000 x%=x%-96
900 IFINKEY-85ANDC=1PROChuff:ENDPR
C
910 IFx%>928x%=928ELSEIFx%<256x%=25
6
920 IFy%>892y%=892ELSEIFy%<220y%=22
0
930 ENDPROC
940 DEFPROCfalse:COLOUR3:VDU7,4:PRI
NTTAB(14,2)"ILLEGAL MOVE":FORd=0TO300
0:NEXT:PRINTTAB(14,2)SPC(12):ENDPROC
950 DEFPROCred_go
960 REPEAT:PROCSight:K%=INKEY$(0)
970 IFchoice%=74PROCjoystick(2,1)
980 IFchoice%=75PROCinkey(66,98,67,
83)
990 UNTILK%=CHR$32ORADVAL(0)AND 1
1000 ENDPROC
1010 DEFPROCYellow_go
1020 REPEAT:PROCSight:K%=INKEY$(0)
1030 IFchoice%=74PROCjoystick(4,3)
1040 IFchoice%=75PROCinkey(73,105,10
3,104)
1050 UNTILK%=CHR$32ORADVAL(0)AND 2
1060 ENDPROC

```



```

DRAW1036,9
1070 DEFPROCdelay:TIME=0:REPEATUNTIL
TIME>25:ENDPROC
1080 DEFPROCcheck_red
1090 IFPOINT(x%+48,y%-15)<>0F=1:GOTO
1180
1100 IFJ=1THEN1120
1110 IFx%<=x%+96ANDx%>=x%-96ANDy%=y%
+96THEN1200ELSEF=1
1120 IFx%=x%+192ANDy%=y%+192ANDPOINT
(x%+144,y%+81)=2THEN1240ELSEF=1
1130 IFx%=x%-192ANDy%=y%+192ANDPOINT
(x%-48,y%+81)=2THEN1240ELSEF=1
1140 IFJ=1THEN1160
1150 IFx%<=x%+96ANDx%>=x%-96ANDy%=y%
-96ANDPOINT(x%+48,y%-48)=2THEN1290ELS
EF=1
1160 IFx%=x%+192ANDy%=y%-192ANDPOINT
(x%+144,y%-111)=2ANDPOINT(x%+48,y%-48
)=2THEN1300ELSEF=1
1170 IFx%=x%-192ANDy%=y%-192ANDPOINT
(x%-48,y%-111)=2ANDPOINT(x%+48,y%-48)
=2THEN1300ELSEF=1
1180 IFJ=1ANDF=1PROCfalse:F=0:IJ=1:E
NDPROC
1190 IFF=1ENDPROC
1200 F=0:IFPOINT(x%+48,y%-48)=2K=1
1210 VDU5,24,x%;y%-92;x%+92;y%:;CLG:
VDU26:GCOL0,1:MOVEx%,y%:PRINTPiec$
1220 IFy%>796ORk=1GCOL0,2:MOVEx%+32,
y%-30:VDU228:K=0
1230 ENDPROC
1240 F=0:IFPOINT(x%+48,y%-48)=2K=1
1250 VDU5,24,x%;y%-92;x%+92;y%:;CLG:
VDU26:GCOL0,1:MOVEx%,y%:PRINTPiec$:I
Fy%>796ORk=1GCOL0,2:MOVEx%+32,y%-30:V
DU228:K=0
1260 PROCdelay:IFx%=x%+192VDU24,x%+9
6;y%+4;x%+188;y%+96:;CLG:VDU26ELSEVDU
24,x%-96;y%+4;x%-4;y%+96:;CLG:VDU26
1270 yellow=yellow-1
1280 PROCred_jump:ENDPROC
1290 F=0:VDU5,24,x%;y%-92;x%+92;y%:;
CLG:VDU26:GCOL0,1:MOVEx%,y%:PRINTPie
c$:GCOL0,2:MOVEx%+32,y%-30:VDU228:END
PROC
1300 F=0:VDU5,24,x%;y%-92;x%+92;y%:;
CLG:VDU26:GCOL0,1:MOVEx%,y%:PRINTPie
c$:GCOL0,2:MOVEx%+32,y%-30:VDU228:PRO
Cdelay:IFx%=x%+192VDU24,x%+96;y%+4;x%
+188;y%+96:;CLG:VDU26ELSEVDU24,x%-9
6;y%-188;x%-4;y%-96:;CLG:VDU26
1310 yellow=yellow-1
1320 PROCred_jump:ENDPROC
1330 DEFPROCcheck_yellow
1340 IFPOINT(x%+48,y%-15)<>0F=1:GOTO
1430
1350 IFJ=1THEN1370
1360 IFx%<=x%+96ANDx%>=x%-96ANDy%=y%
-96THEN1450ELSEF=1

```

```

1370 IFx%=x%+192ANDy%=y%-192ANDPOINT
(x%+144,y%-111)=1THEN1490ELSEF=1
1380 IFx%=x%-192ANDy%=y%-192ANDPOINT
(x%-48,y%-111)=1THEN1490ELSEF=1
1390 IFJ=1THEN1410
1400 IFx%<=x%+96ANDx%>=x%-96ANDy%=y%
+96ANDPOINT(x%+48,y%-48)=1THEN1540ELS
EF=1
1410 IFx%=x%+192ANDy%=y%+192ANDPOINT
(x%+144,y%+81)=1ANDPOINT(x%+48,y%-48)
=1THEN1550ELSEF=1
1420 IFx%=x%-192ANDy%=y%+192ANDPOINT
(x%-48,y%+81)=1ANDPOINT(x%+48,y%-48)=
1THEN1550ELSEF=1
1430 IFJ=1ANDF=1PROCfalse:F=0:IJ=1:E
NDPROC
1440 IFF=1ENDPROC
1450 F=0:IFPOINT(x%+48,y%-48)=1K=1
1460 VDU5,24,x%;y%-92;x%+92;y%:;CLG:
VDU26:GCOL0,2:MOVEx%,y%:PRINTPiec$
1470 IFy%<316ORk=1GCOL0,1:MOVEx%+32,
y%-30:VDU228:K=0
1480 ENDPROC
1490 F=0:IFPOINT(x%+48,y%-48)=1K=1
1500 VDU5,24,x%;y%-92;x%+92;y%:;CLG:
VDU26:GCOL0,2:MOVEx%,y%:PRINTPiec$:I
Fy%<316ORk=1GCOL0,1:MOVEx%+32,y%-30:V
DU228:K=0
1510 PROCdelay:IFx%=x%+192VDU24,x%+9
6;y%-188;x%+188;y%-96:;CLG:VDU26ELSEV
DU24,x%-96;y%-188;x%-4;y%-96:;CLG:VDU
26
1520 red=red-1
1530 PROCyellow_jump:ENDPROC
1540 F=0:VDU5,24,x%;y%-92;x%+92;y%:;
CLG:VDU26:GCOL0,2:MOVEx%,y%:PRINTPie
c$:GCOL0,1:MOVEx%+32,y%-30:VDU228:END
PROC
1550 F=0:VDU5,24,x%;y%-92;x%+92;y%:;
CLG:VDU26:GCOL0,2:MOVEx%,y%:PRINTPie
c$:GCOL0,1:MOVEx%+32,y%-30:VDU228:PRO
Cdelay:IFx%=x%+192VDU24,x%+96;y%+4;x%
+188;y%+96:;CLG:VDU26ELSEVDU24,x%-96:
y%+4;x%-4;y%+96:;CLG:VDU26
1560 red=red-1
1570 PROCyellow_jump:ENDPROC
1580 DEFPROCmulti_jump
1590 COLOUR3:VDU4:PRINTTAB(4,30)"DO
YOU WANT TO JUMP AGAIN? (Y/N)";
1600 Q$=GET$
1610 IFQ$="Y"ORQ$="y"THEN1630
1620 IFQ$="N"ORQ$="n"J=0:GOTO1630ELS
E1600
1630 PRINTTAB(4,30)SPC(32)
1640 ENDPROC
1650 DEFPROCchuff
1660 COLOUR3:VDU4:PRINTTAB(7,30)"HUF
F! Are You Sure? (Y/N)";
1670 Q$=GET$

```

```

1680 IFQ$="Y"ORQ$="y"C=2:PRINTTAB(7,
30)SPC(26):GOTO1700
1690 IFQ$="N"ORQ$="n"PRINTTAB(7,30)S
PC(26):ENDPROC ELSE1670
1700 IFq=1ANDPOINT(x%+48,y%-15)=2vel
low=yellow-1:GOTO1730ELSEF=1
1710 IFq=2ANDPOINT(x%+48,y%-15)=1red
=red-1:GOTO1730ELSEF=1
1720 IFF=1F=0:PROCfalse:ENDPROC
1730 F=0:VDU24,x%;y%-92;x%+92;y%:;CL
G:VDU26:ENDPROC
1740 VDU4:PRINTTAB(1,17)SPC(5);TAB(3
4,17)SPC(5)
1750 VDU5:GCOL0,2:IFq=1MOVE388,973:P
RINT"RED has conceded"ELSEMOVE336,973
:PRINT"YELLOW has conceded"
1760 GOTO340
1770 DEFPROCred_jump:J=0
1780 IFPOINT(x%+240,y%+177)=0ANDPOIN
T(x%+144,y%+81)=2ANDx%+240<1020ANDy%+
177<892J=1:GOTO1820
1790 IFPOINT(x%-144,y%+177)=0ANDPOIN
T(x%-48,y%+81)=2ANDx%-144>256ANDy%+17
7<892J=1:GOTO1820
1800 IFPOINT(x%+48,y%-48)=2ANDPOINT(x
%+240,y%-207)=0ANDPOINT(x%+144,y%-11
1)=2ANDx%+240<1020ANDy%-207>128J=1:GO
TO1820
1810 IFPOINT(x%+48,y%-48)=2ANDPOINT(x
%-144,y%-207)=0ANDPOINT(x%-48,y%-111
)=2ANDx%-144>256ANDy%-207>128J=1
1820 IFJ=1PROCmulti_jump
1830 ENDPROC
1840 DEFPROCyellow_jump:J=0
1850 IFPOINT(x%+240,y%-207)=0ANDPOIN
T(x%+144,y%-111)=1ANDx%+240<1020ANDy%
-207>128J=1:GOTO1890
1860 IFPOINT(x%-144,y%-207)=0ANDPOIN
T(x%-48,y%-111)=1ANDx%-144>256ANDy%-2
07>128J=1:GOTO1890
1870 IFPOINT(x%+48,y%-48)=1ANDPOINT(x
%+240,y%+177)=0ANDPOINT(x%+144,y%+81
)=1ANDx%+240<1020ANDy%+177<892J=1:GOT
O1890
1880 IFPOINT(x%+48,y%-48)=1ANDPOINT(x
%-144,y%+177)=0ANDPOINT(x%-48,y%+81)
=1ANDx%-144>256ANDy%+177<892J=1
1890 IFJ=1PROCmulti_jump
1900 ENDPROC
1910 *TAPE
1920 NZ=PAGE-&E00:FORLX=PAGE TO TOP
STEP4:!(LX-NX)=!LX:NEXT:PAGE=&E00
1930 VDU21:*FX138,0,128

```

*This listing is included in this month's cassette tape offer. See order form on Page 205.*



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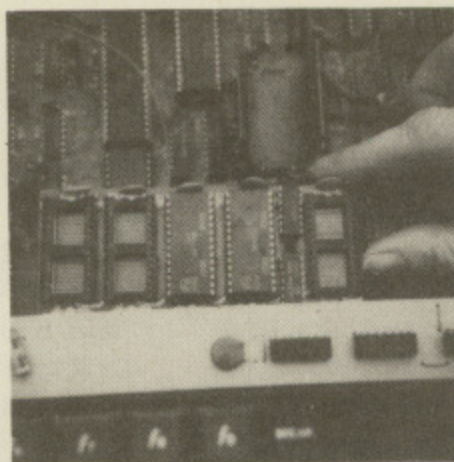
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4	50000	40815	50000	40815
5	50000	38145	50000	38145
6	50000	35644	50000	35644
7	50000	33306	50000	33306
8	50000	31122	50000	31122
9	50000	29080	50000	29080

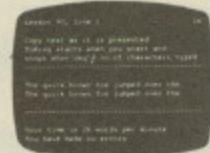
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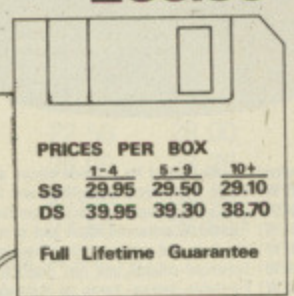
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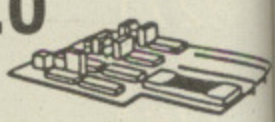
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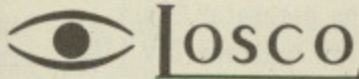
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## Double Height listing

From Page 110

```

10 REM Double height characters
20 REM Michael Mitchell 1985
30 REM (c) The Micro User
40 MODE 4
50 REM Init the constants
60 oswrch = &FFEE : REM Addresses
of operating system routines
70 osbyte = &FFF4 : oscli = &FFF7
80 osword = &FFF1
90 unwrch = &FFCB : REM Unvector
ed version of OSWRCH
100 wrchv = &20E : REM OSWRCH v
ector address
110 cursorX = &318: REM Text
cursor X byte
120 dispMode = &355: REM MODE
byte in the VDU variables
130 vduQueuePtr = &26A: REM VDU q
ueue ptr
140 explodeCset = &14 : REM OSBYT
E to explode the font
150 getPattern = &0A : REM OSWOR
D to read a character definition
160 redefineChar = &17 : REM OSWRC
H to redefine a character
170 vt = 11 : REM ASCII
codes for cursor movement
180 bs = 8
190 lf = 10
200 del = &7F
210 pattern=&100 : REM Param
eter block for OSWORD 10
220 saveA=&DA : REM VDU works
pace location
230 start=&FFFF0A00
240 DIM buff 50
250 FOR pass=0 TO 2 STEP 2
260 PROCass
270 NEXT pass
280 PROCoscli("SAVE X.DblHite "+STR
$*start+" "+STR$*PZ+" "+STR$(init OR
&FFFF0000)+" "+STR$*start)
290 REM Do a quick demo
300 *KEY9*/X.DblHite:IM*BASIC:L:IMFOR
IX=32 TO 126:VDU IX:NEXT:IM
310 *FX138,0,137
320 END
330 DEF PROCass
340 PZ=start
350 [ opt pass
360 \ Double height. This produces
double height characters in the
370 \ soft modes. It intercepts OSW

```

```

10 REM Double height characters
20 REM Michael Mitchell 1985
30 REM (c) The Micro User
40 MODE 4
50 REM Init the constants
60 oswrch = &FFEE : REM Addresses o
f operating system routines
70 osbyte = &FFF4 : oscli = &FFF7
80 osword = &FFF1
90 unwrch = &FFCB : REM Unvector
ed version of OSWRCH
>GOTO 1000

```

```

RCH so characters may be copied
380 \ as normal. It also deals with
double height line feeds and VTs
390 \ and converts VDU 31,x,y into
VDU 31,x,2*y+1
400 .init
410 \ This routine reserves space f
or the extra characters used to
420 \ produce double height. After
this has been called, character
430 \ c is in two halves. The top f
our lines are in c+128 and the
440 \ bottom four lines are in c.
450 lda #mywrch MOD &100 Check
it's not already installed
460 ldx #mywrch DIV &100
470 cmp wrchv
480 bne notInstalled
490 cpx wrchv+1
500 beq installed Return
straightaway
510 .notInstalled
520 sta wrchv Redire
ct oswrch to our code
530 stx wrchv+1
540 lda #explodeCset Do an
*FX20,6 to reserve space
550 ldx #6
560 jsr osbyte
570 lda #ASC" " Redefi
ne the printable characters
580 sta pattern 'patte
rn' is the parameter block for
590 .initLoop
600 lda #getPattern OSWORD
10 - read character definition
610 ldx #pattern MOD &100 XY poi

```

```

nts to the parameter block
620 ldy #pattern DIV &100
630 jsr osword Read t
the pattern bytes
640 ldx #1 Redefi
ne top half as c+128
650 lda #&80 Adds
28 to c
660 jsr redefineHalf
670 lda #0 Redefi
ne bottom half as c
680 jsr redefineHalf
690 lda pattern Next
character
700 inc pattern
710 cmp #ASC"" Reache
d the last one?
720 bcc initLoop No
730 .installed
740 rts Go hou
e
750 .redefineHalf
760 \ This redefines character + A
to the four lines of the
770 \ character from line X, duplic
ating each line.
780 pha Save
displacement (0 or &80)
790 lda #redefineChar VDU 23
800 jsr unwrch Must u
se unwrch as we've revector
ed oswrch
810 pla Add di
splacement to character code
820 ora pattern
830 jsr unwrch
840 ldy #4 Do fou
r lines of the definition

```

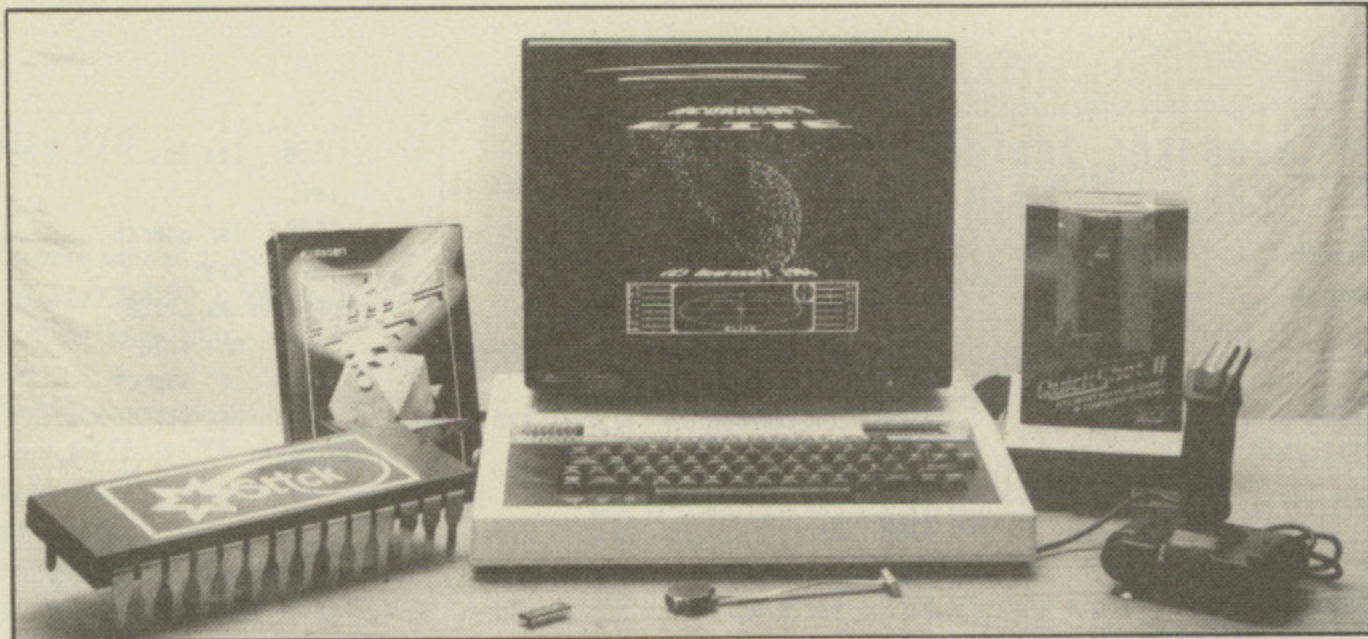


850	.initLoop2		st send the character		1590	lda #bs	Cursor
860	lda pattern,X	Get a	1250 bit vdu31flag	Was it	left		
line			a VDU 31 queue?		1600	jsr unwrch	
870	jsr unwrch		1260 bpl noAction	No, ju	1610	txa	Print
880	jsr unwrch		st send the character		top half as c+128		
890	inx		1270 asl saveA	Double	1620	ora #&80	
900	dey	More l	the Y coord		1630	jsr unwrch	
ines?			1280 inc saveA	and ad	1640	lda #lf	Cursor
910	bne initLoop2	Yes, d	d l		down		
o it			1290 clc		1650	jsr unwrch	
920	rts		1300 ror vdu31flag	Clear	1660	lda cursorX	If we'
930	.delete		the flag		ve moved onto a newline		
940	lda cursorX	Do a d	1310 bpl noAction	and se	1670	bne restore	then d
ouble height delete			nd the char		o an extra LF		
950	bne not0del		1320 .noQueue		1680	lda #lf	
960	lda #vt	Go up	1330 lda saveA	Retrie	1690	.unwrchRestore	
a line if X=0			ve A		1700	jsr unwrch	
970	jsr unwrch		1340 cmp #del	Delete	1710	.restore	
980	.not0del		is a special case		1720	pla	Restor
990	ldx #endDel-delString		1350 beq delete		e		
1000	.delLoop		1360 cmp #ASC" "	Contro	1730	tax	
1010	lda delString-1,X		l character?		1740	pla	
1020	jsr unwrch		1370 bcs noCntrl	No	1750	tay	
1030	dex		1380 cmp #lf	Make L	1760	lda saveA	
1040	bne delLoop		F into LF LF		1770	rts	and re
1050	beq restore	Return	1390 beq doubleIt		turn		
after restore the registers			1400 cmp #vt	Same w	1780	.noAction	
1060	.delString		ith VT		1790	pla	Restor
1070	opt FNequs(CHR\$lf+CHR\$bs+" "+		1410 beq doubleIt		e and print A		
CHR\$vt+CHR\$del)			1420 cmp #31	VDU 31	1800	tax	
1080	.endDel		?		1810	pla	
1090	.aywrch		1430 bne noAction	No, pr	1820	tay	
1100	\ This is where OSWRCH gets red		int it		1830	lda saveA	
irected to. It prints a character			1440 ror vdu31flag	Set th	1840	jmp unwrch	
1110	\ c as c,cursor up, cursor left		e flag		1850	.vdu31flag	
, c+128, Cursor down. It also checks			1450 bmi noAction		1860	opt FNequb(0)	
1120	\ for non-graphics modes, chara		1460 .doubleIt		1870	]	
cters in the VDU queue etc.			1470 jsr unwrch	Print	1880	ENDPROC	
1130	sta saveA	Save t	A twice, then restore		1890	DEFFNequs(string\$)	
he registers			1480 jmp unwrchRestore		1900	\$P%=string\$	
1140	tya		1490 .noCntrl		1910	P%=P%+LEN(\$P%)	
1150	pha		1500 and #&7F	Force	1920	=pass	
1160	txa		it to be ASCII 32-126		1930	DEFFNequb(byte)	
1170	pha		1510 cmp #ASC" "	Don't	1940	?P%=byte	
1180	lda dispMode	See if	print &80-&9F as they become ctrl cod		1950	P%=P%+1	
it's MODE 7			es		1960	=pass	
1190	cmp #7	Don't	1520 bcs printIt	Conver	1970	DEFPROCoscli(string2\$)	
do anything in MODE 7			t &80-&9F to space		1980	\$buff=string2\$	
1200	beq noAction		1530 lda #ASC" "		1990	X%=buff MOD 256:Y%=buff DIV 256	
1210	ldx vduQueuePtr	See if	1540 .printIt		2000	CALL oscli	
there are any pending bytes			1550 tax		2010	ENDPROC	
1220	beq noQueue	No, so	1560 jsr unwrch	Print			
carry on			the lower half				
1230	inx	Is thi	1570 lda #vt	Cursor			
s the last byte?			up				
1240	bne noAction	No, ju	1580 jsr unwrch				

*This listing is included in this month's cassette tape offer. See order form on Page 205.*



## It's here, the New Issue 2+ Starstick ROM & Quickshot Joystick



Picture shows Starstick ROM, Patchlead and Quickshot Joystick (along with Acornsoft's Elite Package - by kind permission of Acornsoft)

This new release of the very popular Starstick & Quickshot programmable joystick offers new possibilities. Over 30 extra commands which include:

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Specifically designed with the Disc user in mind, the software is not affected by any combination of the BREAK, SHIFT, or CONTROL keys.

The self centring, rapid action Joystick plugs into the user port and is managed by the Starstick ROM. The ROM monitors O.S. calls and patches the joystick into games programs. The Starstick functions with most games and even those that are not designed to function with joysticks. IT IS VERY IMPORTANT HOWEVER THAT THE GAMES USE LEGAL OPERATING SYSTEM CALLS AS MOST DO.

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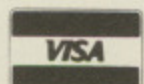
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# MICROMAIL

IN answer to so many letters from readers, may I say that the object of Mornington Crescent, featured in the April issue of The Micro User, is to get there!

You move there on the Tube, by turns. First you and then the computer. You may travel up to four stations from the station you are at. This can be changed by line 140 in the program.

You may travel down any line, but you cannot change lines in the course of travelling your four stations. If you remain on the same line as the previous computer turn you must travel in the same direction until you reach the end of the line.

When playing north of Camden Town the game resembles Nim. Always try to restrict the computer's choice by moving to a station with no connecting lines.

Playing Mornington Crescent is rather like nuclear war – you can achieve your object easily but it is bad form to do so.

This game has little relationship with Mornington Crescent as played on the radio, as that game does not exist.

The spoof was that this game should not exist. But as you see, it does. So who's the April Fool? – Mike Cook.

## Solution

THE disc loader program in the November, 1984 issue works well, but the list of file names does not include the directory letter. The program can be easily modified by adding the following line:

```
145 LDA &60F,X:JSR
&FFEE:LDA #46:JSR &FFEE
```

– P.J. Vincent, Sutton Coldfield, West Midlands.

● Thank you for the useful addition to the disc loader. This provides a simple solution for users who have files with the same name but in different directories.

## Service

I HAVE a Torch disc pack with BBC Basic (Z80) and in the documentation it was mentioned that two versions of a screen

# What's my line? Any line – but no changing

dump utility were available from M-Tec Computer Services in Reepham, Norfolk, at £5 each.

I wrote and asked for them, and by return of mail I got the following kind answer: "Please return your master disc and we will supply free of charge copies of the screen dump for Epson MX80. It will include instructions on how the program works".

What I got was not only the screen dumps, but a complete disc with the new version of Torch Basic and a manual.

That is really excellent service! – Bendt Nordentoft, Tranekaer, Denmark.

## The clocks go back

FAR from being the suggested pimple-faced schoolboy, more a 38-year-old dad with a 14-year-old daughter, I have found that Elite is one game a Klutz-with-the-keyboard can manage.

As your review article states it takes but a few attempts to move from Harmless to Dangerous (my status at the time of writing) and is, as far as I can judge, one of the few games in which those of us no longer in our first flush of youth can show some prowess.

I mean Rocket Raid and Planetoid are impossible aren't they? And is there really life after screen three in Ghouls? And can anyone really fly upside down in Aviator? And turn corners?

The main problem with Elite is not the marauding hordes inside but the marauding wife outside. "Will you stop playing that \*\*&%!\*@ game and come to bed" reverberates in sepulchral tones at two in the morning from the bedroom along the corridor.

To this end I have somewhat defeated she-who-must-be-obeyed by turning all the clocks

in the house back one hour at midnight and by installing an external volume control on my Beeb.

The former is quite simple but plays havoc with the morning ritual if you forget to turn 'em forward again upon retiring.

The latter, though more complicated, is more effective and involves introducing a 47 ohm cermet potentiometer (RS components number 162-760) into one of the wires leading to the internal speaker.

The new pot is mounted on the back of the Beeb. The Reset button pre-drilled hole would prove a suitable mounting although I drilled a fresh hole because I was mucking about with various pots.

This control has been installed for a little over a month now and doesn't seem to have put any strain on the sound output circuit.

By adjusting the internal volume control potentiometer (VR1 in the circuit diagram) the newly installed external volume control can now be set to a comfortable (muted) level for the night shift and turned up loud for the day shift.

For anyone unfamiliar with the circuit, this is how you find VR1. Remove the BBC's lid (four screws, two at the back and two underneath). Remove the keyboard (two nuts and bolts, one on each side) and ease the keyboard up and forward.

By following the two wires from the speaker down to the printed circuit you should be able to locate a small rectangular box (coloured yellow in my case).

It is a little above and slightly left of the speaker wires plug and just below resistor R24.

On the far side of this box is a small white wheel with a slot which will accept a screwdriver blade. Turning this increases and decreases the volume.

A word of warning – use a plastic screwdriver. No I'm not

being dumb, plastic screwdrivers do exist. You can get them as TV and hi-fi alignment tools from most electrical component stockists.

If you use a metal screwdriver and touch something you're not supposed to it might turn out expensive.

Having had experience of a fair few computers – micros minis, and mainframes – over the past few years I still think the BBC is the best thing since sliced bread. Elite is the jam to put on it. – Eric Warmington, Camberley, Surrey.

## Super Mouse!

THANK you for the AMX Mouse calculator listing in the April issue. It was a great idea and put the mouse to good use. For once, due to its short uncomplicated lines, it worked first time after typing it in, and I hope that more programs for the AMX Mouse can be included in future issues. – Martin Bubeat, Gosport, Hants.

● Thank you for the praise. The author has come up with something else, and we hope to publish it in the not-too-distant future.

## Strange...

LATELY, when playing around with my computer, I occasionally found a very strange \*command. It was \*/ and obviously had something to do with the cassette player as it promptly wrote "Searching" on the screen.

I would like to know what it does, and why it hasn't been mentioned in the manual.

PS: I have fitted Aries B20 – could it have anything to do with it? – Steen Nielsen, Copenhagen, Denmark.

● Your Aries B20 is not



# MICROMAIL

## From Page 185

responsible for the "Searching" message. the answer can be found in the operating system. You see, \*/ is an abbreviation of \*RUN, much in the same way \* is the same as \*CAT.

## Wordwise

USERS of the new Wordwise Plus may be interested in two thoughts which struck me recently:

1. With the inclusion of a

"query language" in the new chip, it is possible to maintain a database.

2. If such a database were kept on disc, and if a number of utilities, such as a search routine, were written in the query language, then these could be loaded into the segments using the auto-boot facility of the computer.

I enclose a sample Search routine in the Wordwise query language, and the !BOOT file which loads it into segment 0 and then returns the master text menu.

The brevity of the search

program is very encouraging, the main work being done by FIND. GLK\$ is the language's equivalent of Basic's INPUT. - A.S. Brown, Bedford.

```
SELECT TEXT
PRINT
PRINT
PRINT "search for: ";
S$=GLK$
F$="T." + CHR$(ASC(S$))
LOAD TEXT F$
FIND S$
END
```

Program I, to search for a string

in the alphabetical file T.x where x is the first letter of the string.

```
*WORDWISE
:SELECT SEGMENT 0
:LOAD TEXT "W.SEARCH"
:SELECT TEXT
A
```

Program II, which is the !BOOT auto-boot program to load Search and return to the main Wordwise menu.

## Cry from the heart

YOU are my last hope. I am writing to you to ask you if you know how to get the Radio Shack TRS-80 Colour Graphics Printer into the graphics mode?

In the manual it says: "To put the printer into graphics mode, send a control code 18 (decimal) to the printer using LPRINT or PRINT#-2. For instance:

```
LPRINT CHR$(18)#
```

or

```
PRINT -2,CHR$(18)"
```

But since the BBC does not

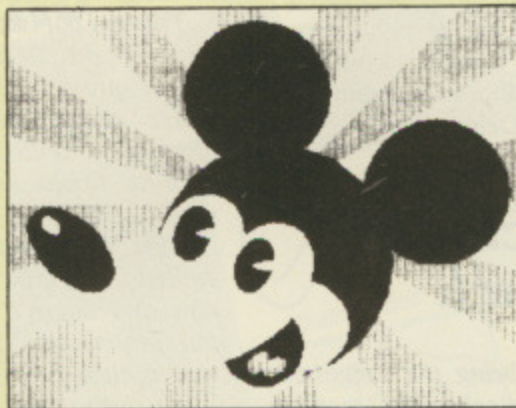
## Who's taking the Mickey?

I HAVE been experimenting with the ellipse drawing routine from The Micro User of April, 1984 and I thought you might be amused by the result (see listing below).

I hope the Editor doesn't complain about people sending in Mickey Mouse programs.

I am now convinced that he was designed by a computer (Mickey Mouse, not the Editor).

- Keith Southwood, Sheffield.



```
10 REM Ellipse drawing r      in%,inc%,xc%,yc%,col)      15
outine                        190 GCOL 0,col                    300 MOVE 0,0
20 DIM T(72,2)                200 MOVE xc%,yc%                390 X%=850+T(AZ/5,2)
30 MODE 1:VDU23,1,0;0;0;      210 DRAW xc%+maj%*T(inc%/5,1),yc%+maj%*T(inc%/5,2)  400 Y%=850+T(AZ/5,1)
0;                              220 FOR AZ=0 TO 360 STEP      410 IF T% MOVE X%,Y% ELSE
40 PRINTTAB(12,15)"Hi th      15                                PLOT85,X%,Y%
ere, folks!"                    230 MOVE xc%,yc%                    420 T%=NOT T%
50 FOR I%=0 TO 72              240 x=maj%*T(AZ/5,1)                430 NEXT
60 T(I%,1)=COS(RAD(I%*5))      250 y=min%*T(AZ/5,2)                440 ENDPROC
)                                260 xt=x*T(inc%/5,1)-y*T(      450 DATA 290,290,0,660,37
70 T(I%,2)=SIN(RAD(I%*5))      inc%/5,2)+xc%                    0,0
80 NEXT I%                    270 yt=x*T(inc%/5,2)+y*T(      460 DATA 180,180,0,620,78
90 PROCbackgrnd                inc%/5,1)+yc%                    5,0
100 VDU29,0;0;                280 PLOT85,xt,yt                    470 DATA 180,180,0,1060,5
105 RESTORE 450                290 NEXT AZ                        480 DATA 120,100,60,480,4
110 REPEAT                     300 ENDPROC                        20,3
120 READ maj%,min%,inc%        310 DEFPROCbackgrnd                490 DATA 120,100,60,650,3
130 READ xc%,yc%,col           320 VDU29,640;512;                50,3
140 PROCellipse(maj%,min%      330 COLOUR129:CLS                    0,3
,inc%,xc%,yc%,col)            340 GCOL0,2                        510 DATA 120,120,0,630,16
150 UNTIL inc%<0               350 MOVE4,12                        0,3
160 I=INKEY(1000):GOTO 90      360 T%=TRUE                          520 DATA 100,100,0,630,16
170 END
180 DEFPROCellipse(maj%,m
```



● *Want to write to Micromail? The address is: Micromail, The Micro User, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.*

have these commands, what do I do?

If and when I get it into the graphics mode, how do I draw lines, since once again the graphic commands are in the LPRINT form?

HELP! – Robert Booth, Elland, W. Yorks.

● You should find that the BBC equivalent of:

```
LPRINT CHR$(18)
```

is:

```
VDU 2,1,18,3
```

With a bit of luck your printer will now be in the graphics mode.

## Those ROM routines

HAVING just read the article on the ins and outs of ROM routines I began to feel slightly confused.

Surely commercial games do not use routines from the Basic ROM, since this would limit their use to machines having a particular Basic, either the 1981 version or the 1982 version.

So how do you print out numbers in machine code, especially double byte ones? I would be grateful if you could help me.

Secondly, I offer some help to Mr Potter, who wrote in January about a screen dump for the Brother HR-5.

The dump printed in the January 1984 Micro User for the Epson will work on the HR-5 with only a few changes to the data.

Basic I changes:

```
1880 DATA 27,65,3,27,76,19
2,3,27,127
```

Basic II changes:

```
1610 .init EQU $1B03411B
1620 EQU $1B03C04C
1630 EQU $00001B7F
```

Incidentally, the Mode 7 screen dump printed in the September issue of The Micro User will also work on the Brother HR-5. – Steve Johnstone, Colchester, Essex.

● Thank you for the additions to the printer listing for our other "Brothers". To answer your first question, as the article points

out, directly addressing ROM routines is bad practice where software is to be transportable.

The techniques shown were simply so that beginners could get a printout of the value in a location to test their own elementary machine code, the technique needed to do the whole task being beyond their ability.

## Drawbacks

I WAS interested to read in your March edition about the methods proposed to draw circles without resorting to calling the trigonometric functions.

Mr Carter's method is fine except that there are two drawbacks – code has to be written to mirror the remaining three-quarters of the circle and code has to be inserted to ensure that division by zero does not take place.

A slightly neater approach is to draw the circle by imagining it to take place as a series of small rotations.

Suppose that we perform  $N$  rotations through a small angle  $da = 2\pi/N$ . If we are on a circle of radius  $r$ , centre the origin at coordinates  $(x,y)$  then we will move to a new position on the circle with coordinates  $(q*x+p*y, -p*x+q*y)$  where  $p=da$  and  $q=1-0.5*da^2$ .

This method requires no divisions and when applied  $N$

```
10 REM Simple circle
20 NX=100
30 r=1
40 XX=1000:YY=1000
50 MODE 4
60 xmin=-r:xmax=r:ymin=-
r:ymax=r
70 da=2*PI/NX:p=da:q=1-0
.5*da*da
80 x=r:y=0
90 x0=XX:y0=-ymin+Y/(ym
ax-ymin)
100 TX=TIME
110 MOVE x0,y0
120 FOR IX=1 TO NX
130 X1=q*x+p*y:y=-p*x+q*y
:x=X1
140 xp=(x-xmin)*X/(xmax-
xmin)
150 yp=(y-ymin)*Y/(ymax-
ymin)
160 DRAW xp,yp
170 NEXT
180 PRINT"Time=";(TIME-TX
)/100;" secs"
190 END
```

times will draw the complete circle. It could be speeded up by applying my method  $N/4$  times and then mirroring the rest of the circle.

I enclose a listing of the method in practice (above). No doubt it would be very fast expressed as two byte arithmetic in machine code.

Of course all these methods

## Pounds are back...

IN the May issue of The Micro User you published my routine which allows printing of \$ and # signs in the same document on an Epson printer.

While this routine works perfectly well it does have one tiny problem in that when a pound is to be printed on the printer a hash is printed on the screen.

This causes no great upset with Wordwise but can be annoying if the screen display is important as well as the hard copy.

Since sending the program to you I have updated it so that pounds and hashes are printed on the screen and on paper as

they should be.

If any reader would like the updated version I would be happy to supply a listing if he sends me a stamped addressed envelope.

I can also be contacted on Prestel 014511332 and could send the listing by mailbox – or even squirt it down the phone line to anyone with a suitable modem and software.

Please note that my Prestel number is not my phone number. – Pete Gaunt, 29 Parolles Road, London N19 3RE.

● We are grateful to Peter for providing, not only useful utilities, but also the follow-up service, which means even more.

depend on taking lots of small steps. The method I propose can then approximate the sine and cosine of the small rotation angle by  $p$  and  $q$  respectively. – Pete Williams, St. Albans, Herts.

## Wild card

HERE is a cautionary tale for newcomers to Wordwise Plus. A colleague typed a three-page document in which he used the hash (#) in its American sense as meaning "number".

He then discovered that the printer had been arranged to print the £ instead of the hash.

Nothing daunted, he used the search and replace option to convert the # to "No.". On printing he was rewarded with repeated "No.No.No..."

He now knows that the hash is a "wild card" in the Wordwise Plus search and replace routine.

Students of Murphy's Law will not need to be told that he chose the global rather than the selective search, and he did not save the document beforehand. – C.W. Robertson, Maidenhead, Berks.

## Dumps on LX80

I BELIEVE that the Lucas LX80 dot matrix printer is the same as the Shinwa CP80, in which case you might be interested in the answer to Mr Jessop's problem of obtaining symmetrical screen dumps.

The Shinwa printers have one considerable advantage over Epson types in that they have a symmetrical matrix wire spacing. This enables round circles to be obtained without any distortion whatsoever.

In order to utilise the screen dump given in the January 1984 Micro User, the following changes must be made:

```
560 LDA #1
610 LDA #3
1880 DATA 27, 65, 8, 27,
75, 128, 2, 27, 127, 27, 7
```

The major change is due to the use of 640 dots per 7.5in line with a consequent change in the



# MICROMAIL

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value of "step" for the different modes. — Peter Seddon, Solihull.

## Service isn't dead!

LIVING in Australia can have its disadvantages when one owns a BBC — least of which is the gamble when buying a British-made peripheral.

If something does go wrong, reliable backup and parts are non-existent.

However, a recent fault in our

British Micro Graphpad has reassured us that customer service is not dead.

A short letter to the manufacturer outlining the fault resulted in a reply in less than a week.

The conditions were analysed to be a damaged pen and a replacement pen arrived via air mail the same day as the letter.

It is obvious that the management and staff of British Micro value their customers anywhere in the world and are willing to properly back-up their excellent product. It would be nice if other firms had the same attitude. —

Lindsay Thachuk, Head of Computing, Scotch College, Mitcham, South Australia.

## My colour guide...

I ENJOYED Peter Walker's excellent article on creating 27 colours in the April edition of Micro User.

A cruder, but less memory-consuming method, is to create used defined graphics characters using the VDU23 command, in which foreground and back-

ground colours can be interweaved.

I enclose a small program I wrote to illustrate this. It draws 10 rectangles of diminishing size. (See left.)

Line 20 defines a graphics character where foreground and background colours are chequered as on a chess board. This displays 27 new colours which can be varied by pressing the space bar. Lines 150 and 140 randomly redefine the actual colours displayed by the logic colours.

Line 30 defines a graphics character in which the foreground colour only occupies 25 per cent of the space. The lower half of each rectangle is drawn with this character.

Notice that although the same colours are used for both parts of a rectangle it results in two different colours or shades.

Sometimes when two adjacent rectangles are the same colour at the top they can be different at the bottom. This is because the foreground and background colours have been switched.

Thus in the lower part of the screen 54 new colours have been created in addition to the 27 at the top of the screen. With the 8 Mode 2 colours used this gives 89 colours in all.

The real significance of this is that multi-colour graphics can be used in modes with higher resolution than Mode 2. — Ian Bunting, Bagshot, Surrey.

```

10 MODE 2:VDU8202;0;0;0;
20 VDU23,224,&55AA;&55AA
;&55AA;&55AA;
30 VDU23,223,&2288;&2288
;&2288;&2288;
40 B=0:C=16:D=30
50 REPEAT COLOUR(RND(8)-
1)
60 COLOUR(RND(7)+127)
70 FOR Y=B TO 16:FOR X=B
TO C
80 PRINTTAB(X,Y)CHR$(224
)
90 NEXT: NEXT
100 FOR Y=16 TO D:FOR X=B
TO C
110 PRINTTAB(X,Y)CHR$(223
)
120 NEXT: NEXT
130 B=B+1:C=C-1:D=D-1:UNT
IL B=10
140 REPEAT VDU 19,RND(8)-
1,RND(8)-1;0;
150 VDU 19,RND(7)+127,RND
(7)+127;0;
160 REPEATUNTILGET
170 UNTIL B=100:END

```

## How not to fall on the dec!

WHILE trying to become familiar with the hex print format in Basic using ~ before variable names, I realised that using this you cannot get the decimal number 10 printed as OA hex and similarly 1024 dec comes up as 200 instead of 0200 hex.

So I've written a function that will do this. It uses recursion

```

10 MODE 7
20 REPEAT
30 INPUT"nn% = "nn%
40 PRINTFNhex(nn%)
50 UNTIL FALSE
60 END
70
80 DEFFNhex(nn%)
90 LOCAL h$,msn%,l$;h$
=" "
100 IF nn%>&FF THEN h$=FN
hex(nn% DIV &100)
110 nn%=nn% MOD &100
120 msn%=nn% DIV &10;l$=
nn% MOD &10
130 IF msn%<&0A THEN h$=h
$+STR$(msn%) ELSE h$=h$+CHR
$(msn%+55)
140 IF l$<&0A THEN h$=h
$+STR$(l$) ELSE h$=h$+CHR
$(l$+55)
150 =h$

```

(line 100) and the fact that the numbers 10 dec to 15 dec can be made the Ascii values of the letters A to F respectively by adding 55 dec (lines 130 and 140). — R.H. Chotalia, Leeds.

## Disc errors pinpointed

PERHAPS I can comment on George S. Barr's letter (Problem Page, June) and earlier letters.

Disc error 18 is typically caused by a sector mis-read and may be the result of an effective timing problem. Our investigations have suggested the following possible causes:

● Disc drive overspeed. This

can normally be adjusted by a pot fitted to the PCB within the disc drive. A strobe disc fitted to the drive motor is of assistance here. I would suggest this adjustment only be carried out by a competent technician.

● Long settle time on the disc drive motor speed during which there can be overshoot. The DNFS ROM has some timing changes to help overcome this and I would recommend a change from 0.90 DFS to DNFS (DFS 1.2).

● Incorrect inter-sector gap when the disc was formatted. Check that the formatter routine and the drive originally used for formatting are OK. DNFS should overcome some problems here.

With regard to D.J. Turner's questions on monitors, please note:

● Most TVs have colour tube dot/stripe pitch of around 0.63mm.

● A medium resolution monitor, such as the Microvitec 1451, with a dot/stripe pitch around 0.43mm will capture the BBC or Electron's potential.

● Many of the new TV/Monitor products do have RGB input as well as Composite Video. This will often be analogue — that is, 0 to 0.7v rather than the BBC's TTL RGB. Some TVs will cope with TTL RGB, others may need a lead with resistors fitted. — David Bell, Project Manager, BBC Micro, Acorn Education & Training Division.

## Ironing out a bug

FURTHER to Jim Notman's disassembler program in February's Micro User, an alteration is needed for Basic I owners. Line 1140 should read:

```

1140 IF type% THEN ON type%
GOSUB 1200, 1210, 1220,
1230, 1240, 1250, 1260,
1270, 1280, 1290, 1300,
1310

```

This is because during disassembly of a ROM the screen heading is corrupted shortly after starting. It is caused by a known bug in Basic I (corrected



in Basic II) where, when using ELSE with ON...GOSUB, the GOSUB token (&E4) is left on the machine stack.

Each time line 1140 is executed with type%=0, &E4 is left on the stack. When a Proc is encountered, the machine stack is pushed on to the Basic stack at Himem eventually overflowing above Himem causing the top of the screen display to fill with the letter 'd', CHR\$(&E4) in Mode 7.

Apart from this, an excellent program. — Martin Dale, Bexleyheath, Kent.

## P% location

CAN I ask if there is a location in the BBC's memory which stores the Basic variable P%, that is the address of the instruction currently being executed?

If you could enclose this address along with the number of bytes involved I should be delighted.

Great magazine — especially the new section on m/c games! — A. Tang, Sheffield.

● The address of the instruction currently being executed is held in the 6502's program counter register. This cannot be directly accessed.

## Underlining solution

D.R. Bowman's problem with underlining in View files on the Silver Reed EX44 can be solved by using the View Printer Driver Generator, which enables drivers to be generated for any

printers connectable to a BBC.

This is available from Acornsoft at £9.96 on cassette and £11.50 on disc. — Robert Macmillan, Acornsoft, Cambridge.

★ ★ ★

IN response to D.R. Bowman's cry for help regarding underlining on his typewriter/printer: This is obviously due to a lack of a compatible printer driver. However, as he is using View this can be easily solved.

View has two highlight keys. These can both be set to generate whatever code you wish, and if Mr Bowman follows the following he should have no further problems:

Reset Highlight 1 to produce the code 1 — HT 1 1, then reset Highlight 2 to produce the code 27 — HT 2 27.

These keys can now be used to produce any effects available on the printer if used as follows:

If the Ascii code for X is the code for underlining and the Ascii code for Y the code to turn underlining off, the following should apply:

**\_ \*XMICRO USER  
MAGAZINES\_\*Y**

Remember “\_” is Highlight 1 and “\*” is Highlight 2. The above title will be underlined.

This I think will probably solve Mr Bowman's problem. However, I have used this method for a long time in preference to the printer driver routines, due to it being more flexible and the Highlight keys do not need to be reprogrammed every time a different effect is required. — Ian W. Moutter, Edinburgh.

## The Prestel connection

I HAVE built the modem from the Body Building Course (and made it direct connect... shhh!) and found that it works correctly except for Prestel-1200/75. Any ideas? — Jonathan Langley, Radlett, Herts.

● Yes there was a bug in the printed listing. Line 1760 should read:

```
1760 IF A$="R" THEN RTS=&DF
ELSE RTS=&EF
```

This should get the thing to work on other standards, but your problem is only just beginning as the codes sent by Prestel are not really compatible with Mode 7. It's all to do with scrolling and paging.

I have written a routine to get around most of the trouble, but some pages still fox it. If you want the listing write to me with an sae — and make the envelope a large one! — Mike Cook.



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MU7



# MICROMAIL

I WAS interested to read Mr Immelmann's letter in the April issue, referring in turn to Mr Rourke's in November, and to what he termed a "Basic II glitch".

If only people (including dealers) would read their User Guides properly, they would find that although these number-and-string phenomena may be unexpected, they are nevertheless exactly in accordance with the information on page 326 and can be adjusted using @%, the formatting variable.

The problem of manipulating "single-precision" decimal floating point numbers accurately is handled better on the BBC than on most other micros, including many so-called "business" machines.

It is inherent in the nature of the binary arithmetic common to all micros that decimal numbers will suffer some inaccuracy in processing.

What BBC Basic does, with its use of @%, is to give you a flexible means of obtaining the best compromise for your needs.

I will not go into an explanation of @%; we all have User Guides. Rather, let us take Mr

## Guide to a 'glitch'

Immelmann's examples and see how @% can help.

● Firstly, his example (interpreting the version printed, which won't work):

```
A=45:PRINT LEN(STR$(A)):
PRINT A
```

produces 11 and 45.1 in Basic II under the default setting of @%, which is &0000090A (B4=0, B3=0, B2=&09, B1=&0A).

This is because the input 45.1 is translated and held internally as 45.09999999 - a number comprising 10 significant figures. The decimal point is also included in the STR\$ version, giving the total length of 11.

So far so good. But why, then, is the numeric form printed as 45.1? As previously stated, the default setting of @% is &90A in Basic II (so as to be compatible with Basic I) and so, in accordance with page 326, the internal number is output to the nearest rounded equivalent in 9 significant figures, which is 45.1.

Now, what about that length

of 11? Well, we can force STR\$ output to conform with numeric output, simply by setting B4 to &01 (page 326 again, readers!). Hence:

```
@%=&0100090A
```

is the statement required here to produce the expected 4 and 45.1.

However Basic II improves on its antecedent in that it is capable of 10-digit output accuracy, if B2 is set to &0A.

In this context "accuracy" means consistency with internal form. Hence, setting @% to &A0A will produce 45.09999999 and 11 for the above expression.

All references on pages 326-7 to 9 for B2 can be taken as 10 for Basic II if @% is set accordingly.

● Secondly, that problem with

```
FOR N = 0 TO 3 STEP
.01:NEXT:PRINT N
```

can be fixed easily with @%.

The internal form of the result is output to 9 significant figures

by default, but if we can put up with 8 significant figures, Basic will do the rounding for us.

Set @% to &80A and run the expression again. You'll get the result you expect, because 3.00999996 rounded to 8 significant figures becomes 3.01.

Now, I accept that all this is rather confusing at first, so here is a program that allows you to play around easily with @% in hexadecimal form and try out the effects. It is listed below.

A # is printed as a prompt for numeric input (which may include brackets, etc; EVAL is used). Try tricky fractions like 1/7 or 11111111/9 to give @% a good workout.

The current setting of @% is shown at the top of the screen, but you can change it by just pressing Return at the # prompt and overtyping as required, using the cursor keys to move about within the displayed digits.

I hope readers will find this useful in disentangling the @% enigma. And before anyone says the length is wrong in "E" format (B3=&01), read Page 326!

- Patrick Sedgwick, London.

```
10 #: @% tutor.
20 #: By Patrick Sedgwick
30 #: (c) The Micro User
40 ON ERROR GOTO 680
50 MODE 7
60 PROCinit
70 PROCshow_@
80 PROCwindow
90 REPEAT
100 PROCinput
110 PROCprocess
120 UNTIL 0
130 DEF PROCinit
140 M%=&A00
150 !M%=@%
160 X%=0:Y%=0
170 ENDPROC
180 DEF PROCinput
190 PRINT CHR$131 "TEST:"
; CHR$130;
200 FOR N= 0 TO 3 STEP .0
1 : NEXT : PRINT; N; " L=";
LEN(STR$(N))
210 VDU129:PRINT "#" CHR$
135; : INPUT "" n$
220 ENDPROC
230 DEF PROCprocess
240 IF n$="" THEN PROCget_
@ : ENDPROC
250 PRINT EVAL(n$); " len
gth = "; LEN(STR$(EVAL(n$)
))
260 PRINT"....+....^....+
....^"
270 PRINT" 5 10 15
20"
280 ENDPROC
290 DEF PROCget_@
300 X%=POS:Y%=VPOS
310 PROCshow_@
320 VDU26,9
330 #FX4 1
340 REPEAT K%=GET
350 IF (K%=136) AND (POS>
1) VDU 8
360 IF (K%=137) AND (POS<
8) VDU 9
450 NEXT
460 @%=EVAL("&"+A$)
470 PROCwindow
480 ENDPROC
490 DEF PROCshow_@
500 VDU26,131
510 !M%=@%
520 FOR I%=3 TO 0 STEP -1
530 B%=M%?I%
540 IF B% < &10 PRINT; "0
";
550 PRINT; ~B%;
560 NEXT : PRINT
570 TX=12
580 CX=134
590 PRINT CHR$130 "B4..B2
.." ' CHR$130 "..B3..B1"
600 PRINT TAB(TX,0) CHR$C
% "B4: STR$ control 0/1"
610 PRINT TAB(TX,1) CHR$C
% "B3: format Gen/Exp/Fix 0
-2"
620 PRINT TAB(TX,2) CHR$C
% "B2: number of digits 1-9
/A"
630 PRINT TAB(TX,3) CHR$C
% "B1: field width 0-FF"
640 ENDPROC
650 DEF PROCwindow
660 VDU28,0,24,39,5,31,X%
,Y%
670 ENDPROC
680 #: error handling
690 ON ERROR OFF
700 REPORT:PRINT " at lin
e ";ERL
710 #FX4
370 IF (K%)=48) AND (K%<=
57) AND (POS>0) AND (POS<9)
VDU K%
380 IF (K%)=65) AND (K%<=
70) AND (POS>0) AND (POS<9)
VDU K%
390 UNTIL K%=13
400 #FX4
410 A$=""
420 S%=&7C01
430 FOR I%=0 TO 7
440 A%=A#+CHR$(S%?I%)
```



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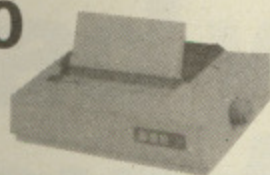
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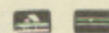
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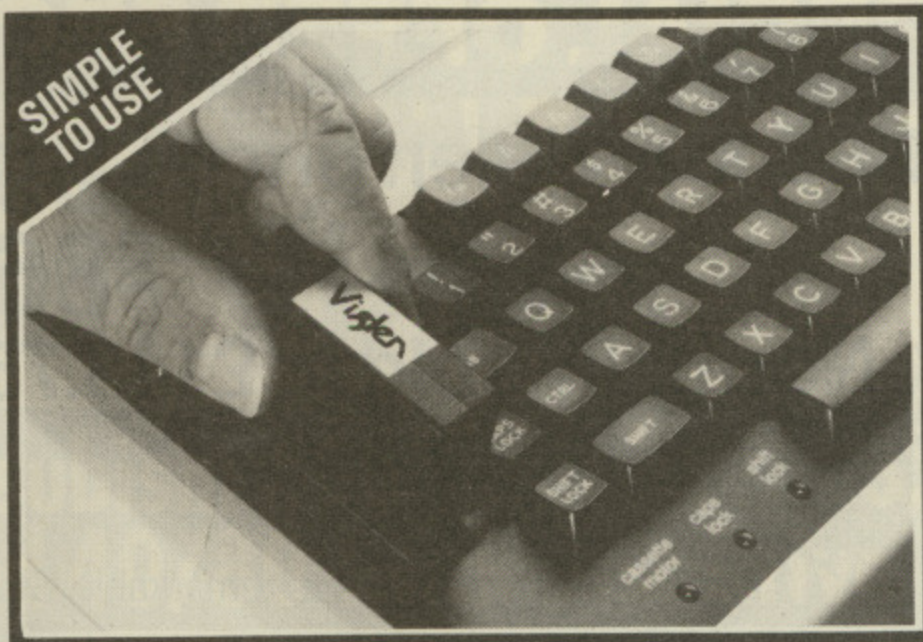
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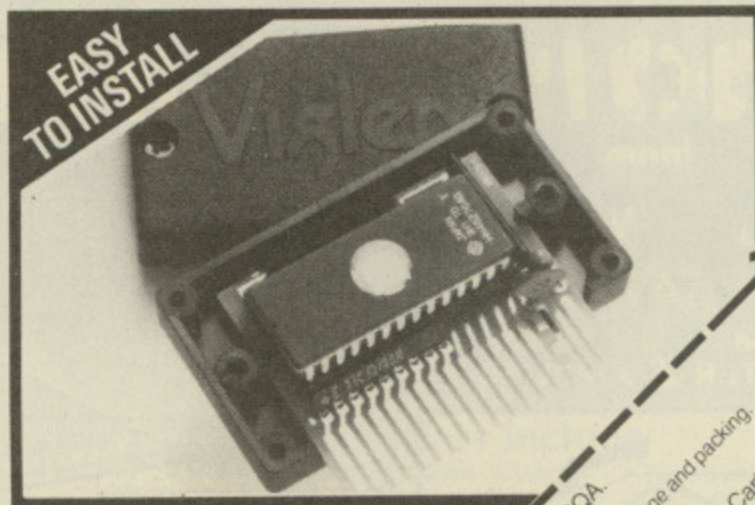
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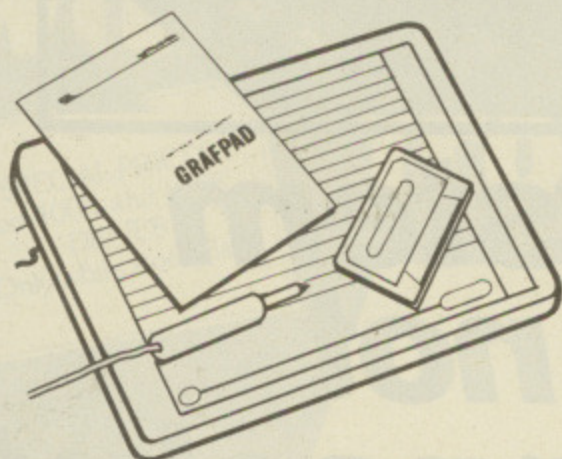
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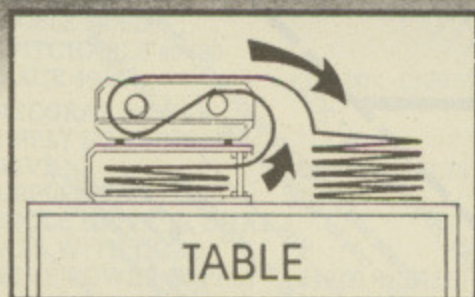
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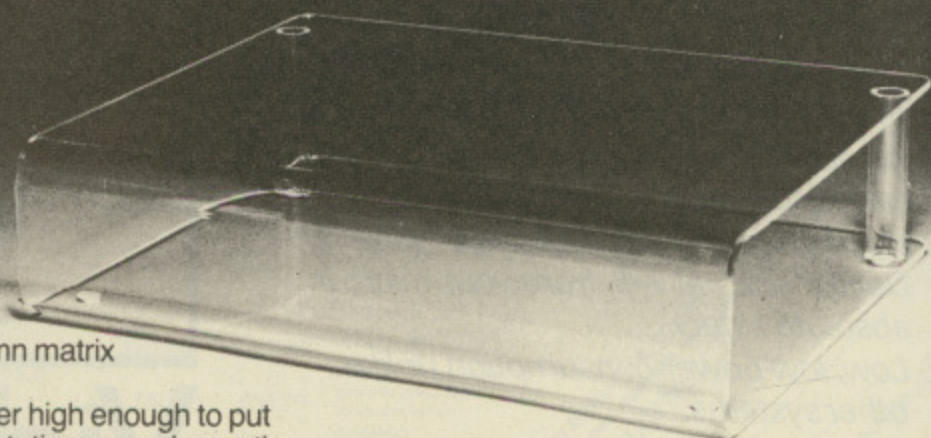
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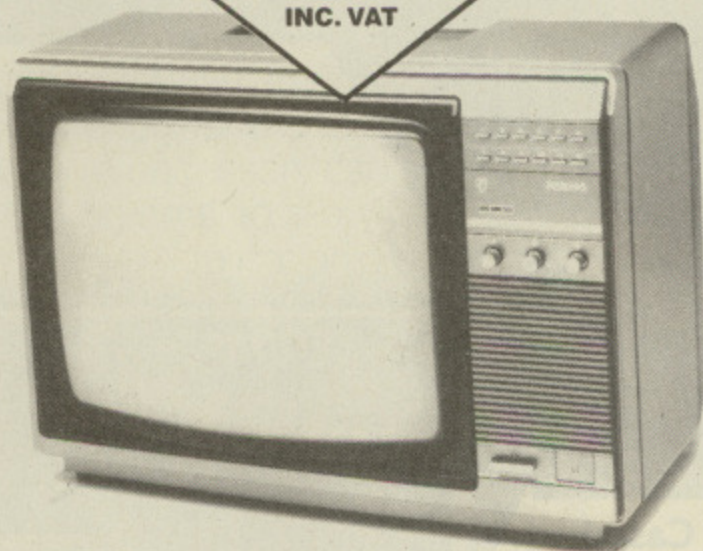
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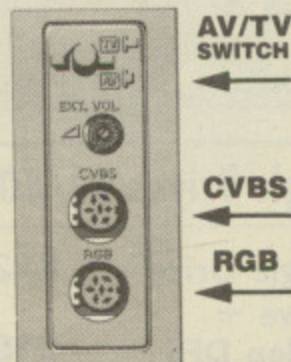
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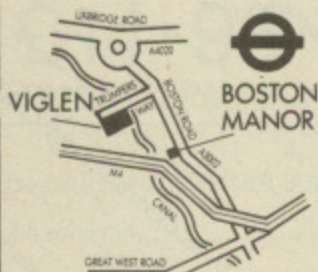
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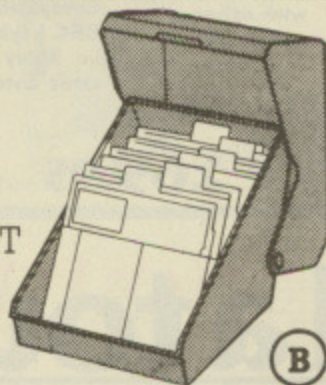
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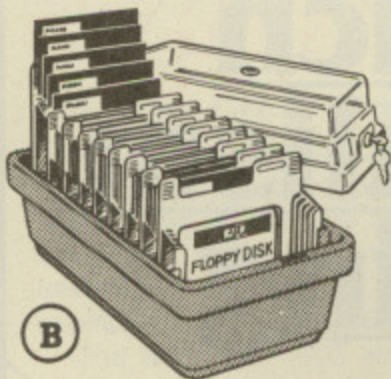
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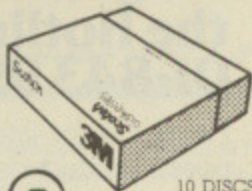
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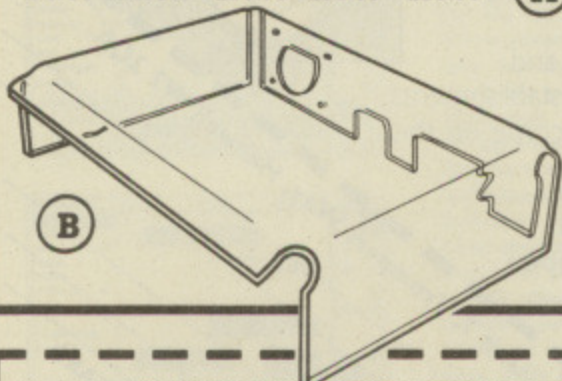
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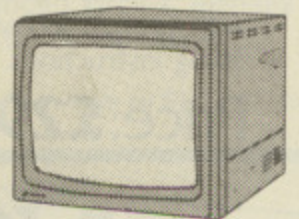
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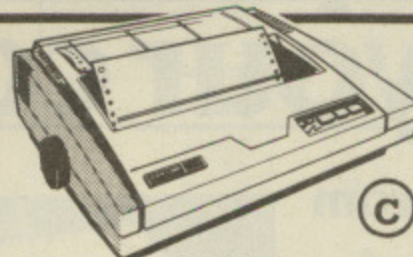
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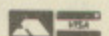
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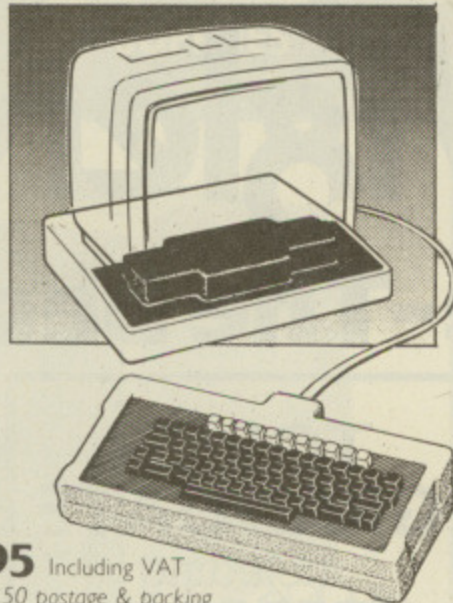


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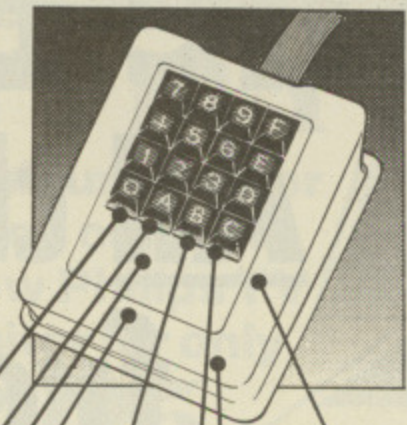
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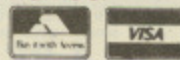
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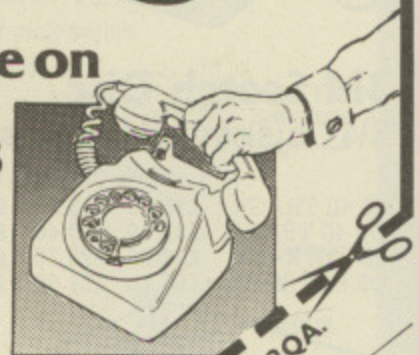
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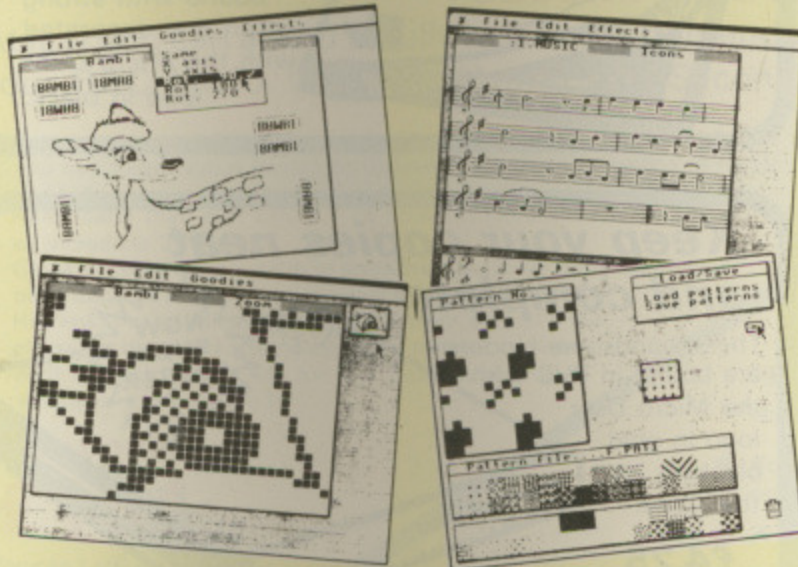
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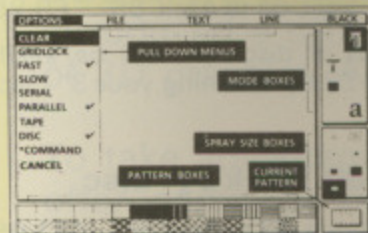
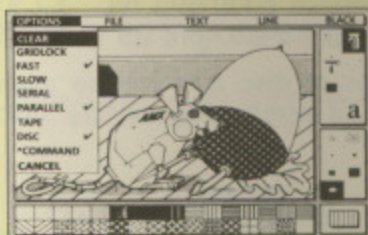
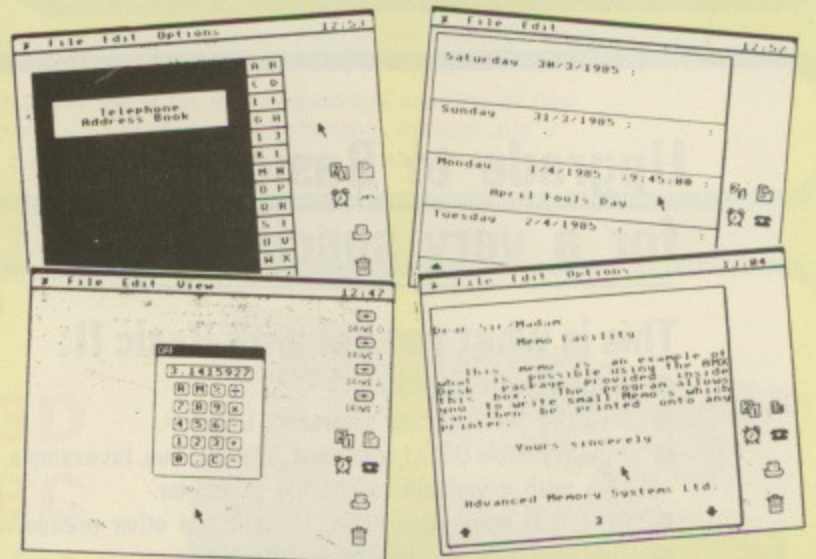
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**Assembly Programming Made Easy** puts the magic world of machine code at your finger-tips

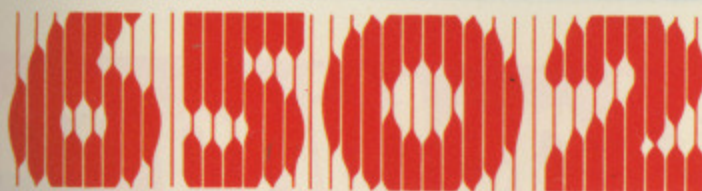
Here is a really easy guide for the enthusiastic beginner to assembly language for the BBC Micro. Using easy examples, cartoons and short, very simple programs you will quickly learn how to put graphics on the screen, use the BBC operating system and bring the machine to life.

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The first in the series, "Getting Started in Sounds & Graphics", is now available.

In this compilation of their highly praised series of articles in *The Micro User*, Michael Noels, Paul Jones and Nigel Peters explore the BBC Micro's outstanding sound and graphics capabilities.

Step by step, with clear explanations and lots of examples, they show you how to harness the power of your micro to create dazzling displays and superb sound.

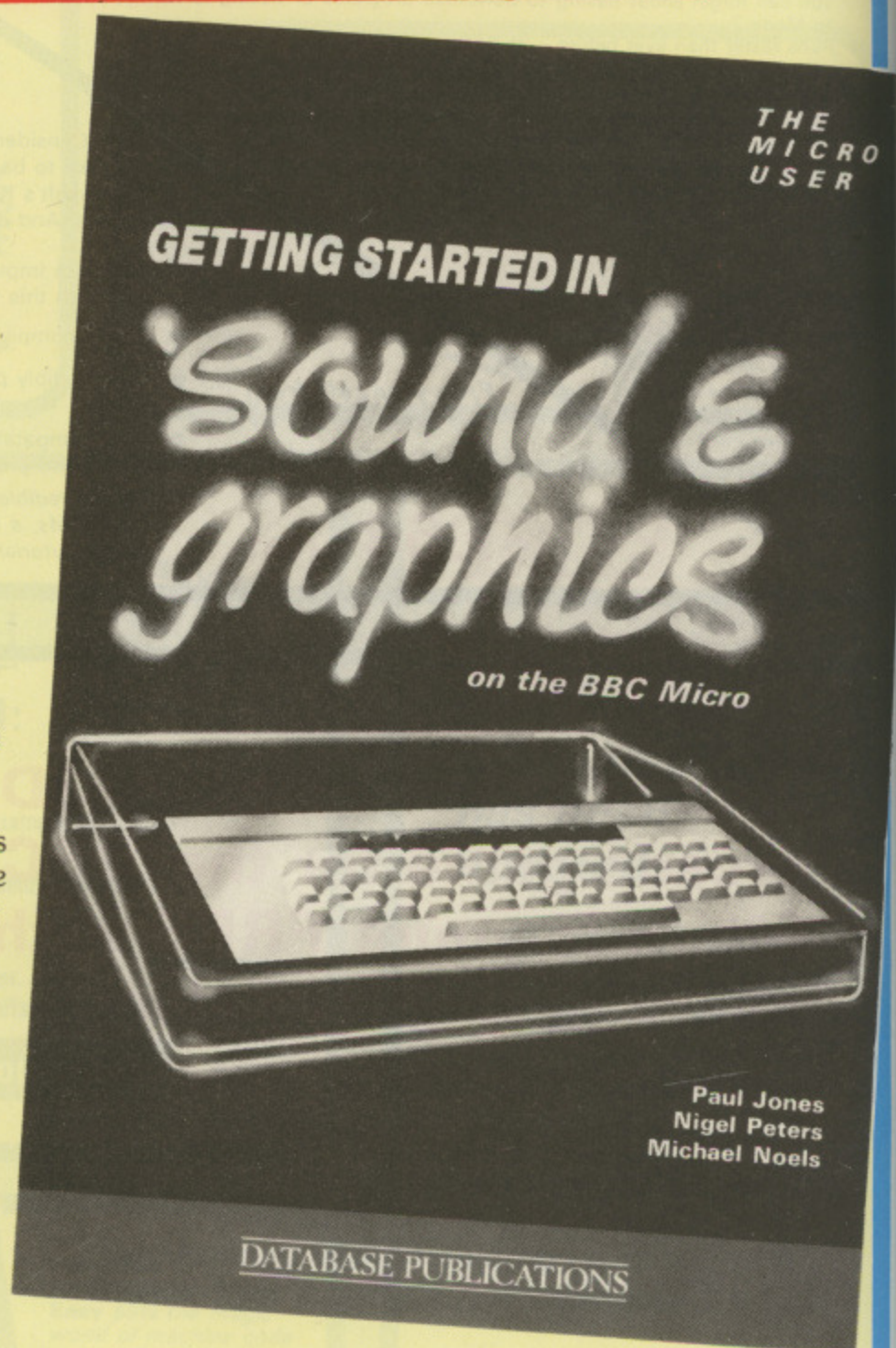
Assuming only a rudimentary knowledge of Basic, the authors thoroughly explain all the programming methods involved, ranging from the simplest to the most complex.

Lots of books describe the BBC Micro's graphics and sound capabilities – this one shows you how to exploit their tremendous potential to the full.

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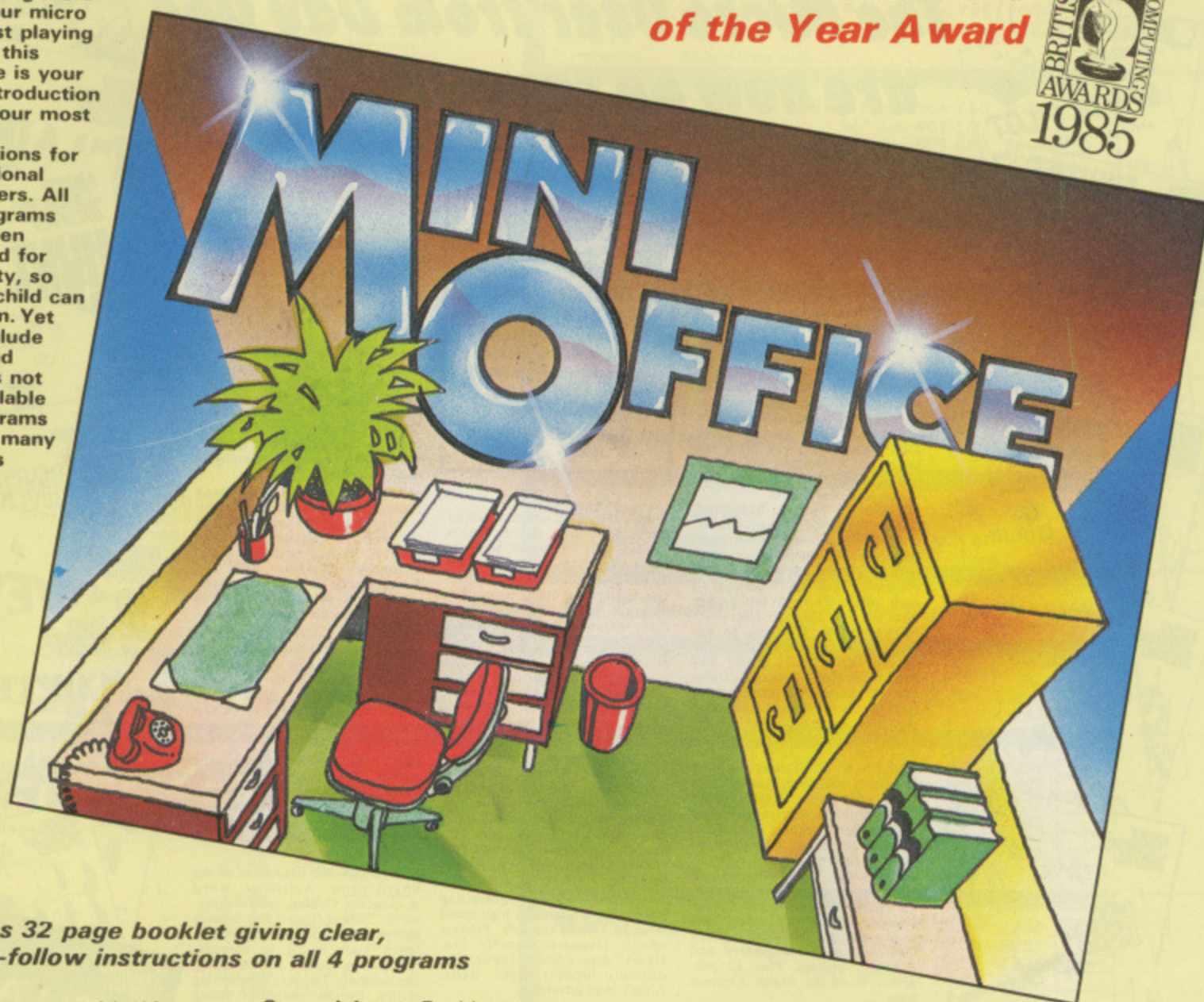


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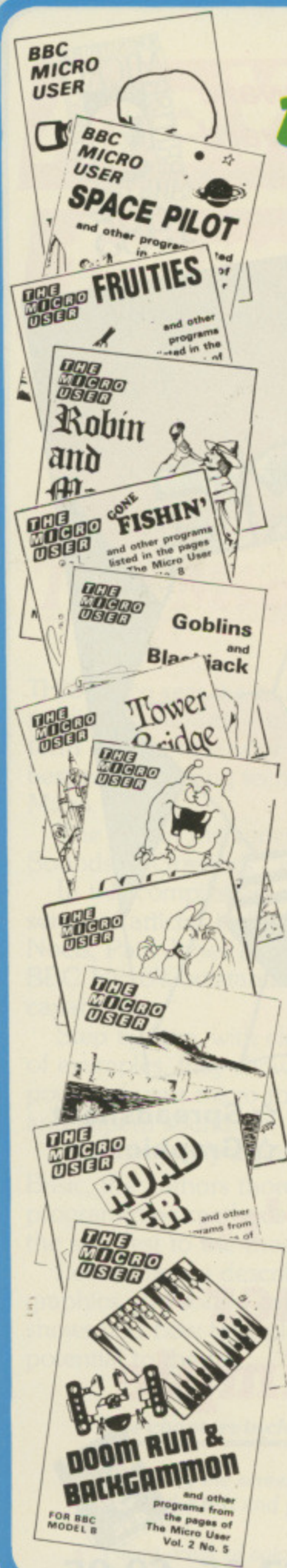
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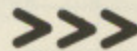
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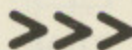
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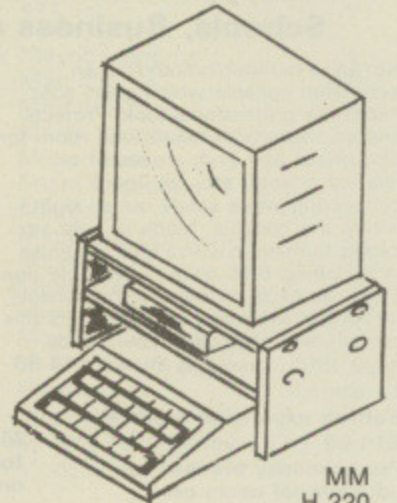
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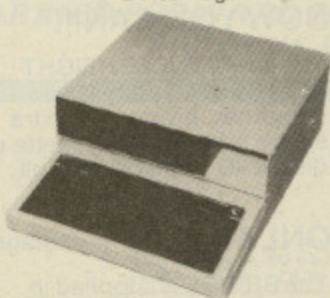
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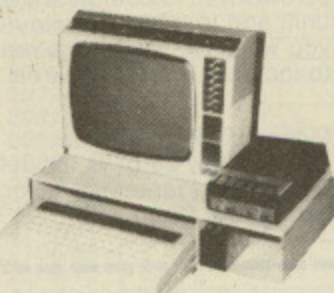
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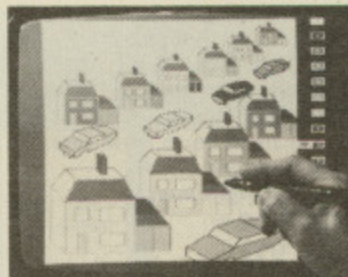
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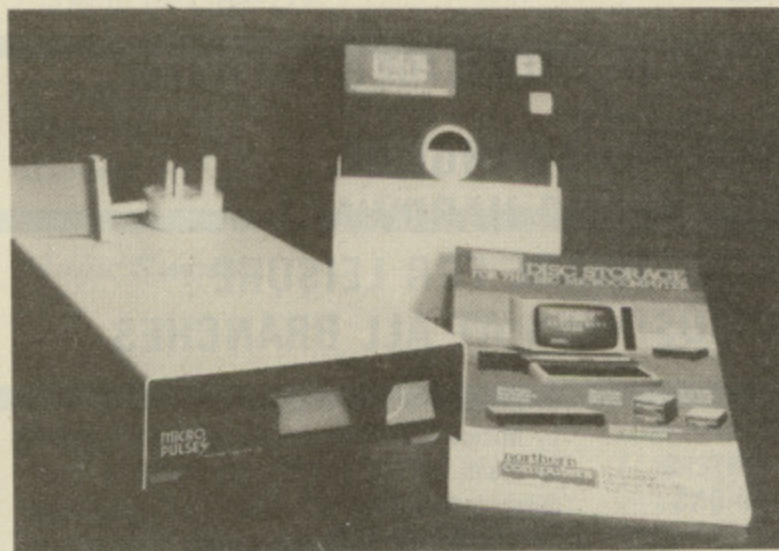
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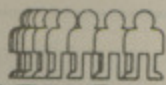
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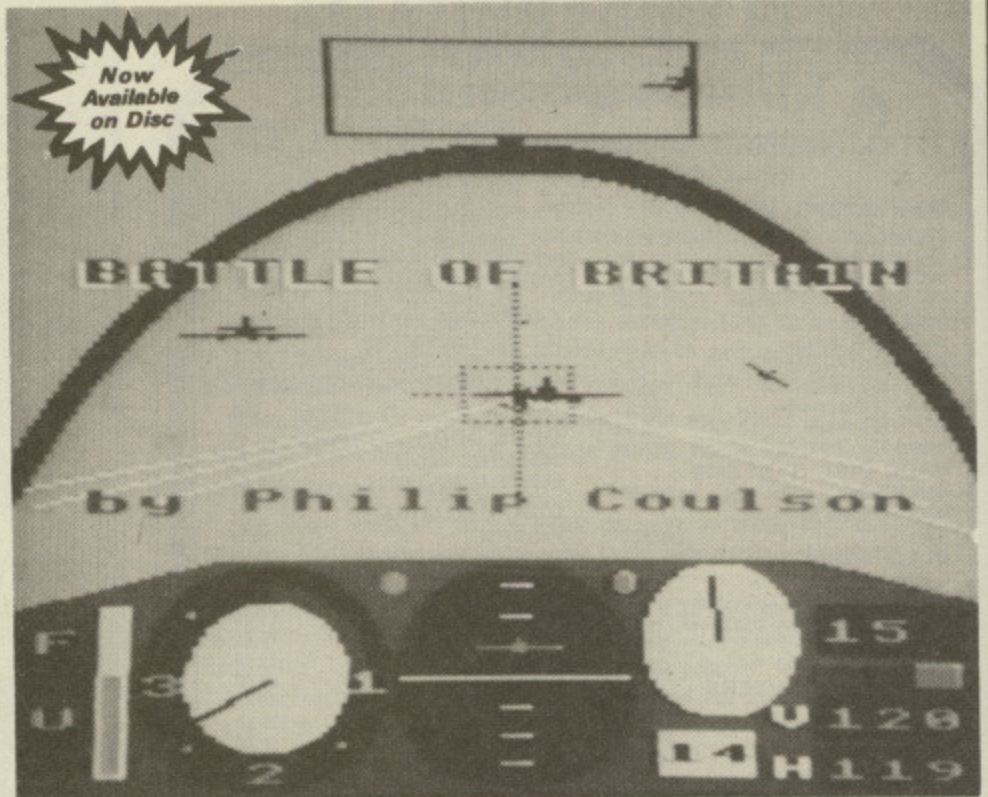


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for 32K BBC Model B  
– any operating system

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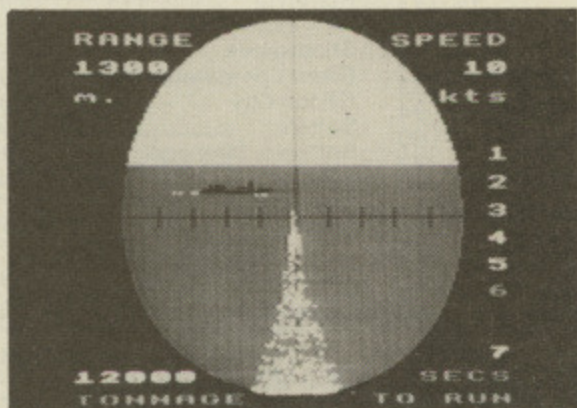
"Tally-ho!" The sky is suddenly full of planes. You get a Heinkel 111 in your sights and have to use all your skill to hold him there as he jinks and weaves to avoid the devastating fire power of your eight Browning machine guns. Your aim is good, and he explodes in flames, strewing wreckage in your path.

Watch out! Your mirror tells you there's an Me109 on your tail. You see the flashes and hear the chatter of his guns. You dive steeply away, and manage to shake him off. A Hurricane fills your sights and you almost open fire on him. That could have cost you a lot of points! Planes zoom towards you and climb and dive around you as you seek out your next target. A slow-moving Stuka falls easy prey to your guns and with your low ammo warning light flashing, you carefully aim your last few rounds at a fleeing Junkers 88.

You throttle back to conserve your dwindling fuel supply and set a course for home. From time to time, clouds blot out your view of the horizon and you are dependent on your instruments. With the airfield in sight you lower your flaps and gear and side-slip gently to line up with the runway. Although you have survived another mission, you cannot afford to relax yet, and the quality of your landing can win or lose you points.

If all this sounds too much in one go, you can opt to concentrate on just one phase of the game – interception, combat, approaches and landings – or just enjoy some stomach-churning aerobatics!

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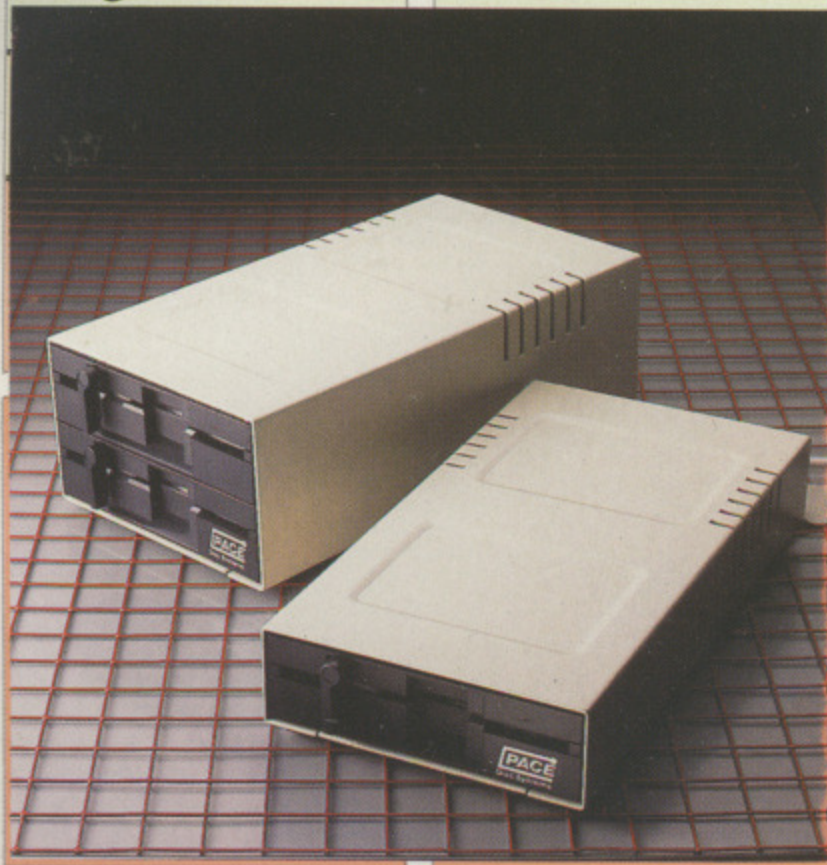
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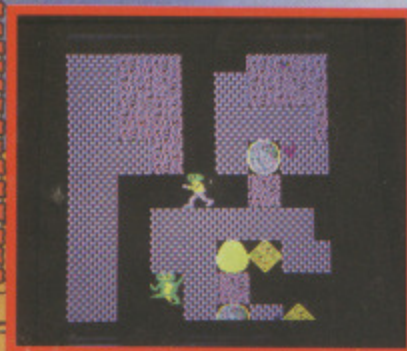
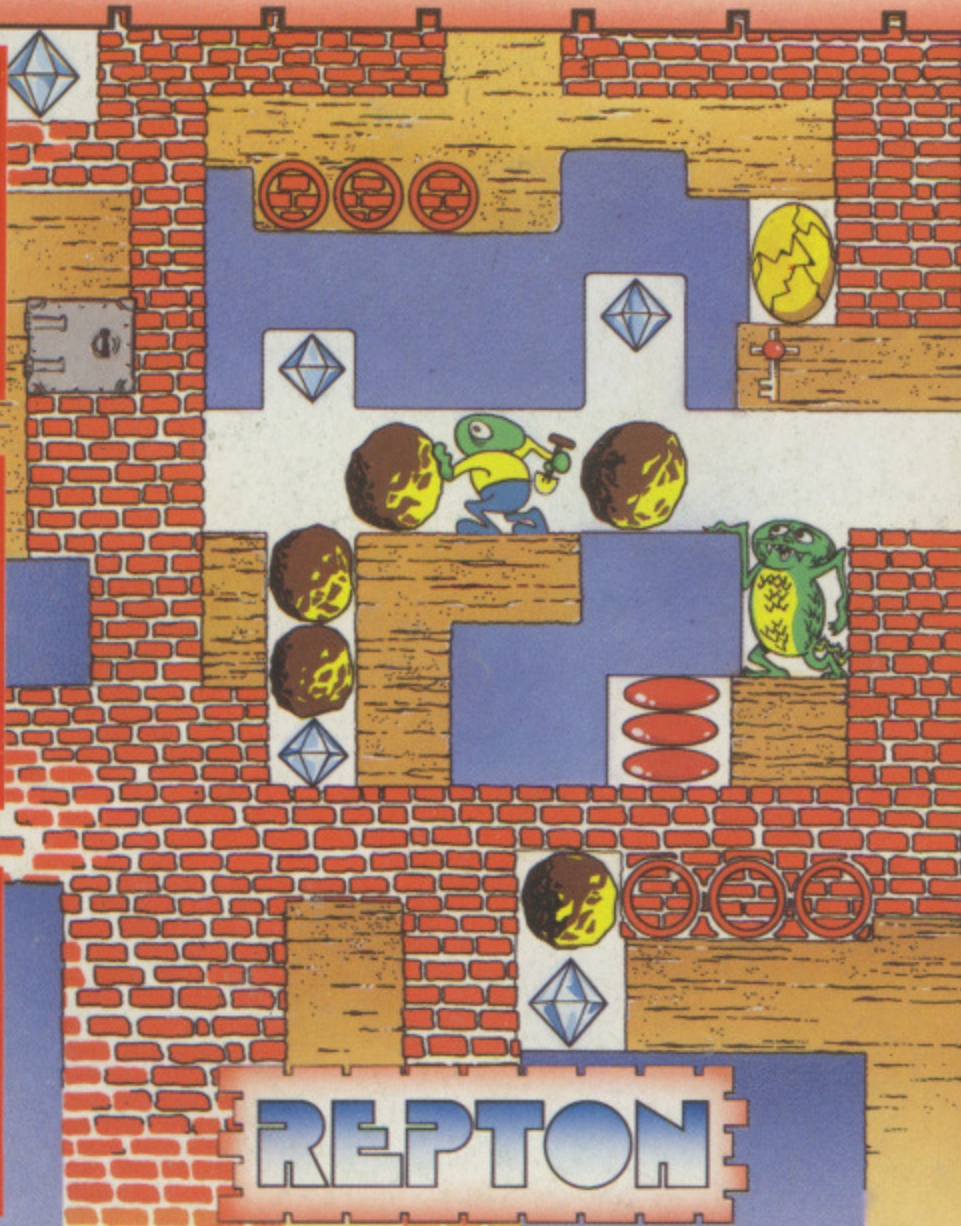


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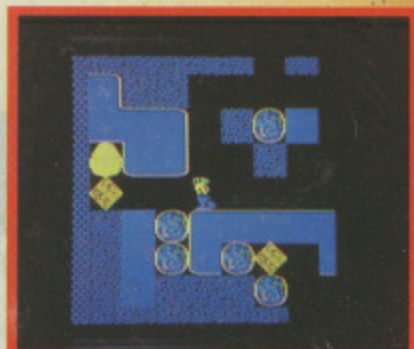
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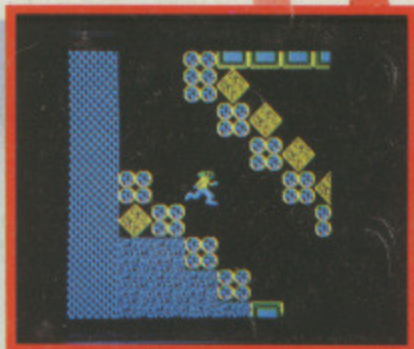
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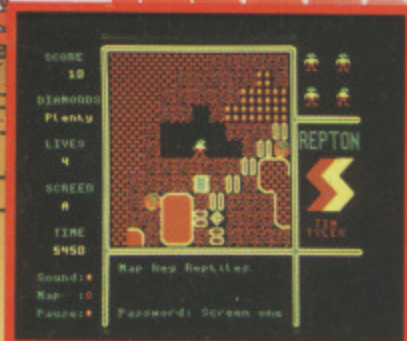
AN EGG ABOUT TO HATCH



THE MAP (SCREEN H)



SCREEN L



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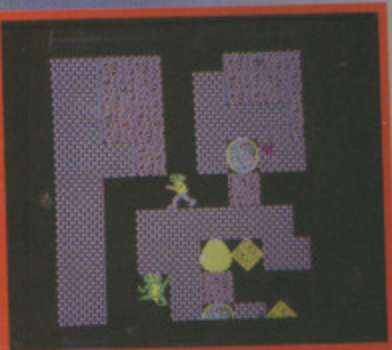
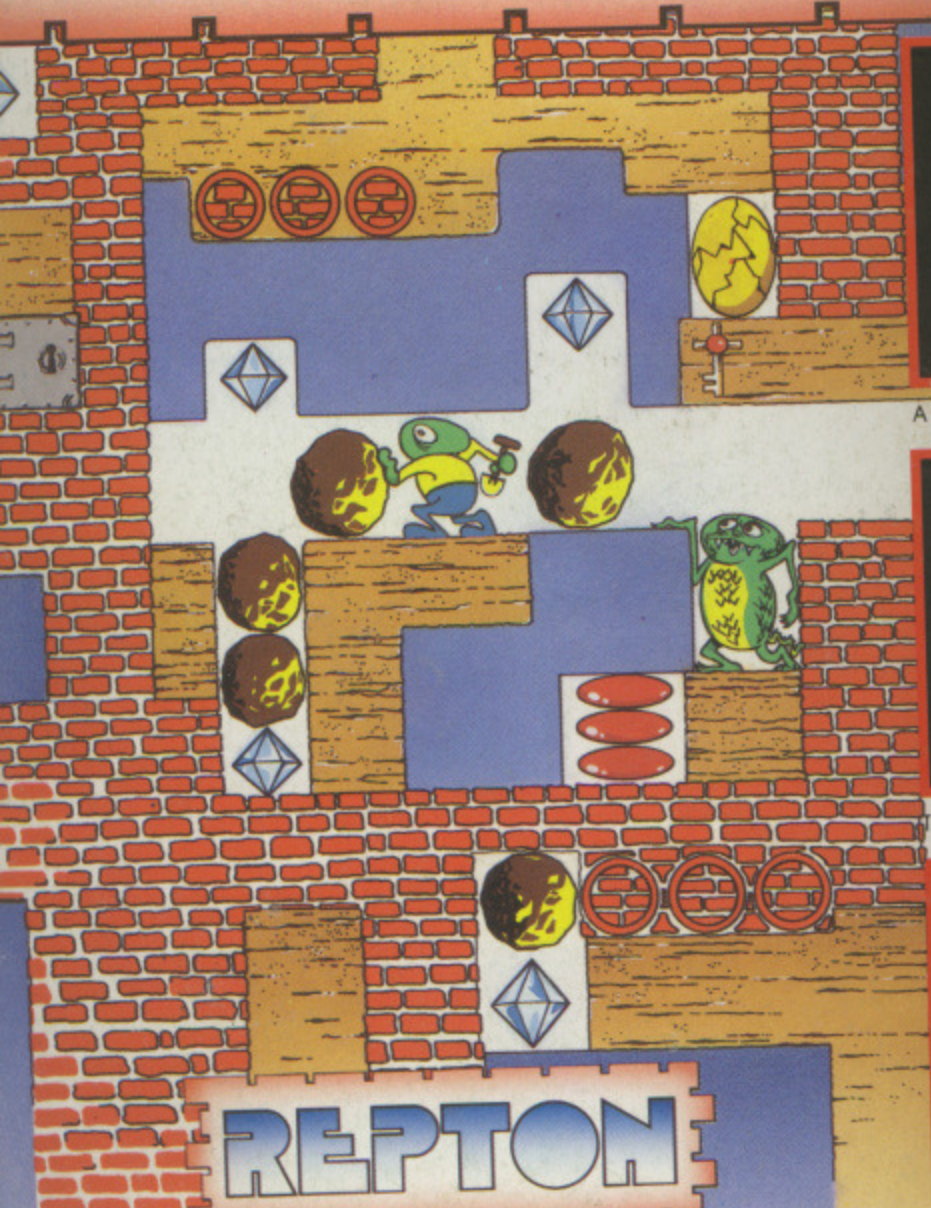
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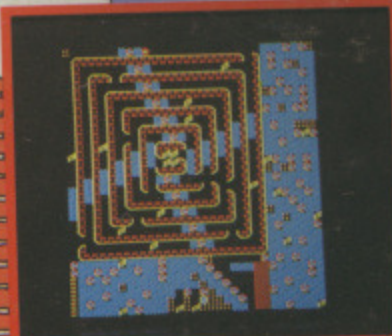


CHALLENGING ARCADE-STYLE ADVENTURE

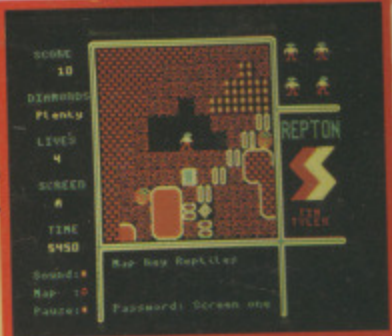
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THE MAP (SCREEN H)



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