

# Computing today

OCTOBER  
1984

90p

## THE AMSTRAD CPC464:

The 'music centre'  
of computing  
comes storming in

Getting to grips  
with Atari graphics

Animate your sprites  
Dragon 32 –  
packages reviewed

Down to business  
with W.H. Smith's  
Advance 86B

Adventuring on  
the Commodore  
64 with Legend  
and Melbourne  
House

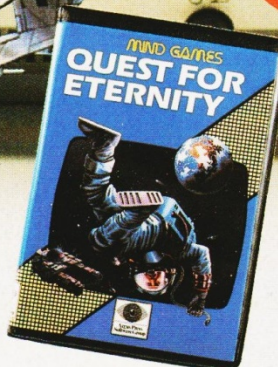




# What's on Your T.V. Tonight



Spectrum 48K - £7.99  
CBM 64/BBC/Atari - £9.99



## MIND GAMES



**Argus Press  
Software Group**

### Recommended viewing

#### Early Evening 6.40 pm Orion Quest

A full feature adventure starring well known nasty aliens the Zargs. Can you play the hero and stop their plans to blow up the earth.

Screen play N. White  
Costume Design D. Jordan  
Directed Martin Edwards  
Produced Argus Press Software

Available for Spectrum 48K, BBC, CBM 64.

### Mid-evening

#### 9.00 pm Quest for Eternity

Starring The Overlords of the Universe  
The candidate (you) have to get to the Chamber of Creation. It's a laugh a minute, since it's 2000 light years away on the most horrible planet in the Universe ... and your starship doesn't work either!

Written by David Cockram  
Directed Martin Edwards  
Produced Argus Press Software

Available for Atari, Spectrum 48K, CBM 64.

### Midnight Movie

#### 11.55 pm Star Force Seven

Starring The Zargs  
After a desperate space battle only one fleet of heroes remain to prevent the invasion of earth. The future of humanity lies with you!

Written by Ian Soutar  
Special Effects Ian Soutar  
Directed Martin Edwards  
Produced Argus Press Software

Available for BBC, Spectrum 48K, CBM 64.

For mail order, write with cheque/P.O./card No. to:  
Mind Games, Argus Press Software Group, No. 1 Golden Square, London W1.





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**Computing Today is constantly on the look-out for well written articles and programs. If you think that your efforts meet our standards, please feel free to submit your work to us for consideration.**

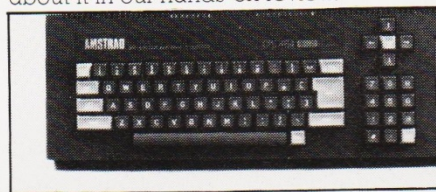
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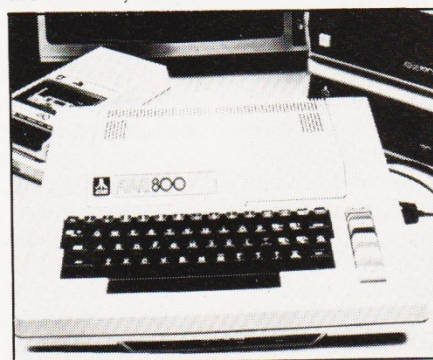
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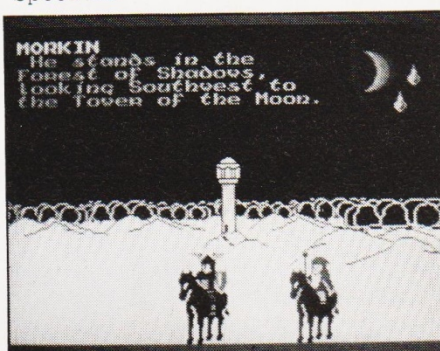
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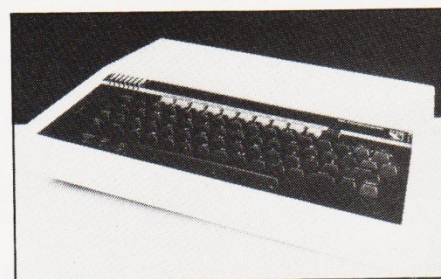
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## DRIVE ON, JAMES

For MZ-700 owners who are fed up with waiting for cassettes to load, salvation is at hand. Not one, but two companies have recently introduced disk drives. Comparatively similar and competitively priced, now the only agony is deciding which one to buy...

Kersten and Partner of Aachen, West Germany, have released the MFD 700 floppy system. Priced at approximately £230, the system incorporates 3½" single-sided double-density drives ready to plug on the Sharp's I/O and has a capacity of 176K. The accompanying software includes S-Disk-BASIC, which is compatible with Sharp Tape BASIC, and a utility program to copy disks with one drive and to transfer material from tape to disk.

If all this sounds very interesting but you think that the price of a return ticket to Aachen might up the price a little, panic ye not. Kersten and Partner have a UK agent in the form of Kuma Computers, 12 Horseshoe Park, Horseshoe Road, Pangbourne, Berks RG8 7JW (phone: 07357 4335).

Alternatively, you could look at the new Quick Disk unit, priced £249.95 from Solo Software. Manufactured under licence by Sharp in Japan, this 3" drive plugs in where the cassette deck is located, but the cassette unit can be connected to the back of the drive to allow existing software to be transferred from tape to disk. Loading BASIC now takes only four seconds as opposed to over three minutes — just think what you can do with all that extra time. For further details, contact Solo Software at Unit 95B, Blackpole Trading Estate West, Worcester WR3 8TJ (phone: 0905 58351).

Of course, waiting for cassettes to load is a pleasure not only restricted to Sharp owners. With the release of a 3" disk drive from Thurnall Electronics, Spectrum owners have an alternative system to the Microdrive. Thurnall are marketing the drive at an introductory price of £199 and promising delivery within 28 days. The package includes a Disk BASIC manual, programmers reference card, demonstration disk, power supply (with plug) and connected leads. The drive can be used with both the 16 and 48K Spectrums and gives 150K formatted

capacity per disk, expandable to 300K with a second drive (you get a £10 discount on a second system).

For more information, contact Thurnall Electronics Ltd at 95 Liverpool Road, Cadishead, Manchester M30 5BL (phone: 061-775 7922).

# NEWS



## BUSICALC 3, SUPERSOFT 1

Hot on the heels of Busicalc 1 and 2, the Commodore spreadsheet programs from Supersoft, comes...Busicalc 3. Busicalc 3, as might be expected, incorporates all the facilities of the earlier programs, plus improvements. The main innovation is its three-dimensional formula which enables the user to pull in information from up to 26 other spreadsheets. As with the others in the

range, Busicalc 3 works with all CBM printers, but it can also be linked to Easy Script or Viza-write which allows the use of RS-232 printers (which aren't supported by the software) as well as giving better quality.

Other new facilities include variable column width on screen and the reproduction of data as bar charts, which can be in both positive and negative format. Busicalc 3 also has a greater display size than the previous packages, up to 999 rows by 200 columns, and

worksheets can have up to 2500 boxes, all of which can be filled.

Written for the Commodore 64 with disk system, Busicalc has been converted for the 8096 and 8296 Commodore business computers. Although less powerful on these machines, it does have the advantage of working on a superior disk system and at £125 plus VAT, competes favourably with existing spreadsheets.

Supersoft are also currently working on a Z80 cross-

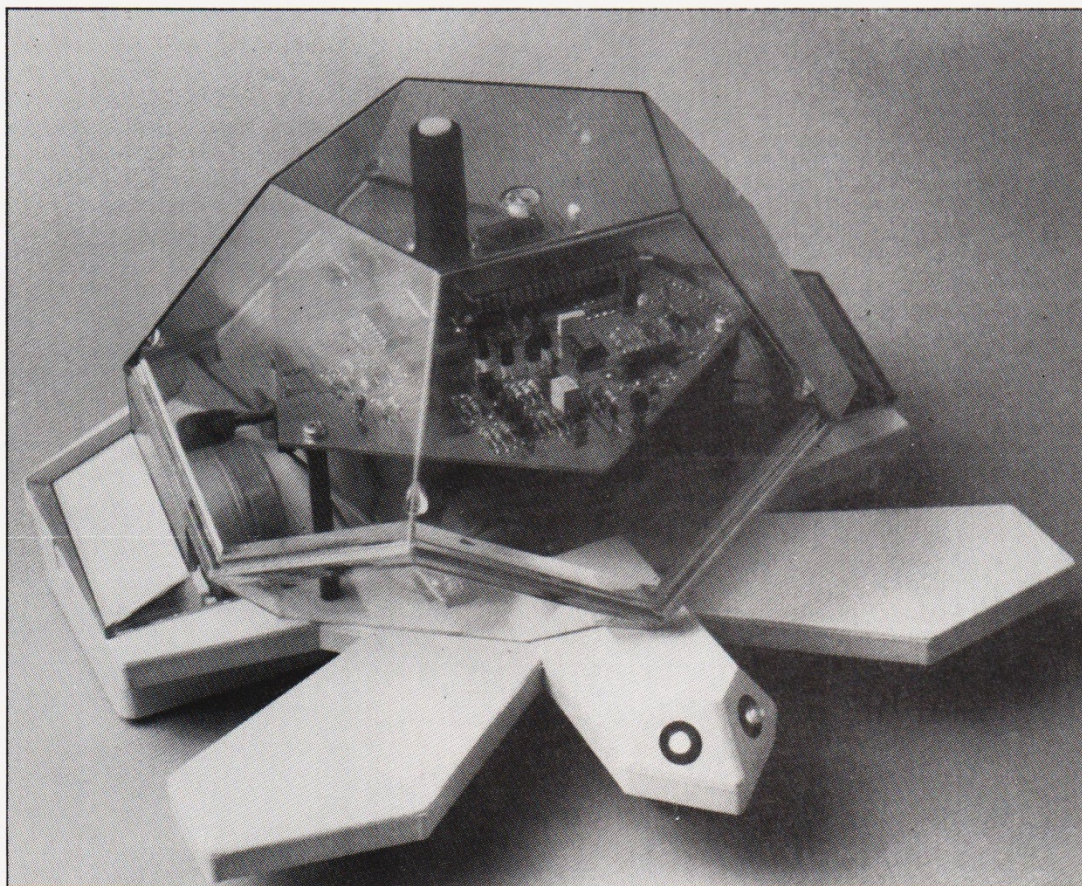


## TURNING TURTLE

The world's first remote-controlled Turtle is to be let loose in schools and high street stores as "the next logical fun/educational development for children after computer games." For the uninitiated who think a turtle is a kind of amphibious reptile that's particularly good in soup, *this* kind of turtle is a turtle-shaped graphics plotter used in conjunction with the children's programming language, Logo.

Logo was developed at the Massachusetts Institute of Technology as part of the 'mathland' approach for introducing children to mathematical ideas. It is now widely used in schools as a first programming language, teaching children to organise and analyse at an early age and will be available on all popular microcomputers by the end of the year.

The Valiant Turtle is the first completely independent turtle unrestricted by wires and interfaces with most popular microcomputers, including the Apple, BBC, Commodore, Digital Rainbow, IBM, Spectrum and RML 380Z. Valiant also provide interface programs to enable the Turtle to run from popular versions of Logo and Turtle Graphics programs such as Dart and Arrow. Moreover, not to bewilder teachers and parents who haven't grown up with new technology, the Valiant Turtle package includes an illustrated user-guide and a copy of Penup



magazine, written by teachers with suggestions for learning games using the Turtle.

The Valiant Turtle is available to schools through E.J. Arnold Ltd, Parkside Lane, Dewsbury Road, Leeds 11 5TD priced at £149. It will shortly be generally available for use in the home, priced at £199. Enquiries to Valiant Designs, Park House, 140 Battersea Park Road, London SW11 4NB (phone: 01-720 3947).

## FAST TALK

There has been an awful lot said recently about software piracy draining millions of pounds away from the computer industry. The Guild of Software Houses has spoken out very strongly about how software theft is "every day driving their

assembly version of their Commodore 64 Mikro Assembler cartridge for Z80-based machines such as the Spectrum, Amstrad and MSX range. Mikro80 is being written in 6502 machine code, to run on the 64 but it will assemble Z80 op-codes rather than 6502 op-codes.

For further information, contact Supersoft at Winchester House, Canning Road, Wealdstone, Harrow, Middlesex HA3 7SJ (phone: 01-861 1166).

members closer to liquidation". Whether or not you entirely agree with the sentiments of GOSH, it is about time that the 1956 Copyright Act was amended to give greater protection against the infringement of computer programs.

So, the industry as a whole, and particularly, the Federation Against Software Theft, welcomed the introduction of a bill on computer software copyright in the House of Commons recently by Conservative MP Nicholas Lyell. The bill, introduced under the Ten Minute Rule, seeks to amend the earlier Act to provide greater search powers and new penalties for copyright infringement.

Despite the enthusiasm with which the industry greeted the move, it is unlikely that a bill under the Ten Minute Rule would lead directly to legisla-



## TOUCH AND GO

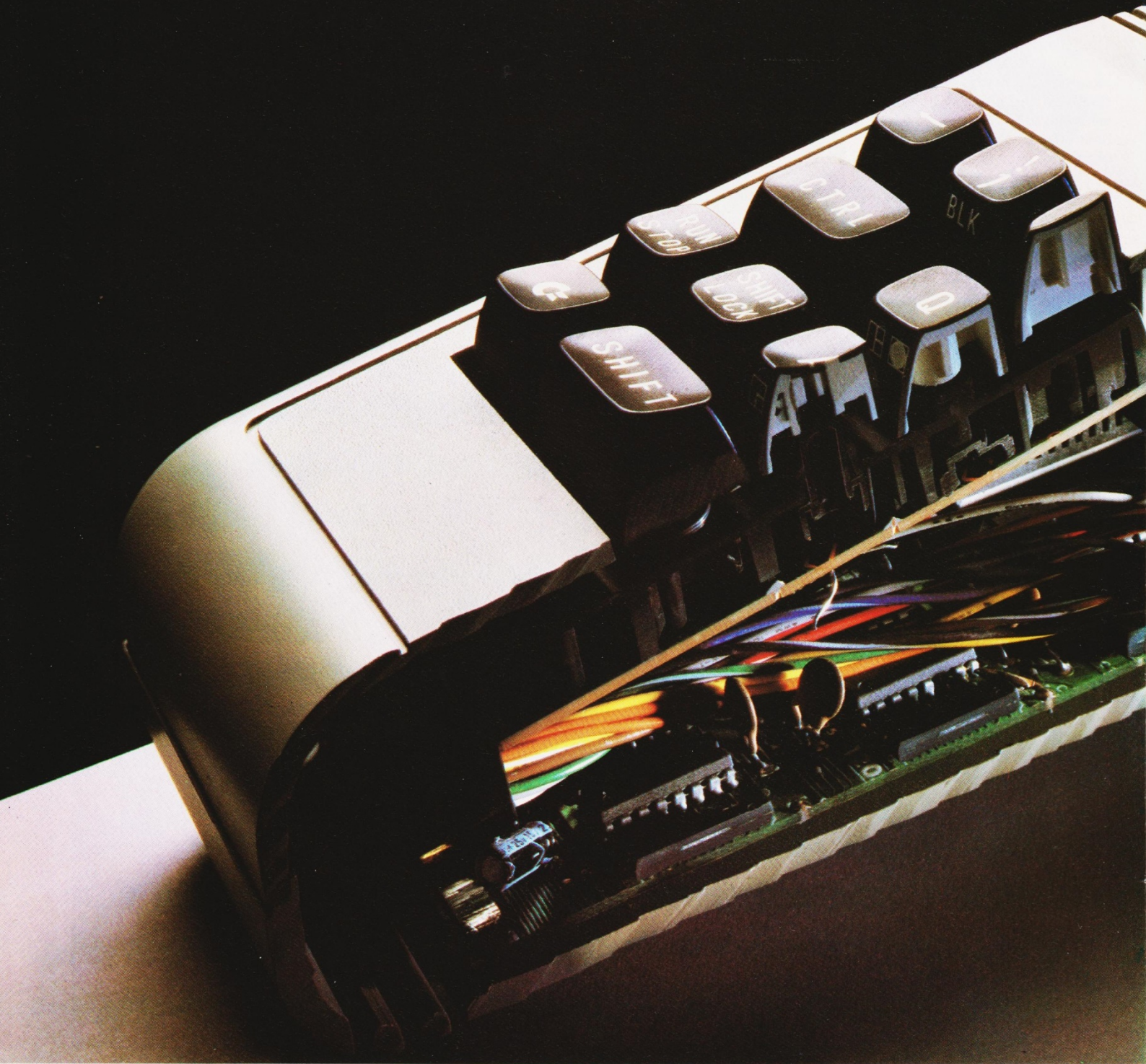
For those who haven't seen the adverts, there is available a computer that you can operate just by touching the screen. The machine is the HP150 from Hewlett-Packard — an 8088-based machine with 256K RAM, dual micro disk drives and a bit-mapped display monitor. Optional peripherals include a printer, hard disk sys-

tem and plotters. Not an ordinary machine, the HP150 ranges in price upwards from £2395; 3½" disk drives and Winchester systems are, of course, extra.

If you like the idea, but balk at the price, have you ever considered hiring a computer? Such a facility is available from MicroLease plc of Forbes House, Whitefriars Estate, Tudor Road, Harrow, Middx HA3 5SS (phone: 01427 8822).

The HP150 can be hired from MicroLease for periods of a week upwards, from £65. There is also a wide range of other electronic equipment available for hire.





# Are you only using

To only play games on a Commodore computer is like asking Albert Einstein to work out the square root of four.

The computer's brain barely ticks over.

To really stretch it, you need more interesting software programs. For example, record keeping, interactive education, stimulating adventure games or word processing.

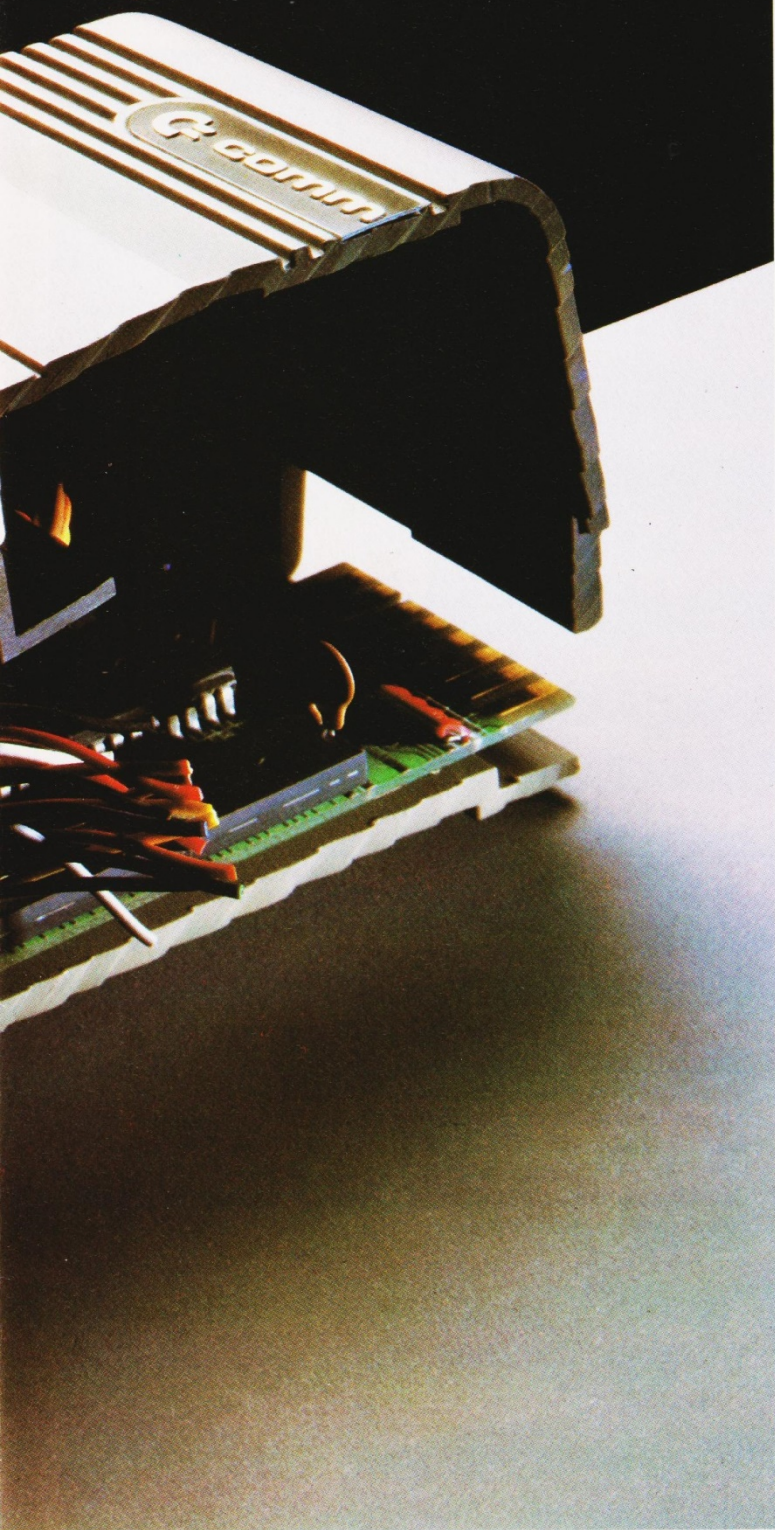
And for those you need peripherals.

Like a Commodore disk drive, a really fast storage and retrieval system with a vast memory.

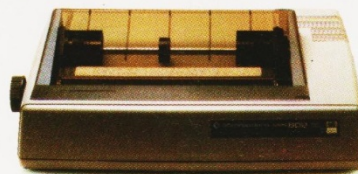
Or a Commodore cassette unit, the inexpensive way of loading and storing programs.

For those who like the idea of text and graphics being more alive and having greater clarity than on a TV, there's the Commodore colour monitor.

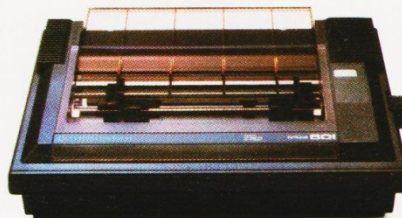




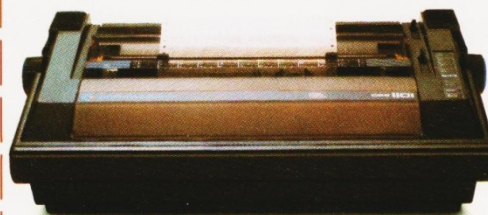
COMMODORE MPS801 ☐  
Dot matrix printer. £230.00.  
Tractor feed. Print speed:  
50 characters per second.



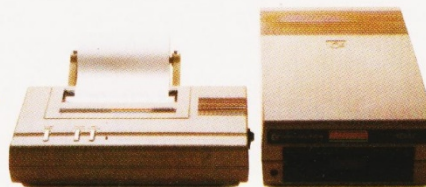
COMMODORE MPS802 ☐  
Dot matrix printer. £345.00.  
Friction feed for standard  
paper. Print speed:  
60 characters per second.



COMMODORE MCS801 ☐  
Dot matrix colour printer.  
£399.99. 7 colours including  
black. Print speed:  
38 characters per second.



COMMODORE DPS1101 ☐  
Daisy wheel printer. £399.99.  
Letter quality print on  
standard paper. Print speed:  
18 characters per second.



COMMODORE 1520 ☐  
Printer plotter. £169.99. For  
charts and graphs. Print speed:  
14 characters per second.

COMMODORE 1541 ☐  
Disk drive. £229.00.  
170K memory. 5 1/4" diskette.



COMMODORE 1531 ☐  
Cassette unit. For Commodore  
16 and Commodore plus/4.

COMMODORE 1530 ☐  
For Commodore 64.  
£44.95 each.



COMMODORE 1701 ☐  
Colour monitor. £230.00.

JOYSTICKS ☐  
(prices from £7.50)

PADDLES (£13.50). ☐

Details correct at time of going to press.

# 1/10th of your brain?

And for hard copy, there are our four printers and a printer plotter. These will preserve on paper—in colour, black and white, chart form, graphs or text, the fruits of all your labour.

Finally, for more exciting games, there are joysticks and paddles.

So use your brain. And make sure you use all of your computer's brain.

FOR FURTHER INFORMATION, TICK ONE (OR MORE) OF THE BOXES ABOVE AND SEND TO THE COMMODORE INFORMATION CENTRE, 1 HUNTERS ROAD, WELDON, CORBY, NORTHAMPTON NN17 1QX. TEL: CORBY (0536) 205252.

NAME \_\_\_\_\_

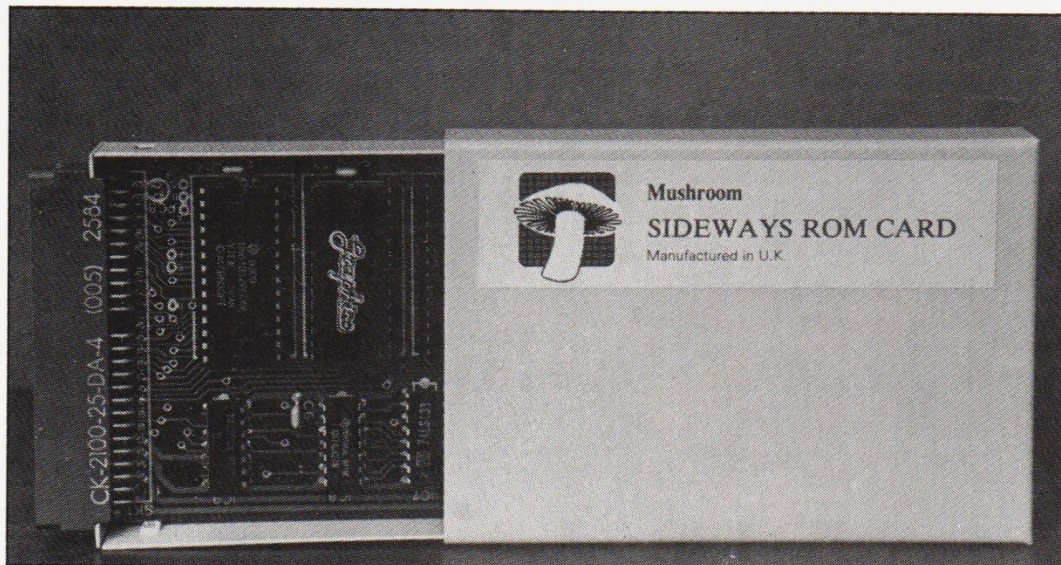
ADDRESS \_\_\_\_\_

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**commodore**





## ELECTRON EXTRAS

One of the major criticisms levelled at the Electron has always been its limited memory, and this has prevented the machine from being taken seriously as anything other than a beginner's machine. Accordingly, add-ons are gradually appearing for the Electron giving it greater potential for more serious applications. With the new Sideways ROM Card from Broadway Electronics, you can

turn your Electron into a low-cost business machine. Priced at £29.95, the card plugs into the extension port enabling software to be called up instantly. With a four-ROM capacity, the card allows you to tackle word processing, graphic design, spreadsheets and accounts programs. Broadway Electronics are at Aston Road, Bedford, Beds MK42 0LJ (phone: 0234 58303).

On the subject of Electron add-ons, Forth masters, Skywave Software, have released Multi-Forth 83 which they claim

to be the only Forth for the Electron which can multi-task (unless of course, you know better...).

A multi-task facility means that the user can execute a number of Forth programs at the same time and transparently of each other. Each task is placed in a queue — the maximum number of tasks is 28 but this is only limited by memory requirements. The system as supplied is set up with 1K (four pages) available for tasks, but this can be expanded. Each task has its own 32-bit clock, so tasks can

be scheduled to execute at a set time interval for real-time, robotics and control applications.

Multi-Forth 83 is compatible with the MOS, so you can type \* commands, eg \*HELP, while in Forth and use all the other MOS commands. You can also program the function keys using \*KEY as in BASIC. These keys can be set up with Forth words, ie VLIST, and any other sequence of characters. The \* command also allows you to switch easily between Forth and BASIC and the word MODE enables you to operate in all screen modes, including Mode 0.

The complete Multi-Forth package contains all the necessary documentation, plus a standard 6502 assembler and a screen editor which uses the Electron cursor keys to allow full screen editing of the Forth source blocks. Other facilities include a stack display utility so that the stack contents can be monitored for learning and debugging purposes.

Multi-Forth 83 costs £45 plus carriage and VAT and is available from Skywave Software at 73 Curzon Road, Boscombe, Bournemouth BH1 4PW (phone: 0202 302385).

## A FAST MOVER

Being marketed as the "first fully mobile 16 bit computer for the man on the move", Gavilan is now available from the aptly-named Ferrari Software company. Battery powered, the computer is designed to fit into a briefcase measuring 11.4 by 11.4 by 2.7 inches and the two units together weigh 14 pounds — one stone. Within this framework you get a full size keyboard with a 10 key numeric pad, a fold-down display screen and 3.5 inch floppy disk drive storing 360K.

Also standard is 96K of CMOS static RAM, expandable to over 256K. As the Gavilan is battery powered, the static RAM will maintain its memory, wherever you are in the program, when the computer is turned off and be able to continue when required. The RS-232 port allows direct data transfer at 9600 baud and there is also a full size video screen output and touch sensitive pad for cursor and menu control.

As with most business machines these days, a set of suitable software packages is also included in the price of

£2295: in this case from Peachtree, and including Peach Text, Peach Calc, Spelling Proof Reader, Mailing List Manager, Business Graphics

System and Telecommunications. The MS-DOS allows for IBM PC data compatibility, which gives access to many other existing software packages.

For more information, contact Ferrari Software at Ferrari House, Station Road, Egham, Surrey TW20 9LB (phone: 0784 38811).







## NOT A FREE GIFT

You might be mistaken in thinking that Sinclair's latest announcement of producing over 200,000 Spectrums a month is because Kellogg's are giving them away in cornflakes packets. Not so — 'Year 2000', the Kellogg Company's first major back-of-pack computer promotion will appear shortly on Kellogg's Corn Flakes featuring the 48K machine. Designed to appeal equally to would-be purchasers, Spectrum owners and those without computer knowledge, the promotion runs for a three month period and will be carried on some 30

million packs, reaching an estimated eight million UK households.

As a central feature, 100 ZX Spectrums — each with a maximum retail selling price of £129.95 — are offered as prizes in a competition, to predict the status of a number of athletics world-records in the year 2000. Entrants can base their estimates on the 1936, 1952, 1968 and current 1984 figures.

Existing owners can obtain a special £5 discount on any three programs bought directly from Sinclair's software catalogue, which includes a wide range of games, business and

education programs. Those still to decide about the purchase of a home computer can obtain more information from a specially written free introductory book, prepared for Sinclair and Kellogg by Pan. Entitled 'What You Always Wanted To Know About Home Computers But Never Dared Ask', it is written in a deliberately simple style and avoids the perils of jargon. The book can be obtained for three pack-top tokens.

But remember — a Spectrum will provide almost none of the average adult's vitamin requirements.

## TA ON THE ATTACK

If you're looking for a high quality printer at a competitive price, you might well consider the new TRD 7020 from Triumph Adler. Priced at £375 the 7020 is available in three versions, with RS232, Centronics or dual interfaces. TA say it is suitable for use with home computers in the over-£200 price bracket, but is really aimed at any system where the main application is word processing. With this in mind, there are over 150 interchangeable print wheels available giving a choice of type styles that can be printed 10, 12 or 15 characters per inch or with proportional spacing. The 7020 is also Wordstar and IBM compatible and suitable for graphics applications. TA are hoping that this printer, broadly compatible and competitively priced, will loosen the stranglehold that the Japanese have on the less expensive daisywheel printer market.

For further details, contact Triumph Adler at 27 Goswell Road, London EC1M 7AJ (phone: 01-250 1717).

## AT LAST THE ENTERPRISE?

Prism Micro Products Ltd has been appointed exclusive UK trade distributor for the elusive Enterprise home computer. Developed by Intelligent Software Ltd., the Elan/Flan/Enterprise is a sophisticated British home micro offering, as standard, a wide range of advanced features; almost as advanced as its announcement over a year ago.

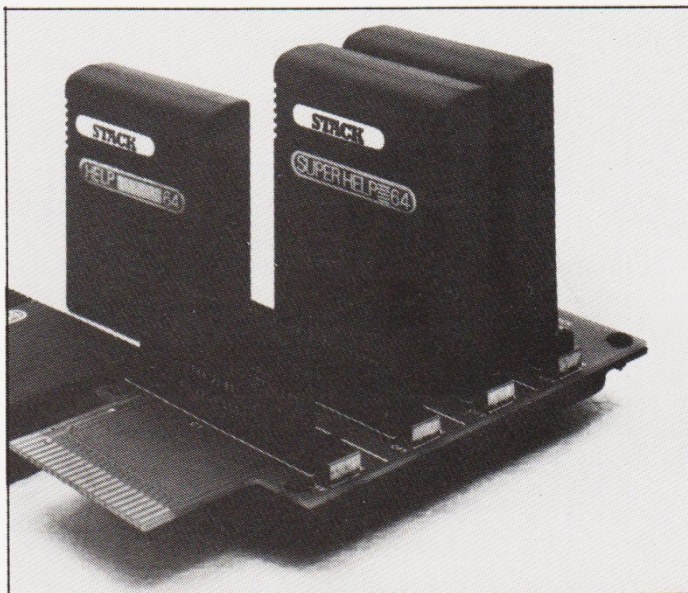
Prism will distribute the Enterprise to a well established nationwide network of retailers and dealers, while a small number of named accounts — including major multiples — will be supplied direct by Enterprise Computers.

Initial delivery for the Enterprise will begin in September, backed by a full programme of TV and national press advertising. Bob Denton, Chairman of Prism Micro Products, believes the Enterprise will make an excellent addition to the range of micros currently distributed by the company. He comments: "To date 20% of all home computer sales in the UK have been supplied by Prism. We see the Enterprise as an ideal product to help us increase our market share."

## LOCK, STACK AND BARREL

Good news for CBM64 owners in need of a little programming aid: Stack Computer Services have introduced a new low-price cassette-based compiler for the Stack 100 range. At £14.95, the compiler is £10 cheaper than the next in the range of programming tools, all of which have been reduced in price. The cartridges available include BASIC extensions, fast tape systems and a two pass assembler and range in price from £25 upwards.

Stack can be contacted at 290-298 Derby Road, Bootle, Liverpool L20 8LN (phone: 051-933 5511).





## TESTING TIMES

Trend Communications, the data communications division of Phicom plc, has launched the Trend V24/RS232 Cable Tester, a battery powered solid state scanner designed to test communications cables. Equipped with dual gender connectors (isn't modern medicine wonderful), this pocket-sized tester is capable of testing any configuration of cables. In addition to testing new cables, it will verify suspect cables, special connections and installed cables. It will also test special cables with the use of adaptors.

The new tester's 9 V battery provides a minimum of 70 hours of operation. The tester drives each cable connector pin in sequence with 7 V and senses all other pins in each cable connector. Fifty LEDs graphically indicate the scanning procedure and the connections to each pin in turn. This process allows detection of short circuits and jumper links at either end of the cable. Scanning may take place automatically at one step per second or manually.

Three additional LED indicators logically monitor the scanning process as follows:



Short — two or more connections at either connector end of the cable; Continuity — one connection at each connector; and Open — no connection between the selected pin and any other pin on either end.

Using the remote unit, installed cables and extended

length data cables may also be successfully tested. This is accomplished by connecting the remote unit to one end, while the cable tester scans connections at the other. The remote unit gives the same comprehensive testing as with the local mode.

The new tester is available for £165 (excluding VAT) and is accompanied by a comprehensive manual. Trend Communications Limited is at Knaves Beech Estate, Loudwater, High Wycombe, Bucks, HP10 9QZ (phone: 06285 24977; telex 849408).

## LCD LEAD

Epson has launched the world's first 25 line liquid crystal display making it the largest commercially available. With 640 by 200 dots, up to 25 lines of 100 characters each can be displayed, giving it a larger capacity than the average desk-top computer. The 128,000 fully dot-addressable pixels have a dot size of 0.35mm square which gives the panel a very high resolution — good for both text and graphics.

Despite its large capacity, the dimensions of the LCD are only 280 by 166 by 15mm. Epson plans to offer the unit with colour electroluminescent backlighting which will enable use in poor light.

Full production numbers of the display are expected to be available by the winter, with samples ready by autumn. For further details, contact Epson at Dorland House, 388 High Road, Wembley, Middx HA9 6UH (phone: 01-902 8892).

## MICROHOFT ANNOUNCE LISP

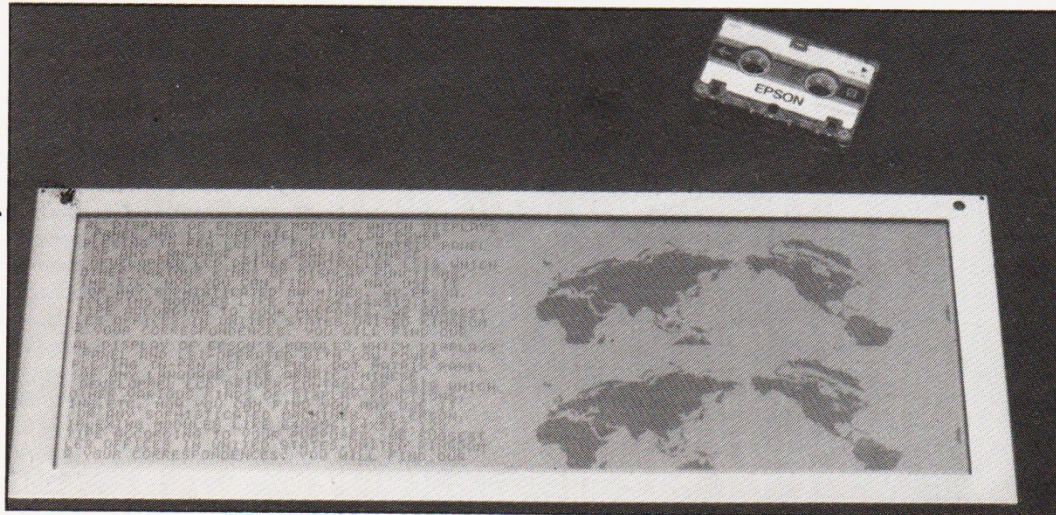
Microsoft Ltd has released the LISP programming language for MS-DOS based microcomputers. The package, called the muLISP-82 Artificial Intelligence Development System, has been designed to be capable of supporting a wide range of serious AI research efforts and is especially tailored to the 8088/8086 microprocessor.

muLISP-82 will run on the IBM PC and other MS-DOS machines, requiring only a minimum of 48K of RAM and one floppy disk drive.

The muLISP Artificial Intelligence Development System consists of a pseudo-code compiler and interpreter, the muSTAR development system, and a resident LISP editor. Useful muLISP utilities and a function trace package for program debugging are also included. As well as two educational games, the package also includes an implementation of the original ELIZA or Doctor program written by Joseph Weizenbaum of MIT.

The relatively small size of muLISP-82 leaves the remainder of the computer's memory available for user data structures. A minimum system will run in as little as 32K of RAM. muLISP-82 utilises a pseudo code compiler, giving a three-fold increase in code density and a 20% improvement in execution speed over previous versions.

Microsoft are at Piper House, Hatch Lane, Windsor, Berks (phone: 07535 59951).





## ONE IN THE EYE

For those of you who keep all your CTs in pristine condition, a glance back to the June 84 issue will remind you that the cover story was a review of the MicroSight System from Digithurst. Well, the company have now released MicroSight-Autocad Link. Without too much brain-searching, you can deduce that this will enable images captured by the MicroSight Imaging System to be transferred to the Autocad CAD system. An object, which can be two or three-dimensional, is placed in front of the camera and digitised. The edges of the object are derived and these boundaries are translated into vectors which are then in the same format as an Autocad exchange file.

The MicroSight Autocad Link, priced at £950, is being released in the UK and Scandinavia. For any further information, contact Digithurst Ltd on 0223 208926.



## DISCS DOWN ON RML

Disc drive prices for Research Machine's 480Z micro have been cut by 20 per cent. The drives now start at £492 — typical education price £399. The drives, originally announced last August, have proved highly popular with schools, over 2,000 having been sold

already for use in primary and secondary schools and further education colleges. They have turned the 480Z into an extremely powerful all-purpose micro, handling single and double density discs automatically.

Full price drops from £616 to £492 for a single drive unit (328K formatted) and from

£924 to £799 for a 656K dual drive unit. The new prices equate to £399 and £648 typical education prices (schools can expect to get a 10 per cent educational discount plus a typical LEA quantity discount of a further 10 per cent). For primary schools which purchased a 480Z under the DTI Micros in Primary Schools

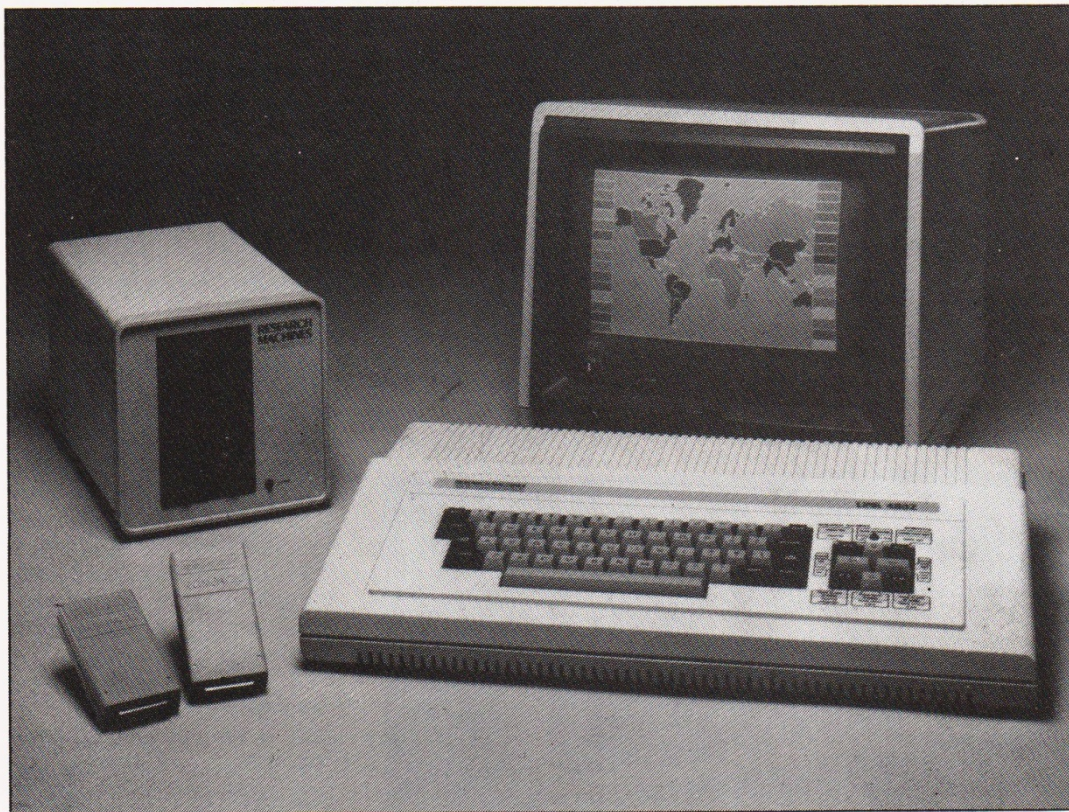
scheme, even greater reductions are available.

The units contain an intelligent disc controller, with its own processor to take care of the different operational modes, plus power supply. The disc drives are supported by the standard CP/M 2.2 operating system to give complete compatibility with software written for RML 380Z systems, so a wealth of existing disc-based software can be run on them.

Research Machines' new Shared Disc — which allows a number of 480Z computers to share the same disc drive — is expected to sell even faster following the news of the price cut. One unit plus the necessary connectors is all you need to give a group of 480Z users a very useful networking capability. The limit to the number of users is set only by the capacity of the drive.

The new system is more powerful than some networks for other micros which often cost more. If the power of a real network is eventually going to be needed, the Shared Disc offers an economic intermediate stage on the upgrade path to a full RML Chain Network.

For full details of LINK 480Z, 380Z and CHAIN network contact Research Machines Limited, Mill Street, Oxford OX2 0BW (phone: 0865 249866).





## MAGNUM FROM DOWN UNDER

What is it? A bottle holding two quarts of Fosters, an automated boomerang lethal at close range or a Hawaiian-shirted private investigator called Bruce? The answer is none of these, but yet another new portable business computer, this time from Dulmont Systems, Australia, launched recently at Australia House.

About the size of a standard telephone directory and weighing approximately 4 kg, the Magnum is designed to fit easily into a briefcase. The keyboard is standard QWERTY layout with 13 programmable function keys and the screen, with an eight by 80 character LCD, folds down neatly onto the keyboard when not in use.

The Magnum is based on the

Intel 80186 processor and has up to 256K of CMOS RAM with 128K ROM containing the operating system and applications. As many as 100 pages of text can be stored in its internal memory which is then retained, even when the machine is turned off. Applications include a built-in alarm calendar/planner/diary and address book as well as word processing, spreadsheet and communication packages. Again, the operating system used is the standard MS-DOS, so any compatible program can be executed on the Magnum.

We hope to be able to publish a full review of the Magnum within the pages of CT shortly, but meanwhile, if you would like any further information, contact the Australian Trade Commission on 01-438



## SORD UNSHEATHED

After two years existence under the name of Socius, Sord has announced that the company is finally registered in England under the name of Sord Computers Ltd. To establish the fact, Sord have introduced their new IS-11 executive micro at a price of £896 (plus VAT).

Included in the price is the main unit (roughly A4 size) with LCD and full keyboard, built-in 32K word processor ROM cartridge and tape recorder, three manuals, and a rather more unusual feature, a half day training course in London. What is more standard is the integrated software (the IS in the name); word processing, calculation and notebook programs and PIPS (Pan Information Processing Software, developed by Sord) database software for spreadsheet, record handling and so on. Sord developed PIPS to be easy to learn and to enable inexperienced users to pick up speed quite quickly as well as develop their own applications.

The IS-11 measures 300 by 49 by 215 mm and weighs 2kg (4.4 lb). It has 32K of memory, expandable to 64K, and an eight window facility on the eight line by 40 character LCD. You can obtain a bar code reader with this computer for warehousing and retailing applications and there are full communications facilities for transmitting and receiving information from remote loca-

tions. Other optional peripherals include a portable printer and a 3" micro-floppy disk drive.

For further details, Sord can be contacted at Kirkman House, 12-14 Whitfield Street, London W1P 5RD (phone: 01-631 0787).

## SPECTRUM CONNECTIONS

The latest releases from DK'Tronics are two interfaces for the Spectrum — a Parallel Centronics Interface at £39.95 and a Dual Port Joystick Interface at £13. Both fit onto the back of a standard Spectrum or the DK'Tronics Microdrive compatible keyboard.

The Centronics interface will run on any parallel Centronics

type printer and comes complete with full instructions and fully relocatable controlling software. All control codes are allowed through to the printer and it interfaces with any software using the printer channel, such as Taswood, DEV Pack and so on.

On the joystick interface, the first port simulates the 6, 7, 8, 9 and 0 keys and the second the IN (31) command, and will accept any Atari style joystick.

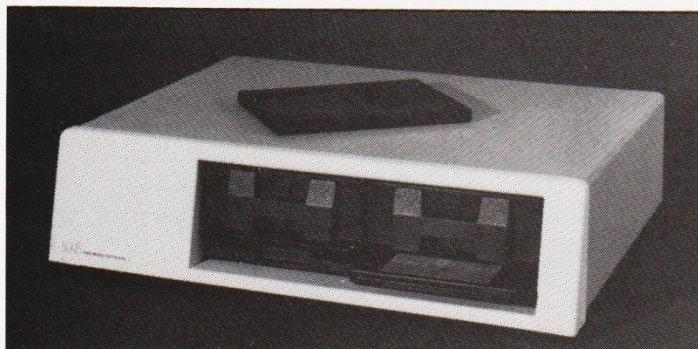
As with other DK'Tronics products, both interfaces are available from high street stores or for further information call DK'Tronics on 0799 26350.

## IT'S ALL GREEK TO ME

Apstor Ltd (previously APS Microsystems Ltd) producers of the Alpha 10 removable cartridge systems, have introduced a little sister model, the Beta 5. Despite being popular with big

businesses, many smaller companies find the 20 Mb of the Alpha 10 just too much for their needs. Beta 5 has only 10Mb, is more compact for desk top use, and is hoped to fit the bill for smaller concerns.

Both systems give the un-



## ZEN AND THE ART OF...

Maybe micro maintenance. Kuma have released Zen, a complete Z80 assembler, editor, debugger and disassembler to enable high quality machine code programs to be written on the MSX micros (once they eventually arrive in the shops, that is). It's hoped that the early release of Zen will help ensure that there will be a wide range of software available for the MSX machines when they are released later this year. Kuma, at least, intend to support them with a range of software and peripherals.

limited storage capacity of a cartridge-based hard disc add-on together with the ease-of-use and removability of a floppy disc and provide an answer for computer users who want a large amount of storage with security back-up. The units are sturdy, free from the danger of head crashes (thanks to Bernoulli and his fluid theorem about air flow) and resistant to dust. The Alpha 10 and Beta 5 are available in compact stacked or side-by-side form depending on your needs.

For further information, contact Apstor Ltd at Unit 5, Victoria Road Trading Estate, Portslade, Brighton, Sussex BN4 1XQ (phone: 0273 422512).



# Hey Prestel. A new dimension for the BBC Micro.

Add the new Prestel Adaptor to a BBC Micro and you can download all programs available on the Prestel service.

Which considering Prestel is fast becoming a major software source, is a very attractive proposition indeed.

You can, for example, connect it to the growing Micronet 800 database. This

also enables you to access Prestel information on any TV or monitor. And store the data so that it can be displayed or manipulated how and when you require it.

What's more, the Prestel Adaptor turns your BBC Micro into a terminal that can link with other dial-up computers with 1200/75 baud interface.

So you can, for example, have access to the British Telecom Gold electronic mail and telex service.

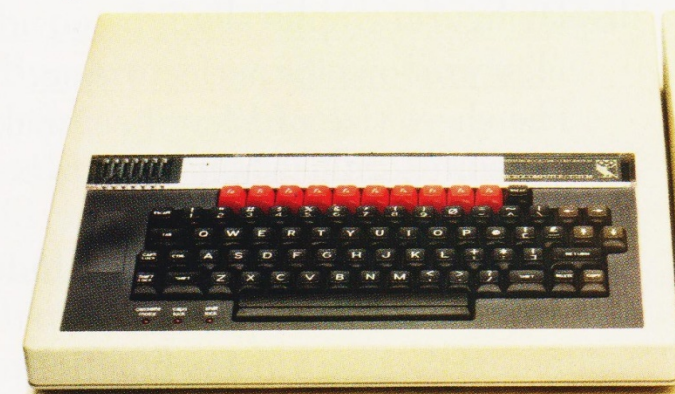
In fact, the enormous potential of our Prestel Adaptor, coupled with a surprisingly modest

price of £99 + VAT, make it a most exciting not to mention economical way to get more from your Micro.

The BBC Prestel Adaptor is currently only available via mail order.

You can order it on your credit card by ringing 01-200 0200 at any time, or 0933-79300 during office hours.

Alternatively, send off the coupon below.



gives you an extensive choice of educational and business programs. Other 'closed areas' for private company communications are also available.

And that's in addition to games that range from simple to sophisticated. Plus electronic shopping and banking facilities, and an extremely useful personal 'mailbox' service.

But that's only the beginning. The Adaptor



## Technical Specifications

For use with any BBC Micro 'B' with 1.2 MOS or later issue.

Prestel Language ROM supplied.

Dealer will install ROM together with MOS update if required in the BBC Micro.

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

A BT socket outlet of the latest type will be required. Connection via RS423 serial port.

Height 70mm. Width 210mm. Depth 350mm.

Colour: BBC Computer Cream.

Power in 240v, 50HZ, 15w.

Operating Temperature 10°-35°C.

To: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.  
Please send me \_\_\_\_\_ BBC Prestel Adaptor at £113.85 each, inc. VAT and delivery. I enclose PO/cheque payable to Readers A/C. Acorn Computers Ltd, or charge my credit card.

Card Number \_\_\_\_\_

Amex/Diners/Visa/Access (Delete)

Name \_\_\_\_\_

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Postcode \_\_\_\_\_

Signature \_\_\_\_\_

CT10

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## The BBC Microcomputer System.

Designed, produced and distributed by Acorn Computers Limited.



# Rebalance this sh

The BBC Micro can now give an astonishing new account of itself.

Because with Acornsoft's new 16K ViewSheet ROM, it develops a head for figures which can save you a vast amount of arduous brainwork.

Imagine, for instance, that you had to make several adjustments to a balance sheet.

If you made those adjustments on ViewSheet, it would revise the balance automatically in a split second.

Or imagine that you had to add 15% VAT to every figure on a price list containing 500 items.

ViewSheet can add the tax to each and every one of those items simultaneously. And once again, in virtually a second.

As simple as pencil and paper.

ViewSheet is a computer-based spreadsheet, the figure processing version of a word processor.

With 255 columns in width and 255 rows in depth, it's also one of the largest spreadsheets on the market.

Originating the sheet is as easy as originating an ordinary worksheet with pencil and paper.

Because ViewSheet comes with an easy-to-follow reference card.

It enables even the most inexperienced users to feed all the data they need to use, and store on disc or cassette, into the BBC Micro.

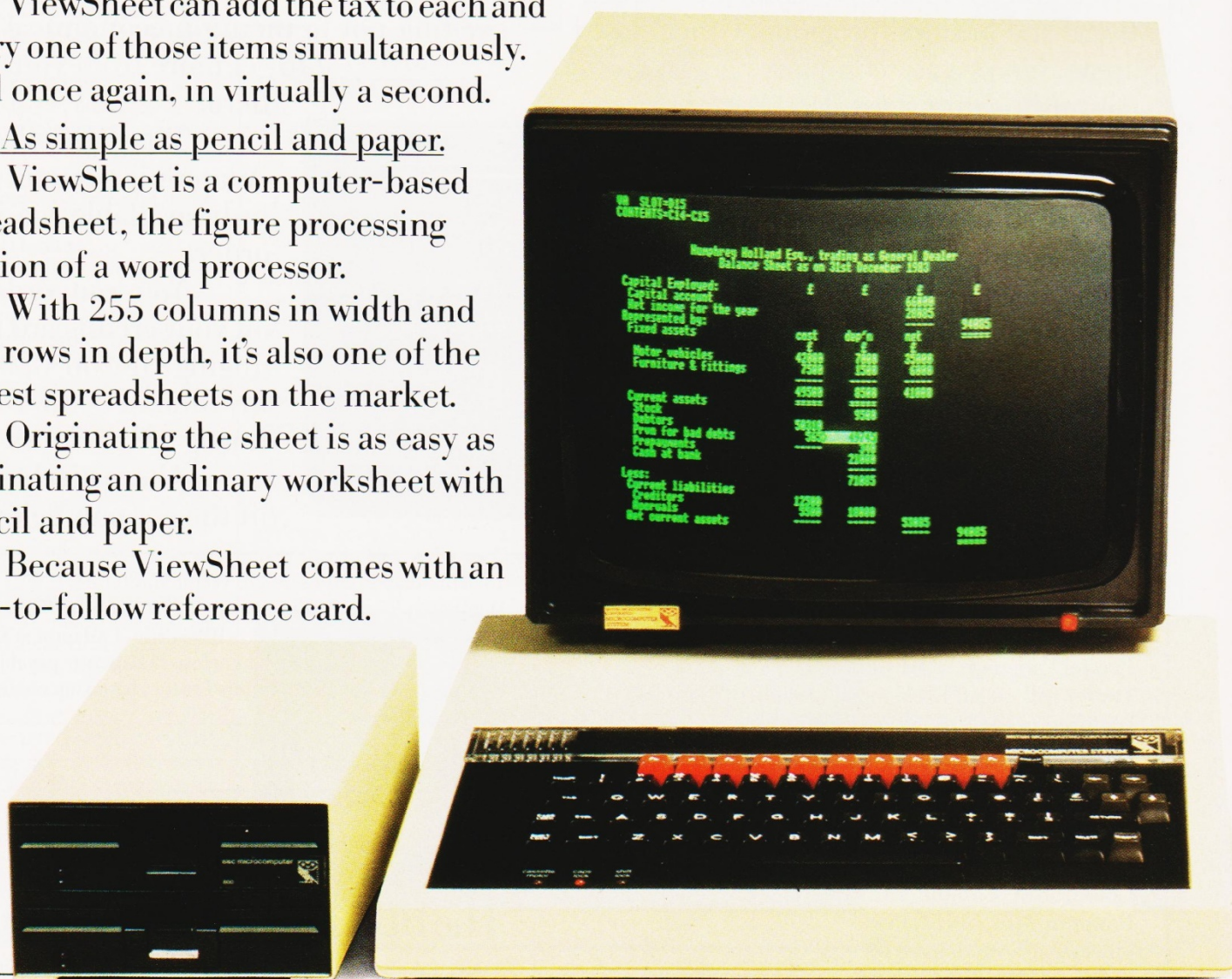
You can nominate headings and sub-headings. And you can create barcharts to display figures graphically.

Ten windows for perfect vision.

The sheer size of ViewSheet makes it impossible for the whole sheet to be visible on the monitor at once.

That's why ViewSheet has ten windows, enabling you to see up to ten different sections of the sheet at any one time.

You can summon the windows onto





# eet in one second.

the screen at the press of a key.

You can cross-reference sections, or even reposition them on the sheet, whenever you need to.

And you can print them out individually, as well as all together.

The possibilities are virtually endless.

By creating special disc files from ViewSheet, you can link two or more spreadsheets together. This means you can build models much bigger than the BBC Micro's considerable memory.

ViewSheet is also compatible with Acornsoft's View word-processing package. This enables you to produce reports and documents which combine text and figures.

In addition, you can use ViewSheet in any screen mode,

making the most of the BBC Micro's potential. And if you use it with the 6502 second processor, you'll have no less than 30K of workspace in any mode.

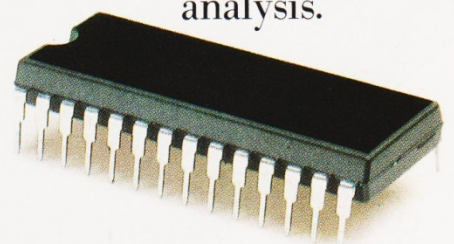
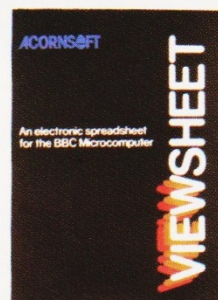
For only £59.80,

you too can have figures like this.

The ViewSheet ROM can be fitted by your BBC Micro dealer in less than three minutes. And with its straightforward user guide, function

key card and reference card, it'll soon have you juggling figures at lightning speed.

Indeed, at only £59.80, it's an invaluable asset for anyone involved in professional or personal finance, forecasts, formulae and analysis.



ViewSheet's operations and functions in brief.

The operations supported by ViewSheet are: addition, subtraction, multiplication, division, exponentiation and bracketed operations.

And the functions supported are: ABS, ACS, ASN, SIN, SGN, RAD, ATN, COS, DEG, EXP, INT, LN, LOG, PL, SQR, TAN, MIN, AVERAGE, MAX, CHOOSE, LOOKUP, COL, IE READ, ROW and WRITE.

## ACORNsoft

c/o Vector Marketing, Denington Estate, Wellingborough,  
Northants NN8 2RL. Tel: 0933 79300.

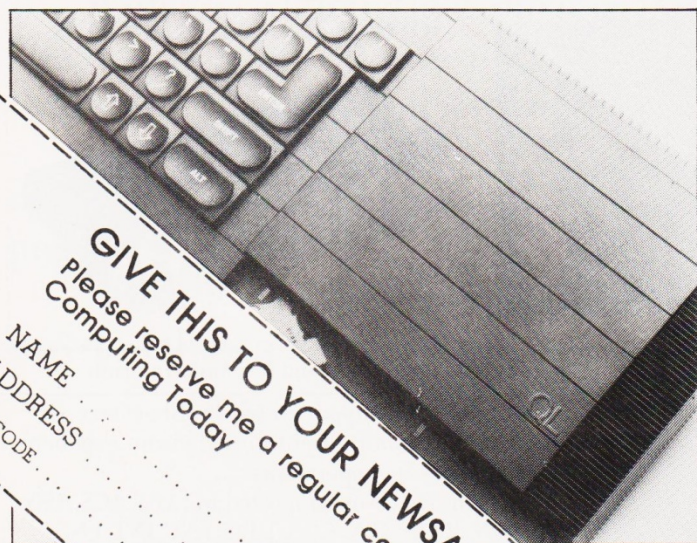




# NEXT MONTH

# Computing today

NOVEMBER  
ISSUE ON SALE  
12th OCTOBER



## BUSINESS MATTERS

In November, *Computing Today* will mean business! A special 16-page supplement will list some of the newest (and not so new) business machines, comparing their strengths and weaknesses, prices and performance. This is not just a buyer's guide — each section will have an informed opinion about the computer in question. If you're interested in the small business market (or, God forbid, you want to see whether the computer you've just bought was the right one for the job!), don't miss the November issue of *Computing Today*.

## PORTABLE POWER

As well as the supplement on business micros, next month's issue will contain full-length reviews of some of the machines mentioned. Two of these will be on so-called portables — the Epson PX-8, which really is a go-anywhere computer, and the Apple IIc, which needs a nearby mains supply to work. Lap-portable or desktop; LCD or monitor; battery or mains; micro-cassettes or disks? Make your mind up in next month's CT.

## AT LAST THE QL

Well, it was rumoured to exist and now we've finally seen one — an undongled QL! Admittedly Sinclair only let us keep it for a week, but our reviewer has made a brave attempt to penetrate the machine's mysteries ready for the November issue. You've read the speculations elsewhere — now read the facts in *Computing Today*.

## A BIG MACREVIEW

On the other hand, Apple couldn't spare us a Macintosh for as little as a week, so we went to our friendly neighbourhood computer shop who lent us one for a month. As the editor can testify, it is a terribly addictive toy to start playing with, particularly with the graphics package MacPaint loaded, and just about everyone who wanders through the office wants a go! However, it isn't a toy (not at that price!) and our review next month will look at the machine's suitability for the businessman.

**PLUS ALL THE USUAL FEATURES,  
INCLUDING LISTINGS TO TYPE IN FOR  
THE MEMOTECH AND SPECTRUM.**

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

**GIVE THIS TO YOUR NEWSAGENT**  
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*Computing Today*

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# THE AMSTRAD STORMS IN

Owen and Audrey Bishop

**Amstrad, long-standing British hi-fi manufacturer, has turned its talents to the computer field. Their music-centre, all-in-one approach gives a good machine at a great price.**

**W**e bought our first Amstrad in 1974. This was the Integra-4000 audio amplifier, of course, not their latest product, the CPC-464 micro. We considered the Integra-4000 good value for money and it has served and continues to serve us well. So it was with some interest that we investigated Amstrad's first endeavour into the field of home computing.

The Amstrad is an attractive machine, supplied in two units, the keyboard console and the video monitor. Although it is possible to connect an ordinary TV set to the micro by using a special Modulator/Power Supply unit, the machine is only sold complete with monitor. The Modulator/Power Supply costs an extra £29.95. Two types of monitor are available, the GT64

Green Colour Monitor, and the CTM640 Colour Monitor: the machine we reviewed came supplied with the colour monitor. Considering that the micro with the RGB colour monitor costs only about £100 more than when supplied with the monochrome monitor, we believe that most users will opt for the colour version.

The predominantly dark grey colour of the plastic cases of the monitor and keyboard give the computer a workmanlike appearance and appear to be suitably robust in design and construction. The monitor screen is tilted slightly back, making it comfortable to view without the need to mount it on a plinth. The monitor case has a carrying handle which folds flat into a recess on top when not needed, but as the system comprises only the





The keyboard is neat, well-laid out and has a splash of colour at either end to relieve the dark grey. The keys are nicely sprung, and touch typists will have no problems. The cursor and numeric keypads are a useful extra.

two units, the micro is readily transportable. There are lugs at the back of the case onto which the power lead can be wound when moving the monitor.

The tape-recorder is built into the keyboard console, making this unit rather wider (570 mm) than usual. Having the recorder permanently wired into the system hopefully serves to eliminate unreliable plug connections, a common cause of bad saving and loading on certain other machines. The recorder circuitry is matched to that of the computer, making adjustments of volume and tone controls unnecessary. Indeed, such controls are not provided but we didn't experience any difficulties in saving and loading.

The Amstrad is unusual in that the power supply for the system is housed in the monitor case. This is why, if the micro is used with an ordinary TV set, you need a combined Modulator/Power Supply unit. There is only one mains lead, which enters the rear of the monitor case. From the front of the case come two self-coiling cables which run side-by-side and plug into two sockets at the rear of the keyboard console. This gives an extremely neat and clutter-free appearance to the micro when it is set up. The cables are about 300 mm long unextended, but will stretch to just over 500 mm, allowing adequate scope for adjusting the distance between keyboard and screen.

## INPUT/OUTPUT

The keyboard console has four other connectors. One is the 'floppy disc' 50-way edge connector. This is not only a disc system port but provides access to the address, data and control busses. All the Z80 control lines are available here, as well as the system clock and there is also a line for light pen input. You should be able to interface all kinds of devices to this machine; the User Instructions include details of which I/O addresses are available. Next to the 'floppy disc' port is the parallel printer port, another edge connector which has the essential Centronics connections to the data bus, together with STROBE and BUSY lines. The paddle port takes a 9-pin D-connector. Amsoft joysticks will be available for this port, to operate singly or as a pair. These are switched joysticks, not the fully proportional type. We found that our Spectravideo joystick worked on this port, except for the fire button input. The BASIC has a JOY(n) function, which makes reading the joysticks very simple. Finally, there is a jack socket into which you can plug stereo headphones. Of the three sound channels, one is 'left', one is 'right' and one is 'centre' which makes possible some sophisticated sound effects in games programs.

## KEYBOARD

The Amstrad keyboard is in the usual QWERTY layout and the control keys are all where you would expect to find them. The keys are lightly sprung, have the usual amount of travel, and their tops are slightly recessed. As such they are suitable for fast touch-typing, and, for the two-fingered operator, the tops are clearly marked in white. The keyboard is less rattly than many — more like the Commodore 64 than the BBC micro or the Electron. The alphanumeric keys are dark grey and all but two of the control keys are green. The ENTER key is hard to miss. It is blue and is just over 30 cm square! There is a second, smaller ENTER key at the bottom right of the numeric key-pad, which is situated to the right of the main keyboard area.

To the top right of the keyboard is a cluster of five editing keys. The central key is Copy, with four direction keys positioned so as to point up, down, left and right. This configuration makes editing easy. These keys may also be used as control keys in games programs.

The ESCAPE key, at the top left, is the only red one on the keyboard. This key functions in an unusual way. Pressing it once halts a program, which can then be re-started by pressing any other key, but to assume a full escape action, you have to press the Escape key twice in succession. A welcome safety feature is that it is necessary to press three keys at once (Control, Shift and Escape) in order to completely reset the machine. As the BASIC has no 'OLD' command, this is an important safeguard.

The tape-recorder has its own row of six keys at the extreme lower right of the console. These perform the usual functions and are arranged in the order found on most, though not all, tape recorders. The Record key is red.

## UP AND RUNNING

The monitor has a push-on, push-off switch at the front of the which turns on the colour tube and the low voltage supply to the computer and there is also a switch at the right-hand end of the console to switch on the computer. A red LED on the console indicates that the computer is on. The monitor has no pilot lamp and the screen is completely dark except when the computer is on. This means that it is possible to leave the monitor switched on accidentally. Admittedly, you can check the small push-switch, but some more obvious indicator would have been preferred.

A few months ago we bought an RGB monitor of a well-known make, which cost more than the Amstrad micro, including its



monitor! We were therefore slightly apprehensive that the performance of the Amstrad monitor might be less than satisfactory. On switching on, our fears were immediately dispelled — the Amstrad colour monitor produces a crisp rock-steady image with excellent colour saturation.

Like the Spectrum, VIC 20 and Commodore 64, the Amstrad screen has a border area surrounding the displayable screen area: the colour of border and screen may be independently set, as explained later. Unlike the Spectrum, the border does not exhibit flashing colours and patterns while programs are being loaded or saved. Instead, you hear the sound of the signal through the built-in loudspeaker. This has a volume control, so you can turn the sound off, if you wish. This is a handy feature for those who wish to play arcade games in a room with others present!

## WELCOME TAPE

As is becoming the custom, the machine is supplied with a cassette to demonstrate its capabilities. In this case, it is a polished display, beginning with examples of graphics and colours and a short musical demonstration (although some of the lower notes sounded a little off-key even to our relatively non-musical ear). Then followed a few tantalising glimpses of business software. The first was a spread-sheet display in 80-column mode which showed that, provided you select a suitable pair of colours, you can easily read figures in this mode. The bar-chart with 3-D bars plotted in three shades of magenta demonstrated the possibilities that exist with the 27 colours that this machine has on its palette. The final business demo was of word-processing. Finally, on side one of the cassette, there followed a few samples of arcade games, with high-res graphics and musical (?) effects.

The program on this side of the tape ran as a continuous loop, giving us no chance to get our fingers on the keyboard, other than to press Escape twice to terminate it. The second side invited more interaction. There was a keyboard familiarisation program, a short program for designing graphics characters and a hangman-type spelling program. This had access to a subset of the words available in the full 'Wordhang' program. Like most of the tape, this was primarily a demonstration, to induce you to buy the software.

## PROGRAMMING

There is no doubt there will eventually be plenty of software available for this machine. With over 42 kilobytes of RAM available for program use, it provides scope for exciting games programs with high resolution graphics, and for elaborate

business utilities. How will it fare as a programmer's machine?

There are two aspects that the programmer needs to consider.

- How easy is it to type in programs and edit them??
- How good is the BASIC?

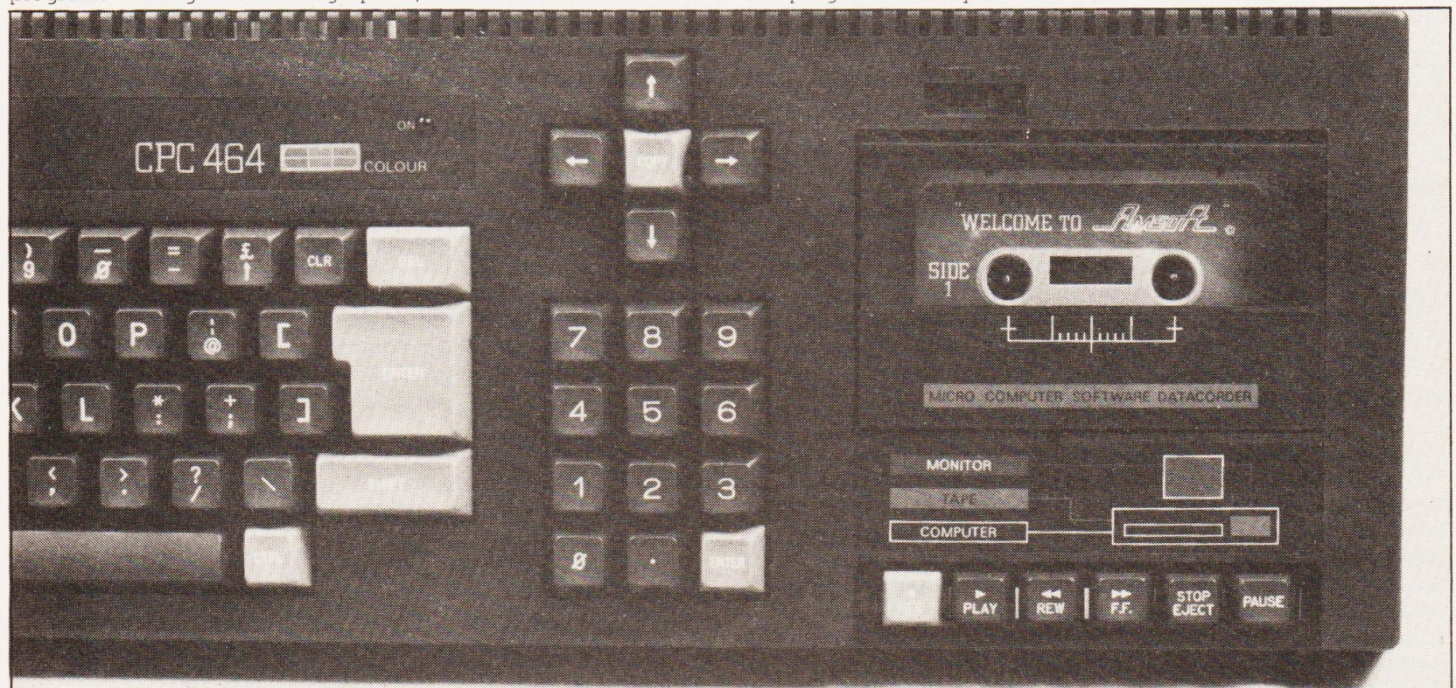
Typing in is made easy by the fact that the machine always works in lower-case mode, like an ordinary typewriter. To obtain capitals, you press Shift. There is a Shift Lock key for typing long passages in upper-case although BASIC keywords may be typed in lower case, as may variable names. When the program is listed, BASIC keywords are converted to upper case, but variable names and any text within double quotes are left exactly as typed. Variable names may have up to 40 characters and may be in upper or lower case, but the machine does not distinguish between cases when looking up variable names. BASIC keywords must have delimiters before and after them (a space or punctuation mark). This is confusing at first, if you are used to a machine which allows you to run keywords together with no spaces. However the corollary is that variable names may have keywords embedded in them, eg 'tableend' contains TAB and END but is acceptable as a variable name.

The Delete and Clr keys are used for amending lines as they are typed in. Typing EDIT followed by a line number causes that line to be displayed and puts the machine into edit mode. You can then use the editing keys to move the cursor, while you insert or delete characters. The edit mode is also called during run time when the computer detects an error. The computer displays an error message, displays the offending line and goes into editing mode, ready for you to correct the mistake. There are 30 different error messages: all fully explained in the User Instructions.

The Copy key can be used in conjunction with the editing keys, to copy program lines in whole or in part, as on the BBC Micro. This provides a fast way of entering a series of lines which have much the same format.

The keys of the numeric keypad are definable as function keys. The programmers can set up one or more of these to print frequently-used commands such as 'PRINT TAB(", or 'LIST 0-100', including carriage returns and so on, or short routines frequently needed while debugging a program, for example 'FOR J=2000 to 2100: PRINT PEEK (J);:NEXT

Three BASIC commands which simplify keying in are DEFINIT, DEFSTR and DEFREAL. These allow you to define all variable names beginning with a given letter to belong to one of the three variable types. It is then unnecessary to type the '\$' or '%' to indicate strings or integers. There is also a full renumber command with which you can renumber the whole or any part of the program with any line interval.



The built-in cassette deck SAVes at either 1000 or 2000 baud. Its keys match the style of the keyboard.



One feature that is missing is the use of abbreviations for keywords and commands. The only shortened form allowed is the '?' for 'PRINT'. A range of abbreviations would have been of great assistance to the programmer.

From the above it is clear that the Amstrad gets almost full marks for ease of programming. What about the BASIC? As far as speed is concerned, it is fast. We conducted the standard benchmark test as described in Microchoice (Winter 1983), with the results shown in Table 1. The results published in Microchoice covered ZX Spectrum, Dragon 32, Commodore 64, NewBrain, Osborne 1, Sirius I and the BBC Micro and we have since carried out the same tests on the Memotech MTX-500. In all the tests BM1 to BM7, the Amstrad is beaten only by the BBC micro. In BM8, the test for speed in evaluating functions (exponentiation, logarithms and sines) the Amstrad is comfortably the fastest of all. We checked the accuracy of some of these functions by asking it to calculate  $1.2345$ , for example, then making it perform the reverse operation on the result. In all cases we got back to the starting value without loss of accuracy.

## THE BASIC

AMSTRAD BASIC incorporates most of the features of other BASICs but also has some novel features of its own, one of the most unusual being the inclusion of two interrupt-generating keywords. AFTER causes the computer to jump to a prescribed subroutine after a given time period has elapsed. Whatever stage of the program has been reached at that time, the computer leaves it and goes to the subroutine, then returns to continue the main program. EVERY causes a jump to a subroutine at regular intervals. Programmers will enjoy themselves finding uses for these two commands.

Other functions and commands of interest include:

- **BINS(n,m)** produces a string containing the value of  $n$  as a binary number of  $m$  bits.
- **DEG** and **RAD** set the computer to degree or radian modes.
- **ERASE 'unDIMS'** an array when it is no longer needed, so releasing memory for other purposes.
- **HEX\$(n)** produces a string containing the value of  $n$  as a hexadecimal.
- **LOWER\$,UPPER\$** converts strings into all lower-case or all upper-case respectively.
- **MAX(a,b,c,d,e,...), MIN(a,b,c,d,e,...)** find maximum and minimum values in the list of arguments.
- **ON BREAK GOSUB** causes the computer to jump to the subroutine when the ESCAPE key is pressed twice.
- **PRINT USING** is a flexible command for specifying the format in which values are to be displayed. Owners of the old TRS-80 Model 1 will remember this and how useful it can be.
- **ROUND(n,m)** rounds a number  $n$  to  $m$  decimal places.
- **TEST(x,y)** reports the colour of a pixel at specified graphics location  $x,y$ .
- **TESTR(x,y)** as TEST, but relative to graphics cursor position.
- **WHILE, WEND** a loop beginning with WHILE, and ending with WEND is repeated while the condition specified in the WHILE statement is true. This type of conditional loop is preferable in many ways to its cousin, the REPEAT UNTIL loop. REPEAT UNTIL tests the condition at the end of the loop, so the loop is always executed *at least once*. WHILE WEND tests the condition at the *beginning* of the loop; if the condition is untrue initially, the loop is not executed at all.

Functions are provided, but only the single-line variety. Thus, function definitions are limited to fairly simple calculations and cannot return string values. There is no provision for LOCAL values of variables. Advocates of structured programming will deplore the absence of procedures from the BASIC. Another feature that is beginning to be standard in computers in this price range but which is absent from the Amstrad, is the ability to include sections of assembler or machine code in a BASIC program. A built-in assembler would have been a welcome provision too, though perhaps we are becoming greedy and wanting too much for our money!

FACTSHEET	
CPU	Z80
Clock	4MHz
ROM	32K
RAM	64K (42K for User)
Language	BASIC
Keyboard	74 keys, including keypad
Display	27 colours, up to 16 at one time; up to 640 by 200 pixels; 20-, 40- and 80- column modes; eight windows
Sound I/O	three tone channels, plus noise
Cassette I/O	Disc drive/Bus extension
VDU	Centronics Printer Port
Cost	Joystick port
Manufacturer	Stereo sound output
	Integral deck
	Supplied with GT64 Green Tube Monitor or CTM640 Colour Monitor (RGB) or MP1 Modulator/Power supply (for use with UHF TV set)
	CPC464 with GT64 £229
	CPC464 with CTM640 £329
	CPC464 with MP 1 £258.95
	Amstrad Consumer Electronic plc
	Amsoft, 169 Kings Road, Brentwood
	Essex CM14 4EF

## GRAPHICS

The Amstrad has three modes, in all of which both graphics and text can be used:

- Mode 0 20 column display, up to sixteen colours.
- Mode 1 40 column display up to four colours (the default mode).
- Mode 2 80 column display, up to two colours.

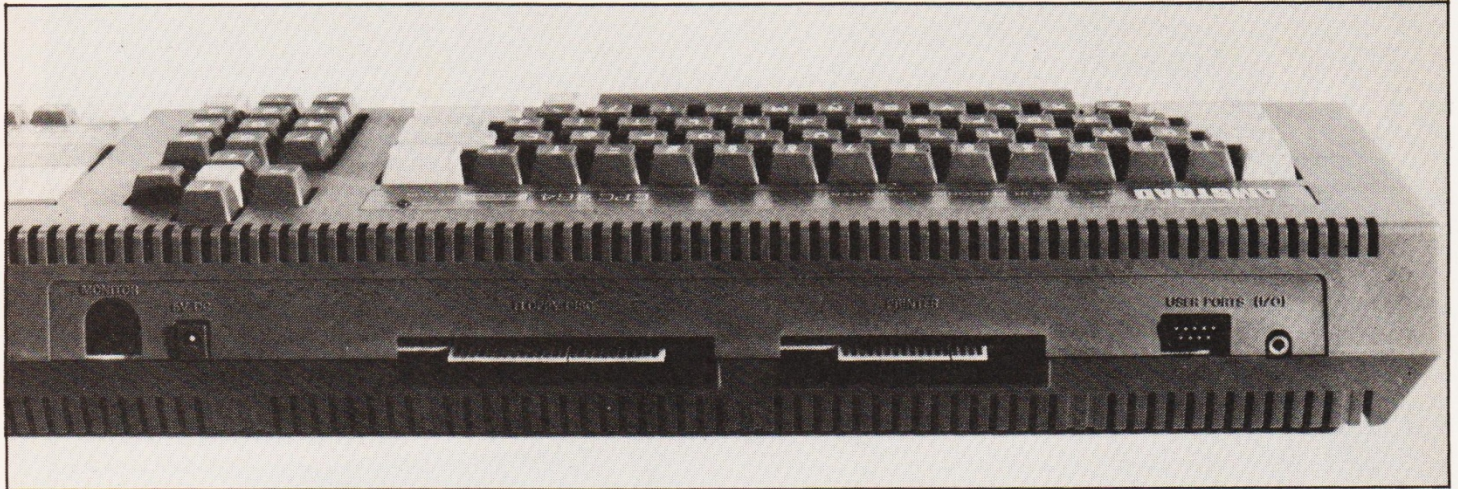
The full 42 kilobytes of user memory remains available whatever the mode. The border colour can be set to any one of the 26 colours (see Table 2) independently of mode. There are default colours in each mode, including flashing blue/bright-yellow and pink/sky-blue in mode 0. Any other combinations of two, four or sixteen colours can be selected from the 26 available. You can also select any pair of flashing colours and control the rate of flashing and the proportion of time for which each is displayed. As might be expected, one needs a clear head to manipulate these colourful effects. The system of key words used is simple when you get used to it, but we found it puzzling at first. Those who are used to the idea of logical and actual colours, as used in the Beeb, should quickly feel at home with the Amstrad's colour system.

The keyword PAPER sets the screen colour to one (or two, if flashing) coloured 'inks'. The number of inks allowed varies with mode, as explained above. The actual colour of each ink is chosen from the range of 26 by using the keyword INK. The colour for displaying text or drawing graphics is set similarly by using PEN to select one of the available inks. By altering the colour of the inks, it is possible to change the colour of the whole display instantly.

The keyword WINDOW defines up to eight text windows on different or overlapping parts of these window independently. This is a useful facility for programming games and also for business and data-base utilities.

The Amstrad can draw line graphics using graphics coordinates and commands such as DRAW, DRAWR (draw relative to previous point), PLOT, PLOTR, MOVE and MOVER. It also has excellent provision for block graphics and user-defined graphics can be set up as on many other computers: although owners will find that the set of graphics already provided is ample for most applications. The usual ASCII alphanumeric characters





A back view of the Amstrad CPC-464 showing the range of connectors available. At the left there is the DIN socket for connection to the Amstrad monitor and, next to it, the power supply socket (also contained in the monitor unit). Next comes an edge connector marked 'floppy disk' but also, presumably, for fitting the expansion ROMs which the system supports (up to 252). Next comes the Centronics interface edge connector, for use by a printer, followed by a standard nine-way D-socket for a joystick and an output socket to feed the sound into an external amplifier.

and symbols are there from ASCII 32 to 126. The remaining ASCII codes from 127 to 255 are all defined with special characters:

127 checkerboard

128-143 2 by 2 'Battenburg' graphics, as on ZX computers.

144-159 Lines, corners and junctions for drawing tables etc.

### TABLE 1

Results of benchmark test

Benchmark	Time (sec)
1	1.1
2	3.4
3	9.3
4	9.7
5	10.3
6	19.2
7	30.4
8	3.6*
	3.4**

\* Using the LOG function (natural logs)

\*\* Using the LOG10 function (logs to base 10)

### TABLE 2

The Amstrad's colour palette

Ink number	Colour	Ink number	Colour
0	Black	14	Pastel blue
1	Blue	15	Orange
2	Bright Blue	16	Pink
3	Red	17	Pastel magenta
4	Magenta	18	Bright green
5	Mauve	19	Sea green
6	Bright Red	20	Bright Cyan
7	Purple	21	Lime green
8	Bright magenta	22	Pastel green
9	Green	23	Pastel cyan
10	Cyan	24	Bright yellow
11	Sky blue	25	Pastel yellow
12	Yellow	26	Bright white
13	White		

160-179 Accents, fractions, useful symbols such as £, ±, and ÷.  
176-191 A large selection from the Greek alphabet, both upper and lower case.

192-205 Slanting lines.

206-233 Battenburg graphics with half-tones.

224-255 A miscellany of pictograms including a happy face, a sad face, playing card suits, a crochet and a quaver, designs for producing an animated walking man, a bomb, a rocket and a selection of arrows.

As if these were not enough, there is another set of designs available to those who care to read the instruction book closely. Like the VIC-20 and Commodore 64, the Amstrad has a number of 'control characters'. Each control operation, such as clearing the screen, or sounding a 'beep' (the bell) is associated with a special character and with one of the ASCII codes in the range 0 to 31. These operations may be initiated in a program either by using the function CHR\$(n), or by actually typing the character itself in a PRINT statement or the prompt message of an INPUT statement. When the computer comes to these embedded control characters, it does not display them as part of the message, but puts them into effect. For example, you can obtain a 'beep' by using the function CHR\$(7) or you can include it in a PRINT statement by pressing the control key (CTRL) and 'G' together during programming. A picture of a bell appears in the message string. When the message is displayed, during the running of the program, the 'beep' is sounded. The Amstrad makes good use of this range of ASCII codes to provide various operations. These include control of cursor movement, clearing the screen (or window) up to the cursor position, clearing the screen (or window) from the cursor position to the bottom right corner, exchange pen and paper inks, and several more.

The control characters can be used as extra graphics characters without causing the associated operation to occur. Use the statement PRINT CHR\$(1)+CHR\$(n), where n is the ASCII code of the character you require. This gives you access to another 32 ready-defined characters, including more faces, a 'lightning' symbol, various lines, circles and arrows, and a school-teacher's 'tick'.

The way to use all these graphics facilities is fully explained in the User Instructions, with many short example programs.

## SOUND

The sound generator has three tone channels. Sounds can be defined by as few as two parameters (channel number and pitch) or as many as seven. The additional parameters are mainly used for bringing previously-defined volume and pitch envelopes into operation. There is also provision to synchronise the action of two channels, to freeze the action of a given channel pending a





The Amstrad comes with a fairly meaty manual. Those with an even greater thirst for knowledge can fork out another £20 each for the BASIC and firmware manuals. The firmware manual, in particular, is a must for the machine code programmer as it contains complete details of the system's operation.

RELEASE command and also to flush the commands currently sent to a given channel. There is also the possibility of adding white noise to a tone. As might be expected, this gives the ambitious programmer plenty to think about and the range of sounds that can be produced is great. However, as with sound commands on several other computers, setting up such effects is a complex matter.

We found the introduction to sound in the "Beginner's Foundation Course" easy to understand, for it had plenty of examples. Later in the Instruction Manual there is a "Sound Primer". This sets out the principles and techniques of sound generation in precise detail, but it is very condensed and contains no working examples. Beginners might find it difficult to make the leap from the earlier section to this one. Obviously there is a need for a sound-composing utility (enterprising programmers please note!).

## USER INSTRUCTIONS

The manual is massive, having 261 pages nearly of A4 size. Spiral bound, for easy use, it provides all the information that the beginner needs to know about the Amstrad, in short and easily

digestible steps. There are plenty of simple and entertaining example programs. But the beginner who wants to learn BASIC programming (as opposed to how to use the Amstrad) will probably need more than is provided in this guide. There is also an extensive "Glossary" of computer terms and a lot of technical information, mainly tabulated in the appendices. Experienced programmers will quickly have the machine doing just what they want. The book ends with a comprehensive index, making it easy to find your way around the guide.

## CONCLUSIONS

- Well made, good appearance, no bugs detected as yet.
- Excellent colour graphics and good sound.
- Plenty of user memory.
- Powerful and very fast BASIC with an extensive and interesting set of commands and functions, though not ideal for those whose main aim is to learn structured BASIC programming.
- Extremely good value for money.
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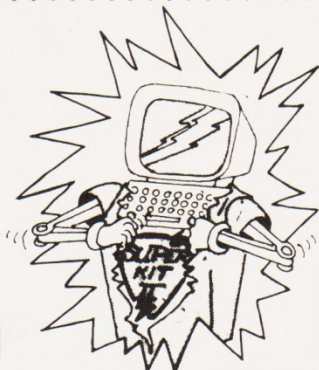
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Programmers can do extraordinary things sometimes. It's probably fair to say that, whatever the apparent defects of a computer, a sufficiently clever software man can patch things up, even if the problem is ostensibly one of hardware.

Take the Dragon 32, for instance. It does not feature sprites. It does have an extremely wide range of graphics options, but no sprites. (For the uninitiated, sprites are 'movable object blocks' which can be positioned on-screen and moved around using simple commands. They usually have priorities, so that one may move in front of another, and collision detection tells the programmer when two sprites are overlapping.) Sprites generally require specialised hardware in the computers that feature them. Atari use the ANTIC and GTIA chips, Commodore have the VIC chip, and most other people use the dedicated Texas Instruments video display processor.

Despite this, Knight Software have produced a small program called Sprite Magic for the Dragon computer which puts most other dedicated systems to shame. It has an astonishing range of facilities, including some which no other system can offer, and totally revolutionises graphics on the Dragon.

## SPRITE MAGIC

The package, when loaded into the Dragon, provides 17 new sprite commands, 11 sprite functions, six new text commands, three each of joystick/keyboard commands and functions, three general commands and three new sound commands. All of these are used from BASIC using new keywords: no machine code calls of any kind are required. Although the system needs to reserve over 4K of RAM even before space is used to hold your drawings, Knight point out that the new commands they provide are so powerful that complex graphical routines can be written much more economically in terms of BASIC text.

Also included on the cassette are seven demonstration programs which are designed to show all the features that Sprite Magic offers. Unfortunately two of the seven stubbornly refused to load, and two others refused to run, but the ones I did get

# DRAGON SPRITES

Christopher Moss

**The graphics system on the Dragon 32 is quite complex and people are continually coming out with new surprises. Here's a product that gives an astounding sprite capability.**

working were very impressive. For example, an arcade-type shooting gallery game has rows of sprites moving back and forth across the screen, together with a gunsight which the player controls, and the animation was very smooth indeed, even at the start of the game when the software had to move the maximum number of objects about.

## SPRITE FEATURES

Rather than just give a list of all the new functions and how they work, it's probably more instructive to follow through the procedure involved in designing a sprite and getting it onto the screen. The first step is to actually design your sprite. This is not done in the usual way, by preparing a list of binary numbers corresponding to the bits

that are set on or off in the shape required. Instead, you actually draw the shape in the top left-hand corner of the screen just as you want it to appear in the final program. You can either use the large number of drawing commands already provided on the Dragon, or else make use of such programs as the Dragon character generator and Dragon Graphics' utilities published in the September '83 and December '83 issues of CT.

Once you have the design you want, the drawing is copied into the space you have reserved for it under MEMTOP with the DGETn (x,y) command. The number n is the drawing number, while x and y represent the width and height of the portion of screen to be used (Sprite Magic assumes that the sprite's top left corner is

at 0,0, which is why the drawing has to be at top left).

Having done this for all the different drawings that you will require, you can initialise the sprites with their drawing number, initial direction of movement and attributes. The command used is SGETn (drawing no, direction + attributes). n can be a number from 0 to 127 in this case, although for DGET you can only have 0 to 31: ie you can have up to 128 sprites on screen but only 32 different shapes for them.

Direction may be a number from 1 to 8 indicating the compass point to which the sprite will head when moving. Attributes is optional and includes the following four flags. Wipe causes the sprite to disappear when it reaches the edge of the screen. Bounce will make the sprite rebound from the edge of the screen. Collision detect will make the software examine that sprite to see whether a collision has occurred, while status indicates whether the sprite is currently being displayed.

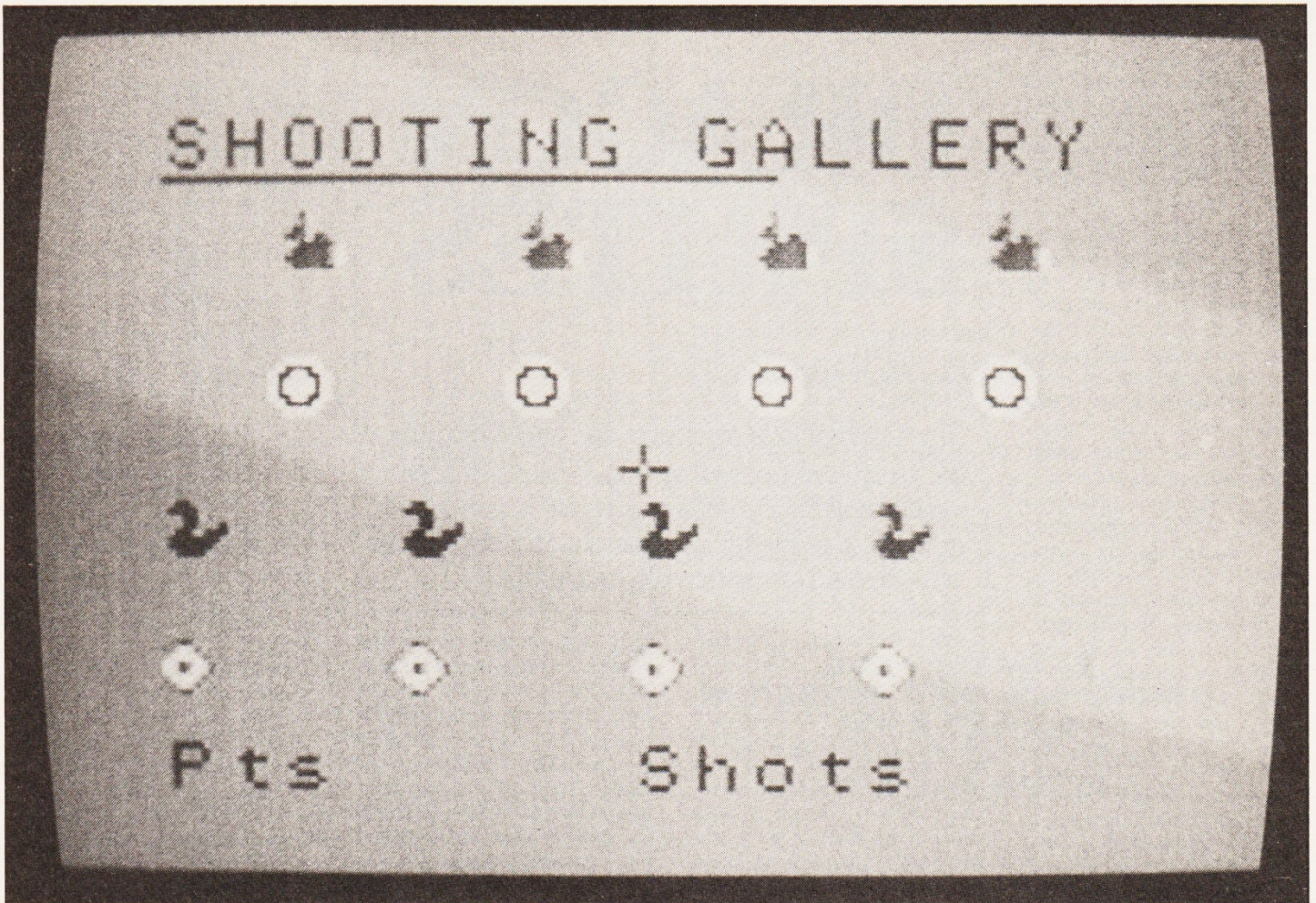
Sprites are displayed using SPUTn(x,y), whose parameters are fairly self-explanatory. Once on the screen, what Knight describe as the 'magic' part occurs: all of the sprites can be moved in the individual directions they were initialised with by using only a single command. To keep the sprites moving perpetually in the pre-determined fashion, simply keep executing the MOVEM command, which moves each sprite a number of pixels in the required direction, the rate of movement being programmed using SPEED (speed range is from 1 to 15 pixels). Alternatively a single sprite only may be moved with the MOVEn command, or a block of sprites using MOVEn1,n2.

Changing the directions and behaviour of the sprites is also simple. Sprites 0 and 3 can be put under joystick control, with 0 and 1 responding to the stick itself and 2 and 3 acting like missiles, appearing from a position relative to the 'mother sprite's' position when the joystick button is fired. The relative start offset may be programmed.

FLETCH(n), on the other hand, places sprite n under keyboard control, and should be executed before moving the sprite with one of the MOVE commands. It scans the arrow keys on the keyboard and alters the sprite's direction of travel







The Shooting Gallery demo program. Here 17 sprites move simultaneously with no apparent jerkiness.

accordingly. FLETCH has auto-repeat, and detects multiple keypresses so that you can move diagonally.

REPORT will return the number of sprites that are in collision at the moment, or will test a single sprite. HIT will provide the actual numbers of the crashed sprites. Individual sprite directions may be altered using the DIR function, and its attributes with ATTR. DRWG is a powerful function which returns the drawing number currently in use for the specified sprite and allows it to be changed. Hence a moving sprite can be animated by swapping drawings at various stages. Alternatively, the ANIMATE command can do this automatically, by specifying the sprite number and the range of drawings to be used. ANIMATE then rotates the sprite through the drawings, one per movement, returning to the first one at the end.

## A-MAZE-ING

Yet another novel feature of this package is the maze-running facility. This has obviously been included with a view to making

Pac-person type games very easy to program. First the NODE command is used to specify each junction of the maze and all the possible exits from each node. Once this is done, executing MAZEON will make all sprites run the maze automatically, and pursue sprite 0 which, you will recall, may be under joystick or keyboard control. Executing FLEEON will make all the other sprites run away from sprite 0, still following the valid maze paths. The possibilities are fairly obvious, I think!

## TEXT

Text can be used in all five graphics modes: text and sprites may be mixed at will. SMODE rather than PMODE is used to enable the new features, which includes PAGE to force a pause at the end of each screenful (useful if you don't want your listing to scroll off the screen), and a HOLD command to force text output to remain in the bottom half of the screen. A dedicated SCORE command automatically handles score output formatting in games.

Text foreground and background can be specified with COLOUR, text positioning has been made easier than using the old PRINT@ command, and CHR(n) allows characters to be redefined. A character generator program is included on the tape (except that it was one of the ones that wouldn't load for me, so I can't comment on it).

Keyboard handling now has auto-repeat, new INKEY functions and Break disable. Pressing Clear will clear the graphics screen and home the text cursor. BUTTON reports the state of the joystick buttons.

## SOUND

The new sound facilities are accessed using the keyword BEEP, which has two forms. BEEP followed by a number from 0 to 15 causes one of Knight's preprogrammed sounds to be generated. These range from explosions and shots to pings and siren noises. Alternatively you can follow BEEP with a list of six parameters which specify the sound period (inverse of frequency, that is, not the length), period change, starting volume and

volume rate of change, the number of sound cycles to be output, and the waveform type. The options here are a square wave or pseudo white noise, which Knight cleverly generates by scanning the 'random' numbers that make up the Dragon ROM. (We mentioned this technique some months ago in *Computing Today*).

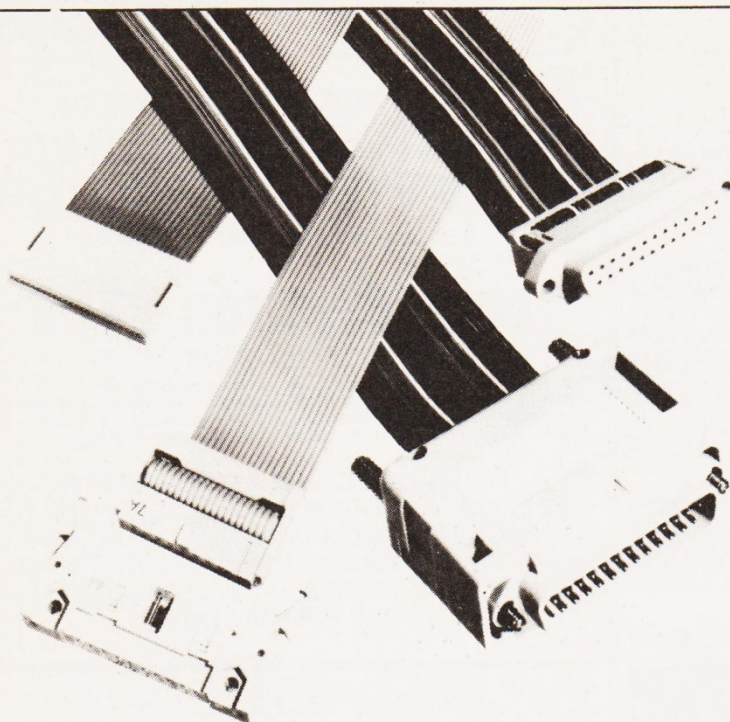
## CONCLUSIONS

Note that I've only skimmed through the list of commands and functions available: the small instruction booklet that accompanies the software gives a good, detailed explanation of the facilities available and how to use them. The results, as I have already said, are excellent, and should enable any programmer to produce smooth, fast, complex animation on the Dragon together with much improved sound effects. I think we can put a 'Highly recommended' label on this one.

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Vic 20 £104 (£97) £117.  
Vic 20 starter pack £150 (£143) £173.  
Converter to allow most ordinary mono cassette recorders to be used with the Vic 20 and the Commodore 64 £9.78 (£9) £11.

Bargain package:- cassette converter + compatible cassette recorder £37 (£38) £44.  
Commodore cassette recorder £43 (£44) £50.  
Centronics printer interfaces for Vic 20 and the Commodore 64 £45 (£41) £46.  
RS232 printer interface for Commodore 64 £45 (£41) £46.  
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BBC Model B £404 (£357) £387.  
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Canom PW1080A £332 (£299) £329.  
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# PRINTERS

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All printers have centronic parallel interface unless otherwise stated. All printers have hi res dot addressable graphic mode. Please send SAE for full details.

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FX100 160 CPS 15" wide friction & tractor feed	£499 + VAT £574
RX80 F/T 100 CPS 10" wide friction & tractor feed	£239 + VAT £275
RX80 F/T 100 CPS 10" wide tractor feed	£199 + VAT £229
RX100 F/T 100 CPS friction & tractor feed	£385 + VAT £443
8143 RS 23 Interface for FX and RX printers	£39 + VAT £45
8148 RS 232 Interface with 2K buffer x on x off	£60 + VAT £69
Ribbon Cartridge for RX80 FX80 & MX80	£5 + VAT £6
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BP 420 designed for the business world, 420CPS in draft mode, 110CPS in NLQ mode.	£1095 + VAT £1259
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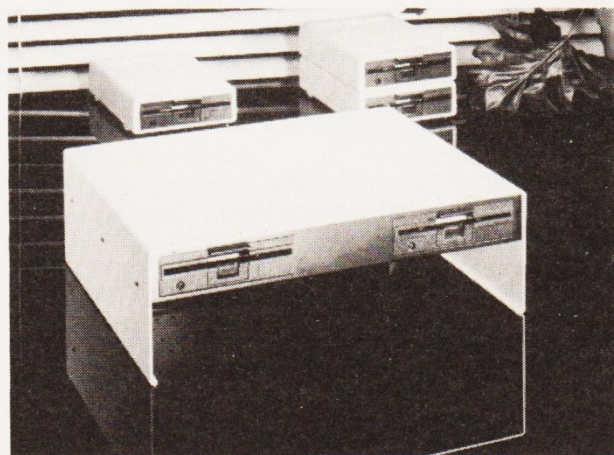


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## DISC

100% BBC COMPATIBLE MITSUBISHI AND TEAC SLIMLINE DISK DRIVES



These drives are supplied ready cased with all the necessary cables formatting program and User Guide There are some very useful utilities included on formatting disc e.g.

- \* DISASSEMBLER: This is 6502 machine code disassembler
- \* DUP: To copy and rename a file on disc
- \* FORMAT: Formatting program for 40 & 80 tracks



# PRODUCTS

BBC Microcomputer Model B	£348	+ VAT	£399
BBC Mod B - disk interface	£409	+ VAT	£469
BBC Mod B - Econet interface	£389	+ VAT	£447
BBC Mod B - disk and Econet interfaces	£450	+ VAT	£517
BBC Compatible 100K disk drive	£86	+ VAT	£99
BBC Compatible dual 800K disk drive	£312	+ VAT	£359
Acorn Z80	£260	+ VAT	£299
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BBC Prestel Adaptor	£115	+ VAT	£132
BBC Telex receiver (Aug)	£196	+ VAT	£225
BBC cassette recorder and lead	£35	+ VAT	£40
Disk interface kit (free fitting)	£84	+ VAT	£96
Mod A to Mod B upgrade kit	£70	+ VAT	£80
Fitting charge for A to B upgrade kit	£20	+ VAT	£23
16K memory upgrade kit	£30	+ VAT	£34
Games paddles	£11	+ VAT	£12
User Guide	£10		
Advanced User Guide	£12.95		
Econet Guide	£7.50		
Econet interface (free fitting)	£60	+ VAT	£69
Speech interface (free fitting)	£47	+ VAT	£54
BBC disk manual - formatting disk	£30	+ VAT	£34
Parallel printer cable	£10	+ VAT	£11
BBC word processor (view)	£52	+ VAT	£59
BBC Fourth language cassette	£15	+ VAT	£17
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# DRIVES

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- \* MDUMP: Enables you to display and modify any part of BBC memory
- \* MERGE: Merge a number of text files into one file
- \* RELOCATE: Downloads a basic program to &E00
- \* SDUMP: Screen dump for EPSON in all graphic modes
- \* VERIFY: Verifies every sector on a disk
- \* MENU: A flexible menu program

Single drive 100K 40 trks single sided	£86	+ VAT	£99
Dual drive 200K 40 trks single sided	£164	+ VAT	£189
Single drive 200K 40 trks double sided	£138	+ VAT	£159
Dual drive 400K 40 trks double sided	£260	+ VAT	£299
Single drive 400K 80 trks double sided	£152	+ VAT	£175
Single drive 400K 40 80 trks switchable DS	£155	+ VAT	£179
Dual drive 800K 80 trks double sided	£303	+ VAT	£349
Dual drive 800K 40 80 trks switchable DS	£312	+ VAT	£359
Dual Drive 800K 40 80 trks + PSU + built in monitor stand	£373	+ VAT	£429

All above drives are low power slimline (0.3 A typ at +12v and 0.4 A at +5v per drive) Normally extra power supply is not required. The BBC Computer power supply is designed to drive to low power drive (IT IS NOT DESIGNED TO DRIVE INTERNAL ROM BOARD)

40 Track SS DD diskettes (10 Box)	£18	+ VAT	£20
40 Track DS DD diskettes (10 Box)	£23	+ VAT	£26
80 Track SS DD diskettes (10 Box)	£28	+ VAT	£32
80 Track DS DD diskettes (10 Box)	£30	+ VAT	£34

ALL ABOVE DISKETTS ARE CERTIFIED EITHER MEMOREX OR DETALIFE

# BUSINESS SYSTEMS

## COMPLETE BUSINESS PACKAGE

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Complete turnkey system at an unbelievable price.

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Delivered and Installed plus 1/2 day training

£1595 + VAT £1834

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"Portable Executive Computer" 16 Bit Micro. 256K RAM up to 1.44 megabytes floppy disk storage. 3 1/2" Sony disks. Portable brief case styling. Modem with auto dialler (optional) hard disk optional. Vast software library (compatible with Sirius 1).

Apricot with Double Drive, Monitor and Free Printer

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### APRICOT XI

As above but with 10MB Winchester Drive and Single 315K Drive plus Superwriter, Supercalc and FREE JUKI 6100 Printer

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16 Bit Micro 128K RAM expandable to 256K. Single or Double Disk drive built in full colour graphics (640 x 200 pixels in 8 colours) IBM compatible. Free software. Sanyo MBC 550 128K RAM single drive and free software including Wordstar and Calcstar

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### SANYO 550-2

As 550 but with Dual Drive 2 x 160K

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### SANYO 550-360

As 550 but with 2 x 360K Drives

£999 + VAT £1149

### SANYO 550-730

As 550 but with 2 x 730K Drives

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### SANYO 555

Sanyo MBC555 128K double drive and free software including Wordstar, Calcstar, Inforstar, Datastar etc.

£999 + VAT £1149

### SANYO 555-360

As 555 but with 2 x 360K Drives

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### SANYO 555-730

As 555 but with 2 x 730K Drives

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**SANYO SYSTEMS INCLUDE FREE HIGH RES GREEN MONITOR**

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**BBC 2:** BBC Micro Model B + Disk Interface, View (or Wordwise) Wordprocessor, 100K Disk Drive, High Res Green Monitor, Quendata 20 CPS Daisywheel Printer, 1 Box of Disks and all the necessary cables £799 + VAT = £803.35

**BBC 3:** Same as System BBC2 but with 400K Drive £875 + VAT = £1006.25

**BBC 4:** Same as System BBC 2 but with 400K Drive and JUKI 6100 Daisywheel Printer £975 + VAT = £1121.25

**BBC 5:** BBC Model B + Disk Interface, View (or Wordwise) Wordprocessor, 800K Dual Disk Drive (Mitsubishi), High Res Green Monitor, JUKI 6100 Daisywheel Printer, 1 Box (10) of 80 Track DS discs and all necessary cables £1145 + VAT = £1316.75.

If you require High Res Colour Monitor instead of High Res Green Monitor in Sanyo Systems please add £320 + VAT = £368 to the above prices.

\*128K RAM Upgrade for all above Sanyo systems (makes a total of 256K RAM) £150 + VAT = £172.50 including fitting.

**SAN 1:** Sanyo MBC 550 Series 16 Bit Microcomputer, 128K Ram, Dual 160K drives (2 x 160K), High Res Graphics (600 x 200 pixels in 8 colours), JUKI 6100 Daisywheel Printer, High Res Green Monitor, 1 Box of 10 discs, Wordstar Wordprocessor, Calcstar spreadsheet and all the necessary cables £1175 + VAT = £1351.25

**SAN 2:** Same as SAN 1 but with Dual 360K Drives (2 x 360K) £1345 + VAT = £1546.75

**SAN 3:** Same as SAN 1 but with Dual 720K Drives £1395 + VAT = £1604.25

**SAN 4:** Sanyo MBC 555 Series 16 Bit Microcomputer, 128K Ram, Dual 160K Drives (2 x 160K), High Res Graphics (600 x 200 pixels in 8 colours) JUKI 6100 Daisywheel Printer, High Res Green Monitor, 1 Box of 10 discs, Wordstar, Wordprocessor, Calcstar spreadsheet, Mailmerge, Spellstar (dictionary), Datastar (database), Reportstar plus all the necessary cables £1295 + VAT = £1489.25

**SAN 5:** Same as SAN 4 but with Dual 360K Drives £1475 + VAT = £1696.25

**SAN 6:** Same as SAN 4 but with Dual 730K Drives £1525 + VAT = £1753.75

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GM1211 18 MHZ High Res Monochrome Monitor with tilt and swivel stand available in green or amber etched antiglare screen (please specify colour) £86 + VAT £99  
7001 High Res Green Screen with sound input £65 + VAT £75

### SAMWOO

24MHZ High Res Monochrome etched antiglare green screen IBM/BBC Compatible £86 + VAT £99

### SANYO

DM8112 12" Green screen 18MHZ Hi-Res £86 + VAT £99

DM2112 12" Green screen 15MHZ £66 + VAT £75

### MICROVITEC CUB

1431 MS 14" RGB Normal Res Colour £173 + VAT £199

1451 MS 14" RGB Medium Res Colour £289 + VAT £332

1441 MS 14" RGB High Res Colour £417 + VAT £479

### MICROVITEC FOR QL

1451 14" Medium Res Colour. Specially designed for Sinclair QL £239 + VAT £275



**I**t really is extraordinary what you can learn by reading computer books. Here is a selection of snippets from those reviewed this month.

- A study on computer use showed that a computerised system for tracking the progress of welfare beneficiaries in an American state was "relatively useless", although the staff using it thought it useful. Nevertheless, welfare agencies using this system were more successful than others in attracting Federal funding because the mere use of a computerised system gave them an image of being administratively effective.
- In Japan, video discs of popular entertainers that allow the user to turn down the sound track so that they might sing along instead of the star are very popular in snack bars!
- The US Army produces video discs to help non-commissioned officers deal with problems such as verbal abuse and insubordination.
- In the baking trade, the price of a product is determined as much by the cost of the ingredients as it is by the overheads.
- Information on a citizen's religion, politics, race or health may not be held on computer files in France.

If you're asking yourself what any of this has to do with computers then you're asking the wrong question. Computers have to do with everything. What the quotes should also show is that this month's books provide an interesting and stimulating read.

**New Information Technology** edited by Alan Burns, has a rather off-putting title, but once you start to read the book you find that it is about what most of you would call simply 'information technology'. The point of the title, though, is that information technology in the form of storage, processing and communication of information has been around for a very long time. The developments made possible by electronics, and more particularly, microelectronics, constitute the 'new' information technology.

Besides describing the developments in this field, the

book seeks to put them in context, historically, socially and politically, and it succeeds admirably in doing so. The book starts with a historical review of the methods of storing, communicating and processing information that have been used from the earliest times. This is interesting in itself and shows quite clearly where the new developments have come from and how they were shaped. It also reveals many requirements that should help to shape new developments, particularly in the area of man-machine

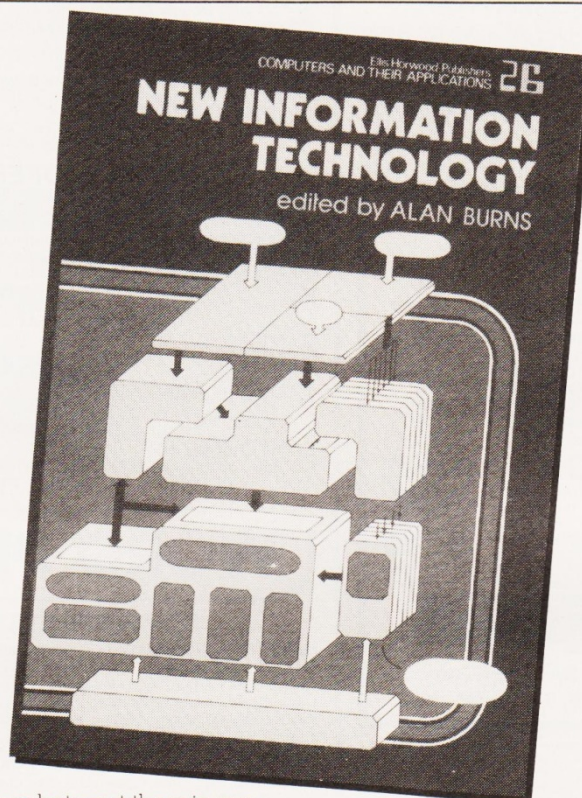
interaction.

I find it particularly interesting to learn that while both storing and communicating information have long histories, the processing of information is a fairly recent development. Even then it has arisen in response to the needs of governments and other large organisations rather than individuals. This tends to reinforce my views that individuals with personal computers use their machines for storing and retrieving information and for communication

# BOOK PAGE

Garry Marshall

**From the two dozen or so computing books sent to the CT office this month, our reviewer has selected a beginner's guide to the IBM PC, Computer Studies revisited and two looks at present day and future technology.**



(via Micronet and so on) but that they have very little need to process it. Why then do they need to learn BASIC?

This view is further backed up by the review of the uses of micros in Chapter 2 which mentions uses by banks (for cash dispensers), by supermarkets (for point of sale terminals and many others by large institutions that require information processing for the use of an individual. The point is also made that of all the pre-electronic forms of information system, the only one that has not been superseded is the Post Office. Electronic mail is discussed in the book and if I were a postman I think I'd be wondering just how long the traditional delivery service would be continuing.

After the historical introduction, the book continues with descriptions of current developments and the final chapters look to the future. The chapter on fifth generation developments is, to my mind, the weakest in the book. In two parts, the first describes Japanese plans while the second is a rather discursive treatment of the elements involved in these developments. Little or nothing is said that cannot be found in **The Fifth Generation** by Feigenbaum and McCorduck: (this book was reviewed in *Computing Today*, February 1984 and is now published in paperback by Pan at £2.95). The two parts in this chapter are written by different authors which highlights one of the disappointing features of the book — they are in two highly contrasting styles: one is academic and rather dry and the other almost racy and they show a degree of repetition.

In general, the book contains rather too many errors in spelling and other matters that

This month's books are:

**New Information Technology** edited by Alan Burns (Ellis Horwood) 245 pages £8.95

**Interactive Video** edited by Eric Parsloe (Sigma Technical Press) 290 pages £10.95

**The IBM Personal Computer** by M de Pace (Granada) 188 pages £7.95

**Revise Computer Studies** by Tony Rackham (Letts) 194 pages £4.25



should have been eliminated by a proof reader or dealt with by items of the new technology! However, all in all, the book covers the subject of information very well and also gives a stimulating discussion of the factors that it affects.

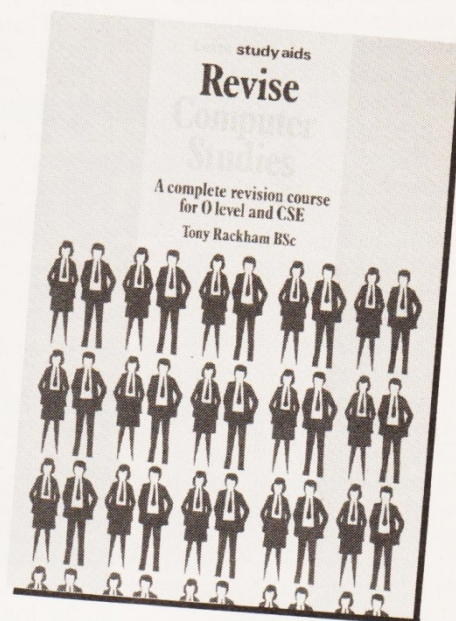
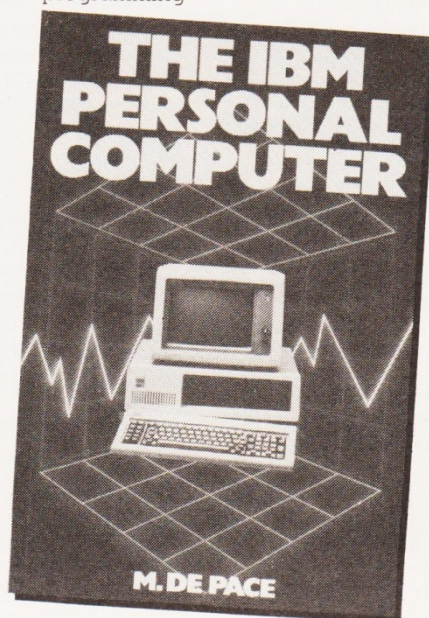
**Interactive Video**, edited by Eric Parsloe is about one particular creation of the new technology, the convergence

of holidays, training videos as animated replacements for manuals, interactive simulation video for training and education, military education and surrogate travel as a substitute for the real thing and many others. All the stages of creating an interactive video are covered, starting with discussions of video and computer hardware and ranging through the programming

written for those who know nothing about the computer and, indeed, nothing much about computing. If there is a need for such a book, then this one fills the gap rather well. The three sections comprise an introduction, an account of the software available and a discussion of the hardware. The introduction explains exactly what the IBM manual tells the user, outlining some-

section on hardware covers discs, printers and expanding the PC.

The balance of the book's contents is strange with, for example, the use of dBase II getting 13 pages while BASIC is disposed of in eight. The illustration of spreadsheet usage is good though, and I should think that if you were thinking of buying an IBM PC 'cold', then this book would be



of computers and video within. Modern video equipment has an interface via which it can be connected to a computer. This means that video is no longer just for watching but for joining in. You will be able to watch a film and make decisions at certain points that will determine the line that the plot will take next. Other facilities will include being able to pick frames or moving sequences from videodisc for incorporation in your own programs instead of labouring at graphics programming for results that are inferior to a simple picture.

The applications for interactive video described in the book include demonstration video presentations for selling anything from baby clothes to

needed to create a video presentation, delivery systems (the total hardware needed to create a presentation) to design and production. The cost of it all is not neglected either.

This is a book of many short, readable chapters in which the enthusiasm of the book's creators for their technology is infectious and leads the reader on, wanting to read more all the time.

The only computers mentioned as having software available for the creation of interactive videos are the Apple and the IBM PC which brings us to the subject of the next book, **The IBM Personal Computer** by M de Pace. This is an account of the IBM PC and its capabilities

thing of the various hardware configurations for the PC and discusses BASIC and DOS. The middle section is much the best of the three, describing word processing, databases, spreadsheets, programming languages other than BASIC and graphics software, giving examples of the use of a specific package for each. However, after reading New Information Technology, the descriptions of the software seems very narrow.

"Word processing is a means of creating a typed document . . ." No mention is made of the separation of keying and printing. No clue that paperless operation and communication is a possibility. But as a description for beginners, it will just about do. The final

of great value.

Finally, in this month's review comes **Revise Computer Studies** by Tony Rackham. This is a revision course for O Level Computer Studies and it relates to one of my hobby horses, namely that normal academic text books often do things much better than the more popular books. This book is no exception and provides a thorough grounding with no gaps in its treatment of computing matters. Self-test questions are provided so that progress and understanding can be checked. It may be a bit staid and old fashioned, but then its contents are governed by the O Level syllabus. It is, more importantly, all good, solid stuff.

# FOOTNOTES

Concise notes from a variety of authors on some of the many and varied computing books that come flooding into the CT office every month. (It was this or move to a bigger office — ED)

With two identically priced books covering such similar ground, comparison is virtually inevitable. However, by design or (more likely) happy chance, there is little duplication of material in the following two Memotech books and the would-be purchaser is not therefore compelled to choose either one or the other. Both books are clearly printed with dot-matrix printouts produced



directly from the computer, and both books are bound and glued so they won't fall apart when you bend them and hold them down flat on the table with paperweights while your hands thump the Memotech keyboard.

## THE MEMOTECH GAMES BOOK

**Owen and Audrey Bishop  
Granada Technical  
Books Ltd  
Paperback 172 pages  
£5.95 June 1984**

This is a book of BASIC listings written to run on the Memotech MTX500/512 and, for a price which is considerably less than that of the single MTX cassette, you receive no fewer than 21 assorted games.

Now, before any Memotech owner switches off thinking this is a "games-only" book, hold on! Games, as listed in a book are not necessarily the same as games as loaded from a cassette. You can't break into cassette games to see how they make use of the computer's facilities, but with the listings, you can see how the structure of the game is built, how the commands and functions so briefly described in the MTX manual, are used in practice and how you can tailor the game to suit your particular enthusiasms.

The 21 games use Memotech BASIC very well. Old favourites such as Nim are included, together with original games inspired by the new computer; none of the programs are insubstantial or mere padding. Nim, for example, can be programmed using a very few lines of code and is then more boring than using the traditional matchsticks. In this book, the authors have programmed the MTX sprites to play Nim with coloured glass thimbles on a delicately embroidered cloth, and the result is entertaining.

Whether or not you like a particular game will obviously depend on your personal prejudices, but the selection is varied and includes games of logic, chance, reaction, and skill. There are games for one player against the computer such as 'Computer Clues', which is a version of the coloured-pegs-in-a-board type game; for two players there is the maze chase, Cops

and Robbers' and for groups of contestants, 'Show Jumping' at the on-screen Memstead course. Very young computer users can build 'Sand Castle' and not-so-young users can pit their wits against 'Snipers'. Ten-to-one any arcade fan will type in 'Minefield' or 'Bombing Run' before most of the other programs but that's just a comment on the times we live in. Incidentally, there are 17 non-violent games in this collection.

The user will discover much about MTX Sprites, Sound, Virtual Screens and the language NODDY after using just a few of the programs in the book, and he or she will be entertained in the process. I can recommend this book to any MTX owner who programs in BASIC and who enjoys playing computer games.

## THE MEMOTECH MTX PROGRAM BOOK

**Peter Goode  
Phoenix Publishing  
Associates  
Paperback 125 pages  
£5.95 June 1984**

There are 23 assorted programs in this MTX program book and a quick look at the table of contents reveals that 17 are games, two are 'utilities' and four are unclassified. Again, congratulations are in order. There are no 10-line programs called "V.A.T. Calculator" or 'Metric Conversions' so you can be sure that all the programs really do make use of the MTX. Admittedly, I was a little suspicious of the program called "Dice", but it turns out to be a perfectly reasonable gambling game adapted to the MTX and neatly coded. Sprites and sound make their appearance in most of the programs where they are appropriate, but, because this is not just a 'games book', there are programs which deal just with text.

What, then, are the non-games like? The two utilities, Screen Dump and Sprite Designer, are very useful. Sprite Designer enables you to plan an 8 by 8 or 16 by 16 pixel sprite and automatically produces the decimal numbers for you to type into a GENPAT statement. Screen Dump is one of two programs in the book written in MTX

assembly language and it sends the graphics screen to an Epson-type dot-matrix printer. If you don't know how to do this using a much slower program incorporating the GR\$ x,y,b function then I would suggest that this program, together with the Sprite Designer, is worth most of the book's cover price.

In 'Simper', the computer takes the role of a psychologist giving seemingly creditable comments to information you feed in. Great fun, especially when you alter the program to fit in with the idiosyncrasies of your family background . . . 'Biorhythm Graphing and Prediction' speaks for itself, while 'Sound to Light' uses machine code to put a kaleidoscope of colour onto the TV screen in response to music fed into the EAR connection at the back of the MTX.

Peter Goode hasn't commented on the programs in quite as much detail as the Bishops have, which is why his book has fewer pages, but there are REM statements in the listings and the code is as easy to follow.

David Norman

## CHOOSING A WORD PROCESSOR

**Francis Samish  
Granada Technical  
Books Ltd  
Paperback 182 pages  
£6.95 April 1984**

This is the book designed to take the mystery out of that great status symbol of the 1980s — the Word Processor. Everybody, it seems, is supposed to know what a word processor is and what it does, but how many business bosses, or for that matter self-employed smallscale entrepreneurs, know if the WP (as it is affectionately known) is good for *them*? One thing is for certain, it is too late to ask questions and to expect impartial advice when the office-equipment rep comes to call. This is where Francis Samish's book comes into its own, with 180 pages of explanation, advice and discussion on word processing in general.

Common sense abounds in this book. A word processing machine should be judged a good buy if it is 75-85% of

what you really want: detail like how quickly a printer can reproduce an A4 page of type is considered rather more to the point than whether the processor is 16-bit or 18-bit; buying a WP is similar to buying a car — the Ford Sierra will take you from A to B and so will the Porsche, but some buyers will always consider the luxuries of the more expensive machine worth having.

In the first chapter, "What can a Word Processor do for you" the specific types of text-processing are described in clear English and some pertinent questions are asked. Is the would-be purchaser buying a piece of cost-effective office equipment or is the unit regarded as some sort of 'universal panacea' because somewhere or other a *micro* is involved? Samish makes the point that buying a secretary a WP may not necessarily make the office more efficient because it could be other non-secretarial duties that were causing the problem anyway.

The question of word processing software for micros versus a dedicated word processing system is a theme which runs implicitly through the whole book. All the book can do is present the facts so that you can decide, but to this end there are clear explanations of types of disk storage systems, types of printer and types of display.

I found the book very easy to read. At the end of each chapter there is a useful resume of the main points covered, and there is a small but adequate index. There are two appendices, one to give information and prices on specific dedicated systems, and the other to give similar information for micros with word processing software. But, as the author says, the systems listed in the appendices describe perhaps a third of the total number of suppliers and should only be taken as guidelines. However, if you're thinking of buying a WP or changing your existing one, then you should certainly buy this book before you part with between £300 and £85,000 of your (or the company's) money.

Dick Leslie







# Software News



INNOVATIVE  
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*from the professionals*

## Info-Scan

Info-Scan is an information reference and retrieval utility. It combines the features of a data base manager, a word processor and display utility.

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As with all data bases, the contents of the records may be changed at any time. They may also be deleted and have information added to them. The record contents may be printed out to any standard line printer.

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# ON THE ADVANCE

Martin Edwardes

An IBM compatible with the reputation and might of Ferranti and W. H. Smith behind it, the Advance 86B looks all set to make an onslaught onto the business market. But can it act up to its grand entrance?





**B**ritain, despite the recent acclaim of the Apricot, is not yet renowned for producing successful business machines. Now, as another assault on the international market, comes the Advance 86B, manufactured by Ferranti and with the weight of W H Smith behind it. A British micro through and through, it also claims full IBM compatibility. But will it be a success?

## LOOKS

The Advance 86B consists of three units, two of which are fixed together to form the main unit. The third component is the keyboard which slides away into a slot when not in use. When being used, it is connected to the main unit by a spiral cable and a DIN plug. Unfortunately, it needs to be disconnected when the keyboard is put away, a rather annoying design detail. The keyboard also has two little legs which can be lowered to angle the keyboard for easier typing.

There are 84 keys on the keyboard, including ten function keys and a numeric key pad. The function keys are rather unusually placed at the left hand side of the keyboard but this isn't too difficult to get used to. The keys themselves are rather tinny to use and the feeling is of a keyboard in a cheaper price range than this computer would warrant.

On top of the keyboard slot and main computer is a double disk drive. Standard 5¼" double density drives are used and this gives over 700K of external storage. The entire unit is large for a personal computer, being about 50 cm wide by 40 cm deep by 15 cm high, excluding the space taken up by the keyboard. To be fair, the Advance looks not nearly as aesthetic as the slimline Sirius or the chunky IBM PC, but it certainly isn't an ugly sister.

## EXTERNAL CONNECTIONS

The Advance has a whole series of connectors to the outside world. For video output there is a standard TV socket, a composite video interface and an RGB monitor socket. There is also a standard centronics printer interface, a joystick and a light pen port, and a DIN connector to a standard household cassette unit. For good measure, there are also four IBM PC compatible expansion slots and two other slots (the IBM slots are eight bit, the other slots are 16 bit). Finally, there is an RS232 port and a novel power out hole which means that a monitor can be driven from the main unit, and the entire system requires only one plug.

## MACHINE FACILITIES

When you switch on the Advance, its first action is to check the memory to ensure that it all works. It will then load MS-DOS from disk if one is present in drive A. BASICA can then be loaded from disc, giving you about 60,000 bytes free. The full RAM is not available from BASICA, but the video display does not swallow up any more memory. The display consists of 24 lines, and an extra line which acts as a separate 'window' at the bottom of the screen. There is some judder on the screen when it scrolls, but the display is steady enough. Owing to the difference between US and UK television standards, the text appears a little squashed vertically but it can be adjusted with a switch inside the main unit.

The Advance has several modes of display to the screen. The power-up mode is 40 characters per line, but there is also an 80 characters per line mode. This, however, is unreadable on an ordinary television screen (as, indeed, are all 80 character displays) and it is fuzzy on a monitor. This is very annoying as the usual business requirement is for an 80 character screen. There may be a monitor that produces a completely acceptable display, but I haven't found it yet. There are also two graphics modes on the Advance offering 320 by 200 pixels and 640 by 200 pixels (the latter in black and white only). The structure of this machine makes it very easy to put text and graphics on the screen at the same time. One advantage of the Advance is that store has been reserved for screen display. This shows that no memory is lost when higher screen modes are chosen, but there is also the facility for storing several screens when a lower screen mode is chosen.

The sound facilities of the Advance are very weak. Only one

voice is available and this voice is very limited, certainly there is nothing like the control available on the Atari or the Commodore 64. The sound is produced through a speaker in the main unit of the computer. Some would say that a business computer does not need a powerful sound facility, but the Advance is not just being marketed as a business machine and my home computer nowadays must compete in all functions with others on the market.

## THE BASIC

There are two BASICs on the Advance, one resident in ROM and the other loaded off disk. As the ROM BASIC is a subset of the disk BASIC, I will concentrate on the latter. The disk BASIC is an adequate application of the language, with the usual package of extra commands to handle the screen and sound facilities. There are some oddities in how this BASIC works; one is that spaces are needed before and after keywords, another is that numbers are not always printed out in the form in which they are entered — they are converted to their binary equivalent when entered and converted back from this when printed out. Advance BASIC supports integer numbers of value -32K to +32K, single precision numbers accurate to eight digits and double precision numbers accurate to 16 digits. Strings are limited to 255 characters in length but string arrays can be set up with multiple

### FACTSHEET

<b>CPU</b>	Advance 86 Model B
<b>Clock</b>	£1499
<b>RAM</b>	Intel 8086
<b>Language</b>	4 MHZ
<b>Bundled products</b>	256K
	BASICA on disc
	MS-DOS
	Perfect Writer, Perfect Speller
	Perfect Calc, Perfect Filer
<b>Dimensions</b>	50 cm x 40 cm x 15 cm
	Text 80 or 40 columns by 25 lines
	RS232 interface
	joystick/lightpen port
	cassette port
	4 x 8 bit expansion slots
<b>OS</b>	VHF, RGB and composite video output
<b>Extras</b>	MS-DOS
	IBM PC compatibility
	twin double density disc drives

dimensions. There are commands available to draw to the screen in graphics modes, and pictures are easily produced without recourse to POKEing or machine code. Pictures can either be saved to cassette or disc with reasonable ease. The sound commands offer a simple tonal SOUND command and a more complex PLAY command to play musical tunes.

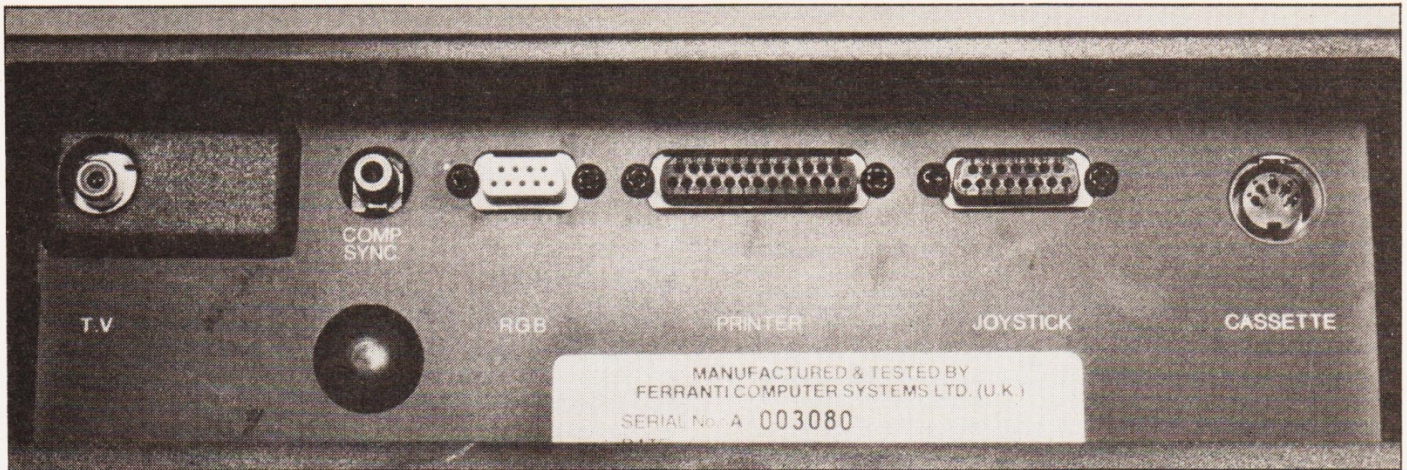
Overall, the BASIC provided is adequate and uses the machine sufficiently well, but is by no means outstanding.

## ALL INCLUSIVE

Included with the Advance Model B are four software packages that make it a plug-in-and-go small business system. First, there is MS-DOS which provides the usual facilities for disk control. Since MS-DOS is recognised as a 'good thing' it is a sensible choice for this machine, especially in the light of the compatibility of the Advance with the IBM PC.

Not only do you get MS-DOS with the Advance, but also Perfect Writer, Perfect Speller, Perfect Calc and Perfect Filer. 'Perfect' is definitely a misnomer as far as the software is concerned; adequate would really be more appropriate. But to be fair, Perfect Writer offers you a sufficiently good word processor to keep you in business until you find your ideal; Perfect Speller is another in the range of computerised (or computerized?) dictionaries. Perfect Code is a version of the spread sheet that no self-respecting business man can afford to be without these days





A view of the Advance's rear panel shows the ports available. The printer port is RS232C, while the joystick/lightpen port is a BBC-style analogue type.



The keyboard slides inside the main casing when not in use.

and Perfect Filer is a miniature database which, if you can fit all your information onto it, you don't really need. Nevertheless, a standard set of software which is worth every penny you will pay for it.

Of course, with IBM compatibility, there is access to a whole range of existing software which immediately and drastically increases the value of this machine. I have tested IBM PC software on the Advance and it *all* loaded, so it looks like the machines are really compatible.

## DOCUMENTATION

The Advance documentation covers all the bundled software, the DOS and the hardware, and the BASIC.

The software documentation is copious and easy to use — I have no complaints about it. The DOS documentation, however, left a little to be desired. Sometimes the information given was incomplete, and sometimes difficult to interpret, although it was possible for me to muddle through the more obscure parts. Whether someone of less experience could do likewise is not certain.

There is only one kind word I can think of for the BASIC documentation and that is 'inadequate'. About 70 pages were dedicated to describing Advance BASIC — it needed at least three times that number. Information is rather haphazardly spread through the manual and the index is far from comprehensive. I hope this is an area that Ferranti will look at to improve.

## CONCLUSIONS

I do think that this machine could be improved upon, but as a cheap IBM PC lookalike it does the job well. And it is very cheap — at under £1500 including VAT it is a positive bargain. Even when comparing the prices to home micros it comes out at not much more than a BBC Model B plus dual double density disc drives — and that doesn't include the bundled software.

If the Advance can break into the business machine market then it should have a rosy future: with the backing of W H Smith it should have a powerful initial boost. However, the scepticism of the British businessman is notorious ("I don't care if it is IBM compatible, I want a real IBM") and it may yet falter on the launch pad. I hope not, for this machine deserves success.







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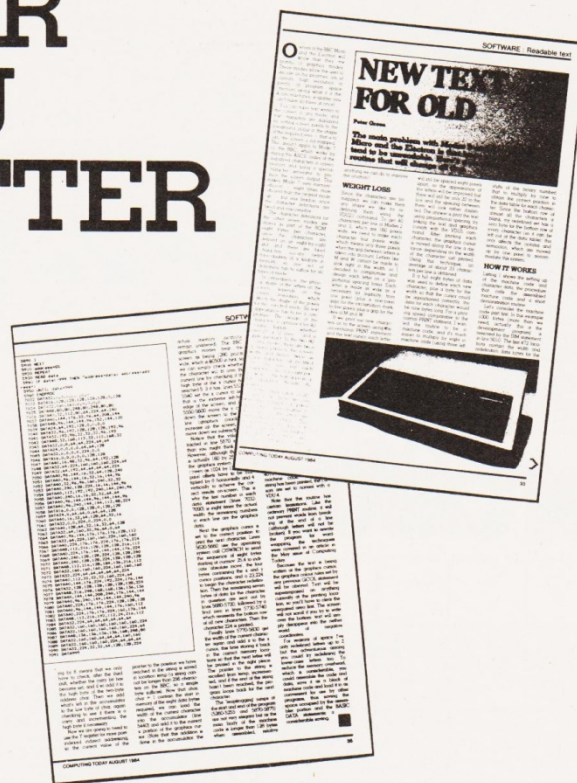
# HAVE YOU EVER THOUGHT YOU COULD DO BETTER THAN THIS?

Then why haven't you? Why not put our money where your mouth is? *Computing Today* is always on the lookout for new and interesting programs and articles for publication in the magazine. All submissions will be acknowledged and the copyright in such works, which will pass to Argus Specialist Publications Ltd, will be paid for.

If you're interested in making your hobby pay its way and you've written a program that you think suits the magazine's content, why not send it to us today with the form below (or a photocopy of it). The address is *Computing Today*, No. 1 Golden Square, London W1R 3AB: and please mark your envelope clearly 'PROGRAM SUBMISSION' so that it doesn't get confused with all the other mail we receive.

We will need a copy of your program on cassette (or disc, for some systems, if you prefer) together with clear documentation on what it does and how it does it, including a list of the major variables, and if possible some indication of how a conversion to other micros might be attempted. We would appreciate a listing of the program and any screen dumps that you feel might be useful, but not on ZX Printer paper (it doesn't reproduce very well in the magazine). Remember that CT is a general computing magazine and accepts articles for any popular computer including Commodore, Acom, Atari, Sharp, Amstrad, Sinclair, Oric, Tandy and Genie models.

If you would prefer to make a tentative approach to see if we are interested in your program *before* you put a lot of



effort into it (or to check whether we have discs for your particular machine), then that's fine too, provided it is understood that a full write-up will be required before we can publish.

Subject matter can be as broad as you like, bearing in mind that the more readers it will interest, the more likely we are to accept it. A brilliant business program that requires the simultaneous use of four disk drives probably won't be accepted! Also we tend to steer clear of simple arcade games unless, like our Frogger, they demonstrate how to use a particular machine's capabilities to the full.

## PLEASE COMPLETE IN BLOCK CAPITALS

Your name: .....

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.....

.....

Telephone number: .....

Program name: .....

Computer/memory size it runs on: .....

Amount of memory program occupies: .....

Any special peripherals required? (joystick, discs, printer (etc): .....

Have you sent your submission to another magazine? .....

Is it original or a variation on a theme? .....

Office use only



**T**here have been many articles written about player missile graphics on the Atari 400 and 800. This article outlines a detailed but easy-to-follow procedure on the subject, pared down to just the essential information.

## DESIGN YOUR PLAYFIELD

This involves you sketching out a screen layout of your game. When you have done this, annotate the sketch with the following information:

- the position and colour of all static objects.
- the resolution required to draw these objects (ie will simple block drawings suffice, or must you have fine detail.)
- the number of sprites, their colours and relative sizes.
- the range of movements of all sprites.
- the relative priorities of all objects (ie which objects will move in front of others and which will move behind).
- whether you will require any collision detection.

## DESIGN YOUR SPRITES

Sketch out on paper your designs for each of the sprites you will require. You should try to make these as simple as possible since the Atari cannot use very complex objects.

Having done this take each sketch in turn and proceed as follows:

- over the sketch draw a grid pattern of equal sized squares. Each *player* can be a maximum of eight squares wide, and each *missile* two squares wide. The height of each sprite can be up to 256 squares.
- shade in all the squares covered by the sketch.
- when you are satisfied with the result, write a '1' in each shaded square and a '0' in each blank square.
- the result will be a series of binary numbers eight bits wide. Starting from the top of your player, convert each of these into its decimal equivalent.
- the list of numbers will be used by the computer to draw your sprite. I would suggest that you add a leading and trailing zero to the data for each sprite; this ensures that it does not leave a trail when moved.

## DIMENSION ALL STRINGS

Atari BASIC demands that all strings and array variables be dimensioned before use. For my method it is essential that the following strings be dimensioned, in this order, before any other variables are used:

A\$(a), M\$(b), PO\$(c), P1\$(d), P2\$(e), P3\$(f)

The lengths are as follows:

**a**, the length of A\$, equal to the total RAM required to store the data for the players and missiles in use. You can find out the value of 'a' from Table 1.

**b, c, d, e, f** the length of the respective sprites including any leading or trailing zeros added for trail clearing. If the value of any of these is zero then you need not dimension the variable.

**TABLE 1**

Table from which to find the value of a.

	1 line resolution	2 line resolution
Missiles only	256	128
Single player	256	128
Missiles/Player 0	512	256
Missiles/Players 0,1	768	384
Missiles/Players 0,1,2	1024	512
Missiles/Players 0,1,2,3	1280	640

## DRAW YOUR PLAYFIELD

- **Select the graphics mode** To decide which mode you will use, choose the most suitable mode from Fig. 1.

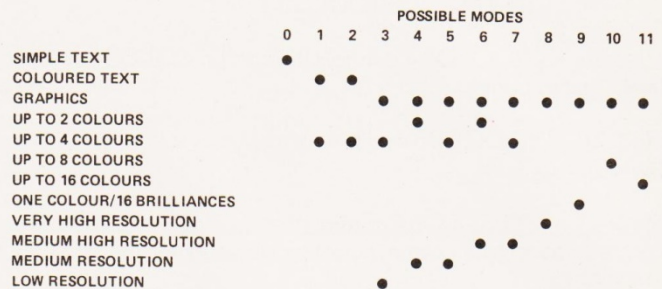


Fig. 1. If you require text below the graphics area, add 16 to the graphics mode chosen.

- **Select the playfield colours** Set up the playfield colour registers using the five SETCOLOR commands. The general form of the command is:

SETCOLOR (register number),(colour number),(luminance)

**TABLE 2**

Colours available when setting up SETCOLOR commands.

0 grey	8 light-blue
1 gold	9 turquoise
2 orange	10 green-blue
3 red-orange	11 green
4 pink-blue	12 deeper-green
5 purple-blue	13 deep-green
6 blue	14 yellow-green
7 blue	15 gold

The available colours are as seen in Table 2. Having set up the registers you may call them using the COLOR command. The registers corresponding to each COLOR are

COLOR 0 - SETCOLOR 4 (byte 712)

COLOR 1 - SETCOLOR 0 (byte 708)

# ATARI ANTICS PART 1

G. Lawrence

**A step-by-step approach to player missile graphics on the Atari which will enable all but the most raw beginners to program their own sprites.**



COLOR 2 - SETCOLOR 1 (byte 709)  
COLOR 3 - SETCOLOR 2 (byte 710)

except for mode 8 upwards, which are as follows:

Mode 8 - COLOR 0 - SETCOLOR 2  
COLOR 1 - SETCOLOR 1

Mode 9 - SETCOLOR 4 controls the colour. COLOR number controls the luminance.

Mode 10 - the COLOR number corresponds to the register number (byte 704 to 712).

Mode 11 - SETCOLOR 4 controls the luminance. COLOR number controls the colour (same numbers as used for the SETCOLOR command).

- **Draw playfield image** Using the graphics mode and colours selected previously draw your chosen playfield.

## SET THE DIRECT MEMORY ACCESS CONTROL

- **Choose playfield width** None - A=40, Narrow - A=41, Normal - A=42, Wide - A=43.

- **Choose resolution** The resolution determines the maximum number of bytes needed to define each sprite. You may use either 256 single line bytes or 128 two line bytes.

Two line resolution - A=A  
One line resolution - A=A+16

- **Do you require missiles?**

Yes - A=A+4

No - A=A

- **Now POKE the DMA control byte (559) with the value of A.**

## SELECT AN AREA OF RAM FOR THE PMG DATA

- Decide where you wish to store the data. Normally the best place is just below the display list. The page number of this area is found by using PEEK(742), which gives the page number of the display list.

- Determine the amount of space required for your data, if you are using one line resolution this will be 2K (ie eight pages), if two line resolution it will be 1K (ie four pages). Call the number of pages N.

- Having decided on these two, calculate the value:

$$V = \text{PEEK}(742) - N$$

- The start of the PMGRAM area must lie on a 1K boundary for two line resolution or a 2K boundary for one line resolution. Calculate this as follows:

$$\text{2 line resolution - Start} = 8 * \text{INT}(V/8)$$

$$\text{1 line resolution - Start} = 4 * \text{INT}(V/4)$$

- Tell the Atari where the PMG RAM is - POKE 54279, START

## CLEAR THE PMG DATA AREA

We clear the area by POKEing zeros to all the bytes of the sprites in use by either BASIC POKEs, machine code pokes or by string handling techniques. I will opt for the third method which is quick and simple.

- Determine the start of the variable address table (VT).

$$VT = \text{PEEK}(134) + 256 * \text{PEEK}(135)$$

- Determine the start of the variable data area (AT).

$$AT = \text{PEEK}(140) + 256 * \text{PEEK}(141)$$

- We must now fool the computer into thinking that our PMG area is a string. In fact we will con it into believing that the first string dimensioned lives at this place. To do this we alter the variable address in the table until it points to the first byte of the first sprite. This address is stored as an offset from the start of the variable data area, so we must calculate the offset of our area from AT.

$$\text{OFFSET} = \text{START OF FIRST SPRITE} - AT$$

where the start of the first sprite is as follows:

Missiles in use: (V\*256)+768 For 1 line resolution.  
(V\*256)+384 For 2 line resolution.  
No missiles : (V\*256)+1024 For 1 line resolution.  
(V\*256)+512 For 2 line resolution.

- We must now convert OFFSET into the two byte configuration ready to poke into the variable address table:

$$\text{High} = \text{INT}(\text{OS}/256); \text{Low} = \text{OS} - \text{High} * 256$$

$$\text{POKE VT+2, Low}; \text{POKE VT+3, High}$$

where OS = OFFSET

- Now we can clear the area by

$$A\$(1) = \text{CHR}\$(0); A\$(x) = \text{CHR}\$(0); A\$(2) = A\$(x)$$

where x = length of RAM area.

## DRAW YOUR PLAYER

- Design your players as described earlier, including the correct number of leading and trailing zeros to ensure the player does not leave a trail when moved. Store this data as a series of DATA statements.

- Use these DATA statements to load up the strings PO\$, P1\$, P2\$ and P3\$. These strings will be used as substrings and moved around the main PMG string area. For example:

```
FOR W = 1 TO LEN(PO$)
  READ X: PO$(W, W) = CHR$(X)
NEXT W
```

When you come to enter this replace LEN(PO\$) with the actual length of PO\$.

- Determine the vertical position you wish your player to start at. Assign the player to its correct vertical position:

$$A\$(V + (256 * X), V + (256 * X) + (\text{player length} - 1)) = \text{PX}\$$$

where V = vertical position of player number X

## DRAW YOUR MISSILES

The missiles are all defined using data stored in the same area of memory. Each missile takes its data from two bits of each byte. The bit assignment is as follows:

Missile 0	bits 0,1
Missile 1	bits 2,3
Missile 2	bits 4,5
Missile 3	bits 6,7

The best procedure to follow is to draw a grid eight squares wide by 256 squares high, then to section this off into four columns. This forms the grid upon which you can draw your missiles in their correct vertical positions. This is essential since the data for all four missiles must be combined into bytes so that we can form the decimal equivalents.



Once we have assigned the missiles and converted them to decimal, we must store them in the missile data area. If you intend moving the missiles as individuals you will probably do this with READ/DATA; I will be using them as an entity so I will again use strings:

```
FOR W = 1 TO LEN(M$)
  READ X:M$(W,W) = CHR$(X)
NEXT W
```

When you come to enter this, replace LEN(M\$) with the actual length of M\$.

## ASSIGN COLOURS TO PLAYERS AND MISSILES

The players (and their corresponding missiles) take their colour data from bytes 704 to 707 which can only be set using POKE. The value to POKE is found from the formula:

$$\text{value} = (\text{colour no.} * 16) + (\text{luminance})$$

When you opt for the fifth player option (see later) all missiles will be the same colour as SETCOLOR 3.

## SELECT WIDTH OF EACH PLAYER

Each player can be in a choice of three widths — normal (8 pixels wide), double (16 pixels wide) or quadruple (32 pixels wide). It is important to realise that these are electronic expansions; they do not increase the resolution. To select the width of each player POKE its width register (53256 to 53259) with one of the following:

- 0 normal width
- 1 double width
- 3 quadruple width

## SELECT WIDTH OF EACH MISSILE

The same rules governing the width of missiles apply as above. This time, however, there is only one byte as the register — 53260. The width choices are stored as bit pairs thus:

- Missile 0 bits 0,1
- Missile 1 bits 2,3
- Missile 2 bits 4,5
- Missile 3 bits 6,7

I find it easiest to draw out a small grid eight squares wide and to fill in each pair of squares with the binary conversion of my choice. When finished, the process is completed by turning this byte into its decimal equivalent which is POKEd into 53260.

## SET UP HORIZONTAL POSITION OF PLAYERS

The horizontal position of the players are controlled by the four registers 53248 to 53251. They are set by a simple POKE, the value normally being in the range 45 to 210. Outside this range the character is drawn off screen and so is invisible.

## SET UP HORIZONTAL POSITION OF MISSILES

For the purposes of horizontal positioning, the four missiles are regarded as independent objects and their positions can be individually set using the four registers 53252 to 53255.

If you wish to make them appear as a single object you may have to give them differing position values.

## SELECT SCREEN PRIORITIES

- Select from the following:

Graphics mode	P
0 to 8	0
9	64
10	128
11	192

**TABLE 3**

Possible overlap colours when players cross.

Colour of 1st player	Colour of 2nd player	Overlap
grey	any	as 2nd player
gold	orange	pink
gold	lilac	light blue
gold	light blue	medium blue
gold	light green	medium green
red-orange	blue	green
red	mauve	blue
lilac	blue	green
lilac	green	gold

- Do you wish the four players to be assigned the same colour as SETCOLOR 3, ie be useable as a fifth player?

Yes — P=P+16

- When your players cross each other, do you wish for the overlap to be in a third colour (see Table 3); if you do then P=P+32.

- Select your priorities from the following:

C0/C1/P0/P1/P2/P3/C2/C3/background	P=P+8
C0/C1/C2/C3/P0/P1/P2/P3/background	P=P+4
P0/P1/C0/C1/C2/C3/P2/P3/background	P=P+2
P0/P1/P2/P3/C0/C1/C2/C3/background	P=P+1

In addition it is possible to make the overlap of P2 or P3 with the playfield appear black using the following:

P=P+3	as for P=P+2 above
P=P+5	as for P=P+4 above
P=P+6	as for P=P+4 above
P=P+7	as for P=P+1 above

The value P=P+0 renders the overlap in another colour.

- Having determined the value for P, POKE this into the Priority Select Byte 623.

## CLEAR ALL COLLISION REGISTERS

This is done by POKing any value into the control register, 53278.

## ENABLE THE DISPLAY

To make your sprites visible and ready for action, POKE the enable byte 53277 with one of the following:

missiles only	1
players only	2
both	3

Your sprites are now ready for action. There are four possible directions in which they may move: horizontal, vertical, diagonal or in/out.

## HORIZONTAL MOVEMENT

By increasing or decreasing the value stored in the horizontal position registers at 53248 to 53255, it is possible to move the sprites. An increase moves the sprite towards the right, a decrease, towards the left.

## VERTICAL MOVEMENT

The Atari has no built in routines for vertical motion, instead we must design our own routines using either BASIC or machine code. The method used here is a BASIC routine using strings.

- Designate the PMG RAM area as a string using the techniques



Listing 1. A demonstration program of the techniques used in this article.

```

10 REM ** SET UP STRINGS
20 DIM A$(1024),P0$(20),P1$(20),P2$(20),P3$(30)
30 REM ** DRAW PLAYFIELD
40 GRAPHICS 7+16
50 SETCOLOR 0,0,15:REM ** COLOR 1 = WHITE
60 SETCOLOR 1,1,8:REM ** COLOR 2 = ORANGE
70 SETCOLOR 2,0,0:REM ** COLOR 3 = BLACK
80 SETCOLOR 4,9,9:REM ** BACKGROUND = BLUE
90 COLOR 1:FOR W=50 TO 60:PLOT W,80:DRAWTO W,30
:NEXT W
100 COLOR 2:FOR W=51 TO 59:READ A,B:PLOT W,A:DRA
WTO W,B:NEXT W
110 DATA 25,25,26,24,27,23,28,21,25,20,28,21,27,
23,26,24,25,25
120 COLOR 3:PLOT 55,30:DRAWTO 55,26
130 REM ** SELECT DMA CONTROL
140 POKE 559,62
150 REM ** SELECT RAM SPACE
160 P=96:REM ** 32K MACHINES ONLY - 48 FOR 16K M
ACHINES
170 POKE 54279,P
180 REM ** CLEAR RAM SPACE
190 C=256
200 VT=PEEK(134)+C*PEEK(135)
210 AT=PEEK(140)+C*PEEK(141)
220 OS=(P*C)+1024-AT
230 H=INT(OS/C):L=OS-H*C
240 POKE VT+2,L:POKE VT+3,H
250 A$(1)=CHR$(0):A$(1024)=CHR$(0):A$(2)=A$
260 REM ** DRAW PLAYERS
270 FOR W=1 TO 18:READ A:P0$(W,W)=CHR$(A):NEXT W
280 DATA 0,0,126,129,153,129,66,36,126,126,36,66
,129,153,129,126,0,0
290 FOR W=1 TO 18:READ A:P1$(W,W)=CHR$(A):NEXT W
300 DATA 0,0,0,126,102,126,60,24,0,0,24,60,126,1
02,126,0,0,0
310 FOR W=1 TO 18:READ A:P2$(W,W)=CHR$(A):NEXT W
320 DATA 0,0,0,0,0,126,129,66,126,126,66,129,126
,0,0,0,0,0
330 FOR W=1 TO 27:READ A:P3$(W,W)=CHR$(A):NEXT W
340 DATA 0,0,0,0,126,255,255,255,126,60,24,24,12
6,126,126,24,24,60,255,255,255,255,126,0,0,0,0
350 REM ** POSITION YOUR PLAYERS
360 V=80:V1=173
370 A$(V,V+17)=P0$:PV0=80
380 A$(V+256,V+273)=P1$:PV1=336

```

```

390 A$(V+512,V+259)=P2$:PV2=592
400 A$(V1+768,V1+794)=P3$:PV3=941
410 REM ** ASSIGN COLOURS
420 FOR W=704 TO 707:READ A:POKE W,A:NEXT W
430 DATA 192,220,192,153
440 REM ** SET UP PLAYER WIDTHS
450 WP=53256
460 POKE WP,0:POKE WP+1,0:POKE WP+2,0:POKE WP+3,
1
470 REM ** SET HORIZONTAL POSITIONS
480 H0=53248:H1=H0+1:H2=H0+2:H3=H0+3:Z=0
490 POKE H0,80:POKE H1,80:POKE H2,Z:POKE H3,60
500 REM ** SELECT SCREEN PRIORITIES
510 SP=623:S1=17:S2=20
520 POKE SP,S1
530 REM ** SET UP A SPECIAL DLI
540 DL=PEEK(560)+C*PEEK(561)+75
550 POKE DL,PEEK(DL)+128:POKE 512,0:POKE 513,6
560 FOR W=1536 TO 1555:READ A:POKE W,A:NEXT W
570 DATA 72,169,28,69,79,37,78,141,10,212,141,26
,208,169,0,141,21,208,104,64
580 POKE 54286,192
590 REM ** ACTION
600 POKE 53277,3:REM ** ENABLE DISPLAY
610 B=1:R=99
620 X=1000:Y=2000:S=3000
630 FOR W=80 TO 119:IF W>99 THEN B=-1
640 GOSUB X:GOSUB S:W=W+1
650 GOSUB Y:GOSUB S
660 NEXT W
670 POKE SP,S2
680 FOR W=119 TO 80 STEP -1:IF W<100 THEN B=1
690 GOSUB X:GOSUB S:W=W-1
700 GOSUB Y:GOSUB S
710 NEXT W
720 POKE SP,S1:GOTO 630
730 END
999 REM ** WINGS OPEN
1000 POKE H0,W:POKE H1,W:POKE H2,Z:POKE H3,2*W-R
1010 A$(PV0,PV0+17)=P0$:A$(PV1,PV1+17)=P1$
1020 A$(PV3,PV3+26)=P3$
1030 RETURN
1999 REM ** WINGS CLOSED
2000 POKE H2,W:POKE H3,Z:POKE H0,Z:POKE H1,Z
2010 A$(PV2,PV2+17)=P2$
2020 RETURN
2999 REM * AMEND VERTICAL POSITIONS
3000 PV0=PV0+B:PV1=PV1+B:PV2=PV2+B:PV3=PV3+B
3010 RETURN

```

described earlier.

- Do likewise for the sprites.
- Move each player using a line of the form:

$$A$(w,w+L) = PX$$$

where X is the player number, and L the length of that player - 1. The variable w defines the position of the player in the string A\$. To determine the value of w, first decide on the resolution, whether the missiles are in use, determine the new position of player V, and set the player number X. Then the value of  $w = (X * r) + (m) + V$  where  $r = 128$

is a two line resolution,  $r = 256$  a one line resolution,  $m = 0$  means no missiles and  $m = r$  means the missiles are in use.

## DIAGONAL MOVEMENT

A combination of the above.

## IN/OUT MOVEMENT

This may be simulated by using the width options, by switching to players drawn on different scales, or by combining players.

## COLLISION DETECTION

Whenever a collision occurs between two players, a player and missile, a player and the playfield or a missile and the playfield, a bit is set in one of the 16 collision registers, see Table 4.

If you wish to test more than a few of these you will have to dive into machine code, but as an introduction there is a short section in the demo program that shows the collision in use by the simple method of varying the frequency of a sound channel.

If you wish to clear the collision registers a simple POKE of any number into the register at 53278 will achieve this.

## REMOVING SPRITES FROM THE SCREEN

To remove sprites from the screen, either set the horizontal position registers to zero or set all the bytes in the sprites to zero, then disable the sprites with:

POKE 559,34:POKE 53277,0



TABLE 4

The 16 collision registers.

missile 0/playfield	53248
missile 1/playfield	53249
missile 2/playfield	53250
missile 3/playfield	53251
player 0/playfield	53252
player 1/playfield	53253
player 2/playfield	53254
player 3/playfield	53255
missile 0/player	53256
missile 1/player	53257
missile 2/player	53258
missile 3/player	53259
player 0/player	53260
player 1/player	53261
player 2/player	53262
player 3/player	53263



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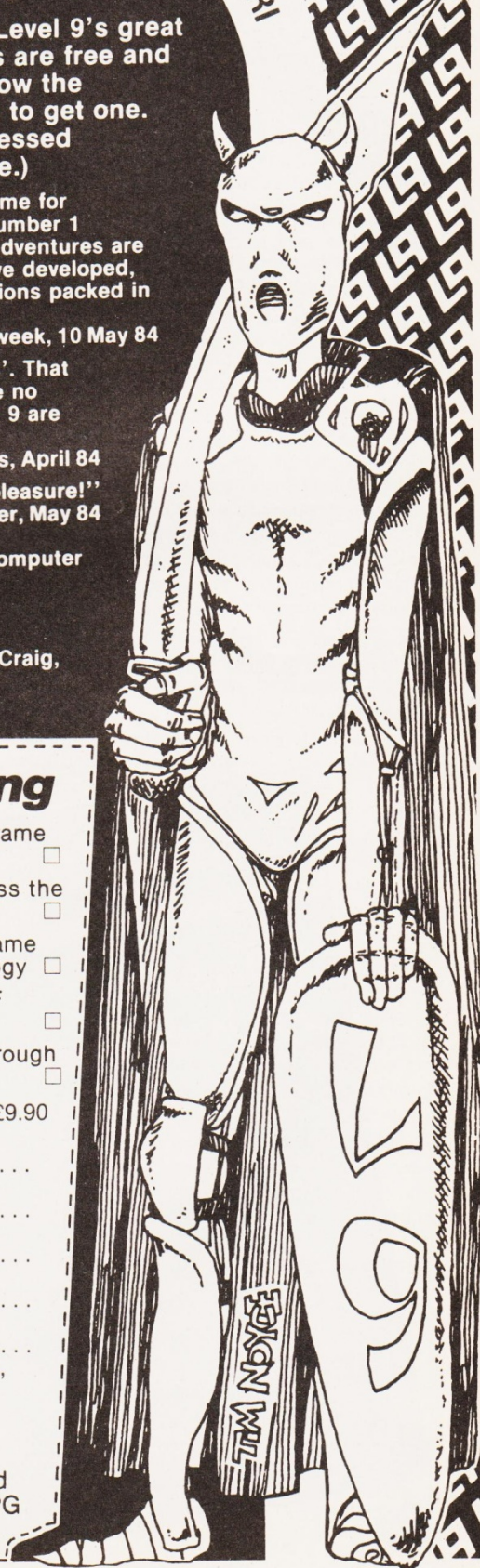
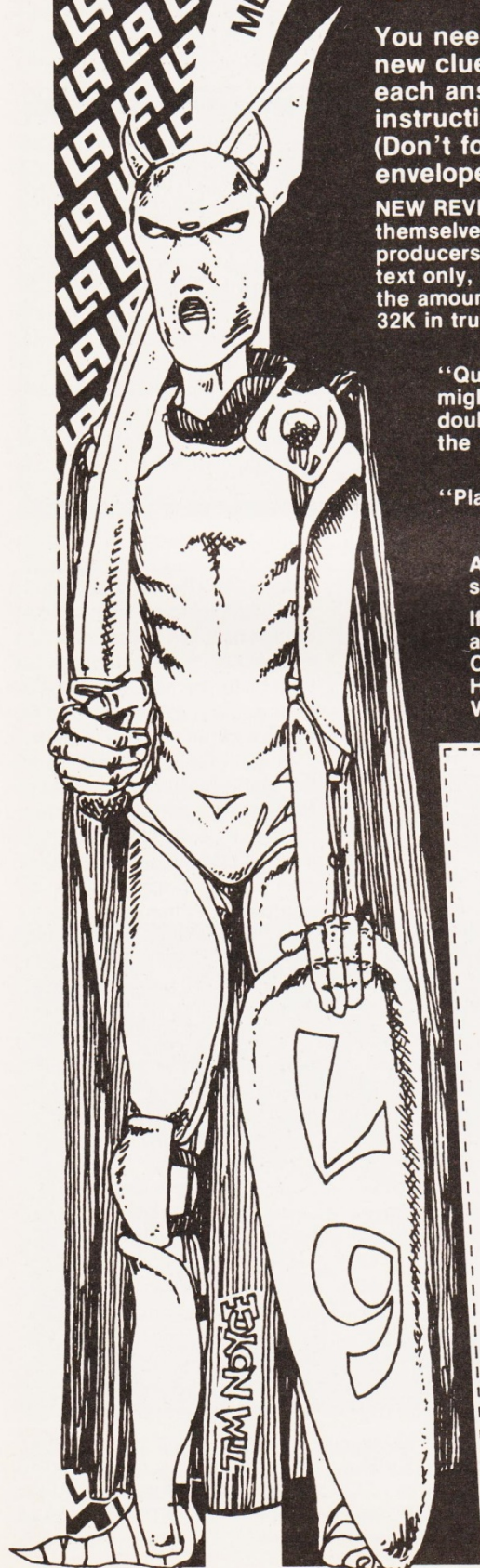
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In Adventure gaming, the one all-time classic program has to be the Crowther and Woods original that was written circa 1978. Called simply 'Adventure', it has become the standard by which its successors are measured, and although it was originally written on a large mainframe computer, a great many software houses have had a stab at making it fit into the meagre memory of the common or garden home computer.

Latest company to attempt this is Melbourne House, who have produced a version for the Commodore 64 and called it, with due deference to the original, Classic Adventure. Commodore owners who realise how big text adventure programs can be, are probably groaning at the thought of horrendous loading times for this game, but fear not. Melbourne House have used the Pavlodafastloadingsystem on this tape which cuts the loading time to only three minutes. A friend of mine said that his review copy of Classic Adventure only loaded one time in four under Pavlodafastloadingsystem, but I've had perfect loads every time I've tried it (about half-a-dozen attempts). So the system seems to work fine, and my friend was unlucky.



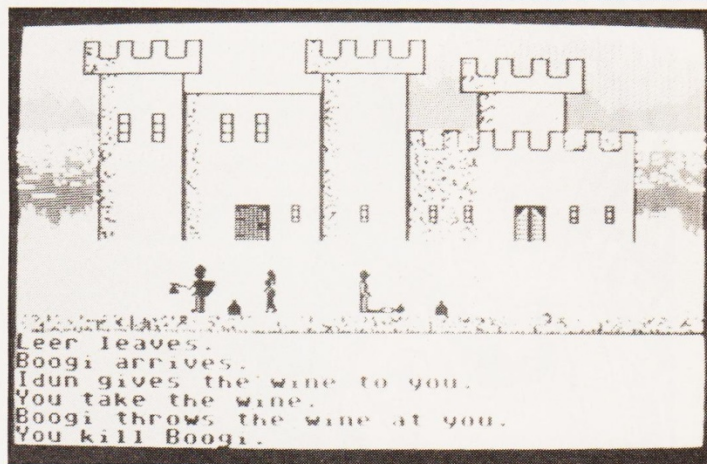
# ADVENTURES

Alan Newman

**A trip into the fantasy world of adventure again, this month with a look at two 'classical' pieces of software for the Commodore 64, and a revolutionary bit of programming for the Spectrum.**

As to the plot, if you haven't heard it already, you begin the Adventure outside a building. By exploring a little, you soon find your way into the fabulous Colossal Caves, where many a treasure may be found and taken. But of course, things are never quite that simple. There are many puzzles to solve, such as getting up to an opening which is far too high to reach. Nasty characters are lurking in the caves with evil intent towards you and your precious belongings. Magic works in the caves, and it's up to you to use it properly. And there is a delightful little twist involving a vase which generally has those not in the know stamping their feet in frustration!

Interaction with the computer is by the usual one or two word command sequence, such as DROP KEYS or CLIMB. The computer will let two-finger



A moment of high drama in Valhalla as you kill Boogi.

typists get away with only the first four letters of a word. Don't forget to have a large piece of paper to hand — map-making is essential, especially when charting the maze (it *can* be done!). And finally — have fun.

## NORSE OF A DIFFERENT COLOUR

Our second game this month also has a 'classical' touch to it, although in this case it's classical Norse mythology which is the subject matter. Valhalla by Legend is a Commodore 64 version of their original Spectrum game, and on the whole I think it's a definite improvement. This is unusual for me, as I am generally of the opinion that, although machines like the BBC and the Commodore have far more sophisticated graphics facilities than the Spectrum, a good programmer can get screens with a much better visual appearance on the latter. For example, I have seen the Commodore and Spectrum versions of Trashman running side by side and the Spectrum game simply looked more real, somehow.

However, Valhalla on the Spectrum had little stick figures

representing the various characters, while this new version finds them a bit more fleshed out and realistic. And it's so much easier typing in commands on the Commodore keyboard than on the Spectrum's pencil erasers.

In Valhalla you find yourself travelling through the world of Norse myths: a world populated by giants, dwarves, and gods such as Thor (cheer), Loki (boo) and Odin. Each of the 36 characters in the game has its own personality make-up, and the way they react to each other and to you depends on this and on your actions. If you act good, the bad guys will hinder you. If you start attacking the good guys, Loki and co. may well co-operate.

The game is played out on a screen with three windows: a high res upper section that shows your location graphically, and on which the characters move and fight; a low res text section for messages from the computer; and an input window where your typed commands appear. Clever machine code interrupt programming is involved in getting different parts of the screen in different graphics modes, but there is a hint of crawl at the window borders; rather a carping criticism, I admit.



Valhalla contains six adventures, each of them being a quest for a special object that was hidden somewhere in the game world. You must find the objects in the correct order, however, and fortunately there is a save game feature because this will probably take you a long time!

The game is unusual in that dying, either from hunger or fighting, is not the end of things. You simply end up in Hell, just another part of the game world.

Since all the characters have completely independent behaviour, it can be quite entertaining to just watch people wandering in and out of the scene (sometimes for no apparent purpose), picking things up and giving them to each other, throwing food at each other (a good way to start a fight), and generally behaving in a soap-opera sort of way. You even have your own moral guardian in the game: if you type in a rude word out of frustration, the dwarf Mary stalks in from stage right and slaps you round the face. A nice touch (no pun intended).

This can be a quite addictive game to play, even if you don't seem to be accomplishing much (like me!). The large number of independent 'people', the expanded command structure (you can ask other characters to do things for you), and the interactions possible, make Valhalla quite absorbing. I could imagine people getting quite involved in this world: perhaps a fan club with T-shirts

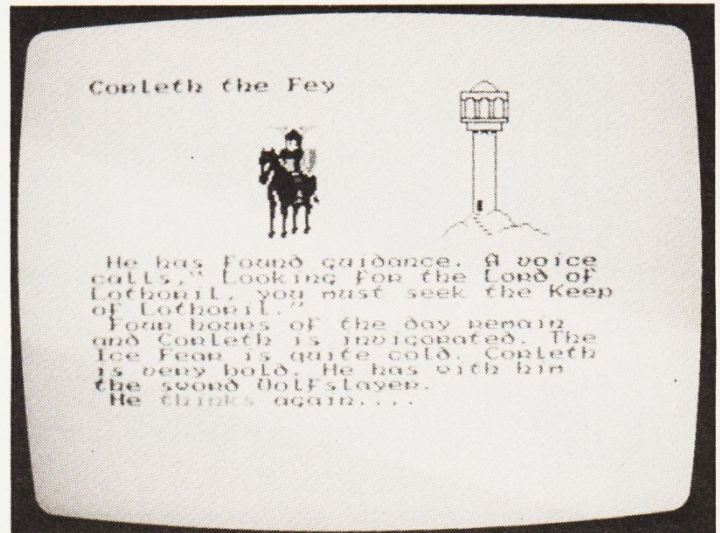
saying "Bragi says REAL-AXE" (sorry!).

## EPIC CURE

Bored with your Spectrum? Fed up with the same old types of game? Look no further — the Lords of Midnight will refresh the memory locations other programs cannot reach. Definitely an epic that will cure your boredom.

The Lords of Midnight is a graphics adventure game from Beyond Software for the 48K ZX Spectrum that has some of the most amazing graphics I've seen on this machine. First, the scene you see on-screen is what your character can actually see in the direction he is looking from his current position. Beyond claim that the game can show 32,000 different views; since you can look in eight directions I deduce that the roughly square map contains 4000 separate locations, making it about 64 by 64. This should be big enough for the most claustrophobic of adventures.

What is more astounding is that, as you move your character from location to location, the scene changes *instantaneously* to show the new view. This is impressive, to say the least particularly so when you bear in mind that there are 15 different types of 'object' that can be displayed (such as mountains, towers, forests and armies), and that each has to be scaled down so that the scene appears in true perspective. The results are very good indeed, and



The Lords of Midnight uses a character's 'thoughts' as a means of showing the player his current status and any artifacts found, or other game interactions that may have occurred. Here Corleth has found guidance from one of the Wise.

show how a single brilliant programmer can still outdo a team of writers. Congratulations to Mike Singleton for this 'landscaping' feature, as he calls it. I am impressed.

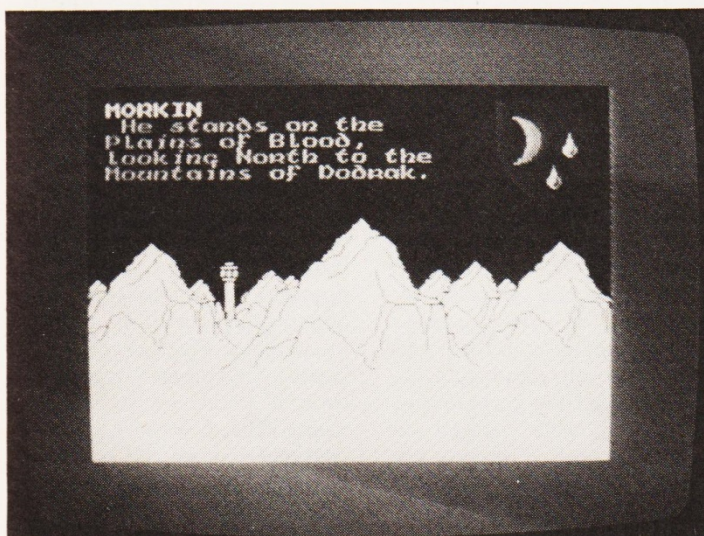
The word epic is apt: the play area is huge, you start by controlling four characters (independent of one another) and you can recruit more individuals and their armies along the way. The idea is that Luxor the Moonprince and his son Morkin, together with Corleth the Fey, Rorthon the Wise and anyone else you can recruit, have to defeat the evil Doomdark and his Ice Fear which threatens the Land of Midnight. There is much more to all this than I can possibly tell you in the restrictions of this article; indeed, Beyond's instruction book is 32 pages long and includes a 16-page fantasy story setting the scene for the game scenario. If you like rich and complex imagery, detailed

characterisations and a complicated strategy-based game, this is a must.

Game play is relatively simple: Beyond supply a keyboard overlay for the Spectrum and all commands are made by pressing the relevant button for the particular option. Play proceeds on a day-to-day basis: the amount and distance a player can cover in a day depends on his state of health and the terrain. At the end of the day, when you have moved all your characters as you wish, night falls and the computer assimilates the information and moves Doomdark's armies around. This is one of the few problems with the game: the Spectrum has a great deal to thing about and dawn takes quite a while to make an appearance.

This is not a game which will bore you after a few hours' play. It is complex, requires a great deal of thought and planning and a fair bit of experimentation to discover the limitations of your characters. The first time I played it, I managed to kill off all four main characters within six game-days, which must be something of a record. Now I'm doing rather better, but I'm nowhere near defeating Doomdark yet.

At the risk of sounding like someone on Beyond's payroll, I cannot recommend this game enough to those who want a challenge and are fed up with arcade games. The only problem is that you may find those game-days and nights eating up large chunks of the real thing!



A sample scene from the Lords of Midnight: landscaping provides a realistic perspective view of the game world as seen through the character's eyes. This is cleverly done — you have to look very closely to realise that all the mountain peaks are different-sized versions of a basic master.

## WHERE TO ENQUIRE

Melbourne House,  
Castle Yard House,  
Castle Yard,  
Richmond,  
Surrey TW10 6TF

Legend,  
PO Box 435,  
Station Road,  
London E4 7LX

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# BBC DRAUGHTS

John Owen

**A blow by blow account of BBC programming and some software that turns your Beeb into a mean opponent.**

I feel that I should begin by confessing that, although I've been writing programs and dabbling generally in home computers for quite some time, I'm a relative newcomer when it comes to the BBC micro. Accordingly, writing this program has necessitated my taking frequent excursions into the depths of the 'User Guide' in order to find out how to do what, by now, comes naturally to others. In fact, one of the main reasons for attempting this program in the first place was not only to educate myself in some of the finer points of the BBC Micro itself but also to enforce a guided tour of the User Guide.

It's not that the User Guide isn't comprehensive — because it is — it's actually *finding* the information that I have trouble with. As an example, 'How To Create Your Own Graphics Characters', on page 170, first refers us to page 486 to see how the existing characters are made and then suggests we see page 384 for more details. With one finger in page 170 and another in page 486, I turn to page 384. After a bit more information we're referred to page 427. So, with my thumb in page 384, I turn to page 427 where \*FX20 ('explode character' definitions) is explained. But what's this OSHWM? Ah! see page 431 for more information. I take my finger out of page 170 to keep my place on page 427, while I turn to page 431. . . . ! Actually, to be fair, I suppose the User Guide does a pretty good job in striking the right balance between giving sufficient information for the more advanced program-

mer and not frightening the life out of newcomers, such as myself.

So, 'Draughts' it was to be; but where to start? Drawing the board seemed as good a place as any and the screen mode more-or-less chooses itself. A four or sixteen colour mode seems best but the problem with Mode 5 is that it only permits twenty characters to a line. By the time the computer's printed its move and provided space for you to type in yours, there isn't much room left on the board! So, Mode 5 is out and so is Mode 2 for the same reason. For me, this is one of the few disappointing features of the entire BBC micro. It's a pity that the one only mode which offers hi-resolution graphics in sixteen colours should have such large (and ugly?) text. So, with apologies to Model A owners, it has to be Mode 1. This mode also has the advantage that (other than Mode 4, which only offers two colours) it's the only mode which has square pixels. This reduces to some extent the mental gymnastics required to plot a square board on the screen. It does, however, devour 20K of memory, leaving only a little over 8K for the program and BASIC's variable storage-area. It is for this reason that the game instructions are very short and to the point but it is assumed that you will already know how to play draughts anyway!

The choice of colours for the board is really a matter of personal preference. My television seems to like blue so I decided to make the board's squares black and blue. A dip into the User Guide reveals that we can't have blue in

Mode 1 unless one of the other colours is re-defined. As my television doesn't like red at all, logical colour red is made actual colour blue. VDU 19,1,4,0; does the trick as part of the initialization procedure, PROCinit. The draughts men/pieces/counters/chips (what do you call them?) will also be defined during this procedure but it seems sensible to draw the board first in order to establish what size the 'men' will have to be.

## THE CORRECT PROCEDURES

PROCboard draws the board by calling two further procedures, PROsquare and PROCbox. PROCsquare is called twice, being inside a pair of nested loops on each occasion. This part of the procedure could be speeded up by converting the various MOVEs and PLOTs into their VDU equivalents and stringing the lot together in one VDU command. There's obviously nothing to stop you doing this — I left them as they are because I think it makes the program more readable and easier to follow what's going on. The procedure PROCbox simply provides a white edge to the board and prints the co-ordinates of the board's squares across the bottom and down the left hand side. In order to print the co-ordinates accurately with respect to each square, they are positioned with the graphics cursor by using the VDU 5 command. The tortuous-looking line PRINT; CHR\$( (X DIV 100)+96) inside the 'FOR . . . NEXT X' loop, prints the lower-case letters a to h across the bottom of the board and

the similar line inside the 'FOR . . . NEXT Y' loop prints the figures 0 to 7 up to the left-hand side. VDU 4 ensures that subsequent printing will be safely under the control of the normal text cursor.

Now that we can view the board, we are in a better position to judge the size of the character for each man and can finally get round to PROCinct. This procedure fills an eight-by-eight array (representing the board) with -1s, 0s and 1s. The -1s represent the computer's men, 0s represent blank squares and 1s are your men. VDU 19,1,4,0; has been mentioned before and sets the colour 1 to blue. VDU 28, 28, 31, 39, 0 sets up a text window at the right hand side of the screen and VDU 23,240 defines character 240 as the normal man. I defined it as a simple solid square but you can obviously choose any square you want. Character 241 is defined as a similar shape but it has a cross in the centre. This character is used when you reach the 'end' of the board and your man is queened.

\*FX 202,255 turns off the CAPS LOCK so that you can type in the lower case co-ordinates for your move. Incidentally, \*FX 202 does not seem to be documented in the User Guide but it is used to read or write the keyboard status. Besides \*FX202,255, I've found \*FX 202,144 useful for turning the CAPS LOCK off and the SHIFT LOCK on. \*FX 202, 239 turns the CAPS LOCK back on. This is used in line 210 of our program to return the keyboard to its 'normal self' at the end of the game.

The main body of the program is between lines 70 and 130. Having set up the starting positions of the pieces in the array 'board' and plotted the bare board on the screen, the program then displays the current positions of the pieces by calling PROCdisplay at line 80. This procedure is fairly straightforward and, again uses VDU 5 (print at the graphics cursor) in order to position the pieces accurately. Each square of the board is checked against the array and, at the same time, two variables I and J are calculated for the 'MOVE I,J' command. This is the graphics-cursor's equivalent of





TAB(X,Y), the variables I and J providing the coordinates for the square which is currently under examination in the array.

The graphics colour is set according to whether the board location is blank or contains a computer's piece or one of yours. As the blank squares can be either black or blue, the colour of these squares is set by reading the screen just inside the appropriate square.

IF board (X,Y) = 0 THEN GCOL0, POINT(I-10, J).

If the array at any particular location contains either 2 or -2, then the piece at that location is a queen and a variable (called queen) is set to 1. The appropriate character is then printed. Note that characters are printed even in

the blank squares but they are set to the appropriate squares' colour. It's necessary to do this in order to blank out any pieces which may have been moved since PROCdisplay was last called. It's not sufficient to simply print a blank character (ie a space) because we are printing at the graphics cursor and a space would be *superimposed* on any character already there rather than actually blanking it out. Before leaving PROCdisplay, control is returned to the text cursor (VDU 4) and the text cursor is turned off with VDU 23,1,0;0;0;0;

You are now requested to enter your move, by calling the procedure PROCyourgo. This procedure begins by clearing part of the text area using PROCclear, switching the text colour to white, print-

ing "YOUR MOVE" and turning the text cursor on. The co-ordinates of your move are obtained by calling PROCinput which inputs the co-ordinates of the piece you are going to move into the variables E and H and those of the square you wish to move to into A and B. You'll see why I didn't use longer, more meaningful, variable names when we look at PROCinput. The board array is updated and your move is displayed by calling PROCdisplay again.

PROCinput is a bit unusual and deserves a more detailed explanation. Lines 1910 to 2070 can be summarised as:

REPEAT

Input move co-ordinates

UNTIL all conditions are met.

So why are there four separate REPEAT... UNTIL loops? This is because of a peculiarity in the way BBC BASIC deals with lines containing multiple conditions. For example, in the line:

UNTIL (condition A) AND (condition B),

even if (condition A) is false, BBC BASIC still insists on testing (condition B). Consider this short program:

```
10 DIM array(7)
20 INPUT X
30 IF array(X) = 99 THEN ..
```

Obviously, if a value of more than 7 is input in line 20, BASIC will protest with a "subscript" error at line 30. With non-BBC BASICs, this possibility can be trapped with:



```

10 ON ERROR GOTO 140
20 MODE 1
30 PROCInstructions
40 CLS
50 PROCinit
60 PROCboard
70 REPEAT
80   PROCdisplay
90   PROCyourgo
100  PROCdisplay
110  wait=INKEY(200)
120  PROCbeebsgo
130 UNTIL beeb<2 OR yours<2 OR R(0)<>-99
140 COLOUR 129 : CLS
150 IF beeb<yours THEN PRINT TAB(2,12)"YOU WIN"
160 IF yours<beeb THEN PRINT TAB(3,12)"I WIN"
170 PRINT TAB(2,16)"Another"TAB(2,18)"game? ";
180
190 Q$=GET$
200 IF Q$="Y" OR Q$="y" THEN RUN
210 *FX 202,239
220 MODE 7
230 END
240
250
260
270 DEF PROCinit
280 DIM board(7,7),R(4) : R(0)=0
290 G=-1 : Q=0 : queen=0 : A$=""
300 beeb=12 : yours=12
310 FOR X%=0 TO 7 : FOR Y%=0 TO 7
320 READ data
330 IF data=2 THEN RESTORE : READ data
340 board(X%,Y%)=data
350 NEXT Y%,X%
360 VDU 19,1,4;0; : REM colour 1=blue
370 VDU 28,28,31,39,0
380 VDU 23,240,&FFFF;&FFFF;&FFFF;&FFFF;
390 VDU 23,241,&E7E7;&E700;&E7;&E7E7;
400 DATA 1,0,1,0,0,0,-1,0,0,1,0,0,0,-1,0,-1,2
410 *FX 202,255
420 ENDPROC
430
440 DEF PROCboard
450 FOR Y%=100 TO 700 STEP 200
460 FOR X%=175 TO 775 STEP 200
470 PROCsquare(X%,Y%)
480 NEXT X%,Y%
490 FOR Y%=200 TO 800 STEP 200
500 FOR X%=75 TO 675 STEP 200
510 PROCsquare(X%,Y%)
520 NEXT X%,Y%
530 PROCbox
540 ENDPROC
550
560 DEF PROCsquare(X%,Y%)
570 GCOL 0,1
580 MOVE X%,Y%
590 MOVE X%,Y%+100
600 PLOT 85,X%+100,Y%+100
610 MOVE X%+100,Y%
620 PLOT 85,X%,Y%
630 ENDPROC
640
650 DEF PROCbox
660 GCOL 0,7
670 MOVE 75,100
680 DRAW 875,100
690 DRAW 875,900
700 DRAW 75,900
710 DRAW 75,100
720 VDU 5
730 FOR X=100 TO 800 STEP 100
740 MOVE X,50
750 PRINT;CHR$(X DIV 100)+96)
760 NEXT X
770 FOR Y=175 TO 875 STEP 100
780 MOVE 0,Y : PRINT; (Y DIV 100)-1
790 NEXT Y
800 VDU 4
810 ENDPROC
820
830 DEF PROCdisplay
840 VDU 5
850 FOR Y=7 TO 0 STEP -1
860 FOR X=0 TO 7
870 I=(100*X)+100 : J=(100*Y)+160
880 MOVE I,J
890 IF board(X,Y)=0 THEN GCOL 0,POINT(I-10,J)
900 IF board(X,Y)>0 THEN GCOL 0,3
910 IF board(X,Y)<0 THEN GCOL 0,2
920 IF ABS(board(X,Y))=2 THEN queen=1
930 PRINT;CHR$(240+queen);:queen=0
940 NEXT X : PRINT : NEXT Y
950 VDU 4,23,1,0;0;0;0;
960 ENDPROC
970
980 DEF PROCyourgo
990 PROCclear(2,5,9)
1000 COLOUR 3
1010 PRINT TAB(2,20)"YOUR MOVE"
1020 VDU 23,1,1;0;0;0;
1030 PROCinput
1040 REPEAT
1050 A$=""
1060 board(A,B)=board(E,H) : board(E,H)=0
1070 IF ABS(E-A)=2 THEN PROCjump
1080 UNTIL A$=""
1090 IF B=7 AND board(A,B)<>2 THEN yours=yours+1
1100 IF B=7 THEN board(A,B)=2
1110 VDU 23,1,0;0;0;0;
1120 SOUND 1,-5,150,3
1130 ENDPROC
1140
1150 DEF PROCbeebsgo
1160 PROCclear(2,20,9)
1170 FOR Y=8 TO 12
1180 PROCclear(2,Y,9)
1190 NEXT Y
1200 COLOUR 2
1210 PRINT TAB(3,5)"MY MOVE"
1220 FOR X=0 TO 7 : FOR Y=0 TO 7
1230 IF board(X,Y)=-1 THEN PROCfirstmove(-1)
1240 IF board(X,Y)=-2 THEN PROCfirstmove(+1)
1250 NEXT Y,X
1260 PRINT TAB(3,8)"From ";CHR$(R(1)+97);R(2)
1270 PRINT TAB(5,10)"To ";CHR$(R(3)+97);R(4)
1280 R(0)=-99
1290 IF R(4)=0 AND board(R(3),R(4))<>-2 THEN beeb=
beeb+1
1300 IF R(4)=0 THEN board(R(3),R(4))=-2 ELSE board(
R(3),R(4))=board(R(1),R(2))
1310 board(R(1),R(2))=0
1320 IF ABS(R(1)-R(3))<>2 THEN ENDPROC
1330 yours=yours-ABS(board((R(1)+R(3))/2,(R(2)+R(4)
)/2))
1340 board((R(1)+R(3))/2,(R(2)+R(4))/2)=0
1350 X=R(3);Y=R(4)
1360 IF board(X,Y)=-1 THEN PROCsecondmove(-2)
1370 IF board(X,Y)=-2 THEN PROCsecondmove(+2)
1380 IF R(0)<>-99 PRINT TAB(2,12)"+ To ";CHR$(R(3)
+97);R(4) : GOTO 1280
1390 ENDPROC
1400
1410 DEF PROCfirstmove(limit)
1420 FOR A=-1 TO 1 STEP 2
1430 FOR B=-1 TO limit STEP 2
1440 PROCcheckmove
1450 NEXT B,A
1460 ENDPROC
1470
1480 DEF PROCsecondmove(limit)
1490 FOR A=-2 TO 2 STEP 4
1500 FOR B=-2 TO limit STEP 4
1510 PROClastcheck
1520 NEXT B,A
1530 ENDPROC
1540
1550 DEF PROCcheckmove
1560 U=X+A : V=Y+B
1570 IF U>7 OR U<0 OR V>7 OR V<0 ENDPROC
1580 IF board(U,V)=0 PROCnextmove :ENDPROC
1590 IF board(U,V)<0 ENDPROC
1600 U=U+A : V=V+B
1610 IF U>7 OR U<0 OR V>7 OR V<0 ENDPROC
1620 IF board(U,V)=0 PROCnextmove
1630 ENDPROC
1640
1650 DEF PROCnextmove
1660 IF V=0 AND board(X,Y)=-1 THEN Q=Q+2
1670 IF ABS(Y-V)=2 THEN Q=Q+5
1680 IF Y=7 THEN Q=Q-2
1690 IF Y=0 OR U=7 THEN Q=Q+1
1700 FOR C=-1 TO 1 STEP 2
1710 IF U+C<0 OR U+C>7 OR V+G<0 OR V+G>7 THEN 1750
1720 IF board(U+C,V+G)<0 THEN Q=Q+1;GOTO 1750

```



```

1730 IF U<0 OR U>7 OR V<0 OR V>7 THEN 1750
1740 IF board(U-C,V-G)=0 OR (U-C=X AND V-G=Y) THEN
Q=Q-2
1750 NEXT C
1760 IF Q>R(0) THEN R(0)=Q
1770 R(1)=X : R(2)=Y : R(3)=U : R(4)=V
1780 ENDPROC
1790
1800 DEF PROClastcheck
1810 U=X+A : V=Y+B
1820 IF U<0 OR U>7 OR V<0 OR V>7 THEN 1830
1830 IF board(U,V)=0 AND board(X+A/2,Y+B/2)>0 PROCn
extmove
1840 ENDPROC
1850
1860 DEF PROCclear(X,Y,L)
1870 PRINT TAB(X,Y)STRING$(L,CHR$(32))
1880 ENDPROC
1890
1900 DEF PROCinput
1910 REPEAT : REM... Take a beeb man?
1920 REPEAT : REM... Empty sq<3 away?
1930 REPEAT : REM... Going the right way?
1940 REPEAT : REM... Still on board?
1950 FOR Y=23 TO 27 STEP 2
1960 PROCclear(2,Y,9)
1970 NEXT Y
1980 INPUT TAB(3,23)"From "From$
1990 INPUT TAB(5,25)"To "To$
2000 E=ASC(LEFT$(From$,1))-97
2010 H=VAL(RIGHT$(From$,1))
2020 A=ASC(LEFT$(To$,1))-97
2030 B=VAL(RIGHT$(To$,1))
2040 UNTIL E>=0 AND H>=0 AND A>=0 AND B>=0 AND E<B
AND H<8 AND A<8 AND B<8
2050 UNTIL (board(E,H)=1 AND H<B) OR board(E,H)=2
2060 UNTIL board(A,B)=0 AND ABS(A-E)<=2 AND ABS(A-E
)=ABS(B-H)
2070 UNTIL ABS(A-E)<2 OR board((E+A)/2,(H+B)/2)<0
2080 ENDPROC
2090
2100 DEF PROCjump
2110 beeb=beeb-ABS(board((E+A)/2,(H+B)/2))
2120 board((E+A)/2,(H+B)/2)=0
2130 PROCclear(2,27,9)
2140 INPUT TAB(2,27)"+ To "A$
2150 IF A$="" THEN ENDPROC
2160 A1=ASC(LEFT$(A$,1))-97
2170 B1=VAL(RIGHT$(A$,1))
2180 IF A1<0 OR A1>7 OR B1<0 OR B1>7 THEN 2130
2190 IF board(A1,B1)<>0 OR ABS(A1-A)<>2 OR ABS(B1-B
)<>2 THEN 2130
2200 E=A:H=B:A=A1:B=B1
2210 SOUND 1,-5,150,3
2220 ENDPROC
2230
2240
2250 DEF PROCinstructions
2260 COLOUR 2
2270 PRINT TAB(12,1)"D R A U G H T S"
2280 PRINT TAB(12,2);STRING$(15,"-")
2290 PRINT TAB(0,5)"In this game, I have the yello
w pieces"
2300 PRINT "and you have the white. You move by
"
2310 PRINT "typing the 'From' and 'To' co-ordinates
"
2320 PRINT "and pressing <return>; For example:"
2330 COLOUR 3
2340 PRINT TAB(10,11)"From a2 <return>"
2350 PRINT TAB(10,13)" To b3 <return>"
2360 COLOUR 2
2370 PRINT "'If you take one of my pieces, you wi
ll"
2380 PRINT "be asked whether you can move again!"
2390 COLOUR 3
2400 PRINT TAB(10,20)" + To ... "
2410 COLOUR 2
2420 PRINT "'If you can't move, just type <retu
rn>"
2430 PRINT "'To end the game at any time hit <escap
e>"
2440 COLOUR 3
2450 PRINT TAB(1,31)"PRESS ANY KEY WHEN YOU'RE READ
Y TO GO";
2460 A$=GET$
2470 ENDPROC

```



```

10 DIM array(7)
20 REPEAT
30 INPUT X
40 UNTIL X<=7 AND
array(X)=99

```

Not so with BBC BASIC; even if X were more than 7, the second condition in line 40 is still tested — again causing the 'subscript' error. The only way round this problem is to have the conditions which terminate the loop on separate lines. So the *inner* loop first checks that the co-ordinates are within the dimension of the array *before* the outer loops allow the co-ordinates to access the array. IF... THEN lines cause the same problem, by the way, so we can't get round it like that!

It's during PROCbeebsgo that the 'procedurists' will no doubt throw their arms in the air in horror! Not only is there a 'GOTO' but the procedure has more than one way out. And, I'm afraid there's worse to come! PROCbeebsgo calls, either directly or indirectly, five more procedures one of which has *five* exits and one having three GOTOs. While I agree that it's better to avoid these features because they can lead to tangled programs which are very difficult to follow, there are times when *avoiding* them makes for 'contrived' procedures which are even more difficult to follow.

If you follow the logic of PROCbeebsgo through, you will find that the procedures which it calls are already

beginning to create a web of their own. I could get out of this the easy way by quoting from other articles: "There is no reason why these procedures should not be tidied up and this is left as an exercise for the reader"! To be honest, I have spent quite a bit of time doing just that and the result seems to be a reasonable compromise between tangled GOTOs and tangled procedures. Because of the way PROCbeebsgo operates it's not really possible to give a simple explanation of what's happening but the main features are as follows.

The board array is scanned for a square containing -1 or -2 (a Beeb piece) and PROCfirstmove is called. This procedure checks adjacent squares looking for one which is unoccupied. If one is found, PROCsecondmove is called if the first move entailed taking one of your pieces. Once satisfied that the move is OK, the move is printed and the array co-ordinates are updated before the program returns to the main body at line 130. This line simply checks that you have some pieces left and loops back to line 80. This test may seem a little simple but it does prevent any 'arguments' arising from the Beeb prematurely claiming victory when you may have felt that you were still in with a chance! In any event, you can terminate a game by hitting the 'escape' key at any time when the 'victory' is obvious.



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**T**his program is, in effect, two routines which as a whole change the text display on the Dragon, from normal to green characters on a dark screen background (or orange equivalents using SCREEN 0,1) with the advantages of being switchable in and out at will, and that it can be used by most existing software, of which more later. As a bonus, the command CLS will clear the screen to dark green.

Some of the Dragon's ROM routines jump to an area of RAM between \$15E and \$1A8 prior to carrying out certain tasks. This area is split into 24 sections of 3 bytes, each byte holding 39 hex, the machine code RTS instruction. If a disc drive is fitted, each section may hold a jump to the DOS. These vectors being in RAM, we can alter them to point to our own routines, so long as we pass control back to the ROM after execution.

The two used here are at \$167, which is passed through during all PRINT commands, called from \$B54A, and \$1A0, used by CLS commands, called from \$BA5F.

The code, which is fully relocatable, can either be assembled from Listing 1, or POKEd into place using the BASIC loader in Listing 2, after clearing memory space for it. I used Dragon Data's Dream Editor/Assembler, which took four passes because I used PC relative addressing. Any start address will do, although \$7F20 (32544) is the highest possible or the routine will not fit! Please remember to save the assembler source code or BASIC loader prior to running, and the object code, once installed, before it is executed, just in case a typing error has occurred. To save the code, the correct format for cassette users is CSAVEM "SCREEN", start end, exec where start is the loading address, end = start + 223, and exec = start as this is the initial executable address. For DRAGONDOS 1.0 users, use SAVE "SCREEN", start,end +1,exec following the same rules as above.

Once saved, type CLS and the usual prompt will appear. Now type EXEC and the start address. You will see a line of dark green under the EXEC

# NEGATIVE THOUGHTS

Mick Seymour

**If you've ever wished that the Dragon 32 had a less dazzling display or wanted to print inverse numbers or non-alphabet-characters without the need to POKE to the screen — this program is the answer you've been waiting for!**



command, with OK in inverse characters at the beginning of the line. Type CLS again. The screen will clear to dark green with the usual prompt in inverse characters. Only true CLS is affected; CLSO will perform as normal. All commands are now displayed in inverse characters, with lower case now displayed as non-inverse.

There are two methods of switching the routine on and off. Once EXEC is input at the start address, the contents of the vectors mentioned above are stored in data bytes within the program, and are replaced by jumps to this routine. EXEC at the start address +50 will reinstate the contents of these vectors so that PRINT and CLS will not pass through the routine. This is to enable other utilities to

use them if necessary, without interference. Once on, it may also be switched off and on at will by the command PRINT CHR\$(17) from a running program or as a direct command from the keyboard. The address at start + 85 holds the character code which is recognised as a toggle on and off; start + 194 is the flag itself, FF hex is on, 0 is off. One other useful address is start + 211, the code used to fill the screen on a true CLS. To get the idea, try POKEing different values into it and typing CLS.

The printing section of the routine checks to see if:

- it is the screen which is being printed to, not cassette or line-printer
- accumulator A holds a toggle or non toggle character
- the toggle flag is on or off
- the character to be printed

falls within the normal alphanumeric range or is a normal control code (eg carriage return or backspace)

Once these conditions have been met, the character is 'adjusted' to the inverse code and printed to the screen, updating the cursor position, scrolling the screen, and filling lines with inverse space characters as required.

The clear screen routine also checks the toggle flag. If it is set, it then ensures that a true CLS is being performed by checking the contents of the accumulator for a 0 or 3A hex, the former being a BASIC end of line and the latter being the ASCII code for ".". If found, a true CLS is performed using the new code.

When the routine on, I think the best way to see the full effect is to load a BASIC program, then LIST it. Everything on the screen will be inverted. PRINT CHR\$(17);LIST and all should be back to normal. EXEC on and off does not affect the toggle flag, which will remain as it was from the last PRINT CHR\$(17) command.

I tend to use the computer with this routine installed all the time as it does not affect programming or execution and may prevent eyestrain! It is loaded at switch-on by CLEAR 200, start address. Cassette users then type CLOADM "SCREEN" and EXEC. For DRAGONDOS 1.0 users, type RUN "SCREEN.BIN" after the clear command.

I find that existing BASIC software often looks better using this program, with





Listing 1.

```

7F20 7F20          ORG    $7F20
7F20 *****
7F20 *
7F20 * SCREEN PRINT REVERSAL *
7F20 * FOR THE DRAGON 32 *
7F20 * FULLY RELOCATABLE *
7F20 *
7F20 * WRITTEN BY M.A. SEYMOUR *
7F20 * VERSION 2:28 JUNE 1984 *
7F20 *
7F20 *****
7F20 XECON LDA    $167    ;PRNT VECT
7F23 A78D00B8 STA    STR1,PC
7F27 FC0168 LDD    $168
7F2A ED8D00B2 STD    STR2,PC
7F2E B601A0 LDA    $1A0    ;CLS VECTR
7F31 A78D00C8 STA    STR3,PC
7F35 FC01A1 LDD    $1A1
7F38 ED8D00C2 STD    STR4,PC
7F3C 308C2F LEAX   ONOFF,PC
7F3F BF0168 STX    $168
7F42 308D009D LEAX   NEWCLS,PC
7F46 BF01A1 STX    $1A1
7F49 867E LDA    $7E    ;JMP CODE
7F4B B70167 STA    $167
7F4E B701A0 STA    $1A0
7F51 39 RTS
7F52 *
7F52 A68D0089 XECON LDA    STR1,PC
7F56 B70167 STA    $167
7F59 A68D00A0 LDA    STR3,PC
7F5D B701A0 STA    $1A0
7F60 EC8C7D LDD    STR2,PC
7F63 FD0168 STD    $168
7F66 EC8D0094 LDD    STR4,PC
7F6A FD01A1 STD    $1A1
7F6D 39 RTS
7F6E *
7F6E 0D6F ONOFF TST    $6F    ;CHANNEL
7F70 266D BNE    STR1    ;NOT 0:OUT
7F72 3414 PSHS   X,B
7F74 8111 CMPA   $11    ;TOGLCHAR
7F76 2605 BNE    TESTON
7F78 638C67 COM    TOGSTR,PC
7F7B 205E BRA    OUT1
7F7D 6D8C62 TESTON TST    TOGSTR,PC
7F80 275B BEQ    EXIT1
7F82 9E88 TEST   LDX    $88    ;CURSOR
7F84 8108 CMPA   $8    ;BACKSPACE
7F86 271A BEQ    BAKSPC
7F88 810D CMPA   $0D    ;CARR' RETN
7F8A 2723 BEQ    CARRET
7F8C 8120 CMPA   $20
7F8E 254D BLO    EXIT1
7F90 8180 CMPA   $80
7F92 2449 BHS    EXIT1
7F94 *
7F94 * LEAVES CHARACTERS TO ADJUST
7F94 * ASC=32-63 64-95 96-127
7F94 *
7F94 8860 EORA   $60
7F96 *
7F96 * NOW=64-95 32-63 0-31
7F96 *
7F96 8020 SUBA   $20
7F98 *
7F98 * NOW=32-63 0-31 224-255
7F98 *
7F98 8140 CMPA   $40
7F9A 2502 BLO    PRINTA
7F9C *
7F9C * LEAVES 224-255 TO ADJUST
7F9C *
7F9C 8B60 ADDA   $60
7F9E *
7F9E * NOW=64-95
7F9E *
7F9E A780 PRINTA STA    ,X+
7FA0 2017 BRA    STOREX
7FA2 8C0400 BAKSPC CMPX   $400
7FA5 2734 BEQ    OUT1
7FA7 8620 LDA    $20
7FA9 A784 STA    ,X
7FAB A782 STA    ,X
7FAD 200A BRA    STOREX
7FAF 8620 CARRET LDA   $20    ;BLACK SOR
7FB1 A780 STA    ,X+
7FB3 1F10 TFR    X,D
7FB5 C41F ANDB   $1F
7FB7 26F6 BNE    CARRET
7FB9 9F88 STOREX STX    $88
7FBB 8C0600 CMPX   $600
7FBE 2702 BEQ    UPLINE
7FC0 2019 BRA    OUT1
7FC2 8E0400 UPLINE LDX   $400
7FC5 EC8820 LOOP1 LDD   $20,X
7FC8 ED81 STD    ,X++
7FCA 8C05E0 CMPX   $5E0
7FCD 25F6 BLO    LOOP1
7FCF 9F88 STX    $88
7FD1 CC2020 LDD    $2020
7FD4 ED81 LOOP2 STD    ,X++
7FD6 8C0600 CMPX   $600
7FD9 26F9 BNE    LOOP2
7FDB 8600 OUT1   LDA    $0
7FDD 3514 EXIT1 PULS   X,B
7FDF 39 STR1   FCB    $39    ;WILL HOLD
7FE0 3939 STR2   FDB    $3939 ;PRNT VECT
7FE2 FF TOGSTR FCB    $FF    ;AUTO ON
7FE3 *
7FE3 3401 NEWCLS PSHS   CC
7FE5 6D8CFA TST    TOGSTR,PC
7FE8 2711 BEQ    EXIT2
7FEA 8100 CARYON CMPA   $0
7FEC 2704 BEQ    CLS
7FEE 813A CMPA   $3A
7FF0 2609 BNE    EXIT2
7FF2 C620 CLS   LDB    $20    ;BLACK SOR
7FF4 BDBA79 JSR    $BA79    ;ROM CLS
7FF7 3514 PULS   X,B    ;OLD CC/RT
7FF9 2002 BRA    STR3
7FFB 3501 EXIT2 PULS   CC
7FFD 39 STR3   FCB    $39    ;WILL HOLD
7FFE 3939 STR4   FDB    $3939 ;CLS VECTR

```

```

10 CLEAR200,20000:CLS
20 INPUT "START ADDRESS";ST
30 IF ST>H7F20 THEN PRINT "TOO HIGH!":GOTO 20
40 IF ST<20000 THEN PRINT ST"IS NOT PROTECTED!":GOTO 20
50 READ D$:IF D$="END" THEN 100
60 D=VAL("&H"+LEFT$(D$,2))
70 'POKE ST,D
80 C=C+D:ST=ST+1
90 IF LEN(D$)>2 THEN D$=MID$(D$,3):GOTO 60 ELSE 50
100 IF C=21375 THEN 240 ELSE PRINT "CHECKSUM ="C"WHICH IS WRONG"
110 PRINT "PLEASE CHECK THE LISTING":END
120 DATA B60167,A78D00B8,FC0168,ED8D00B2,B601A0,A78D00C8,FC01A1
130 DATA ED8D00C2,308C2F,BF0168,308D009D,BF01A1,867E,B70167
140 DATA B701A0,39,A68D0089,B70167,A68D00A0,B701A0,EC8C7D
150 DATA FD0168,EC8D0094,FD01A1,39,0D6F,266D,3414,8111,2605
160 DATA 638C67,205E,6D8C62,275B,9E88,8108,271A,810D,2723
170 DATA 8120,254D,8180,2449,8860,8020,8140,2502,8B60,A780,2017
180 DATA 8C0400,2734,8620,A784,A782,200A,8620,A780,1F10,C41F
190 DATA 26F6,9F88,8C0600,2702,2019,8E0400,EC8820,ED81,8C05E0
200 DATA 25F6,9F88,CC2020,ED81,8C0600,26F9,8600,3514,39,3939,FF
210 DATA 3401,6D8CFA,2711,8100,2704,813A,2609,C620,BDBA79
220 DATA 3514,2002,3501,39,3939
230 DATA END
240 PRINT"END ADDRESS ="ST-1,"EXEC ADDRESS ="ST-224
250 PRINT"EXEC OFF ="ST-174

```

Listing 2.

changes only necessary in the following places:

- where CLEAR commands do not reserve enough of a partition for the routine
- where software PRINTs CHR\$(17) to the screen for another purpose
- where PEEKs to the screen are used to find printed alphanumeric characters or, conversely, they are POKED to the screen.

Machine code software can also benefit from passing through this routine.







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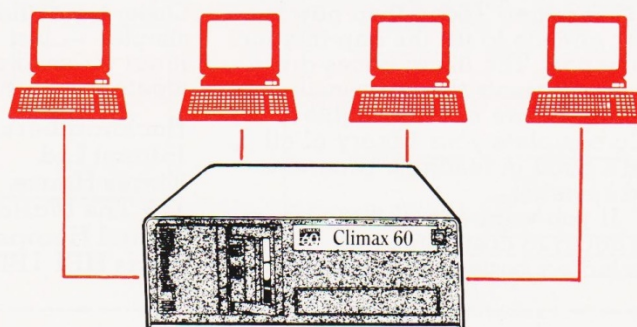
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The reason this utility was written is that, having recently been working on a search mode for BASIC, I found the need to save screen information gained from differing software packages, all of which needed to be set up to output to the serial port, or have an I/O routine needed to do the job. This, unfortunately, leaves the screen full of additional commands with the data that you wanted scrolled off the screen! The other problem is that the top, or title line is difficult to control; when using the ZEAP assembler, this line contains useful information which you might wish to keep.

My answer is an additional monitor command which outputs the entire screen contents, with EVEN parity supporting the printer BUSY signal, to the serial port.

This brings a few points of interest:

- The hardware configuration for the serial port is either cassette or TTY, the selection being made by DIL switches.

SW2/1 and TX/RX speed  
SW2/4 selection  
SW/2 TX clock select  
SW2/7 Serial input select TTY or CASS

If the TTY option is needed then SW2 2/4/7 will need changing. However, if you look at the Nascom circuit, you will see that transmission at cassette speed (300 or 1200 baud) is possible without the need to change any switches.

● If we do use the cassette speed for the V24 outlet, then we may be faced with further problems, ie, will the device that we are sending to expect to have a valid parity bit? Or, at a speed of 1200 baud, can the device keep up?

The following paragraphs explain some of the terms and conventions used later in the article.

**A bit of parity** When communicating in a normal asynchronous mode, the serialised data is 'boxed up' with stop bits, start bits and the parity bit (the MSB of the data — see Figure 2).

# NAS-SYS PRINTING

A. C. Ellis

**At last, for Nascom users, a program that demonstrates a simple method of getting screens from NAS-SYS to a printer without switch option changes.**

The function of the parity bit is to ensure that the data has not been corrupted. Normal parity options available are even, odd, mark and space. The last two options set the parity bit to 1 and 0 respectively, but the first two work as follows:

Let's send data with even parity: A = 41H = 0100 0001. The number of 1s is even, so leave bit 7 at 0.

Now C = 43H = 0100 0011.

This time the number of 1s is odd, so set bit 7 to make the total number even. Hence, C even parity is 1100 0011, ie, C3H not 43H. If you make the number of 1s odd, then you are running odd parity.

## TTL/V24 voltage levels

When transmitting using the V24 convention, the signal swings (ideally) between -12V, logic 0, to +12V, logic 1. The switching thresholds are at  $\pm 3V$  (see Figure 3).

Using TTL the inputs to the devices expect to see a logic 0 voltage of between 0 to 0.8V and the logic 1 voltage spread of (2-5V) (see Figure 4).

## THE HARDWARE

Running this program without any changes to the software requires a hardware modification. It is only a case of adding a V24-to-TTL converter to the spare input on port 0 (bit 7) but if you do not feel sufficiently confident about brandishing a soldering iron, an alternative software patch will be outlined.

The circuit in Figure 5 allows the BUSY signal generated from the external

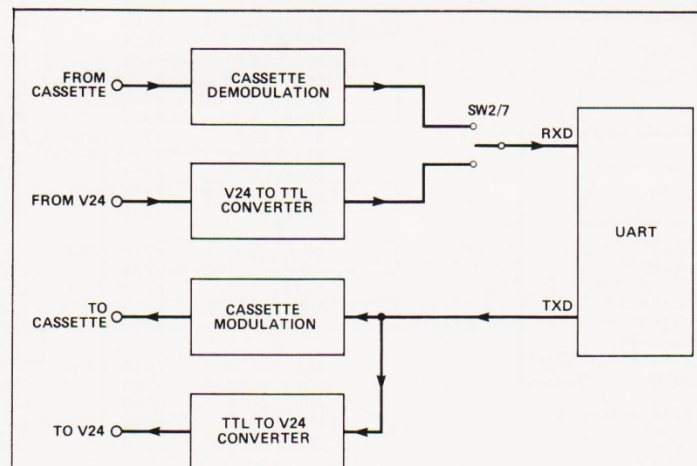


Figure 1 Block diagram of serial connections to UART.

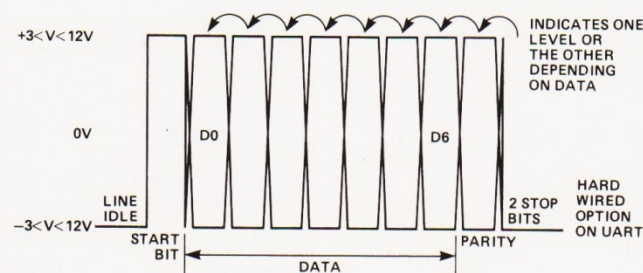


Figure 2 Serialised data 'boxed up' with stop bits, start bits and the parity bit.

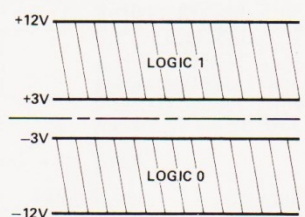


Figure 3 Transmissions using the V24 convention — the switching thresholds are at  $\pm 3V$ .

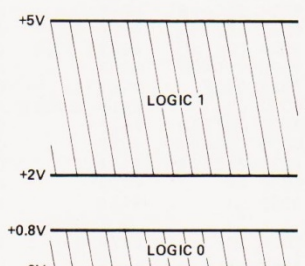


Figure 4 Transmissions using the TTL convention.



device to enter the Nascom. It only needs four connections, IN to printer BUSY, OUT to test point 3 and the supplies to -5V and 0V. In my own machine it fits on a small board attached to the underside of the main card. You could just as easily use a custom IC such as a 75154, but as I already had the components in my bits box, and Nascom themselves didn't use custom drives, I took the easy way out.

## BUSY

In the specifications of most printers you will find the print speed, usually in characters per second, and the line speeds at which the printer will work. At low line speeds the printer will keep up with the input, printing at, or above

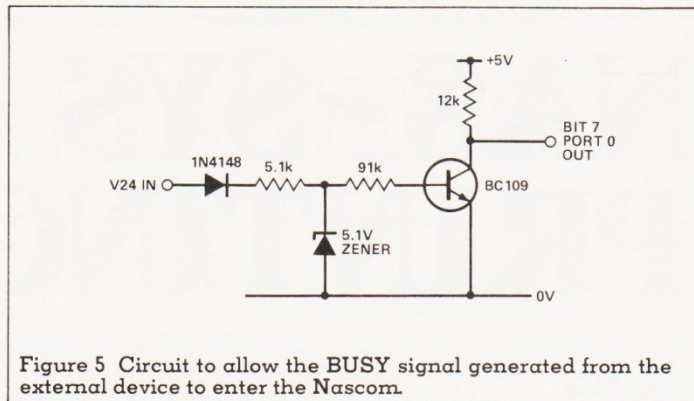


Figure 5 Circuit to allow the BUSY signal generated from the external device to enter the Nascom.

the rate at which the characters appear from the line. If, however, the printer is used with higher line speeds, more and more data builds up in the buffer. Eventually the point is reached when the buffer is full and then incoming information will be missed. To avoid this situation, the printer sends

an output line to the host telling it that it cannot accept any more data. This is the BUSY signal. At line speeds of about 1200 baud the BUSY signal is needed as the printer buffer fills very quickly, but at 300 baud it should be possible to leave it out.

One point to note is that if

your machine is not logic seeking, the print rate will fall as the data per line decreases. This is due to the fact that the time taken to complete the head movement is non-productive, and data may still be coming in from the line. BUSY is also asserted by most printers if the machine is on, but deselected if the paper runs out.

## THE PROGRAM

The process of altering the command table of NAS-SYS is well known by now so I will omit the explanation as it has been described in other articles.

To use the D command, first load the machine code into RAM from 0C80H upward then execute the trigger program at 0CF8H. This will

### Listing 1. Assembler source listing for the screen dump routine.

```

004F
ZEAP Z80 Assembler - Source Listing

0080      0010 ;Equate variables
          0020      ORG 0C80H

0080 0BFE      0030 TABLE EQU 0BFEH
0080 0C71      0040 STAB EQU 0C71H
0080 000D      0050 CR EQU 0DH
0080 000A      0060 LF EQU 0AH

          0080 ;Space for table

0080 0078      0100      DEFS 078H

          0120 ;Trigger program
00F8      0130      ENT
00F8 218807      0140      LD HL,0788H
00F8 11880C      0150      LD DE,0C80H
00F8 017800      0160      LD BC,078H
0001 EDB0      0170      LDIR ;Copy table to ram
0003 21FE0B      0180      LD HL,TABLE
0006 22710C      0190      LD (STAB),HL ;Set new Pointer
0009 21110D      0200      LD HL,DUMP
000C 22860C      0210      LD (TABLE+"D+"D),HL
000F DF5B      0220      SCAL 05BH

          0240 ;The screen dump command

0011 F5      0260 DUMP      PUSH AF
0012 C5      0270      PUSH BC
0013 D5      0280      PUSH DE
0014 E5      0290      PUSH HL
0015 CD6C0D      0300      CALL CRLF
0018 0632      0310      LD B,50
001A 3E2A      0320 LP1      LD A,"*"
001C CD510D      0330      CALL OUTPUT
001F 10F9      0340      DJNZ LP1
0021 CD6C0D      0350      CALL CRLF
0024 21CA0B      0360      LD HL,0BCAH
0027 CD770D      0370      CALL LINE ;Output the top line
002A CD6C0D      0380      CALL CRLF
002D 210A0B      0390      LD HL,080AH
0030 060F      0400      LD B,15
0032 C5      0410 DUMPLP      PUSH BC
0033 CD770D      0420      CALL LINE
0036 CD6C0D      0430      CALL CRLF
0039 011000      0440      LD BC,16
003C 09      0450      ADD HL,BC
003D C1      0460      POP BC

003E 10F2      0470      DJNZ DUMPLP
0040 0632      0480      LD B,50

0042 3E2A      0490 LP2      LD A,"*"
0044 CD510D      0500      CALL OUTPUT

0047 10F9      0510      DJNZ LP2
0049 CD6C0D      0520      CALL CRLF
004C E1      0530      POP HL
004D D1      0540      POP DE
004E C1      0550      POP BC
004F F1      0560      POP AF

0050 C9      0570      RET

          0590 ;Subroutines

0051 F5      0610 OUTPUT      PUSH AF
0052 DB00      0620 BUSY      IN A,(0) ;Loop to test
0054 CB7F      0630      BIT 7,A ;busy line of Printer
0056 C2520D      0640      JP NZ,BUSY
0059 F1      0650      POP AF
005A CBBF      0660      RES 7,A
005C B7      0670      OR A
005D EA620D      0680      JP PE,OVER
0060 CBFF      0690      SET 7,A
0062 D301      0700 OVER      OUT (1),A ;Output the char.
0064 DB02      0710 EMPTY      IN A,(2)
0066 CB77      0720      BIT 6,A
0068 CA640D      0730      JP Z,EMPTY
006B C9      0740      RET

006C 3E0D      0760 CRLF      LD A,CR
006E CD510D      0770      CALL OUTPUT
0071 3E0A      0780      LD A,LF
0073 CD510D      0790      CALL OUTPUT
0076 C9      0800      RET

0077 3E2A      0820 LINE      LD A,"*"
0079 CD510D      0830      CALL OUTPUT
007C 0630      0840      LD B,48
007E 7E      0850 LINELP      LD A,(HL)
007F CD510D      0860      CALL OUTPUT

0082 23      0870      INC HL
0083 10F9      0880      DJNZ LINELP

0085 3E2A      0890      LD A,"*"
0087 CD510D      0900      CALL OUTPUT

008A C9      0910      RET

ZEAP Z80 Assembler - Symbol Table

0052H 0620 BUSY      000DH 0050 CR
006CH 0760 CRLF      0011H 0260 DUMP

0032H 0410 DUMPLP      0064H 0710 EMPTY
000AH 0060 LF      0077H 0820 LINE

007EH 0850 LINELP      001AH 0320 LP1

0042H 0490 LP2      0051H 0610 OUTPUT

0062H 0700 OVER      0071H 0040 STAB
00BFEH 0030 TABLE

```



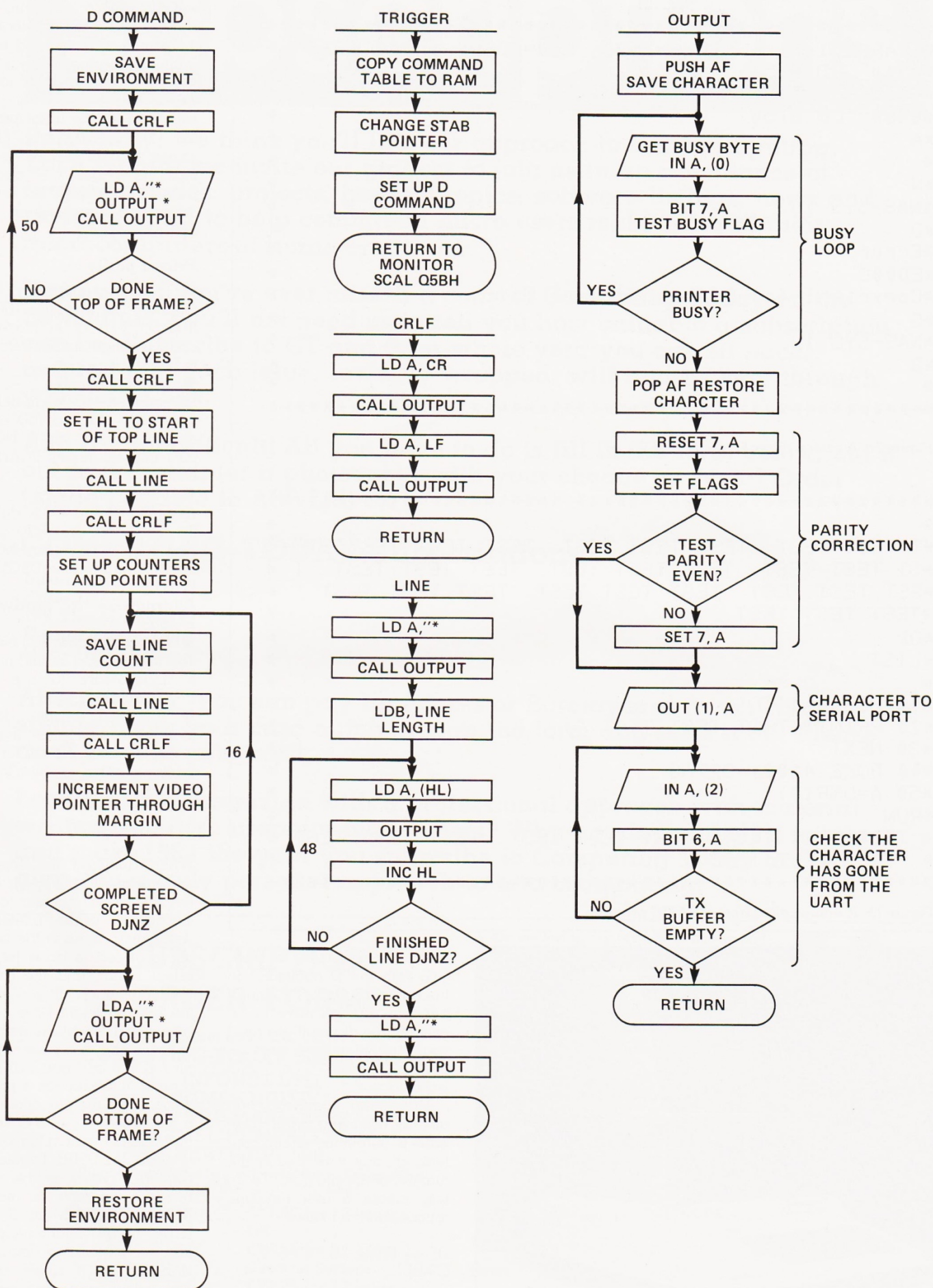


Figure 8 Flowchart to illustrate the logic of the program.



```

*****
*ZEAP 2.1/      Free=2526  End=0D8B  Ent=0CF8  *
*0310 LD B,50  *
*f/49/         *
*0480 LD B,50  *
*A            *
*            *
*N            *
*NAS-SYS 1     *
*D            *
*Error        *
*ED003        *
*Copyright (c) Sigma Software Unit  *
*G            *
*NAS-SYS 1     *
*D            *
*            *
*****

```

Figure 7a A screen dump under NAS-SYS.

```

*****
*
*T TEST TEST  TEST TEST TEST  TEST TEST TEST  TE *
*ST TEST TEST  TEST TEST TEST  TEST TEST TEST  T *
*EST TEST TEST  TEST TEST TEST  TEST TEST TEST  *
*TEST TEST TEST *
*Ok            *
*LIST         *
*            *
*10 FOR X=1 TO4 *
*20 PRINT" TEST TEST TEST "; *
*30 NEXT      *
*40 DOKE 4100,-32768 *
*50 A=USR(0)  *
*RUN         *
* TEST TEST TEST  TEST TEST TEST  TEST TEST TEST *
*  TEST TEST TEST *
*****

```

Figure 7b A dump called from a BASIC program.



return the machine to NAS-SYS with the D command in the operating system. Remember that you will have to re-execute the trigger if you reset your Nascom as it will reset the STAB pointer in the workspace.

The dump command can also be used in a BASIC program to output the screen contents at any time during the running of the program. To do this, create a user machine routine such as follows:

```

DF 44 SCAL "U;" U=55H
C9 RET

```

An example of the dump routine called from BASIC is

shown in Figure 7. In this case the machine code location was 08000H and set up by lines 40 and 50. Notice that as the screen was dumped from within the program, it will not show the screen as it looks when the program is terminated with the usual prompt, Ok or whatever. The screen is bordered by \*s so that the edges are clearly defined. They might not be so easy to determine from the characters alone.

#### Printer parity

- To support odd parity  
Change assembler line 760 to JP PO,OVER or in machine code, change address D5DH to E2H.

- To support mark  
Assembler X 740 760 to delete lines 740, 750 and 760 or in machine code, insert NOPs 00H into addresses D5AH to D5FH.

- To support space  
Assembler X 750 770 to delete lines 750, 760 and 770 or in machine code, insert NOPs 00H into addresses D5CH to D61H.

#### Alternatives to hardware BUSY

- Run cassettes at 300 baud.  
The lower speed should make it unnecessary to use the BUSY signal.

- Supply a software delay loop as a subroutine that is timed just long enough for the printer to catch up, then insert the assembly line:

```
515 CALL DELAY
```

When dumping the screen, the cursor will disappear and the screen will appear to be locked up if the printer is deselected. If this is the case, all you need to do is hit the select button and the dump will commence. If you think the printing might have been suspended, count the number of times the computer scans bit 7 port 0 and gets BUSY as a reply. If it exceeds a preset value, have the machine print a message such as "I/O timed out" and then return to monitor under SCAL 05BH. I wrote my own I/O system in this way because attempts to modify NAS-SYS didn't work! If you leave the first character position vacant then you can use NAS-SYS as a single page text editor and then dump the information to a printer.



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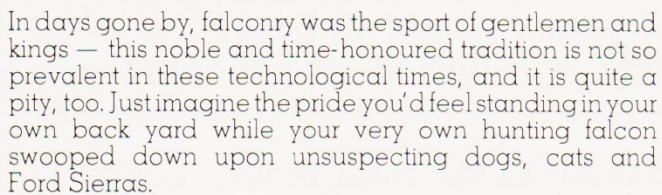
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## NASCOM 3

**Notes.** The Nascom 3 is the latest in a long line of Z80-based personal computers. The RAM may be expanded to 64K, and the screen resolution may be improved by adding the Advanced Video Controller card (plugs into NASBUS). This gives 784 by 256 two-colour or 392 by 256 eight-colour high resolution graphics. There is also a light pen option and user-programmable characters. Often used as an industrial control unit or development system.

**Notes.** The Lucas LX is a computer which is aimed at the more professional and business users. The use of the CP/M 2.2 operating system means that a wide range of applications software is available, including Wordstar, Supercalc, and Calcstar. The choice of serial and parallel interfaces allows most popular printers to be used. There is an additional parallel interface connector which provides up to 16 on/off signals.





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## COMMODORE 715B

<b>CPU</b>	6509
<b>MEMORY</b>	256K RAM, 20K ROM
<b>LANGUAGE</b>	Commodore BASIC
<b>MASS STORAGE</b>	No cassette Single or dual 5¼" floppy disk drives
<b>OS</b>	Commodore's DOS
<b>KEYBOARD</b>	QWERTY, cursor, numeric pad, function keys
<b>INTERFACES</b>	RS-232C, IEEE 488, memory bus, eight- bit parallel, cassette port, second processor bus
<b>DISPLAY</b>	Monochrome monitor supplied
<b>GRAPHICS</b>	80 by 25 text, block graphics
<b>SOUND</b>	Three channels

**Notes.** The Commodore 715B is the top model in the 700 range of business machines. Although built round the 6509 processor, there is a second processor option (8088). The machine has been designed to meet IEC specifications. The black-and-white monitor screen is integral and features tilt and swivel. The keyboard may be detached.



## COMMODORE 64

<b>CPU</b>	6510
<b>MEMORY</b>	64K RAM, 26K ROM
<b>LANGUAGE</b>	Commodore BASIC
<b>MASS STORAGE</b>	Cassette unit at 300 baud 5¼" floppy discs available
<b>OS</b>	Commodore's own
<b>KEYBOARD</b>	QWERTY, cursor, function keys
<b>INTERFACES</b>	IEEE 488 bus, cartridge port, cassette port, two joystick/light pen ports
<b>DISPLAY</b>	TV output
<b>GRAPHICS</b>	40 by 25 text, block graphics (user- definable) 320 by 200 high resolution graphics in 16 colours
<b>SOUND</b>	Three channels

**Notes.** The Commodore 64 is a popular micro with a great deal of games software available. There is also some business software, such as spreadsheets and word processors, available but this suffers from the lack of an 80-column screen. Graphics and sound have extensive capabilities, for example eight multicolour sprites and three channels of sound covering nine octaves each.





# SHARP MICRODEALER

# ACT

## SHARP MZ-700

<b>CPU</b>	Z80A
<b>MEMORY</b>	8K ROM, 68K RAM
<b>LANGUAGE</b>	S-BASIC
<b>MASS STORAGE</b>	Optional built-in cassette, 1200 baud. Disks available.
<b>KEYBOARD</b>	QWERTY, cursor pad, function keys
<b>INTERFACES</b>	Parallel expansion bus, printer port, joystick port
<b>DISPLAY</b>	40 by 25 text, 80 by 50 eight-colour graphics
<b>SOUND</b>	Single channel

**Notes.** The MZ-700 series is Sharp's latest addition to the MZ range of home computers. The basic unit may have either an optional cassette deck, or four-colour printer/plotter, or both, which slot into the main case. Disk drives are now available from several suppliers. The ROM includes a 4K character generator for twice the usual number of block graphics, while the 4K video RAM is separate from the other 64K, all of which is available for the resident language and program text (BASIC or other language must be loaded from tape or disk).



## SHARP MZ-3541

<b>CPU</b>	Z80A (two), 80C49
<b>MEMORY</b>	128K RAM, 8K ROM
<b>LANGUAGE</b>	Sharp BASIC
<b>MASS STORAGE</b>	Twin integral 5¼" floppy disk drives, total capacity 1.28 Mb
<b>KEYBOARD</b>	QWERTY, cursor, numeric pad, function keys
<b>INTERFACES</b>	RS-232C, Centronics, interface for extra external floppy disks
<b>DISPLAY</b>	Monochrome monitor, colour optional
<b>GRAPHICS</b>	80 by 25 text, 640 by 400 high-resolution graphics
<b>SOUND</b>	Single channel

**Notes.** The Sharp MZ-3541 is aimed at the businessman. RAM is expandable to 256K, while two disk drives may be added externally to complement the integral pair. Colour is only possible with the optional graphics expansion RAM. One Z80 handles the main CPU activities while the other handles peripheral activities. The third processor handles the keyboard. The availability of CP/M means a ready supply of business software.

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## xi APRICOT

<b>CPU</b>	8086
<b>MEMORY</b>	256K RAM
<b>LANGUAGES</b>	Microsoft BASIC, Personal BASIC
<b>MASS STORAGE</b>	No cassette drive Integral Sony 3½" 315K microfloppy disk drive
<b>OS</b>	Integral 5 or 10 Mb hard disk MS-DOS 2.11 with GSX bundled CP/M-86 (not yet available) Concurrent CP/M-86 (not yet available)
<b>KEYBOARD</b>	QWERTY, cursor, numeric pad, function keys
<b>INTERFACES</b>	RS-232C, Centronics, Microsoft mouse
<b>DISPLAY</b>	Monitor (supplied)
<b>GRAPHICS</b>	80 by 24 text with block graphics 800 by 400 high-res graphics under GSX
<b>SOUND</b>	No

**Notes.** The Apricot xi is a development of the award-winning Apricot, and replaces one of the latter's disk drives with an integral hard disk, providing vastly increased storage with faster access. Memory may be expanded in 128K increments to a maximum of 768K. The languages and operating systems mentioned above come bundled (except for Concurrent CP/M) and four software tools are also bundled, including an asynchronous package for use with the optional modem card.

## APRICOT F1

<b>CPU</b>	8086
<b>MEMORY</b>	256K RAM
<b>LANGUAGES</b>	MS-DOS, Concurrent DOS (Optional)
<b>MASS STORAGE</b>	No cassette drive One integral 3½" 720K Sony microfloppy disk drive
<b>OS</b>	MS-DOS 2.11, Concurrent DOS (optional)
<b>KEYBOARD</b>	QWERTY, cursor, numeric pad
<b>INTERFACES</b>	Infra-red link for keyboard or mouse, expansion slot, RS-232C, Centronics
<b>DISPLAY</b>	TV or optional monitor
<b>GRAPHICS</b>	80 by 24 text 640 by 256 four-colour, 320 by 256 16-colour maximum high resolution
<b>SOUND</b>	No

**Notes.** The Apricot F1 is designed as a low-cost entry-level machine for small businesses (a cheaper cut-down version, the F1e, is for schools and colleges). It includes several bundled applications including SuperCalc, SuperWriter and SuperPlanner. An optional five-slot expansion bus may be added: also a 10 Mb Winchester unit. There is an optional infra-red mouse/trackball. RAM is expandable to 768K.



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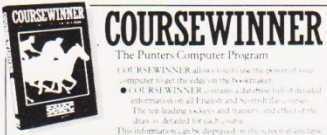
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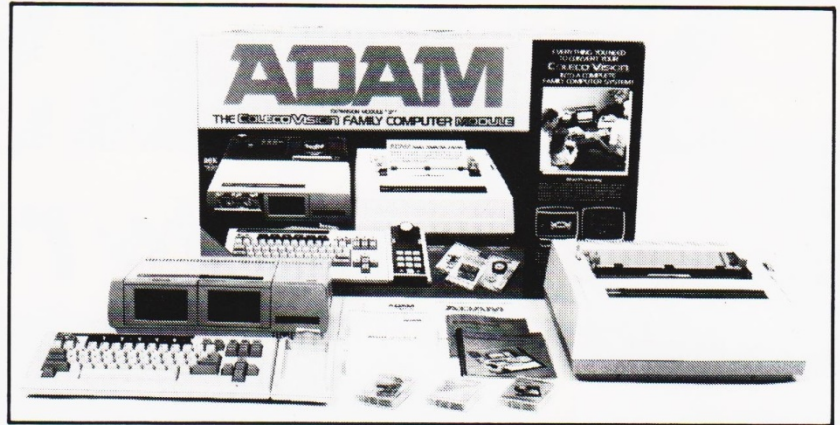
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**MEMORY CONSOLE/DATA DRIVE:** The heart of the Adam system is the 40K ROM and 64K RAM memory console which combines with the 32K ROM and 16K RAM in Colecovision to give you a total of 72K ROM (including 24K cartridge ROM) and 80K RAM (expandable to 144K). Built into the memory console is a digital data drive which accepts Adam's digital data packs, a fast and reliable mass storage medium that is capable of storing 256K of information, that's about 250 pages of double spaced text! The console is also designed to accommodate a second optional digital data drive.

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**BUILT-IN WORD PROCESSOR:** Adam comes with SmartWriter word processing built-in. This program is so easy to use that you only have to turn the power on and the word processor is on line and ready to go. Detailed instruction books are not necessary as the Computer guides you step by step, working from a series of Menu commands. It enables you to type in text, then completely edit or revise it with the touch of a few keys. Changes are readily made and a series of queries from the computer confirm your intentions, so that you can continuously double check your work as you type.

**COMPATIBILITY WITH COLECOVISION:** By using high speed interactive microprocessors in each of the modules, the Coleco Adam is designed to take additional advantage of both the 32K ROM and 16K RAM memory capability in the Colecovision. If you do not already own a Colecovision Console (£99 inc VAT), then you will need to purchase this when you initially purchase your Adam Computer package (£499 inc VAT), making a total purchase price of (£598 inc VAT).

**WHAT IS COLECOVISION:** Colecovision is one of the worlds most powerful video game systems, capable of displaying arcade quality colour graphics of incredible quality on a standard Colour TV set. The console (see picture bottom left) accepts 24K ROM cartridges such as Turbo and Zaxxon and is supplied with the popular Donkey Kong cartridge and a pair of joystick controllers. Colecovision has a range of licenced arcade hits available such as: Gorf, Carnival, Cosmic Avenger, Mouse Trap, Ladybug, Venture, Smurf, Pepper II, Space Panic, Looping, Space Fury, Mr Do, Time Pilot, Wizard of Wor and many others. So there you have it, Adam plus Colecovision the unbeatable combination. Send the coupon below for your FREE copy of our 12 page Colour brochure giving details on the complete Adam system.

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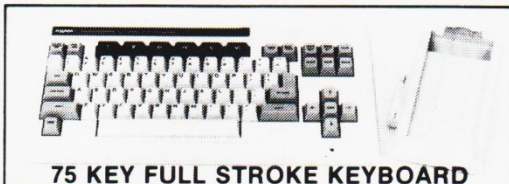
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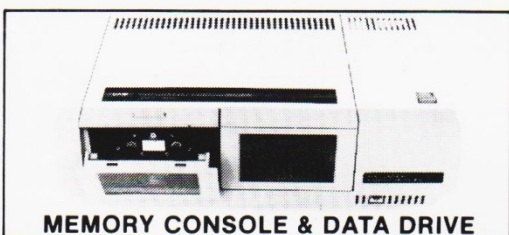
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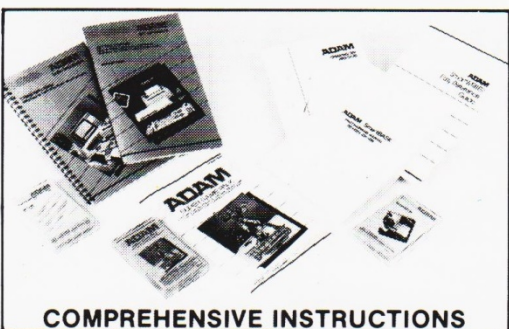
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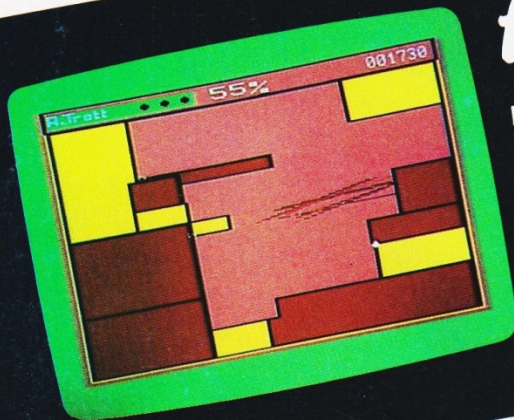


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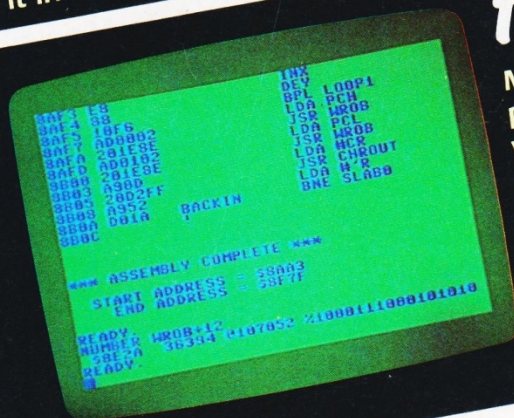
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