

# COMPUTER

## Answers

SOLVES YOUR MICRO QUERIES & PROBLEMS

### COMMODORE CLINIC



Turn your 64 into a professional system... Measure the size of your programs... Magpie: builds a nest for your data?

### SINCLAIR

Programming tips plus listings for quick draw graphics and animation...

### BBC

Scupper the pirates using routines that keep your program listings private.

### DRAGON

The Dragon's 6809 processor revealed, plus programming hints.

### MSX MICROS



Do they set new standards?



### BATTLESIPS

**WORLD FIRST:** program listing for playing Battleships on two Vics and/or 64s wired together..

### GAMES CHARTS



The top ten games for the Spectrum, Commodore Vic and 64, BBC and Dragon, plus reviews of the top three and fast movers.

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We try out the new fast fire games designer from Melbourne House.

### CYPHER RESULTS

We reveal the winner of the toughest decoding exercise outside GCHQ, plus a listing to send secret messages.

### DISK DRIVES

We test out budget disk drives.

### KEEP IT CLEAN

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### SUPERCHARGED 68000

The QL's and Macintosh's chip offers a new order of power to the people.

### CROSSWORD

A program listing for the Oric and Dragon to help you solve crosswords.

### OPERATING SYSTEMS

Details on the differences between disk operating systems.

### CABB

Our free electronic magazine/mail service is waiting for your call.





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MAY, 1984

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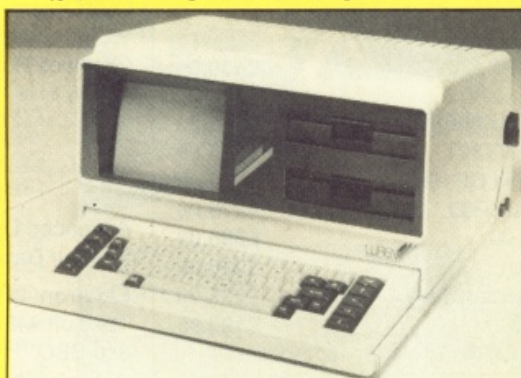
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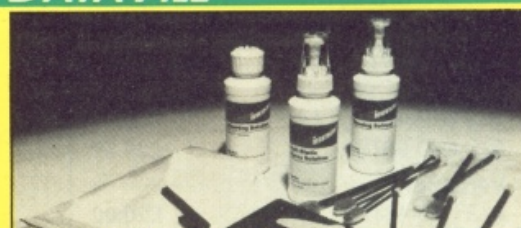
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COMPUTER  
Answers



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## BBC Joysticks

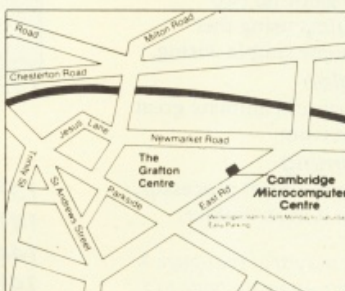
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# CABB: UP AND BUZZING!

**G**et onto *Computer Answers'* bulletin board with this simple step-by-step guide:

1: Check the interfaces on your micro. It must have an RS232 (or, in the case of the Beeb, RS423) serial port. If it hasn't then goto step 2, else step 3.

2: If you haven't got an RS232 port you will have to buy one to plug in. Fig. 1 gives sources of these.

3: Get a suitable modem. If your 'phone connects to the wall via a standard British Telecom jack-plug, goto step 5, else step 4.

4: Get a BT jack-plug socket installed (normally well worth the £25 expense) and goto step 5; or, if you can't afford it, buy an acoustic coupler (unless you have a Trimphone, in which case you will have to get the plug). Goto step 6.

5: As they're cheap these days (£86 instead of £150 +), your best bet is to buy a direct coupled (or 'hard wired') modem, like the Buzzbox.

6: Get the correct type of modem. It must be either: 300/300 baud, CCITT (V21), asynchronous, full duplex, originate—used to communicate with bulletin boards and on-line databases; or 1200/75 baud (viewdata), CCITT (V22) asynchronous, full duplex, originate—used to communicate with Prestel and Micronet and a few on-line databases.

It is useful but not necessary to have options for answer/originate and half/full duplex.

7: Check you have communications software. If not, see March issue (page 146) for examples that will run on popular micros. If you have a problem finding the right program go to step 8. Else step 9.

8: Contact the supplier of the micro to find out what software's available, armed with the specifications given below, if no luck contact your user group, if no luck contact us.

9: The software must support the baud rates used by your modem (check against step 6). If you are simply wanting to chat with the board, find out what mail you've got and place orders then goto step 11, else if you want to download files (including program listings), then goto 10.

10: Your software must sup-

port the following protocol setting: 1 start bit, 8 data bits, 1 stop bit, no parity. You will need an error checking protocol to ensure clean transmission.

We recommend that you get software that supports the Christensen (also known as 'Xmodem') protocols, which is supported by CABB. These aren't necessary if you only intend to download straight text (ASCII) files, in which case goto 12.

11: Your software must support the following settings: 1 start bit, 7 data bits, 1 stop bit, even parity.

12: If you want to download text files, check that your software supports the X-ON/X-OFF software handshaking protocol and that it has facilities for down/uploading files.

13: 'Phone *Computer Answers* Bulletin Board (CABB) on (01) 631 3076 (24 hour service).

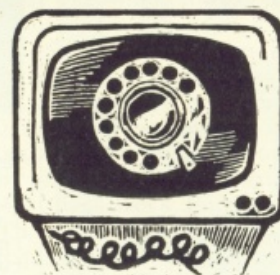
By **Tony Dennis**, deputy editor.



FIG. 1  
RS232 add-ons

Micro:	Interface name:	Price:	Supplier:
Apple 11e, 11	RS232 interface card	£108	Apple dealers.
Atari 400/800 600/800 XL	850 interface	£135	Atari dealers.
Commodore Vic, 64	RS232 interface	£23	Minor Miracles, PO Box 48, Ipswich IP4 2AB. Tel: (0473) 50304.
64 only	Modem/RS232	£95	Commodore dealers
Dragon 32, 64	RS232 interface	£49.50	Cotswold Computers, 6 Middle Row, Chipping Norton, Oxfordshire.
Lynx	Hardware modification		(See forthcoming issue.)
Oric/Atmos		£31.50	Modular Concept Peripherals, 13 High Street, Clydach, Swansea SA6 5IF. Tel: (0792) 844465.
Tandy TRS-80 (IV)	RS232 board	£79.95	Tandy dealers.
Texas TI 99/4A	Expansion box + RS232	£194	Parker Electrics, 4 Dorset Place, New Street, Honiton, Devon EX14 8QZ. Tel: (0404) 44425.
ZX 81	Universal modem adaptor	£29.95	Microcomputer Resources, 1 Branch Road, Park Street Village, St Albans, Herts. Tel: (0727) 72917.
ZX Spectrum	Micro Mania interface (+ software)	£33.50	J W V Software, 139 Allington Drive, Strood, Kent.

## BULLETIN



COMPUTER  
ANSWERS IS ON THE  
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HOW TO GET ON  
TO CABB AND ALL  
RELEVANT  
INFORMATION

Left: the hardware for our own bulletin board.

'Bulletin' information continues on page 144.



# PREVIEW

## ELAN ENTERPRISE: MORE WAITING

This computer caused something of a stir when it was shown at the PCW show last year. However, after a little investigation the computers on show turned out to be empty. The machine was supposed to appear in April, no May, wrong again, now it is sometime round September. One of the apparently good features was its large memory, but this seems a little obscure at the moment. We have heard the first model will only be 64K, with the 128K version appearing up to one year later. If the Elan (Flan, Enterprise or whatever the company is going to call the machine) does come out with only 64K, then this would disappoint many possible buyers. It would also, in our view, be a major mistake. With only 64K as standard, and the need for expensive add ons to upgrade the memory, then software houses will be reluctant to produce software for the expanded machine, because they will only be marketing to a small number of machine owners. The specs of the Elan/Flan have also been quietly changing. Originally multiple statement lines in Basic were not going to be allowed, but now, we are glad to say, they have been implemented. The Basic itself has a number of statements that come under the heading of 'Structured'; such as a SELECT (a case statement), WHEN and WHILE. Another interesting claim made at the launch was the 'hundred programs ready when the machine is available'. To make any sense these would have to be arcade standard (or equivalent), not games of the 'million programs for the Spectrum' ilk. By all accounts Elan is a long way off this target too, and as far as we know most have only been up and running on a Sirius with emulation software. Enterprise is committed to writing 15 packages for the launch, and also claims that up to 30 other companies are preparing software. We shall see.

## WHITHER THE QL REVISITED

So what's happened to the QL? Still no one seems to have got one. Word from the industry suggests Sinclair has had a few production problems that he hasn't been too keen to let everybody know about. It seems QDOS turned out to be too large a program to fit into the ROMs, and the multi-tasking features were causing a big headache. Oh yes, and there was problems with the ULAs. But some good news! Well, not that good, but at least it's a start. QLs are at least available for review, and we should be getting our mits on one later on in April.

## GAMES SOFTWARE UNDER FIRE

The state of the games software market is looking parlous, not to say perilous. There is a current hysteria amongst games houses, generated by the threat of a price war and companies loosing lots of revenue to pirates. As you may have read, the latest confusion has stemmed from Imagine. The company first told the trade it was going to drop all its prices to £3.95,

and then reversed the decision. Its reason? 'Some of the smaller software houses would undoubtedly have gone to the wall in any prolonged price war' was the official statement. The other sign of trouble is a series of reports, widely publicised in national newspapers, that the sales projections for 1984 were wildly optimistic. Tens of millions of sales were hoped for, less than two million are expected.

These developments are likely to have one of two entirely contradictory effects on the games you buy: they might get better or they might get worse. They might get worse if panicking companies feel they have to bang out cheap games in order to beef up sales.

They might get better because we the consumers will get fussier and less inclined to buy games for novelty. There are signs of this happening already. For example, a number of book publishers looking to cash in on their quality image by launching into the market with a selection of more 'cultivated' products. They realise that the images of some of the games software houses have lost their lustre, and not unjustifiably. Many of the games dedicated micro mags feature 'dud of the month', highlighting the appalling quality of some games we may have the misfortune to buy.

There's no doubt that most micro games are boring or borrowed, based on ideas that were interesting a year ago but not any more.

As for piracy, there's genuine concern amongst software houses that a large number of foreign outfits have emerged with facilities for copying games and forging cassette covers. One software games house told us it was having difficulties in some areas finding a genuine copy of its own game.

The response to this has been an appeal to computer magazines to help publicise the damage pirates can do. Piracy is a plague in creative industries like software publishing; it gives nothing and takes a lot. It does more: it stunts the development of new ideas and products. The view that piracy is in the consumer's interest (because it brings down prices) is a pathetic fallacy. Pirates have no interest in or accountability to users of their products. They take the money and run. We hope to bring you a fuller report on piracy next month.

## ATARI BUTCHERS ITS XL RANGE

Machines you won't be seeing in the shops in future months are the long-awaited 1400 and 1450 XL top of the range budget micros. The 1400 nearly made it over here, but was dropped mid-Atlantic. The 1450 has suffered the 'TI treatment' and been killed off at birth, as has the CP/M add-on, a bad blow to the XL range's upgrade potential. Why has Atari brutalised its products, many of which have been so successful? We suspect development of a 32-bit super-system.



# MSX HEADS WEST

**A**lthough still mostly Eastern promise to us in the UK, the MSX boom is now parallel to that of the Spectrum's in its inceptual country, Japan.

There are now 11 manufacturers building MSX machines, and in just three months it's said that they've captured 30 per cent of their home market.

With a range of MSX machines poised to enter the Western market, what exactly can we look forward to? What is it about MSX that has impressed everyone under the rising sun? We went there to find out, and returned with details of several MSX

## THE FIRST PART OF A LOOK AT THE COMING RANGE OF JAPANESE MSX MICROS.

machines, two of which we'll be looking at this month (Sony and Hitachi), and the rest in next month's issue

MSX computers use the Z80 CPU, TMS 9918A (by Texas Instruments) and Microsoft's MSX Basic. Going on the specification, many in this country have dismissed them as low performance machines, but having been to Japan to see the actual machines, we can assure you that for a £150 to £200 computer, they are very good value – if only for the fact that they are all extremely well

built to the expected Japanese standard.

When ASCII Microsoft of Japan presented the MSX standard to the manufacturers, it ensured that all MSX machines are built to the full MSX requirements, so that they are hardware and software compatible. All MSX machines have the same basic circuits within them, however, they may have different extensions. The MSX machine is built so that it is as flexible and expandable as possible.

They have one or two cart-

## UPGRADE

ridge slots which you can plug in interfaces, expansion RAM or a disk operating system. The cartridge slot can be expanded to take up to 16 peripherals. The RAM can be increased upto 1 Mbyte in steps of 64K, by plugging into the cartridge slot (like Elan's Enterprise). The minimum memory requirement for a MSX computer is 32K MSX Basic ROM, and more than 8Kbyte of RAM; however, most have at least 16K of RAM.

MSX graphics can handle upto 192x256 with 16 colours and 32 sprites. The good thing about the TMS 9918A graphics chip is that it has its own video RAM (16K), so graphics do not eat up the user RAM. Its colours are some- ▶

**T**rue Sony, known to opt for good designs, to bring out the most elegant looking MSX computer. The word Hit Bit is a pun on the Japanese word for 'people', and it certainly is a friendly-looking computer, advertised more like a hi-fi.

Hit Bit comes in a choice of two colours, red and silver. Its body is well-shaped, with a very conspicuous shiny black section behind the keyboard which contains the on/off switch and the cartridge ROM slot. It has a touch-type keyboard with large and clearly marked keys, making it easy to use, with the function keys and editing keys slightly smaller than the rest; the reset key is thoughtfully protected to prevent accidental reset.

You could say that Sony Hit Bit is about the most complete MSX machine, as the basic model comes with all the necessary interfaces: there are UHF and video outputs for the display; you can connect up to two Atari type joysticks; and there is one 50 pin I/O bus, a cartridge slot at the top, and a Centronics port.

The Sony Hit Bit comes with 16K of memory, plus a 4K non-volatile RAM cartridge. When the machine is switched on a menu is displayed so you can choose which of the four firmware options you require, as well as MSX Basic. The computer is equipped with an address manager, Schedule note and Memo program. The CMOS RAM cartridge can be used with these programs (so you can store your friends' address and telephone

## SONY HIT BIT 55



### THE HIT BIT MAINTAINS SONY'S TRADITION OF GOOD-LOOKING MACHINES – WHAT ELSE HAS IT TO OFFER?

numbers, for instance). One cartridge can hold up to 80 names and addresses.

The good thing about it is that it's very accessible com-

pared with tape or disk address software – plug in the cartridge and there it is. The database programs was certainly easy to use but it is not really all that

sophisticated.

The Hit Bit is excellent for games playing: its cursor keys are large, well spaced and arranged in a neat square. The optional joystick is robust but much too firm (the second joystick port enabling two player games).

Sony is one of the few hardware companies which also sells games software, such as *Othello* and *Jenofast*. *Jenofast* is a 3-D 'Defender'-type game. (Sony has joined forces with a number of arcade game manufacturers to convert video games to MSX machines). *Othello* (which incidentally is the proper version), in on ROM cartridge as with all Sony software. It plays a rather weak game at level one, but level 4 is very tough. *Othello* is very nicely written as placing a stone is done using cursor keys controlling an arrow and when you place it you see the relevant pieces nicely flip over.

One of the strong points about MSX computers is, of course, software compatibility: over 100 software titles have been released, and you are assured of high quality since the software houses have to compete with reputable companies like Sony, only 20 per cent of it comes in cassette form (prices averaging about £8.50, and cartridges £13.50).

For a computer which has an almost complete range of interfaces (except RS232) and built-in software, the Sony Hit Bit is a bargain – definitely one of the cheaper MSX micros. If you don't mind not having a proper keyboard, this machine is well worth considering.

### SONY HIT BIT 55 SPECIFICATION

CPU: Z80A
ROM: MSX Basic ROM 32K, and HB 55 utility soft ROM 8K.
RAM: 16K.
Video RAM: 16K.
Screen: 32 × 24 or 40 × 24 text, and 256 × 192 16 colour graphics.
Sprites: 32.
Keyboard: Touch type.
Interfaces: composite video and TV output; cassette 1200/2400 baud; printer Centronics; audio mono 1 CH; one 50 pin expansion port and a cartridge slot; two joystick port (Atari type).
Additional item: CMOS data cartridge.

### MULTI-INTERFACED AND WITH BUILT-IN SOFTWARE, THE HIT BIT IS A BARGAIN.



## UPGRADE

what pale (like the TI/99 and unlike BBC Micro). We are unsure whether this is due to the Japanese TV system or because of the graphics chip, but they are excellent if used with a monitor.

The graphics are suitable for drawing hi-res pictures on screen, and some MSX computers include utility firmware to do so. There are enough sprites to do animation, and they can be controlled easily using Basic statements. There are also event handling facilities which allow Basic programs to be interrupted when sprites collide, keys are pressed, errors occur and so on.

The cassette interface has two baud rates: 1200 baud and 2400 baud. When reading cassettes, the baud rate is automatically detected so that the user does not have to specify the baud rate for the cassette. The printer interface is the usual Centronics type interface, and there are MSX printers which cater for all graphics characters (but ordinary printers with a Centronics interface can be used).

MSX Basic is an extended version of Microsoft Basic version 4.5, but generally speaking it is designed to follow the GW Basic which is a standard Basic in the 16-bit machine

**MSX MICROS ARE EXCELLENT FOR THEIR PRICE: THE HARDWARE AND MSX BASIC WORK WELL, AND EXPANSION FACILITIES ENSURE WIDE RANGE OF ADD-ON SUPPORT.**

### MINIMUM MSX SPECIFICATION (SET BY ASCII MICROSOFT)

Z80A CPU
TMS 9918A Graphics Chip
AY 3 8910 Sound Generator
32K MSX BASIC ROM
More Than 8K of RAM
Audio output
Video output
Cassette interface
One cartridge slot
One joystick port
This is the minimum spec; most machines have at least 16K of RAM and more interfaces.

world. Although it does not have the sophistication nor structure of BBC Basic, we feel that MSX Basic is about the best version of Basic Microsoft has produced. MSX Basic is featured with up to 14 digit accuracy – which is more accurate than most 8-bit micros. You can specify whether you want integer, single precision or double precision, also when numbers are printed they can be formatted a similar manner to Fortran.

The graphics commands are similar to that of the Dragon – there is a graphics macro

language and commands such as DRAW, CIRCLE and PAINT (FILL); however, it is expanded to cater for 16 colours and 32 sprites.

Sprites are shapes which can be moved around on top of the static screen so they can be used for fast moving animation. Their size and colours can be set and priority given to which sprite appears in front and which behind.

Unlike Sinclair's or Acorn's machines, MSX computers do not use totally up-to-date technology – in fact, it appears to me that they have gone out of

the way to make it orthodox. There are a couple of reasons for this: first, because MSX was to become the industry standard, it had to be made with chips which are widely available (chips like Z80 have so many second source manufacturers, that it is cheap and they are guaranteed from chip shortage problems, which have been getting worse recently); second, the chips chosen are those which have been proven to be successful and that most makers are familiar with. The MSX computers are designed to be as expandable as possible, and because the chips are the familiar Z80 and TMS 9918A, the peripherals are easy to build.

So where does this lead to for the average customer? There are a number of prospective benefits. The staggering number of manufacturers will ensure high standards; and because the peripherals must be made to the MSX standard, you get a huge choice of add-ons by quite a number of manufacturers.

By the time you read this, the MSX DOS (disk operating system) cartridge and floppy disks will be out in Japan. When we researched this article a prototype of MSX DOS was in working order, and we were told that it was up to the disk drive manufacturers to adapt it to their disks.

**H**itachi's entry into MSX can only be described as cautious, and its offering, rather strange. One of the biggest chip and mainframe manufacturers in Japan, they have not made much impact on the home computer market.

The MB H1 is designed as a portable computer of the Epson HX20 and Tandy M100 variety, with carrying handle and a detachable power pack. Why a home computer would want to pretend to be a portable is beyond us, but it certainly is full of surprises.

Switch the machine on and you will see a Hitachi logo and an introduction with a menu of options in hi-res graphics – a nice touch. Press the function key F2 and you get a machine code monitor; Hitachi is the only manufacturer to provide such a utility software. There are 13 commands, and this monitor was used to develop the MSX machine and its utility firmware by Hitachi pro-

## HITACHI MB H1

**RATHER AN ODDITY IN THE MSX WORLD,  
HOW DOES THE HB MBH1 COMPARE TO  
WESTERN LAP-TOP MICROS?**

grammers, so it is well tried and tested.

If you press F3 the machine explains to you how to use a

ROM cartridge software. It is very brief and is in graphics. F4 is a graphics program which allows you to draw pictures on

### HITACHI MB H1 SPECIFICATION

CPU: Z80A
MSX Basic ROM 32K and 8K utility ROM.
RAM: 16K.
Video RAM: 16K.
Screen: 32 × 24 or 40 × 24 text and 256 × 192 16 colour graphics.
Sprites: 32.
Keyboard: full travelling keyboard.
Interfaces: composite video and TV output; cassette 1200/2400 baud; audio mono (one CH); two cartridge slots; two joystick ports (Atari type).

**WITH UNSOPHISTICATED BUT INTERESTING  
FEATURES, THE MBH1 IS IDEAL FOR THE  
MICRO BEGINNER.**

screen using the cursor keys; F5 is a music program which turns it into a simple musical keyboard (the display shows the keyboard and how the keys correspond to notes).

The utility firmware included is not that sophisticated, but interesting and simple enough to get a complete beginner used to a computer just by switching on.

Apart from all the standard features of MSX computers and softwares described, this little machine has two joystick ports, a Centronics port, and one feature totally unheard of in the West – a switch to slow down the speed of the Z80 processor. When we first heard about it, we thought *slow the computer down, that's crazy – you want it to run as fast as possible!* But we reckon it's intended for the slow of response, who need to play the super-fast arcade games at a more leisurely pace!

**By Tom Sato, a Japanese computer journalist.**



**O**ffering £1,000 of free software if you buy a £1,000 micro, as the makers of the new Wren micro are doing, sounds rather dubious; but the deal really is as good as it sounds.

Take another look at the full price of the computer: there are very few serious twin disk, CP/M business machines at anywhere near this price even without software, so if the packages are useful to you, the Wren offer represents a real bargain.

After a year of development it seems Transam have fulfilled their intention of producing an exciting and innovative machine, based on proven technology, attractive price and capabilities. And here's why...

### HARDWARE

The Wren is what we'd call transportable which is different from truly portable, such as the battery operated LCD 'lap top' computers like the Tandy 100 and Epson HX20. The transportable machine is designed to be easily man-handled from office to car and car to home, in one convenient package.

A big mistake that many manufacturers make with this type of machine is to compromise the working facilities such as screen size, number of disk drives and so on, for the portability; this is foolish, as the carrying time is only a small fraction of the machine's use.

Thankfully the Wren has not fallen into this trap. It achieves its transportability in a very unusual way: instead of the common fold up keyboard, the computer slides forward on its base to simultaneously cover the keyboard and reveal the carrying handle.

The keyboard has a 67 key QWERTY layout with a separate cursor key (and home) pad and the two Prestel keys (\* and #). An additional five function key pad, capable of 15 programmable actions, is provided to the left of the main board. The action itself is good and the control and return keys are in the best position for typists - in line with the 'home keys'.

The processor is the 8-bit Z80B running at 6MHz. The standard free memory is 64K RAM which is expandable to 256K using memory banking techniques. These are employed even in the basic machine to enable the screen to have its

# WREN



**IS THE NEW WREN AND ITS £1,000 WORTH OF  
COMPLEMENTARY SOFTWARE, REALLY AS  
GOOD A DEAL AS IT SOUNDS? WE FIND OUT.**

own 36K of RAM for the graphics without impinging the main store. There is an additional 8K ROM for power on diagnostics and 50 bytes of CMOS RAM with battery back-up to store time, date and Prestel code. For a single user machine it is bristling with connections to the outside world: it has the obvious ports, serial RS232 75-19200 baud (faster than most!), and Centronics for parallel printers.

The rest are much less common: six analogue inputs that can be used with two joysticks and the included BBC Basic. However, the machine

could be used as a very economical six channel data capture system, monitoring heat, light and temperature.

Communications are already built-in and British Telecom-approved, using an auto dial modem with 1200/1200 and 1200/75 (Prestel) baud options. For users of the BBC modes the sound can be produced internally (through a small speaker) or fed out through a DIN connector. Colour output is via the RGB socket to a suitable monitor or can be fed to a normal TV using a RGB to RF converter.

Lastly, for those users who

## UPGRADE

need more storage than the floppies offer, a range of Winchesterstors are available. This option is accessed via a socket already present and is not the usual promise for the distant future. Three sizes are produced 5MB (at £1,595), 10MB (at £1,795) and 20MB (at £2,495). The standard disks are half height 5¼ inch with a total of 400K storage - a double sided option will be available at extra cost.

The display is a 7 inch screen with a flat face and is amber. This may seem fairly small, especially to those used to a full size terminal, but there is no need to worry as the characters are clear and well formed, and it presents no problems in use. It has three selectable modes: 80 x 24 televideo TV1 910 emulation, 40 x 24 Prestel and 512 x 256 graphics.

On powering-up, the shift-lock key lights up and the diagnostics are performed in a few seconds. If all is well, the main power light goes on and the Wren logo appears on the screen with an instruction to load the operating system disk into the top drive. Shortly after loading, the main 'Wren Menu' displays, and at the top right is a permanent display of day, date and time (note this has not required any user intervention as the operating system has gone to the battery backed-up real time clock for its information).

Most machines have to prompt the user on power-up for this data. The best way to describe the rest of the screen layout is to imagine 10 playing cards laid in two rows of five starting at the top centre and moving to the bottom edges. Each 'card' is laid down half covering the previous card. The end result is ten labeled options one on each card.

The selection is made by using the left and right arrows, confirming the option by pressing return. On the last line are function key effects; which are - F1 re-set time, F2 and F3 directory for disks A and B, F4 is not used and F5 is an exit to CP/M.

### SOFTWARE

The software options provided on the screen are: Executive Desk top; Communications; Perfect Writer; Perfect Calc; Perfect Filer; Additional Software; Programming; Disk Copy (Exec Desk); Format ▶

### WREN SPECIFICATIONS

Price: £1,000 (exc. VAT) including software

Memory: 64K RAM expandable to 256 (banked), 8K ROM diagnostic, 50 bytes CMOS RAM with battery for permanent time, date and Prestel code storage.

Keyboard: 67 key QWERTY, cursor keys, separate Prestel keys (\* and #) and five function key capable of 15 programable actions.

Processor: Z80B at 6MHz

Interfaces: RS232 75-19200 baud, Centronics (parallel printer), 4 analogue inputs, winchester port, auto dial modem (BT approved) 1200/1200 and 1200/75 (Prestel) baud, sound and RGB colour output.

Disks: Twin half width 5.25 inch 200K storage each. Optional double density.

Display: 7 inch flat faced amber with 36K screen memory and 3 selectable modes - 80 x 24 Televideo TV1 910 emulation, 40 x 24 Prestel and 512 x 256 graphics.

**A WEALTH OF FACILITIES AND GOOD  
PRICE FOR ITS RANGE, MAKE THE  
WREN WELL WORTH CONSIDERING.**



## UPGRADE

Disk (Exec Desk); Utilities.

For want of any better method, we will cover the software in a clockwise direction, as it is presented on the Wren screen.

On selecting this option a similar menu to the main one is displayed and contains the Time Management, Addresses, Desk File, Filing, Calculator, Utility/Backup, and Finish options.

This system as a whole is designed to be an executive aid, an electronic replacement for the traditional office worker's tools such as a diary or calculator memo pad. It is written in the 'C' language, and is (at the moment) a Wren-exclusive application package. Certain features of the system are active throughout. For example, the typewriter and calculator can be invoked from the menu or anywhere in the system. Whilst in use a window is made which closes when you have finished. In addition, a telephone number can be automatically dialled (using the internal modem) simply by placing the cursor over the number and pressing a couple of keys.

The Time Management system is built around a day diary in the sections, appointments, things to do and events. The event file is very useful, as it not only allows fixed date fields but also has the ability to enter wild card dates; for example, 25:12:\*\* = Christmas Day will prompt every year, and 18:\*\*:\*\* = Mortgage payment will prompt every month. It also has good general purpose search facilities, and can print out a month in advance listing all major events.

The Addresses system, as you would imagine carries addresses, but in addition, 'phone numbers, group (retrieval aid) and comments. It can also list out telephone numbers and print labels and envelope addresses.

The Desk File is an unusual system, comprising of a general retrieval system, and a document creation system. The latter part allows the building of shells with headings and input areas to which the system automatically jumps, which can be used for memos, agendas, expenses (it has automatic totalling facilities), and many other applications.

The Filing System is not what you would expect by its

name. It is a way of systematically ordering your manual filing system; up to nine major headings can be created, to each of these a further nine sub-headings can exist and to those yet another nine sub-headings - therefore, a maximum of 999 filing subdivisions can be created. When something has to be filed, the system leads you through the classification, concluding with a descriptive and numbered label ready for filing.

The Calculator (which can be called by this option or anywhere in the system) is a four function, five memory facility which can, on command insert the end result into a document. The Typewriter, in the same way as the Calculator, be called directly anywhere in the executive system, can control the dumping of pages, and act as a simple one line editing typewriter. The Utility/Backup routine's prime purpose is to create backups and format new disks, and, when required, create new skeletons for the Executive Desk Top functions. In addition, it allows system configurations such as label formats, printer types and whether the phone numbers should be preceded with a '9' (for an outside line) as would be required in an office environment.

The Finish option returns you to the main menu. Throughout the system many defaults were provided - such as automatic time and date entry - and as a whole the system fulfilled its function. However, there were one or two slight anomalies and bugs (but this is to be expected so early in a system's life): pages in the address system can have both a 'blank' for the name or two pages the same name. There is also some slightly 'loose' handling of screen updates: for example, after a calculator has been called and cleared some of the box edges of say the diary page may be lost. The data is not corrupted in any way nor is the usage affected, but it leaves a rather untidy impression.

Two features which would be of great use, but did not appear to exist, were the ability to take a 'phone number from the address file into the diary to build up a list of calls to be made for the 'to do' list, and the ability to list off the complete diary for a number of weeks ahead. In the time available we were not able to fill the

systems, so if you wish to check out the speeds of these systems arrange to do so at a machine demo.

## COMMUNICATIONS

The communications with the system are simple and menu driven. The main menu allows logging on and off using four pre-set numbers or manual dial. There is a sub-menu control of the range of pre-set numbers and their descriptions. For example, the Prestel identity number is not stored on disk, but in the CMOS RAM for security reasons but can be changed as required. Once on line, frames can be viewed in the normal way and can be saved for future use. When off-line these frames can be re-viewed from a disk file. With the addition of a suitable printer, hard copy of the frames is possible.

Program down loading (tele-software) is available and a number of Wren programs are already on Micronet 800 (see Prestel page 600). The Wren is also capable of message preparation, sending and receiving. The colour graphics of Prestel are represented on the Wren screen in 'grey' tones, but full colour is possible by the addition of a suitable monitor (RGB) or a converter (RGB to RF) and a normal colour TV.

Programming is a facility to load BBC Basic (Z80 version) for programming and execution of Basic programs. The manual provides a summary of the added commands unique to the BBC interpreter over and above MBasic.

The Disk Copy (Exec Desk) and Format Disk (Exec Desk) utilities are provided to menu drive formatting and disk copying (the latter formats prior to copy). Both work well, but lack an obvious exit option at the start should you enter them by mistake.

A utility menu is provided to interface with CP/M to menu drive its functions such as rename, which makes life much easier for the first time user. In addition, some features often only found on the more up-market systems are provided, such as Design Characters Sets, Define Keys and Configure System.

CP/M 3.0 (sometimes known as CP/M plus), the operating system supplied, is the most advanced 8-bit version from the Digital Research stable. This arrived a while after the 16-bit versions such as

CP/M 86, illustrating the company's continuing commitment to 8-bit machines. It offers considerable improvements and added facilities over the CP/M 80 system version 2.2. The first noticeable advance is the increased speed of the random file disk access.

Included along with the Wren user guide are the three 'Perfect' manuals; it is also possible to purchase the full CP/M 3.0 manual, an in-depth guide to BBC Basic and a Wren technical manual. The user guide introduces the hardware and basic concepts, provides an overview of the 'Perfect' suite and in-depth coverage of the Communication and Executive Desk Top options. A section is devoted to the operating system and sufficient information is provided (if you already program in Basic) to work with the BBC Basic. The manual was good, providing useful training and information for the first time user, and reference information for the more experienced. It was one of the few manuals that covered the very important area of backup and security.

The only obvious criticism of the Wren is that it is not 16-bit - but if it is speed you're wanting, then you will have to think again after consulting the benchmarks - the Wren beats some of its so called faster 16-bit relatives.

When considering a machine to compare it to the only one that seemed appropriate was the IBM PC. Both machines are ideal for business and yet can still be used for home and 'fun' uses. They both have mainstream serious operating systems and yet also have colour sound and joystick capability.

So the Wren is a machine with a wealth of features at a good price which is ideally suited to a wide range of applications, and equally as good operating as a desk top business system for serious applications, as it would as a fun home machine.

**By Eric Bagshaw of the National Computer Centre.**

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# DOT-MATRIX COMES OF AGE

CAN THE LATEST RANGE OF DOT-MATRIX PRINTER ACHIEVE QUALITY ON A PAR WITH DAISYWHEELS? WE FIND OUT.

**A** new generation of dot-matrix printers have gone some way to overcoming many of the traditional shortcomings associated with the machines. Latest models on the market are not only able to produce colour graphics, but also (on some) print that's smart enough to impress even the most fastidious bank manager.

In the January issue of *Computer Answers* we saw how daisywheel printers are excellent for producing smart print, but because of the way they produce an image on paper they're not suitable for drawing graphics. If you want to produce nice screen dumps and pretty printouts, as well as text, the type of printer used will have to be a dot-matrix, inkjet or thermal type.

Unlike daisywheel printers, which print using a hammer to strike an arm with the character on it, (see *Computer Answers*, January '84 issue), dot-matrix printers use a matrix, or 'mesh' grid. By forcing pins through the grid and onto a ribbon, the dot matrix printer can produce virtually any shape, not being confined to any set characters. As the resolution of print depends on how close together the holes on the grid are, or how many pins the head uses, the print is not usually letter quality, although reasonably acceptable.

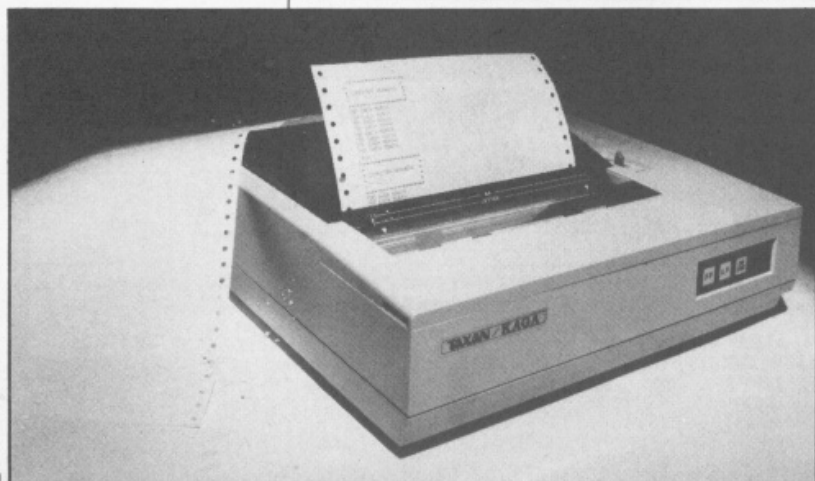
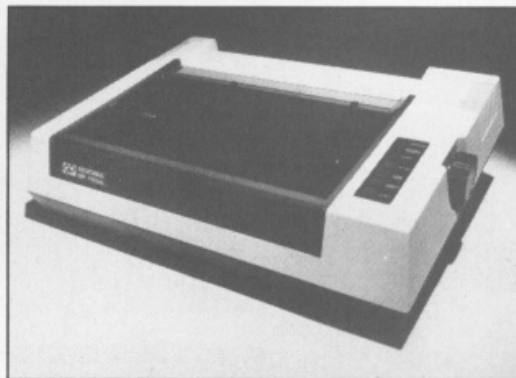
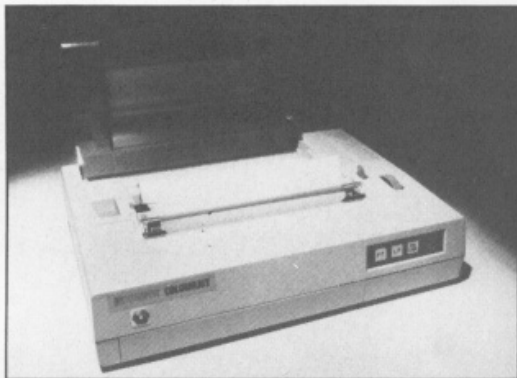
Epson is the name most people associate with robust budget printers, and recently it has launched a new machine in the form of the LQ1500.

The LQ is a real beast, and its size, as well as a price of £1,265, will prevent most people using it as a table top printer sat next to their micro. All the features anyone could want have been included on it – enlarged and condensed print, italics, near letter quality print mode, proportional spacing (important when producing letters), and a facility allowing user defined character sets to be downloaded.

The machine is quite complex, so Epson supply with it a suitably comprehensive manual that rivals *War and Peace* for size. Every feature is explained in detail, and starting off with the machine is very straightforward. Like the daisywheel printers looked at in the January issue, all the special effects on the LQ1500 are executed through ESCAPE codes, as we used a BBC Micro with the printer, all the ESCAPE codes took the form of VDU statements. Although these can look a little mind-boggling and long winded, they are quite easy to use after a bit of practice. All the commands used are placed in a VDU 1 statement, the code that causes the next character to be sent to the printer.

The print head of the LQ uses either 24 or 8 pins. In the former mode, near letter-quality print can be obtained, as good as some daisywheels (see Fig. 3); but on close inspection it does tend to smudge a little and become fuzzy around the edges. However, as far as dot matrix printers go, the quality is great. Should you not want to print at near letter quality,

Far right: the Seikosha GP700A – nice looks, shame about the print;  
right: Rainbow rising with the Integrex colourjet;  
below: Taxan/Kaga – near letter-quality print at a low price.



(for example, if you want a fast print out) there is a draft print mode that prints at 200 cps rather than 67; a vast improvement, though the print is very dotty.

One feature that stands out on the LQ, as well as the near letter quality print, is the ability to accept user-defined characters and mix them with character codes already used. Up to 128 user defined characters can be downloaded to the printer and stored in its RAM (the RAM is not normally used by the printer as it usually accesses its characters from one of eight character sets it has in ROM).

Before defining a character, a location in RAM must be stated to tell the printer where in memory it is to be stored. Once the location is specified and the character designed, it can be sent to the printer. It is not possible to print the character until the RAM is stated as the place where the character is stored. This is done using another ESCAPE code ESC



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% 1. It is then possible to print the character by sending its code to the printer.

Another bit image mode gives the user the ability to print an image in dot units using only 8, or all 24 pins. There are six 8 pin and four 24 pin image modes. By using the various bit image modes, simple dot drawings and lines can be constructed in different print densities; ESC Z even gives a quadruple density mode.

Included in the LQ's ROM are 11 character sets including Japanese, German and Danish, each of which is software selectable using ESC R. Using ESC O, it is also possible to put any of the sets into a download character set so that they could've printed out.

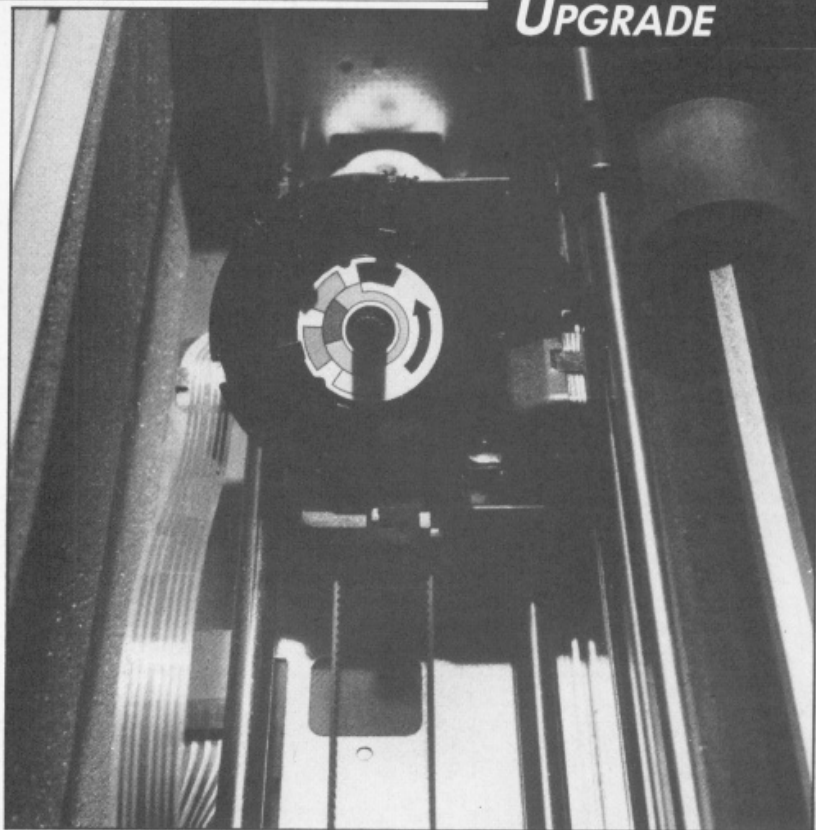
To complement its excellent printing ability, the LQ also has a good external design, with some natty features: a removable interface card on the rear is a very handy facility, as it allows Centronics, RS232 and IEEE 488 interfaces to be easily interchanged; The operation of the machine can be changed by dipswitches, as well as through software control, and these are placed where they are easy to reach - you don't have to spend time undoing lots of screws and removing half of the printer's body. Even with its massive size, the LQ is a surprisingly quiet machine, that lets out a soft purr from its internal fan.

Although the facilities offered by the LQ are very comprehensive, they are not enough to justify the high price, what you are in fact paying for is a robust design that should give the printer a long life. For most people a vast majority of the features will be unused, as there are not many word-processors that can handle them. *Wordstar*, one of the most popular word-processors, cannot be customized to use all the features, and *Wordwise*, with which this article was written certainly can't.

The Taxan/Kaga KP810 is a dot-matrix printer far cheaper than the LQ, but still produces some very favourable print. Virtually all the features on the LQ, including near letter quality mode (see Fig.

4), enlarged and condensed print, and super and subscript mode are available on the KP810 and they are all accessed in the same way using ESCAPE codes (NLQ mode can be switched into directly by holding down the FORM FEED key on power-up); it is even possible to define your own RAM character set (128 characters in all) in the same way and download the ROM set. Data Efficiency are also working on a ROM that will allow you to download ►

## UPGRADE



Above: the GP700A printhead putting a new slant on things, below: printer prices and features compared.

FIG. 1

Printer	Speed (cps)	Interface	Add-ons	Price	Supplier
C.JET	40	Centronics RS232 (688.85) Viewdata+RS232 (757.85)	Black ink (4.60) Colour ink (11.50)	573.85	Integrex
GP-700A	50	Centronics RS232 (92.00)	Ribbon (18.95) Ink pots (12.95)	399.05	Akhter
KP-810	140	Centronics RS232 (N/A)	Ribbon (6.90) 64K buffer (N/A)	343.85	Data Efficiency
KP-910	140	Centronics RS232 (N/A)	As above	458.85 (wider platen)	Data Efficiency
LQ-1500	200	Centronics RS232 (138.00) IEEE488 (138.00)	Tractor feed (59.80) Ribbons (N/A) Single sheet feeder (N/A)	1265	Epson

(Note: figures in brackets denote price of options. N/A means the price was not available at the time of going to press)

FIG. 2

Printer	Bi-directional	Proportional Spacing	Graphics mode	Colour	Supplier
C.JET	YES	NO	YES	YES	Integrex
GP-700A	NO	NO	YES	YES	Akhter
KP-810	YES	YES	YES	NO	Data Efficiency
KP-910	YES	YES	YES	NO	Data Efficiency
LQ-1500	YES	YES	YES	NO	Epson



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DIABLO 630 TRACTOR	149.00
JUKI 6100	335.00
TRACTOR	89.00
SHEETFEEDER	199.00
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QUME 11/55 (RO)	1375.00
QUME 9/45 (RO)	1590.00
QUME 9/55 (RO)	1940.00
RICOH RP 1300 (P or S)	899.00
RICOH FLOWWRITER 1300	999.00
RICOH RP 1600 (P or S)	1239.00
RICOH FLOWWRITER 1600	1299.00

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OKI MICROLINE 84(P)	635.00
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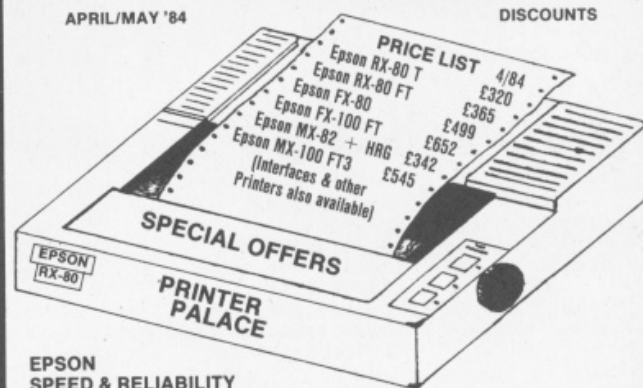
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such things as Greek and gothic fonts.

The printing speed is slower than the LQ however, being 140 (slower in NLQ mode), compared to the LQ's very fast 200 cps. The KP810 will probably be better for the home user because of its small size and modest price. Sitting on your desk next to your micro, it won't take up room that is best occupied by a plate of sandwiches and some beverage.

There are various cheap printers on the market that not only print-out graphics but also colour, making them a good proposition for the latent artist. One of the best is the Integrex Colourjet printer. Unlike a dot-matrix printer, the Colourjet actually sprays ink onto the paper from several ink sacks housed in the machine's main body. The sacks are held in two plastic cartridges, one containing just black ink, and the other several colours.

A flap on the front of the printer can be opened to reveal two slots into which the cartridges are fitted; one cartridge contains just black ink, whilst the other has all the colours. There shouldn't be any worry about constantly having to replace the ink cartridges, as Integrex claims each one will last for eight rolls of paper, or four million characters (needless to say we took their word on this). Up to eight different colours (one of which is white) are available on the Integrex, giving the user a fair bit of scope when it comes to printing out screen designs.

Those users with a BBC Micro are particularly lucky, as the printer manual contains a listing for a BBC screen dump program. As well as handling screen dumps, the Integrex has some functions that allow the user to perform special effects on text.

Various things such as double density printing, enlarged print, print width and colour change can all be done on text, and the real beauty is that when something is finally printed out the whole process is virtually silent—no road drill rattle. Finally, graphics: the Integrex, as mentioned earlier, has the capacity to print out graphics characters which, by putting the printer into colour graphic image mode, can be multicoloured, however, image code has to be entered in hexadecimal, so a bit of knowl-

edge of this notation is required.

At £573.85, the Integrex Colourjet is a good buy. Although it is not one of the fastest printers at 37 cps, it provides good print, a compact design and a pleasant buzz during printing (instead of a Bren gun impression).

A colour printer that hasn't quite the quality in print, or quietness of the Integrex, is the Seikosha GP700A. Our first hassle with the GP700 was trying to get different colours, out of it: a confusing manual does not help, but once we'd sorted out the required codes, all worked perfectly.

The print however, was, in all of the seven colours, very smudged due to the multi-coloured ribbon being dragged across the paper as the print head moved along the platen. The manual pointed out why this could be happening, but our attempts to remedy it using the methods proposed did not make any difference, though it might not be a hopeless case. Where the GP700 scores over the Integrex with its print speed, but this isn't much of an advantage given the quality of print. All the effects available on the Integrex are possible on the GP700, and are all executed in the same way using ESCAPE codes. The graphics mode is also the same.

If you are looking for a colour graphics printer and have sifted through the advertisements in various magazines, you could well have the GP700 on your short list. Out of the Integrex and GP700, we would certainly recommend the former, but because of the print quality of the GP700 it is very hard to give a reason why it should be purchased.

From the printers looked at, it appears that the daisywheels could at last be getting some serious competition from the dot-matrix corner. Using machines such as the LQ and KP-810 printers, it is now possible to produce some very acceptable near-letter-quality print, at a lower price and much faster print speeds than most good quality daisywheels at equivalent prices. And for the user who likes a splash of colour to liven things up, the Integrex will fulfill most people's needs.

By Steve Applebaum, staff writer on *Computer Answers*.

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*Fig. 3 shows classy print from the Epson LQ1500; Fig. 4 ditto from Taxan/Kaga.*

FIG. 3

THIS IS AN EXAMPLE OF THE LQ'S NEAR LETTER QUALITY PRINT

THIS IS AN EXAMPLE OF THE LQ'S DRAFT MODE.

THIS IS AN EXAMPLE OF THE LQ'S PROPORTIONAL SPACING

ENLARGED TEXT      CONDENSED MODE      UNDERLINE      ITALICS

FIG. 4

THIS IS AN EXAMPLE OF THE TAXAN/KAGA'S NEAR LETTER QUALITY PRINT

THIS IS AN EXAMPLE OF THE TAXAN/KAGA'S DRAFT MODE

THIS IS AN EXAMPLE OF THE TAXAN/KAGA'S PROPORTIONAL SPACING

ENLARGED TEXT      CONDENSED MODE      ITALICS      UNDERLINE



# DRIVE AHEAD WITH DISKS

ADDING A DISK DRIVE CAN GIVE YOUR MICRO A NEW LEASE OF LIFE — BUT WHICH IS THE BEST FOR EACH SYSTEM? WE FOUND OUT...

**D**isk drives can change the whole character of your micro — not only do they provide fast access to masses of data, but with a good DOS, can give a machine a new lease of life. Compact and efficient, they can free you from the drag of cassettes.

In the last issue of *Computer Answers*, we took a look at ways of linking disk drives to the more popular micros, so let's take a closer view of the drives themselves. The systems we'll be looking at are those with a 34-way pin connector, the BBC, and the Spectrum (with disk interface).

Since the early days of the home/office micro, the 5¼ inch disk has been regarded as the most popular standard, but this is now being superseded by the 3 inch and 3½ inch drive. Most of the popularity of the smaller drive comes from its compact design, but there is an advantage that 3 inch disks have over their larger relatives — that of strength. Unlike larger drives, 3 inch ones use disks that are housed in a sturdy plastic jacket, protected from prying fingers and the hazards of bending.

The Micro Pulse, from Northern Computers, is one such toughie housed in a strong metal case with Northern Computer's own plastic front. The 3 inch Hitachi drive comes complete with all power cables, utilities disk and an interesting little piece of software called the Mirror. The Micro Pulse is compatible with the Acorn interface, so there are no hassles trying to get a DFS ROM.

The capacity of the 3 inch drives compares favourably with that of the larger ones. For instance, when a disk is formatted to 40 tracks on the Micro Pulse, the capacity per side of a double sided disk is 100K bytes. This increases to 200K

when it is formatted for 80 tracks. As with larger disks, those on the Micro Pulse are split up into sectors of 256K bytes, usual for a BBC disk.

If your Beeb has the Acorn DFS, you will also have the Acorn utilities disk, but on a 5¼ inch disk. As a result, a utilities disk supplied with the Micro Pulse has all the formatting and verifying programs on it. These include both 40 and 80 track versions. If, on the other hand, you have the Watford Electronics or Pace/AMCOM DFS, then there is no need for a utilities disk, as everything is contained in ROM.

The Mirror, an intriguing utility, enables the user to transfer virtually any BBC program from cassette to disk; something which no other DOS (to our knowledge) offers. By following three easy steps, programs could be loaded hassle-free, with no messing around with sound levels, and at a far higher speed.

After loading the Mirror, the user is asked the

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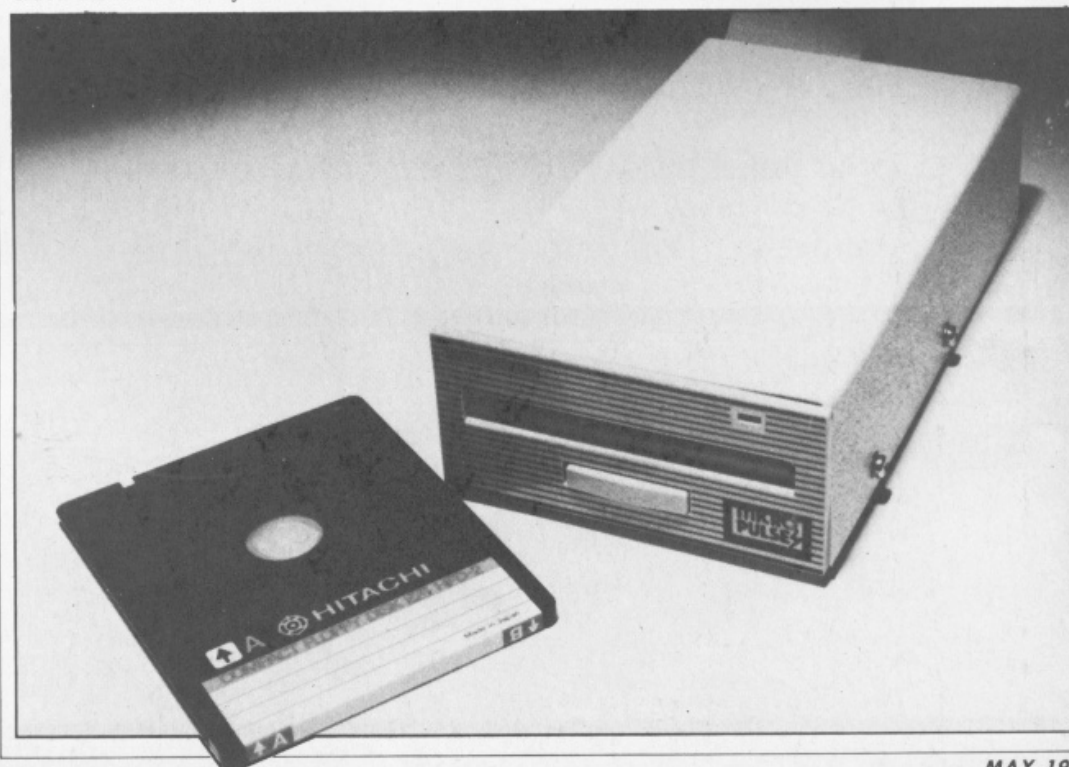
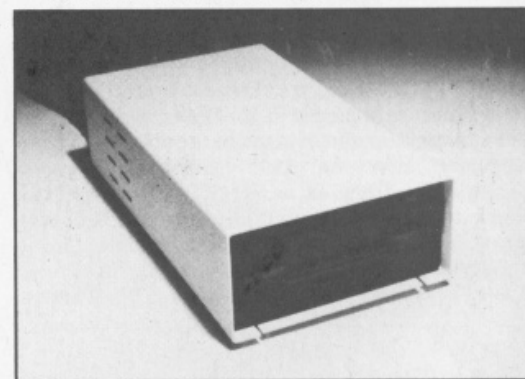
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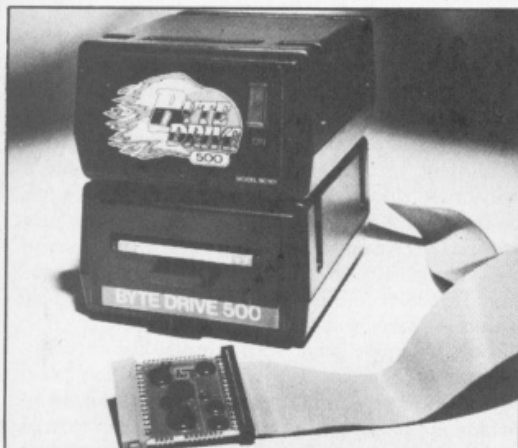




name of the game to be copied, and how many stages it LOADs in. Then you must say how the program is run (CHAIN", \*RUN", or, \*LOAD"), start the tape, and *hey presto*—the program transfers onto disk. Although this is an extremely useful utility that could attract users, it should be borne in mind that the use of the program could infringe the copyright rules governing the pirating of software.

Opus Supplies is another company that produces a disk drive almost identical to that from Northern Computers. It is again made of metal in the same creamy colour as the BBC micro. The capacity is exactly the same and it uses the Acorn interface, though in this case you do not get the Mirror for transferring your programs from one storage medium to another.

Premier Microsystems has not gone for the Hita-



chi standard, but rather the 3½ inch one set by Sony. The drives, together with the DELTA disk interface, comprise a total disk system for the Dragon 32. There are several versions of the DELTA system available, coming with either a 40 track drive with a storage capacity of 180K, or an 80 track version with 360K.

Premier has housed two 3½ inch Sony drives in a large plastic case, giving them full protection.



(Left): The MCD1 from Electronequip — £129; (far left): The drive with more byte-ITL Kathmill.

Though they lose none of their compactness, the two drives do gain somewhat in weight. With the weight, they have a good sturdy feel and a robust look, giving the impression they will last for a long time, and stand up to a lot of bashing around.

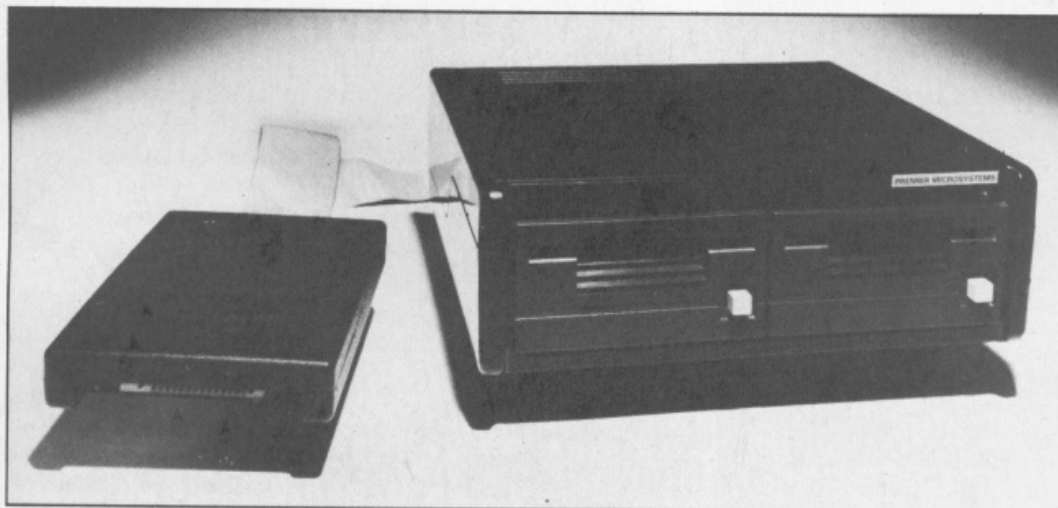
As well as all the cables, disks, and so on, Premier supplies a book on disk systems for the Dragon that is written in conjunction with Cumana, another company that sells its DELTA interface. Everything about the Dragon Disk Operating System (DOS) is explained in the book, along with how data is set out on the disk and how the interface can be customized, by the user, to take different drives.

Unlike the BBC that uses the 8271 controller chip, the DELTA interface allows the Dragon to read double-density disks. Like the BBC, each sector on a formatted disk contains 256 bytes, but instead of 10 sectors, there are 18. This means that a formatted, single-sided, 40 track disk, has a storage capacity of 200K, whilst the 80 track version has 400K.

The DELTA disk system comprises disk controller circuitry, and an 8K ROM containing the DELTA DOS. Premier says that its main reason for using a ROM to store the DOS, is that it uses only around 1.8K of user RAM, a very small amount compared to the overall 32K of the system.

The DELTA system manual is comprehensive with a wide range of commands. So the user can mix the type of disk drive used on the system, 40 and 80 ►

*Opposite page: (above) certainly not one of the no-hopers from Opus; (below) best things come in small packages — the Micro Pulse from Northern.*



Left: Premier Microsystems double drive; (below); a drive comparison box.

FIG. 1

Drive	Size (ins)	Capacity	40 track	80 track	Sides/density	Price	Supplier
Opus 5401	5.25	200	yes	no	ss/dd	179.95	Opus Supplies
Byte Drive 500	3	440	yes	yes	ds/dd	192.37	ITL Kathmill
Premier	3.5	400	no	yes	sd/ss	213.00	Premier
Opus 3402	3	400	yes	no	ds/dd	229.95	Opus Supplies
Akhter	5.25	400	yes	no	ds/sd	249.00	Akhter Computer



## UPGRADE

track ones for example. Premier has introduced a CONFIG function that configures the computer to use a certain disk when it is booted. Six parameters go with the CONFIG command, each of which specifies a different characteristic of the disk; drive letter, number of tracks, number of sectors, number of sides, step rate (given in the manual), and data rate, are also given. Once all the requirements have been fulfilled, the CONFIGURATION data can be stored on disk with the INIT command. Anyone that already has a drive and wants to build up their system, but doesn't want to get rid of any existing hardware, could find this a rather handy function.

FIND# is another useful command which provides the ability to search through both serial and random access files for a specific string. FIND# can be used to search through whole, or, parts of a file, and in conjunction with INPUT# will return the start of the string or the start of the record containing the string.

One of the best features of the DELTA system is the ability to alter the length of random access files (a random access file is where a file is spread out over a disk in several different records, each one independently accessible). The industry standard for the length of a record is 128 characters, but with DELTA's CREATE "RAND/F",N, where N is the number of characters per record, the length can be expanded and contracted between 1 and 255 characters as the user wishes.

The DELTA interface not only links the Dragon to a disk drive but can, with the help of an EPROM that fits inside the connecting box, also provide a fairly substantial toolkit. Although Premier's Toolkit is available on both disk and cartridge, it is not compatible with Dragon Data's own disk system, so Premier's own must also be purchased. Some of the

facilities provided by the Toolkit are full screen editing, programmable function keys and a facility that attempts to recover crashed programs, or ones that have been lost using the NEW command.

For anyone looking for a disk system for their Dragon, the one from Premier Microsystems is probably the best bet, although at £213 (for one single-sided 40-track drive and interface) it could be considered a bit expensive.

The Byte drive 500 and Hybrid cable (already mentioned in the April issue of *Computer Answers*), could prove to be a revolutionary advance in the world of home micro disk systems. At time of writing, the drive was available to run with the BBC, Oric 1 and Atmos. The Hybrid cable is only needed with the Oric versions due to the Oric's lack of a disk interface; it consists of a 34-way cable with disk controller and ROM, all squeezed into a wafer thin unit at one end (see the photo on page 19).

As far as the Oric version is concerned, the Byte drive gives the machine a complete facelift, adding much more than just a convenient means of mass storage. Far from being just a drive, the system, devised by ITL Kathmill, gives the machine a totally new dimension. Commands that were left out from its Basic such as WINDOW, INVERSE, and SWAP have all been added, allowing the Oric user to enter new territory. The DOS also lets the programmer select colours (both foreground and background) by merely using control codes.

From what we have seen, things are certainly changing in the world of the disk drive. Not only do they provide a system for mass storage, but, as in the case of the Byte drive and Oric, they can change the whole character of a micro, allowing it to grow into a 'real', adult machine.

By Steve Applebaum, staff writer.

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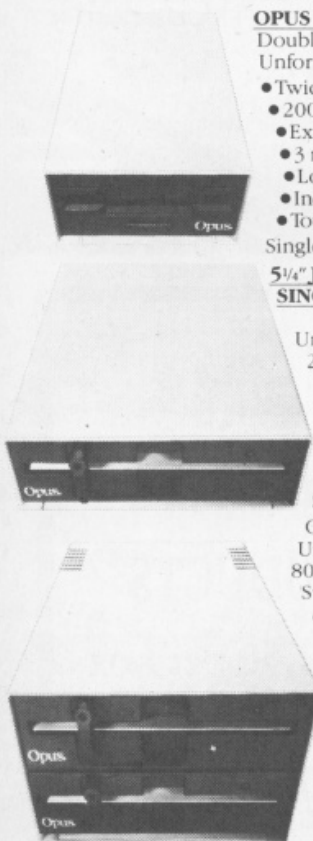
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**T**o novice micro owners, the new generation of packages that help design games are a godsend – the chore of having to learn Basic before you can use your computer to its fullest potential can be a real stumbling block. HURG, from the Australian software company Melbourne House, takes the genre a step forward.

Unlike some of the previous attempts, HURG (High level User friendly Real-time Games designer), for the 48K Spectrum, tries to free the programmer of the restrictions of the old chestnut themes (Space Invaders, Defender, and so on) and offers a package which makes almost anything possible. This might sound ambitious, but Melbourne House has carried it off quite well.

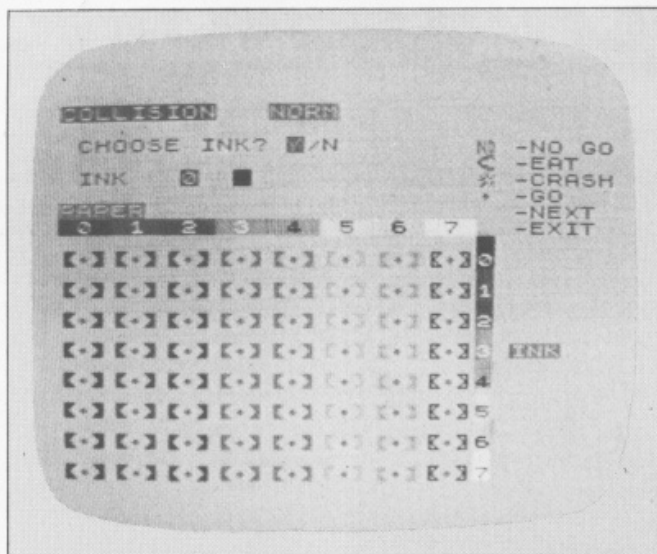
It is misleading to refer to HURG as a programmer's tool, as there is absolutely no programming involved. All the HURGist has to do is flick through the program, menu by menu, selecting various options to make up the game. However, some programming might be necessary to design a background, which means using Basic, or a commercial design package.

The HURG user is never left short of menus and options. One menu, the player/object table, has nine options alone. The player/object table is one of the most important, as it gives access to the shape generator for all the characters that will appear in the game.

The size of the player's figure can range between a character 4 x 2 and 1 x 1 squares, and can take any of the eight colours available on the Spectrum. Before designing a character, the user is asked if the same character is to be used in each direction, and if not, is there going to be any animation. If the same character is used in each direction, a total of eight different positions can be composed to form a complex movement. On the other hand, when a different design is used in each direction, two figures are used per movement. Although this only gives a simple movement, it can still be quite effective.

After designing a character for the player, the object menu is entered and the same done for the 'aliens' and other nasties. This is the same as the player menu with the exception of an option to design a user defined path for the aliens.

# HURG



**WHAT GOES TO MAKE THE HURG GAMES DESIGNER ONE OF THE BEST IN ITS FIELD? WE FIND OUT.**

In an arcade game the movement of the aliens should be made as unpredictable as possible to sustain interest, and HURG has a very clever system to do this. A movement table that refers to the aliens lets the designer give each direction a weighting, or ratio, that will determine how likely a character is to move in any one direction. Paths can also be defined for a bullet, and a jump path for the player's character. Both of these are executed during play by pushing the fire button on the joystick, or a key, depending on which is being used.

As well as a weighting system for alien movements HURG has a powerful collision table (shown above) which can be used for both player and object characters. The table consists of an 8 x 8 grid with each column representing a different colour. Along the top of the grid are all the possible PAPER colours, whilst all the INK ones are down the right hand side. Symbols at the top right of the table denote such things as EAT, NO GO, GO and CRASH. By placing these on different INK/PAPER combinations

it is possible to say what will happen when the colour combination occurs. As there are 64 different positions on the grid, every INK/PAPER combination is available.

Various other embellishments can be added to make a game more exciting. These include the boundaries within which a player and object can move, where pre-defined explosions will take place and the existence of a player or object. At each stage of the design it is best to SAVE any data using the SAVE SHAPE DATA facility in the menus, because creating good characters can take some time.

While trying to design a game, we took advantage of a PLAY game option in the main menu. With this the game can be played at any point throughout its development. In most of the cases we used it, the game did not perform the way it was supposed to; this could be more due to bad design on our part rather than HURG itself, but whatever, it shows that it is not as easy to use as it is said to be. Sometimes the result was different coloured characters moving randomly around the

**AS FAR AS GAMES DESIGNERS GO, HURG IS THE MOST COMPREHENSIVE WE'VE SEEN; BUT WHEN IT COMES TO ADDING BACKGROUND AND SOUND, ITS LIMITATIONS ARE APPARENT.**

## UPGRADE

screen making absolutely no sense at all.

Like some of the other games designer packages looked at in the January '84 issue of *Computer Answers*, HURG has some draw-backs that stop it being the perfect program. Where HURG is lacking – compared to Quicksilver's *Games Designer* – is in the exclusion of a sound editor. In *Games Designer* sounds could be changed by moving slide controls displayed on screen, which made it very easy to use.

The other shortcoming is the lack of a facility to design backgrounds; though the manual says this can be done through Basic and LOADED into a game – however, if you have ever tried to do screen designs using Sinclair graphics commands, you will know just how time consuming it can be. Melbourne House mention that they produce a design package called *Melbourne Draw* (see *Computer Answers* April '84 issue) – another £8.95 to pay.

Melbourne House hopes HURG will appeal to a large number of newcomers to computing who bought micros for Christmas, and want to write their own games without having to go to the trouble of learning Basic. HURG certainly provides this facility – but don't believe a game can be designed within minutes as the adverts suggest. However, compared to designing a game in Basic, from scratch, the time is very short.

If HURG had come out before Christmas it would have been a sure-fire winner, but because of the launch of *Game Designer* it will not rise to software 'super stardom' as quickly as it might have. Of the two packages, we would recommend HURG because of the greater variety it allows. There is also the added bonus of being able to sell any games written using HURG, though these would be confined to other people with the package, as it must be used as the master program.

**By Steve Applebaum, staff writer.**

HURG is priced £14.95 (inc. VAT) and available from: Melbourne House, Castle Yard House, Castle Yard, Richmond TW10 6TF. Tel: (01) 940 6064.



# MOTOROLA - THE CHALLENGING CHIP

WHY HAS THE 68008 PROCESSOR AROUSED SUCH INTEREST?  
WE LOOK AT THE CHIP THAT'S GIVEN THE QL AND MACINTOSH  
THEIR EDGE.

Controversy is common in the computer world - but rarely over the technical specs of a microchip: Motorola staff call it an 8-bit chip, Sinclair calls it a 32 bit chip, Motorola's data manuals refer to it as one of a family of 16 bit chips, and one journalist described it as a '32 bit stomach with an 8 bit mouth'!

The 68008 is one in a family of microprocessors - the others are the 68000, the 68010 and 68020. The picture on the opposite page shows a blown-up picture of the 68000, so called because it contains over 68,000 effective components. The use of the 68008 in Sinclair's new QL and the 68000 in the Apple Macintosh has given this family a terrific boost - some other manufacturers are no doubt now thinking twice about sticking to the Intel 8088, the chip elevated to the fore by its use in the IBM PC.

The 68000 is known to be more popular with programmers than almost any other processor, so here is an overview of some of the features it offers, and some insight into this 8/16/32 bit confusion.

First the question of compatibility: the 68000 series, although showing some resemblance to the

6800 series, is not compatible to any former chip produced by Motorola. Making this upward compatibility would mean making compromises in the design, which would affect the performance and the 'cleanness' of the new instruction set. This is something Motorola has been anxious to avoid.

However, compatibility within the family is maintained. The 68000 and 68008 have identical instruction sets, and programs written on one processor will run on the other. The 68010 has a few more instructions than these two, but will run programs produced on them. Likewise, the 68020 will run code from all the other three, but again some more instructions have been added. At the moment only the 68000 and 68008 are available (to exclusive customers, that is), the other two will only begin to appear towards the end of 1984.

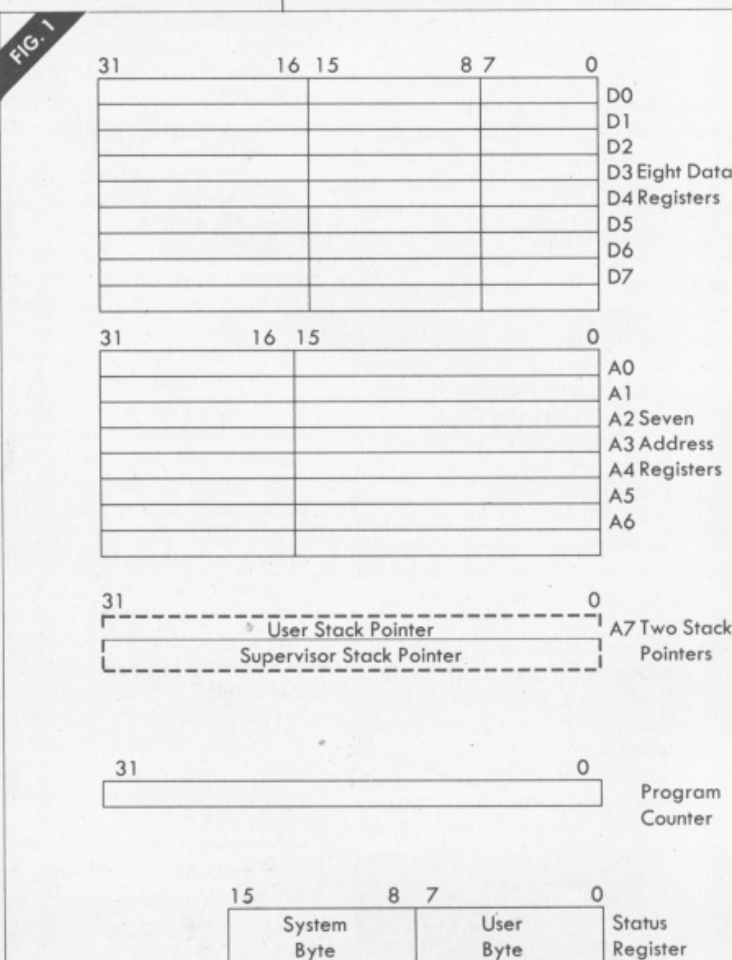
Only the 68020 is a full 32-bit processor. That is, supporting both 32 bit internal registers and a 32-bit data bus. This chip will not first appear in a micro, although Motorola does anticipate there will come a time when it will. Considering that it will support such things as virtual memory and run at around 16MHz, the good old 6502 and Z80 are going to appear positively prehistoric. Virtual memory, by the way, is a system that allows the user to play with a memory that appears 'virtually' enormous (that is, a great deal bigger than the actual physical memory size); but back to the present...

The main difference between the 68008 and 68000 is that the former has an 8-bit data bus and the latter a 16-bit data bus. Both have 20-bit address buses. A 20-bit address bus means that the processor can directly access (without any paging, segmentation, bank switching or anything complicated) one Megabyte of memory. Why one megabyte? Because 20 address lines means that the number of discernible addresses is 2 to the power of 20, which equals 1,048,576 bytes. So the processor uses the address bus to tell the memory which location it wants to read from, and, after a very short period of time, the contents of that address will appear on the data bus. The significance of having only an 8-bit data bus is simply that long instructions and data take several accesses before it all arrives at the processor. For example, a 32-bit number will take 4 accesses by the 68008 (8 bit bus), 2 by the 68000 (16 bit bus) and only one by the 68020. Data is divided into five categories: a bit, a BCD digit (4 bits), a byte, a word (16 bits) and long words (32 bits). The 68008 will, therefore, 'slow down' if a lot of word or long word data manipulation is done. As instructions also have to be fetched from memory, long instructions will also be less efficient than short ones.

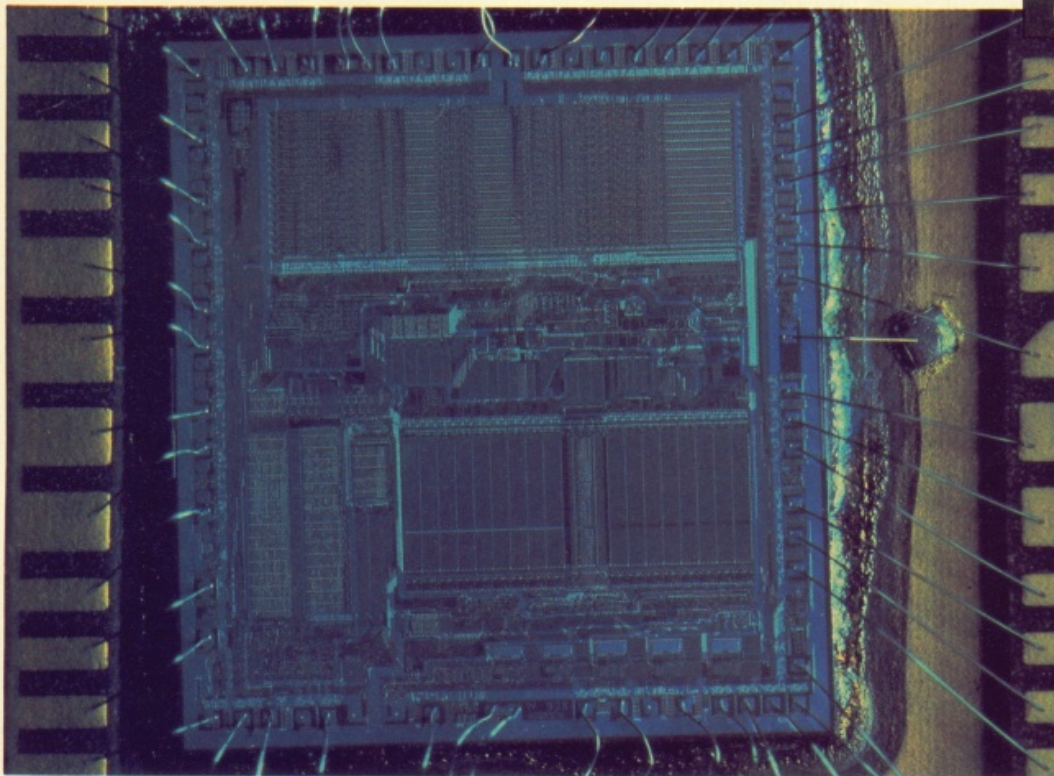
The advantage to a manufacturer of using the 68008 is one of size and cost. The chip is smaller than the other three, and requires simpler and cheaper circuitry to handle its 8-bit 'mouth'. The cost saving is partly because most currently available TTL chips (the ones that surround the processor chips) are designed for 8-bit systems.

Fig 1 shows a programmer's model of the chip. 6502 or Z80 programmers will no doubt be gloating

Fig. 1 (below) shows a model of the M68008's register set, one of its most impressive features.







An enlarged photograph of the Motorola 68008 chip – so called because it contains 68,000 effective components.

over the number of registers (well if they're not they should be). The more registers you've got to play with, the easier it is to write short and fast programs. Like bytes of main memory, you just can't have too many of them!

A register is a unit of store that resides in the processor. The 6502 has only three 8-bit data registers, and the instructions that can be performed using two of these is limited. This means that there is one single 8-bit register that has to do almost all the work. It also means data has to be continually read into the processor and stored back into memory. This is where the 68000 really scores: there is no single important register (which on 8-bit processors is called the accumulator), almost all of the instruction set can manipulate the eight data registers. The seven address registers can be used to store base addresses or software stack pointers and similar info. This sort of flexibility means a lot to systems and assembly language programmers, by saving a vast amount of tedious hassle.

Another big plus is that there is only 56 instruction codes to remember. As there are few special cases, and many different ways of combining commands with their parameters to address the memory; there are, in fact, many thousands (probably millions) of different possible commands to the processor. Fig 2 shows the 56 instructions: note such nice things as 32-bit multiply and divide, bit testing and multiple moving of registers. These are not in themselves unique, it is the flexibility with which they can be used that is attractive.

An often quoted, and important, specification of a processor is its clock speed – 1MHz, 4MHz or whatever. The number of instructions performed per second is directly proportional, but not equal to, this speed; for example, most micro-instructions take two or three clock cycles to complete, so on a processor running at 1MHz, the number of instructions executed per second is usually between 300,000 and 500,000. The 68008 on the Sinclair QL runs at 7.5MHz, although the chip itself is capable of working up to around 10-12MHz. This will mean that several million instructions could be executed in a second. We say 'could' because if a lot of

long instructions and long words are used, this figure would drop to around a half to one million.

A programming principle on the 68008 would appear to be to try to manipulate data in bytes, to keep to short instructions where possible, but ►

FIG. 2 68008 INSTRUCTION SET	
Mnemonic:	Description:
ADBC	Add Decimal With Extend
ADD	Add
AND	Logical And
ASL	Arithmetic Shift Left
ASR	Arithmetic Shift Right
BCC	Branch Conditionally
BCHG	Bit Test and Change
BCLR	Bit Test and Clear
BRA	Branch Always
BSET	Bit Test and Set
BSR	Branch to Subroutine
BTST	Bit Test
CHK	Check Register Against Bounds
CLR	Clear Operand
CMP	Compare
DBCC	Test Condition, Decrement and Branch
DIVS	Signed Divide
DIVU	Unsigned Divide
EOR	Exclusive Or
EXG	Exchange Registers
EXT	Sign Extend
JMP	Jump
JSR	Jump to Subroutine
LEA	Load Effective Address
LINK	Link Stack
LSL	Logical Shift Left
LSR	Logical Shift Right
MOVE	Move
MOVEM	Move Multiple Registers

68008 instruction set continues overleaf.



maximise use of all the internal registers; for example, if a 32-bit number needed to be temporarily stored, it would be quicker to bung it in, say, an address register, rather than save it to RAM.

However, it is important to note that a program running on the QL at 7.5MHz could run even faster than 7.5 times the speed of an (algorithmically) identical program on a 1MHz 6502 micro. This is because fewer lines of 68000 code would be required to perform the same task as the equivalent 6502 program. So, in addition to the 7.5 clock speed advantage, the 68000 should require only one half to one third of the number of lines of code.

This would mean that the QL has an execution speed advantage over the 2MHz 6502 BBC of anything from two to 10 times. The register layout of the 6502 looks very sparse in comparison with Fig 1.

Whereas the QL will be competing against 6502 machines (such as the BBC, Atari and Commodore), the Apple Mac will be competing against the IBM PC and the vast range of boring compatibles currently appearing, all using the Intel 8086/8088 processors. In this competition there is no clock speed advantage to the Apple's 68000, as the Intel chips are quite capable of working up to 10MHz, so a speed comparison has to be based on the efficiency of the instruction sets. For a true application, the 68000 in the Apple is likely to run an equivalent program up to twice as fast as the IBM PC, this speed advantage being possible because both fewer lines of code would be required and the 68000 instructions are slightly more efficient.

But to end by quoting a press release from Motorola (*not* Sinclair), 'the performance of the MC68008 is higher than any 8-bit microprocessor and superior to several 16-bit microprocessors'; no, 32-bit power is not yet available in the home.

By Dr Peter Turcan, technical editor.

**FIG. 2**  
**68008**  
**INSTRUCTION SET**

Mnemonic:	Description:
MOVEP	Move Peripheral Data
MULS	Signed Multiply
MULU	Unsigned Multiply
NBCD	Negate Decimal with Extend
NEG	Negate
NOP	No Operation
NOT	One's Complement
OR	Logical Or
PEA	Push Effective Address
RESET	Reset External Devices
ROL	Rotate Left without Extend
ROR	Rotate Right without Extend
ROXL	Rotate Left with Extend
ROXR	Rotate Right with Extend
RTE	Return from Exception
RTR	Return and Restore
RTS	Return from Subroutine
SBCD	Subtract Decimal with Extend
SCC	Set Conditional
STOP	Stop
SUB	Subtract
SWAP	Swap Data Register Halves
TAS	Test and Set Operand
TRAP	Trap
TRAPV	Trap on Overflow
TST	Test
UNLK	Unlink

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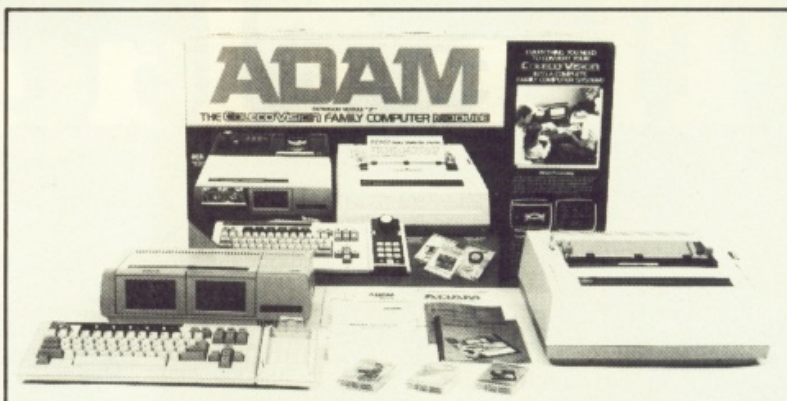
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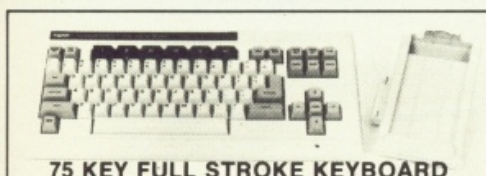
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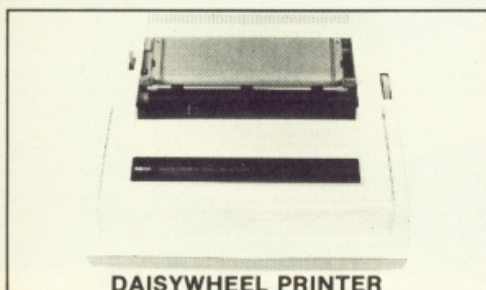
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**BUILT-IN WORD PROCESSOR:** Adam comes with SmartWriter word processing built-in. This program is so easy to use that you only have to turn the power on and the word processor is on line and ready to go. Detailed instruction books are not necessary 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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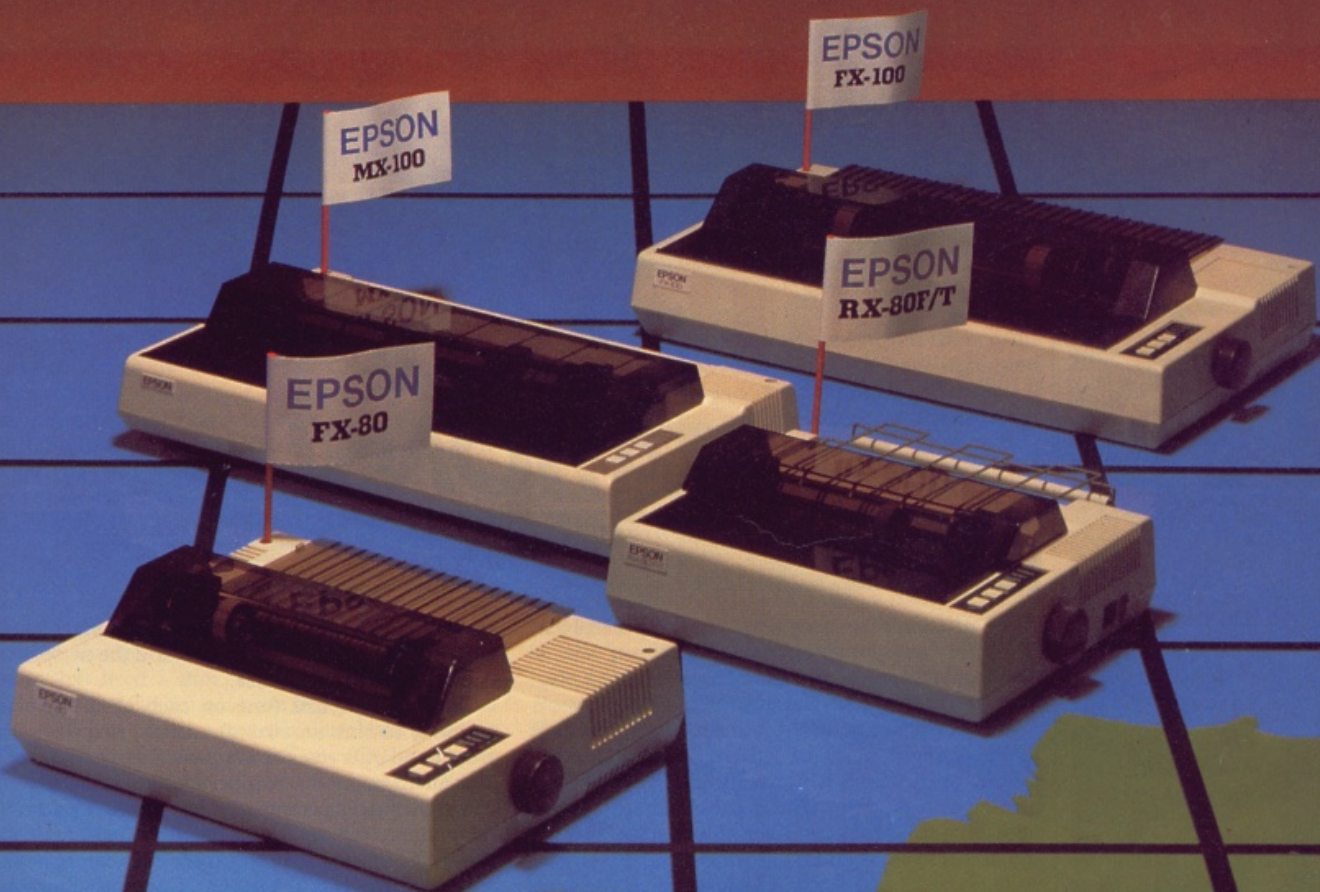
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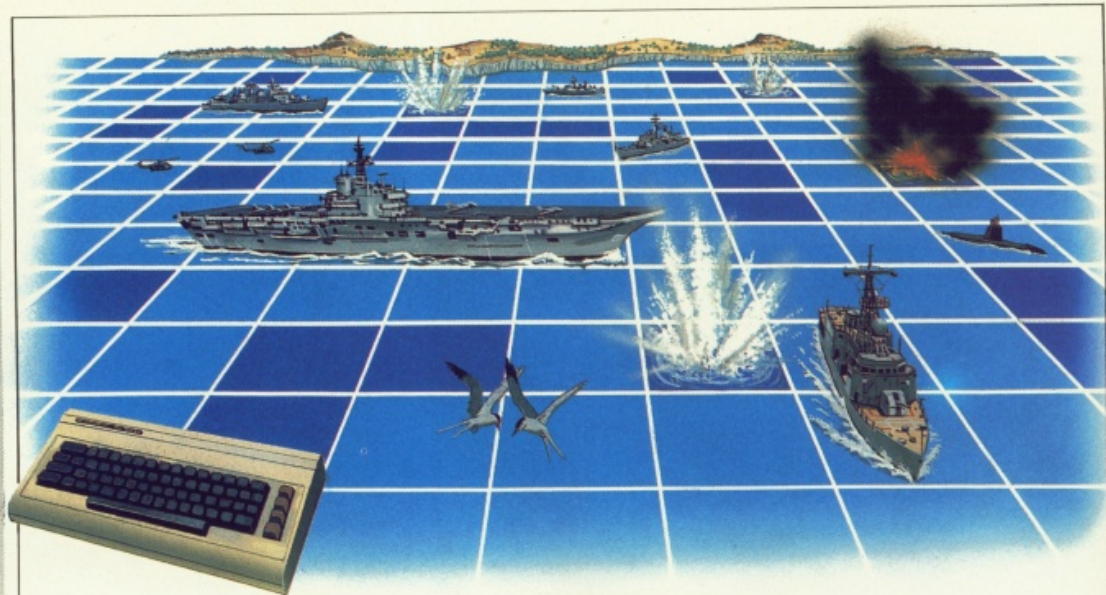
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## BATTLE STATIONS!

**GOT TWO VICS AND A SPARE FRIEND? THEN YOU'RE READY TO SET SAIL FOR BATTLESHIPS — OUR COMPUTER VERSION OF THE TRADITIONAL GAME**

**B**attleships has been a pen-and-paper stalwart for years — but here's how all you Vic 20 owners can pass those rainy afternoons playing the game on your steaming micros.

Part of the design of the Vic allows the user port to be configured as an RS232 serial communications port, which is normally used to connect a printer or a modem. Under these conditions it is necessary to use an interface to convert the Vic's signal voltages, 0 and 5V to the RS232 standard voltages, -12 and +12v. However, if all you want to do is to connect two Vics together, then a short piece of cable is really all you need. Having done this you have the ideal set up for *Battleships*. The game is intended to run on two Vics (with at least a 3K expansion), but will also run on a 64 (although the screen messages need tidying up a little).

The principle of the game is quite simple: the two players each have a Vic linked by a cable and arranged so that they cannot see each other's screen. Each player has a number of ships (in this game he has one aircraft carrier, two destroyers and three frigates) arranged over a square battle area, and he has to guess the locations of his opponent's ships before his own are destroyed.

An aircraft carrier covers four squares, a destroyer two and a frigate only one. The battle area is divided into 9x9 squares, each of which has a co-ordinate to identify it. The top row are A1, B1, C1 to I1, the next row are A2, B2, C2 to I2 down to the bottom row A9 to I9.

Each player first of all sets up his own ships, then when both are ready, they take it in turns to shoot at each other's ships by typing in the co-ordinates of a square where they think a ship may be lurking. After a player has made a shot, the screen tells him whether he has scored a hit or not, and the square he shot at is changed to reverse video on his screen, so that he knows which squares he has already tried. In order to keep the size of the game down, some things are left to the honour of the players. You

should make sure that the squares forming your aircraft carrier lie in a straight line, and the two players must take it in turns to fire.

It takes four hits (one on each of the relevant squares) to sink an aircraft carrier, two for a destroyer and only one for a frigate. The first player to sink all his opponent's ships has won the battle.

Before you can commence battle you need a cable to connect the two user ports together — Fig. 1 shows the connections required. You should be able to get all the bits from your Commodore dealer, who will also make the cable up for you if you are not an expert at soldering. The cable itself should be proper computer-quality screened cable or ribbon cable and should not be too long (six feet is probably the maximum) and it should be kept well clear of mains leads, and TV/monitors. Fig. 2 shows the listing of the program. If you are running on a small Vic you should leave out subroutine 31000, which explains how to play the game.

Line 100 opens the channel to the RS232 port, and lines 110 to 130 set up a few variables; lines 1000 to 1080 give the introductory dialogue, and ask if you need instructions on how to play; lines 1100 to 1110 put the battle area on the screen, and lines 1120 and 1130 prompt for a ship type (A, D or F). Depending on which ship was selected, the program jumps to 1300, 1500 or 1700 to enter the co-ordinates of each square for the ship. (Owners of 64s and large Vics may care to put some extra code in here to stop people cheating and spreading their aircraft carrier all over the screen instead of on four adjacent squares). As each square is entered, an 'A', 'D' or 'F' is put into the corresponding element of the array BF\$(,). (The symbol '(,)' is our convention for referring to a two dimensional array.

Lines 2000 to 2020 check whether the setting up phase is complete. Line 2140 is quite interesting: because we are not using a true RS232 link, it is possible that once you had opened the channel, some garbage will come down the line before the





other station is ready to transmit, if so, the RS232 software will think that there is a half-assembled character in the buffer, and will give a framing error when the real first character appears. 2140 tests to see if this has happened, and if so, a GET#1 clears the buffer. ST will show an error after this, but that does not bother us.

The game proper starts at 2200, which prompts the player for the co-ordinates of the square he wishes to attack, and line 2210 starts the cursor flashing. Line 2220 tests if a key has been pressed; if so, the player is making an attacking move and the program jumps to 2260. Line 2230 tests if the enemy has fired a shot. If not the program loops back to 2220. If a shot has been fired, X% contains the X co-ordinate of the square under attack and line 2240 gets the Y co-ordinate. Line 2250 stops the cursor flashing and the program jumps to line 3000.

If the player is keying the co-ordinates of a square he wishes to attack, the program comes to line 2260, which inputs the co-ordinates. Line 2270 sends them to the other computer, and line 2280 waits for a message to come back giving the result of the shot. If C% is 'M', then the shot missed; if 'H', then a hit was scored. A 'W' means that all the other ships have been lost and the player has won. Lines 2310 and 2320 tell the player whether he has hit or missed, and lines 2330 and 2340 change the square on his screen to reverse video so that he knows that he has already attacked that square. The array A%(,) normally contains zeros; a -1 in an element means that the corresponding square has already been fired at, and subroutine 36000, which displays a character in that square on the screen, will print in reverse video.

When the enemy fires a shot, the program comes to line 3000, which determines whether a ship has been hit or not. If a ship is hit, that square on the screen is blanked out, and the corresponding element in the array BF\$(,) changed to a blank by line 3010. Line 3020 decrements N, the count of the number of squares left, and if it is zero it tells the player that he has lost the game, and sends a 'W' back to the other computer to tell it that it has won. If a hit or a miss has been scored, then an 'H' or 'M' respectively is sent back.

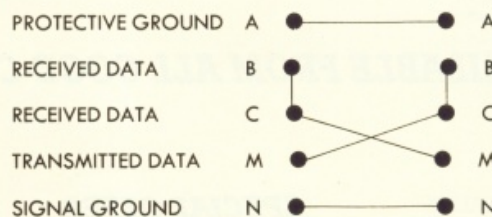
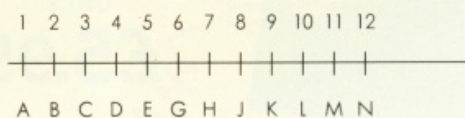
The program contains a number of subroutines. 30000 displays the battle area on the screen; 31000 gives the instructions on how to play. Subroutine 33000 starts the cursor flashing, waits for a key to be pressed and then turns the cursor off and displays the character on the screen. The key pressed is

returned in A\$. Subroutine 34000 inputs the co-ordinates of a square, verifies that they are legal, and puts them into X\$ and Y\$. Subroutine 35000 tests if a square is occupied by looking at the relevant element in BF\$(,). Subroutine 36000 puts a new character into an element of BF\$(,) and displays the character in that square on the screen. If the square has already been shot at by the player, then the corresponding element of A%(,) will be set, and the character is displayed on the screen in reverse video. Subroutine 41000 displays a message on the bottom line of the screen.

Now you know how it all works, you're ready to have fun playing - and maybe tinkering with - the *Battleships* program, which is overleaf on page 33.

**By Chris Preston, a computer programmer.**

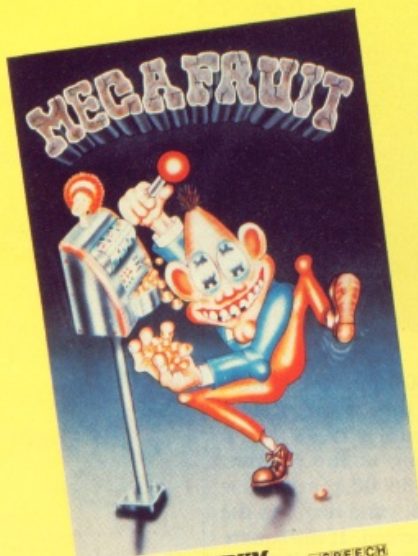
**FIG. 1**  
USER PORT  
PINOUT



User Port Pinout (see page 152 of the Owners Manual).



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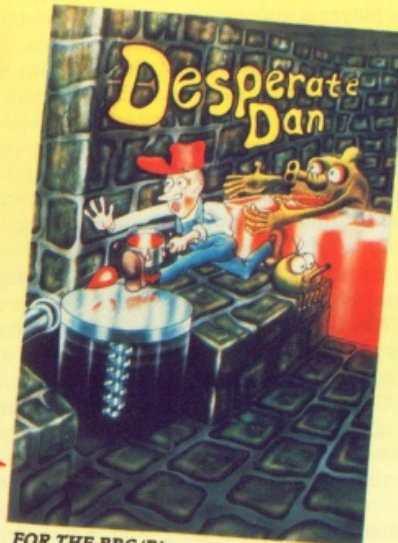
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# EXTENDED ANIMATION

THE FIRST PART OF A LOOK AT GETTING THE MOST OUT OF YOUR SPECTRUM'S UDG FACILITIES TO ACHIEVE ANIMATED EFFECTS.

**A**s most ZX Spectrum owners are likely to be versed only in Basic, exploiting the machine's nifty abilities to handle user-defined graphics can be limited.

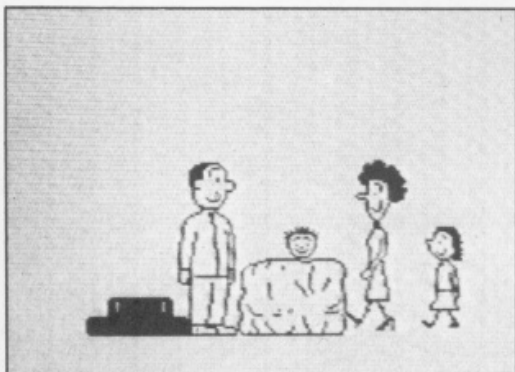
The two programs in this article enable you to draw hi-res pictures, any size, anywhere on the screen, almost instantaneously, during the running of your Basic programs. You can achieve cartoon animation, using Basic only, with no knowledge of machine-code.

There are two ways of drawing detailed pictures using Basic: the first way is to use a sequence of PLOT, DRAW and similar commands—a good method for drawing boxes, circles, buildings and so on, but not for anything more complex. The second way of drawing detailed pictures in Basic is to use UDG characters.

To draw a whole car two characters high and three characters long, you need  $2 \times 3 = 6$  UDG characters. This involves working out 48 numbers (6 characters  $\times$  8 lines per character = 48). You could either define one UDG six times, or to gain more speed, use six UDG characters, but you still need to keep changing the UDGs, as there are only 21 altogether, and this is enough for only three car-sized pictures.

So if you want to use Basic commands alone to draw detailed pictures there are two problems—difficulty and slowness. The two programs, GR3 and STORE, which we will be looking at, make the drawing of detailed pictures much easier and quicker.

The techniques are intended for the 48K Spectrum, but you can apply it to the 16K Spectrum if you replace all occurrences of 50000 with 29000, and replace 50001 with 29001. Also, type in the 16K version of the program GR3MAKER (Fig. 7), not the 48K version (Fig. 8). Both versions are listed at the end of the article. The program STORE (Fig. 9) is suitable for the 16K and 48K Spectrum.



GR3MAKER is a Basic program which makes a machine code program when you run it called GR3. GR3 is a subroutine to accompany your own Basic program. GR3 draws a picture any size from  $1 \times 1$  characters up to the full screen of  $32 \times 24$  characters, almost instantaneously, whenever it is called.

STORE is a Basic program which you use to transfer your drawings from paper to computer memory. Once you have stored these drawings, save them on

tape. GR3 uses the picture data generated using STORE to display the picture on the screen.

Your Basic

Program now occupies part of the computer's memory. In another part goes GR3, and in another goes the data for the drawings.

During the running of the Basic program, use GR3 and the data to draw pictures almost instantaneously on the TV screen. To begin with make a design of your graphic on paper. Use  $8 \times 8$  grid-paper, not  $10 \times 10$  like ordinary graph paper (an example is shown in Fig. 1).

Now it's time to fit the program components in memory. Type CLEAR 50000. Now everything above address 50000 is safe from being overwritten by a Basic program which fits below 50000. GR3 and the pictures fit above 50000. GR3 consists of 75 numbers, and each occupies one address. The addresses are 65280–65354. When you run GR3MAKER, it pokes the 75 numbers into these addresses to make GR3. The pictures consist of lots of numbers, each between 0 and 255, and each occupying one address. The addresses are 50001 onwards. Between RAMTOP (50000) and the start of GR3, there are 65279 minus 50000 = 15279 spare addresses which can be used for pictures. The programs STORE pokes the numbers for a picture into addresses 50001 onwards. The car illustrated in Fig. 1 occupies 48 addresses. You cannot have GR3MAKER and STORE in memory at the same time, so you use them one after the other.

GR3 works in the following way: suppose you have a  $2 \times 3$  characters drawing of a car stored in memory in addresses 50001 onwards, and GR3 is also in memory. You cannot see the car, but if you write a few lines of Basic and call the subroutine GR3, it will copy the 48 numbers which define the car into another part of memory, the screen-display area of memory, and you will be able to see the car. This is because the screen-display area of memory is scanned 50 times a second by the computer to create the TV display, so when you see the car, you are just looking at 48 numbers which were previously not visible because they were elsewhere in memory. If the rest of the screen is blank, you are looking at 48 numbers which define the car, and 6096 number zeros. The procedure for using GR3 ►

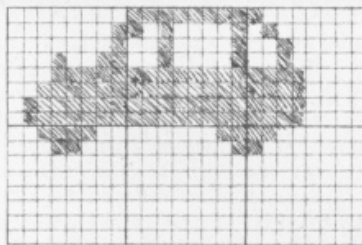


Fig. 1 (left) shows a preliminary grid design of a car graphic

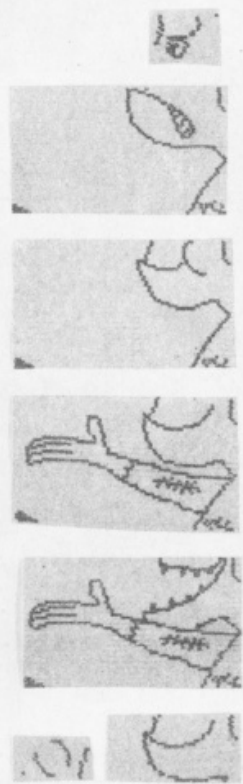


Fig. 6 (above) shows an animated sequence taken from the 'Giant's Dinner' package.

Animation for all the family? The picture left shows a still produced by the package 'Cartoon Animation', which employs many of the techniques mentioned here.



and *STORE* are shown in Fig. 2.

Remember that you could include *GR3MAKER* in a larger Basic program of your own, as in stage 6 in Fig. 2. Alternatively, once you have *GR3* in memory, save it onto tape using the command: *SAVE "GR3" CODE 65280,75*. When you want it back in memory after the computer has been switched off and on, use the command: *LOAD "" CODE*.

To use *STORE* to store your pictures, type *CLEAR 50000*, type *LOAD "STORE"*, then *RUN*. When asked for the start address, type 50001 (then *ENTER*). Specify the length (L) and height (H) of your picture. You are now provided with a grid L characters long and H characters high. Altogether there are  $L \times H$  character locations or 'squares'. Choose one of these using the direction keys, then press S when you have selected one. This square is magnified 64 times, and drawn as a large square (blank at this stage) to the left of the grid. Fill in each line at a time (8 lines altogether). Press B for a black line, W for a white line (strictly speaking 'ink' not 'black', and 'paper' not 'white'). Press R for a repeat of the previous line. Press L for a unique line. If you press L then you will have to make a unique line from 8 bits. Each bit can be black or white, so eight times you

are asked to choose a white bit or a black bit.

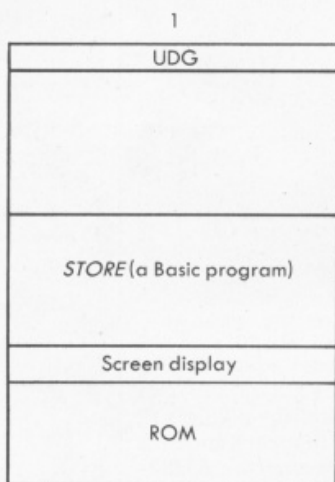
*STORE* provides you with one *SAVE* instruction for each drawing, which it writes on the screen for you to type in. Suppose the instructions for the first two drawings are: *SAVE "NAME" CODE 50001, 48* and *SAVE "NAME" CODE 50049, 8*. You can save the pictures one after the other on tape using these *SAVE* instructions, or alternatively, you could save them together using the line: *SAVE "NAME" CODE 50001, 56*. Note that the individual lengths have been added together to give a new length of 56.

When you type *RUN*, *GR3MAKER* will poke 75 numbers into addresses 65280-65354. These numbers form the machine-code subroutine *GR3*, which has just been stored in computer memory.

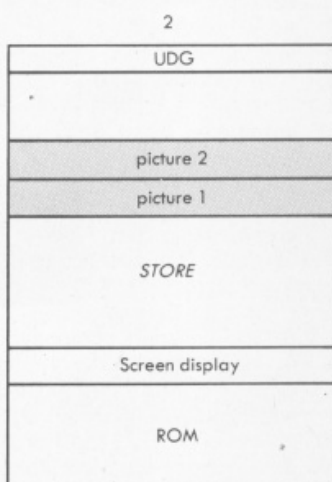
As well as making *GR3*, *GR3MAKER* includes a few lines of Basic to test it out. In case you have not got a picture stored above *RAMTOP* at this stage, *GR3MAKER* draws 'part of the computers brain' (a section of ROM). To do this, *GR3* is told that the start address of the picture is zero. At zero onwards is ROM memory, and ROM provides us with the Basic language. It consists of thousands of numbers between 0 and 255. When these are treated as data for a picture, we get a picture of 'sand'.

**FIG. 2**  
**GR3/STORE**  
**PROCEDURE**

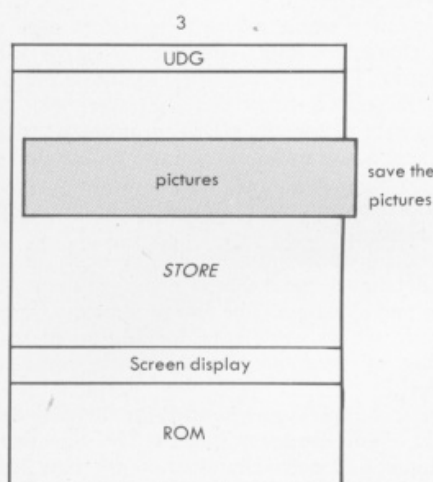
RAMTOP is set to 50000



Switch the computer on *CLEAR 50000*  
Load *STORE*  
*RUN*

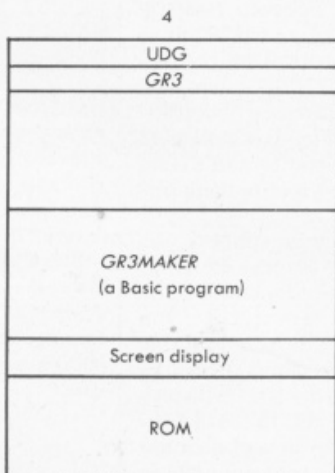


Use *STORE* to store one or more pictures above *RAMTOP*

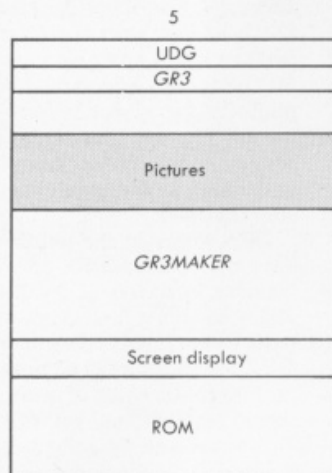


Save the pictures on tape using the line *SAVE "NAME" CODE 50000*, length The car has a length of 48 (option: you can switch off the computer).

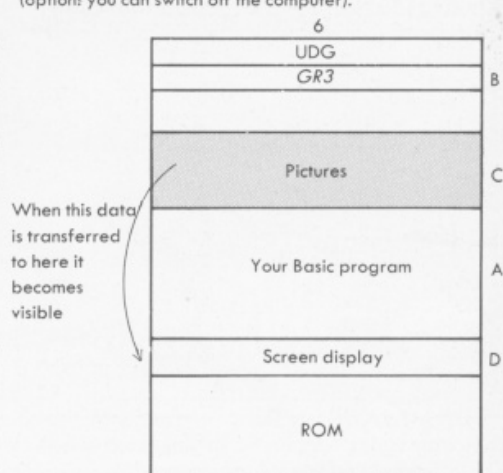
75 numbers  
POKE here  
by *GR3MAKER*



Switch on the computer  
*CLEAR 50000*  
*LOAD "GR3MAKER"*  
*RUN*



*LOAD* on the pictures using the line *LOAD "" CODE* (this stage can be omitted if you left the computer switched on between stages 3 and 4).



Add some Basic of your own to *GR3MAKER* to make your own Basic program. A uses B to transfer C to D; B is a subroutine; A calls B whenever a picture needs drawing.



GR3 will draw your own picture as fast as it draws the sand. You could experiment by using different values for length, height, start address and so on. It is important that you do not draw below the bottom line of the screen. You can draw as low as row 23 (there are 24 rows: 0-23=24), but no lower, or you will draw all over your Basic program.

If you run GR3MAKER, then type in the lines in Fig. 3, then type GOTO 120, you will see a demonstration of the amazing speed with which the computer can manipulate 6144 numbers, which is the total number in the screen-display. You also see what happens when the computer uses its own screen-display as data for a picture.

To call GR3 during the Running of a Basic Program (in order to Draw a Picture) first provide it with the following information about the drawing, using the lines of Basic in Fig. 4.

Note that the address of the picture is split into two numbers called 'highbyte' and 'lowbyte'; these can be worked out from the address as follows:

```
LET HIGHBYTE = INT (ADDRESS/256)
LET LOWBYTE = ADDRESS-HIGHBYTE*256
```

To call GR3 after all this information has been poked, use the command: LET M =USR 65280.

If you had a Basic program where line 283 was 283 LET M =USR 65280, then when the program reaches line 283 it will draw a picture, and then go on to line 284 in the Basic program (or the next higher line if there is no line 284).

There are two ways of achieving cartoon animation: the first is to move a picture around the screen; suppose you want to move a car from left to right: To the rear of the picture of the car include a column of blank squares, equal in height to the height of the car. Now poke the appropriate values for length, height, Y co-ordinate, highbyte, and lowbyte, then use the loop which starts at line 200 in Fig. 5, to move the car. The blank squares erase the previous drawing. If you did not have the blank squares, you would end up with 20 rear ends of cars.

The second way of achieving cartoon animation is to draw different pictures at the same place.

Fowler Software sells a children's game called *Giant's Dinner*. The program lines for the giant eating his dinner are: FOR I=1 TO number of chews draw mouth 1; BEEP for chewing noise draw mouth 2; BEEP for chewing noise NEXT I. Fig. 6 shows the giant and the two mouths plus all the other parts used to animate the giant.

In next month's issue of *Computer Answers* we'll be looking at how you can incorporate colour into these techniques.

By Stephen Fowler, author of the Spectrum packages *Graphics Subroutine*, *Draw 15* and *Giant's Dinner*.

FIG. 3

```
100 POKE 65365,55: REM highbyte
102 POKE 65364,8: REM lowbyte
104 POKE 65363,32: REM length
106 POKE 65361,24: REM height
108 POKE 65360,0: REM Y row
110 POKE 65359,0: REM X column
112 LET M=USR 65280
114 RETURN
120 FOR B=0 TO 255
125 GOSUB 100
128 NEXT B
130 GOTO 120
```

FIG. 4

```
POKE 65365, highbyte of picture address
POKE 65364, lowbyte of address
POKE 65363, length of picture in characters eg 3
POKE 65361, height of picture in characters eg 2
POKE 65360, Y co-ordinates where the top-left corner
POKE 65359, X of the picture appears on the screen
```

FIG. 5

```
100 POKE 65365,195: REM highbyte
102 POKE 65364,81: REM lowbyte
104 POKE 65363,4: REM length
106 POKE 65361,2: REM height
108 POKE 65360,1: REM Y row
200 FOR X=1 TO 20
202 POKE 65359,X
203 BEEP .05,-30
204 LET M=USR 65230
206 NEXT X
```

Fig. 3 contains the GR3Maker demo lines; Fig. 4 is the GR3 drawing information; Fig. 5 car moving routine.

FIG. 7

```
1 REM GR3MAKER 16K VERSION
50 DATA 58,79,127,6,5
51 DATA 203,39,16,252,33
52 DATA 78,127,134,50,76
53 DATA 127,58,79,127,230
54 DATA 24,198,64,50,77
55 DATA 127,237,91,76,127
56 DATA 42,82,127,58,80
57 DATA 127,71,197,213,58
58 DATA 81,127,71,197,6
59 DATA 8,126,18,20,35
60 DATA 16,250,122,214,8
61 DATA 87,28,193,16,239
62 DATA 209,123,198,32,95
63 DATA 48,4,122,198,8
64 DATA 87,193,16,219,201

70 CLEAR 29000
71 RESTORE 50: LET T=0
75 FOR I=32500 TO 32500+74
80 READ M: POKE I,M: LET T=T+M
85 NEXT I
91 IF T<>7645 THEN PRINT "ERROR IN DATA STATEMENTS"
92 IF T<>7645 THEN STOP
93 INPUT "PRESS ENTER ":A$
100 POKE 32595,0: REM HIGH ADD
102 POKE 32594,0: REM LOW ADD
104 POKE 32593,12: REM LENGTH
106 POKE 32592,15: REM HEIGHT
108 POKE 32591,1: REM Y ROW
110 POKE 32590,3: REM X COLUMN
112 LET M=USR 32500
```

Fig. 7 shows the 16K version of GR3Maker; Fig. 8, the 48K version.

FIG. 8

```
1 REM GR3MAKER 48K VERSION
50 DATA 58,80,255,6,5
51 DATA 203,39,16,252,33
52 DATA 79,255,134,50,77
53 DATA 255,58,80,255,230
54 DATA 24,198,64,50,78
55 DATA 255,237,91,77,255
56 DATA 42,84,255,58,81
57 DATA 255,71,197,213,58
58 DATA 83,255,71,197,6
59 DATA 8,126,18,20,35
60 DATA 16,250,122,214,8
61 DATA 87,28,193,16,239
62 DATA 209,123,198,32,95
63 DATA 48,4,122,198,8
64 DATA 87,193,16,219,201

70 CLEAR 50000
71 RESTORE 50: LET T=0
75 FOR I=65280 TO 65280+74
80 READ M: POKE I,M: LET T=T+M
85 NEXT I
91 IF T<>8808 THEN PRINT "ERROR IN DATA STATEMENTS"
92 IF T<>8808 THEN STOP
93 INPUT "PRESS ENTER ":A$
100 POKE 65365,0: REM HIGH ADD
102 POKE 65364,0: REM LOW ADD
104 POKE 65363,12: REM LENGTH
106 POKE 65361,15: REM HEIGHT
108 POKE 65360,1: REM Y ROW
110 POKE 65359,3: REM X COLUMN
112 LET M=USR 65280
```

In the next issue of *Computer Answers* we will be looking at how to employ colour with the animation techniques outlined above.



# PROGRAMMING

Fig. 9 (right) shows the full STORE listing.

FIG. 9

```

1 BORDER 5
2 INK 0: PAPER 7: FLASH 0: BRIGHT 0
3 LET OK=1
4 LET A$="123456789abcdefghijklmnopqrstuvwxyz"
5 LET Z$=""
6 LET d$=""
7 PRINT "Press S to start"
8 IF INKEY$="S" THEN GO TO 424
9 IF INKEY$<>"S" THEN GO TO 8
10 CLS : INPUT "Start address= ";J
11 IF J<=PEEK 23730+PEEK 23731*256 THEN GO TO 422
12 INPUT "Height (upto 17)=";H
13 INPUT "Length (upto 22)=";L
14 LET D=L*H*8
15 FOR M=0 TO H-1
16 PRINT AT M,10;A$(1 TO L)
17 NEXT M
18 LET Y=0: LET X=10
19 PRINT OVER 1: BRIGHT 1:AT Y,X:CHR$ 128
20 GO SUB 300: PRINT "POS DRAW FINISH"
21 LET C$=INKEY$
22 IF C$<>"p" AND C$<>"f" AND C$<>"d" THEN GO TO 21
23 BEEP .1,0
25 IF C$="p" THEN GO SUB 50
26 IF C$="d" THEN GO SUB 90
28 IF C$="f" THEN GO TO 400
30 GO TO 20
50 GO SUB 300: PRINT "PRESS THE DIRECTION KEYS"" 5 6 7 8"" THEN S"
51 LET B$=INKEY$
52 IF B$<>"s" AND B$<>"5" AND B$<>"6" AND B$<>"7" AND B$<>"8" THEN GO TO 51
53 BEEP .1,0
54 IF B$="s" THEN RETURN
56 LET B=VAL B$
58 LET Y1=Y: LET X1=X
60 IF B=5 THEN LET X1=X-1
61 IF B=6 THEN LET Y1=Y+1
62 IF B=7 THEN LET Y1=Y-1
63 IF B=8 THEN LET X1=X+1
65 IF Y1<0 OR Y1>(H-1) OR X1<10 OR X1>(L+9) THEN GO TO 50
70 IF OK THEN PRINT BRIGHT 0: OVER 1: PAPER 8: INK 8:AT Y,X:CHR$ 128
71 LET OK=1
72 LET Y=Y1: LET X=X1
74 PRINT BRIGHT 1: OVER 1: PAPER 8: INK 8:AT Y,X:CHR$ 128
76 GO TO 51
90 FOR I=0 TO 7: POKE 65496+I,0: NEXT I
91 PRINT AT 0,0: FOR I=0 TO 7: PRINT PAPER 6:D$: NEXT I
92 LET F=J+(Y*L+X-10)*8
95 FOR I=0 TO 7
96 GO SUB 300: PRINT "BLACK WHITE LINE REPEAT"
98 LET A$=INKEY$
99 IF A$<>"b" AND A$<>"w" AND A$<>"1" AND A$<>"r" THEN GO TO 98
100 BEEP .1,0
101 IF A$="b" THEN GO SUB 150
102 IF A$="w" THEN GO SUB 160
103 IF A$="1" THEN GO SUB 200
104 IF A$="r" THEN GO SUB 280
108 POKE (USR "Q"+I),V
109 POKE (F+I),V
110 PRINT AT Y,X:CHR$ 160
111 LET OK=0
112 NEXT I: RETURN
150 LET V=255
152 PRINT PAPER 0:AT I,0:D$
155 RETURN
160 LET V=0
162 PRINT AT I,0:D$
165 RETURN
200 GO SUB 300: PRINT "1 FOR BLACK BIT""0 FOR WHITE BIT"
201 LET V=0
202 FOR P=7 TO 0 STEP -1
204 LET E$=INKEY$
206 IF E$<>"1" AND E$<>"0" THEN GO TO 204
207 LET E=VAL E$
208 BEEP .05,-E*2
223 IF NOT E THEN PRINT AT I,(7-P);" "
224 IF E THEN PRINT PAPER 0:AT I,(7-P);"X"
225 IF E THEN LET V=V+2^P
227 IF NOT E THEN LET D=100+2^P
230 NEXT P: RETURN
280 FOR Z=0 TO 7
283 IF (ATTR ((I-1),Z))=56 THEN PRINT AT I,Z;" "
284 IF (ATTR ((I-1),Z))=0 THEN PRINT PAPER 0:AT I,Z;"X"
285 NEXT Z: RETURN
300 PRINT AT 17,0:
302 FOR M=1 TO 5: PRINT Z$
303 NEXT M
310 PRINT AT 17,0: RETURN
400 GO SUB 300: PRINT "HEIGHT= ";H;" LENGTH= ";L;" ADDRESS OF DRAWING= ";J
402 LET HIGH=INT (J/256)
403 PRINT " (HIGHBYTE= ";HIGH:
405 PRINT " LOWBYTE= ";J-HIGH*256:)"
408 PRINT "SAVE ""NAME""CODE ";J;" ";D
410 PRINT "START NEXT DRAWING AT ";J+D
420 STOP
422 PRINT "NO DRAWINGS BELOW RAMTOP": STOP
424 PRINT "DON'T USE CAPITALS": STOP

```

The programs in this article are based on Fowler Software's Graphics Subroutine, Draw 15, and Giant's Dinner. Although Fowler Software holds the copyright on this article, you are welcome to use the programs it contains to develop non-utility commercial programs of your own.



# THE HEART OF THE DRAGON

WHAT ARE THE ADVANTAGES OF THE DRAGON'S MOTOROLA 6809 CHIP?

HOW CAN IT HELP YOU TO PROGRAM DIRECTLY IN ASSEMBLER?

**D**espite being rather unfashionable, the Dragon 32's Motorola chip is a very sophisticated device. The 6809 chip offers the Dragon user more advanced Assembly programming facilities than the popular 6502 or Z80 processors.

At the assembly level the user has the opportunity to learn about the nature of their machine at a much more fundamental level; but before going on to explore its potential, let's take a brief look at the history of the 6809, a bit of a curiosity in the hardware world.

When the Dragon 32 was originally put together, the designers adopted the Motorola 6809, which was (and still is) an unfashionable processor. In many ways it was a bold step: while there were many software writers prepared to turn their hand to games writing for the predominant 6502 and Z80 based machines, very few had even encountered the Motorola chip in domestic programming applications.

Perhaps of greater importance, it was more lucrative to adapt existing assembly programs to Z80 and 6502 based machines, such as the Spectrum and the Vic 20, than to translate their code to a significantly different microprocessor—thus giving the machines a larger software base than the Dragon.

This is not to say that there is anything wrong with the 6809 chip. It is hailed by some programmers, academics and commercial systems designers alike as the best 8-bit microprocessor ever marketed. Given the processor's obvious respect, it is curious as to why the 6809 lost out in the home micro stakes. Essentially, it was simply a matter of timing: all the competitive chips had been firmly established long before the arrival of Motorola's offering. So what puts the Motorola device technically head and shoulders above its rivals?

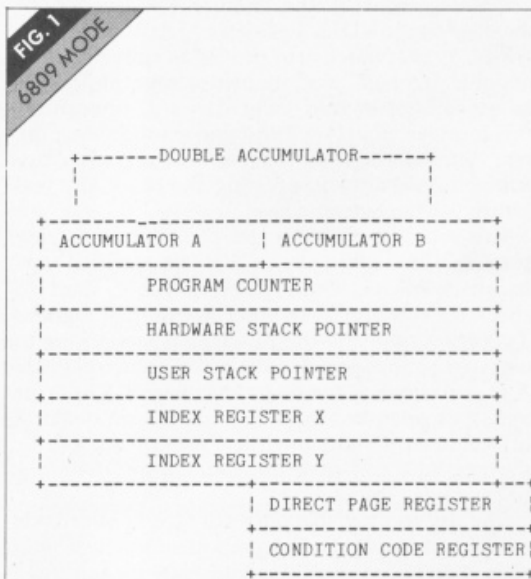
Principally, it is the programming facilities directly available from the chip itself. The specification is advanced: the assembly language is composed of 59 basic instructions, which when given the complement of 10 addressing modes and 24 indexed sub-modes bring the total number of instructions to a powerful 1,464. Combine this with two 8-bit and four 16-bit registers, plus a range of sophisticated device handling facilities and the 6809 has the potential to rival the performance of many 16-bit processors. *Fig. 1* gives a programming model of the 6809.

However, the Dragon's performance does not actually match that of a 16-bit business machine, at least in terms of sheer speed. This is directly related to the manner in which the resident Basic generates the 6809 assembly code during program execution. To execute a Basic command, it first has to be translated into a form the 6809 can understand (that is 6809 assembly language or more precisely, a binary representation of the assembly code). Where the Basic is interpreted, as in the case of the Dragon, the command has to be translated *every* time it is executed—clearly an inefficient process, especially where a loop is involved.

Moreover, because the interpreter never knows

what Basic command it is going to translate next, the resulting assembly code will naturally be inefficiently structured. The method of translation of Basic is by no means unique to the Dragon, it is shared, together with the inherent problems, by almost every home micro.

By programming the Dragon directly in assembly language you can by-pass the Basic interpreter, and in the process have the opportunity to harness much of the power not afforded in the Basic.



*Fig. 1 (left) gives a programming model of the Motorola 6809 chip; Fig. 2 (below) Assembly conversion program.*

**FIG. 2**  
ASSEMBLY  
EXAMPLE

```

NAM EXAMPLE
* Define symbolic names for variables
NUM EQU $64 NUM is 100 in hex
TEN EQU $0A TEN is 10 in hex
HUN EQU $64 HUN is 100 in hex
CNT1 EQU $7000 Declare locations for counters
CNT2 EQU $7001
STRT EQU $7100 Declare start addr of array

* Assembly program starts here
ORG $7002 Put program at addr $7001
LDX £STRT Load counter register with STRT
LDA £TEN Load acc A with TEN
STA CNT1 Store TEN in count variable
L1 LDA £HUN Load acc A with HUN
STA CNT2 Store HUN in other count variable
L2 LDA £NUM Load acc A with number to be assigned
STA 0,X+ Store NUM in element of array and Inc
increment counter register
DEC CNT2 Decrement CNT2
BNE L2 Branch to L2 if CNT2 <> to 0
DEC CNT1 Decrement CNT1
BNE L1 Branch to L1 if CNT1 <> to 0
RTS Return to MACE monitor

```



Beginning to program assembler does not have to be as horrendous as you may imagine. The best introduction is to purchase an Assembler. This is a program similar to a compiler, which converts assembly language programs directly into binary form. Although it might seem that an Assembler seems just to mimic the Basic interpreter, there are fundamental differences. The Assembler only translates the text of the assembly program once, and it is the programmer who structures the code directly – not the assembler.

We looked closely at one Assembler package in particular, the Mace editor/assembler/monitor (from Windrush Microsystems). This comprises an editor, for the creation of assembly programs, an Assembler to generate the machine instructions, and a monitor for testing and debugging the programs typed in (for more on editor/assembler packages, see *Computer Answers*, January '84 issue).

MACE is ROM based, so as with any such package, care should be taken when powering up the Dragon with the cartridge in place. After power on, you are greeted by the familiar Basic copyright message on the VDU. To invoke Mace simply type: EXEC 49152 (which to us proved an eminently forgettable number). You are then within the MACE editor command level, denoted by a 'C' prompt. At this level, an 'I' is typed and you start entering the text (lines of assembly code) of the program. After completing that task, pressing the BREAK key will return you to command level.

In itself, the editor is not bad, offering string searches, line editing as well as the essential tape backup/retrieval. Once entered, you'll want to check the correctness or otherwise of the program. Typing 'A' will run the Assembler, attempting to translate your code into 6809 machine instructions. Any syntax errors will be picked up here. The error messages generated by the assembler can be fairly informative, if you know what they mean, but for the beginner they will be infuriatingly obscure – like any error message.

Getting this far, the binary image of your code must be placed in the Dragon's memory; here your code is directly accessible to the 6809 for summary execution! The "A:M" command achieves this.

Now the painful part begins: running the program is the only way to find out if your code has the desired effect. Unfortunately, the 6809 always does exactly what you tell it, and in assembly code you can tell it to do almost anything. Nevertheless, the MACE monitor allows the user to run their program in a fairly fault tolerant environment, and look closely at how the 6809 and memory are affected by the program.

Typing M at editor command level gets you into the monitor. Once in, typing J plus the start address of your program, starts the 6809 running. In the monitor, two of the most valuable debugging tools are the V and B commands. V allows you to look at a block of memory, the contents of which are displayed in both ASCII and hexadecimal (numbers to the base 16) notation, so if you think some variable should contain the character A after a program run, this can be easily verified. The memory location will be displayed as: 41 and A. The B command is often used in conjunction with V. When an area of the program is suspect, a break point can be set to stop the program in mid-execution, whilst preserving the values of all variables and registers for inspection.

As with any language, assembly is no exception when it comes to iron out the bugs; it can be difficult. One point to note, however, is very few higher order languages such as Basic and Pascal offer such advanced interactive debugging facilities when

based on a home micro.

A nice touch to the MACE package is the inclusion of a hexadecimal calculator, which would certainly become invaluable to the beginner and much appreciated by a dedicated assembly hack.

Now let's move on to the assembly language itself. Assembly statements are comprised of four fields, namely: LABEL, OPERATOR, OPERAND and COMMENT. A typical statement might be: LI LDA NUM [Load accumulator A with NUM].

The label field is equivalent to the line numbers in Basic in that it provides a point of reference for assembly's jump instructions. With MACE, the field can be up to eight characters long, and consist of any combination of numbers and letters – with the proviso that the label must start with a letter or full stop. The operator field should contain any of the 59 instructions, selected from those available on the 6809.

The operand is the most involved of the four fields. In simple terms, it contains assembly's equivalent of Basic variables and constants. As in Basic, they can have symbolic names, or just be numbers; however, the operand field carries two additional sets of information, the first being a form of TYPE declaration. As in other languages, assembly can have several TYPES of variable and constant, the most commonly used being hexadecimal and binary. The declaration actually takes the form of a single character which prefixes the operand name, for instance, a 'H' means that the variable is hexadecimal; a '%' means that the variable is binary.

Second, the operand field contains information about the addressing mode of the operator. At its most simple, this again takes the form of a character prefixing the operand, but there are other notations available. Here the character is a 'E'. In the case of the 'E', if it's there it means that the value of the operand is directly used by the 6809 instruction; if it's absent, then the value of the operand is an address of a memory location containing the value to be used. The latter may sound complex, but it is the same principle as an array variable, where the index of the array (say, i) is not actually the value needed, but tells us where it is located in the array. To give you some idea of the flexibility of the assembly, there are eight other methods of addressing values in memory other than those mentioned above.

Finally, the comment field in the assembly instruction is used for a meaningful remark about the code, just like any other commenting facility in a language. But unlike Basic, these comment statements do not slow down or otherwise affect the running code in any way. They only exist in the source file, not the assembled code. It's a good idea to comment exhaustively on an assembly program.

Don't let all these options put you off – a few hours with the manual and you'll be rewriting all your Basic programs in assembly code. To put MACE and the 6809 to work, we typed in a short assembly code program, and compared it with the equivalent Basic program. Although not staggeringly complex and hardly touching on the true 6809 power, it may serve to give a feel for assembly programming technique on the Dragon.

In Basic the program took about seven seconds to run. We found timing the assembly program almost impossible – around 0.1 of a second for total execution time was the best guess. So, with a bit of determination it's possible to have your Dragon breathe fire – in assembly.

**By Adrian McKie, a scientific officer at the National Physical Laboratory, and Graham Bland, of Text 100.**

*By programming the Dragon directly in Assembly language, you can by-pass the Basic interpreter, and in the process have the opportunity to harness much of the power not afforded in Basic.*



# NEVER A XWORD

PROGRAMMING

WE PRESENT CROCUS - A CROSSWORD-CRUSHING PROGRAM FOR THE APPLE, ORIC AND DRAGON MACHINES.

Crosswords drive me crazy - I don't know any South American passion fruit, and finding anagrams of ten letter words is more than my fuddled brain can handle.

However, as crossword cash prizes are worth having, and, as W C Fields said, 'anything worth having is worth cheating for', we set out to devise a simple computerised 'aid' to solving crosswords. Nothing that would help solve cryptic clues, but a program that would take away some of the 'word list reciting' that crossword puzzlers seem to have to go through. The final program was called *Crocus the Crossword Crusher*, rather a misnomer, as we haven't won a penny from any crossword competition. Nevertheless, here is the program for your adaptation and improvement.

The *Crocus* system basically consists of a large dictionary of words, and a number of routines to search through them in a number of ways. The words are held in a special order so there is no need to type in most plurals or 'D' extensions. There are many ways in which a crossword puzzler may wish to search through a word list, but two methods stand out as the most useful. First, the program should be able to find all known anagrams of any given set of letters. Second, given a template of letters and empty spaces (for example --A--S--) the program should be able to find all words that match.

The stored dictionary has different areas for each word length. The shortest sensible length being three letters, and the longest around 15 letters.

Each word length is further divided into three

sections to take account of allowable single letter extensions. Almost all words that end in E take both a D and S extension; many words take an S but not D, but very few take a D but not an S. Because of this, the dictionary is organised into the sections shown in Fig. 1; and a word can be added by following the procedure in Fig. 2. The idea behind this ►

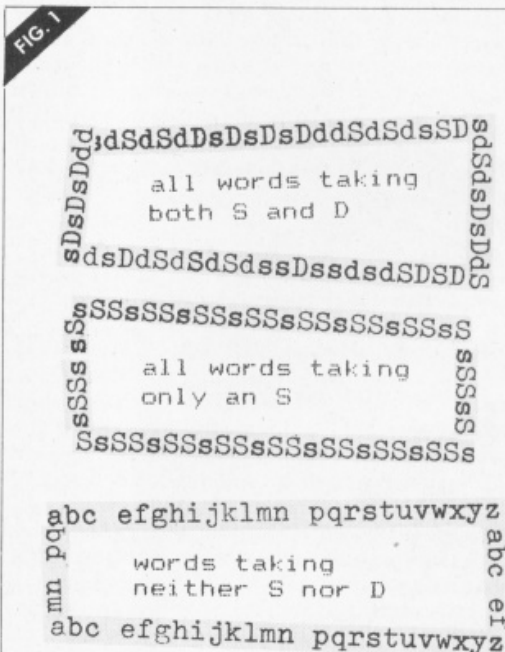


Fig. 1 shows the organisation of the Crocus dictionary; Fig. 3 shows some sample Crocus output; Fig. 2 illustrates the procedure for adding a word to the Crocus dictionary.

FIG. 3

```
*****
* COMPUTER ANSWERS *
*   CROCUS   *
*****

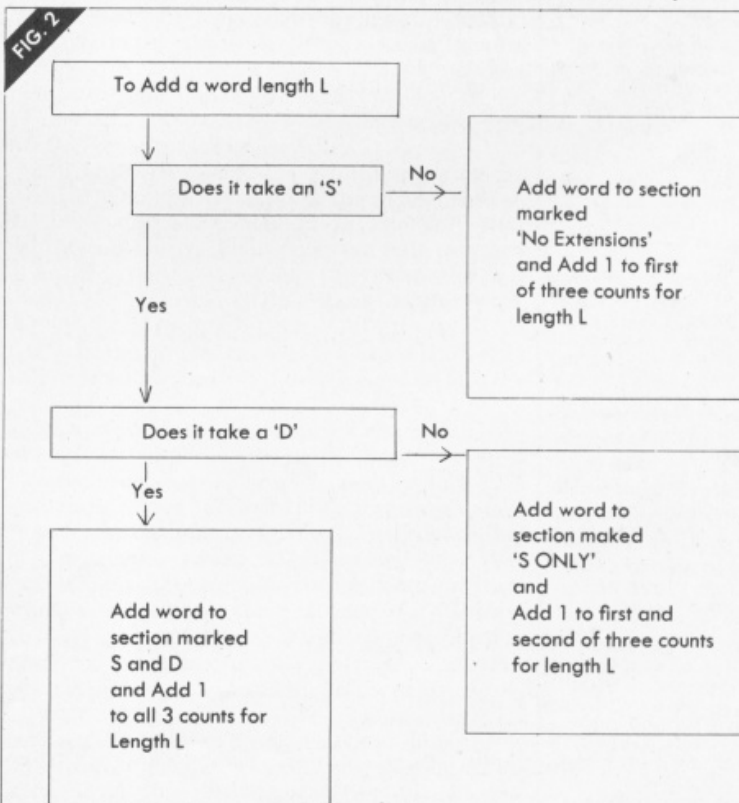
ENTER SEARCH TYPE -
A:  ANAGRAM
T:  TEMPLATE
Q:  QUIT

SEARCH (A,T,Q):T
TEMPLATE:--C-D
ACID  ICED
READY (PRESS RETURN):

SEARCH (A,T,Q):A
ANAGRAM OF:DICE
ICED
READY (PRESS RETURN):

SEARCH (A,T,Q):T
TEMPLATE:-----D
ADVANCED  ABSOLVED
AGONISED  AGITATED
READY (PRESS RETURN):

SEARCH (A,T,Q):Q
```





**Fig. 4 (below) contains the Crocus program – notes on how to adapt it for the Apple, Oric and Dragon machines are outlined in the text above.**

system is that around 80 to 100 per cent more words are in the dictionary than are actually typed – they exist by virtue of their position in the word lists. This means the searching algorithms have to be slightly more sophisticated than straight linear ones, but that is much preferable than having to type in all those extra words.

This is the main form of compaction I have used to get my Scrabble program to fit into the Beeb's 32K. A judicious choice of words has meant that a dictionary of 8,000 words has only used the space of 4,000 words.

The program listing is given in Fig. 4. It was pro-

grammed on an Apple II, but there should be little difficulty translating it for any other machine, as no machine dependent PEEKs or POKEs are used. In particular line 840 (HOME) will be changed to CLS on a number of machines, in particular the Dragon and Oric. Fig. 3 shows some sample output. The real chore is typing all the words in, but then again the word list could be used in other ways. For example, you could always improve the program to set crossword puzzles (possibly purely anagrammatical ones), or something more exotic (like a cryptic clue solver).

**By Dr Peter Turcan, technical editor.**

**FIG. 4**

```

10 REM COMPUTER ANSWERS: CROCUS
20 REM MAX=MAXIMUM WORD LENGTH
30 MAX = 7

40 TRUE = 1:FALSE = 0
50 DIM C(MAX + 1)
60 DIM WD(MAX + 1)
70 DIM D(MAX,3)
80 DIM Y$(MAX - 2,100)
90 REM INITIALIZE DICTIONARY
100 FOR L = 3 TO MAX
110 FOR K = 1 TO 3
120 READ D(L,K)
130 NEXT K
140 NEXT L
150 FOR L = 3 TO MAX
160 IF D(L,1) = 0 THEN GOTO 200
170 FOR K = 1 TO D(L,1)
180 READ Y$(L - 2,K)
190 NEXT K
200 NEXT L
210 GOTO 840
220 REM ANAGRAM TEST
230 FOR L = 1 TO S:C(L) = ASC ( MID$( W$,L,1)):NEXT L
240 L = 0
250 AN = TRUE
260 IF L = S OR AN = FALSE THEN GOTO 350
270 L = L + 1:F = FALSE:L2 = 0
280 IF L2 = S OR F = TRUE THEN GOTO 330
290 L2 = L2 + 1
300 IF WD(L) < > C(L2) THEN GOTO 320
310 C(L2) = 0:F = TRUE
320 GOTO 280
330 IF F = FALSE THEN AN = FALSE
340 GOTO 260
350 IF AN = FALSE THEN RETURN
360 PRINT W$;" ";
370 RETURN
380 REM TEMPLATE TEST
390 TT = FALSE:L = 0
400 IF L = S OR TT = TRUE THEN GOTO 450
410 L = L + 1
420 IF WD(L) = 45 THEN GOTO 440
430 IF WD(L) < > ASC ( MID$( W$,L,1)) THEN TT = TRUE
440 GOTO 400
450 IF TT = TRUE THEN RETURN
460 PRINT W$;" ";
470 RETURN
480 REM VOCAB SWEEP
490 IF S = MAX + 1 THEN GOTO 560
500 IF D(S,1) = 0 THEN GOTO 560
510 FOR I = 1 TO D(S,1)
520 W$ = Y$(S - 2,I)
530 IF Z$ = "A" THEN GOSUB 220
540 IF Z$ = "T" THEN GOSUB 380
550 NEXT I
560 IF S = 3 OR (D(S - 1,2) = 0 OR LSD = FALSE) THEN RETURN
570 FOR I = 1 TO D(S - 1,2)
580 REM ADD "S" TO END OF WORD
590 W$ = Y$(S - 3,I) + "S"
600 IF Z$ = "A" THEN GOSUB 220
610 IF Z$ = "T" THEN GOSUB 380
620 IF I > D(S - 1,3) THEN GOTO 670
630 REM ADD "D" TO END OF WORD
640 W$ = Y$(S - 3,I) + "D"
650 IF Z$ = "A" THEN GOSUB 220
660 IF Z$ = "T" THEN GOSUB 380
670 NEXT I
680 RETURN
690 REM TEST INPUT WORD
700 LSD = FALSE
710 S = 0
720 IF LEN (V$) > (MAX + 1) OR LEN (V$) < 3 THEN GOTO 830
730 FOR L = 1 TO LEN (V$)
740 P = ASC ( MID$( V$,L,1))
750 IF Z$ = "T" AND P = 45 THEN GOTO 770
760 IF P > 90 OR P < 65 THEN GOTO 830
770 S = S + 1:WD(S) = P
780 IF Z$ = "A" AND (P = 83 OR P = 68) THEN LSD = TRUE
790 NEXT L
800 IF S > (MAX + 1) OR S < 3 THEN GOTO 830
810 IF Z$ = "T" AND (WD(S) = 83 OR WD(S) =
68 OR WD(S) = 45) THEN LSD = TRUE
820 OK = TRUE: RETURN
830 OK = FALSE: RETURN
840 HOME
850 PRINT "*****"
860 PRINT "* COMPUTER ANSWERS *"
870 PRINT "* CROCUS *"
880 PRINT "*****"
890 PRINT
900 PRINT "ENTER SEARCH TYPE -"
910 PRINT " A: ANAGRAM"
920 PRINT " T: TEMPLATE"
930 PRINT " Q: QUIT"
940 PRINT
950 INPUT "SEARCH (A,T,Q):";Z$
960 IF Z$ = "Q" THEN END
970 IF Z$ < > "A" THEN GOTO 1030
980 INPUT "ANAGRAM OF:";V$
990 GOSUB 690
1000 IF OK = FALSE THEN GOTO 980
1010 GOSUB 480
1020 GOTO 1080
1030 IF Z$ < > "T" THEN GOTO 950
1040 INPUT "TEMPLATE:";V$
1050 GOSUB 690
1060 IF OK = FALSE THEN GOTO 1040
1070 GOSUB 480
1080 PRINT
1090 INPUT "READY (PRESS RETURN):";CR$
1100 GOTO 840
1110 REM DICTIONARY INFO
1120 REM 3 LETTER WORDS
1130 DATA 16,12,8
1140 REM 4 LETTER WORDS
1150 DATA 12,8,4
1160 REM 5 LETTER WORDS
1170 DATA 12,8,4
1180 REM 6 LETTER WORDS
1190 DATA 12,8,4
1200 REM 7 LETTER WORDS
1210 DATA 12,8,4
1220 REM TEST DICTIONARY FOR CROCUS
1230 REM THREE LETTER WORDS
1240 REM 3:TAKING S AND D
1250 DATA "AGE","AXE","DIE","DYE"
1260 DATA "EYE","HDE","OWE","ICE"
1270 REM 3:TAKING S ONLY
1280 DATA "ACE","ACT","ADD","AID"
1290 REM 3:NO EXTENSIONS
1300 DATA "AFT","AGO","ALL","ANY"
1310 REM FOUR LETTER WORDS
1320 REM 4:TAKING S AND D
1330 DATA "ACHE","BAKE","BARE","BASE"
1340 REM 4:TAKING S ONLY
1350 DATA "ACID","ACRE","AEON","AREA"
1360 REM 4:NO EXTENSIONS
1370 DATA "ABLE","ABLY","ACNE","AFAR"
1380 REM FIVE LETTER WORDS
1390 REM 5:TAKING S AND D
1400 DATA "ABUSE","ADORE","AGREE","AMAZE"
1410 REM 5:TAKING S ONLY
1420 DATA "ABBOT","ABHOR","ABORT","ACTOR"
1430 REM 5:NO EXTENSIONS
1440 DATA "ABEAM","ACUTE","AGILE","AGONY"
1450 REM SIX LETTER WORDS
1460 REM 6:TAKING S AND D
1470 DATA "ADMIRE","ADVISE","AROUSE","ASHAME"
1480 REM 6:TAKING S ONLY
1490 DATA "ABJECT","ABUSER","ACTION","ADJOIN"
1500 REM 6:NO EXTENSIONS
1510 DATA "ACTIVE","ATOMIC","AFRAID","BEATEN"
1520 REM SEVEN LETTER WORDS
1530 REM 7:TAKING AN S AND D
1540 DATA "ADVANCE","ABSOLVE","AGONISE","AGITATE"
1550 REM 7:TAKING S ONLY
1560 DATA "ACROBAT","BROTHER","BUILDER","CABINET"
1570 REM 7:NO EXTENSIONS
1580 DATA "ABYSMAL","AGILITY","AIDLESS","AMBLING"
1590 REM END OF CROCUS

```



# SHORTCUTS TO SECURITY

PROGRAMMING

WE PROVIDE SOME SIMPLE RUSES TO HELP PROTECT  
YOUR VALUABLE BBC PROGRAMS.

**M**ost of us worry about the security of our software at some time—even if it has no real commercial potential. If you belong to a club, or write software for a school, or perhaps have written something you hope to market, you should consider some form of built-in protection—and here are a few hints, based around the BBC micro, to help you.

We reckon that no software is truly secure; at least, not in the microcomputer arena (indeed, all the information to defeat such efforts is contained in the User Guide). However, by incorporating the ruses described here, you could confuse would-be inquisitors enough to make them give up; or more likely, you could do things to your own software that defeat their skills (nevertheless, it must be stressed that if someone really wants to take a look at your program, they will).

In order to effect some degree of protection, you must have an understanding of how the BBC stores Basic in its memory, and also some understanding of hexadecimal. One of the best tools for this type of work is a hex/decimal programmer's calculator. At least with such an aid you can avoid being fluent in hex. The Texas Instruments model is good (if a little expensive), but Casio have a similar product at half the price; alternatively, you can use the number base conversion program published in the April 1984 issue of *Computer Answers*.

Though the hex numbering system has been covered in past *Computer Answers*, for the still uninitiated here is a brief outline. Hexadecimal is a numbering system that uses numbers and letters. It is meaningless to any micro, as they only 'understand' binary. Hex makes large binary numbers easier for people to contend with. Fig. 1 shows a table showing the hex Alpha-numeric, and the equivalent decimal and binary.

Expressing half a byte (nybble) in terms of binary is not mentally difficult. As you can see, with only one hex character, the most we can count to is decimal 15. For practical purposes we will at least be looking at one byte (8 bits), in this case the maximum is decimal 255 or hex FF. To convert binary to decimal, the binary is first split into nybbles, from the right, and the hex code of each nybble is written down, producing our hex value.

Take a look at Fig. 2. Suppose we have a number in decimal 41004. Each nybble is considered the same as that in the least significant byte, in other words, it has a maximum possible of hex F, so, the number 41004 may be expressed as A02C hex. You can see this is far easier to consider mentally than its binary counterpart. From now on we adopt the BBC convention and suffix all hex number with the '&' sign (thus, 41004 = &A02C).

Now let's look at how the BBC stores Basic in memory. This is the format for a line of Basic, as stored in RAM. Take a squint at Fig. 3. The start of each line is marked by a carriage return—&0D. Next come two bytes that contain the line number. The byte after this indicates the length of the line, from &0D to the last text item. Then comes the tokenised text.

As the line length is contained in one byte, the maximum amount of characters including &0D and line number is decimal 255. Should the first byte (high byte) of the line number be &FF, it indicates the end of the program. At the back of the User Guide is a list of BBC tokens. This list shows what is actually stored when certain words, keywords, are used. Suppose we had a line of Basic:

```
10 PRINT "BBC MICRO": REM TITLE.
```

In memory this line would be:

```
0D 00 A0 17 F1 22 42 42 43 20 4D 49 43 52 4F 22
```

```
(Line) 10 " B B C M I C R O "
```

```
3A F4 20 54 49 54 4C 45
```

```
: T I T L E
```

F1 is the token for PRINT, and F4 is REM.

The actual memory parameters of the BBC micro change under certain circumstances: if you have no disk interface, your programs are stored from &0E00 upwards (the upper limit varies with the mode); with the BBC DFS, it starts at &1900, and with the Amcom DFS at &1500. For our own convenience, the routines described were run with page &1500 as the start point for Basic programs. This was to save waiting for tapes to load each time the routines did their job (it was quicker from disk). The majority of users will be using cassette, so for you, page starts at &0E00. We recommend you load a short program from cassette to experiment with. Let's assume you have done that.

In our case, we loaded a short game called 'Sub-kill'. When loaded the micro shows; SUBKILL 0B 0BA0. &0BA0 is the length of the program. We could use this and pages to work out the memory location at the end of the program (page + &0BA0 - 1 = last byte), but there is an inbuilt variable to do it for us: Type PRINT "TOP<RETURN>". Remember, use the ' (shift ' ) key to get the values in hex.

The hex code returned is the first free memory location after the program. Page in our case is &1500, so the code displayed is &1500 + &0BA0 = &20A0 (obviously, it will differ for your test program). You must now subtract 1 from the value that print TOP has displayed, in this case &20A0 - 1 = &209F. Now type PRINT "?&209F <RETURN>". This will print the value of the byte at location &209F, in this case &FF, the byte indicating the end of the program.

Now type ?&209F=0. Your program will still run—try it. It will not list—the old bogey BAD PROGRAM appears; just one snag—it won't save either!

In order to save a doctored program, you will have to start with the clean program and do the following: first, print the hex value of TOP using PRINT "TOP". Add a line at the beginning of the clean program which sets LOMEM to the hex value of TOP (say, 2090). Type 5 LOMEM = &2090. Remember, the line number 5 is only an example; use whatever number will put the line at the beginning of the program.

PRINT "TOP" again. Note that it has changed (as a result of the addition of the new line). Edit line 5, replacing the old TOP value (in our example, 2090) with the new one. Remember to put the '&' sign before the number to denote a hex value.

Now's the time to doctor the program. PRINT ►

*No software is truly secure; however, by incorporating the tricks described here, you could confuse would-be inquisitors enough to make them give up.*

*In order to effect some degree of protection, you must have an understanding of how the BBC stores Basic in its memory, and also some understanding of hex.*



the contents of TOP minus 1 as above. It should be FF. Change the value to zero, again as above, and the program won't list.

The next stage is to save the program. Type 'SAVE "Subkill" 1500 2090 <RETURN>'. 1500 is the hex value of PAGE, and 2090 the hex value of TOP plus one (note that you're adding one to a hex value; for example, hex 2099 + 1 doesn't equal 2100, but 209A). These values will differ if you're using a different DFS, or none at all, and according to the length of your program.

Your Basic program is now saved as a block of memory from page to the length of the program. To load and run this now, we have to type:

```
'LOAD "Subkill" 1500 <RETURN>
RUN <RETURN>
```

In order to disguise this, we need to load it from another program. This short loader routine should be well protected. There is nothing to stop you protecting both as much as you like, but be devious.

Let's consider a small loader to 'chain' our main program 'Subkill'. We will suppose we have a short program containing a title and perhaps instruction, and a line such as 'LOAD "Subkill" 1500: RUN - this will not work! 'Subkill' will attempt to load on top of this header, and destroy it.

This is how we could construct a loader for our main program:

```
10 GO TO 100
20 'LOAD "SUBKILL" 1500
30 PAGE = &1500: RUN
100 FOR A% = 0 TO &xxx1 STEP 4: A%!&5000 = A%!&xxx-
2: NEXT: PAGE = &5000: RUN
```

xxx1 is the number of bytes occupied by lines 20 to 30, and xxx2 the address of the first byte of line 20. When run, line 100 moves lines 20 and 30 into page &5000, well away from the end of 'Subkill'. Page is then set to &5000, and 'Subkill' is loaded into &1500, then RUN. How do we find xxx1 and xxx2? As ever, the answer is in the User Guide. Type: 'KEY 0 FOR X = 0 TO 20: PRINT "M+X, "M?X: NEXT IM <RETURN>', then M = &1500 <RETURN> (or 0E00, if you have no disk).

Hit function key 0, and the screen will display twenty addresses on the left, and the contents on the right, starting from 'M', in this case &1500. Refer back to how a Basic line is constructed. We are looking for &0D followed by &00 14 (on the display leading zeros do not show, so all you see is D). This is line 20. The address to the left of the '0D' at the start of line &00 14 is entered in xxx2.

Count the number of bytes from this point until you reach the end of line 30 (you may have to change 'M' to get this far). Enter the total in hex as xxx1. Now run your loader. This is fine, but if the first program is loaded and listed, it is obvious what has happened to the main program.

Before we look at how to prevent listing either, let's stay with the page concept to introduce more problems for the would-be pirate. Set up function key 1 as follows:

```
'KEY 1 FOR Y% = 0 TO &xxx2 STEP 4: Y%! (PAGE + &200)
= Y%! &xxx2: NEXT IM
```

xxx1 and xxx2 are the same codes that we have used in line 100. Hit function key 1. Line 20 and 30 are now in page + &200. Delete all the program now, and make up your titles and instructions. For reasons that will be explained shortly, start at a random line of about 25000, and make each new line some odd figure such as 25000, 25001, 25011, 25027, 25030, there should be no set pattern. When your header is complete add this as a last line (use your own line number):

```
FOR A% = 0 TO &xxx1 STEP 4: A%! &5000 = A%!
(PAGE + &200): NEXT: Page = &5000: RUN
```

Now, our header program needs to include any

**FIG. 1**  
HEX  
EQUIVALENTS

HEX:	DECIMAL:	BINARY:
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
A	10	1010
B	11	1011
C	12	1100
D	13	1101
E	14	1110
F	15	1111

instructions and so on that you have written, and the short routine in page + &200. If page is &1500, then this routine is at &1700. Let's say it is 200 bytes long; the command will be: 'SAVE "HEADER" 1500 1700 <RETURN>'.  
When 'saved' this will still load or chain as a Basic program. There is one more twist we can apply before looking at how to stop the header from listing. Remember how we doctored 'Subkill' (&FF was removed)? Assign a function key like this:

```
'KEY 9 FOR D% = &1500 TO &20A0 STEP 4: D% = !D%
FOR &FFBCCBF: NEXT IM
```

Use 'LOAD "SUBKILL" to load in the main program. When loaded hit function key 9, and then re-save with 'SAVE. You now have a memory dump on tape that is garbage! The actual codes you use will differ of course - your 'page' may well be &E00, and the end of your program (ours was &20A0) will differ. The magic in this routine was EOR (Exclusive OR). You can use any hex code you like, but to make sense of the program, the same operation must be done after loading. How?

Refer to the original routine we have put into page + &200. A line needs to be added: 25 FOR D% = &1500 TO &20A0 STEP 4: !D% = !D% EOR &FFBCCBF: NEXT. You cannot just add this line, so you will have to start again to find xxx1 and xxx2, and so move 20, 25 and 30 into page + &200.

Now we reach the final and most interesting (frustrating) part - how to stop the program listing at all. Earlier, we said to use high line numbers, with random increments. Add this line to your header: 0 REM ..... <RETURN>. Note there's no space after the REM.

This line will now be in the first memory location. Any lines will now be in the first memory location on. Any lines you add will alter xxx1 and xxx2. Reassign key 0 as already shown, if you have 'lost it'.

In direct mode (with no line numbers), key in: M = &1500 (or your page setting) and hit function key 0. The screen display will be something like this:

1500	D
1501	O
1502	O
1503	10
1504	F4
1505	2A

*Decimal to hex conversion charts (see Fig. 1) are useful; but often when you get down to looking at bytes, a second computer/calculator can be very useful to help perform more complicated conversions.*



1506	2A
1507	2A
1508	2A
1509	2A
150A	2A
150B	2A
150C	2A
150D	2A
150E	2A
150F	2A
1510	D
1511	O
1512	A
1513	17

(&1504 contains the REM in line 0.)

Now, in the direct mode, type ?& 1505 = &17, and change the values of locations &1506 to &150F to zero. Do this one location at a time, ?&1506 = 0. List your program. . . don't worry - the noises from your TV or monitor are not causing damage. What you have done is to put a VDU 23 command directly into memory, in this case the command that allows control over the CRT chip in the BBC. Since you have followed with all zero bytes, the chip runs 'out of control' and you get no video. Nasty.

Let's put in another line, 100 REM \*\*. Remove line 0, or you will not see the effect of line 100. Use key 0 and 'M' to find the start of line 100. After the address containing F4 will be two bytes containing &2A (because &2A is the hex value of ASCII character \*). Change these bytes to &0C and &15. In memory, the line should now be:

0D 00 64 07 F4 0C 15

List the program. Fun, isn't it? Nothing on the screen and the keyboard will not work. Don't forget, we have only to remove the &FF at the program end, and your only escape - break - will give you 'BAD PROGRAM'.

What has happened here is that the control code to clear screen (&0C) and control code to disable VDU drivers (&15), have been executed. When part of a running program they have no effect, because of the REM.

The pirate has to be pretty lucky to guess the high line numbers you have used for the read information. One more thing we can do to the listing before a final nasty bit of protection. Type:

\*226, 150

10 PRINT "THIS IS A DEMO"

20 PRINT " SECSoft < SHIFT F2 > ": GO TO 10

RUN

After you have used shift and function key 2 you will not see the characters you type. Be sure you

## PIRACY TIPS

For commercial products, here are some practical guidelines to help minimise piracy:

- Make the packaging as expensive and glossy-looking as possible. Make it look as if the buyer is getting something more than a cassette.
- Include any extra in the box if you can think of one, like a competition entry form, book (*viz a viz, The Hobbit*), and in any case well produced instructions.
- Include as many traps in the software as your knowledge and imagination allow (as discussed above).
- Put one copyright notice well into the software, and another that only comes up when a unique and unpredictable sequence of characters are typed at some obscure point in the program; so if your code does get ripped off, and the copyright notice removed, there is still a chance you can prove it's yours.

**FIG. 2**  
NYBBLE  
HEX VALUE

32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
1	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0
A				0				2				C			

**FIG. 3**  
BASIC  
STORAGE

OD	LINE NUMBER	LINE LENGTH X	TOKENISED TEXT
X			

type correctly. All you have done is use teletext code to conceal the display - use it all over the place to hide parts of lines. It is pretty easy to get round, but the more confusion the better.

Now for the final frustration generator. Memory location &700 normally contains &F1 (the token for print). When handling cassette files it may contain the token for load, chain, save and so on. You will always instruct a user to 'chain' your program, if only because it looks better.

Add this line to your loader (we will experiment with the loader because we don't have so long to wait when loading):

10 IF &700 < > &D7 THEN PRINT "I TOLD YOU TO CHAIN IT!" : PAGE = &6000. Now load and run it. Crashed again. &D7 is the token for chain. You loaded and ran, so that token was not in &700.

Change line 10 to: 10 JF &700 < > &D7 THEN CALL !!!! Add this line: 15 ON ERROR CALL !!!!

CALL !!!! is nonsense, a bad call. If the program is not chained, or escape used, the error calls an error, and the whole thing crashes. Again.

We now reach the grand finale, and a routine we are particularly fond of. Type:

15 on error procdstroy

31000 DEF PROCDESTROY

31001 FOR X% = 0 TO &01F4:X% & 1500 = 0:NEXT

31002 ENDPROC

Any attempt to escape from the program will cause the first 500 bytes (or more if you increase &01F4) to be overwritten with zero, even a hunt through memory will reveal nothing.

These, then, are some of the ways you may make your software secure. Use them liberally, and in any combination you see fit. Always remember that even simple routines are only simple because you wrote them - the more traps you lay the better. For example, consider chaining a section between the loader and main program at 300 baud. Simple to do, but if the thief cannot see what has happened, the program won't load it.

Finally, as we said earlier you will not beat someone who is really determined to penetrate your software - let's hope that the people who do this seek only to broaden their own knowledge and not make an easy profit on the hard work of others.

By Mike Houghton, a control engineer.

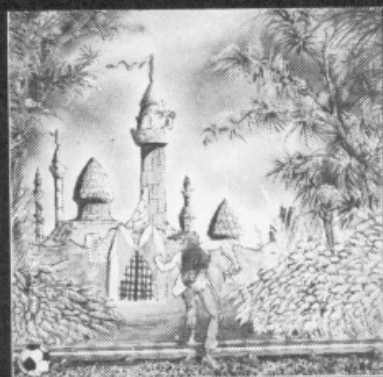


## 48K Spectrum



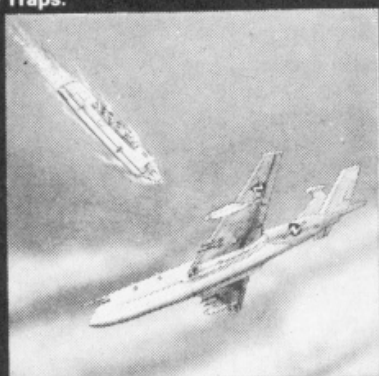
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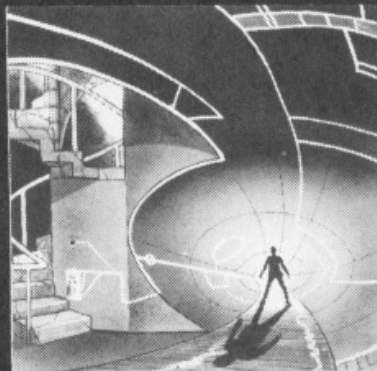
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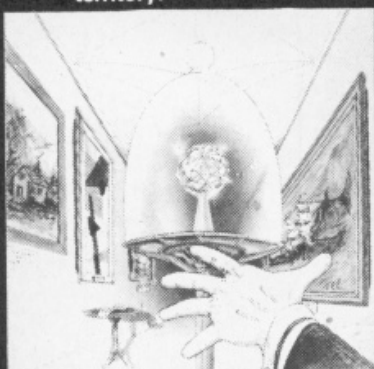
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### Barsak The Dwarf

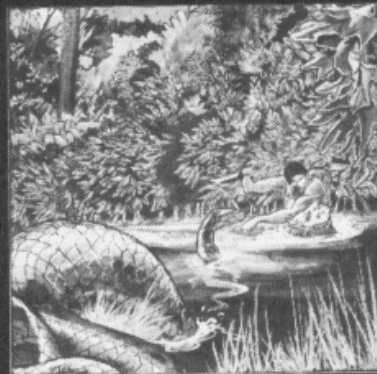
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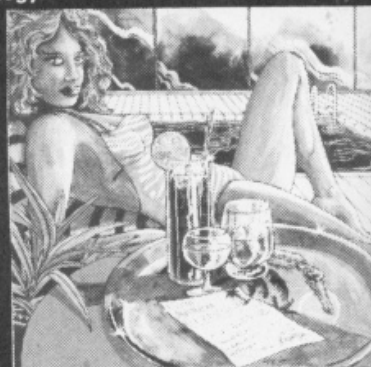


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(b) 1530 cassette unit	£45	(h) Epson RX80	£260	
(c) 1541 disk unit	£199	(i) 1701 monitor	£210	
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# software selection

Please note that the prefix (d) before a price denotes that the program is available on disk (for example d25). The prefix (r) (as in r29) indicates that the program is in cartridge form and costs £29.00. Tape programs prices have no prefix. Thus (d29 16) indicates a disk version at £29.00 and a tape version at £16.00.

## WORD PROCESSING

PAPERCLIP (d90) is the most sophisticated and versatile word processing program for the 64. Very good too is VIZAWRITE (r78 d75) which has a spell-check program VIZASPELL (d20 if bought with VIZAWRITE, else d65). But for casual wordprocessing of extreme sophistication we recommend HOMEWORD (d35) which is outstanding value and very easy to master. It uses 'icons' to symbolize menu options (as used by Lisa). Contains several really innovative features. Mail label programs available to match.

## UTILITIES

DISCO (9.95) can be used to transfer most of your tape-based programs onto disk — a must for all disk users. DISKEY (d36) is a really powerful disk editor which enables you to manipulate fully your 1541 and files produced on it. PROGRAMMER'S UTILITIES (d14.95) surely represents the best value if you have a disk: sprite, character, and sound editors are provided in addition to a PET emulator, and disk copy utilities — a dozen in all COMPACTOR (d10.50 8.50) cuts out all wasteful programming including REMs and spaces. This can speed up programs and salvage memory. Various good quality sprite and character editors are available including SUPERFONT 4.0 (6.75) SPRITES/

GRAPHICS EDITOR (5.99) SPRITMAKER 64 (5.75). On the music side there's MUSIC COMPOSER (r9.99) ULTISYNTH (14.95) SYNTHESOUND (r25 d25) amongst others. GRAPHIX 64 (d13.50 11) helps you use the fabulous graphics capabilities.

## PROGRAMMING AIDS

These range from improvements to C64 BASIC to actual programming aids. SIMONS BASIC (r50) adds 114 extra commands and facilities, and the rather better planned program BC BASIC (r50 17.95) does must the same. Best of the compilers and excellent value is PETSPEED (d50). For database generation we highly recommend THE LAST ONE (d95) and CODE WRITER (d85) — both produce standalone code which can be compiled. On the machine code front there are numerous monitors and assemblers the best of which is MIKRO ASSEMBLER (r53) but MONITOR (r29.95) is MIKRO DEVELOPMENT (d24.95) HESMON 64 (r29) and MASTERCODE ASSEMBLER (14.95) can all be recommended. If you want to learn about machine code programming we suggest ASSEMBLER TUTOR (d29.95 29.95) or Honeyfold's BEGINNER'S (d29.95) ASSEMBLY LANGUAGE PROGRAMMING (14.95). A multifunction utility which adds many disk commands to the 64 is the highly acclaimed VICTREE (r56). ARROW (r44) has a TIM monitor, renamer and delete, as well as offering tape LOADs/SAVEs at disk speeds!

## DATAFILES/DATABASES

Unquestionably the one program to have if you can afford it is SUPERBASE 64 (d88) which we have on special offer by way of encouragement! This is a

This is a selection of some of the best programs for the Commodore 64 from a list of over 800 we can supply, covering the products of 100+ software houses from the UK, rest of Europe, and the USA. A 20-page listing and later updates are available free to customers (otherwise 50p and large SAE). Add 50p postage for orders under £20. £1 per item on all software orders to Europe.

## RECREATIONAL

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Our list includes details of EDUCATIONAL, ACCOUNTING, BUSINESS and GAMES programs not possible to itemize here. PLEASE TRY US IF YOU ARE HAVING DIFFICULTY LOCATING A PROGRAM. Please make cheques/POs payable to The Six-Four Supplies Company.

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# COMPETITION CRACKED

**FIG. 1: THE ENCRYPTING PROGRAM.**

```

10 DIM C1,C2(3)
20 DIM CM(255)
30 INPUT "type in message:";MS
40 FOR L=1 TO LEN(MS)
50 CM(L)=ASC(MID$(MS,L,1))
60 IF CM(L)=32 THEN GOTO 100
70 IF CM(L)<91 AND CM(L)>64 THEN GOTO 100
80 PRINT "only use upper case characters and spaces please!!"
90 GOTO 30
100 NEXT L
110 LN=LEN(MS)
120 INPUT "type in rotation factor:";F
130 RF=INT(F)
140 IF RF>0 AND RF<27 THEN GOTO 170
150 PRINT "factor must be in range 1 to 26"
160 GOTO 120
170 FOR L=1 TO LN
180 IF CM(L)=32 THEN GOTO 250
190 IF CM(L)=65 OR CM(L)=69 OR CM(L)=73 OR CM(L)=79 OR CM(L)=85 THEN GOTO 230
200 CM(L)=CM(L)+RF
210 IF CM(L)>90 THEN CM(L)=CM(L)-26
220 GOTO 250
230 CM(L)=CM(L)-RF
240 IF CM(L)<65 THEN CM(L)=CM(L)+26
250 NEXT L
260 GOSUB 600
270 REM ENTER THE TWO KEYWORDS
280 PRINT "type in two three letter words"
290 PRINT "any letter must only appear once"
300 INPUT "word1:";W1$
310 INPUT "word2:";W2$
320 IF LEN(W1$)<3 OR LEN(W2$)<3 THEN GOTO 280
330 FOR L=1 TO 3
340 C1(L)=ASC(MID$(W1$,L,1))
350 IF C1(L)<65 OR C1(L)>90 THEN GOTO 280
360 C2(L)=ASC(MID$(W2$,L,1))
370 IF C2(L)<65 OR C2(L)>90 THEN GOTO 280
380 NEXT L
390 FOR L=1 TO 3
400 FOR M=1 TO 3
410 IF L<>M AND C1(L)=C1(M) THEN GOTO 470
420 IF C1(L)=C2(M) THEN GOTO 470
430 IF L<>M AND C2(L)=C2(M) THEN GOTO 470
440 NEXT M
450 NEXT L
460 GOTO 490
470 PRINT "do not use duplicate letters"
480 GOTO 280
490 FOR M=1 TO 3
500 FOR L=1 TO LN
510 IF CM(L)<>C1(M) THEN GOTO 540
520 CM(L)=C1(M)
530 GOTO 560
540 IF CM(L)<>C2(M) THEN GOTO 560
550 CM(L)=C2(M)
560 NEXT L
570 NEXT M
580 GOSUB 600
590 END
600 REM print message subroutine
610 FOR L=1 TO LN
620 PRINT CHR$(CM(L));
630 NEXT L
640 PRINT
650 RETURN

```

With over 500 entries, many interesting 'answers', no bugs in the listings (phew!) and a good prize, our Cypher puzzle lived up to being a cracking competition.

All you had to do was decode the message (Fig. 2), and answer a question contained within it. An engaging little twist to the competition was that the deadline was contained in the message itself, so the sackful of late entries we received had to hit the shredder (sorry, rules is rules).

So how could the message be solved? The encrypting program is listed in Fig. 1. A message is typed into the program, then the letters are rotated according to a number (the rotation factor). If the letter was a consonant then the rotation was forwards; if a vowel, then it went backwards. The message was further jumbled by two three letter keywords. There was probably many ways in which the problem of decyphering the message could be tackled - here are a few of them.

With a micro it was possible to alter the program slightly so that the coded message could be typed in, and then rotated by different amounts. It was then possible, with a sharp eye, to pick up the rotation factor by noticing legitimate letter combinations, despite the jumbling done by the keywords. One problem with this technique, though, was that it was not possible to rotate the message one at a time (that is, rotate by one, examine message, rotate by another one and so on), for example, the letter D would become E, then the rotation would reverse and it would become D again! It was necessary to start from the original message each time and rotate by one, then two, then three, and so on.

We thought most people would start off by trying it this way. Obviously other methods were discovered, and were necessary if trial and error proved fruitless. One was to notice the repetition of the word OPTL, and to take the hint from the write



up that it may be written as a telegram. This implies that punctuation would be spelt out, so OPTL becomes STOP, and the rotation factor can be calculated.

Encoding the deadline gave away another hint, that a date was included in the message. Given that the date would probably include a month, then there was only a limited number of words in the message that could have been the month. Other forms of inspired guesswork were probably also used, but most entrants got the correct rotation factor of 22. By rotating every letter in the opposite direction to the one in the program it was then possible to pick out those letters that made up the keywords. Some entrants obviously got confused at this point, perhaps not noticing that the keywords affect the message after the rotation – so, to find out the letters making up the keywords, those letters had to be taken from the rotated message, not the 'rotated back' message. Nevertheless, most people got it right, the letters being E, I, N, S, T and X. It didn't take a cryptanalytical genius to notice that these letters make the words 'SIX' and 'TEN', the two keywords.

The original message falls out as 'ADD THE SUM OF THE TWO THREE LETTER KEYWORDS TO THE YEAR OF ORWELL STOP TELL US WHAT HAPPENS THEN STOP ANSWERS BY THE TWENTY SIXTH OF FEBRUARY STOP'. With the mass of publicity surrounding Orwell's 1984, it wasn't difficult to get 1984 + ten + six = 2000.

Unfortunately, some entrants left their entry at that, simply '2000' – but this is not answering the question 'what happens then?' ... well, we got some interesting suggestions.

Mr Love of Surrey told us we'd celebrate as *Computer Answers* would be 18 years old (heaven forbid – not still answering ZX81 loading problem questions!). A Mr Maher of Birmingham told us all the planets of the solar system line up – not the piece of information we were looking for, but interesting nonetheless. And Mr Hewitt of Brighton will be having his 51st birthday. Congratulations in advance Mr Hewitt, and we sincerely hope you make it to 52, as Mr Hamilton of Larkhall, among others, informs us that it will be the end of the world (according to some dude called Nostradamus).

On a lighter note, a C J Copley-May thinks Sinclair will release details of his new 'AD2000' computer (no doubt with a delivery time of 28 Sinclair days – that is, an unspecified period, not less than a couple of months); and Mr Dabell of Nottingham wants to spoil all the fun, suggesting that computer magazines will print programs without bugs.

Back on the time track, Mr Bradbury tells us that February will only have 28 days, despite it being a leap year; but Mr Woodhouse of Sheffield says this is not so, years divisible by 100 are leap years except when also divisible by 400. Returning to the astronomical theme, Mr McGowan from Harrow says that there will be a conjunction and three solar eclipses (what a lot we have to look forward to!).

You will notice the male sex bias in the entries, so just to even things up the teacher of computer studies at The Queen Katherine School informed us that Ruth, a 12-year-old pupil, almost completely solved the problem without a computer – well done Ruth!

However, back to basics. All we really wanted as 'what happens then' was simply that it is the start of a new century and millennium (a 1,000 year period). By far the bulk of entries gave one or both of these facts as the answer.

As we felt it would be unfair to put too much emphasis on the answering part of the competition,

we bundled all the entries that made an accurate effort as to what happens in the year 2000 into a big (computerized) hat, and the randomly selected winner is, Mr Robert Rybak from Hull. Well done, Mr Rybak, you have a standing invite to lunch with us (at your earliest convenience) to collect your Corona personal computer.

And that's it! Many thanks to everybody else who sent in an entry – we'd need a factory full of Coronas to give all the correct entries a prize. Another competition, this time based on programming, will appear in our June issue, but to finish this one off Fig. 3 shows a jumbling alphabet encrypting program for budding GCHQ employees. Don't send us any coded messages though – we'll only feed them to the computer.

By Dr Peter Turcan, technical editor.

## FIG. 2: THE CODED MESSAGE.

```
IZZ PDE OYE TB PDE PTT PDXEE HEPPEX GEUTTXZO PT PDE
UEIX TB TXTEHH OPTL PENH YO TDIP DILLEJO PDEJ OPTL
IJOTEXO NU PTEJPU OMSPD TB BENXYIXU OPTL
```

## FIG. 3: SUPPLEMENTARY PROGRAM

```
10 REM COMPUTER ANSWERS
20 REM JUMBLED ALPHABET ENCRYPTION PROGRAM
30 DIM A(26)
40 DIM CH(255)
50 DIM C(26)
60 FOR I = 1 TO 26
70 A(I) = I
80 NEXT I
90 HOME
100 PRINT "COMPUTER ANSWERS ENCRYPTION PROGRAM"
110 PRINT
120 REM FILL ARRAY-C WITH RANDOMLY
130 REM SELECTED LETTERS
140 FOR L = 1 TO 26
150 X = 1 + INT ((27 - L) * RND (1))
160 C(L) = 64 + A(X)
170 IF X = 27 - L THEN GOTO 210
180 FOR K = X TO 26 - L
190 A(K) = A(K + 1)
200 NEXT K
210 NEXT L
220 PRINT "TYPE IN YOUR MESSAGE (UPPER CASE ONLY)"
230 INPUT "MESSAGE: "; M$
240 FOR L = 1 TO LEN (M$)
250 Z = ASC ( MID$ (M$, L, 1))
260 CH(L) = Z
270 IF Z > 90 OR Z < 65 THEN GOTO 310
280 CH(L) = C(Z - 64)
290 REM LETTER IN STRING IS REPLACED
300 REM WITH LETTER FROM ARRAY-C
310 NEXT L
320 PRINT
330 PRINT "YOUR CODED MESSAGE IS: "
340 FOR L = 1 TO LEN (M$)
350 PRINT CHR$ (CH(L));
360 NEXT L
370 PRINT
380 PRINT : PRINT
390 PRINT "SEND SEPERATELY CODING OF ALPHABET:"
400 PRINT
410 FOR I = 1 TO 26: PRINT CHR$ (I + 64);: NEXT
420 PRINT
430 FOR I = 1 TO 26: PRINT CHR$ (C(I));: NEXT
440 END
```

```
JRUN
COMPUTER ANSWERS ENCRYPTION PROGRAM

TYPE IN YOUR MESSAGE (UPPER CASE ONLY)
MESSAGE:HULLOOD THERE THIS IS A SECRET MESSAGE

YOUR CODED MESSAGE IS:
XQLLFFF JXAGA JXNM NM B MASGAJ TAMBEDA

SEND SEPERATELY CODING OF ALPHABET:

ABCDEFGHIJKLMNPOQRSTUVWXYZ
BUSVAYDXNCZLTPFIHGMJKOERW
```



# TOP

### SPECTRUM

# TEN

↑ 1	HUNCHBACK OCEAN	↑ 6	CHEQUERED FLAG PSION
↶ 2	MANIC MINER SOFTWARE PROJECTS/BUG-BYTE	↑ 7	FLIGHT PSION
↓ 3	ATIC ATAC ULTIMATE	↓ 8	3D ANT ATTACK QUICKSILVA
↑ 4	STONKERS IMAGINE	↓ 9	MR. WIMPY OCEAN
↑ 5	DEATHCHASE MICROMEGA	↓ 10	ALCHEMIST IMAGINE

#### FAST MOVERS:

Skull (Games Machine);  
Doomsday Castle  
(Fantasy); The Snowman  
(Quicksilva); Wheelie  
(Microsphere); Scuba Dive  
(Durell); Space Shuttle  
(Microdeal).

Right: truly adventurous: a  
screen from Atic Atac (see  
below).

### HUNCHBACK

Playing Ocean's *Hunchback* is a delicate balance between addiction and frustration. The addiction comes from a detectable improvement in performance the more you play, the frustration comes from crashing out at a high level and having to return to the beginning. More lives for fewer points would have been appreciated. The graphics and speed are just right.  
(You can read details on how the game works on the Commodore games review page.)

### MANIC MINER

*Manic Miner* started life on the Spectrum, distinguished by good graphics and one of the weirdest collections of characters you're ever likely to meet. Its greatest virtue is its size; it seems to go on for ever – it has 20 levels (including The Cold Room, Miner Willy Meets the Kong Beast, the Wacky Amoebatrions and the Attack of the Mutant Telephones), each with its own bestiary, including dodos, penguins, mutant telephones, blinking eyes and revolving Escherian triangles.

The game is basically of the 'Kong' variety, with you (as Miner Willy) jumping between levels (some of which collapse as you walk over them), avoiding the beasts and poisonous pansies, and trying to climb into the next level.

It's a tough game, and gets tedious when you are stuck at a level, lose your last life, and have to start all over again. The graphics on the Spectrum are excellent, and it is easy to use either with keyboard or joystick.

### ATIC ATAC

*Atic Atac* is a truly graphic adventure game – no words to worry about. It is also one of the most complicated games for the Spectrum.

You can be one of three characters, knight, surf or wizard. You start off at a central room in The Castle (it doesn't say which) which has a number of exits. The goal is to get the magic key which will let you through these doors. The route you can take through the Castle changes according to which character you are playing.

You search through a variety of rooms viewed



from above, picking up various objects, food and a number of significant clues. You're surrounded by a group of ghosts and ghouls, which you're warned will do their best to hamper your progress. Every so often one of the beasts will kill you.

The graphics are great, the idea intriguing, but I must confess, we were never quite sure what we were doing. The game demands some thought: for example, there are a lot of objects to pick up, but you've then got to work out how to use them.

### SNOWMAN

There's the book (beautifully illustrated), the film of the book (beautifully animated), and now the game of the book. But though Quicksilva's *Snowman* game for the 48K Spectrum bears that same name as Raymond Briggs's excellent children's book, it has none of its charm.

It's a *Donkey Kong*-type game which involves wandering around and between various levels collecting materials (snow, scarves, and so on) to build a snowman. Your progress is hampered by creatures which will either prevent you from collecting the Snowman's components, or send you to sleep (the game's equivalent of losing a life, represented by falling into bed at the bottom of the screen). It's also bed-time if you fall off one of the levels.

This game offers nothing new. It's quite entertaining, but given its pedigree it offers disappointingly little.

By Benjamin Woolley, editor.

*Hunchback* (priced  
£6.90) from:

Ocean Software,  
Ralli Building,  
Stanley Street,

Manchester M3 5FD.  
Tel: (061) 832 9143.

*Manic Miner* (priced  
£5.50) from:

Ultimate,  
Tel: (0530) 411485.

*Snowman* (priced £6.95)  
from:

Quicksilva,  
Palmerston Park House,  
13 Palmerston Road,  
Southampton SO1 1LL.

Tel: (0703) 20169.



# TOP

# TEN

BBC

↑ 1	TWIN KINGDOM VALLEY BUG-BYTE	↑ 6	ZALAGA AARDVARK
↑ 2	CHUCKIE EGG A & F SOFTWARE	↓ 7	HUNCHBACK SUPERIOR
↑ 3	747 FLIGHT SIMULATOR DOCTOR SOFT	↑ 8	SPACE SHUTTLE MICRODEAL
↓ 4	THE HOBBIT MELBOURNE HOUSE	↑ 9	SNOOKER VISIONS
↑ 5	APOCALYPSE RED SHIFT	↑ 10	FELIX IN THE FACTORY PROGRAM POWER

### TWIN KINGDOM VALLEY

Life in Watersmeet is hard for a greedy, adventure seeking bounty hunter – not only do you have to contend with the elements, but with the fury of a host of weird and wonderful monsters.

Watersmeet is the location for the action in *Twin Kingdom Valley*, a new adventure game from Bug-Byte. As a more or less direct assault on *The Hobbit*, TKV has full screen graphics for locations – 175 of them – and the ability to talk to some of the characters who live in Watersmeet. Although not quite in *The Hobbit*'s class, it is a worthy contender.

There's no real story behind the game, but there is supposed to be two kings in the valley, each of whom hates the other. Most of the area is taken up by various rivers and lakes, the largest of which is said, through local gossip given at the start of the game, to have magical powers along with the secret of life nearby. 'All' the player has to do is stay alive as long as possible whilst trying to collect pieces of treasure, each of which can be stashed in 'The Sword Inn' – Watersmeet's local.

With a good vocabulary, interesting graphics and plenty of variety, *Twin Kingdom Valley* is a welcome arrival on the adventure scene, and should give hours of entertainment to adventure-minded Beeb owners, a 'jewel-in-crown' of BBC adventure software, well worth looking at.

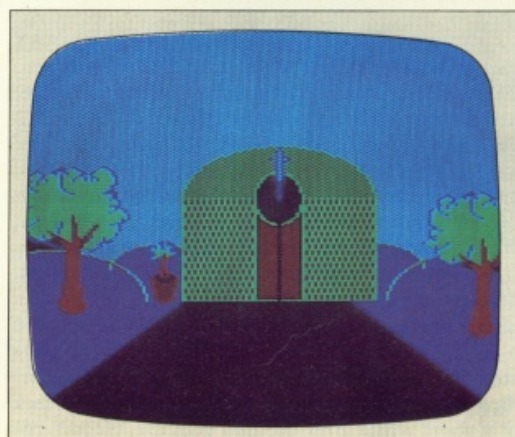
### CHUCKIE EGG

*Chuckie Egg* (from A&F Software) is yet another variation on the 'ladders-and-baddies' theme. You play the farmer, who must race up and down the various ladders and elevators collecting eggs, whilst avoiding a host of mad chickens. What there is in the way of documentation also gives a warning concerning a crazy duck, caged in the top left hand side of the screen; in all the times we played *Chuckie Egg*, the cage remained closed and the webbed footed fiend safely locked up – more of a dead duck than a crazy one.

Although *Chuckie Egg* is second in our BBC list of best-sellers, it is certainly not one of the best games for the Beeb and it's slow speed (we managed to get through three levels first time) will limit its appeal to new arcade games players. To the hardened games player *Chuckie Egg* will prove no more than a slow '*Space Panic*/*Donkey Kong*' clone. Not much of a challenge.



Left: rural settings from Bug Byte's *Twin Kingdom Valley*.



### 747 FLIGHT SIMULATOR

747, from Doctor Soft, is a flight simulator for those who would like to fly, but get vertigo standing on tip-toe. The screen display shows a control panel of the 747 and view through the cockpit window. As the pilot, it is your job to land the plane safely and softly, so none of the passengers spill their in-flight food.

Like so many flight simulators, 747 is complex, using many of the BBC's keys, and quite dull. It is also sadly under-documented. However, if flight simulators are your thing (there aren't many others for the BBC), Doctor Soft's offering is probably worth looking up.

By Steve Applebaum, staff writer.

*Twin Kingdom Valley* (priced £9.50) from: **Bug Byte**, Tel: (051) 709 7071. *Chuckie Egg* (priced £7.90) from: **A&F Software**, Tel: (0706) 341 111. *747 Flight Simulator* (priced £8.95) from: **Doctor Soft**, Tel: (0903) 206076.



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DRAGON 32

↑ 1

**DRAGRUNNER**  
CABLESOFT

↑ 2

**HUNGRY HORACE**  
PSION/MELBOURNE

↶ 3

**RING OF DARKNESS**  
WINTERSOFT

↶ 4

**CUTHBERT IN THE JUNGLE**  
MICRODEAL

↓ 5

**SPACE SHUTTLE**  
MICRODEAL

↓ 6

**CAVE FIGHTER**  
CABLESOFT

↓ 7

**MOON HOPPER**  
DRAGON DATA

↓ 8

**TRANSYLVANIAN TOWER**  
SHEPHERD

↑ 9

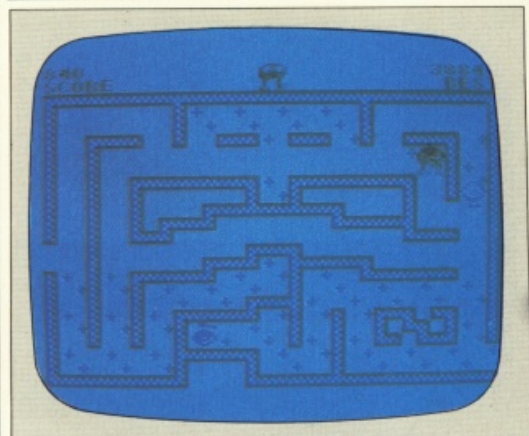
**SKRAMBLE**  
MICRODEAL

↑ 10

**FROGGER**  
MICRODEAL

**FAST MOVERS:**  
*Pinball* (Microdeal);  
*Shuttle Zap* (Dragon  
Data); *Space Fighter*  
(Microdeal).

Far right: from 'Frogger'-  
spawned *Dragrunner*, by  
Cable Software; right:  
frantic gobbling from  
Melbourne House's  
*Hungry Horace*.



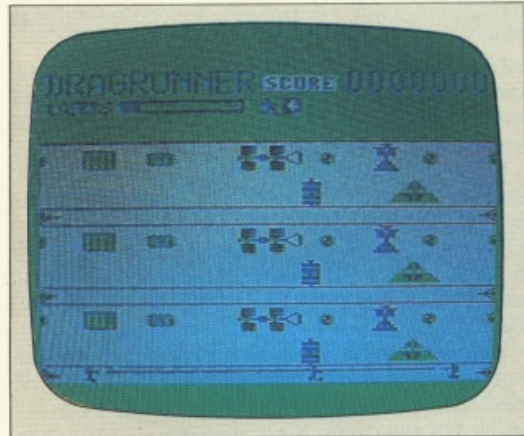
### HUNGRY HORACE

*Hungry Horace* (from Melbourne House) is a 'Pac Man' game-a-like: close enough to be recognisable, but different enough to be legal. You control Horace as he runs round a park that has a variety of areas (any one being on the screen at one time), chomping flowers and being chased by guards *en route*. Horace is a large head (or bottom!) on legs, while the guards are heads in official looking hats.

As well as gaining points for chomping flowers, Horace gains extra points for eating any of the guards lunches that they accidentally drop from time to time. Even more bonus points can be accumulated by activating the alarm bell, and then trampling all over any guards in range; guards go berserk for a short while after the ball goes off. Horace responds fairly instantly to the cursor keys, but some of the park areas are a little uninspired, and become tedious after playing a few times.

### PINBALL

*Pinball* (from Microdeal) has three levels of skill—which is really the only variable feature in the game. Other than that, you simply mindlessly bash the '7' key to flip a square ball round an uncomplicated pinball machine simulation. The key activates both the spring and the flippers. The ball moves rather unrealistically up the spring-shaft, but then makes a reasonable impersonation of the real thing while bouncing around inside the simulation (though it's nothing in comparison with the excellent *Pinball Construction Set* on the Apple). More pin-balls than anything else—thumbs down.



### DRAGRUNNER

*Dragrunner* (from Cable software), number 1 in our 'Hit List' charts, is a 'Frogger'—type game, except Sidney has to be guided through a radio-active factory. It is just as well you're told in the manual what the place is, because the obstacles are hardly recognisable. Sidney can only be controlled by a joystick, which is a pity as we think it is much more friendly to offer both keyboard and joystick options. The movement of the radioactive conveyor belts is rather jerky; nevertheless, the game is good fun, and a fairly well-deserved winner.

### RING OF DARKNESS

*The Ring of Darkness* (by Wintersoft) transports the player into a strange land of monsters, mystics and magic. As far as adventures go, playing *Ring* can be frustrating to the point of giving up very early on.

The game begins with the player having to guide a 'z' around a map. Small black squares representing different locations are dotted around the screen. Getting to the different places is not easy, as evil rangers and bandits have to be constantly fended off. Attacks are frequent, and generally last until either opponent has been weakened to the point of death; boredom soon sets in. Another major hassle is having to rewind and reload the tape after leaving several of the locations—but as most of them are the same, there seems little point visiting more than one.

Compared to such as *Black Crystal* (for the Spectrum) *Ring of Darkness* is positively pedestrian.

By Dr Peter Turcan, technical editor.

*Hungry Horace* (priced  
£5.95) from:  
**Melbourne House,**  
Tel: (01) 940 6064.  
*Pinball* (priced £8) from:  
**Microdeal,**  
Tel: (0726) 67676.  
*Dragrunner* (priced  
£8.75) and *Ring of  
Darkness* (priced £9.95)  
from:  
**Wintersoft,**  
Tel: (01) 367 5720.



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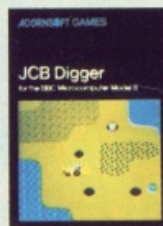


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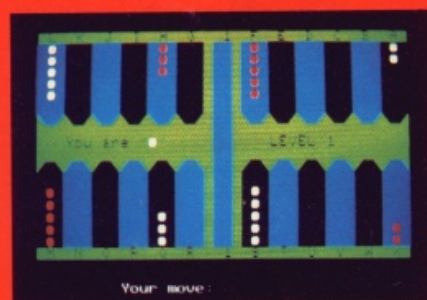


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How long can you survive in the multi-storey building filled with alien bugs. This machine-code programme accurately simulates the arcade game where you climb ladders and dig holes to catch the aliens then fill them in again once they are caught. The red ones must fall through one floor, the green ones, two floors and white ones, three floors. Red aliens who have time to dig themselves out get rather cross and become green. PANIC!! Joy stick or keyboard control.



**NIGHTMARE PARK — £6.95**

If you have never played this type of game before, you're in for a treat. As you make your way along the intricate pathways to the exit, you are constantly given tasks to perform or games to play. Each of these must be successfully completed before you are allowed to continue. It takes a lot of doing. You must remain quick and alert at all times. A little luck is handy. Amazing graphics and sounds!!!



**XANAGRAMS — £9.95**

Not only a terrific spelling test but also a great game. You are asked to guess up to five words, represented by blocks on the screen in a crossword format. All the letters that you need are shown on the right of the screen in alphabetical order and the computer will give you the first letter if you ask it nicely. Suits almost any age with 3 skill levels and from 1 to 5 words to be guessed. Really habit-forming!!!



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A high-speed machine-code version of the popular arcade game where the massed space invaders must be cleared from the skies. After a few seconds they will begin to swoop and dive at you, showering you with scatter bombs as they go. The game becomes progressively more demanding as you kill more and more of the marauding aliens. Very entertaining — hours of fun!!! Joy stick or keyboard control.



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YOURS — SNAKER — STARTREK — CHANNEL TUNNEL — CONVI  
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## COMMODORE 64

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↑ 2	HUNCHBACK OCEAN	↑ 7	HORACE AND THE SPIDERS PSION/MELBOURNE
↑ 3	MR WIMPY OCEAN	↓ 8	REVENGE OF MUTANT CAMELS LLAMASOFT
↑ 4	HORACE GOES SKIING PSION/MELBOURNE	↑ 9	KICK OFF! BUBBLEBUS
↑ 5	HOBBIT MELBOURNE	↑ 10	INTERNATIONAL FOOTBALL COMMODORE

## HUNCHBACK

Already a popular Spectrum game, Ocean's *Hunchback* has made a fairly successful transition to the Commodore 64. The object is to guide quirky Quasimodo through his 15-screen quest to rescue Princess Esmarelda from the prisonous castle, jumping ramparts fraught with fireballs and arrows, swinging the fiery pit, and vaulting spear-thrusting guards, to get to his incarcerated beloved.

Although this Commodore version lacks some of the smoothness of scrolling of its Spectrum counterpart, it's still good fun – apart from the fact that initial obstacles, such as catching the rope to cross the pit, are very tricky, so you can end up repeatedly tackling the early stages of the game.

## CHINESE JUGGLER

*Chinese Juggler* (another from Ocean) is a game where you pit your skills against the vagaries of micro-induced gravity. You have to shuffle an oriental plate player round a pretty precenium stage in an effort to get eight plates spinning simultaneously on rods before the first one slows and falls off; manage to do this in the allotted time, and you start again – but with less spin and less time.

The graphics are well designed to give some impression of dimension and stagery, and the spinning plates are quite effective. You can even do a bit of on the spot tossing – although if you throw the crockery too high it does have a tendency to disappear into orbit. All this to a jaunty little tune, which goes on, and on, and on. . . *Chinese Juggler* provides fair fun in its limited format, and can be played with either keyboard or joystick.

## MR WIMPY

Fast food meets software in Ocean's *Mr Wimpy*, and proves to be a fairly compatible marriage. Manoeuvre the Beefeateresque Mr Wimpy as he endeavours to make hamburgers, first assembling the ingredients (hassled by Moving Manholes and Waldo the Burger Thief), then moving onto the kitchen to cook them, avoiding the Kitchen Rebels. If you get trapped by the rebels you can pepper them according to your score, determined by gathering bonus gems, coffee or ice-cream.

The only interesting feature we found about *Mr Wimpy* was the way in which the quality of the game is in apt relation to the hamburgers that inspired it – limp and unappetising.

## MANIC MINER

Another ex-Spectrum success, *Manic Miner* (from Software Projects) is now available for the Commodore 64. The game really offers nothing very exciting in the way of challenge: you have to take prospector Willy through several chambers (screens) of subterranean adventures, as he encounters the remains of an earlier civilisation's mine workings. The object of each screen is to clamber round the obstacles gathering keys and avoiding various hazards as Manic Mining Robots, Poisonous Pansies, Slime and the like; once you've collected all the keys you can move on to the next chamber. Scenarios include Oil Refinery, Uranium Workings, Endonian Forest, and Skylab Landing Bay(!), and so on – all permutations of two or three basic formats.

We found *Manic Miner* rather annoying, principally because if you get 'caught' having gathered all the keys, you're straight back to square one, and have to go through the whole rigmarole again – which gets very tedious after the first two dozen goes.

However, as the originator of the 'cavern'-type game it's fairly good. A notable feature is Spectrum-like loading lines – a blessed reassurance, as Commodore games usually leave the screen blank, which can mean ten minutes wasted pumping in a crash.

## SCUBA DIVE

Can't afford that snorkelling holiday in the Seychelles this year? Then why not stay at home with your Commodore 64 and splash a few games of *Scuba Dive* (from Durell Software). The aim of the game is to guide the frenetic frogman down through fast-flowing shoals of submarine nasties, in order to reach the sea bed (fall prey and you sink stricken to the bottom where your corpse is dragged away by a scavenging octopus). Once there you can collect pearls then either return to the yacht and amass points, or chance the deep sea caves – fraught with perilous molluscs and poison coral – to find the treasure chest, which bumps your score up and replenishes your air supply for more oceanic jinks.

So if you fancy yourself as the Cousteau of the Commodore, good varied visual activity (a notable clawing lobster) goes to make *Scuba Dive* a worthwhile frolic.

By Jim Hayes, sub-editor.

## FAST MOVERS:

*Hungry Horace* (Psion/Melbourne);  
*Forbidden Forest* (Cosmi);  
*Blogger* (Alligata);  
*Super Pipeline* (Taskset);  
*Scuba Dive* (Martech/Durell).

*Hunchback* (priced £6.90), *Chinese Juggler* (priced £6.90), and *Mr Wimpy* (priced £5.90) from:

**Ocean Software**,  
Ralli Building,  
Stanley Street,  
Manchester M3 5FD.  
Tel: (061) 832 9143.  
*Manic Miner* (priced £7.95) available from:  
**Pilot Software**,  
Rathbone Place,  
London W1.  
*Scuba Dive* (priced £6.95), from:  
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## WIZARD & PRINCESS

*The Wizard & the Princess* for the Vic 20 (from Melbourne House) was not impressive, probably because it has been written to run on an unexpanded machine. It is an adventure using graphics rather than text; a nice idea but the result is pin men.

There are five chapters (or tasks) which make up the whole adventure. If you finish (or abandon) one chapter you then wait for the next one to load. We failed to understand the first chapter, or escape from the labyrinth in the third. By contrast, killing the troll and dragon seemed amazingly easy. Rather a disappointment.

## JETPAC

*Jetpac* (from Ultimate Play The Game), is yet another 'blast-the-aliens' game for the 8K Vic 20, and a good example of the genre at that. For a start, *Jetpac* is fast flowing and initially difficult, which means you won't be fed up within 20 minutes. The idea is to get your spaceman to build up the three stages of a rocket ship, fuel it up, then take off in search of booty in other galaxies. The alien blobs change shape and colour as you change galaxies; however, the spaceman's trajectory when flying appears realistic. No major bugs, and good fun.

## SNOOKER

Visions' *Snooker* is the same game that everyone seems to enjoy watching on TV. A reasonable conversion for the 3K Vic 20, the game seems to be let down by the graphics (presumably a colour TV is essential). Even on our colour set, the different balls were hard to distinguish, and often changed colours while moving. We found a combination of using the joystick plus keyboard helped the game.

By Tony Dennis, deputy editor.

## PROGRAMMING

## GAMES

# TOP TEN

### VIC 20

<p>↑ 1 JET PAC ULTIMATE</p> <p>↑ 2 SNOOKER VISIONS</p> <p>↑ 3 WIZARD AND PRINCESS MELBOURNE HOUSE</p> <p>↓ 4 ARCADIA IMAGINE</p> <p>↑ 5 CRAZY KONG INTERCEPTOR</p>	<p>↓ 6 LAZERZONE LLAMASOFT</p> <p>↑ 7 FROGGER INTERCEPTOR</p> <p>↑ 8 GRIDRUNNER LLAMASOFT</p> <p>↑ 9 COMPUTER WAR THORN/EMI</p> <p>↑ 10 ABDUCTOR LLAMASOFT</p>
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*Jetpack* (priced £5.50) available from:

**Ashby Computer and Graphics,**  
The Green, Ashby de la Zouch,  
Leicestershire LE6 5JU.

*Snooker* (priced £8.95), available from:

**Visions,**  
1 Felgate Mews, Studland Street,  
London W6 9JT.

*The Wizard and the Princess* (priced £5.95)  
available from:

**Melbourne House,**  
131 Trafalgar Road, Greenwich,  
London SE10 9TU.

### FAST MOVERS:

**Metagalactic Llamas**  
(Llamasoft); **Cosmonaut**  
(Melbourne House);  
**Paratrooper** (Rabbit); **Mini**  
**Kong** (Anilog); **Space**  
**Warm** (Software-Projects).

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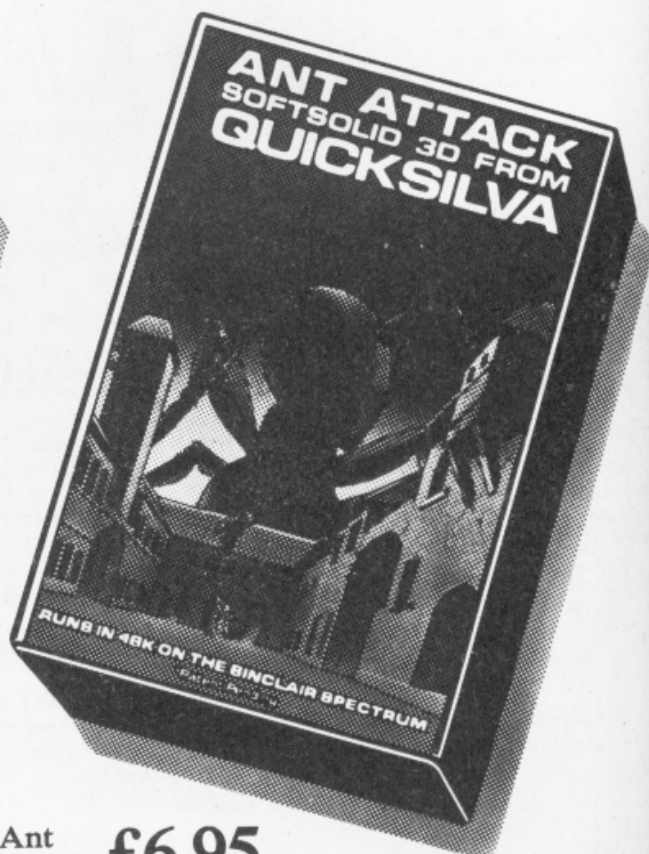


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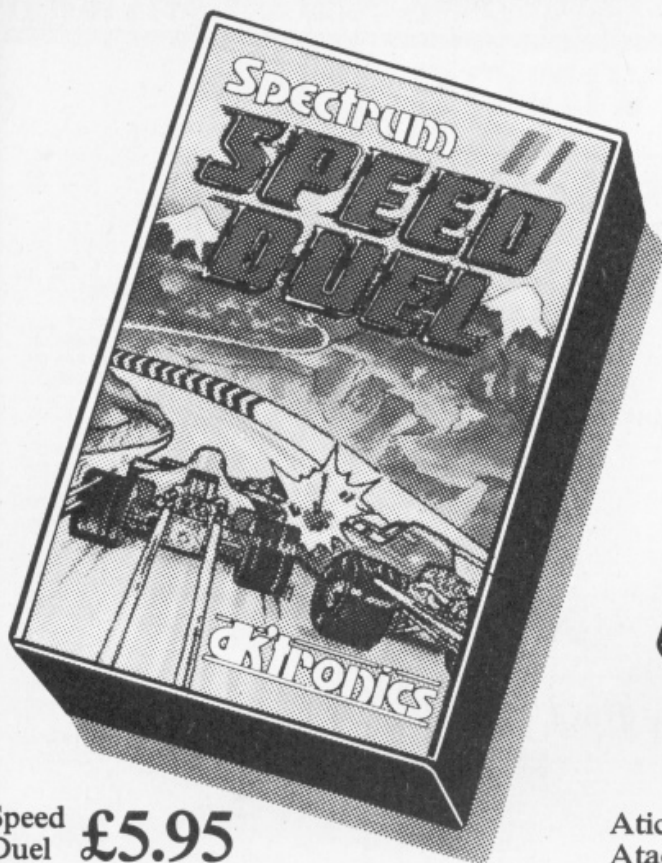


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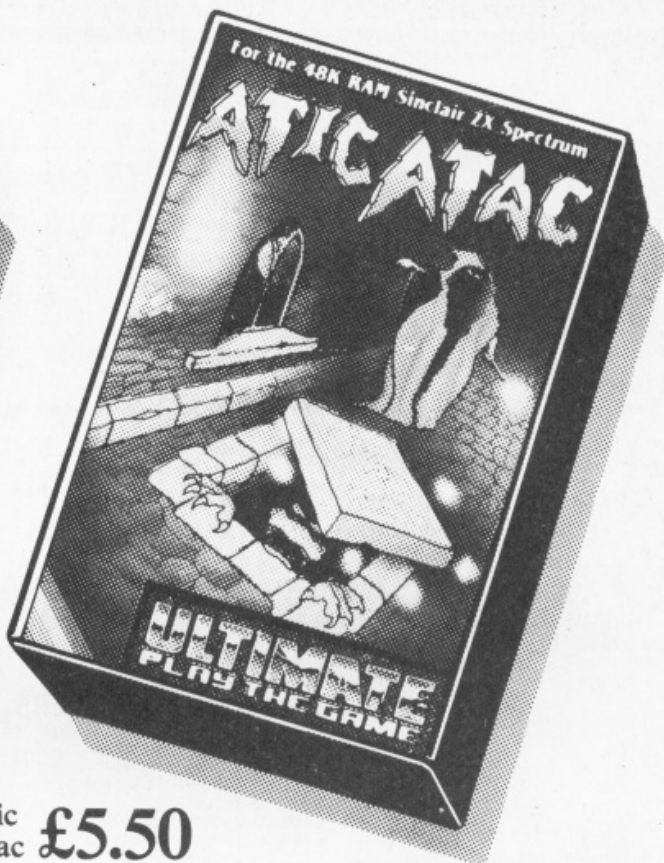


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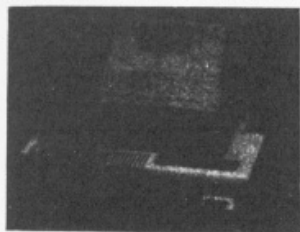


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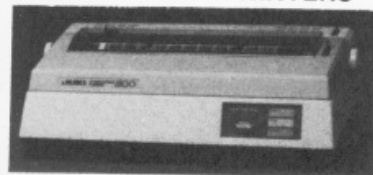
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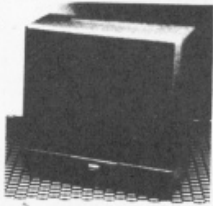
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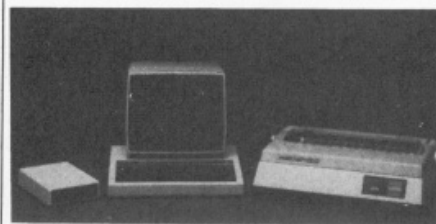
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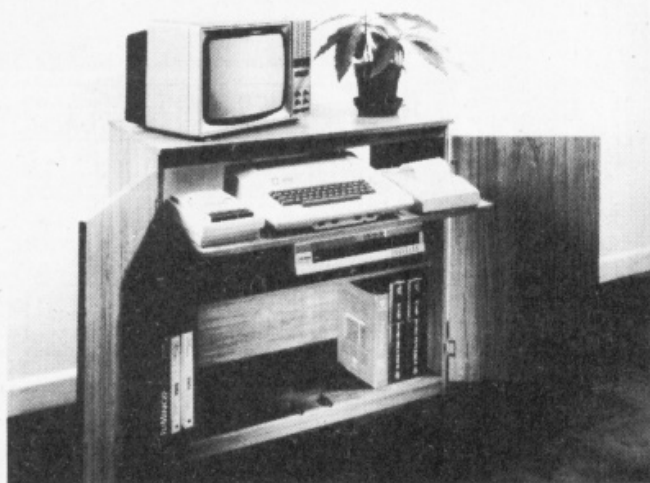
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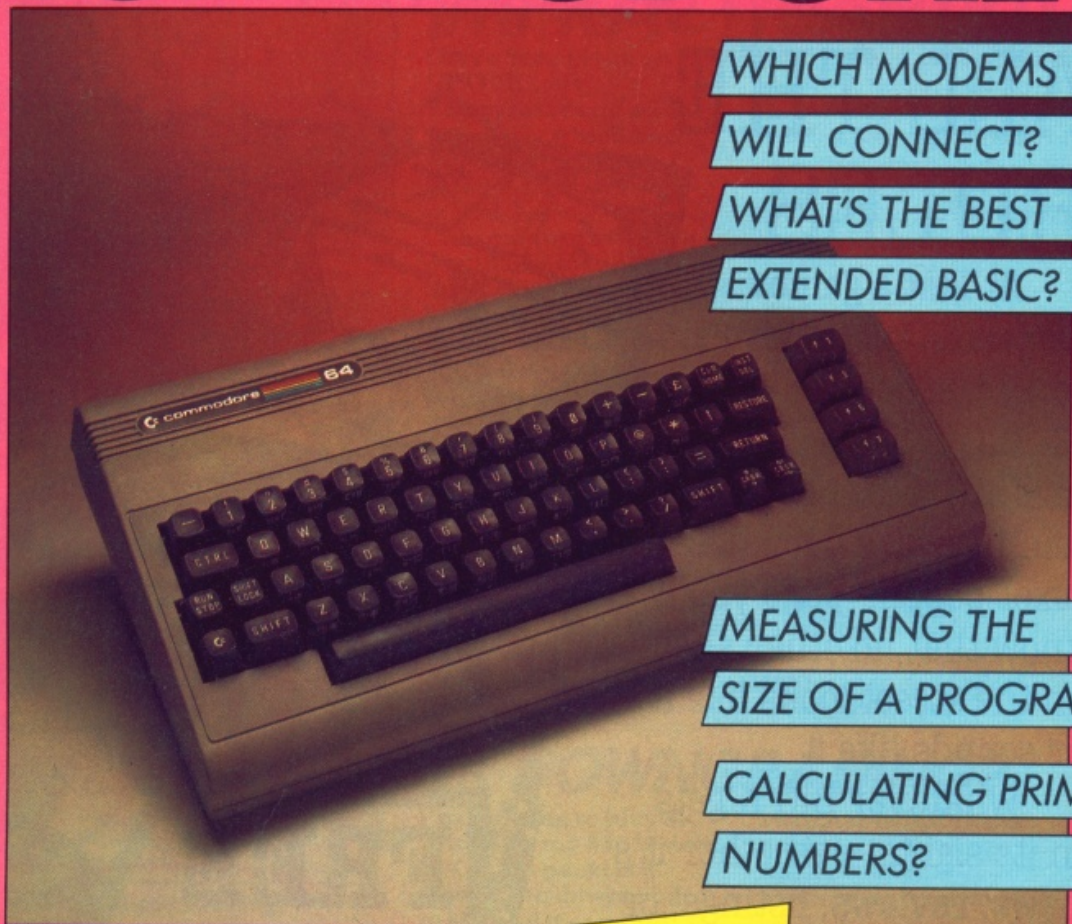
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Falklands victor General Sir Jeremy Moore reviews the latest war games. 1984 giant test — 3 forthcoming British versus 3 American micros. Adventure X — a superb adventure game for you to type into your Spectrum. Amazing games for Dragon, BBC, Vic 20, Spectrum, Atari. Spectrum graphics special — how to program great graphics into your micro.

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The Z80 Video Pac (left) enables Commodore 64 owners to run CP/M software; available from Impex (tel: (01) 900 0999).

## TELEPRINTER IMPRACTICABLE

**I have been given an ex-GPO 7E 250V**

**Teleprinter and serial interface, which had worked previously, I believe, from a Z80 micro. I own a Commodore 64 which I would like to use with this Teleprinter: do you know of any software which would do it? Can you tell me the cost of Commodore 64 Z80, so that I can use this cartridge to utilise with serial interface and software?**

*EJ Clark, Bromley.*

We think it unlikely that anybody would have produced commercial software to drive a teleprinter, because the potential market would be so small. The Z80 cartridge for the Commodore 64 is still unavail-

able (however, Impex produces a 280 Video pac - see above). In any event, it would not represent a cost effective solution to your problem, because the Z80 cartridge will be marketed with CP/M (which is the main reason for its existence), so you would be paying not only for the hardware, but also for the operating system.

The total cost would be close to that of the cheapest of the currently available dot matrix printers, any of which would run around ten times faster, occupy less than a quarter of the space, have many more facilities, and you wouldn't need ear protectors every time you used it.

So we're afraid that anything you do which involves an expenditure of more than a few pounds will exceed the value of the teleprinter.

## MODEM MANIA

**Which modems can be used with Commodore 64 to get into Micronet 800? How do you join? What software is required? Is it available on cartridge? Will the unit have to be machine dependent? What will a complete package cost? Will I be able to access CABB using my Micronet 800 modem? Are there any Commodore-approved units?**

*DWM Hughes, Gwynedd.*

At present, Prism has not released a package to allow access to Micronet for the 64. However, Tandata has the TM100 plus software which will allow access to Prestel databases, including Micronet. The software should be

available on cassette, disk or ROM from Tandata.

Commodore itself has plans to launch its own modem plus cartridge-based software for around the £100 mark, but we can't say for certain that it will have Prestel frequencies.

Armed with the Tandata modem you can access Prestel for £5 per quarter or both Prestel and Micronet for £13 per quarter. We don't know if Tandata's software will be compatible with CABB (*Computer Answers Bulletin Board*), but armed with the correct software you could use the TM100 to access our board.

**Tandata Marketing,**

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## 8K DOWNGRADING?

**I'm wanting to play 8K games on my Vic 20 with 16K RAM pack; is it possible to downgrade to 8K, and if so could you give me the necessary program (or should I buy a**

**switchable 16K RAM pack)?**

*Kenneth Woolard, Edinburgh.*

There is no need to downgrade your Vic, as programs written for an 8K machine will work equally successfully with 16K expansion.

## ANY ROM COMMS?

**I have a Vic 20: can you tell me if there is a ROM chip to be used in conjunction with a modem, so communication is possible between a uc and other computers and could you suggest a suitable modem?**

*C Dichinsou, Hull.*

We know of no ROM chip with communications software for the Vic 20 as yet. Commodore UK is only planning one for the 64 for the moment. See page 146 of the March issue of *Computer Answers* for a range of suitable modems. You will need an RS232 interface from either Oxford Computer Systems or Minor Miracles companies.

## MEMORY CHECKING

**Is there a quick and easy way to ascertain the size of a program in memory in Kbytes? Also, what is the storage capacity of one side of a C10, C12 and C15 cassette?**

*F G S Starr, Bristol.*

There are a number of system variables whose contents can be PEEKed to give you almost any information you could want about the size of your program and its data.

First there is a variable called TXTTAB at locations 43 and 44, which points to the start of the Basic program. So  $\text{PRINT PEEK}(43) + 256 * \text{PEEK}(44)$  will give you this memory location in decimal. Usually, this gives 2049, which is one byte further on from where the

manual says the program area starts, because 2048 always appears to contain a null byte. A second variable called VARTAB, pointing to the start of your variable area, appears in the next two locations (45 and 46). So you can write  $\text{PRINT PEEK}(45) + 256 * \text{PEEK}(46)$  to determine this value.

The result is one byte after the end of the program itself, so just subtracting the two numbers printed out gives the length of the program text. ARYTAB (47 and 48) tells you where any arrays used begin, so subtracting VARTAB from ARYTAB in the same way gives the space occupied by simple variables. STREND (49-50) gives the end of the arrays (+1), and FRETOP (51-52) identifies the end of string storage.

If you need to know how much memory is left, MEMSIZ (55-56) tells you the highest address used by Basic.

As far as tape storage capacities are concerned, it's difficult to give hard and fast figures, because a lot depends on how many programs or files you are saving on a tape. Each file will have a header and trailer label which occupies quite a lot of space, not to mention the physical gaps between files. As a rough rule of thumb, reckon that you are saving about 100 bytes/sec, so that five minutes of tape will save  $5 \times 60 \times 100 = 30\text{K Bytes}$ .

This means that one side of a C10 cassette will hold about 60K, a C12 cassette about 72K, and a C15 cassette about 90K.



# PRINTER POSSIBLES?

**I am an Open University student and intend using my Commodore 64 with Easyscript for writing assignments. Can you advise me on a suitable A4-capable printer for this purpose?**

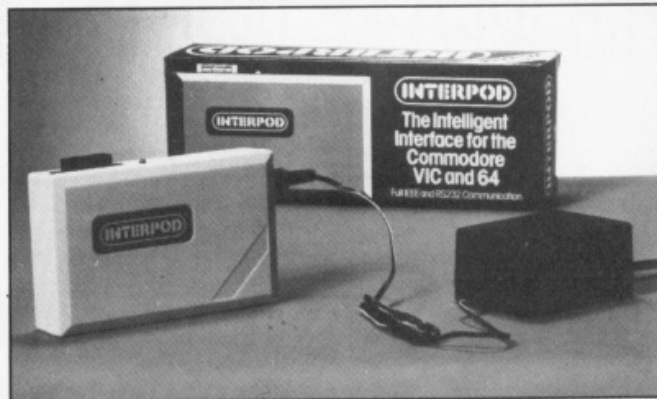
*James Redford, Bradford.*

Most of the current generation of dot-matrix printers such as the Shinwa CP80, the Star Gemini 10 and Delta 10 models, and the Epson FX80 will produce acceptable quality output in a number of modes; for example, double strike, emphasised and italic scripts are now common, and the printers require only an appropriate sequence of control characters to be sent to them to initiate (or cancel) these modes. All of them will handle 9 inch wide (A4) continuous stationery.

You don't say how much you are prepared to pay, or how important print speed is to you, and this is the primary area for a trade-off. The cheaper printers (such as the CP80) print at about 80 characters per second, while

the more expensive (FX80 and Delta 10) operate at twice this speed; however, this doesn't necessarily mean that a given document will take twice as long to print on a CP80 as on an FX80, since the quoted print speeds do not include the time taken for line feeds or print head movement over white space. These differ with the printer design.

Another factor you will have to consider is the interfacing of your Commodore 64 to the printer. Most printers have only a Centronics interface as standard with an RS232 as an option (an exception to this rule is the Star Delta 10, which has both on board, together with a generous 8K byte buffer). Unfortunately, Centronics interfaces for the Commodore 64 are a little thin on the ground at the moment. There is one available from Microware in the US, and there is a universal interface system called Interpod available from Oxford Computer Systems. The alternative is to go for an RS232 option on the printer, which will probably cost £50-£80 more. In this



*The universal interface system Interpod (right) enables your Commodore machine to function with a variety of peripherals.*

case you still need an RS232 adaptor from Commodore, because, although there is an RS232 interface built into the 64, it is not conventional and uses different voltages from the normal standard.

Unless you are familiar with the electronics of interfaces, it is a good idea to buy the whole assembly from a dealer and

insist that he demonstrates it working with a Commodore 64 before you part with your money. Otherwise, there are a great many variables which in accordance with Murphy's law, will go wrong.

**Oxford Computer Systems,**  
Hensington Road,  
Woodstock, Oxford.

## PRIME EVALUATE

**I have a Commodore 64, and would like to write a program to deduct the prime numbers from 1 to 1,000. I've almost worked out a way, but wanted to know if there was a special command for it in Basic, something like ATN? If not, are there any short routines I could use, as the one I'm using at the moment is rather long and cumbersome.**

*HJ Fleming, Northampton.*

There is no standard Basic function for the evaluation of prime numbers. The obvious technique for evaluating tests of primes is to create an array of them, containing to begin with, only the first (2) and then divide every odd number in the required range (since no even number can be prime) by all the numbers in the array so far. When a number which is not exactly divisible by any of

these values appears, it is a new prime, so add it to the array. Here is the code:

```
10 DIM a(300)
20 a(1)=2:ep=1
30 FOR n=3 TO 1000 STEP 2
40 FOR p=1 TO ep
50 IF n/a(p)=INT(n/a(p)) THEN
GOTO80
60 NEXT p
70 ep=ep+1:a(ep)=n:PRINT n
80 NEXT n
```

This still executes fairly slowly, and there are some reasonably obvious ways to soup it up a little. For example, there's no point in testing a number to see if it is divisible by any number greater than its own square root; so you could replace the inner FOR loop (lines 40-60) with a manual loop which terminates when  $a(p) > \text{SQR}(n)$ ; however, make sure that you evaluate  $\text{SQR}(n)$  outside the loop; if you don't, it saves no time because  $\text{SQR}$  takes so long to execute.

## MORE BASIC COMMANDS

**I recently bought a Commodore 64, and after experimenting with its somewhat limited Basic, am very interested in finding a good extended version. Could you please comment on the merits of various packages: I've been recommended Simon Basic, but at a cost of over £50, what advantages does it have over the cheaper versions? I am also interested in Machine Code - and could you recommend the best assembler/disassembler for under £25?**

*Nicholas Day, West Didsbury.*

You're right - Commodore's ROM Basic interpreter is limited. Simon's Basic gives you an extra 114 commands. The most significant additions are in the areas of graphics (colour and hi-res operators being particularly useful), and programming aids such as RENUMBER and TRACE. There is a somewhat half-hearted attempt to build some procedural structure into Basic, but it is not possible to pass parameters to procedures and this is a serious omission.

Certainly, these extra features are useful, but the

result is not a match for BBC (or even Spectrum) Basic. Other Commodore 64 toolkits are available from Kuma and Stack.

As far as assemblers are concerned, there is an element of personal preference about the display format, editing procedures and so on, which makes recommendation difficult. It helps if you can tinker with one before you buy. Sunshine market the *Master Code Assembler* (limited but cheap) on cassette at £14.95, and this is retailed through Boots and WH Smith, so you should have a chance to see it working. Most assemblers are available only on disk, but Audio-genic produces a cartridge monitor at £29.95. It includes a limited Basic toolkit, and so could satisfy both your needs relatively cheaply. Again, you should be able to get it through Boots. A full article on editor/assemblers appeared in our January issue, which we recommend you look at.

**Kuma Computers Ltd,**  
11 York Road,  
Maidenhead.  
**Stack Computer Services,**  
290-298 Derby Road,  
Bootle,  
Liverpool L20 8LN.



## TV OK FOR INDIAN TAKEAWAY

A friend of mine from India would like to buy a Commodore 64, but the Indian TV is Pal B and the sound is a different frequency – will the 64 work with Pal B? If not, is there any other home computer suitable for use in India?

*Dr V T Thomas, London.*

We think it is unlikely that a British standard Commodore 64 will run properly on PAL B, and the same will go for any other micro with UHF modulated output. There are two solutions: first, replace the modulator with a local one (this will, however, invalidate the guarantee); second, use the composite video output to a monitor rather than a television.

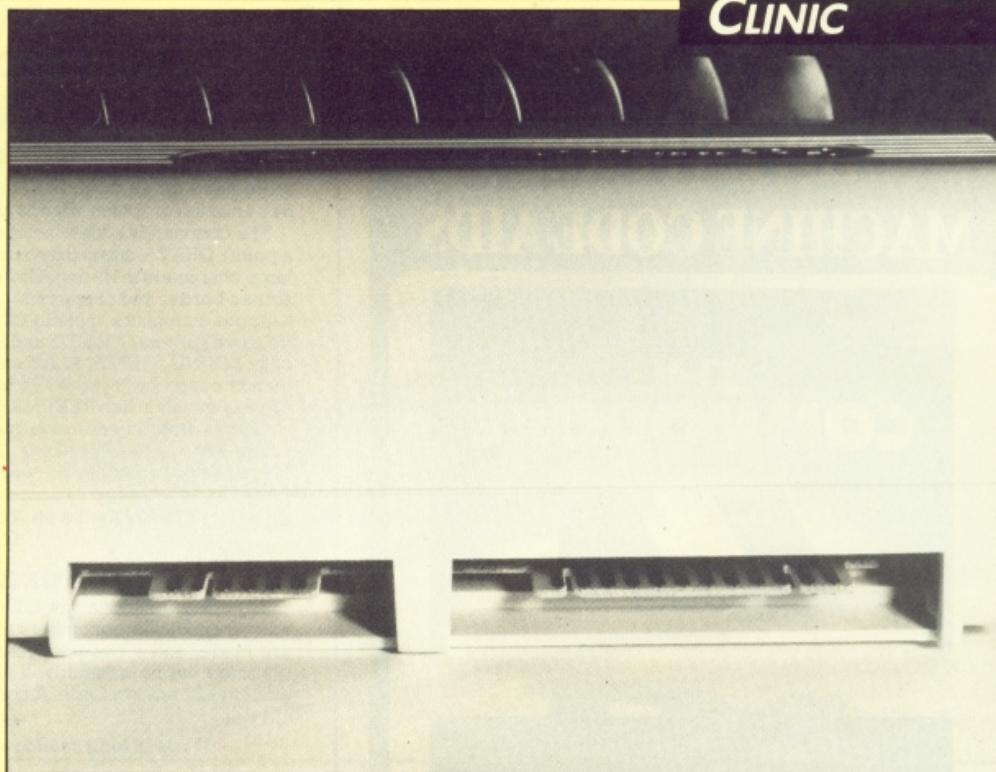
Since several colour monitors are now available at a similar price to a portable colour television, this is not an expensive solution, and the picture will, of course, be higher quality.

## CAN I SAVE MY CODING!

I often see programs using machine code routines with Basic loaders. I would like to be able to save the actual machine code to tape or disk for future use, rather than always have to use the Basic loader program – can this be achieved?

*R J Miller, Liverpool.*

Any program must be loaded by some other program (unless of course, it is held in ROM), so whatever technique you choose entails the use of a loader of some sort. The reason most authors choose a Basic loader is because everybody has Basic, and it's easy to do. An assembler will include machine code save and load routines, and, if you propose to do much work at machine level, will be an invaluable aid to writing code as well.



Backside view of a Vic 20 — the serial interface orifice is the one on the left.

## ▲ MAKING MODEM CONNECTIONS

I am thinking of buying a Vic 20. I want to use it to store information such as names and addresses, titles of books, author and publishers – possible on this machine?

Also, is there a modem suitable for the Vic, and do I need to buy an RS232 interface?

*Alistair Langston, Somerset.*

To answer your second question first, you will need an RS232 interface in order to use the Vic 20 with a modem. Minor Miracles is planning to release an RS232 for the Vic

priced just over £20, enabling it to use their own (unapproved) modem. Otherwise you could use the Interpod from Oxford Computer Systems (priced £99.95), or build your own interface for around £30 using the articles we printed in the November '83 and January '84 issues of *Computer Answers*. Commodore UK has no plans for a Vic 20 RS232 interface just yet.

BT-approved modems, like DaCom's Buzzbox, cost from £80 upwards.

For an interesting selection of software applications, memory expansion and other

add-ons, contact Stack Computers, who have a large range of extras.

**Oxford Computer Systems,**  
Hensington Road,  
Woodstock, Oxford.  
Tel: (0993) 812700.

**Minor Miracles,**  
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Ipswich IP4 2AB.  
Tel: (0473) 50304.

**Stack,**  
292-298 Derby Road,  
Bootle,  
Liverpool L20 8LN.  
Tel: (051) 933 5511.

## 'MOON BUGGY' SPLASH

I have made many attempts at loading Anirog's *Moon Buggy* on my Commodore 64. I have tried switching off sprites and using different methods of loading, but all to no avail. I would be grateful if you could suggest other methods of loading.

*James P Hill, Northampton.*

Assuming that your Commodore 64 loads other programs

happily, there can be no fault with the cassette system, so it can only be that there is some fault with the tape itself.

Whatever name you use when loading, the computer should still indicate that it has found a program, and display the actual name on the screen. In fact, the safest thing to do is type LOAD "" if you are unsure of a program name, because the Commodore 64 will then load the next program on the tape whatever its name.

We did consider the possibility that you had been sold a version of *Moon Buggy* for some other machine in error, but as far as we can tell. Anirog has so far only issued it for the Commodore 64. We suggest you request a replacement tape from your dealer, or contact Anirog itself.

**Anirog Software,**  
Co-op,  
Crawley,  
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# IS THE 64 A GOOD BEGINNERS CHOICE? ▼

CLINIC

The Commodore 64's specs compares favourably to the BBC - well worth considering as a first time buy.

Originally I was going to get a BBC B, but later I thought the Commodore 64 a better buy for the average user. Could you give me your thoughts on this?

Could you also tell me if a Commodore 64 starters kit will come out in the near future?

Christopher Gill, Clwyd.

Broadly, the BBC Model B and the Commodore 64 have pretty similar features, and on the face of it, that makes the 64 a good buy on price grounds. You'll pay around half as much again for a Model B as for a 64!

However, there are differences worth pointing out. In particular, BBC Basic is a very pretty and fast implementation. It allows for procedure handling and automatic parameter passing, features which are very unusual; In contrast, the Commodore Basic looks way out of date. It doesn't even have built in features for handling hi-res graphics or its sound chip. Consequently, programs can frequently consist of lists of apparently meaningless POKES. On the other hand, the 64's sound chip is more sophisticated than that on the Beeb. Each channel can be given independent



sound characteristics.

Back on the Beeb's side of the fence, the highest resolution graphics modes are much higher than that of the 64, and, in the same general area, the resolution modes are more flexible.

In the end, it all depends on what the 'average user' wants to do with his machine. If, for instance, good sound is more important than very hi-res graphics, then the 64 has the edge. You should start by making a list of the general areas you're most likely to be

interested in, and match those to the computer you ultimately buy.

One other consideration is software. The best range of software (and the cheapest) is always going to be that available for the most popular

machines because of the potential market. Worldwide, the Beeb is pretty small beer compared to the 64, so that would be another reason for choosing the 64. Lastly, we don't know of any plans for a 64 starter kit.

## LISTENING BANK?

Apart from your own CABB, I would also like to access my bank account out of normal hours (due to the nature of my work) with my Vic 20. I understand that the Bank of Scotland operate such a scheme, due to their lack of high street branches. Could you tell me what modem I would require, bearing in mind a possible and logical upgrade to a 64. Also, are other banks operating or contemplating such operations?

RA Charlesworth, Shepply.

The Bank of Scotland's service is offered in conjunction with the Nottingham

Building Society. It is part of Prestel, called Homelink, and can be accessed with a 1200/75 baud modem. You should be able to obtain a suitable modem and software for the 64 or Vic 20 from Tandata. The modem is the same, TM100, for both machines.

We believe that the Midland Bank is also toying with the idea of offering banking facilities to Prestel users. Homelink should be on Prestel page \*444#.

**Nottingham Building Society,**  
Nottingham House,  
5-13 Upper Parliament Street,  
Nottingham NG1 2BX.

**Tandata Marketing,**  
Albert Road North,  
Malvern, Worcs. WR14 2TL.  
Tel: (06845) 68421.

## ERROR FAULTS

**When I try Unifile II, a problem arises when loading data: I get ERROR message, String too long ERROR in 20180 - can you help?**

R Cousins, Leeds.

We haven't used *Unifile*, and since it's quite a complex piece of software, we'd suggest you write to David Lawrence, author of *The Working Commodore 64*, at Sunshine Books. As the author, he's much the most likely person to put his finger on the problem.

However, you could do a little detective work yourself first. The line on which the error occurs is accepting single

characters in T\$, testing them to see if a carriage return code (CHR\$(13)) has been reached, and if not, adding them to A\$(51). Try putting a STOP in this line and printing A\$(51). Then CONTINUE and reprint it. This way you can see how the string is being built up, and at what stage the error message occurs. You'll probably get some clues as to why the problem is happening, and perhaps, even how to solve it.

**Sunshine Books,**  
Hobhouse Court,  
19 Whitcombe St,  
London WC2 7HF.

## ADDRESS ERRATA

In the *Commodore Clinic* of the February issue of *Computer Answers*, we mentioned an accounts package from the Specific Software company, but printed a wrong address.

Their correct address is given below. Our apologies for any inconvenience this may

have caused them or their customers.

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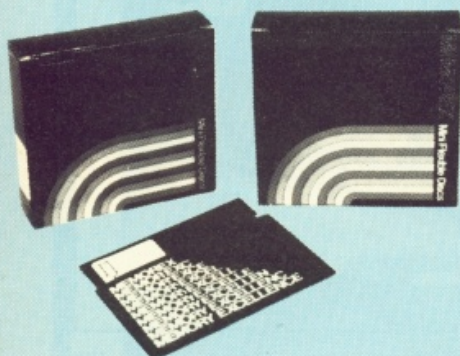


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THE COMMODORE 64 IS A MACHINE WITH GREAT ADD-ON POSSIBILITIES  
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**T**he basic specification of the Commodore 64 offers plenty of 'serious' potential, but not without adding a number of extras which push the price way above the price of the basic machine. However, the end result opens more possibilities than models in higher price range, the advantages being the name of Commodore and the increasing number of independent companies providing attractive add-ons. Here are a few.

Initially the Commodore 64 seems lacking in features which are just taken for granted by users into serious applications. But its shortcomings can be redeemed. When using word-processing and database packages, the speed of loading and finding data really requires a disk drive. With word-processing, the facility for seeing 80 columns on the screen makes things far easier (so that what is seen on screen can be the same as the printed output).

Business users really need the opportunity of using the CP/M operating system with its almost unlimited choice of programs; and for creating charts a simple graphics tablet priced in proportion to the Commodore 64 would be very useful; and add-ons to provide all these facilities are around.

## DISK DRIVES

Floppy disks have the advantage of random access for finding data fast – and the drawback of costing as much as the original Commodore 64. The Commodore 1541 disk drive uses  $5\frac{1}{4}$  inch disks and has a capacity of 170K – not large by today's standards, but larger than the drives supplied as standard for the Apple II. The drive just plugs into the back of the Commodore 64 using the RS 232 socket with a cable supplied. There are drives looking virtually identical with just one difference, the number 1540. They were originally intended for use with the Vic 20, so make sure you get the 1541.

Using just a single disk drive in a serious or business environment makes it more difficult to make copies and back-ups, so a second 1541 drive could be fitted into the system by just fitting a cable from the drive into the back of the first one. This is technically known as 'daisy chaining'. If the capacity of the Commodore 1541 drive just isn't enough, use one of the floppy disk drives designed for other microcomputers in the Commodore range.

Your first step will be to buy an interface, as the standard on the rest of the Commodore drives is the IEEE fitting. Here there is a choice which depends basically on how much you want to spend and the amount of versatility required. By far the most sophisticated (and the most expensive) is the Interpod from Oxford Computer Systems (priced £99). This accessory plugs in to the back of the Commodore 64, and has both RS232 and IEEE ports available. Not only is the Interpod virtually transparent to the user, it also doesn't take any memory from the computer and has its own range of commands.

Another interface is available from Dams with just the IEEE fitting, priced £59.95. Audiogenic

also have their own interface and a software cassette to go with it. Impex have special cables allowing non-Commodore printers to be used with the 64, with the parallel interface using CMOS circuitry, and doesn't need an external power supply. Once an



interface has been selected, the choice of drives is only Commodore. The independent disk drive market doesn't seem to have expanded for Commodore as much as for the Apple and BBC micros, probably as a result of low demand.

Commodore do produce a 4040 disk system, which is a double drive unit with each drive having the same 170K capacity as the 1541 model (make sure here that the system uses the latest version of Commodore's disk operating system). Pricewise it costs around the £300 mark, less than two 1541s, but 50 per cent more than the cost of a Commodore 64 alone. There's a good case here for disk drive prices to drop with the rapid increase in sales to people who can't afford doubling the price of their system by adding a disk drive – and tripling it if they need a twin drive system. If the capacity of the 4040 is still insufficient, then the monster 8050 is available. This will provide around 500K per drive, but the price is going to be in the £800 area, four times the cost of a Commodore 64. This isn't the final type of drive available which could be used with the 64, but above this amount, a different type of system probably makes more sense.

In any case the cost of the interface must be added to the cost, and the combination of 64, interface and drives should be seen to work with a program before purchasing it. Currently the Commodore 1541 disk drive comes complete with a word-processing package *Easyscript* free of charge.

## PRINTERS

Commodore do provide their own range of printers, many priced in proportion to the micros like the Commodore 64. There is a choice really depending on whether the Commodore products meet your budget and technical needs or not – if they don't, then you are back to the interfaces we mentioned to open the door for using brands like Epson, Seikosha, and so on.

The range from Commodore includes the 1525, a dot-matrix printer operating at 30 cps with tractor

*The Impex Data 20 Video Pac (right) is a plug-in cartridge 80-column screen expander and terminal emulator that enables the Commodore 64 to act as a dumb terminal. It's priced £1,250. (Far right:) The Commodore 1541 uses  $5\frac{1}{4}$  inch drives, and has a capacity of 170K.*

*(Far right:) the Commodore 1526 is a dot-matrix printer bi-directional with a speed of 60cps.*



feed mechanism. This model costs £230. Further up the scale there is the 1526, which is twice as fast at 60 cps, and is bi-directional. However, the 1520 printer plotter costs just £169.99, and plots graphs, and histograms in four colours, plus letters and numbers at 14 cps.

If you use another make of printer, an interface will be required. Further examples of interfaces are the Centronics parallel supplied by Stack (priced £18) with cable and cassette for the conversion routine, alternatively Stack can also supply an IEEE and RS 232 interface at £39 and £29 respectively.

Audiogenics' cable costs £19.95 for Centronics, and it needs the companies interface software. RAM Electronics provide a Centronics add-on which includes automatic conversion into readable mnemonics of the 64's control codes. Commodore themselves also produce an RS232C interface at



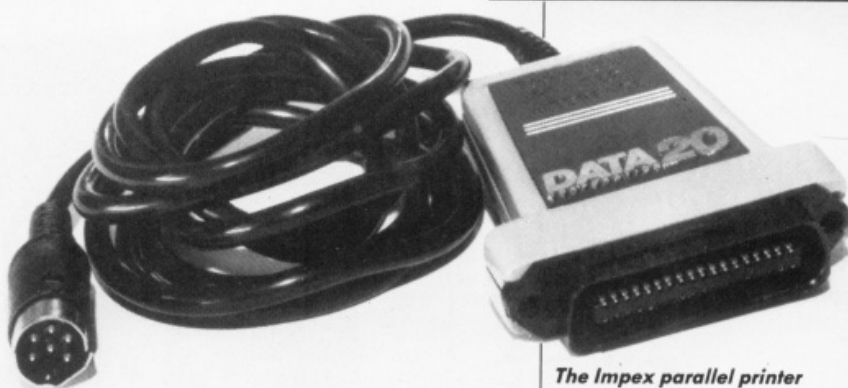
£34.95.

Adding another manufacturer's interface to yet another company's printer has all the possibilities of things going wrong with nobody taking the blame—so make sure you see the combination working before parting with money. More people have problems with interfacing printers to micros than almost any other problem—don't try to cut corners, saving a bit here and a bit there.

SPT supply a Centronics printer program on tape or disk, priced £35 with lead, £10 without.

### MONITORS

The domestic TV set was never really intended for use with a micro, though it does work acceptably,



*The Impex parallel printer interface can translate the character set to ASCII, and pass through graphics characters; priced £69.52*

but if the type of work to be done with the Commodore 64 involves figures, text and a display of 80 columns then you will need a monitor. Using a monitor has the added advantage of freeing the domestic television set for the rest of the family, making you far more popular.

But before you start considering an outlay of around £230 from Commodore (or at least £199 from other supplier) it's best to assess your needs. For example, do you really need colour?—one of the suppliers of 80 column attachments for the Commodore 64 specifies the use of a monochrome monitor. The extra cost will be around £80–£100, plus a new cable which will be under £10.

In the monitor/TV debate, there is a form of compromise when a colour TV set that has direct video input can be used (but not with the 80 column attachment and CPM extras we have mentioned here). This input is used when a film from a video recorder is shown, and can give a better result than a conventional one.

### 80 COLUMN DISPLAY

By adding this facility to the Commodore 64, it can compete with the far more expensive micro systems. The system we examined came from Impex Designs and is called VideoPak 80. Adding this plug-in cartridge replaces the original C64 border, and provides clear characters in either 40 or 80 column mode. There is a tremendous increase in the screen raster rate, which means that this up▶



### SUPPLIERS OF INTERFACES:

**Audiogenics,**  
Box 88,  
Reading, Berks.  
Tel: (0734) 586334.

**Dams Office Equipment,**  
Gores Road, Kirkby,  
Liverpool L33 7UA.  
Tel: (051) 548 7111.

**Impex Designs,**  
Metro House,  
Second Way,  
Wembley HA9 0TY.  
Tel: (01) 900 0999.

**Ram Electronics,**  
106 Fleet Road,  
Fleet, Hants GU13 8PA.  
Tel: (02514) 5858.

**Stack Computer Services,**  
Freepost, Bootle,  
Merseyside L20 0AB.  
Tel: (051) 933 5511.

**Softex Computers,**  
37 Wheaton Road,  
Bournemouth BH7 6LH.  
Tel: (0202) 422028

**Interpod,**  
Oxford Computer Systems,  
Hensington Road,  
Woodstock,  
Oxford OX7 1JR.  
Tel: (0993) 812700.

**SPT Electronics,**  
Tollesbury,  
Essex CM9 8SE.  
Tel: (0621) 868484.

**Impex,**  
Metro House,  
Second Way,  
Wembley,  
Middx HA9 0TY.  
Tel: (01) 900 0999.



The Commodore 14 inch colour monitor (right) costs around £230 (exc. VAT) – but before buying, ask yourself if colour's really necessary.



grade needs a monochrome monitor instead of a domestic TV.

Adding the facility for 80 columns on screen (with 40/80 softswitch) is in itself very useful; however, Video Pak 80 (from Impex) offers far more. Included in the package is the *Word Manager*, a word-processing package with Mailmerge facilities (which costs £39.96 on its own). There is also *Plan Manager*, an easy to use spreadsheet which can have up to 63 rows and 254 columns. The package includes communications software which allows screen dump to printer at the touch of a button to an RS232 type printer. With the Video Pak 80, the use of a disk drive is optional, though it will increase the effective speed of operation. Complete, this package costs £125; If the cost of the software supplied with the system is subtracted, the cost of the bare 80 columns attachment (if available on its own) will be very low. However, it makes sense to have the package all-in-one.

SPT electronics also do an 80 column card, which costs £110, or, with two slots and EPROM, £134.

#### ADDING CP/M

Still the most popular operating system of all, but shortly to be overtaken by PC DOS, CP/M is a planned product (according to the current Commodore 64 price list). No firm price and availability are known as yet; however, there is a form of CP/M available, not from Commodore, but again through Impex Designs.

Called the Z80 VideoPak, this plug-in cartridge attachment has a built-in Z80 microprocessor designed to run any CP/M 2.2 program in 80 columns. As long as the disks have been formatted for use with Commodore disk drives, and according to Impex, programs formatted for the 64 are available through Lifeboat. Almost at the same time as this attachment became available, Microsoft announced that *Multiplan* would be available for the Commodore 64; so this could be the first of many programs available in Commodore disk format.

The Z80 Video Pak also includes a disk-based version of an improved user friendly version of CP/M called SB-80. In fact the SB80 DOS adds a direct printing mode to your choice of printer. Again this upgrade must be used with a monitor not a domestic TV, so must be added to the cost of using CP/M with the Commodore 64. An external power supply is also required, and is included in the price of £225.

Again bearing in mind that this add-on also includes the features of the Video Pak, the *Plan Manager* spreadsheet and *Word Manager* word-processor, the actual net cost of adding CP/M is just £100 – so although this attachment is virtually the same price as a complete Commodore 64 computer, the improvements it brings make it virtually a different system altogether, with just the name the same.

CP/M from Commodore themselves is likely to be available soon, and probably from other sources eventually. One thing that's certain is that there will be no shortage of programs for the Commodore 64 once these attachments become more widely available.

#### GRAPHICS ATTACHMENTS

Although there is a printer plotter available for the Commodore 64 for creating charts, graphical designs and presentations, a graphics tablet is extremely useful. With one of these attachments the user 'draws' using a stylus and the whole system should come complete with software.

One is available (from Audiogenics) for just £89.95, called the Koala Pad (measuring just 8x6x1 inches and weighing just 1lb). The active pad surface is a slightly recessed four inch square with two push buttons located above it. The Koala Pad is held in the left hand, with the left thumb pushing one of the buttons, and the right forefinger or stylus doing the actual drawing. The Koala Painter menu is split into three sections, Commands, Brushes and Colour Palette, so that the user can build up a picture using freehand drawings combined with the basic shapes contained in the menu.

By Neville Ash, a Computer Consultant.

SUPPLIERS OF DISC  
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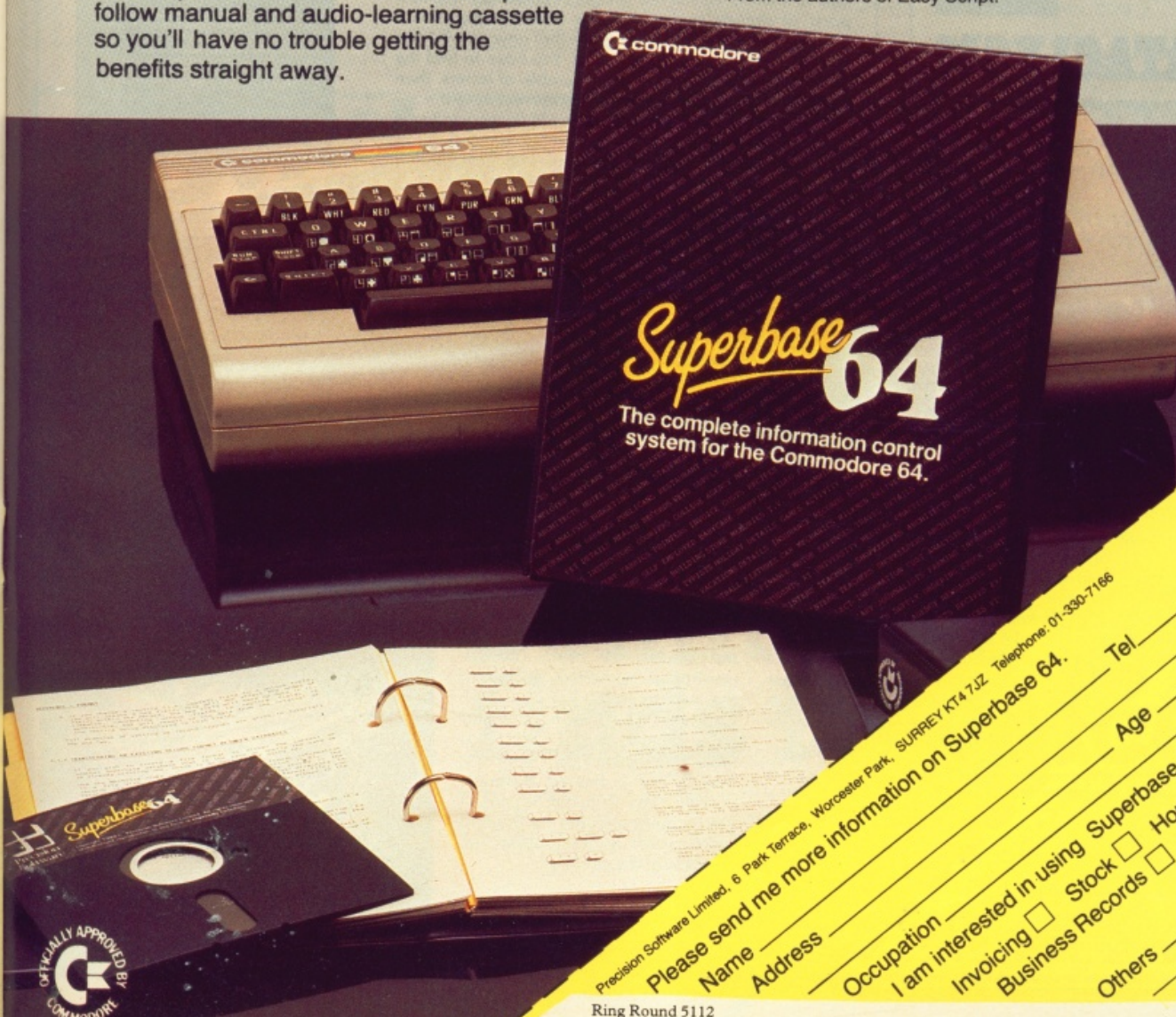


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6 Park Terrace, Worcester Park,  
Surrey, KT4 7JZ

Precision Software Telephone: 01-330 7166  
Telex: 8955021 PRECIS G

More information on Superbase 64 is available from Commodore Dealers, Major Retailers or from Precision Software direct.

From the authors of Easy Script.



Precision Software Limited, 6 Park Terrace, Worcester Park, Surrey KT4 7JZ Telephone: 01-330-7166

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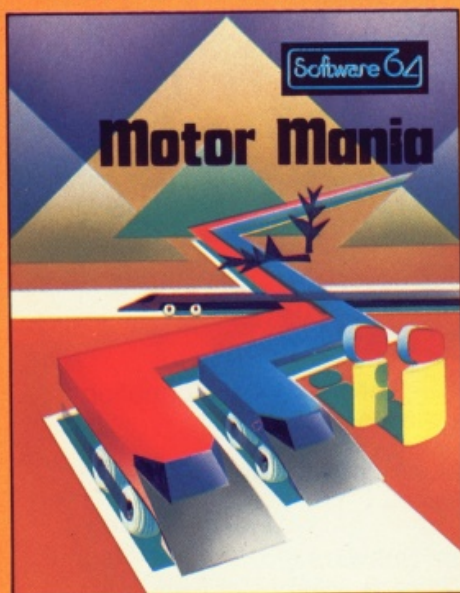
Others \_\_\_\_\_



# MACHINE CODE GAMES ACTION FOR THE

# 64

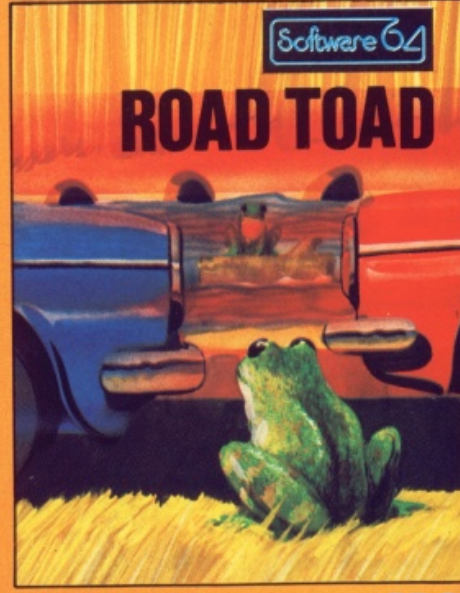
Software 64



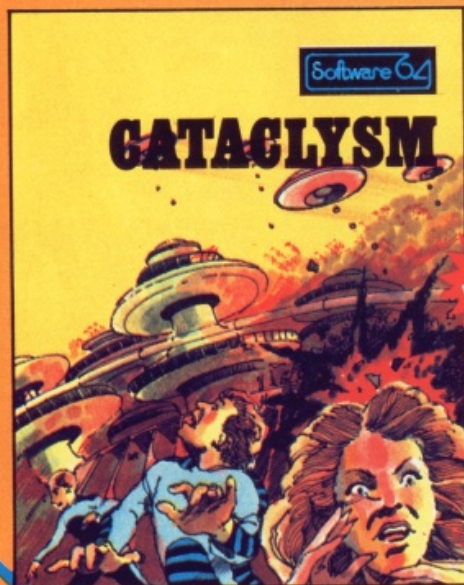
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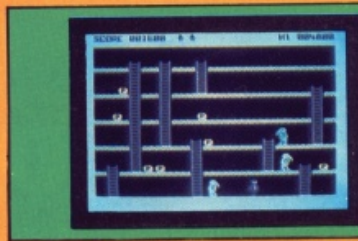
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## BONZO 64

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This best-selling game for the VIC-20 is now available on the 64! Featuring the most intelligent and devious monsters you have ever tried to avoid, the Bonzos, this game is a real joystick wrencher. Move Hans, the handyman, up and down the ladders to pick up the boxes from the different levels.

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## BURNIN' RUBBER



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# MAGPIE: A USER-DESIGNED DATABASE?

CLINIC

A database program called *Magpie* sounds slightly worrying – will it filch all your valuable data and hoard it in some inaccessible nest deep inside the system? However, this new package from Audiogenics for the Commodore 64 is nothing if not user-friendly, and in some respects quite innovative.

*Magpie* uses the unusual combination of a cartridge for the program and disk to store the data and applications. The package contains the cartridge, a disk which has Help screens for the commands, with two example applications and the manual.

Use of *Magpie* revolves around 'pop-up' menus, something which is more often found with the new mouse operated systems like Macintosh and Lisa. The second difference is the cursor: instead of a square and ready, the option selected is shown in red on a white background; once this option is selected the choice changes colour to black.

After inserting the cartridge the main menu appears on the screen. There are five choices: Run procedure; Use calculator; Get system; Create system; and Load and run (see above right).

The Commodore 64's special function keys are used to manipulate the cursor. F1 brings the cursor to the top of the list; F3 moves the cursor up by one option at a time; F5 operates the chosen selection; F6, produced with shift lock, produces the Help facility for the particular option being used; and F7 moves the selection down one option at a time.

Before reaching the main menu, *Magpie* wants to know which disk drives are being used. The program can be used with the 1541 drive, and also with the 4040, 8050 and 8250 (when a suitable interface like the Interpod is used).

Taking the second option on the menu, Calculator, brings up *Magpie*'s choice of up to 26 different variables, user selected. This option can also be used as a conventional calculator.

The third option, System, refers to a complete application which will be held on disk, loaded into the 64 when required. As each option is taken, a second menu appears

which overlaps the original one; the chosen selection appears in white on a black background.

Mailing list is an example of an application produced using *Magpie* and the menu has eleven options: Add names; Modify name; Delete name; Print labels; Selective print; Help with index; Make new index; Get saved index1; Indexed modify; Sorted print; and Create new file.

All applications using *Magpie* start with a form (or page) which will contain the basis for all the information that is to be used. *Magpie* can have two of these pages (forms) active at the same time, and each can have its own datafile.

Once this form has been created, it can be accessed in a number of ways: sequential access can be used where the program starts at the first record and works its way through to the end of the file; numeric access where the numeric position of the infor-

mation is used; searched access is where *Magpie* works through according to criteria that you have already defined.

Indexed access can be used with a named field as the key. So that when the key is entered *Magpie* can find the appropriate record; sorted access can be used where one of the special attributes of the index file is its sorted order. With this system records can be entered at random, and *Magpie* finds them in order.

The various components of *Magpie* are controlled by Procedures. This is just another name for a group of commands which linked together perform a specific job. The user selects the procedure title from the menu, and *Magpie* actions this command, then returning to the menu and display end of procedure.

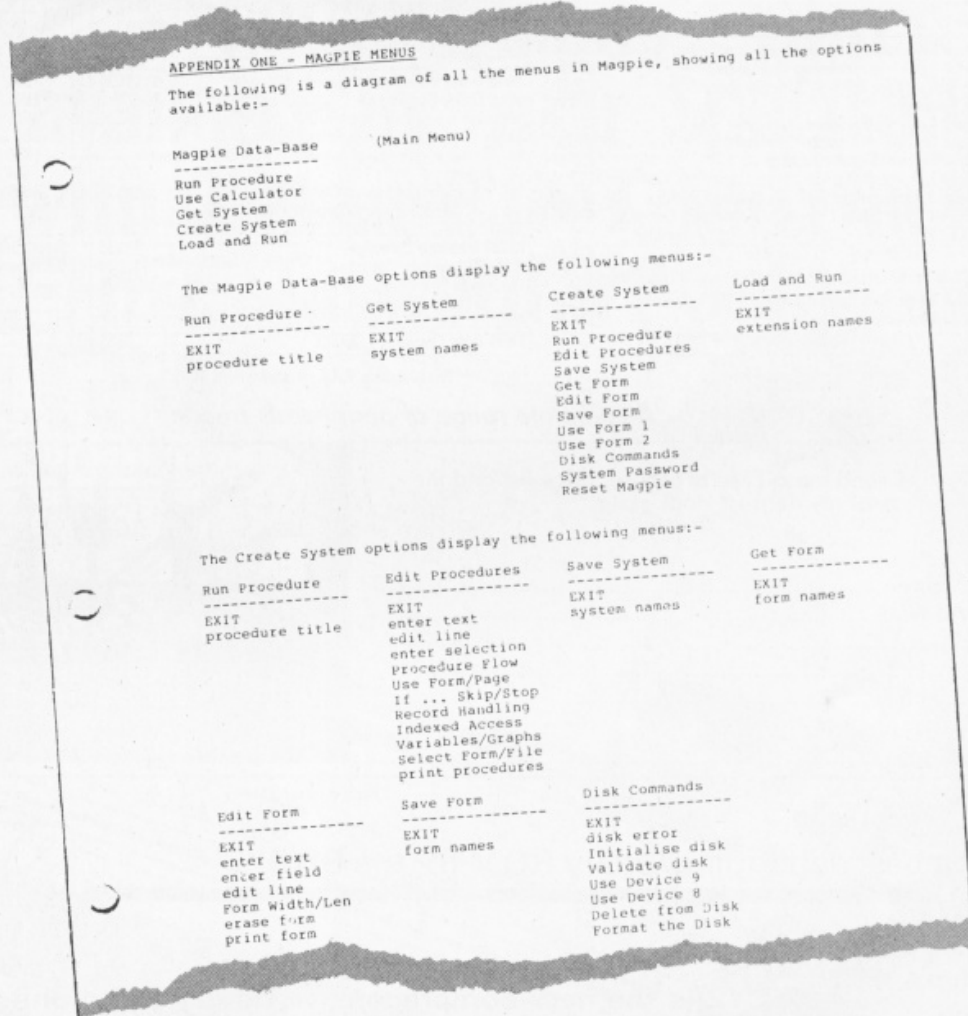
By using *Magpie* a whole sequence of commands can be used with the Begin and Repeat structure available, and

a procedure can be altered after a set number has been reached, or changes made to allow multiple decisions. If this wasn't enough in a sophisticated database, *Magpie* can also produce graphics – such as horizontal bar graphs, vertical bar graphs and x and y points.

*Magpie* must be the most advanced type of database currently available for the Commodore 64. Its easy to use, employs the latest state-of-the-art systems with its pop-up menus, has password security, and is truly programmable. The package can be as simple or as sophisticated as the user requires; in fact, the only main drawback could be the speed of operation of the 1541 disk drive.

By Neville Ash, a computer consultant.

*Magpie* is priced £99 from:  
**Audiogenics,**  
PO Box 88, Reading, Berks.  
Tel: (0734) 664646.





# COMPUTER ACCESSORIES

**SLR** (Stack Light Rifle - available for VIC-20, CBM64, BBC/B) comes complete with three free games - As Seen On T.V.! **£29.95**

**Stack Lightpen +** (available for VIC-20, CBM64, BBC/B, Atari 400/800) supplied with one free game on cassette **£28.75**  
Other games are available, titles include: Othello, Life, Go, Draughts, Lost in the Labyrinth, Crossword Twister, Shuffler, Seek & Destroy and Simon. Each game costs **£5.75**

**Stack Analogue Joystick** (available for VIC-20, CBM64, BBC/B) BBC/B only **£13.80** VIC-20/CBM64 only **£14.95**

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For disk based systems:- Help (Toolkit/Monitor/Disassembler) **£28.75**  
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These products available for CBM64 only

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BBC (A or B) **£2.90**  
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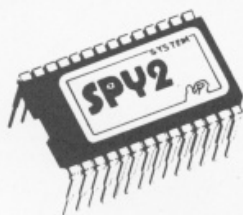
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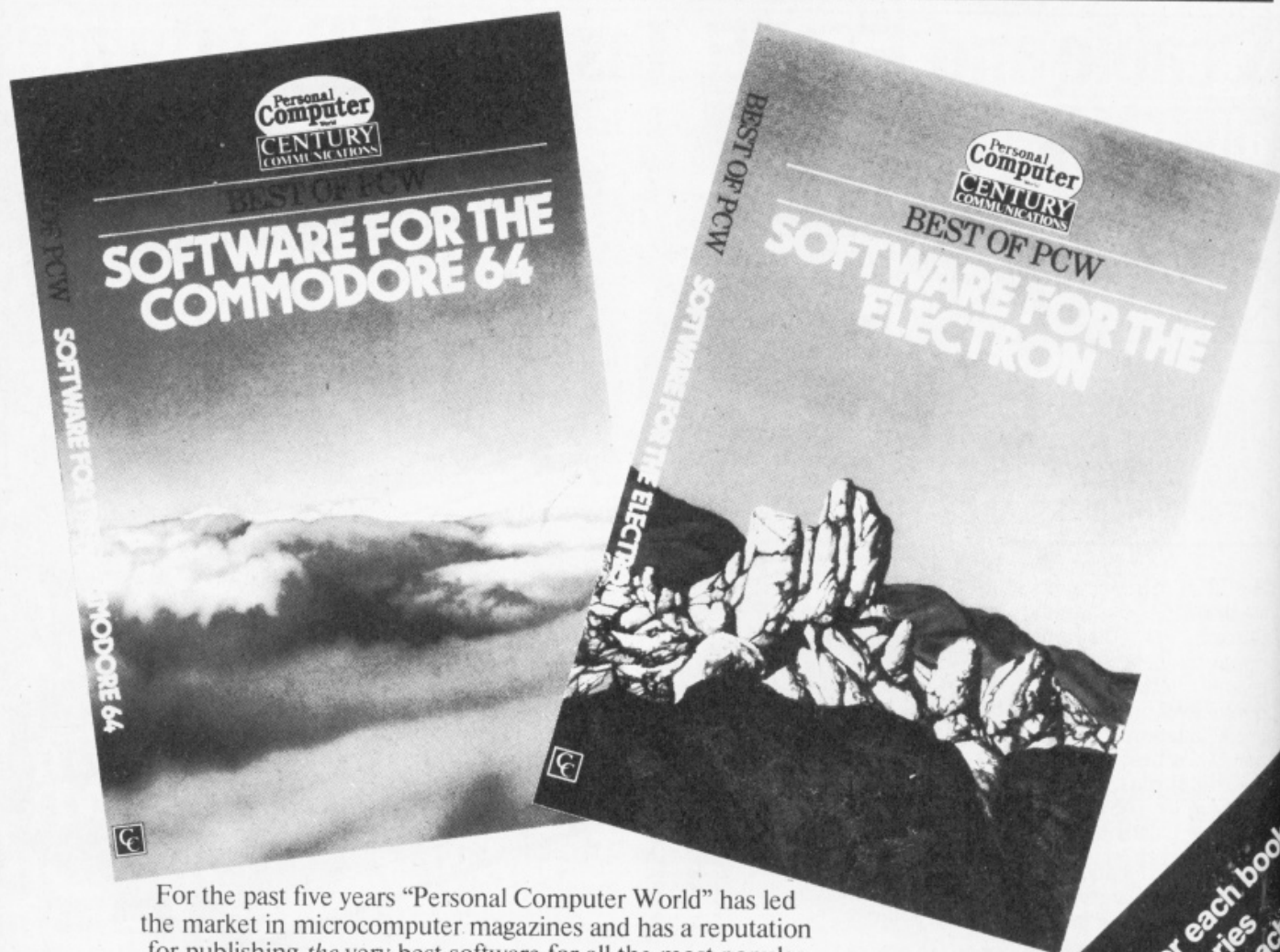
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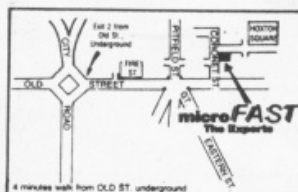
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MAY, 1984



## WHICH VDU COMMAND

Acorn's ViewROM supports programmable highlights; Epson printer driver supports an enhanced 132 character typeface. What is the View code for this effect?

George A Fortune, Reading.

The following line, entered from Basic, will put the Epson into 132 character mode: VDU2,1,27,1,80,1,3,3.

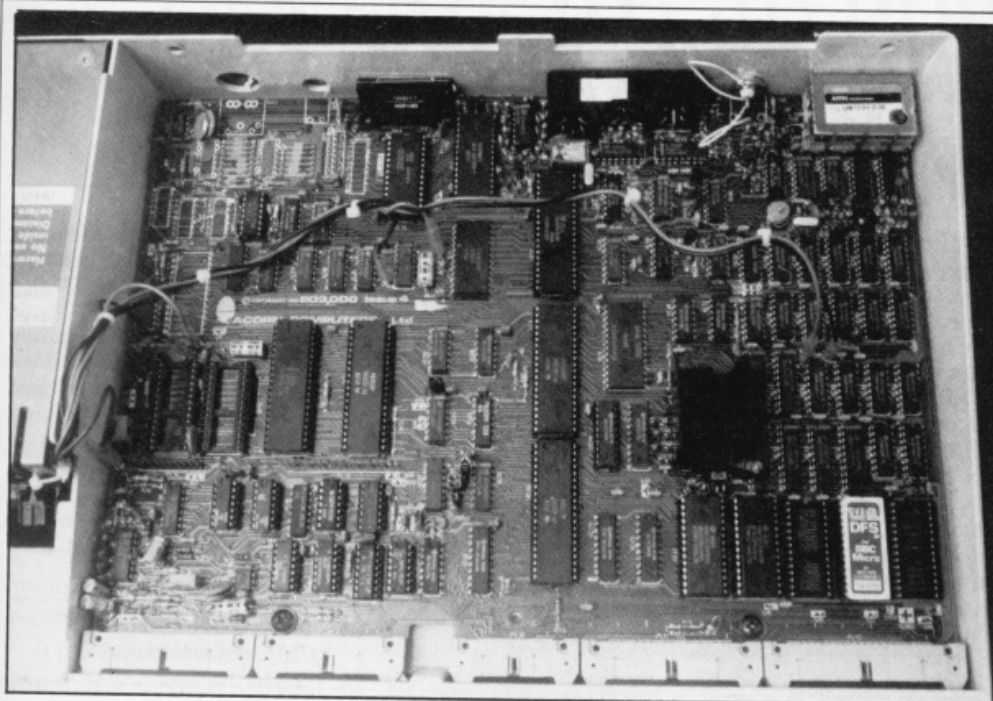
Unfortunately, you cannot enter VDU commands once you are in View, and to cap it all, the Epson printer driver resets the printer back to its default starting values every time a print is begun. This means that it is reset to 80 column mode. We examined Acornsoft's Epson printer driver, and it is a very complex piece of code. It would have been nice to be able to amend it so that the 132 column option would be one of the highlight codes, but we were unable to achieve this. However the following steps will create an Epson driver that does not reset the printer back to 80 columns:

\*LOAD EPSON1800

7&1BD5=0

\*SAVE EPSON1 1800 + 100

The procedure will then be to enter the VDU command above (which you could \*BUILD to create a \*EXEC file), then once you are in View command mode, enter PRINTER EPSON1.



City of dreadful circuits – can a dodgy ROM cause damage to your BBC system?

## ▲ CAN ROMS DAMAGE?

There are an ever increasing number of ROMs coming onto the market for the BBC Micro. Provided the instructions are strictly adhered to, the fitting seems to be simple enough; however, opinions seem to vary as to whether any damage can be done to a

computer if one of these ROMs is defective, either because of the program itself or due to a production fault, or by mishandling during the fitting of the ROM. Obviously there is no way of testing beforehand. Any views?

EA Allchin, Bridgewater.

We haven't come across any

cases of faulty ROMs causing damage. Since they are only memory devices, it would seem unlikely that a dodgy one would do anything more serious than crash the system. If you are really nervous, you could install a RAM board in a sideways ROM socket, and copy your ROM software into it! Damage could, however, be done by incorrect insertion of ROMs, bending or breaking legs, and so on.

Both the BBC and ROMs are surprisingly robust, but any reputable dealer should be willing to fit a ROM for you if you are worried. All the ROM-based software that we have seen has been supplied with clear fitting instructions.

## ACADEMIC CHOICE

I am going to do some Open University computing courses over the next two or three years. I am willing to spend up to about £1,500 on hardware and £500 on software. I must be able to program in UCSD Pascal, structured-Basic and assembly language. I am also interested in Lisp – what machine would you recommend? Also, how close is HCCS Pascal-T to UCSD Pascal?

DH Robinson, Ilkley.

A BBC Model B with twin disk drives and printer would be a good choice and well within your budget, but wouldn't quite meet your specification. BBC Basic offers structuring in the form of REPEAT...UNTIL loops and fast and powerful procedures. It also has a 6502 assembler built into the Basic interpreter.

We haven't come across anyone offering UCSD Pascal for the BBC yet. HCCS's Pascal-T is a Pascal subset in ROM, and doesn't support records, sets or reals. It compiles down to threaded-interpretive code; and if it sounds like Forth it's not surprising, as this Pascal compiler was written in Forth!

Acornsoft's S-Pascal is also a subset, compiling down to 6502 machine code, rather than the UCSD P-system. It is not yet available at the time of writing. However, Acornsoft's Lisp is available at £16.85 for cassette, and £19.90 for the disk version.

Pascal-T costs £59 (exc. VAT) from:

**HCCS Associates,**  
533 Durham Road,  
Low Fell, Gateshead,  
Tyne and Wear NE9 5EY.  
Tel: (0632) 821924.

## DRIVE SWAP

I use Pet 4032 and 4040 drives in a school; we will shortly take delivery of a BBC B and disk interface. I feel it should be possible to use the 1MHz bus to send and receive the signals to use our 4040 disk drive. We cannot afford BBC compatible drives at the moment (and I prefer the Commodore system in any case). Is it feasible and how should it be done?

K Goodier, Bridlington.

We have been (pleasantly) surprised to find that disk drives

from other computers have worked successfully with our BBC Micro. Drives that have been used with a Nascom and with a Pet (using a Compu-think disk system) were able to be plugged straight into the BBC disk interface and used. All the drives used were Shugart standard, and it may be that your drives are the same. Trying to use the 1MHz bus would take you down a very non-standard road. If your drives don't work, then remember that drives are getting cheaper all the time, so you may soon be able to afford them.



## SCROLL INFO SOURCES

I have a 48K Spectrum on which I'm writing an arcade-style game, and am after getting continuous sideways scroll (such as in *Scramble*) and a constant background sound. How do I achieve these effects?

Also, could you recommend some books on programming the Spectrum which include hints on graphics, sound and Machine code?

*Andrew Patmore, Brighton.*

A book would probably be the best source for finding the information you require, as you need a machine code routine which moves the screen data about. We suggest you buy a book called *Delving Deeper into your ZX Spectrum* by Dilwyn Jones (published by Interface), priced £7.95. This contains all the information you should need to get the effects you require.

## RAMPANT GRIZZLY CURE

I have a problem with my copy of *Imagine's Ah Diddums* game. When I am not touching the keyboard the bear character has a mind of its own and goes tearing around the screen. Can you help me?

*P Fletcher, Notts.*

It sounds as if you either have a bad copy (if the rest of the ZX Spectrum works normally) or you are affected by the 'Model 3 Syndrome': on Model 3 Spectrums, the EAR socket (Bit 6 of the keyboard byte) is now Binary 1. On Models One and Two, it was Binary 0.

This mucks-up the keyboard checking routine causing the effect you describe. Send the program back in both cases and get an up-to-date copy which should work on all models.

# FINDING FUNCTIONS/ MODEM CHOICE

On the ZX Spectrum there is no scroll function; neither is there any 'fast' or 'slow', as on the ZX81. Can you give me the Spectrum equivalent? Will this allow me to use many ZX81 programs on my ZX Spectrum? Also, could you tell me how to use a modem on a Spectrum, and how much would it cost?

*M Savage, Aldershot.*

The Spectrum equivalent of SCROLL is RAND USR 3280. There is no fast or slow modes on the Spectrum, it is always 'fast' in comparison with the ZX81. Simply ignore these two statements when you are translating from ZX81 to

Spectrum Basic.

As the Spectrum has no serial port you will need an RS232 interface in order to use a modem. To allow Spectrum users the facility to access Micronet/Prestel, Prism has produced the VTX5000 which is interface, modem and software on ROM all in one unit and costs £99.95.

Should you wish to access other databases, such as our CABB, then the Micro Mania interface is suitable, priced £33.50. With regard to software for communications using the Micro Mania interface, we printed a program called Specterm in the March '84 issue of *Computer Answers*. JWV Software has two pro-

grams to run with the same interface and will sell you software plus interface at £33.50.

Using the Micro Mania interface, any commercially available modem can be used. As yet, no-one has produced the software to allow the Prism VTX to be used either as a 1200 half duplex modem (user to user) or as a 1200/75 baud modem for Prestel in compatible boards like our own CABB.

**Micro Mania,**

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**JWV Software,**

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Strood, Kent.

## ACCOUNTING FOR TASTE?

I have a 48K ZX Spectrum: could you suggest a program for invoicing?

*B Simons, W Yorkshire.*

I am a 48K Spectrum owner: could you please tell me if it could help me keep a daily account, with up to 300 entries for a whole year, and then work out the total loss/profit?

Also, could I subscribe to Micronet - are some of the pages which can be accessed free of charge?

*C Ulahovie, Huddersfield.*

Your number of entries (300 a day) is quite high, Mr Ulahovie, but some of the firms given below might be able to provide a suitable program. The data can be stored on tape or disk, but disks are more expensive of course.

To subscribe to Micronet you must first obtain an adaptor like their VTX5000 to which you can 'talk' to Prestel. This costs approx £99. You then have to have a socket fitted to take the modem by British Telecom, and pay rental charges for the socket and the telephone time to B T

and a three-monthly subscription charge to Micronet for access Prestel and Micronet. The page charge comes on top of this. Most of the pages are free, and there is plenty of warning before you pay for a page.

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Regents Park,  
London NW1 7AA.

**Hestacrest,** PO Box 19,  
Leighton Buzzard,  
Beds LU7 0DG.

## MONOROAM

I have a ZX Spectrum, which I use with my colour TV, but I keep getting just a black-and-white display. What's wrong?

*Jonathon Camp, Essex.*

The ZX Spectrum needs time to warm like any other device, try adjusting the TV control after it has been on for about half an hour.

## GETTING TO DATA FASTER

Could you explain how a Microdrive and interface would make a difference to using a database (as opposed to just using a Spectrum 48K and cassette system). I know that a Microdrive can hold just under 100K, but as only 48K (or under) can be fed into RAM, I don't quite see any advantage.

*Steve Bowman, London.*

The simple advantage is speed! Databases need to access information quickly. Rewinding a tape from beginning to end can take a few minutes, but any information on a Microdrive can be found and loaded in 10 seconds.

In any database the information is held in files which on tape or Microdrive can be up to 85K long. Only the section of the file required at the time is loaded into the ZX Spectrum (as you say, a maximum of 48K). The sections need to be swapped at the fastest speed possible, hence the improvement by using the Microdrive. Files can also be copied much quicker and easier using two files.



# The BBC Micro can now give your children a private education.

The BBC Microcomputer now accounts for 80% of the computers being ordered under the current D.O.I. Primary School Scheme.

It's also the computer which a rapidly increasing number of people are choosing for their homes.

One of the reasons for its success is that it makes learning highly entertaining for everybody. From children who are getting to grips with the alphabet, to adults who want a gentle but intensive introduction to the complex world of computing.

Now, there's a substantial new catalogue of educational programs specially for the BBC Microcomputer.

It has been developed by Acornsoft, the software division of Acorn Computers who manufacture the BBC Micro.

## Making faces without getting scolded.

With the new Facemaker program, your children can make over a million faces. It's like an identi-kit, allowing them to depict anyone they want. They start by choosing the eyes. Then they can choose the mouth, the ears, the nose, the facial outline and the hairstyle.

And if they really fancy dressing up, they can add earrings and hats.

In doing all this, they learn to read and spell, as well as developing their powers of description.

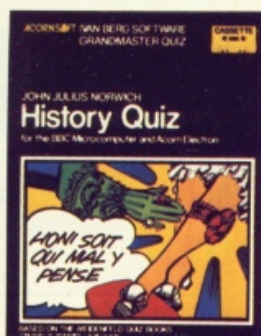
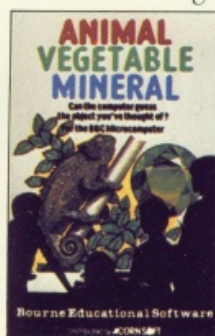
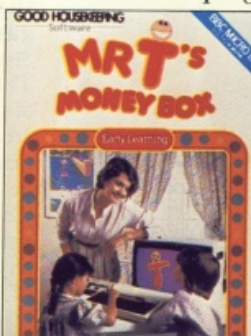
## The money program, two games for the price of one.

Mr. T. is an engaging little figment of the microchip who can teach your children all the complexities of our coinage system.

His Money Box program has two games, each of which can be played at different levels.

In Money Match, the challenge is to collect a set of coins, matching them according to shape, size and value.

In Money Box, you can give your child and Mr. T. a helping hand to get all the coins on the screen into the box. (It's always different, because the coins on the screen are based on the small change you have to hand.)



A chance to teach the Micro a thing or two. With the Animal, Vegetable, Mineral program, the children can get the computer guessing.

They think of an object. The BBC Micro has to decide what it is.

If it doesn't come up with the answer, the children can keep giving it hints.

In doing so, they are encouraged to question the difference between such things as crocodiles and alligators, or whether oil is vegetable or mineral.

The program also encourages them to consult refer-

ence books so that they can ask the computer increasingly tough questions.

## Questions on Julius Caesar from J. Julius Norwich.

John Julius Norwich's History Quiz is one of the new BBC Micro Grandmaster quiz series which also covers theatre, crime and detection, music, science fiction and royalty.

On the history front, there are 300 brain-testing questions, covering all aspects of British history from Julius Caesar to Margaret Thatcher.

And to increase the educational value, Mr. Norwich has posed the questions from angles which will give a broader understanding of events.

## For the full catalogue, clip the coupon.

There are thirty more new BBC Micro programs in Acornsoft's new catalogue.

For a free copy, complete the coupon, or telephone 0933-79300. Or ask your local BBC Micro dealer.

If you're not yet a BBC Micro owner, you can get full details of the computer at the same time.

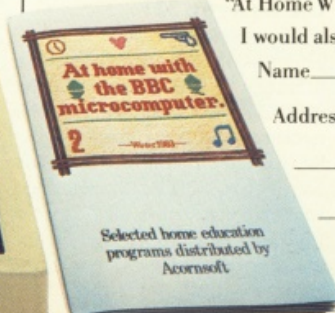
To Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Please send me the new Acornsoft catalogue "At Home With The BBC Microcomputer." CA5

I would also like details of the BBC Micro ☐ (tick)

Name \_\_\_\_\_

Address \_\_\_\_\_

Postcode \_\_\_\_\_



**ACORN**SOFT



**I understand that it is possible to make your own leads to use an ordinary tape recorder with the Commodore computers; is the same thing possible with the new Atari, and if so, how?**

*C F Price, Fife.*

## CUSTOM CASSETTE

The 410 cassette recorder is not just any old recorder with an expensive lead hanging out – apart from the fact that it has a two track head, it is also modified internally. The Atari computers record data using a method known as Frequency Shift Keying; the Atari generates the required sound frequencies and sends them out

to the recorder and these frequencies are sent out to a very fine tolerance. The 410 receives the signals and records them onto tape.

This may seem just like any other computer's recording method, but the system alters slightly when the data is sent from the 410 to the computer. The 410 listens to the tape

itself and interprets the frequencies that were recorded onto the tape, either high or low frequencies. After listening to the sounds, the 410 sends out an electrical current to the computer, which is either zero voltage for a binary zero or 5 volts for a binary 1.

No other commercial tape recorder will have the necessary circuitry installed. Commercial tape recorders are only able to send out sound frequencies and not the straight voltages required by the Atari; one advantage to this is a more reliable load.

Adaptors are available to reproduce the circuitry inside the 410 but we have only seen them advertised in the US. You could buy one from the US, but by the time you have paid for it and shipped it over you may as well have bought the 410 or 1010 recorder.

Reliability is such an important consideration, that we think paying the extra is probably worth it.



*All in the family: the Atari 800 is able to use VCS joysticks.*

## JOYSTICK DIVISION?

**Can the Atari 800 take the Atari VCS video games and joysticks?**

*Simon Gluster, Holybourne, Alton.*

The Atari 800 will accept any of the joysticks or paddles that are available for the VCS machine. It will not, however, be able to use the cartridges. The VCS and 800 use different processors, and apart from anything else, the physical size of the things is too big for the 800.

## DRAGON WHICH IS BEST DOS?

**I run both Dragon and Commodore 64 systems. I hear that the Dragon disk system will run OS9 and Flex, and that these have advantages over CPM and the Commodore operating system I use now. Is this so? (Principal use is for a small business.)**

*Graham Alcock, Swansea.*

Flex and OS9 do have advantages over CP/M, largely due to the fact that they were designed later and take advantage of advances in software technology. However, CP/M has one enormous advantage over both these operating systems – it has been around for so long that there are literally hundreds of applications programs which will run under it. A combination of *Wordstar* and *dBase II* will cope with the word-processing and file handling demands of a small business, but there are plenty of other packages to choose from. The choice for users of Flex and OS9 systems is likely to be more limited.

## DOUBLE DRIVE COSTS

**I am interested in purchasing a Dragon disk drive. How much would a double disk drive cost, and what makes are available?**

**Also, what is the cheapest graphics printer on the market for the Dragon?**

*J Ingleton, Kirby.*

Dragon Data's disk drives cost £275 for a single drive and £385 for a dual. An alternative

system is the Cumana drive which works with the Deltados system, these cost £299 for a single drive and £425 for a dual. The two systems are comparable in terms of disk capacity, but the Deltados system is more 'user-friendly' and versatile than Dragon Data's disk extensions to the Microsoft Basic supplied.

As disk drives for the Dragon are a relatively new product, disk-based software

is fairly scarce at the moment, but this situation is likely to change rapidly. The cheapest graphics printer for the Dragon currently available is the MCP 40 colour printer/plotter. This offers four colour printing using miniature ball point pens, and costs £149.50. All the items mentioned above should be available from your local Dragon dealer.

The quality of print is quite reasonable.

## MEMORY ADDITIONS

**Can you add RAM chips on a circuit board via the ZX81 cartridge board to a Dragon 32? Could you tell me how to add it to the existing Dragon memory? Also, is there a compiler for the Dragon 32?**

*Nadeem Walayat, Sasan.*

It is possible to interface extra memory to the Dragon via the cartridge socket, as all the necessary address, data and R/W lines are brought out at the connector. The cartridge socket connections are exactly the same as those in the Tandy Colour Computer and are

detailed in the Colour Computer Technical Reference Manual (available from Tandy at 99p). 8K and 16K RAM-packs for the Dragon are also advertised by Soft Shop, priced £34.95 and £44.95 respectively.

One word of warning – any extra RAM attached to the cartridge port will *not* increase the amount of memory available for Basic programs, as it is not contiguous with the Basic program area. It will only be useful for data storage and machine code routines.

The Spring Basic compiler is an integer subset of Dragon

Basic, and it is claimed that programs written for it will run 5-10 times faster than the interpreted equivalent programs. It costs £14.95, and is available from Oasis Software.

Oasis software also market a Pascal computer, called *Petite Pascal*, worth looking at.

**Soft Shop,**  
66 Catherine Drive,  
Sunbury-on-Thames,  
Middlesex TW16 7TG.

**Oasis Software,**  
Alexandra Parade,  
Weston-super-Mare,  
Avon BS23 1QT.



# COLOURJET

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Options available:

- Buffered RS232 interface.
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- Apple II interface.
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Specifications:

640 dots/line, 1280 dots/line hi-res

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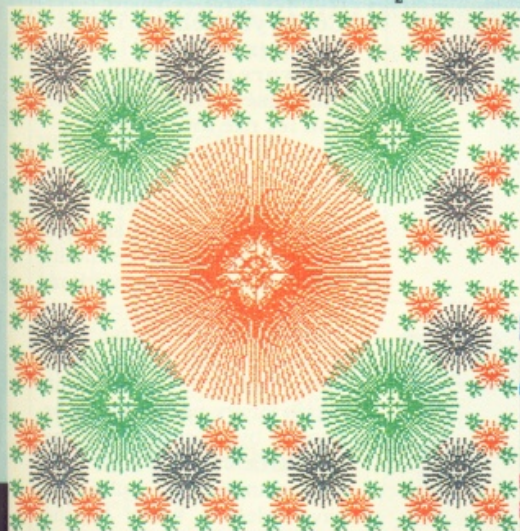
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## DISPLAY IS DIS-ARRAYED

I own an Oric 1, and am having difficulty tuning it in to a 26 inch Pye colour TV.

There are two problems: no matter how much I fiddle with fine tuning, colour and contrast controls, I cannot get a clear picture free from interference; also, every sound from the micro produces screen jump. I have tried two other TV sets with no improvement.

J P Warren, Barnes.

The Oric 1 has two outputs for video display: one to a television and the other to a monitor. An RGB (red, green, blue) DIN socket allows users who want a rock-steady colour picture to connect a suitable monitor to their Oric 1; alternatively, you could try a composite video signal fed into the UHF modulator, and a lead is provided with the Oric 1 to connect the modulator output to a UHF television. A set tuned to channel 36 will normally give a clear picture, but adjustments can be made using the control screws.

Two small holes on the base of the Oric 1 case give access to these screws. The silver screw controls the bias on the signal fed into the TV modulator, while the brass screws controls colour contrast by adjusting the frequency of the colour subcarrier. Many TVs give a good picture without these screws being touched, but adjustment can be necessary with some sets. To carry out such an adjustment, first set up a colour picture on the Oric 1. Next, using a fine screwdriver, adjust the silver screw until the picture is properly centred on the screen. Finally, turn the brass screw until a satisfactory colour contrast is achieved.

The interference to the display caused by sound commands should disappear once the display is properly tuned. If not, the Oric itself could be faulty, and you should seek help from your dealer.

# MANUAL UNMANGLED

I'd like to know whether to issue a corrected printing I've done of the Oric user manual (with full 6502 instruction code listing); also, could you tell me where I can obtain the new op system ROM, and how much will it cost? Is there a book on machine code programming on the Oric?

L Cottam, Cleveland.

Oric Products International has already issued a number of corrections to the Oric 1 User Manual, but a new edition will not be produced. There were a number of type-setting errors in the guide, and

many Oric owners found the details on advanced use of the machine sadly lacking.

However, the new Atmos manual is light years ahead in both its style and content. Written by Ian Adamson, and published by Pan for Oric, its approach is much less condensing and its 12 appendices contain fascinating facts on ROM entry points, system variables, use of the VIA chip and much more.

The new ROM is at present only obtainable by buying an Atmos! However, Oric does have plans for an upgrade service whereby Oric 1 owners may send in their machines to get a new keyboard and ROM

fitted. Earlier reports from the company that this would cost around £50 have subsequently been denied; apparently Oric is currently finalising plans for the upgrade facility, and the end price will depend upon costs of raw materials. It is expected that the service will be available from the early summer of this year.

We have not come across any books specifically aimed at machine-code programming on the Oric 1, although Zaks' *Programming the 6502* (published by Sybex) is a good general-purpose standby, and available from most good computer bookshops.



The Oric Atmos has a 13 command disk operating system.

## DOS COMMANDS REVEALED...

Could you explain what the separate Oric disk operating system commands do, and how (if possible), could I use them in Basic?

Philip Potter, Maidenhead.

The 3 inch diameter Micro Disks for the Oric Atmos are due for release very shortly. The disk operating system provides a selection of 13 commands, summarised below:

BACKUP copies a disk.

COPY copies a file.

DEL deletes a file.

DIR displays the directory of a disk.

DRV sets the default drive number.

FORMAT formats and initialises a disk.

LOAD loads a file from disk.

PROTECT changes the protect status of a file.

RECALL recalls a data array from

disk.

REN renames a file.

SAVE saves a file to disk.

STORE stores a data array on disk.

SYS reconfigures the disk configuration.

The commands LOAD and SAVE are the Micro Disk equivalents of the cassette CLOAD and CSAVE instructions. Similarly, the STORE and RECALL commands are the same as the new Atmos commands for storing real, integer or string arrays onto tape.

The Micro Disks are connected to the Atmos via the expansion socket. This port contains control lines which enable the disks to blot out the Atmos ROM, and provide many new facilities. Therefore the DOS instructions above will be available from Basic.

## SOFTWARE SOURCES SEARCH

Could you tell me if the number of Oric software companies will increase? Also, could you let me know what books are available for the Oric.

Gary Butcher, Basingstoke

Although not much software has been produced specifically for the Oric 1, many software houses have converted their standard range to the machine. Tansoft is the largest Oric-only software house, and details of its products can be found by writing to the address below.

A number of publishers have released books on the Oric-1. A few notable titles are: *The Oric 1 Companion*, by Bob Maunders (published by Linsac at £6.95); *The Oric 1 and How to Get the Most from It*, by Ian Sinclair (published by Granada at £5.95); *Easy Programming for the Oric 1*, by Ian Stewart and Robin Jones (published by Shiva at £5.95); and *The Oric Handbook*, by Peter Lumpton and Frazer Robinson (published by Century at £5.95).

All of the books mentioned here should be available from good booksellers.

Tansoft,

Units 1/2,

Techno Park,

Newmarket Rd,

Cambridge CB5 8PB.



# Free software, only £225.

If you own a BBC Micro, you can now download, store and run programs (transmitted free of charge via Ceefax) with the new Teletext Adaptor, priced £225 inc. VAT.

These programs make up the BBC Telesoftware Service (which is intended to become a computer software broadcasting channel) and although primarily educational, they will soon develop into general interest and business areas.

And, as they will change every two weeks, you'll soon be able to build up a vast bank of top quality software without ever having to put your hand in your pocket.

But that's not all the adaptor has to offer. It also enables you to gain access to the normal teletext store of data. This is different to simply having a teletext TV because it means

this data can now be transferred to memory and manipulated in any way you wish (making graphs or bar charts for instance).

It's yet another development in our programme to help you fully realise your BBC Micro's potential.

If you're a credit card holder you can order the Teletext Adaptor by ringing 01-200 0200 at any time or 0933-79300 during office hours.

(You can also find out the address of your local BBC Micro dealer by calling the same numbers.)

Alternatively, you can order it by sending off the coupon below.



## Technical Specifications

Access to Teletext and Telesoftware Services broadcast on U.H.F. channels E21 to E69.

Speed of max. data capture rate approx. 128k baud. (8 lines of Teletext per frame.)

Height 70mm. Width 210mm. Depth 350mm. Weight 2kg.

Colour: BBC Computer cream.

Construction: Moulded top and bottom to match BBC computer profile. ABS injection moulded plastic.

Controls: Four tuning potentiometers on rear panel.

Mains on/off switch on rear panel.

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## The BBC Microcomputer System.

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## How can I transfer files between an Osborne portable, IBM PC, and a TI99/4A, via a RS232?

H R Jones, Newtown.

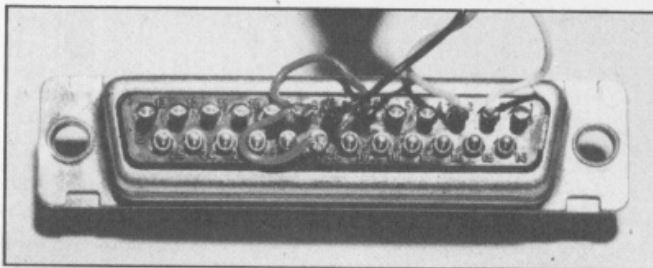
Of your three machines, communications to the TI99/4A is likely to present the most problems. The transfer of files, both programs and data, is a daily function, even between quite different disk-based machines. Obviously trouble may well occur if you try to transfer a program to a computer with an operating system on which it was not designed to run.

However, data can be successfully communicated to virtually any computer. If your IBM PC has the CP/M operating system, you can get quite a way using the provided PIP and STAT utilities. With these it is possible to re-assign devices in such a way that one computer port can be configured to send data and the other computer to receive.

This is an extension of the ability that PIP is normally used for, (transferring a group of named files from one disk to another in the same machine). If you have not yet investigated the full range of facilities of these two wide ranging programs, then this would be a good incentive.

Even so, PIP is not without its limitations and it can be re-

## RS232 TRANSFER CONNECTIONS



RS232 information transfer is a tricky but possible operation.

strictive in the size of programs it can transfer. In addition, it is not very good at coping with groups of files. These problems are overcome by a number of programs that can be purchased specifically for file transfer. A simple standard is the package BSTAM, which is available from most good dealers. It is very simple to use as both the computers have BSTAM installed: one is set to receive files on a named disk and the other is set to transmit a named file or wild card group of files. Providing such things as baud rates and parity are set to match there will be no problems.

The main draw-back though is that both machines have to have BSTAM installed; BSTAM has to be customised for each machine (a bit of

assembler programming) which may well be beyond the average user. The normal route is to go for a dealer who has already done the work and has a version suitable for the machines you want to use. A more sophisticated package without this need to customise and possessing other additional facilities, is the package Sapphire Link from Sapphire Systems. Communications to the TI99/4A may well require a small specially written program, but in the first instance try Texas Instruments themselves.

**Sapphire Systems,**  
1-3 Park Avenue,  
Ilford, Essex IG1 4LU.  
Tel: (01) 554 5082.

**Texas Instruments,**  
Tel: (0234) 67466.

## MEMORY EXPANSION?

### DRAGON

**Which is the best business computer for under £600? Is there a disk drive for the Dragon? Is there a 32K memory expansion, and optional CP/M? Which is the best printer for the Dragon? Which is the best word-processor under £60?**

F Murray, Belfast.

Nowadays, the term 'business computer' when applied to micros tends to mean either a Z80-based machine with two floppy disk drives, with 64K RAM running CP/M; or a 8086/8-based machine with two floppy disk drives, 128K (minimum) of RAM, running under MSDOS. Increasingly, these sort of systems are used with hard disk drives to increase the mass storage capability.

Let's say straight away that you will be able to buy neither of these configurations for under £600, so we are talking about computers with the capability to be used as business machines. Without doubt, the best value for money should be the recently announced Sinclair QL at £399 - although at the moment the only software available for it is the four free packages which come with the machine.

As regards the printer, the QL has two RS232 ports, so your choice of printers is wide open. The reason dual disk drives are common in business micros is first because floppy disk drives are often of limited capacity (although this is improving by leaps and bounds), and dual drives enable you to have your programs on one disk and data files on the other, and second, to allow the backup of import-

ant data files.

Some disk operating systems (such as Acorn's DFS) allow you to back up files with only one drive, but CP/M's PIP utility requires a dual drive for disk copying. There is a disk drive for the Dragon which is available from Dragon Data, also a 64K upgrade on a part exchange basis. CP/M is not available, as this requires a 8080 compatible processor (the Dragon uses the 6809).

You can use any printer with a Centronics interface with the Dragon, Epson printers are renowned for reliability and offer excellent value for money. As regards word-processors for the Dragon; *Telewriter* is highly spoken of. It costs £49.95 and is available from Microdeal.

**Microdeal,**  
41 Truro Road,  
St Austell, Cornwall.

## ALLSORTS

### ANSWERS

## UPGRADE TO WHERE?

### APPLE

**I have had an Apple II for four years, and have been very pleased with it. I want to upgrade to another Apple, as I'm impressed with the reliability and software available. I have thought about a IIe and III. What d'y'reckon?**

F Nietzsche, Turin.

Of the three recent launches from Apple, only the IIe seems to have been a success. The Apple III got rather a half-hearted launch, didn't catch the imagination of the independent software companies, nor sold in any great numbers. We suspect the Apple III is often used simply to emulate the Apple II, which is rather pointless.

Prices of the IIe seem to be falling again, and we have found it down to £495. If it continues to fall it may be a better bet, because of the software and hardware support, than the BBC B. However, it is still hardly new technology.

The Lisa got the most ecstatic welcome when it was first launched - ecstatic, except on the price. It was initially priced around £8,000, which we now suspect Apple is regretting. The price has dropped a bit, but it can't drop too much too quickly because of the lack of credibility and confidence that such a change of plan generates.

We have not used the Lisa extensively, but have used the Xerox Star system, based on a similar idea, and was in fact available quite a bit before the Lisa. The machine and software is very impressive, and puts all current cheaper micros well in the shade (except on price).

Apple seem to have quite cleverly got round the problem by launching a new micro, the 'Macintosh'. This is a cut-down Lisa, at the far more aggressive and sensible price of around £1,700.

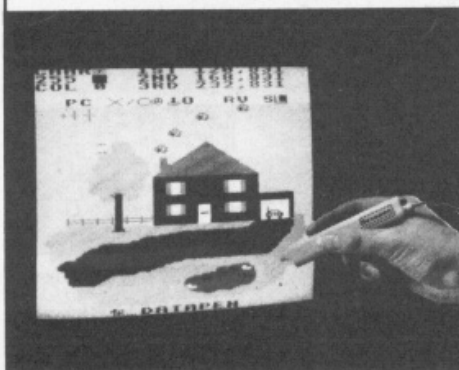
We reviewed the Macintosh in the April issue of *Computer Answers* (page 10), and suspect that this machine is probably your best bet.



Datapen

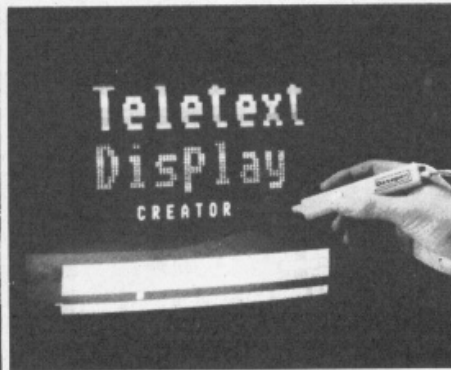
## BBC Lightpen Programs

Datapen

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A comprehensive Mode 2 colour drawing program allowing plot commands, painting, circles, text, character defining, saving and loading to tape or disc, all to be selected and used with the lightpen.

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**SUPERIOR PROGRAMS**

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- Good documentation
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The Datapen Lightpen itself comes complete with handbook, software on tape including two drawing programs and a printed listing showing useful routines.

**PRICE £25.00**

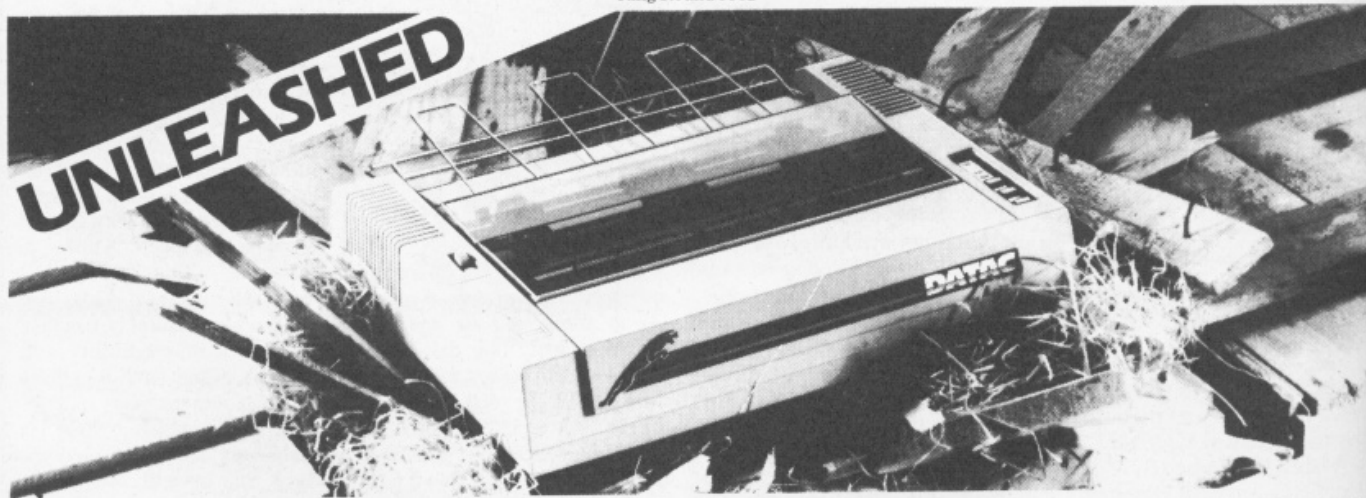
Two drawing programs, SKETCH and SHAPE-CREATE are included with the lightpen and the programs shown above may be ordered additionally, or separately as required.

All prices above include VAT, postage and packing.

Please send your cheque/P.O. to:-

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- 5 Two images for every sprite to allow ultra-smooth motion (left, righthand pixels). Can be defined separately for animation e.g. jumping frogs, running men, etc.
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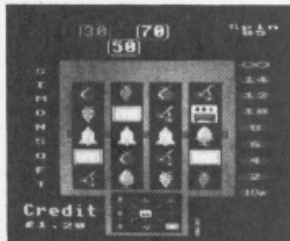
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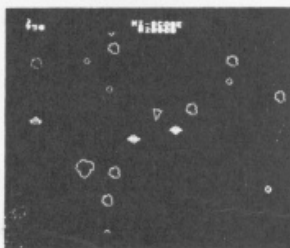
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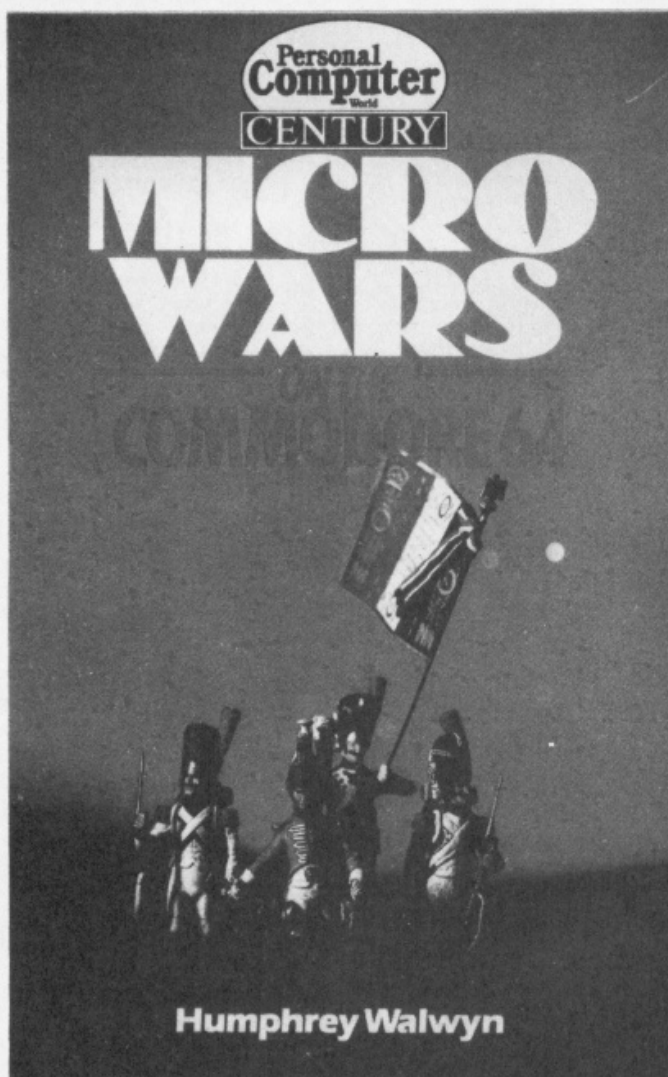
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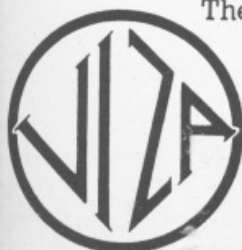
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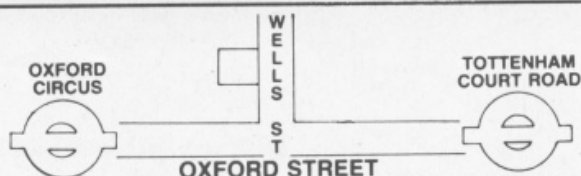
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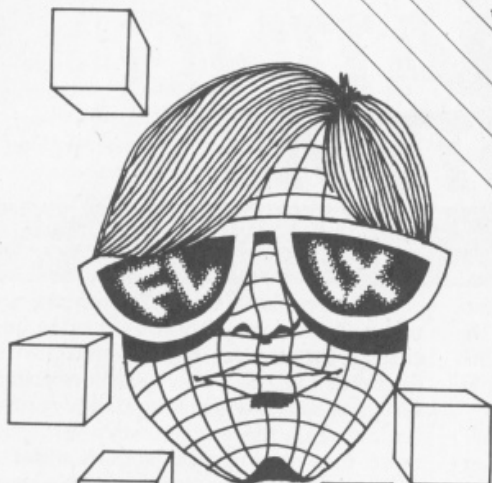
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# OPERATING SYSTEMS

## THE THIRD PART OF OUR OPERATING SYSTEM OVERVIEW FOCUSES ON THE PRACTICAL MERITS OF VARIOUS SYSTEMS.

In this last part of the *Computer Answers* operating system trilogy, we will concentrate on the practical use of the more common systems, covering accurate listings, the facilities available, and any idiosyncrasies.

As these are provided primarily for the end user, we will not cover the system utilities such as debugging tools, assemblers or complex text editors; neither will we go into great detail on the language-like facilities provided by certain operating systems.

In some computers, the language (usually Basic) and the operating system are intermingled, and the divisions between the two blurred; the Pet, Apple and BBC being well known examples of this aspect. The reason for this is that the language is an integral part of the machine, usually in ROM, and not loaded from disk.

In the next issue we will be printing conversion tables which summarize and provide a quick reference of the popular features that are commonly required. The text below will cover each operating system in turn and detail the features provided concentrating on those not covered in the tables and those that need greater amplification. A list of abbreviations are provided to enable compact text and tables to be produced.

### APPLE

The DOS 3.3 operating system of the Apple is a simple system having a small number of commands. The machine has a unique 'slot', 'drive' and 'volume' disk accessing technique. The unit itself has a simple bus - the disk controller card can be in any of these seven sockets or 'slots', and each card can support two drives. At initialization (formatting), a label and 'volume' number can be applied. If the numbering is used it will have to be specified when sending some types of commands to the disk. The directory lists files according to their types; a summary is illustrated below.

Type:	Description:	Creation method:
I	Integer Basic program file.	SAVE
A	Applesoft Basic program file.	SAVE
T	Text File.	OPEN and SAVE
B	Binary memory-image file.	BSAVE

All the machines' main commands (INIT, CATALOG, RENAME and DELETE) are covered in the conversion table. LOCK (and UNLOCK) is a simple delete

FIG. 1

UNIT ADDRESS:	
100-199	- diskettes.
200-299	- Winchester fixed and removable.
500-599	- printers.
UNIT ID's:	
\$B	Backup diskette drive (see \$SAVE and \$RESTORE).
\$P	Program unit.
\$PR	Logical printer (in single user this is a 500-599 address but in multi user it may be assigned to a disk drive for spooler output).
\$RP	Real printer (multi-user systems only).

FIG. 2

\$A	-controls for assignments of the unit numbers.	\$MOVE	-convert files from old (obsolete) format.
\$C	-clear screen.	\$NF	-read native file (see \$CPM).
\$CALC	-calculates sorting and storage requirements.	\$OUTPUT	-output file interchange format.
\$CATAL	-catalogue file maintenance.	\$P	-page throw.
\$CPM	-native interface program for CP/M.	\$PRINT	-print text or data files.
\$COBOL	-system language.	\$RELOC	-relocatable program builder.
\$CONV	-relative to index sequential conversion.	\$REMEXEC	-remote file executive.
\$D	-set date and time.	\$REMOTE	-remote file interface.
\$DEBUG	-system debugger.	\$RESTORE	-restore from backup cycle.
\$E	-end foreground working.	\$S	-displays basic system information.
\$EDIT	-text editor.	\$SAVE	-create backup cycle.
\$END	-sign off.	\$SEARCH	-search file for specified string.
\$F	-file utility.	\$SORT	-file sorting utility.
\$FORM	-screen mapping and formatting utility.	\$SP	-initiate print spooling.
\$INPUT	-input file interchange format.	\$SPOOL	-print spool file.
\$INSPECT	-terminal inspection of disk files.	\$STATUS	-displays system status.
\$JOB	-batch file.	\$T	-displays terminal attributes.
\$JOBMAN	-as above.	\$TAP	-terminal attributes builder.
\$L	-hex file listing utility.	\$TAPE	-magnetic tape interface.
\$LIBM	-program library utility.	\$TAPEXEC	-magnetic tape executive.
\$LINK	-link editor.	\$U	-displays unit descriptions.
\$MENU	-menu command.	\$V	-initialize and format utility.
\$MENCUS	-menu customization program.	\$XREF	-cross reference utility.
		\$ZAP	-applies a software fix (patch).



FIG. 3

nu1-1 - change input or output device.  
 BAC - backup a data file.  
 CFI - compare input and output files.  
 COP - copy file(s).  
 DEL - delete output file(s).  
 LIS - list any directory.  
 LSF - list file(s) in directory.  
 PFI - protect file(s) from deletion.  
 PRI - print any directory.  
 PRO - protect output volume from deletion.  
 PSF - print file(s) in directory.  
 REL - release volume from scratch protection.  
 REN - rename a file.  
 RFI - release file(s) from deletion protection.  
 SCR - scratch output volume.  
 SEC - secure file(s) with password.  
 SET - set old and new password.  
 VER - verify any output volume.  
 VFI - verify file(s).

protection, and is not a full password protection system. The two commands PR#n (directs output to a slot), and IN#n (directs input from a slot) offer simple device routing.

## BOS

BOS (Business Operating System) is a sophisticated single, multi-user and networking operating system with many facilities. It would be impossible to cover to any depth all the options provided (the company use eight manuals to do this!) in a short article. The system (like many others) has logical and physical addresses; a summary of those used is given in Fig. 1.

BOS has many commands but in general the system is menu driven: a command is given and you are then routed to an interactive series of prompts which may require more commands or simply the numbers of which ever units you wish the command to act upon. A list of commands is given in Fig. 2.

Some of the 'main' commands have a series of sub commands; the \$F - file utility - is one of these. It has a total of 38 options, we have listed some of those of most interest to a casual user of the system.

FIG. 5

B - block Read.  
 Dn - delete characters after column n.  
 E - echo to screen.  
 F - remove form feeds.  
 Gn - get data (files) from user number n.  
 H - check source proper hex.  
 I - ignore hex at location 00 and turn on 'H'.  
 L - convert upper to lower case.  
 N - line number destination data.  
 O - treat file as object data.  
 Pn - page throw after n lines.  
 Q\$Z - quit copy after finding string s.  
 R - read and copy sys files.  
 S\$Z - start copy after finding string s.  
 Tn - expand tabs to column n.  
 U - convert lower to upper case.  
 V - verify file copy.  
 W - write over read only files.  
 Z - zero high order bit.  
 REN new ufn = old ufn File rename utility.  
 SAVEnufn Save n pages (256 bytes) to a disk file.

FIG. 4

Device:	Function:
LOGICAL:-	
CON:	console.
LST:	List information - printer.
PUN:	Send information - paper tape punch.
RDR:	Receive information - paper tape reader.
PHYSICAL:-	
BAT:	Batch, console in from RDR: console out
LST:	
CRT:	Console (Cathode Ray Tube).
LPT:	Printer.
PTP:	Paper tape punch.
PTR:	Paper tape reader.
TTY:	Slow console.
UC1:	User defined console.
UL1:	User list device.
UP1:	User punch number 1.
UP2:	User punch number 2.
UR1:	User reader number 1.
UR2:	User reader number 2.
Valid Assignments:	
CON = BAT: OR CRT: OR TTY: OR UC1:	
LST = CRT: OR LPT: OR TTY: OR UL1:	
PUN = PTP: OR TTY: OR UP1: OR UP2:	
RDR = PTR: OR TTY: OR UR1: OR UR2:	
DIR	- Displays all files on logged drive.
DIR d:	- Displays all files on drive d.
DIR afn/ufn	- Displays selected files.
ERA afn/ufn - File erase command.	
PIP d: = d: afn/ufn [options]	

One of the unique facilities of BOS is the ability within the operating system to produce a screen-based menu. This makes the design of a turnkey system very easy.

## CP/M 2.2 / CP/M 3.0 / CP/M 86

The single user/single tasking systems from Digital Research have many underlying similarities. 'DIR' has the same basic effect across the whole range; however in some varieties a command may have some extra facilities, CP/M 3.0 for example, expands this to the powerful DIR [FULL] option. A ►

Fig. 1 (far left) shows a summary of BOS addresses; Fig. 2 (ditto) contains the main BOS commands; Fig. 3 (above left) shows the BOS sub-commands; Fig. 4 (left) shows CP/M 2.2 command functions and assignments.

Fig. 5 (left) contains a list of PIP options.

STAT	- displays disk drive unused space.
STAT DEV:	- displays actual devices assigned.
STAT VAL:	- displays command summary / possible devices.
STAT log: = phy:	- assigns logical to physical devices.
STAT d: = R/O	- sets drive d to read only.
STAT d:afn/ufn	- displays files sizes and status.
STAT d:afn/ufn \$R/O	- sets file(s) specified to read only.
STAT d:afn/ufn \$R/	
W	- sets file(s) specified to read / write.
STAT d:afn/ufn	
\$SYS	- sets file(s) specified to system.
STAT d:afn/ufn \$DIR	- sets file(s) specified back to dir.
STAT DSK:	- displays disk characteristics.
STAT USR:	- displays active user areas.
SUBMIT ufn.sub	- submit allows the batching of CP/M commands.
TYPE ufn	- displays the contents of file to the screen.
USER n	- change to user number n (0-15).



COPYSYS - copies CP/M system to a new disk - menu driven.  
 DATE - set and display date (see conversion)  
 DEVICE - the device command replaces the STAT facility for assigning logical and physical devices and adds port customization facilities.

Logical Devices:	Device Type:	Usual Physical Assignment:
CONIN:	CONSOLE INPUT	KEYBOARD
CONOUT:	CONSOLE OUTPUT	SCREEN
AUXIN:	AUXILIARY INPUT	NULL
AUXOUT:	AUXILIARY OUTPUT	NULL
LST:	LIST OUTPUT	PRINTER

DEVICE - display/change current logical and physical assignments.

DEVICE NAMES - displays physical devices and their characteristics.

DEVICE VALUES - displays current logical assignments.

DEVICE phy - displays the attributes of the named physical device.

DEVICE log - displays the assignment of the named logical device.

DEVICE log: = phy{[options]} - assigns devices.

DEVICE log: = null - detaches device.

DEVICE phy [options] - sets attributes.

DEVICE {[PAGE, COLUMNS = n, LINES = n]} - display and set console layout.

Device options are XON (sets XON/XOFF protocol), NOXON (turns off the protocol) and baud rate from 50-19200.

DIRSYS - The same effect as DIR but also displays files with the SYS attribute set.

DIR and DIRSYS have in CP/M 3.0 some extra options if used with the below syntax.

DIR {d:} afn/ufn [options]

**DIR options:**

ATT - displays user attributes F1-F4.

DATE - displays date and time stamping if set.

DIR - displays file with dir option.

DRIVE = ALL - acts on all logged drives.

DRIVE = (A,B,C,...P) - acts on specified range of drives.

DRIVE = d - acts on drive d.

EXCLUDE - Displays files not matching the afn/ufn.

FF - paper form feed.

FULL - displays all available directory information sorted order, file name, size, attributes, password mode, time stamps and the drive label.

LENGTH = n - displays n lines before a table heading.

MESSAGE - displays drives and user numbers active during a search.

NOPAGE - continuous scroll of listing.

NOSORT - unsorted display.

RO - displays only files set to Read only.

RW - displays only files set to Read/write.

SIZE - displays file names and sizes.

SYS - displays only files set to sys.

USER = ALL - searches all user numbers.

USER = n - searches user number n.

USER = (0,1,...,15) - searches all user number specified.

The ERA command is extended to incorporate a confirm option.

GET - redirects CP/M to take its console input from a file (see PUT).

HELP - on line help utility for the CP/M operating system and its commands with facilities to create your own help files.

INITDIR - initialize directory for date time stamping.

PIP - as CP/M 2.2, but includes the 'A' or archive option, and 'C' or confirm for selective file copy, and if the file is protected must include the password (such as PIP a: = b: afn/ufn :pass [options]).

PUT - opposite to get, allowing console or printer output to a disk file.

RENAME - this is extended to a menu driven option if just RENAME is entered.

SET - this option controls most of the attribute setting in CP/M 3.0. It has the following syntax.

SET [options]  
 SET d: [options]  
 SET afn/ufn [options]

**Set Options:**

DIR - DIR attribute.

SYS - SYS attribute.

RO - read only.

RW - read/write.

ARCHIVE = OFF - archive mode off.

ARCHIVE = ON - archive mode on (see PIP option 'A').

F1 = ON/OFF - on or off user defined attribute 1.

F2 = ON/OFF - on or off user defined attribute 2.

F3 = ON/OFF - on or off user defined attribute 3.

F4 = ON/OFF - on or off user defined attribute 4.

SET [NAME = ufn] - disk label.

SET [PASSWORD = pass] - password protect a disk label.

SET [PROTECT = on/off] - enable/disable protection.

SET afn/ufn [PASSWORD = pass] - password protection to a file(s), the disk must be password protected and enabled before this can be used.

SET afn/ufn [PROTECT = mode] - protection mode for passwords, these can be read, write, delete or none.

Two of the following time and date stamping modes can be assigned.

SET [CREATE = ON]  
 SET [ACCESS = ON]  
 SET [UPDATE = ON]  
 SETDEF - This controls the disk search order and the console display of system messages.

SHOW - Show replaces many of the functions of STAT and adds a few of its own.

SHOW d: - displays logged drive, read/write access and space left.

SHOW [LABEL] - displays label and all attributes.

SHOW [USERS] - displays active users and their files.

SHOW [DIR] - displays free directory entries.

SHOW [DRIVE] - displays drive characteristics.

command may be replaced or enhanced - for example, the STAT command of CP/M 2.2 is superseded and expanded upon by the combination of SET and SHOW in CP/M 3.0. CP/M 2.2 is configured to have four logical devices, which perform conceptual functions - the user can address them without worrying about the inner workings (see Fig. 4).

In addition there are 12 physical devices some of which will have been patched in with all the necessary and complex driver routines for whatever com-

munication are required, whether they be printer, terminal or other ports. Therefore, the user can assign a pair of devices, one logical and one physical, and communicate with the minimum of problems.

PIP, the Peripheral Interchange Program (which is in most installations), is only ever used in its simplest form, as a file copying tool; however, as its name implies, it can be used in many more powerful ways: it can send a file to a device, receive data from a device and convert it to a file, and,

Fig. 6 (above) contains a list of CP/M 3.0 commands.



FIG. 7

CHKDSK -simple display of disk and memory status.  
 COMP {d:} {afn/ufn} {d:} {afn/ufn} - compare files.  
 COPY {options} {d:} {afn/ufn} {options} {d:} {afn/ufn} {options} -  
 DATE -display and enter date.  
 DEL {d:} {afn/ufn} -file delete command.  
 DIR {d:} {afn/ufn} {options}-simple directory listing. Option '/P'  
 pages the list and '/W' lists file names only across the screen.  
 PAUSE -temporary halt in the process of a batch  
 command.  
 REM -remark in a batch command.  
 REN {d:} {old afn/ufn} {new afn/ufn}-rename utility  
 TIME -display and enter time.  
 TYPE {d:} {ufn} -displays the contents of a file to the screen.

FIG. 8

CHDIR {d:} -displays current directory path (CHDIR = CD).  
 CHDIR {d:} -change current directory.  
 ECHO ON/OFF -enable or disable screen display during batch  
 operations.  
 FOR -simple loop structure for replaceable parameters  
 in the batch mode.  
 GOTO -batch goto label.  
 IF -batch if (or not) conditional  
 MKDIR {d:} path -creates a sub directory (MKDIR = MD).  
 PATH {d:} path -directory search.  
 PRINT -print queue.  
 RMDIR {d:} path -removes a sub directory, must be empty  
 (RMDIR = RD).  
 SHIFT -double up the number of replaceable  
 parameters in the batch mode.  
 TREE {d:} {/F} -lists out the tree directory, if '/F' is specified it  
 also lists the file in each directory.  
 VERIFY ON/OFF -disk write verify, toggle on or off.

FIG. 9

E(DIT -multi option text editor.  
 R(UN -executes the current work file  
 (compiling and linking if required).  
 F(ILE -filer - see later.  
 C(OMP -pascal compiler.  
 L(INK -links in P-code subroutines.  
 X(ECUTE -load and executes a Pascal code file.  
 A(SSEM -assembles 6502 assembler.  
 D(EBUG -not yet implemented.  
 U(SER  
 RESTART -retry last option.  
 I(NITIALIZE -warm boot.  
 H(ALT -cold boot.

ABORT -stops the execution of a program on the  
 virtual console.  
 ERAQ -erase with confirm.  
 SDIR -like DIRS, includes system files in  
 directory.  
 SYSTAT -detailed system status display.  
 VCMODE -displays and sets background/  
 foreground mode of the virtual consoles.

Fig. 7 (above left) contains  
 a list of MS/PCDOS 1/2  
 commands; Fig. 8 (above  
 right) lists the batch  
 commands; Fig. 9 (left)  
 shows the P-System  
 options.

## MP/M II

The main difference between the CP/M and MP/M, is that MP/M (Multi-Processing Monitor control program) is the former's multi-user brother. The first thing most users will notice is that the prompt is different. In a normal CP/M system the display for a user logged onto drive A would be: - A>; however, in the case of MP/M in addition to this, the area in which the user is logged is added; therefore a user on drive A in user area 5 would have the prompt: - 5A>. In addition to the facilities described, DIR, ERA, ERAQ, PIP, REN, SDIR, SET, SHOW, STAT, SUBMIT, TYPE and USER MP/M has some extra programs and commands these are presented below.

## MS/PCDOS1 / MS/PCDOS2

MSDOS and PC DOS are very similar, the only major differences being the machine specific commands, such as port attribute setting therefore these will be omitted from the discussion. To save space we will henceforth refer to both systems as MSDOS. MSDOS 1 is very similar to the basic versions of CP/M (2.2 and 86), but has fewer features.

## MS/PCDOS 2

In addition to the commands (in Fig. 7.) MSDOS 2 incorporates many UNIX-like features and an extended batch facility. The directory now incorporates a UNIX type tree structure, and therefore if a file is to be accessed which is not in the current (or working) directory then to find it a 'path name' must be provided. This path name must proceed any file name in command, if required. The path name consists of the sub directory name separated by a backslash '\'. If the line starts with the backslash then the path begins at the root (top most) directory.

DIR1 \ DIR2 \ DIR3 \ FILENAME.EXT -PATH NAME  
 \ DIR1 \ DIR2 \ DIR3 \ FILENAME.EXT -PATH NAME  
 STARTING AT THE ROOT

The Batch command has been greatly extended with the addition of IF, GOTO replaceable para-

lastly, transfer from device to device. (A list of PIP options are given in Fig. 5).

## CP/M 3.0 (PLUS)

CP/M 3.0 (or CP/M Plus as it is also called) is the latest version of the 8-bit CP/M series following CP/M 2.2. It incorporates many improvements which bring it close to CP/M 86 and CCP/M, and some that set it apart. The basic DIR, ERA, PIP, REN, SUBMIT, TYPE and USER are the same; however, a number, such as DIR are extended. In addition, some new commands are introduced, these are DIRSYS, COPYSYS, DATE, DEVICE, GET, HELP, INITDIR, PUT, SET, SETDEF and SHOW. We will cover each new command in turn after providing details of the extra options provided on the 'old' commands (given in Fig. 6).

## CP/M 86

This has many similarities to the other CP/Ms; the equivalents are DIRS to DIRSYS, COPYDISK to COPYSYS, and TOD to DATE. The following facilities have already been covered elsewhere. DIR, ERA, PIP, REN, SUBMIT, TYPE and USER.

## CCP/M

Concurrent CP/M has many similarities to MP/M and CP/M plus. A number of extra commands in addition to the DIR, DATE, ERA, HELP, INITDIR, PIP, REN, SUBMIT, TYPE and USER have been added. These are:





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meters. A batch job is a file of DOS commands with the extension .BAT which is executed by typing in the file name minus the extension. The extra commands will be described in the next section along with the other new MSDOS 2 commands.

## P SYSTEM

This section on the UCSD P operating system will concentrate on the version installed for the Apple II, as this is the machine that most people are likely to come across. The system is menu driven, and therefore in the conversion chart the option required is given rather than the full command. On loading the system, the user is presented with a series of options. These are selected by pressing the first letter of the required option. If the Apple in use has a 40 column screen, then to view the last three a '?' has to be hit. The options are summarized in Fig. 9.

The FILE option covers all the commands to be tackled in this series. The options available are outlined in Fig. 10:

## PET

The Commodore Pet, like the Apple, is a simple machine with few operating system commands; it also has its own peculiarities: not 'slots' in this case, but the IEEE 44B communications bus. All the systems commands, BACKUP, CATALOG, COPY, HEADER, RENAME and SCRATCH will be covered in the conversion table next month.

## TRSDOS

The Tandy operating system TRSDOS has for a simple system many useful commands. It is especially unusual in having a help facility. In addition the system uses a '/' and not a '.' to mark the start of the file and the disk designator is 'd' and not 'd:'. The system has a range of password protection facilities, which can protect whole disks and individual files. On formatting a disk, a master password can be assigned, if an individual file can be accessed by the full command (if protected) by the command below.

filename/ext.password:d

The password is set by the ATTRIB command:

ATTRIB ufn (vis,ACC=pass,UPD=pass, PROT=level)

Prot	
<b>Levels:</b>	<b>Degree of access:</b>
FULL	full access no protection.
KILL	kill, rename, read, execute and write — total access.
NAME	rename, read, execute and write.
WRITE	read, execute and write.
READ	read, and execute.
EXEC	execute only.

The BACKUP, COPY, DATE, DIR, ERROR, FORMAT, HELP, KILL, LIST, RENAME and TIME will be covered in the conversions tables next month. In addition there are the commands given in Fig. 11.

## UNIX

Unix is a complex and sophisticated operating system with many commands, some of which most people will never use. The majority of the commands have been summarized in the tables; however, there are quite a few extra options that do not fit in to the categories of the chart and some that do have extra options that need expanding upon. Unix has a tree directory structure and the ability to PIPE — send the output of one process to the input of another. The simple commands that will

FIG. 10

B(AD-BLOCKS	- test disk block integrity.
C(HANGE	- renames file or disk.
D(ATE	- display and enter date.
E(XTENDED-DIRECTORY-LIST	- detailed directory listing.
G(ET	- gets a work file.
K(RUNCH	- packs disk (removes unused space).
L(IST-DIRECTORY	- simple directory listing.
M(AKE	- produces dummy disk file.
N(EW	- clear work file.
P(REFIX	- change default work vol.
Q(UIT	- exit from filer to main menu.
R(EMOVE	- delete disk file.
S(AVE	- saves work file.
T(RANSFER	- copy (or list to screen/printer).
V(OLUME	- lists volume assignments.
W(HAT	- name and state of work file.
X(AMINE	- fixes or marks bad blocks.
Z(ERO	- erase and rename a disk directory.

Vol No:	Volume Name:	Input/output Device:
#1:	CONSOLE:	screen keyboard with echo.
#2:	SYSTEM:	keyboard without echo not used
#3:		not used.
#4:	DISK NAME:	boot disk (slot 6, drive 1).
#5:	DISK NAME:	2nd disk drive (slot 6, drive 1).
#6:	PRINTER:	printer (slot 1).
#7:	REMIN:	remote input (slot 2).
#8:	REMOUT:	remote output (slot 2).
#9:	DISK NAME:	5th disk drive (slot 4, drive 1).
#10:	DISK NAME:	6th disk drive (slot 4, drive 2).
#11:	DISK NAME:	3rd disk drive (slot 5, drive 1).
#12:	DISK NAME:	4th disk drive (slot 5, drive 2).

FIG. 11

AUTO command	- auto load after boot up.
BUILD ufn	- building of a batch command file.
CLOCK {(OFF)}	- toggle real time clock screen display.
DO ufn	- execute the file create by build.
DUAL {(OFF)}	- dump to printer of screen contents.
ERROR n	- displays description of an error number.
FORMS (WIDTH = n, LINES = n)	- forms set up.
FREE:d {(PRT)}	- disk free space map.
LIB	- command list.
LIST ufn {(PRT, SLOW, ASCII)}	- list a file to screen (or printer).
MASTER (DRIVE = d)	- assign master drive.
PROT :d(PW, LOCK)	- use or change master password. pw = allows to change master password, lock assigns master to all unprotected users.
PURGE :d{(type)}SYS/INV/	
ALL	- mass deletion.
ROUTE (orig = s, dest = s)	- input/output routing, substitute for sets of the two letters as below.
DO = display	
PR = Printer	
KB = Keyboard	
RI = RS232 input	
RO = RS232 output	
SETCOM (OFF, WORD = n, BAUD = n, PARITY = n, MODE)	- port setting.
OFF	- turns RS232 off.
WORD	- number of bits 5-8.
BAUD	- 50-9600.
STOP	- stop bits 1 or 2.
PARITY	- 1 = odd 2 = even 3 = none.
MODE	- wait or nowait.
WP (DRIVE = d)	- write protect drive d.
WP	- write protect off.

be covered in the table in next month's issue of Computer Answers are \$CAT, \$DATE, \$CP, \$MV and WHO. The rest are given in Fig. 12.

Fig. 10 (top) lists P System commands; Fig. 11 (below) lists TRSDOS additional commands.



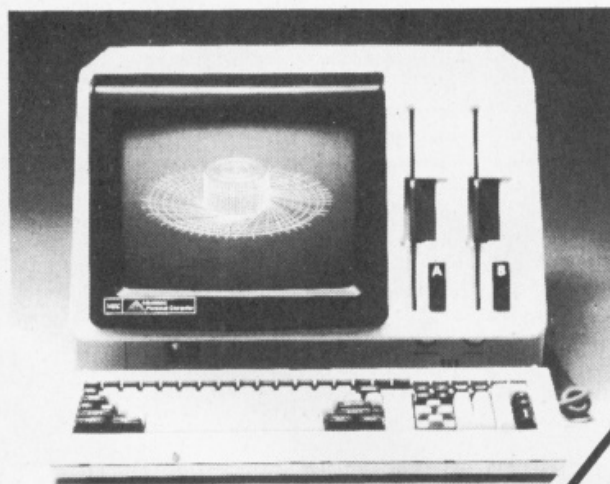
Fig. 12 (right) gives a list of Unix operating commands.

FIG. 12

<b>\$AT</b> time {(day)} {file}	- run command at specified time.
<b>\$CAL</b> {(month)} year	- prints a calendar for a single month (month 1-12) or a full year (year 1-9999).
<b>\$CAT</b> ufn	- display file to screen.
<b>\$CD</b>	- Return to the login directory.
<b>\$CD</b> dir	- change working directory to dir.
<b>\$CHMOD</b>	- {who} op-code permission ufn.
<b>Who:</b>	
u	- login owner (user).
g	- group.
o	- all others.
a	- all of above (default).
<b>Op-Codes:</b>	
+	- add permission.
-	- remove permission.
=	- assign absolute permission.
<b>Permissions:</b>	
r	- read.
w	- write.
x	- execute.
u	- user permission from present mode.
g	- group permission from present mode.
o	- other permission from present mode.
<b>\$COMM</b> ufn ufn	- compare the similarities and differences between two sorted files.
<b>\$CRYPT</b> key	- encode/decode using a encryption key.
<b>\$FIND</b>	- sophisticated file searching utility.
<b>\$GREP</b>	- search file for a specified string.
<b>\$KILL</b> n	- kill process number n.
<b>\$LPR</b>	- option ufn Queue file for printing.
<b>\$LS</b>	- directory list.
<b>\$MAIL</b> loginname	- send or receive mail.
<b>\$MAN</b>	- online manual.
<b>\$MKDIR</b>	- create directory.
<b>\$PR</b>	- print a file.
<b>\$PS</b>	- status of active processes.
<b>\$PWD</b>	- path name of working directory.
<b>\$SORT</b>	- sorting utility with many options.
<b>\$SPELL</b>	- spell check (even an English option!).
<b>\$STTY</b>	- full terminal port and options configure.
<b>\$TTY</b>	- path name to users terminal.
<b>\$UNIQ</b>	- removes multiple occurrences in a sorted file.
<b>\$WC</b>	- counter with character, word and line options.
<b>\$WRITE</b> user	- writes on another terminal.

By Eric Bagshaw, of the National Computing Centre.

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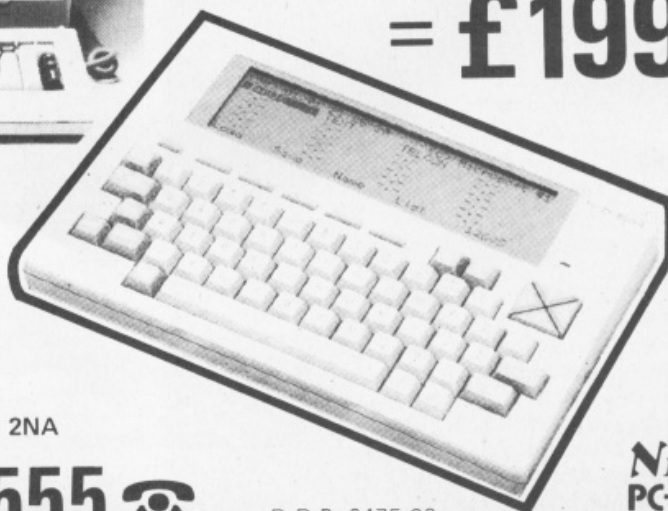
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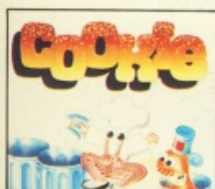
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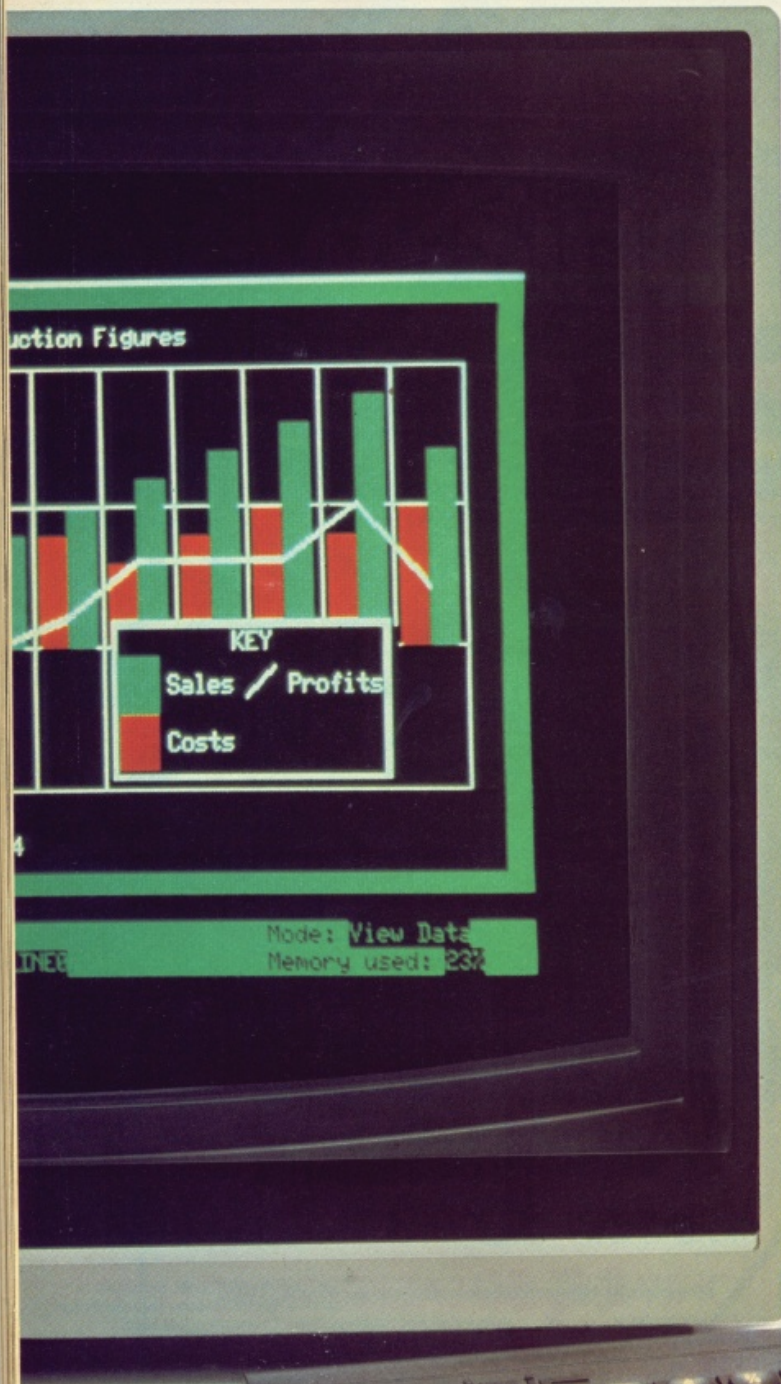
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# New-Sinclair QL

## There's no comparison chart, b



The Sinclair QL is a new computer.

Not just a new Sinclair computer, but a totally new sort of computer – nothing like it exists anywhere.

It's not just a bit better than this, or a bit cheaper than that – it's a computer that's very hard to compare with anything. Just check the features below – and if you don't agree, take up the challenge at the end of the advertisement.

If you do agree, there's only one course of action you can take... get yourself a Sinclair QL at the earliest possible moment.

### The Sinclair QL has 128K RAM. Big deal?

Several micros offer 128K RAM, or more, as standard. The 'What Micro?' table for December 1983 lists over 50 of them – but 40 of the 50 micros listed cost over £2,500!

The Sinclair QL offers you 128K RAM for under £400, and an option to expand to 640K. That's a lot of bytes to the pound!

### The Sinclair QL has a 32-bit processor. Who else?

Under £2,700, nobody. Even the new generation of business computers, such as the IBM PC, are only now beginning to use 16-bit processors.

At prices like this, the Motorola 68000 family – widely regarded as the most powerful microprocessors available – will remain a luxury.

Yet with the Sinclair QL, the 32-bit Motorola 68008 is available for less than £400.

You can also be sure that the QL will not become outdated. 32-bit architecture is future-proof.

32-bit processor architecture, 128K RAM, and QDOS combine to give the QL the performance of a mini-computer for the price of a micro.

### Exclusive: new QDOS operating system

No competition! QDOS sets a new standard in operating systems for the 68000 family of processors, and may well become the industry standard.

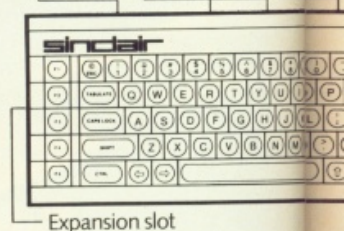
QDOS is a single-user, multi-tasking, time-sliced system using Sinclair's new SuperBASIC as a command language.

One of its most significant features is its very powerful multi-tasking capability – the ability to run several programs individually and simultaneously. It can also display the results simultaneously in different portions of the screen. These are features not normally available on computers costing less than £7,000.

### Eleven input/output ports

QL ROM Cartridge slot

2 x Joystick ports 2 x RS-232C



### New professional keyboard

The QL keyboard is designed for fast input of data and programs.

It is a full-size QWERTY keyboard, with 65 keys, including a space bar; left and right-hand shift keys; five function keys; and four separate cursor-control keys – key action is positive and precise.

A membrane beneath the keyboard protects the machine from dust (and coffee!), and for users who find an angled keyboard more comfortable, the computer can be raised slightly at the back by small detachable feet.





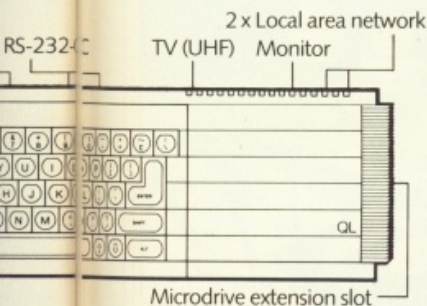
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# , because there's no comparison!

## Advanced new friendly language – Sinclair SuperBASIC

The new Sinclair SuperBASIC combines the familiarity of BASIC with a number of major developments which allow the QL's full power to be exploited.

Unlike conventional BASIC, its procedure facility allows code to be written in clearly-defined blocks; extendability allows new procedures to be added which will work in exactly the same way as the command procedures built into the ROM; and its constant execution speed means that SuperBASIC does not get slower as programs get larger.



## Two 100K microdrives built in

The Microdrives for the Sinclair QL are identical in principle to the popular and proven ZX Microdrives, but give increased capacity (at least 100K bytes each) and a faster data-transfer rate. Typical access speed is 3.5 seconds, and loading is at up to 15K bytes per second. The Sinclair QL has two built-in Microdrives. If required, a further six units can be connected.

Four blank cartridges are supplied with the machine.



## Included – superb professional software

The suite of four programs is written by Psion specially for the QL and incorporates many major developments. All programs use full colour, and data is transportable from one to another. (For example, figures can be transferred from spreadsheet to graphics for an instant visual presentation.)

### Word-processing



Certain to set a new standard of excellence, QL Quill uses the power of the QL to show on the screen exactly what you key in, and to print out exactly what you see on the screen.

A beginner can be using QL Quill for word-processing within minutes.

QL Quill brings you all the facilities of a very advanced word-processing package.

### Spreadsheet



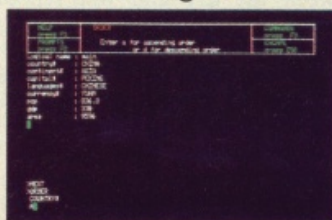
QL Abacus makes simultaneous calculations and 'what if' model-construction easier than they've ever been. Sample applications are provided, including budget-planning and cash-flow analysis. QL Abacus allows you to refer to rows, columns and cells by names, not just letters and numbers. Function keys can be assigned to change a variable and carry out a complete 'what if' calculation with a single key-stroke.

### Business graphics



QL Easel is a high-resolution colour program so easy to use you probably won't refer to the manual! It handles anything from lines, shaded curves or histograms to overlapping or stacked bars or pie charts. QL Easel does not require you to format your display before entering data; it handles design and scaling automatically or under your control. Text can be added and altered as simply as data.

### Database management



QL Archive is a very powerful filing system which sets new standards, using a language even simpler than BASIC. It combines ease of use for simple applications – such as card indices – with huge power as a multi-file data processor.

An easy-to-use labelling facility means that you don't have to ask for your file by its full name – a few letters are enough.

## New – the Sinclair QLUB

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# KEEPING IT CLEAN

IF YOUR SYSTEM IS CRUNGED WITH CRUD AND GROTTED WITH GRUNGE, WHAT'S AROUND TO HELP CLEAR IT OUT? WE FOUND OUT...

It is amazing how inspiring a sparkling clean micro can be – just remember when you first got it! A clear screen can literally be less of a headache than a filthy one; however, the biggest advantage to be gained from a well-maintained micro, apart from piece of mind, is reliable data loading.

The most interesting part of our investigation concerned data recorder cleaners. The majority of these are quite understandably supplied by the same manufacturers who service the audio market, and the difference between these markets is significant: while the audio world places a good deal of emphasis on the tone head, the pinchroller and capstan are more important to the computer world. If dirty, these two parts of the recorder can affect tape speed and prevent accurate data read/writing. A clean tone head is not as critical.

The cheapest form of data (cassette) recorder cleaner is the cloth-ribboned cassette type. These tend to get dirty very quickly and therefore need frequent replacement. There is also a danger that the abrasive action of rubbing previously collected dirt across the head will scratch it. WH Smith sells a Bib-made data cassette head cleaner which comes with a small tube of cleaning fluid. At £1.99 (inc. VAT), it represents a reasonable compromise between the dry and wet schools of cleaning thought. Presumably, if your cloth/cassette wears out before you run out of fluid you could buy just the cassette and save even more money.

A rather different approach to head cleaning is taken by Allsop (available from Three Marketing). It has a computer deck cleaner in the form of a transparent cassette case; instead of a cloth tape, this cleaner has a set of felt pads onto which the user sprays the special cleaning fluid supplied. A series of cogs cause the tone head pad to automatically wipe off the debris. When we tested the Allsop cleaning cassette we found that it became dirty very quickly; therefore, if you are serious about keeping your data recorder clean, we'd recommend Allsop's audio version, as the pads are replaceable and as few (if any) data recorders have twin capstans, you in effect already have a spare. Allsop makes the audio version deliberately so that the capstan pads clip in and out, making them disposable.

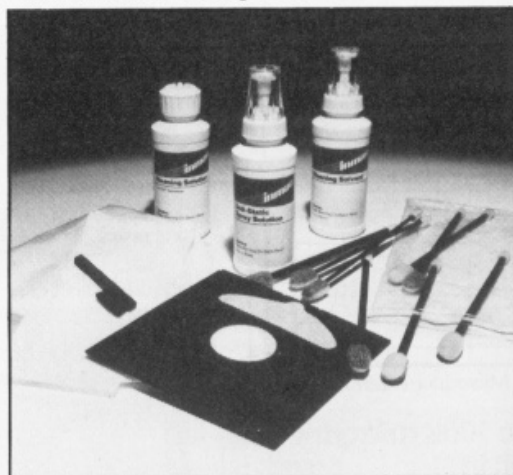
Despite the praise just heaped on Allsop products, a cotton bud soaked in a good cleaning fluid could still find oxide that the cassette had missed, but for sheer convenience the cleaning cassettes win hands down. Good news for Epson HX20 owners is that Allsop also makes a micro cassette version of its cleaning cassette.

Micro owners with more money can afford disk drives instead of cassette, and this seems reflected in the price of drive head cleaners – the cheapest complete system we spotted was around £10 or £6 for just a disk. Just like cassette cleaners, completely dry disk drive cleaners are available: Inmac does one, which doesn't require the user to add solvent. The 'dry' method of cleaning has its advantages in that the user does not get solvent everywhere.

On the other hand, the danger with dry cleaning is again abrasion – particles of dirt cleaned off will

scratch the drive head. The way out of this is to provide disposable cleaning disks which slip inside the disk jacket. The cleaning disk can be sprayed by the user or come pre-saturated in a sachet (the latter being more expensive).

When buying, ask whether the cleaning disk is suitable for double sided disk drives. Few manufacturers sell single-side-only disk cleaners, but it is a point to check. Automation Facilities, which makes the Floppicle head cleaners, claims that other manufacturers use too thick a knock-out for double sided drives. This can lead to the cleaning disk failing to clean a single drive properly. To overcome this Automation uses a peel-off label. (Frankly, we didn't come across this problem ourselves.)



The Clean Cycle kit from Inmac (priced £32).

There is an element of risk in using disposable disk drive cleaners in that the cleaning disk might disintegrate and break up in the drive. It is also important for the solvent to be cleaned off the head thoroughly. For this reason repeated use of the same drive cleaner is not recommended – if the cleaner looks filthy it should be thrown away regardless of how many times it has been put through.

At present only 5¼ inch and 8 inch disk drive cleaners are on the market. The big cleaning companies are developing items to cope with the new 3 to 3½ inch drives (many of which are now available for the Beeb). Automation told us that it expects to have a disposable disk which fits inside a cartridge and should be suitable for machines like the Apricot. For the present, a company like MAP will clean the Sony 3.5 inch drives for you, should you so desire.

Finally, there is an interesting dispute over approvals for disk cleaners – obviously they can't all have the only product approved by the big disk drive manufacturers! Interestingly, MAP said that it had ended up supplying 3M cleaning kits because of the experience its own maintenance department had when testing various makes on approximately 50 machines.

It was hard to find much wrong with cassette and disk drive cleaners, but screen cleaners were some-





Automation Facilities' personal computer kit includes 5 1/4 inch floppy disk drive cleaner (priced £17.50).

thing else (when we came to trying the products for ourselves). For a start nothing seemed to work on the mesh screen that covers our Sirius monitor. ACT said it used foam cleaner, but we came to the rapid conclusion that actually taking the cover off was the only way to clean that particular monitor. We did try a roller cleaner from Action that worked well on external dust, but not compacted dirt.

On CRT (glass) screens the purpose-made cleaning fluids we tried seemed to work perfectly adequately. Brian Mansfield of Spray Systems explained in some depth why he thought specially formulated screen cleaners should be used. One problem with using washing-up liquid (detergent) and a wet rag is that everybody hates having smelly rags around! On a more serious note, it is difficult to prevent smears with washing-up liquid plus the fact that detergents almost inevitably contain salt, which is corrosive.

Brian Mansfield also put a persuasive argument against using the same kind of solvents used for disk drives onto the VDU screen. Most drive solvents use isopropyl, which is both inflammable and toxic and thus not the kind of thing you want to spray all over yourself or the micro. His own company's product is formulated to be non-flammable and non-toxic, as well as including corrosion inhibitors. When you consider that its Clean Screen costs around £2.70, it seems worth the trouble. Automation makes anti-static screen wipes which are reasonably priced.

The majority of cleaning equipment manufacturers avoid selling their computer products in aerosol form for two good reasons. The less important one for micro users is that aerosols mess up the controlled environment so beloved by mainframes, more important is that aerosols often have propellant gases which are inflammable. The by-product of using pump sprays or just simple bottles instead is that you actually get more for your money.

The same sort of argument can be levelled against lint free cloths which cleaning companies supply. Although they work, such cloths take up far more room in a cleaning kit than they merit, and therefore cost more than they are really worth. Unless you are really fussy, using standard tissues or toilet roll can be just as good. The above does not really apply to

cleaning circuit boards, as they can be extremely sensitive. In reality a tool like the Dust-Off II (from Pelling & Cross) would be the ideal piece of equipment to use. It uses a canister of pressurised gas to blow away debris, and is priced around £25.

For general cleaning there are a variety of cleaners available for removing the dirt from the keyboard and body of the micro. The foam-type cleaners seemed to work very well but a lot did depend on personal preference. For instance, one cleaner did a very effective job, but left behind a rather unpleasant smell. Again, the special cloths provided for this kind of job seemed very expensive for what they were, and toilet roll would appear to be just as good (and far easier to obtain).

Part of the reason for keeping your micro bright and sparkling is to reduce the chances of dust and dirt finding its way onto your disks or cassettes, thus, it does make sense to take advantage of the anti-static sprays and solutions on the market to cut down the amount of dust and static around your micro. However, while this does seem rather OTT for your average home owner, people who work in nylon-carpeted offices might find them useful.

So far no real mention has been made of how to clean peripherals like printers. For the casing, the same foam and spray cleaners intended for terminal can be used. To clean the type font there are a variety of methods that you can use. Inmac provide a special font brush for removing the heavy deposits, lighter deposits could then be removed with one of their cleaning wands (a heavy-duty cotton bud) dipped in solvent. A more sophisticated method would be to buy special daisy wheel, thimble and golfball cleaning kits from a company like DNCS or Action, priced around £10.

When buying cleaning materials it does pay to shop around. Spectrum shops sell a Leda disk care kit which includes a VDU cleaner and air blast aerosol as well as disk cleaner for £12.95 (inc. VAT), which seems good value.

Those micro owners who want to thoroughly disassemble their micro to clean it, should try camera shops for air blasters and lint-free cloths, while audio shops are alternative sources for quality cassette head cleaners.

By Tony Dennis, deputy editor.

## CLEANERS:

### Acco,

Bretton Way,  
Bretton, Peterborough.  
Tel: (0733) 264711.

### Action,

6 Abercorn Trading Est,  
Manor Farm Road,  
Alperton,  
Wembley, Middx.  
Tel: (01) 903 3921.

### Automation Facilities,

Blakes Road,  
Wargrave, Berkshire.  
Tel: (073522) 3012.

### Consup,

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London SE1 7EN.  
Tel: (01) 928 3252.

### Crowndata,

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Macclesfield,  
Cheshire. SK11 6JF.  
Tel: (0625) & 615050.

### Disking,

Freeport, Liphook,  
Hants.  
Tel: (0428) 722563.

### DN Computer Services,

Green Lane, Heywood,  
Manchester.  
Tel: (0706) 67567.

### Inmac (UK),

Davy Road,  
Astmoor, Runcorn,  
Cheshire WA7 1PZ.  
Tel: (09285) 629819.

### MAP,

105-107 Windsor Road,  
Oldham OL8 1RP.  
Tel: (061) 624 5662.

### Password Electronics,

62 Normandy Road,  
Alton, Hants.  
Tel: (0420) 86977.

### Pelling & Cross,

Wooburn Industrial Park,  
Wooburn Green, Bucks.  
Tel: (06285) 28121.

### Spray Systems,

275-276 Argyll Avenue,  
Slough, Berks.  
Tel: (0753) 33037.

### Spectrum,

Burrowfield,  
Welwyn Garden City,  
Herts.  
Tel: (07073) 34761.

### Stralfors Data Products,

Techno Trading Estate,  
Bramble Road,  
Swindon, Wilts.  
Tel: (0793) 37837.

### Three Marketing (UK)

1 Berens Road,  
London NW10 5DV  
Tel: (01) 969 2514.



# Exactly what been looking

A microcomputer is only as useful as the software package run on it. And - until now - finding the package tailored to your needs (or your customers') hasn't been too easy.

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We've included details of over 3,000 painstakingly edited business packages, as well as some of the more exciting games.

PRODUCTS 3 ACCOUNTING GENERAL PACKAGES		
<b>ABC Invoicing/Accounting Business Controller (ABC)</b> Supplier: ABC Software Ltd Cost: £199.95 Index categories: General packages (301) Description: The ABC Invoicing system is one of a series of modular packages in the Accounting Business Controller which is an integrated suite designed specifically for the 'M' range of Sord Microcomputers. ABC Invoicing is integrated directly with ABC Sales, stock control and nominal ledger modules. Invoices, credit notes, delivery orders, packing slips produced on plain or pre-printed stationery. Choice image layout available with invoice depth up to 100 lines. Facility to set up a product line in ABC Stock Package not being used. 15 extra descriptions and nine VAT rates. Interactive stock and credit control. Selection of discount options, price overrides and invoice time. Invoice line recall and edit. Direct update of sales and stock files. Hardware: Sord M23 all models; Sord M243 all models; Sord M343 all models. Operating System: Sord operating system. Minimum Memory: 40 Special peripherals: None Date first operational: 1981 No. of users: 10 Is documentation available separately? Y Cost: £1.10 per manual Associated Packages: ABC Stock, Sales Ledger and Nominal Ledger. Warranties: 1 year Approved by: Occupational interests ABC Nominal Ledger/Accounting Business Controller (ABC)		
which is an integrated suite designed specifically for the 'M' range of Sord Microcomputers. The system allows full stock control facilities which direct integration to ABC Invoicing and Sales Ledger Modules. Up to 25,000 stock lines which 99 product groups. Picking facilities for sales, receipts, orders, returns, allocations and adjustments. Your selling and two cost prices per item with global classified by activity, location, class, units of sales and VAT rate. Reports include: Sales activity, month and year to date, stock valuation, profitability and gross margins, price lists, future guide and re-order schedules, current, low and express stocks. All reports shown by user defined parameters. Hardware: Sord M23 all models; Sord M243 all models; Sord M343 all models. Operating System: Sord Operating System. Minimum Memory: 64 Special peripherals: None Date first operational: 1981 No. of users: 200 Is documentation available separately? Y Cost: £1.10 per manual Associated Packages: ABC Invoicing and Sales Ledger. Warranties: 1 year Approved by: Occupational interests ABC Sales, ABC Purch/Nom, ABC Stock/ABC Accounts		
Index categories: General packages (301) Description: GMS provides all regular accounting needs. Credit & Purchase Ledgers, Statements, VAT Returns, Sales Analysis & Stock Control etc. However, GMS also offers increased control by producing a full Net Worth statement; some fully designed for Service Station use. The Net Worth statement shows sales, gross and losses by department. There is a month and year to date analysis and balance sheet with forecast. The assets and liabilities determine the true Net Worth, checked against the Net Profit. There is a whole page of performance indicators and statistical information such as Daily Sales figures, Wages to Gross Profit, Daily Operating Costs, Net Profit per gallon, Petrol Gross Profit per gallon, sales per 1,000 gallons of petrol and credit card sales as a percentage of Motor Fuel Sales. Hardware: Commodore 8032/8050/8033 Operating System: CPM DOS Minimum Memory: 32K Special peripherals: None Date first operational: Late 1982 No. of users: 15 Is documentation available separately? No Associated Packages: Payroll from Computations Warranties: None Approved by: Occupational interests Hired Hand		
Supplier: AC Software Ltd Cost: £199.95 Index categories: General packages (301) Description: Hired Hand provides plant or tool hire companies with a comprehensive invoicing package allowing six items stock control and sales ledger. Own hardware available on request.		
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A glance at our twelve main category headings confirms just how comprehensive Microcomputer Software Directory is. 3,100 software products are listed, under these titles: Systems Software\* Utilities\* Accounting\* Management Systems\* Other Business & Commercial Systems\* Professional Services\* Industry & Manufacturing\* Retail & Distribution\* Scientific\* Educational\* Government\* Games/Home/Hobby\* Miscellaneous\*

Each entry gives the package name, function, supplier, cost and also tells you which machines it will run on.

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If you already have a machine, you'll want to know about compatibility. So we've included an index by machine make and model. And, just to make life easier still, we also cross refer machine type with operating system.

PRODUCTS 3 ACCOUNTING GENERAL PACKAGES		
<b>Sord</b> Operating system: Sord Operating System Machine model: Sord M23 - all models, Sord M243 - all models, Sord M343 - all models Memory: 64 Package: ABC Stock Control Accounting Business Controller (ABC) (page 24) Supplier: ABC Software Ltd. Machine model: Sord M23 MKII, MKV, MKVI; Sord M243 - all models, Sord M343 - all models Memory: 64 Package: ABC Nominal Ledger/Accounting Business Controller (ABC) (page 23) Supplier: ABC Software Ltd.		



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In short, if you want to find exactly what you're looking for, Microcomputer Software Directory is exactly what you've been looking for.

[illegible]

**Cost:** £1,800  
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**Commodore 64 Machine Code Master**, by D Lawrence and M England.

**M**achine code programming is one of those things that either fires you with enthusiasm to squeeze the last byte and microsecond out of your program – or leaves you cold.

For many applications, only machine code is good enough. The trouble is that programming in assembly language is a very time-consuming affair without the right support software – a monitor and assembler.

*Commodore 64 Machine Code Master* aims to provide those essential pieces of system software for users of the Commodore 64. It also gives some examples of machine code in the form of modifications to the Basic interpreter. It is not, as the subtitle claims, a library of machine code routines; sure there are some machine code routines in there, but primarily the book is about an assembler. Neither is it an introduction to assembly language or assembly language programming for the 6502 or 6510 micro processor. If you don't already know how to program in assembly language you'll have to look elsewhere.

The first chapter of the book covers a monitor program. This is a piece of software, in this case written in Basic, which lets you examine and alter the contents of memory. In the old days, simple monitors were the only way of communicating with micros – and a tedious business it was. Monitors still have their uses if you're programming in machine code, though.

The next section covers a disassembler program which translates machine code programs into assembly language. If you know what you're doing programs are marginally more comprehensible in this form than as a stream of hex – a handy utility both for checking your own programs and taking apart other people's.

The rest of the first part of the book covers the assembler program itself, along with its associated editor. Again, the whole thing is in Basic, which proves that it is possible to write an assembler in Basic. It also shows that it's not a very good idea: even with the full explanations provided, the program is very difficult to follow. This is not for lack of effort on the part of the auth-

**commodore 64 machine code master**

A library of machine code routines

david lawrence & mark england



ors, although a few diagrams or flowcharts might have helped to illustrate some tenuous points. The problem lies in part with the difficulty of the concepts – an assembler is quite a complicated program; mostly, though, the trouble is the primitive unstructured Basic of the Commodore 64, which hides the concepts in a mess of line numbers.

One interesting point is the provision of checksums for each line of the program, along with a routine to check them. This should help trap some of those typing errors that always seem to creep in.

The second part of the book provides some machine code routines which extend the commands available in Basic. Reviving programs which have been accidentally deleted, removing superfluous REMs and spaces and deleting multiple lines are some of the additions. In the process you can learn a lot about how the Basic interpreter works, though again some diagrams might have helped.

This book will give you an inexpensive assembler for the 6502 and a good idea of what a complex program an assembler is. Once you've got it running the fun has only just begun.

**Practical Basic Programming**, by PE Gosling.

**O**nce you've learned to program, but before you've gained the confidence needed to embark on writing your own programs, you might want some practice in implementing 'real life' problems in Basic. The aim of this book is to show the reader how to write practical and useful Basic programs.

The first chapter gives a brisk survey of the features of Microsoft Basic, which is used throughout the book. As one of the more 'standard' Basics

around, Microsoft Basic should present few problems, but it's as well to start off with a clear idea of the language we're using.

The next chapter contains a very useful set of programs with bugs in them – deliberate bugs, that is, which it's your task to spot. Some of the programs are quite complex, doing things like hash coding and string processing. It's thus quite a challenge to get them sorted out. For the more difficult programs sample input is given along with the required output.

This would seem to be a good way to get to grips with Basic. You don't have to write the whole program yourself, but you certainly need to understand what's going on if you're going to find the bugs. Unfortunately no solutions are provided. It would have been nice to have had some suggested solutions, both for comparison with your own and for reference if you got stuck.

The next two chapters, which together form about half of the book, consist of a number of problems. These are generally of a business or data-processing type, and range from simple calculations of bills and wages to more complex processing of census and address list information. In each case a statement of the problem is given. This is followed by some general suggestions as to how it might be solved, along with fragments of code where appropriate. Test data is provided, as is a sample of what the final output might look like (some of this is a bit over the top – with almost ten pages of information on imaginary houses to illustrate a program for estate agents).

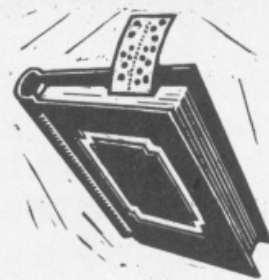
The techniques suggested for solving the various problems are quite valid, but perhaps more space could have been devoted to explaining them more fully; the book seems to concentrate on the generalities of the problems rather than the specifics of how they might be implemented. This is not necessarily a bad thing, it just means that you'll need to be quite familiar with the mechanics of programming to be able to take advantage of the book.

If you want to look at 'business' applications this could be the right approach for you.

**By Ron Yorston, a research assistant in computational physics.**

## DATA FILE

### BOOKSHELF



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*Commodore 64 Machine Code Master*, by D Lawrence and M England (Sunshine), 191 pages, priced £6.95.

*Practical Basic Programming* by PE Gosling (Macmillan), 106 pages, priced £3.95.



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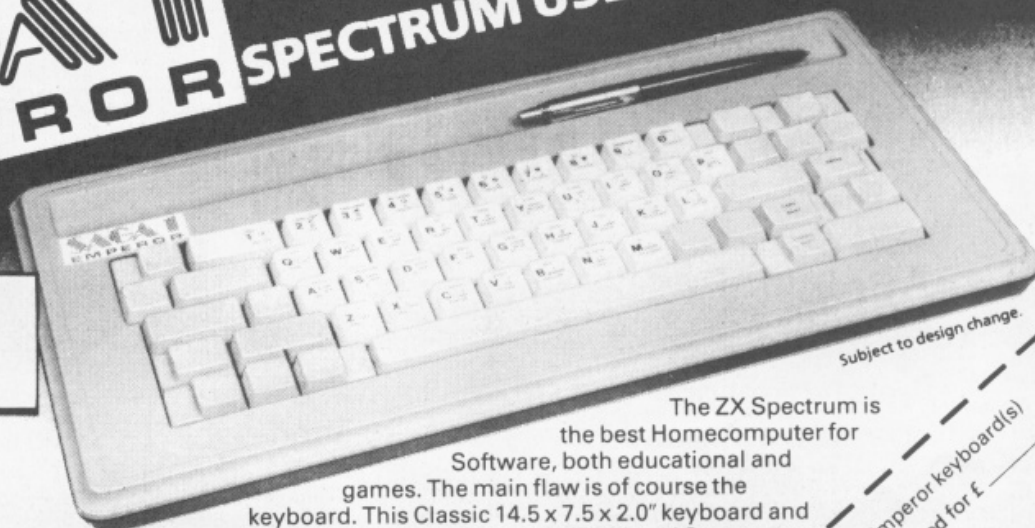
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# 'SHARKS' BITE BACK

It was the French philosopher Proudhon who coined the phrase 'property is theft'; 125 years later Malcolm X expressed these same sentiments in a rather more forceful tone: 'Show me a capitalist, and I'll show you a bloodsucker'.

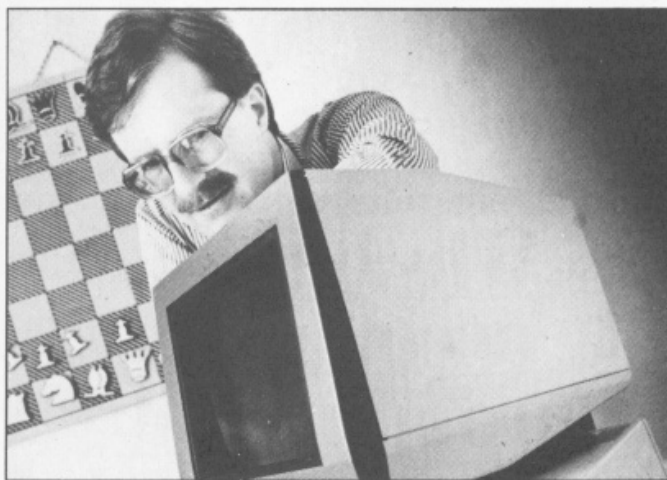
It's obvious that many of our readers share the same sort of views about the software industry, looking back through 18 months of Legal Files. Time and again problems have arisen in which micro-users have found themselves in conflict with software houses over the ways in which they use their programs.

So are software houses really nothing more than a bunch of sharks who exploit the laws of the land in order to rip off the consumer? Should we in this country opt instead for the point of view that is now being advocated in at least one Australian State—that software should not be protected by copyright, as programs are for the general good and should be made freely available to anyone who wants them? (Into the language of a latter-day Proudhon, this would presumably come out as 'is intellectual property theft?') Or could it just be that software houses do actually have some arguments in their favour, and are not such dyed-in-the-wool villains as some people might have you believe?

Without getting too bogged-down in all the intricacies of this country's intellectual property laws (which are in a mess anyway), there are currently in existence a whole range of legal devices to help manufacturers protect the fruits of their labours from unauthorised reproduction—or piracy, as it is more frequently termed. 'Patents', 'trademarks' and 'copyright' are just three of them. Although each one is aimed at protecting a different aspect of intellectual property, they all share the same ultimate objective—to enable the 'creator' to reap the maximum rewards for his efforts by being able to commercially exploit his or her creation, invention or whatever, for a specified period of time—without competition.

Now admittedly it may be morally difficult to justify the

idea of patent rights—which normally last for 16 years—being extended to cover an invention which could help fend off starvation amongst the world's teeming billions. But that is certainly not the case



with most computer related products. Despite inroads into the education field, most computer products, whether hardware of software, are aimed at the business and entertainment markets. Thus, they are primarily commercial products upon which lives do not depend and which, if we are going to be fairly honest, until relatively recently most people could do without altogether. There can therefore said to be no 'moral' objections to, say, a software house commercially exploiting a word-processing program for all it is worth.

Closely allied to this is another factor which has to be taken into account if you are to understand why the software industry attempt so jealously—and zealously—to protect their secrets: the fact that the computer market is highly volatile. Thus, unlike many other products (such as, for example, the zip-fastener which has enjoyed a relatively long life despite variations in demand prompted by the vagaries of fashion), with computers the life expectancy of a specific product is usually very limited.

Take, for instance, something as 'trivial' as games software. In late-1982 Atari's *Pacman* was the undoubted market leader, yet had it been launched a few months later, by which time another game might have caught the public's imagination, or if it had simply failed to catch-on, *Pacman* would have sunk into an unme-

asurable obscurity.

The lesson, then, is simply this: with computer-related products there are no second bites of the cherry. The manufacturer—albeit a hardware company or a software house—

either gets the product right the first time around and exploits it for all it is worth for the duration of its short life, or the product fails and completely sinks without trace.

Bearing in mind the development costs and the vast promotional budgets most companies within the computer industry now incur, it is hardly surprising that when they do pick a winner, they are highly intolerant and whip out the big legal stick against anyone whose activities may have an adverse effect upon their profit margins.

It is also worth bearing in mind that 'profitability' means a lot more than just keeping company directors in cars and cigars: without profits companies do not have the funds to reinvest in the development of new product lines, or expand their production facilities. And they do not have the returns to maintain the confidence of their investors. Diminished profits—in other words—not only mean fewer smiles for directors from their bank managers, but can also have an adverse effect upon the health of the UK computer industry generally—which is something we're sure no-one wants.

Protecting profits then may well be one of the considerations when organisations like software houses make such an effort to fight piracy, but simple greed is certainly not the sole motivating factor behind their actions.

## DATA FILE

### LEGAL FILE



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*Charles Christian (above) is a qualified barrister and a computer writer, who will be using his knowledge of Britain's impenetrable legal system to answer your complaints and queries in a comprehensible way. If you want access to the Legal File use the question card bound in with this issue.*



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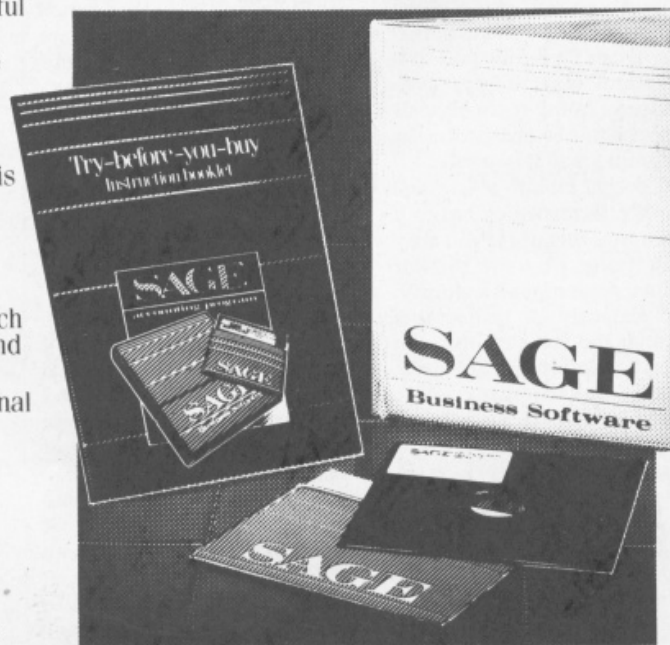
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## PRISM MODEM 1000

We have at last had a chance to properly test the Modem 1000 from Prism. It is provided as part of the package to allow the BBC to access Prestel/Micronet. Included in the cost (£93.65 inc. VAT) is the Micronet software on ROM, as well as free installation of a Telecom jackplug socket (if you buy in time). Unlike the Networking Interface previously provided by Prism, the Modem 1000 is direct connect rather than acoustically coupled.

Incidentally, if you already have a Networking Interface for the BBC and wish to upgrade from cassette to ROM, the latter can be purchased separately from Micronet for £9.00.

Having satisfied ourselves that the Modem 1000 worked efficiently on Micronet, we were pleased to find out that the Modem 1000 did indeed work at 1200/1200 half duplex. In order to do this we used the dumb terminal listing printed in our June '83 issue, reconfigured to 1200 baud operation, thus:-

180 \*FX8,4

190 \*FX7,4

Using two separate BBC Micros both attached to Modem 1000s, it was prearranged who set their modem to Tx (transmit) while the other was set to Rx (receive). After that it was a matter of communicating à la 'walky-talkie', using the word 'over' once

# PRISM MULTI-MODEM - HERE AT LAST



For BBC owners who wish to access Prestel/Micronet, Prism have the Modem 1000 (above). OEL sells the same modem under the name Telemod 2.

transmission had ceased. We then simply reversed settings so that the other micro could begin transmitting.

The same modem is used for Micronet's Apple package so 1200/1200 half duplex operation will be possible. It is feasible to use Prestel software to access other compatible 1200/75 databases but sadly CABB is not one of them; however, bulletin board software in most cases is compatible with Prestel if you aren't worried receiving about graphics.

There are a few free public access 1200/75 databases

which can be accessed with Prestel software; C-view on (0702) 546373 is one of them (the others were printed in the April issue of *Computer Answers*).

At the time of writing it is now possible to use the Prism VTX5000 in the 1200/1200 half duplex manner as intended, but Prism still hasn't said how much the appropriate software will cost.

However, you can buy what amounts to a Modem 1000 direct from the manufacturer, OEL, for £84. OEL has produced its own communications packages for the BBC, Ataris, Apple II, Tandy Model III, Commodore 64, 3000, 4000, and 8000. Prices range from £15 to £80. Again the OEL Telemod 2 is capable of only 1200/75 or 1200/1200 half duplex operation but it does have BT approval.

OEL will also be selling the 1200/1200 half duplex program for the VTX 5000.

## TANDATA TM100 MODEM

Another piece of equipment kindly loaned to us was the TM100 from Tandata which is again a 1200/75 (viewdata) modem. The one we tested was supplied for the BBC. Called a 'smart' modem, the TM100 is BT approved and auto-dial. The software supplied on cassette also allowed storage of nine separate telephone

numbers, along with the relevant passwords if required.

Unfortunately, it didn't seem possible to use the TM100 along with other communications software, such as Pace's Commstar ROM, which would have allowed sophisticated file transfer.

The other problem with Tandata's software was that not all the bugs seem to have been ironed out. At one point the software crashed losing all the numbers we'd fed into memory. It would have been interesting to have experimented with 1200/1200 half duplex communications, but the otherwise detailed manual wasn't forthcoming. At £98.90 (inc. VAT), the TM100 did its job, but seemed limited.

Other packages available now include Apple, Commodore 64 and Pet, and IBM PC. Future releases will cover the Vic 20, CPM machines and (hopefully) Dragon, Electron, Spectrum, Macintosh and QL. Prices depend on the machine used.

## MORE MODEMS

We are constantly being asked to recommend modems which can be used to access CABB or Micronet. Fig. 2 gives some typical examples. We have not had the chance to fully test the Answercall modem yet, but it looks good value if the price really will be £75 (inc. VAT) in the shops.

# SPECTRUM MODEM SELECTION

**Can one obtain a modem for the ZX Spectrum? If so, would it be possible to give details of price and use. Also, is there a disk drive available for the same machine?**

Phil Nash, Grasend.

There are two clear choices of modem: either a Prism VTX5000 which allows you to access Prestel/Micronet and other 1200/75 baud databases; or a 300/300 baud modem to access bulletin boards.

For the latter you need an RS232 interface such as the one from Micro Mania and costing £33.50. The Prism costs £99.95, while 300/300

baud modems start from £86 (DaCom Buzzbox) upwards. A new generation of multi-baud rate modems are coming, but as yet the cheapest ones still don't have BT approval.

You'll also need a communications software package such as Andrew Glaister's Specterm (featured in the March '84 issue of *Computer Answers*), the software for accessing Micronet comes with the VTX on ROM, though.

As far as disk drives go, see the article on the same in our April issue.

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### ATARI TERMINAL

So that you can use your Atari (400, 800, 600XL and 800XL) to access CABB, Jonathan Sanders has supplied us with the simple program (Fig. 2). It has been slightly modified by Ron Stewart so that it will run on both disk and cassette based systems. The only catch is that you will need Atari's own 850 interface which costs £135

FIG. 1

Make/model:	Specification:	Price:	Supplier:
<b>Buzzbox</b>	300 baud asynchronous. Full duplex. Answer/originate. CCITT. BT approved direct coupler.	£86.00	<b>Scicon,</b> Brick Close, Kiln Farm, Milton Keynes, MK11 3EJ. Tel: (0908) 567567.
<b>Prism Network Interface</b>	1200/75 asynchronous. Full duplex. CCITT Originate. BT approved. Acoustic coupler.	£60.10	<b>Micronet 800,</b> Scriptor Court, 155 Farringdon Court, London EC1R 3AD Tel: (01) 278 3143.
<b>Portman</b>	300, 1200/75, 1200. Full/half duplex. Answer/originate. BT approved. Direct coupler.	£224	<b>Interlekt Electronics,</b> Portman Road, Reading, Berks RG3 1LU. Tel: (0734) 589551.
<b>Manual Mini modem MM 102</b>	300 baud asynchronous. Full duplex. Answer/originate. BT approved.	£75	<b>Answercall,</b> Kangley Bridge Road, London SE26 5AH. Tel: (01) 659 1133.
<b>Minor Miracles* WS2000</b>	300, 600, 1200, 1200/75 baud. Full/half duplex CCITT/BELL. Direct coupler. NO BT approval.	£115	<b>Minor Miracles,</b> PO Box 48, Ipswich, IP4 2AB. Tel: (0473) 50304.
<b>Tandata TM100</b>	1200/75 baud. Full duplex. Autodial. Asynchronous. CITT. BT approved. (*Illegal on British Telecom circuit unless approved by local BT engineers sales office.)	£98.90	<b>Tandata Marketing,</b> Albert Road, Malvern, Worcs. Tel: (06845) 68421.

(and is generally available) but this can be used for far more than just communications – it's a printer interface as well. In addition you will need a 300 baud modem.

Jonathan Sanders is the system operator of his own Southern BBS on (0243) 511077, which has plenty to interest owners of Atari machines. Jon tells us that he

has permission to distribute the American intelligent communications program for the Atari, Jterm. Leave a message to him and he'll tell you how to download it.

FIG. 2

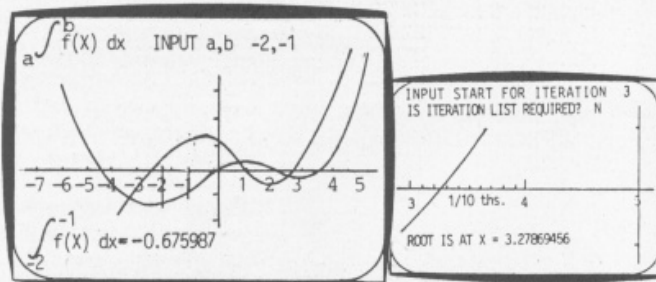
```

10 REM ***SIMPLE DOWNLOAD PROGRAM ***
20 REM
30 REM RUN - ENTERS TERMINAL MODE
40 REM START - BEGIN DOWNLOAD
50 REM SELECT - SAVE DOWNLOADED TEXT
60 REM OPTION - DISCONNECT AND END
70 REM
80 REM *****
90 MEM=FRE(0)-100:IF MEM>32767 THEN MEM=32767:DIM FILE$(15),DAT$(MEM):DAT$(1)="
":DAT$(MEM)=" ":DAT$(2)=DAT$
100 OPEN #1,4,0,"K:"
110 TRANSLATION=0
120 DOWN=0:CLOSE #2:XIO 34,#2,192,0,"R:":XIO 38,#2,TRANSLATION,0,"R:":OPEN #2,13
,0,"R:":XIO 40,#2,0,0,"R:"
130 SETCOLOR 2,12,2:PRINT "Terminal..."
140 STATUS #2,S:IF PEEK(747) THEN GET #2,S:IF S>31 THEN ? CHR$(S):IF DOWN THEN
POKE ADDR,S:ADDR=ADDR+1:GOTO 140
150 IF PEEK(764)<255 THEN GET #1,S:PUT #2,S:GOTO 140
160 IF PEEK(53279)=7 THEN 140
170 IF PEEK(53279)=3 THEN CLOSE #2:XIO 34,#2,160,0,"R:":? :? :? "Disconnected..."
":END
180 IF PEEK(53279)=6 AND DOWN=0 THEN DOWN=1:ADDR=ADR(DAT$):SETCOLOR 2,2,2:? "Down
load mode":GOTO 140
190 IF PEEK(53279)<>5 OR DOWN=0 THEN 140
200 CLOSE #2:? :? "Save to device (C: or D:filename.ext)":INPUT FILE$
210 TRAP 200:OPEN #2,8,0,FILE$:TRAP 240
220 FOR C=1 TO ADDR-ADR(DAT$)+1:S=ASC(DAT$(C,C)):IF S<32 THEN NEXT C
230 PUT #2,S:NEXT C:GOTO 120
240 ? :? "Buffer empty":GOTO 120

```



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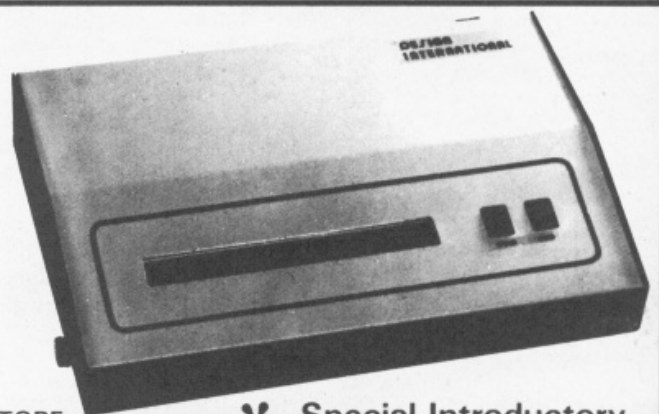
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## WORKSHOP STROP

I would like to take issue with the Programming Workshop in the March '84 issue of *Computer Answers*.

First, it is bad programming practice to jump out of FOR-NEXT loops. This is not just a matter of 'style', but can actually cause program crashes. Try this program on some versions of the 'de facto industry standard' Microsoft MBasic interpreter:

```
10 FOR I = 1 to 3
20 IF I = 2 THEN 40
30 NEXT I
40 FOR I = 1 to 3
50 IF I = 2 THEN 10
60 NEXT I
```

On early revisions it fills the stack and causes an 'out of memory' error after a certain number of loops; on later revisions it gives a 'Syntax Error' on the second entry to the first loop.

Second, the 'idiom' is slow because it neglects to take advantage of the fact, that as he says '(V) will definitely be found. . .'; in fact the FOR-NEXT construct automatically performs a test at every loop to see if it is time to stop. This test is unnecessary. The correct

algorithm is hence:

```
A(T) = V
I = 1
WHILE A(I) < > V:
I = I + 1
WEND
```

At this point may I point to the first occurrence of V in the array A. We may determine whether the value was already in A and perform the insertion if necessary by IF I = T THEN T = T + 1. Of course, this is still an optimum method for linear search whether or not insertion is necessary.

Finally, I disagree with the use of the word 'idiom' - idiom is a phrase that is obscure and peculiar to a particular dialect, not clear and independent of whichever programming language is used, as good computer algorithms should be.

Ben Sturio, Cambridge.

## SHARP MZ STAYS SHARP

As an owner of a Sharp MZ 700, may I express my surprise at two items in the March issue of *Computer Answers*: on page 82 you say the ZX Spectrum allows you to go back along the line you have just put in to insert or delete parts of it - something no other computer

does. This facility is provided by the Sharp MZ 700, indeed, I have the impression that for ease of entering program it has few or any rivals. Auto and Renumber are provided. Similar blocks of program can be purchased very quickly by listing the first block and simply changing the line numbers. This leaves the original block intact, as well as producing the new one. The separate grouping of the four cursor controls adds to the ease of editing.

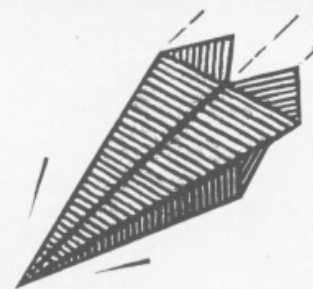
Then on page 149 a Mr Halligan of Liverpool complains about the non-availability of pens and paper for the printer-plotter. As I have had no trouble at all in obtaining these (since I bought the printer-plotter in December), I wonder whether the fault lies with dealers who are not interested in stocking these items, rather than with Sharp. Fortunately, however, my office is close by the premises of Sharpsoft (Ltd) who are Sharp main dealers.

A R Gardner, Surrey.

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**ISSUE 1** (Nov/Dec 1982): If you want a copy of an article from this issue, please send 50p per article (see contents page for address) marking the envelope 'Copy service'. We will send you photo copies of the appropriate pages. Jupiter Ace, DEC Rainbow, Commodore 64 (reviews); ZX81 upgrade; 8/16 bit choice; Z80 cards; ASCII code; Program swapping; I/O concepts; Printer plug-in; Assembler course (introduction); Program generators; Basic queries; Graphics; Communications; Database management systems; The UCSD p-system; Multi-user systems; CP/M utilities; Bad-quality software.

**ISSUE 2** (Jan/Feb 1983): CP/M Plus (CP/M facelift); Memory (RAMs and ROMs explained); Baud explained; Configurations (WordStar on Epson); Program editors; Assembler course (part 1); List sorting program; Program concurrency; CP/M revealed; **Computer Answers File No 1**: Home Computing (domestic applications); Word-processing advice; Communications modems; Maintenance; Sales talk; Legal File (maintenance agreement small print).

**ISSUE 3** (March/April 1983): VisiOn and Lisa (reviews); Torch upgrading (the Tube); Changing print characters; Z80 workhouse; Assembler course (part 2); APL program language; CP/M utilities and corrupted disks.

**Sinclair Clinic**; Systems expertise; Beware of selling hype ('relational databases'); Business graphics (principals); Stargazing and biorhythmic software; Copyright clauses; Budget micros; Micro manufacturers answer back; Renting software; Legal File (piracy problems).

**ISSUE 4** (May 1983): Sage IV (review); Microflopies; Data preservation; Apple IIe (review); Government's choice of micros; Monitors; Slide-show controlling; Digital input; Random numbers; Assembler (part 3); Professional games programmers.

**Dragon and Texas Clinic**; Making music on micros; Spreadsheets (Planer-Calc); Business graphics (practice); Toolkits; Ergonomics; Legal File (small claims procedure).

**ISSUE 5** (June 1983): Pinball Construction Set (review); VisiWord (review); Power (what constitutes a micro's muscles); IBM Clones; Buses; Data structures; WordStar Workshop (part 1); Number base conversion; Random numbers; Gw Basic; **BBC Clinic**; Business Operating System; Horserace Forecast Package (review); MasterCalc (review); Classroom computing; Games simulation; Software security; Setting up (selling your own software); Legal File (defaulting mail order advertisers).

**ISSUE 6** (July 1983): New Osborne Executive (review); Lotus 1-2-3 integrated software package (review); Plotters; Memory expansion; User-friendly software; 'Turtle' conversion job; Communications (file transference); **Commodore Clinic**; Lisp language; WordStar Workshop (part 2); CP/M supervisors; Computer aided design; Spreadsheets (Multi-Plan); Micros in the music studio; Insurance; Computer holidays.

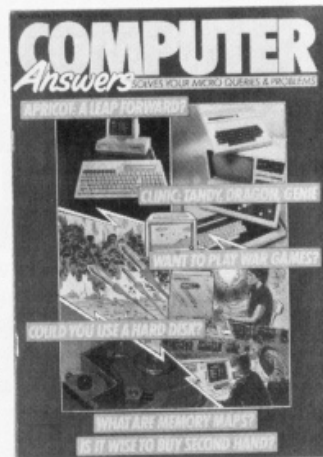
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**ISSUE 7** (August 1983): System speed; Choosing a printer; Typewriter conversion; Preserving on Proms and Eproms; 'Turtle' conversion (Part 2); Assembler course (final part); Programmers Ten Commandments; WordStar Workshop (part 3); **Atari Clinic**; Exploiting Operating Systems; Cassette-based word processing, spreadsheets, and databases (reviews); Computer Aided Learning (CAL); Pilot (CAL language); Data management; Selling your programs to companies; Legal File: the intricacies of copyright.

**ISSUE 8** (Sept. 1983): AMS 3 inch microdisks (review); **Computer Answers File No 2: Interfaces**; Making 3D images; WordStar Workshop (part 4); dBase II Workshop; Numbers; Recursion; Game of Life; Programming logic statements; Data compaction; **Apple Clinic**; Microsystem's insides; BCPL (language); Speech synthesis and recognition; Spreadsheet formulation; micros in schools; Abstract computer Art; High street retailers; Legal file: the cost of going to court.

**ISSUE 9** (Oct. 1983): Colne's Armadroid robot (review); Advanced VisiCalc; Coping with cassettes; Tandy 100 versus Epson HX20; Translating Basic into Assembler; Data Programming; WordStar Workshop (part 5); dBase II Workshop (part 2); Bill Budge interview; True Random Number Generation;

Logo (language); **CP/M Clinic**; Probing the processor; micro-designing computer; database reviews; Spreadsheet formulation; computerised graphics on Rock albums; Disk prices; Legal File: customer/dealer disputes.



**ISSUE 10** (Nov. 1983): ACT Apricot (review); Hard disks (overview); The Sord M5/CGL M5 (review); Spectrum expansion (add-ons); Vic port project (Rs232 card); Break into Barcodes; Getting RAM; Wordstar Workshop (part 6); **Tandy, Dragon, Genie Clinic**.

Memory Mapping; Peripheral chips; MSX Compatibility; War games (reviews); An Epson in Turkey (roadtest exotique); Keyboard trainers; Computer training courses; Brixton ITec (Econet); Buying second hand systems; Legal File (problems of setting up a software library).

**ISSUE 11** (Dec. 1983): New generation of cheap modems; printer buffers; Watford Electronics disk filing system; Disk benchmarking test; Mice-like inputting devices; Communications software; Using arrays; Seymour ('Logo') Papert (interview); Programmers Workshop ('Wolf Fence Algorithm'/'Instrumentation'); Worms; **Sinclair Clinic**; Device drivers; Bulletin boards; dBase version 2.4 ('dBase III'); Spreadsheet DIF facility; Choosing a user group; Correspondence course in computing;



GOSH - the Guild Of Software Houses; Legal File: options on going to court.

(Also incorporating the **Computer Answers Upgrade Supplement** (gratis), which contains full information on the upgrading possibilities of the 13 most popular microcomputers.)

**ISSUE 12** (Jan. 1984): Elan Enterprise; Atari 600XL; Spectravideo; Cheap daisy-wheel printers; Best games of '83; Personal CP/M; Converting one Basic into another; **BBC/Electron Clinic** Cassette editors and assemblers; Games programming with sprite graphics; Bank Street Writer word processor; Reflexive VisiCalc; Start your own user group; Furniture to keep your micro tidy.

**ISSUE 13** (Feb. 1984): Inside Oric ROM; IBM PC jr; Joysticks; scope (games writer); Instructional games videos; special effects from dot-matrix printers; Interface 1 problems; Beyond Basic; Getting Sound Effects; Game of Go (Part 1); Game of Nim (Part 1); Programmers Workshop: speeding up; **Commodore 64/Vic 20**



**Clinic**; Microcache package; Business databases; Everyman database package; Disk corruption; Cassette duplication; Second-hand peripherals; Setting-up a bulleting board; Legal File; second-hand micro sales.



**ISSUE 14** (March 1984): Memotech MTX; Dragon 64; Vic 20 add-on boards; adventure game writing packages; fancy fonts for the BBC; RS232 interface revealed; Bluff (game); Go (Part 2); BBC disk file expansion; Nim (Part 2); Fog Index (game); Wordwhizz (game); Assembler Workshop; Basic Workshop; **Spectrum/ZX81 Clinic**; Operating systems; Business; accounts packages; accessible mega-databases; weekend training course.

**Computer Answers Bulletin Board - CABB** - our very own, free electronic magazine. Legal File - what are the pros and cons of buying a micro with a credit card.



**ISSUE 15** (April, 1984): Sinclair QL; Apple Macintosh; Disk drives; programming by video; Tactical computer war games; Spectrum graphics packages; VDU conversion; Documentation; Data compaction; Atari Graphics modes; Oric synthesizer; Four-sight game; Philip 'The Hobbit' Mitchell interview; screen display storage; **BBC/Electron Clinic**; Operating systems (Part 2); Using your micro to make money; **Brainstorm** 'ideas processor'; **Starburst** and **Starindex** data management packages; Micro repair sources; Legal File: up-market micro deals.



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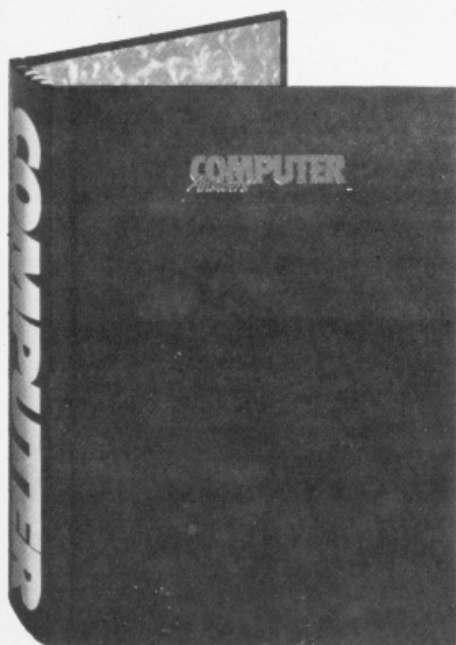
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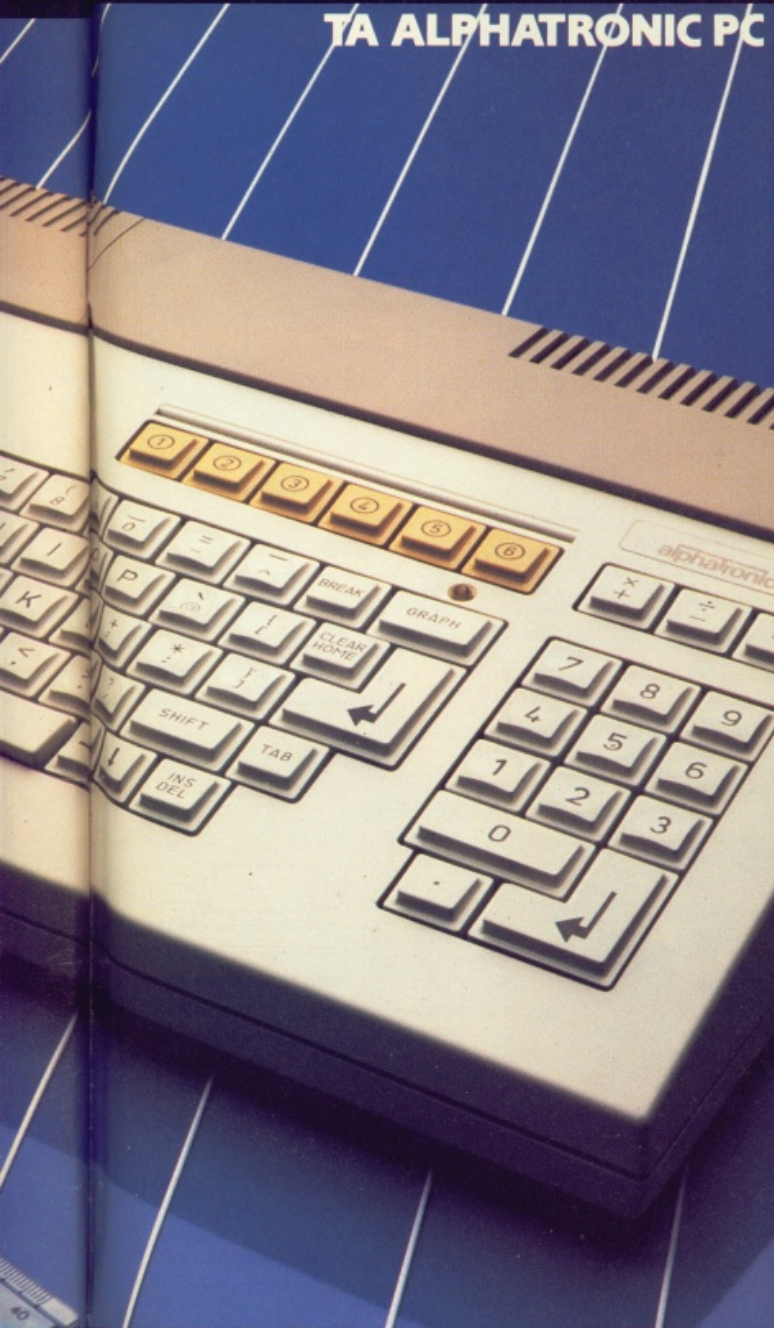
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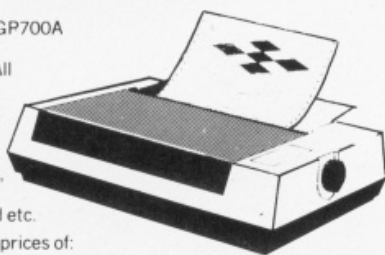
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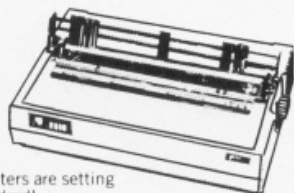
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Please add 95p per Box of 10.

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Printer Classification	6 +	12 +
Brother HR1	MS 3.65	£3.28
Brother HR15	MS 4.00	3.75
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Commodore 4022	3.60	3.00
Diablo Hytype I	MS 4.60	3.60
Diablo Hytype II	MS 2.45	2.35
Epson FX80, MX80, RX80	3.60	3.00
Epson MX100	8.00	6.50
Epson HX20	2.80	2.40
Juki 6100	MS 3.65	3.28
Mannesman Tally		
MT100, 110, 120, 160	5.00	4.90
Mannesman Tally		
MT130, 140, 180	5.00	5.00
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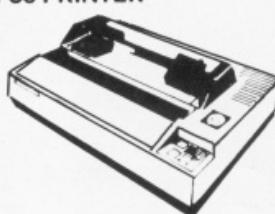
### BROTHER DAISYWHEEL PRINTERS

	CPS	PRINT BUFFER	OUR PRICE
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HR15	18	3K	£431

Please specify if Serial or Centronics Interface required.

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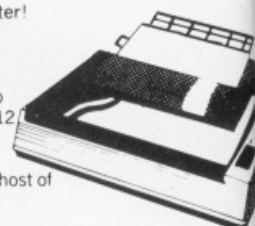
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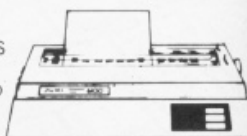
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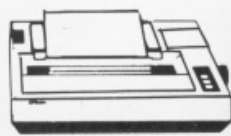
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RX80FT	100	315
FX80	160	415
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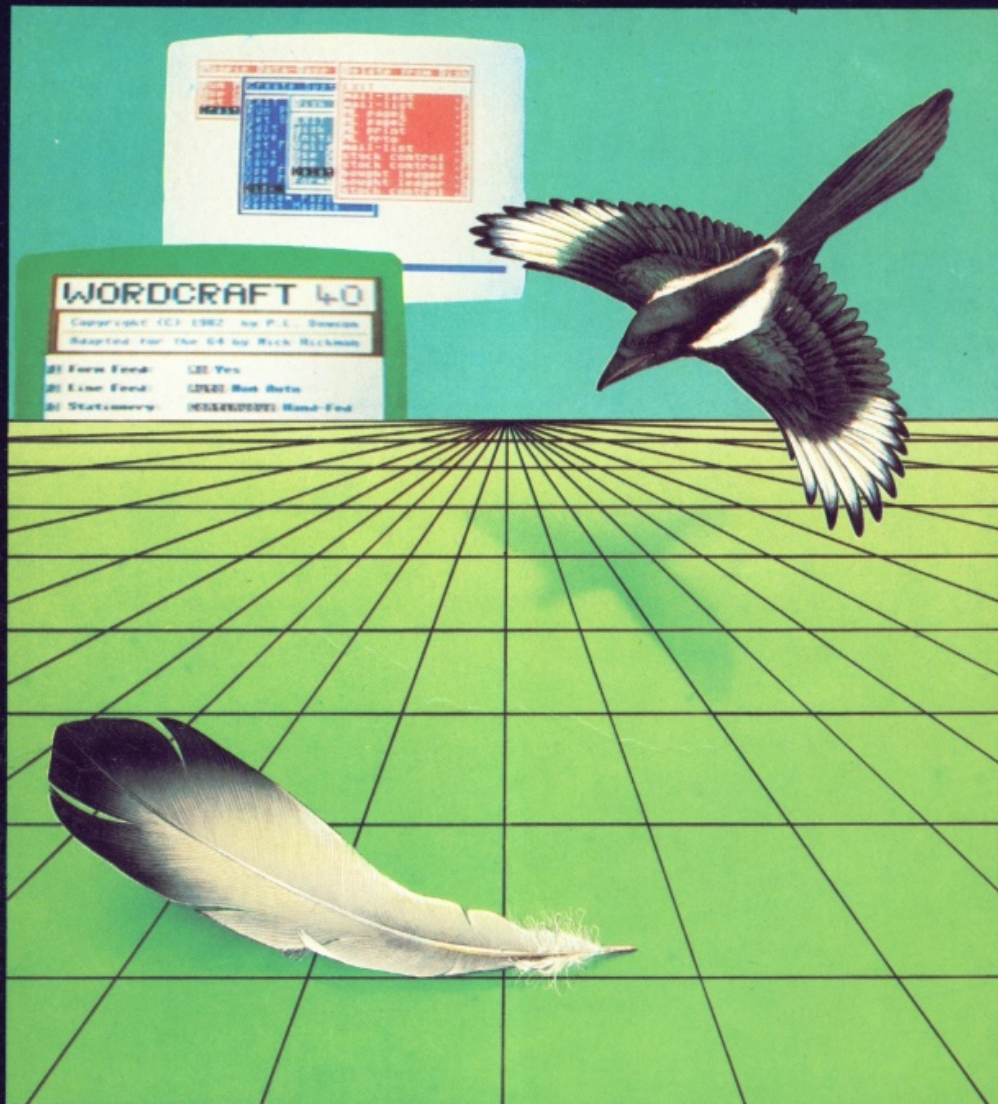
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