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MON	TIC	IF	BAUD	PURGE	TON
	SQN	ELSE	CALL	NUMBER	DIM
	BIT	ON	DATA	RENUM	DEF
FUNCTIONS	CRB	GOTO	READ	BOOT	NEW
ABS	CRF	GOSUB	RESTOR	GRAPH	END
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ASC	MWD	REM	STOP	PLOT	CRB
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Origination and design by MM Design & Print.

ABC **Member of the Audit Bureau of Circulation**

ISSN 0142-7210

Computing Today is normally published on the second Friday in the month preceding cover date. Distributed by: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. 01-247 8233. Printed by: Alabaster Passmore & Sons Ltd, Maidstone, Kent.

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All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

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CONSUMER NEWS

CONSOLING THE SPECTRUM

You know what it's like when you have your micro, cassette recorder, printer and an assortment of other necessary 'bits and pieces' lying around on your desk and they're in such a state of 'professional disarray' that you can't even find your pen! Well in an attempt to help us all be tidy minded TTL have produced a ZX Spectrum desk console. The console comes ready assembled and can accommodate the following: the ZX Spectrum, the power unit, Sinclair printer, RS232 interface, joystick control, two Microdrives, a cassette recorder, cassettes and pencils.

The price is £42.18 including VAT and postage and packing and can be obtained from Traffic Technology Limited, PO Box 2, Warminster, Wiltshire BA12 7QX.

BUG BYTES

Well it's time for the Editor to don his sackcloth and ashes garb, because it's time for us to inform you of errors that have appeared recently in issues of *Computing Today* and *Personal Software*. In the February issue of *Computing Today* an error appeared in the article called Tailoring VIC Characters. Please note for Listing 1:

Line 70: There is a missing "after the REV and before the;
Line 410: Should read POKE PP,4:POKE CP,0
Line 540: Should read POKE PP,RM:POKE CP,CM

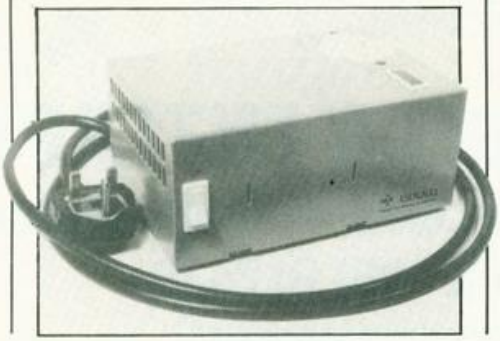
In the Spring issue of *Personal Software* an error appeared in the article called Hints and Tips. Please note that for Listing 1 line 190 should read:

190 .FIX1 PHA:JSR &F521:PLA:RTS

We apologise to all of you who have had problems with these programs but we hope we have now shed some light on the matter.

POWERFUL PROTECTOR

Computers can be quite sensitive animals particularly where their power is concerned. Well we can now give a plug (sorry about that!) to a line conditioner which is



specifically designed to protect home computers from malfunctions caused by power line noise and mains variations.

The Mainstay can provide an output that is stable within±6% even if the input voltage drops to 75% of normal. The price of the unit is £49.95 excluding VAT. You can get more information by writing to Gould Electronic Power Conversión Division, Rhosymedre, Wrexham, Clwyd LL14 3YR.

FARSEEING COMPANY

COLVIS is a solid state camera connected to a powerful microcomputer which is capable of 'seeing' an object and remembering its shape. The information is composed of a range of parameters such as area, perimeter and centre of gravity of the image. The system can be used with any microcomputer which has or can be fitted with an 8-bit bidirectional port. The system is aimed at the educational market and constitutes an invaluable low cost peripheral to existing robotic arms.

COLVIS is priced at £395 and you can get more details by writing to Colne Robotics Company Ltd, Beaufort Road, Off Richmond Road, East Twickenham, Middlesex TW1 2PQ or by 'phoning 01-892 8197.

REDUCING POCKET COMPUTERS

The volume of demand and high factory production rates are allowing Casio to reduce the prices of their FX 700P and PB 100 pocket computers. The new recommended retail prices, complete with comprehensive guides, manuals and program libraries are £69.95 for the FX 700P and £59.95 for the PB100.

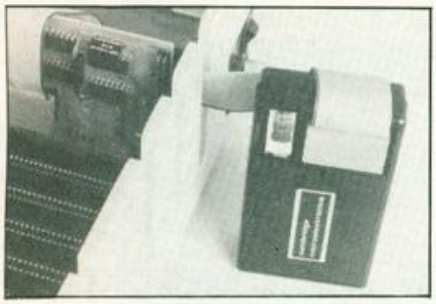
For details of these and other Casio products, contact Casio Electronics Company Ltd, Unit 6, 1000 North Circular Road, London NW2 7JD or 'phone 01-450 9131.

RAMS ARE CAMEL'S

A 4K version of the earlier 2K MEMIC L CMOS RAM unit is now available. The unit uses the latest True CMOS static RAMs which take only a fraction of a uA of current to retain data, this standby power being supplied by an integral lithium battery for 10 years or so. The unit comes in a moulded black ABS case and is priced at £35.95 plus VAT. For more details

you should contact Cambridge Microelectronics Ltd, One Milton Road, Cambridge CB4 1UY.

Some of you may remember the item we ran in this column in the January issue of *Computing Today* when we reported the 2K CMOS RAM unit and asked you to scrutinise the photo published and tell us into which computer the unit was plugged. Well the response to that little quiz was so good we've decided to test you even further and ask you again to tell us which computer the unit is plugged into. The first correct answer pulled from the Editof's cardboard box (his hat somehow got mislaid!) will receive the MEMIC L.2 as their prize, kindly donated by those sporting people at Cambridge Microelectronics. All entries should be received by May 9 either on the back of a sealed envelope or on a postcard please.



STICKING WITH IT

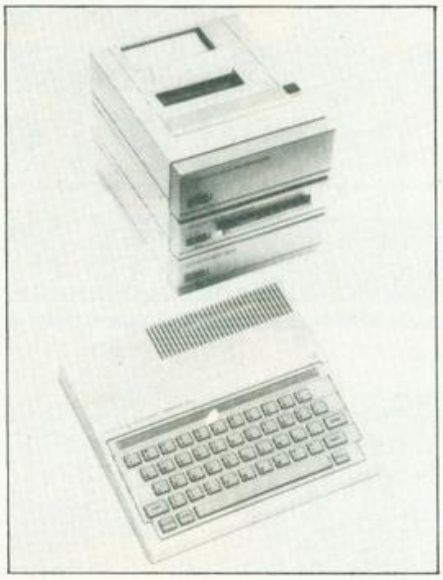
A simple plug-in joystick for the ZX Spectrum is now available. With eight direction commands and two large fire buttons, high speed games can now be played at ease. Six games are presently available for use with joysticks with more on the way.

The joystick is priced at £25.00 plus postage and packing. For more information, please contact Kempston (Micro) Electronics, 180a Bedford Road, Kempston, Bedford MK42 8BL.

IT'S TI AGAIN

Texas Instruments have announced a cheap 16-bit computer, the TI-99/2, which they claim is designed to allow computer novices to learn to program a computer in TI BASIC and BASIC-supported assembly language. The machine is targeted primarily at the technical enthusiast, engineer or student in the home.

The machine has a QWERTY style keyboard, with 4.2K RAM, of which 4K is user accessible and which can be expanded to 36.2K. Any TI peripherals can be connected; two software cartridges, Learn to Program and Learn to



program BASIC, will be available initially for the unit, with more planned for later. Twenty programs will also be initially available on cassettes including educational, personal management and entertainment cassettes, all of which will also run on the TI-99/4A computer.

The bad news is however that the TI-99/2 will not be available in the UK until the third quarter of 1983, but it may well be worth waiting for as it is priced at just £75. More information can be obtained from Texas Instruments Limited, Manton Lane, Bedford MK41 7PA or by 'phoning 0234-67466.

MANCHESTER HOME COMPUTER SHOW

April 21, 22 and 23 will see the first Manchester Home Computer Show at the Midland Hotel. On show will be a complete cross section of hardware and software available for the home user with emphasis on the lower end of the market featuring computers from £50.00 to £400. There will be a Computer Advice Centre at the exhibition where the uninitiated can try out machines in a demonstration area, and see programs in operation covering educational, games and small business applications with a team of experts on hand to provide impartial advice.

Two home computers will be given away in the show competition, entry forms for which are available with advance tickets or with show guide on all three days. Advance tickets are £1.00 from the organisers, Manchester Home Computer Show, ASP Ltd, 145 Charing Cross Road, London WC2H 0EE. Children under eight and OAPs have free entrance and there is a 25% discount on groups of 20 or more.

BRIEFING

From Pete & Pam comes **Track Ball**, a new omnidirectional guidance system designed for games requiring rapid paced, multiple movement commands. Two firing buttons are recessed well below the ball control place for easy firing and unobstructed movement during game play. Track Ball comes in models to fit the Atari, Apple and IBM personal computers, and is priced at £45.95. More details can be obtained from **Pete & Pam Computers**, New Hall Hey Road, Rossendale, Lancashire BB4 6JG, or 'phone 0706-227011.

HI-STAK can make your micro easier to use by raising the back to a calculated level. It can be instantly applied and comprises two precision injection moulded ABS ramps with built-in rubber feet, self adhesive tops and simple locating instructions. HI-STAK is priced at £3.95 including VAT and postage and packing and is available by mail order from **Warp Factor Eight**, 6 Pelham Road, Braughing, Ware, Hertfordshire SG11 2QU.

Vectrex is described by its manufacturers as the first ever portable computer games system: it incorporates its own screen thereby making it independent of the TV. Vectrex has good graphics and sound effects and a unique control panel is also available. Vectrex retails at approximately £130-140 with cassettes at around £19.95 and you can find out more from **Milton Bradley Limited,** CP House, 97/107 Uxbridge Road, Ealing, London W5 5TZ or 'phone 01-567 3030.

W H Smith have ordered 50,000 **Oric 1** microcomputers for delivery between April and October 1983. This and promising sales targets have resulted in Oric pulling out of the mail order business from the end of March. Oric have also received large orders from a variety of other high street stores and independent UK dealers.

A new 64K Sinclair ZX81 RAM expansion module, also designed to accept an EPROM as an alternative, has been announced by Camel Products. Called **Dream-81** it is priced at £69.95 plus VAT. For further information contact **Cambridge Microelectronics Ltd,** One Milton Road, Cambridge CB4 1UY, or 'phone 0223-314814.

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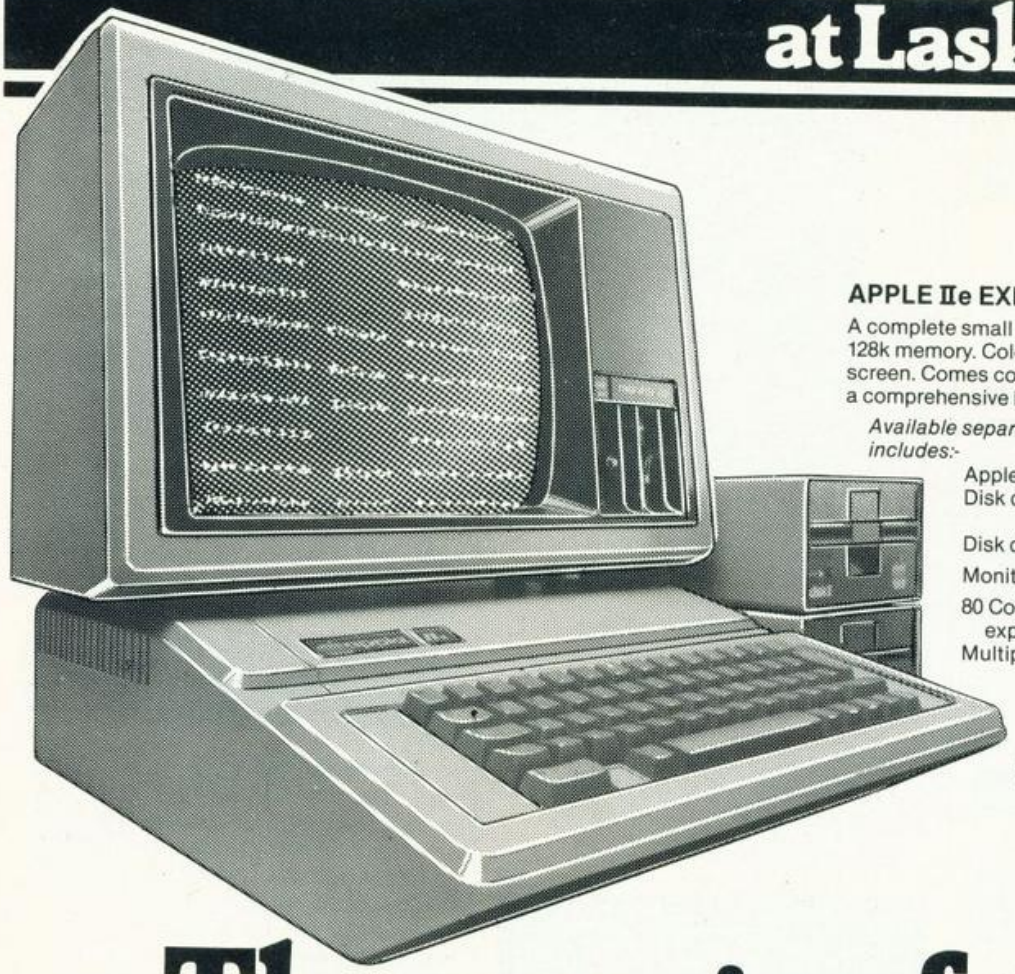

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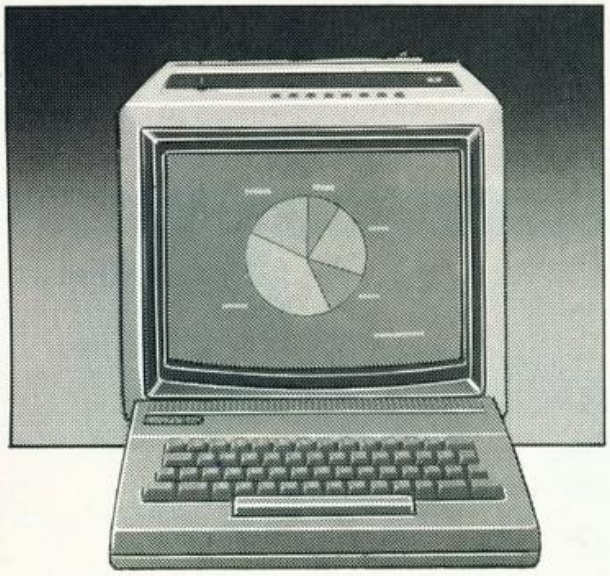

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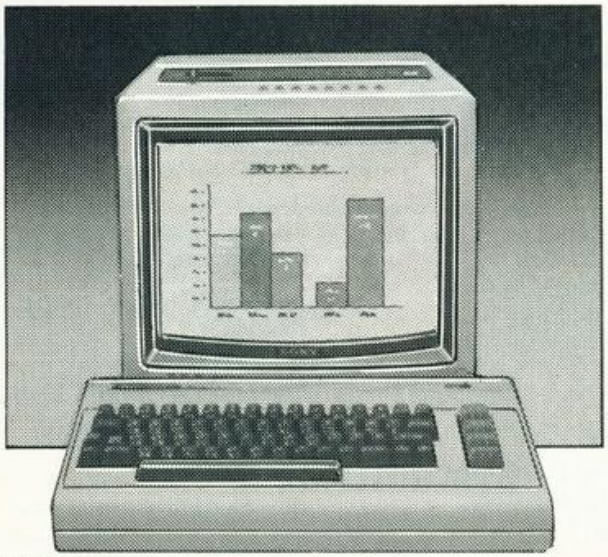
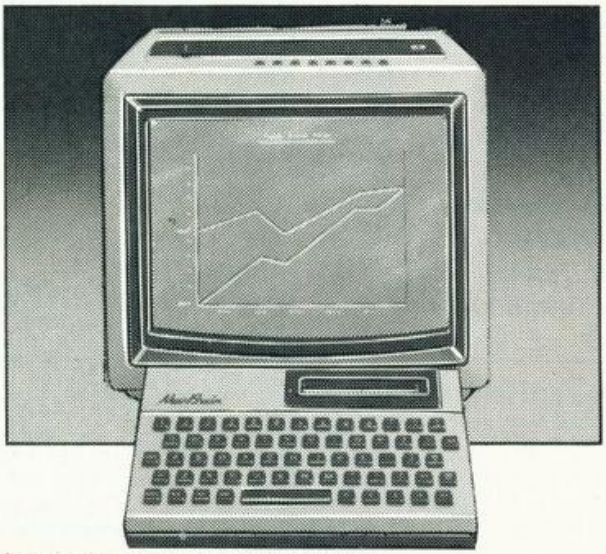


VIC 64

A home computer with a full size keyboard. Powerful 64K memory, sprite graphics, colour and sound.

£294.78 + VAT



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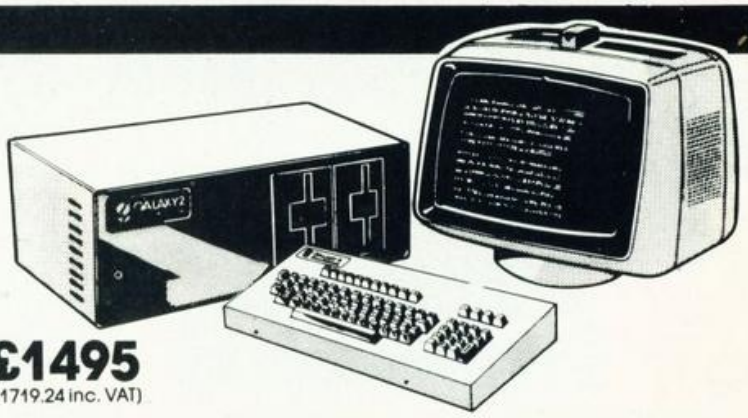

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Total support for Gemini & nascom Products

nascom 3 available from MicroValue

Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.

48K System
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80x25 Video for nascom

£125
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Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with on-board Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Software supplied on Gemini system disks. Built and tested.

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GM802K 16K RAM Kit	**£80** (£92 inc. VAT)

Disk System for Gemini & nascom

GM825 Disk Drive Unit – The GM825 floppy disk housing is supplied with either one or two 5.25" single sided, double density, 96TPI high capacity Micropolis 1015F5 disk drives. These provide 400K bytes of formatted storage per drive. (Gemini QDSS format). The CP/M2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers.
An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single Drive System
GM825-1S
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Dual Drive System
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£575 (£661.25 inc. VAT)
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(GM532 for Gemini)
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POLYDOS 4
for Nascom
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GM809 Disk Controller Card
for 8" and 5.25" drives
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GM829
for 8", 5.25" and Winchester Drives
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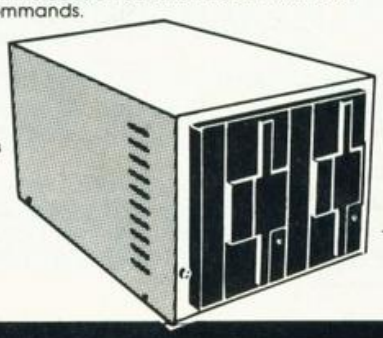

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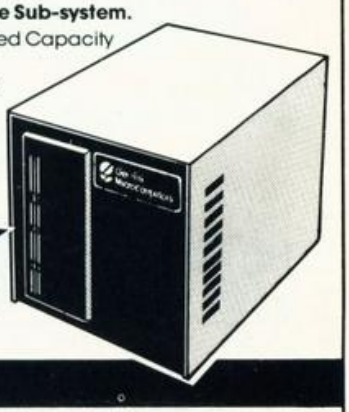

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SEIKOSHA GP100A
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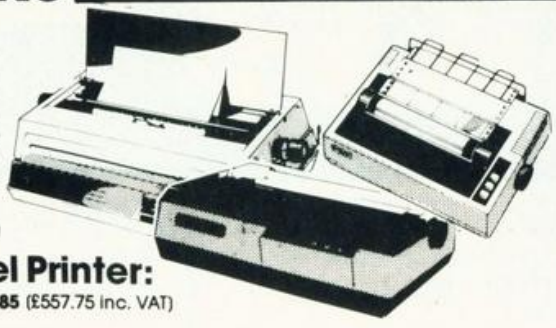
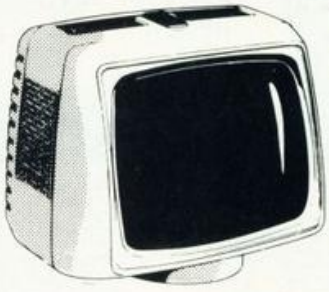


Daisy Wheel Printer:
Smith-Corona TP-1 **£485** (£557.75 inc. VAT)



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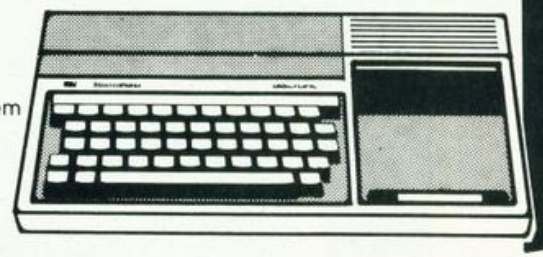

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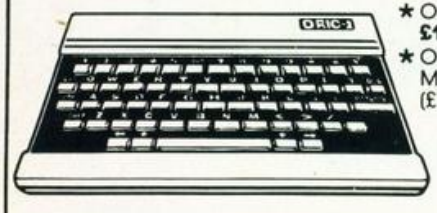
ORIC 1 when used with the ORIC MODEM will allow access to PRESTEL-Viewdata, which has 200,000 pages of interactive information covering sport, travel, hotel bookings, games, etc.



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Emprise Electronics Ltd.,
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MDW (Electronics),
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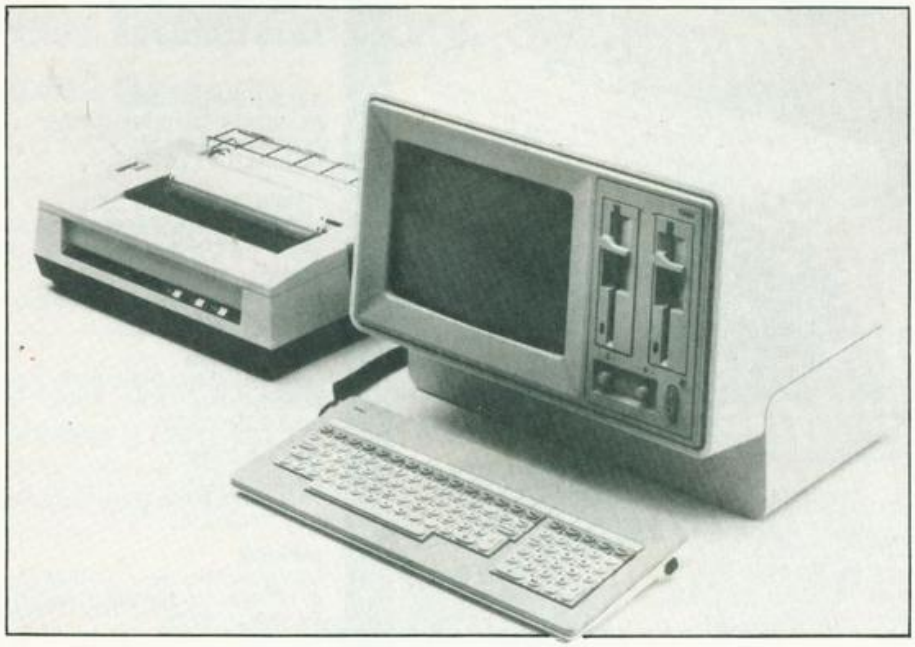

GETTING MATEY▲

NCR has entered the personal computer market with a range of Decision Mate V microcomputers. And with the introduction of Decision Net they have created a local area network for linking computers of varying makes into a communicating and resource sharing system. Decision Mate V has been launched with comprehensive software; single and dual-processor models are available which feature memory sizes up to 512,000 bytes, flexible or Wincester disc drives, high speed monochrome or colour capabilities and a 12" CRT display. An advanced feature is that you can add peripherals and memory without opening the cabinet.

Prices for the compact eight bit processor Decision Mate V with monochrome graphics start at £1825. A dual processor model sells for £2175. Prices include dual floppy disc drives, 64K memory, an operating system and a high speed graphics subsystem. For more information write to NCR Ltd, 206 Marylebone Road, London NW1 6LY.

APPLE LIGHTS UP ▶

Gibson Laboratories have produced a new light pen system for the Apple II, called LPS II. This is a 'true' light pen with which you can draw on the screen as though it were a piece of paper. You can create graphics or select from the menu. LPS II consists of the pen, a sealed card that goes in slot 7, and supporting software. It is the software that allows the pen to perform its 'magic'. Many of the programs on the preliminary software disc are demo programs to familiarise the user with the capabilities and use of the pen. The retail price is £249 and you can get more details from Pete & Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG or 'phone 0706-227011.

HEADACHE SAVER

New slide on anti-glare screens designed to fit any VDU are now available from Dams Business Computers. The screens are easy to fit, clean and maintain.

One range of screens suitable for monitors up to 13" costs £19.95 excluding VAT, with a price of £24.95 for any bigger size. The screens and further information are available from Dams Business Computers Ltd, Gores Road, Kirkby Industrial Estate, Liverpool L33 7UA or 'phone 051-548 7111.

BRITISH IBM LOOKALIKE

The new personal computer from CAL is a lookalike of the IBM machine recently launched in the UK. CAL-PC has a twin processor structure giving eight and 16 bit to suit the growing market for users wanting an 8 bit capacity immediately plus an ability to move

up to 16 bit in the future without any operating upheavals. It also has an RS422 interface for a fast networking facility if needed.

The machine has a standard VDU with a full colour graphics monitor as an option; the machine's keyboard is similar to the IBM's one, which means that IBM software manuals will be relevant for existing IBM users who choose the CAL-PC. Operating systems are CP/M, CP/M-86, MS-DOS and BOS and the full language range for the systems are supported by CAL for the CAL-PC. Various 8 and 16 bit multi-user packages are available.

The basic price for a CAL-PC with 128K RAM with two floppies, screen, keyboard and two additional communications ports is £1,995. One CAL-PC plus 17 cps daisywheel printer, any four CAL single user software packages, plus training, installation and one year guarantee costs £2,945. Further details are available from Computer Ancillaries Limited, 64 High Street, Egham, Surrey.

COMPACT MICRO ▶

Texas Instruments have announced the Compact Computer 40, a portable computer for professionals. It has an integrated LCD display, is programmable in enhanced BASIC and can run pre-programmed applications software loaded from either plug-in solid state cartridges or from small tape cartridges.

The computer console has a 34K built in ROM that contains a BASIC language interpreter and calculator functions are easily available. It is battery operated. The computer contains 6K of RAM and can be expanded to 16K. The Compact Computer has a suggested retail price of £169.95. Further information can be obtained by writing to Texas Instruments Ltd, Manton Lane, Bedford MK41 7PA or 'phoning 0234-67466.

CAPTURING APPLES

Portapple is a new data capture system for the Apple II which comprises an MSI data capture terminal with wand scanner, interface card and a floppy disc software starter pack. A universal connector on the Portapple interface card enables many different terminals to be linked to it which further extends the data capture capability of the Apple II. The Portapple interface card, software and an MSI/66 hand-held terminal with a wand scanner costs £778. The system is fully supported by several manuals describing how to operate the terminal, capture data using the wand scanner and transmit it to the Apple micro. For more information contact MSI Data International, IVC Building, 10 Portman Road, Reading, Berkshire or 'phone 0734-587661.

CRA Corner

As I have said in earlier columns, one of the prime objects of the Computer Retailers Association is to act as a liaison between the customer and the dealer.

The customer quite rightly wants to obtain the best value he possibly can for the hard earned money that he spends on a microcomputer. After all, to most end users the computer is not very much short of a luxury. Even if this is not so, in most cases it is certainly not going to be classed as a necessity. It is, therefore, important that the customer should get the very best value that he possibly can.

On the other hand, the dealer is in business to make a profit. If he does not, he will go out of business; hence he is to some extent under pressure to sell. The CRA takes a lot of steps to make sure that its members do not go beyond the bounds of reasonableness in attaining their objectives.

By the law of averages, however, occasionally either the customer or the dealer exceeds the bounds of reasonableness in making a deal. A contentious situation arises, both sides inevitably think they are right and the necessity for a third party appears. This is where the CRA steps in, very often as an Arbitrator. In all cases that I am aware of, in the past the CRA has been able to bring together and effect a satisfactory settlement.

A particular member of the Executive Committee is appointed to look after complaints from the customers of members. Unfortunately, as this column goes to press, our Annual General Meeting is about to be held and that person may well be changed. Consequently, it would be best, should any customer wish to make a complaint about a member of the CRA, that such complaints be forwarded to me at this address: 1 Buckhurst Road, Bexhill on Sea, E Sussex.

We are often asked to adjudicate between customers and dealers who are not members of the Association. We are quite prepared to do this, but it must be understood that we have no 'leverage' with any firm that is not a member of the CRA. In other words, we will do our best, but we cannot guarantee success.

A J Harding

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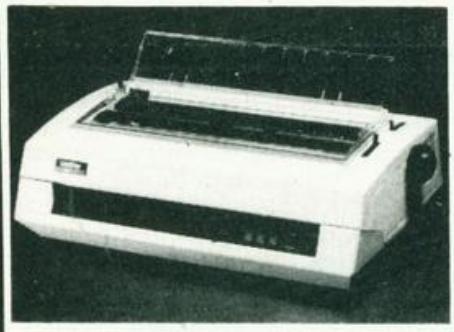

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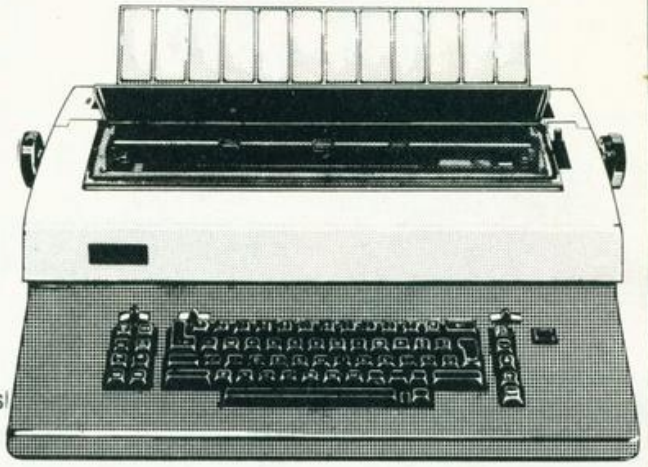

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SOFT WARES

IBM TAKES OFF▲

A flight simulator from Microsoft has been announced for IBM's PC. Flight Simulator is a highly accurate simulation of flight in a single engine aircraft, is adaptable to any interest or ability level, and you can vary the environmental factors such as weather, time of day and the season.

For a change of pace you can choose the 'British Ace' game mode and transform your flight world into World War 1 Europe. Flight Simulator has a retail price of £30.95. For more information contact Pete and Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG or 'phone 0706-227011.

WRITING IN CODE

Codewriter is a new program generator allowing a beginner to write programs in English without having to learn a special language such as BASIC, Pascal or FORTRAN. Codewriter users will need a minimum hardware requirement of an IBM Personal Computer and a floppy disc drive unit, although presumably a printer would be useful in a large number of instances. Codewriter is priced at £249.00.

Also from Dynatech comes Easitran which allows you to transfer data from an Applesoft BASIC program directly into VisiCalc data files. Available for Apple II Plus computers, it is priced at £65.00. Further information is available from Dynatech Microsoftware, Summerfield House, Summerfield Road, Vale, Guernsey.

BUG BYTES BACK

Customers who have purchased the Aspect assembler from Liverpool software specialists Bug Byte, are being advised of faults in the program; a copy sheet of corrections and errata has been drafted and will be supplied on request.

Bug Byte have also produced three new games, Space Invaders, City Defence and Galaxy Wars, all high resolution machine code games suitable for the BBC Micro Model B and all priced at £7.50 including VAT. Games should soon be available for the Oric and Dragon 32 and the game Scramble for the unexpanded VIC-20 is now in stock at £7.00. Bug Byte is in fact dropping the mail order side of its business, following the recent agreement with the Spectrum chain of computer shops to stock Bug Byte software.

For Aspect correction sheets contact Bug Byte (Dept Aspect), Freepost, Liverpool L3 3AB.

HOLE IN ONE

When it is cold and wet outside and you're itching to get at your golf clubs, you can enjoy nine holes without even getting the car out of the garage! Dragon Golf, which is a nine hole golf course, features all the normal hazards associated with the real game. The graphics display each hole as it is played, including all bunkers, water hazards and greens. In addition wind strengths and directions play an important part in the match as well as ensuring that each hole plays differently, even if the same clubs are selected by each player. The player can select from a full range of clubs and has to choose the angle of shot and the strength of stroke. Dragon Golf is supplied in tape format and is priced at £7.95. Obviously the game is for the Dragon 32 machine.

Designed specifically for use with the VIC-20, Grand master is a challenging chess game requiring an 8K expansion. There are 10 levels of play including one special level for analysis or postal chess. Grand Master costs £7.75 including VAT and is available from Audiogenic or via the nationwide VIC dealer network. Further information on either of the above can be obtained from Audiogenic Ltd, PO Box 88, Reading.

WORDPROCESSING MADE EASY

The WDPRO wordprocessing package has been enhanced to Version 2.24 adding several new features (existing users can easily upgrade by contacting Kuma). The extra features are additional printer routines to handle not only the Epson HX-20, Sharp P5, Sharp P6, Seikosha GP-100, daisywheels (in general) but also the Brother HR-1 and Mannersman-Tally matrix. The agonising situation where the operator has inadvertantly returned to the operating system before saving the text can now be recovered from using the new 'REENTER' procedure. The price of the package is £39.50 (cassette), £79.95 (disc) and £5.00 (upgrade), all prices excluding VAT.

Kuma have also announced FORTH for the Osborne 1 operating under CP/M, including the following major features: full Z-80 assembler with standard Zilog mnemonics, screen editor, floating point operators, a comprehensive tutorial manual and demonstrations of CP/M file handling and BASIC like string handling. Two major

innovations are introduced to make FORTH more attractive to the professional user. The Z-80 assembler allows development of assembly level programs within the powerful interactive environment offered by FORTH. The use of CP/M files for all operations will also free users of the need to operate two different disc formats. The recommended retail price is £85.00.

Further details can be obtained from Kuma Computers Ltd, 11 York Road, Maidenhead, Berkshire SL6 15Q.

BACK TO SCHOOL

Bourne Educational Software has been launched to satisfy the need for high quality software for the educational market. Programs developed by BES are aimed in particular at children of primary school age and are initially written for use on the BBC Micro.

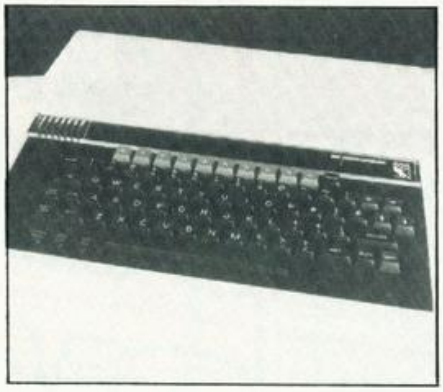
Two programs are Wordhang, a word guessing game utilising the BBC Micro's high resolution graphics capability to the full, costing £7.95, and Animal/Vegetable/Mineral', where

the computer tries to guess the object the child has thought of by means of a series of initial questions, costing £4.95. For more details please write to Bourne Educational Software, Bedfield Lane, Near Winchester, Hants SO23 7SQ.

MAKING FORECASTS

The Forecaster uses sophisticated mathematical techniques to forecast the future behaviour of a series of numbers from its past history. The user needs to have no knowledge about mathematical forecasting — he just has to type in the past values of the series he wishes to forecast and tell the computer how far into the future he wishes to look. The Forecaster then selects the best mathematical model to fit the data, and will then produce forecasts based on the model and will give a confidence interval for that forecast.

The Forecaster is designed for the Commodore 8032/96, and is priced at £320. For more details contact Microcomputer Program Design, 2 Hillside Place, Newport-on-Tay, Fife, or 'phone 0382-645979.



POETRY IN MOTION▲

OK then all of you with BBC machines you can now get a fully equipped word processing program, the Wordsworth, which is cassette based and requires no hardware modification. The package is designed to work with the 0.1 operating system, this system still being supplied with new machines, although versions for later systems are of course available. The Wordsworth is currently configured for the Epson MX-80III printer, and comes complete with a detailed manual and sample text. The price is £20.00 including postage and packing. Please specify the operating system, the author will gladly make every effort to adapt the program to suit individual requirements.

The Wordsworth was written by Ian Copestake and is available from him at 23 Connaught Crescent, Brookwood, Woking, Surrey GU24 0AN or 'phone 048 67 4755.

BRIEFING

A new series of educational packages from Pete & Pam Computers for the Apple II is now available: **Invader Round Up, Space Scanner, Invader Attack** and **Space Mouse** each cost £31.95. Together these constitute 24 programs in the Mathematics Competency Series, contact **Pete & Pam Computers,** New Hall Hey Road, Rossendale, Lancashire BB4 6JG for more information.

A new business simulation for the Sinclair ZX81 and ZX Spectrum, called **Dallas,** is available from CCS. Written as a board game it is a simulation of oil exploration with all the excitement and hazards involved. The ZX81 version costs £5.00, 16K ZX Spectrum version is £5.00 and 48K version is £6.00. For more details contact **Cases Computer Simulations,** 14 Langton Way, London SE3 7TL.

Two pieces of software for the Epson HX-20 come from Kuma: **Desk Master 1** is a microcassette based program causes the micro to duplicate the functions of a normal printing calculator, with comments, date and time easily added to the printer listing. Desk Master 1 costs £29.50 plus VAT. Also available is **Home Budget,** a microcassette costing £17.35. Kuma also announce **Gobbler,** for the Grundy Newbrain, a game using the hi-res graphics and priced at £9.20 including VAT. Information on these products can be obtained from **Kuma Computers Ltd,** 11 York Road, Maidenhead, Berkshire SL6 1SQ or 'phone 0628-71778.

Spider Software have announced a distribution agreement for overseas sales of their **Access** data base management package for the Apple II, the distributor being **Datamost,** 8943 Fullbright Avenue, Chatsworth, CA 91311, USA, 'phone number 0101-213-709 1202. For more information on **Spider Software** contact them at 98 Avondale Road, South Croydon, Surrey CR2 6JB or 'phone 01-680 8606.

From Popular Computing Weekly comes **Cruising on Broadway,** a cassette based program written for the 16K or 48K ZX Spectrum. Priced at £4.95 including VAT, it is available through major branches of **W H Smith** and many computer dealers and also on mail order from **Sunshine Books Ltd,** Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Stainless Software has announced more software for the TI 99/4A computer: in extended BASIC are **Devil Craze** (£11.00), **Sky-diver** (£13.00), and **Hang Glider Pilot** (£13.00) and a **Display Enhancement Package** on disc, requiring also 32K RAM and either extended BASIC, editor/assembler or mini memory (£16.00). Two other games are **Crazy Caver** and **Wonkapillar** at £6.00. The software is only available by mail order from **Stainless Software,** 10 Alstone Road, Stockport, Cheshire SK4 5AH.

Commodore Business Machines have announced the top twenty best selling VIC-20 software products. Introduction to BASIC Part I and II were numbers one and two, and the best selling game was Hoppit.

NEXT MONTH

computing today

JUNE ISSUE ON SALE MAY 13th

MICRO SURGERY REQUIRED?

It has been said that there are two ways of doing something, the accepted way and your way. Whilst the former may well provide a computer company with a standard product lacking in any innovation the latter can be fraught with problems. British computer makers are renowned for their innovation but usually the basis of each new machine is a tried and tested product; the BBC Micro and the Acorn Atom for example. Christmas saw the launch of a totally new British system called the Lynx. Initially well received by the Press, although tests were only performed on pre-production models, it appeared to have the makings of a very fine computer until certain quirks started to surface.

To say that we have thoroughly reviewed the machine would, if anything, be an understatement! Our reviewer even disassembled the BASIC ROM to try to establish why certain faults occur and his findings are, to say the least, essential reading for anyone considering the purchase of the machine or, indeed, anyone who already owns one and wonders why funny things happen. So, if you are after a British computer that offers colour and an impressive looking specification should you put the Lynx on your shortlist? We'll tell you next month!

THE ACME CUBE

Made in genuine simulated plastic and guaranteed to be totally breakable if you drop it this software simulation of the by now infamous Rubik Cube is only missing one facility, the solution! Converted for us onto the ZX Spectrum by the author of the original simulation it includes full colour display of the cube, the ability to store and retrieve your moves, twist and rotate movements and a complete unscrambler that retraces your moves. As an executive toy it surpasses even the all-time favourite, Newton's Cradle and as it runs on the 16K or 48K ZX Spectrum you'll be able to cost it all to research!

A NEW SERIAL

One would have thought that something described as an industry standard would, just possibly, have been the same in every respect regardless of where you find it. Well, as with many other so-called standards the RS232 serial interface has been subject to more than a little alteration and adjustment over the years as various manufacturers try to stamp their mark on it. To the purchaser of a microcomputer featuring this option it would appear that he or she could just buy any RS232 printer and they would happily talk to one another. The shock that one gets when they don't can quite put you off salesmen!

In next month's issue we'll be taking a long hard look at the serial interface that carries that innocent label, RS232, and showing you just how to ensure success in your connections. Maybe not first time but at least you'll know what to look for rather than tearing your hair and insulting your local microshop!

GET COMMUNICATING

The word interrupt often seems to strike a cold chill into the hearts of programmers. It looks complicated and should, therefore, be avoided at all costs! The trouble with this ostrich approach is that one tends to miss out on the most interesting area of computers, communication. In a new two-part series we present the complete idiot's guide to understanding interrupts. The only requirement for entry to the course is that you have a micro with a PIO or similar device as an output port. You'll need a friend with one as well to make the thing work properly of course!

As well as showing you how you can get information to be passed from one micro to another and opening up a whole new area of applications programming we'll be presenting a very, very special program which uses these techniques to allow the ultimate in two player games.

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

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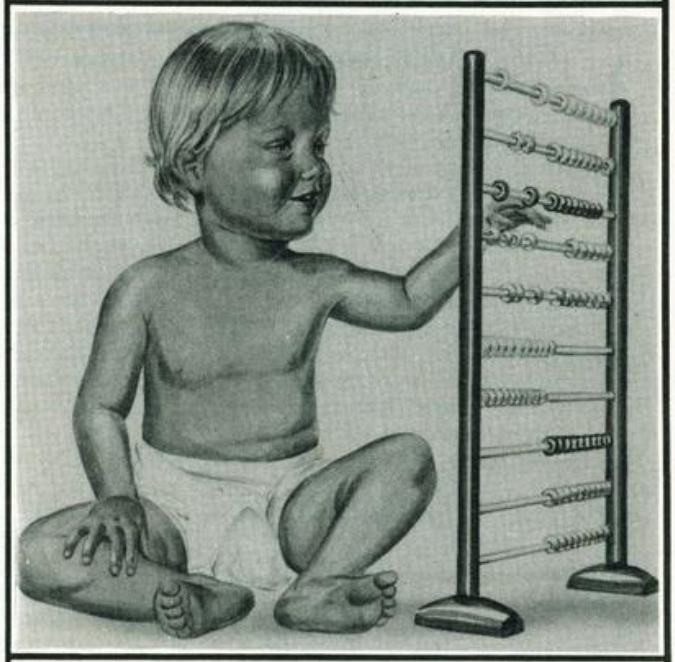

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INTO ATARI'S BASIC

In this month's piece we take a look at a simple renumbering routine and investigate the possibilities of producing a self-modifying program.

In March's **Computing Today** I looked at the way in which the Atari BASIC interpreter stores its programs and variables and, hopefully, demonstrated that the adventurous programmer can make use of this information to generate better, more efficient software. Once you have started to grasp the information and realised that it should be quite simple to make use of it a whole host of possibilities spring to mind. I'm only going to look at two; renumbering and program self-modification but there are many more.

PARTIAL RENUMBERING

Listing 1 is another program using the information given in last month's article. It is a 'partial' renumber routine. It is partial in the sense that it only renumbers the lines and ignores imbedded line references like GOTOs and GOSUBs. However, as Atari BASIC offers no such facility, even this is much better than nothing.

If any budding (and patient) programmers out there want to tackle the full facility version, the imbedded statements to be altered are GOTO, GOSUB, ON...GOTO, ON...GOSUB, RESTORE, LIST and TRAP. Again, all the information needed about Atari BASIC has been given here. However, BEWARE! As Atari BASIC allows variables to be used in all line referencing statements, the value of any variables used in this way will also have to be altered in the variable storage area — Good Luck!

USEFUL TIPS

Because Atari BASIC tokenises the program lines as they are typed in, a number of non-obvious tactics may be employed to achieve more efficient programming. For example, if a section of code is time-critical, the execution speed may be optimised by ensuring that the variables used in the code are specified as early as possible in the program. Simply initialising them to zero will do. This will place them at the beginning of the variable storage area and will therefore be found quicker by the interpreter at run time.

Note carefully, that there is no way, other than typing NEW or switching off the machine, of clearing unrequired variables which have been previously defined. So if you type LOUNT = 1 by mistake instead of COUNT = 1 and then alter it later, LOUNT will stay there forever. Even if you SAVE the program to cassette or disc and then type NEW or switch off and then re-LOAD the program, LOUNT will still be there. This is because a SAVE operation records the variable storage area with the program. To clear the RAM out of all unwanted variables, you must LIST the program to disc or cassette, type NEW and then ENTER the program back again. Under these conditions, the program is re-entered line by line as if from the keyboard.

To save RAM in your programs, avoid real numbers like the plague. Remember, all real numbers in Atari BASIC take six bytes of RAM every time they appear. A variable consumes one byte for each character of the name and eight bytes for its value but thereafter only one byte for each reference to the variable in the program. So if your program uses any number more than two or three times, it would be better to specify a variable to replace it. For example, if you use the number 1 a lot (as most programs do), specify a variable, say N1 = 1, early in the program and use N1 thereafter. The extended use of this technique can save a large chunk of RAM in a long program. Remember, this can also be used for line numbers in GOTOs etc.

MANY HAPPY RETURNS

If, like me, you are a keen programmer and if, like me, you don't have enough money to feed the kids ***and*** buy that neat little disc drive for your system, then you are probably already familiar with the horrors of cassette storage.

Provided your system stores and retrieves ones and noughts with some semblance of integrity, program storage need not be too traumatic. The real fun begins, however, when data storage and (more to the point) data modification is required.

For example, having just completed that foolproof pools forecasting program, you need to store mountains of statistics (form) to make it work. This vital data is stored on a different cassette to the program and must be updated every week with the latest results. The process of updating requires you to load the program from the program cassette, change cassettes, run the program and load your data. Having added last week's results, the updated data must be saved on yet another cassette (must retain the original for back-up). The whole process is fraught with difficulty and danger and can easily lead to corrupted data and hours of work lost.

How much easier it would be in such cases for the data to form an integral part of the program

Line	Function
Lines 32700-32704	The program inputs the old and new start line numbers and the required increment.
Line 32706	Sets ADD1 to the start address of the program storage area.
Line 32707	Gets the first line number.
Lines 32708/9	If the first line number is higher than the old start line number, then line 32727 is executed and the program restarts. If it is lower, then in line 32726, the contents of the third byte of the current line (ie the number of bytes used to store the line) is added to ADD1 so that it points to the beginning of the second line. This is repeated until the old start line number is found.
Lines 32711-32715	These count the number of lines from the old start line number to the end of the program.
Line 32717	Having determined the number of lines in the part of the program to be renumbered, this is multiplied by the increment and added to the new start line number. If the result is greater then 32699, line 32730 is executed and the program restarts.
Lines 32719-32725	The two-byte line number is constructed (LB,HB) and POKEd into the beginning of each altered line. This continues until the address of the last line is exceeded.

Table 1. The line by line breakdown of Listing 1.

which is loaded with the program, is modified and can be re-saved (once again along with the program) at the end of the update session. This requires only two cassettes (first and second generations) and is less likely to lead to disastrous human or machine errors.

In BASIC, the means to include great chunks of data as part of the program is afforded by the DATA statement. However, it is not normally possible for a BASIC program to generate and modify its own DATA statements. So, are we back to square one? Not if you use an Atari 400 or 800 we're not. There is a little trick with the operating system which forces the Atari to generate 'soft' Returns. That is, a quick POKE at the optimum moment fools the machine into thinking that someone just hit the Return key and it will keep on doing it until the original value in memory is replaced.

So, the idea is this. When the BASIC program generates new data and needs to include it permanently as a DATA statement, it prints a free line number on the screen followed by the word DATA followed by the information which needs to be stored. The cursor is suitably positioned, the POKE is POKEd and the line is entered into the program. Well, almost. Actually, to enter the line, the program needs to be stopped momentarily so that the editor in the BASIC interpreter can enter the line into the program. Then some means must be found to restart the program automatically.

Listing 2 illustrates the idea with a simple but powerful program which allows the user to input raw data and which automatically formats the DATA statements and integrates them into the program.

Lines 150 to 170 ask the user where the DATA line numbers should start what step to insert between them and then prompt for the actual data. Lines 190 to 210 build the string LINE$ which will form the new DATA statement. Lines 220 to 270 are the clever bits which, when included in that pools forecasting routine, could generate or modify the 'form' statistics.

Line 220 clears the screen and places the cursor one row down from the top. Lines 230 and 240 print the entire DATA statement in LINE$ followed, on the next row, by the BASIC reserved word 'CONT'. Line 250 places the cursor at the 'home' position (top left). Now the magic POKE in line 260 puts the Atari into continuous Return mode and STOPs the program.

Because the program has stopped, the Atari prints the message 'STOPPED AT LINE 260' at the current cursor position (top row of the screen) and moves the cursor down to the second row. Now the first soft Return takes place which enters the DATA statement into the program. The next soft Return enters the immediate mode command CONT which restarts the program at line 270. This line repairs the POKEd location to return the operating system to normal.

Lines 280 and 290 ask if there is more data to enter and, if so, increments the line number by STEP for the next DATA statement, clears the strings and loops back.

Listing 3 shows the same technique used to provide a crude 'Line Delete' function. In this case, the program asks for the limits of the line numbers to be removed and then proceeds to delete them by printing each line number on the screen and then doing a soft Return. In other words, just doing what you would do to remove a line number, but automatically and somewhat faster!

Any BASIC statement may be printed and entered into the program, not just DATA, which opens up all sorts of possibilities for sophisticated, self-modifying programs and even program generators (The Last One, Pearl and so on). So don't forget, if you think of a good application, let's all hear about it.

```
32700  PRINT "OLD START LINE NO.",:INPUT OLDSTART
32701  IF OLDSTART>32699 OR OLDSTART<0 THEN GOTO 32728
32702  PRINT "NEW START LINE NO.",:INPUT NEWSTART
32703  IF NEWSTART>32699 OR NEWSTART<0 THEN GOTO 32729
32704  PRINT "INCREMENT[5 SPC]",:INPUT INC
32705  COUNT=0
32706  ADD1=PEEK(136)+PEEK(137)*256
32707  LINE=PEEK(ADD1)+PEEK(ADD1+1)*256
32708  IF LINE>OLDSTART THEN GOTO 32727
32709  IF LINE<OLDSTART THEN GOTO 32726
32710  REM ** LINE=OLDSTART
32711  ADD2=ADD1
32712  COUNT=COUNT+1
32713  ADD1=ADD1+PEEK(ADD1+2)
32714  LINE=PEEK(ADD1)+PEEK(ADD1+1)*256
32715  IF LINE<32700 THEN GOTO 32712
32716  ADD3=ADD1
32717  IF NEWSTART+COUNT*INC>32699 THEN GOTO 32730
32718  REM ** START RENUMBERING
32719  HB=INT(NEWSTART/256):LB=NEWSTART-HB*256
32720  POKE ADD2,LB:POKE ADD2+1,HB
32721  ADD2=ADD2+PEEK(ADD2+2)
32722  NEWSTART=NEWSTART+INC
32723  HB=0:LB=0
32724  IF ADD2<ADD3 THEN GOTO 32719
32725  END
32726  ADD1=ADD1+PEEK(ADD1+2):GOTO32707
32727  PRINT "LINE NUMBER NOT FOUND":GOTO 32700
32728  PRINT "LINE NO. OUT OF RANGE":GOTO 32700
32729  PRINT "LINE NO. OUT OF RANGE":GOTO 32702
32730  PRINT "RUN OUT OF LINE NUMBERS": GOTO 32700
```

Listing 1. The simple renumber program. Note that it does not cater for jumps, we've left that for you!

```
100  DIM STAT$(5):STAT$="DATA "
110  DIM LINE$(131),DATA$(120),AN$(1)
120  PRINT CHR$(125):REM ** CLEAR SCREEN
130  POSITION 12,4
140  PRINT "DATA GENERATOR"
150  POSITION 4,7:PRINT "ENTER FIRST DATA LINE NUMBER ";
     :INPUT LINE
160  POSITION 4,9:PRINT "STEP BETWEEN DATA LINE Nos. ";:
     INPUT STEP
170  POSITION 4,11:PRINT "ENTER RAW DATA"
180  INPUT DATA$
190  LINE$=STR$(LINE)
200  LINE$(LEN(LINE$)+1)=STAT$
210  LINE$(LEN(LINE$)+1)=DATA$
220  PRINT CHR$(125):PRINT
230  PRINT LINE$
240  PRINT "CONT"
250  POSITION 0,0
260  POKE 842,13:STOP
270  POKE 842,12
280  PRINT CHR$(125):POSITION 4,4:PRINT "MORE";
290  INPUT AN$:IF AN$<>"Y" THEN 999
300  LINE=LINE+STEP
310  LINE$=" ":DATA$=" "
320  GOTO 170
999  END
```

Listing 2. The automatic DATA statement generator routine.

```
110  DIM AN$(1)
120  PRINT CHR$(125):REM ** CLEAR SCREEN
130  POSITION 12,4
140  PRINT "AUTO LINE DELETE"
150  POSITION 4,7:PRINT "ENTER FIRST LINE NUMBER ";:
     INPUT LINE
155  POSITION 4,9:PRINT "ENTER LAST LINE NUMBER ";:
     INPUT LINEND
160  POSITION 4,11:PRINT "STEP BETWEEN DATA LINE Nos.";:
     INPUT STEP
220  PRINT CHR$(125):PRINT
230  PRINT LINE
240  PRINT "CONT"
250  POSITION 0,0
260  POKE 842,13:STOP
265  POKE 842,12
270  LINE=LINE+STEP
275  IF LINE<=LINEND THEN GOTO 220
280  PRINT CHR$(125):POSITION 4,4:PRINT "MORE";
290  INPUT AN$:IF AN$<>"Y" THEN 999
300  GOTO 130
999  END
```

Listing 3. A further adaptation of the idea to provide a line deletion routine.

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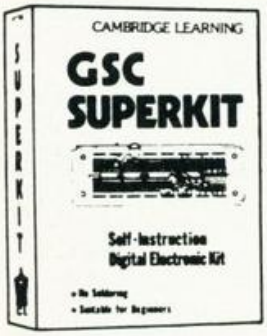

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SPECTRUM BOOKS SURVEY

Our reviewer has taken a look at the spectrum of books that have appeared about the ZX Spectrum.

As each new Sinclair computer comes into sight, and sometimes a little before the actual hardware appears, a flock of related literature begins to emerge. There have been unkind suggestions that this is encouraged by the inadequacy of the official manuals, which are really quite comprehensive – up to a point – but a more credible explanation is that many purchasers have been first-timers, with no background experience to help them fill in the gaps.

Producing books related to a new computer can have its difficulties. Possession of an advance model, by fair means or foul, is essential. Without that, a lot of guesswork would be needed. Then comes the need to work out new programs relevant to the machine concerned, and give them a thorough test. That takes time, and time is precious when others are trying to get their books on to the market first.

A particular dilemma concerns the manner in which program listings are presented. Direct reproductions of computer printouts are less prone to error, but those based on the Sinclair printer are not always too easy to read, and they do little to help the 'image' of the book. With other computers, it is possible to link up a high-grade printer, but that is more difficult with ZX machines.

Transcribing the listings into a more readable form improves the image, but presents two problems of its own. Meticulous proof reading is essential, and this is not helped by the fact that some type faces fail to make a clear distinction between, say, 1 and l (the numeral and lower case L, to make the point clear!) Whereas the right interpretation is rarely a problem in ordinary text, it can be a matter of sheer guesswork in a listing.

The books considered below solve these problems in different ways. Some, frankly, are re-cooked versions of books published for the ZX81 or ZX80. Others show only a rather remote relationship with the ZX Spectrum, being just as applicable to other machines. However, there are one or two which genuinely give their readers an insight into the special characteristics of this interesting machine, either by explanation or example.

It was not possible to set up and run all the programs given in the books, but a sample selection was chosen as a basis for statements regarding program quality, which ranged from very moderate to extremely good, though some programs in the latter category proved difficult to debug when typing errors had been made during input.

As a last point, it may be suggested that there is room for a further wave of ZX Spectrum literature to fill in the gaps left by these forerunners, and to condense the accumulated data they contain into more accessible form.

Introducing Spectrum Machine Code
Ian Sinclair
Granada Publishing Ltd
151 pages: £7.95

In essence, this is an elementary programming manual for the Z-80 microprocessor, with some fairly superficial data on the way the device is used in the ZX Spectrum. It would provide a good starting point for a beginner, less daunting than the professional Z-80 books, but a need for additional data on the more exotic instructions would soon become evident. Reference is made to the ULTRAVIOLET assembler program, but more information could have been given on 'manual' assembly methods, which are valuable in showing how the essential processes work. A useful stepping stone to higher things, but it needs a follow-up going into greater detail.

Computer Puzzles for Spectrum & ZX81
Ian Stewart and Robin James
Shiva Publishing Ltd
60 pages: £2.50

The title indicates the weakness of this book: The programs are first presented in ZX81 form, and conversions for the ZX Spectrum are then given, except in the case of the last four of the nineteen programs, which are specifically for the ZX Spectrum alone. The special capabilities of the ZX Spectrum are therefore left unexplored. However, the concept of basing the programs on puzzles does open up new fields for those who are tired of seeing the same old program titles again and again. The programs are at a fairly elementary level.

The ZX Spectrum and how to get the most from it
Ian Sinclair
Granada Publishing Ltd
130 pages: £5.95

Starting with some useful down-to-earth points about the electrical connections and the way to tune the television set, this book goes on to illustrate programming principles by short printouts given in facsimile. Of about seventy such examples, a few are self-contained programs, but all are aimed mainly at illustrating the text. Broadly speaking, the result is an expansion of the ZX Spectrum manual, without much enlargement of the area covered. A solid book, full of patient explanations which will help the comparative beginner.

The Spectrum Programmer
S M Gee
Granada Publishing Ltd
141 pages: £5.95

This book is mainly a BASIC primer, with sections dealing with the special characteristics of Spectrum BASIC. Short program examples are given, but the reader is left to link them together to form working programs. Much of the material can be found in the ZX Spectrum manual, though it is expanded and explained in more detail. A book for the beginner.

Programming Your ZX Spectrum
Tim Hartnell and Dilwyn Jones
Interface Publications
231 pages: £6.95

A tightly-packed assembly of programs, mostly very short, arranged to illustrate particular statements and methods. The listings are in printout facsimile, and cover a wide field. Some are adaptations from ZX81 practice, and in one or two places this shows a little, but not to a serious extent. One of the most useful sections deals with conversion of programs written for other computers. The rapid sequence of sections dealing with different subjects can look confusing at first, but an adequate index allows a particular section to be found quickly. There is little of an abstruse nature, but much useful material for those on the way up in their understanding of BASIC.

The Spectrum Book of Games
Mike James, S M Gee &
Kay Ewbank
Granada Publishing Ltd
146 pages: £5.95

Twenty-one games programs, some quite substantial, none trivial, and including some familiar titles and some novelties. The printouts are facsimiles, but not of a Sinclair printer product, apart from some screenprints. Suggestions are offered regarding possible enhancements to the programs, and adequate supporting explanations are provided. The book is heavensent for those who have run out of ideas for new games programs, but the full capabilities of the ZX Spectrum are only partially explored.

Understanding Your Spectrum
Dr Ian Logan
Melbourne House Publishers Ltd
192 pages: £7.95

A crash course in the Z-80 microprocessor is combined with some useful information on the inner workings of the ZX Spectrum, including the location of essential routines in the ROM and the way they can be called. Perhaps a little alarming for the beginner, but invaluable for someone who has already dabbled in the use of machine code as an adjunct or alternative to BASIC. Information on assemblers and disassemblers which were available to the time of publication is useful, and there is even a section on bugs in the ZX Spectrum ROM program. A very useful book.

Games ZX Computers Play
Tim Hartnell (Editor)
Interface Publications
167 pages: £3.25

Thirty programs, 15 of them for the ZX Spectrum, the rest for the ZX81. (Actually, there appear to be 32, but the book itself claims only 30). As varied as their origins, the programs

are interesting without being outstanding.

Games To Play On Your ZX Spectrum
Martin Wren-Hilton
Shiva Publishing Ltd
43 pages: £1.95

Thirteen programs, mostly games, with limited explanatory notes. All are fairly short, and use of the ZX Spectrum special characteristics seems limited.

Exploring Spectrum BASIC
Mike Lord
Timedata Ltd
191 pages: £4.95

This book sets out to teach, in an unobtrusive way, how the more difficult problems in BASIC can be handled. There are several illustrative programs, including a very good Maze program and a three-dimensional display routine. The section on sound and colour is rather more comprehensive than in some other books, being brief but to the point. Not bad at all.

Easy Programming for the Spectrum
Ian Stewart and Robin Jones
Shiva Publishing Ltd
139 pages: £5.95

A BASIC tutorial presented in a fairly light-hearted way to encourage those who are struggling. A number of programs are provided, some to illustrate particular points, but all are relatively small. Listings are type-set. While the general content relates to BASIC, the characteristics of the ZX Spectrum are by no means ignored.

20 Best Programs for the ZX Spectrum
Andrew Hewson
Hewson Consultants
118 pages: £5.95

A varied collection of programs, ranging from Hangman to utilities for handling machine code. The listings are in facsimile of Sinclair printer output, and are occasionally difficult to decipher, but are readable with a little thought. The machine code utilities are probably the most important of the programs.

The ZX Spectrum Explored
Tim Hartnell
Sinclair Browne Ltd
218 pages: £5.95

About 46 listings are used to illustrate ZX Spectrum characteristics in BASIC. The listings are facsimiles of Sinclair printer output. There are sections on colour, sound, business applications, educational aids, and games. None are sensational, just reasonable material to guide the steps of an inexperienced programmer, who might soon begin to see possible enhancements. The title seems to be well justified.

Spectrum Machine Language for the Absolute Beginner
(Edited) William Tang
Melbourne House (Publishers) Ltd
245 pages: £6.95

A Z-80 microprocessor primer with references to the ZX Spectrum characteristics. A machine code monitor in BASIC, a loader for hexadecimal data, and a complete 'Freeway Frog' program in machine code are provided. The standard of presentation justifies the book's title, but the coverage provided will take the beginner quite a long way. However, the link to the ZX Spectrum, rather to any other Z-80 computer, is a little tenuous.

Over The Spectrum
Edited by Philip Williams
Melbourne House (Publishers) Ltd
164 pages: £6.95

A compilation of 28 programs in BASIC, some with machine code support. Each program is supported by adequate explanations, and for some there are coloured pictures of the display. The only criticism that must be made is that some of the programs are so ingenious that it can be quite difficult to locate errors made when typing them in. There are some superb implementations of the ZX Spectrum graphics, and if there are instances where a simpler program structure can be seen as both possible and preferable, it is easy to be wise after the event, and at least something has been learned. A book to make you think, rather than just a source from which to copy programs.

Cambridge Colour Collection
Richard Francis Altwasser
R F Altwasser
64 pages: £6.95

Twenty programs written by a man much involved with the development of the ZX Spectrum. The listings are type-set but avoid ambiguities by using upper case and slashed zeroes. As might be expected, good use is made of the special ZX Spectrum characteristics, and the programs

cover a wide field, from home accounts to random pattern generators. It should be noted that the listings are very compact, and the book would be much bigger if they were presented in facsimile form. Perhaps more important is the high standard of program writing, which puts some of the competitive offerings to shame and sets an excellent example to beginners.

The Spectrum Pocket Book
Trevor Toms
Phipps Associates
160 pages: £6.50

This successor to the **ZX80** and **ZX81 Pocket Books** is essentially a collection of varied programs, plus some useful inside information about the machine covered. The programs include an Assembler, a Disassembler, a machine code monitor and a Screen Toolkit, as well as a number of games and a budget account system. Some emphasis is placed on the use of a direct interface to ensure accuracy of the listings, the whole book having been created with the aid of a Diabolo 630 printer. Rather more than a third of the book is devoted to machine code, including the support programs already mentioned, and there is useful information regarding linkage points in the ROM program.

The Working Spectrum
David Lawrence
Sunshine Books Ltd
216 pages: £5.95

Where most of the ZX Spectrum books illustrate their points with the help of games programs, this one concentrates on more serious applications, though not exclusively. A filing system, financial programs, home tutor routines and a chapter on graphics handling are supported by a selection of miscellaneous routines, including a couple of games. The programs are listed on a respectable dot-matrix printer, and are quite easy to read. An unusual feature is that the listings are divided into blocks, which helps clarity and allows entry sessions to be broken up conveniently, but as the blocks are not in numeric order there is a need to dart from page to page when working out the overall function. As they stand, the programs are complete, but there is scope for further extension in most cases, and suggestions for this are offered. This is, in general, a book for the more serious user. The title is qualified by Volume 1, so its successors will be looked for with interest.

LATE COMERS!

Almost as if to prove the point that there is a constant flow of books onto the market, more have come to our attention since this survey was written. Indeed one of the following (by Dr Logan) was still only at manuscript stage at the time this issue of *Computing Today* was being put together! Since we did not get a chance to look at these boks in detail, the below merely aims to inform you of their content, rather than give an actual appraisal.

40 Best Machine Code Routines for the ZX Spectrum
John Hardman and Andrew Hewson
Hewson Consultants
144 pages: £5.95

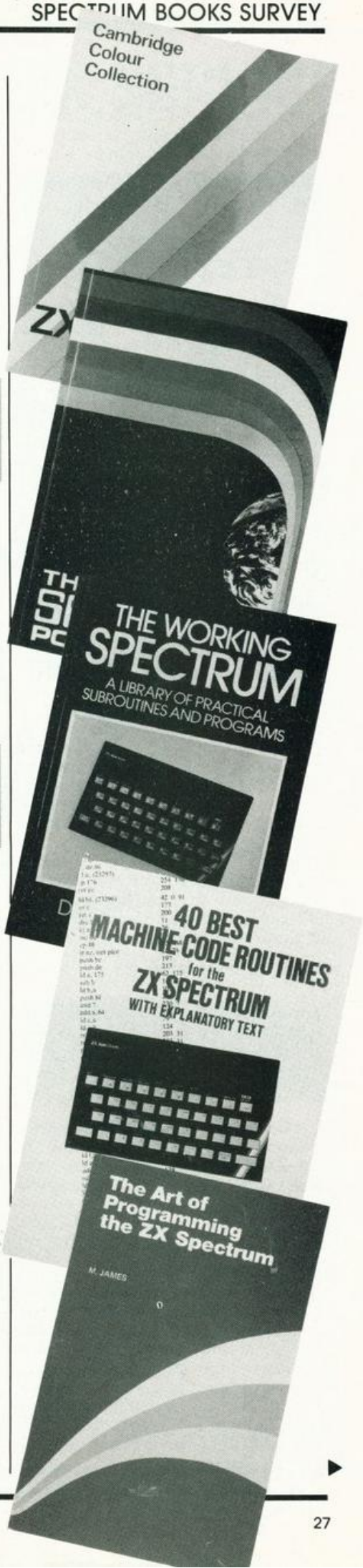
The book comprises two sections: Section A written by Andrew Hewson, introduces the beginner to machine code and its nomenclature. Section B is written by John Hardman, provides both the beginner and the experienced programmer with 40 machine code routines including Scroll Left and Line Renumber in easy to load forms. The functioning of each routine is clearly explained.

The Complete Spectrum ROM Disassembly
Dr Ian Logan and Dr Frank O'Hara
Melbourne House
236 pages

This book, which was still at the manuscript stage at the time of my writing this brief summary, contains the following sections: The restart routines and tables, The keyboard routines, The loudspeaker routines, The cassette handling routines, The screen and printer handling routines, The executive routines, BASIC line and command interpretation, Expression evaluation, The arithmetic routines and The floating point calculator. Also included are appendices covering BASIC programs for the main series (SIN X, EXP X, LN X & ATN X), The 'DRAW' algorithm, The 'CIRCLE' algorithm, and Note on small integers and −65536.

Advanced Graphics with the Sinclair ZX Spectrum
Ian O Angell and Brian J Jones
Macmillan Press
288 pages: £9.95

This book, which should appear in April 1983, is intended primarily for ZX Spectrum owners who are competent BASIC programmers, but who are complete beginners in computer graphics. It contains the



elementary ideas and basic information about pixel and 2-D graphics which have to be mastered before the more involved concepts of character and 3-D graphics.

More Real Applications for the ZX81 and Spectrum
Randle Hurley
Macmillan Press
172 pages: £7.50

The object of this book is to take the ZX81 and the ZX Spectrum a long way along the path towards use as a small business or 'working' computer. All listings have been produced using the Sinclair printer and have been run in the computer before being listed. The programs in the book include subjects such as file handling, statistics packages, animation programs and more. Backup tapes are also available which also include some programs that are not in the book at a price of £9.00.

Spectrum Hardware Manual
Adrian Dickens
Melbourne House
£5.95

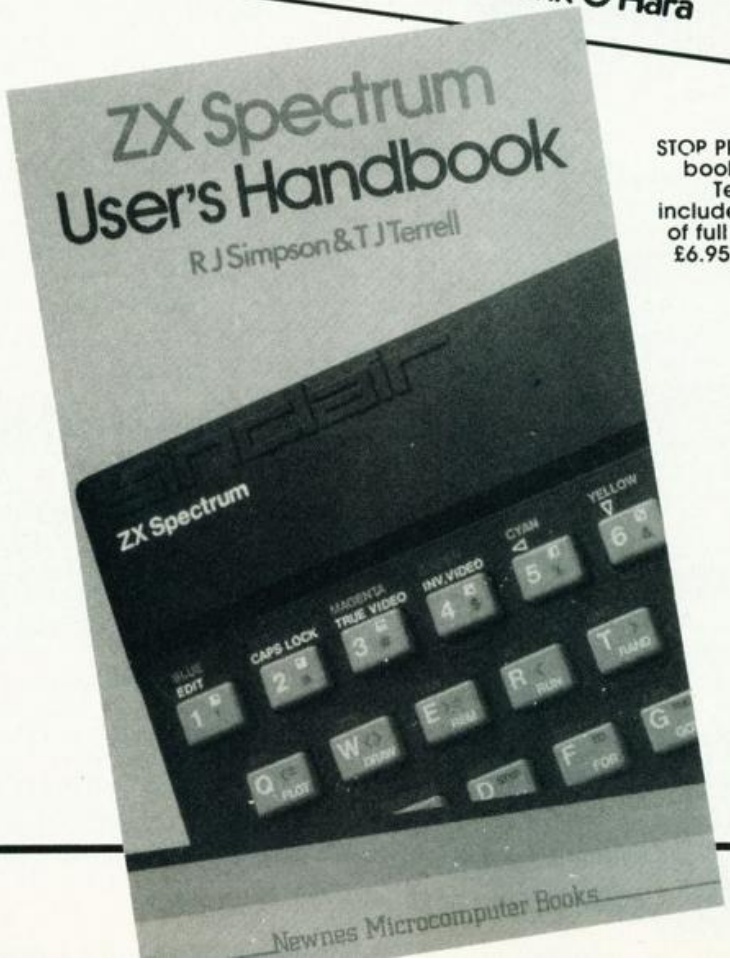
This book explains exactly what is inside the ZX Spectrum and how it works. Full circuit diagrams and a detailed explanation of each component are given. Many features not in the manual are discussed here — how to adjust the colours for your own TV set, how to amplify the sound of the internal loudspeaker and much more. Practical hardware projects include how to connect a full size keyboard, connecting the ZX Spectrum to the outside world, and how to build your own joysticks for use with the ZX Spectrum.

The Art of Programming the ZX Spectrum
M James
Bernard Babani (Publishing) Ltd
138 pages: £2.50

This book introduces all the features needed to write games programs for the ZX Spectrum. Graphics are dealt with in a number of the chapters as well as the sound capabilities and the use of PEEK and POKE.

MORE TO COME?

It almost goes without saying, but we'll say it anyway, that we could carry on adding to this list almost *ad infinitum* since new books are appearing all the time. We have tried to cover as many as possible in these pages but we don't doubt that more will be available by the time you actually get to read this!



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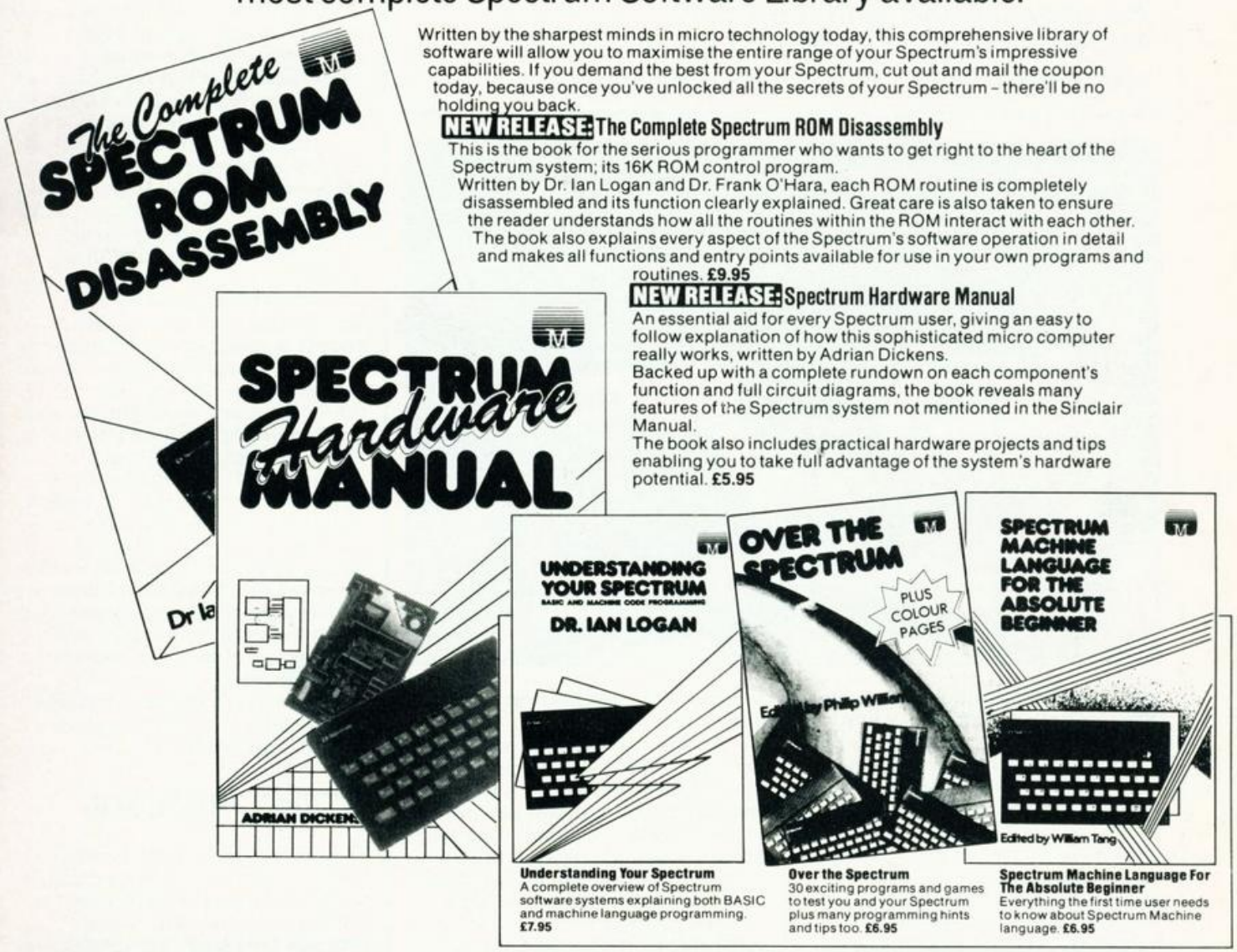

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GETTING ADVENTUROUS

We play around with the Scott Adams' games and let you know just what you're letting yourself in for.

Scott Adams did for adventure programs what Henry Ford did for motor cars. He didn't invent them – that honour probably goes to Will Crowther – but he refined and popularised them, bringing them to a large consumer market. In doing so, he set standards which have been widely accepted throughout the industry, and has left a trail of imitators following closely in his footsteps.

THE OVERALL PICTURE

The adventures all have a similar screen layout, similar presentation and the plots follow the same sort of lines. There is always a task for you to achieve, and this takes you right to the end of the game. In some, there are treasures to collect, and it doesn't always tell you how many there are. In others, there is a single objective. For example, in **Mission Impossible**, an early and easy game, your orders are to destroy a bomb planted by a saboteur in a nuclear power station. Your instructions are given to you by a tape recorder, which you find in a small room. The tape recorder is large, and may have other uses!

All the games begin with the same frontispiece, welcoming you, giving you a few words of the vocabulary, and giving suggestions to newcomers. This really seems a bit of a waste of space — it is the same introduction in all the games, right down to the same spelling mistake in one word. And the vocabulary contained in the instructions doesn't even work in some of the games! Still, I'm sure he knows what he's doing.

Unlike some other adventures, it isn't possible to display the entire vocabulary, of which there are at least 120 words. Many of these have the same effect, and there seems to be no difference between GET, TAKE and GRAB. Abbreviations are accepted for compass points, and 'I' gives an inventory. Incidentally, most words can be shortened to the first three or four letters, which makes it much easier to deal with the Neanderthal or the Test tubes.

The screen is divided into two parts. In the upper half, you are told where you are, what you can see, and some obvious exits. These obvious exits are only half the story, for there are other less obvious ones. If you are standing at the base of a volcano, with an obvious exit to your right, you can try GO VOLCANO. If you were standing on a cliff, you could try GO CLIFF, or even JUMP CLIFF. The effects would be similar (unless there was no gravity!)

The bottom half of the screen is used for you to type in your commands, which may be one word (SLEEP, BREATHE, HELP) or two words (GET PLANT, CHEW GUM). The program replies are also displayed here. This may just say OK, or give you a valuable piece of information, especially if you have just EXAMINED or READ something. It is always worth looking at the top part of the screen after every instruction.

Death features in all adventures. This usually affects you. It is possible and often highly desirable to save the game. When you suffocate, drown, get poisoned, eaten or blown up, you get the message 'This adventure is over', and you are offered the chance of starting again: either from scratch or from the position at which you saved the game. Hopefully, this would be just before you tried to do battle with the dragon! At the end of the game, you are congratulated, and given the same message. Perhaps it's childish of me, but I feel that after staying up all night to achieve this, one deserves a little more, and a flourish of pixels wouldn't go amiss.

SETTING THE SCENE

Each of the adventures is set in a familiar setting, and the ground rules are known to all. **Ghost Town**, set in the Wild West, **Strange Odyssey**, the space-travel adventure, and **Mystery Fun House**, based in a funfair, all have well known backdrops with, to some extent, well understood and even cliched scenarios.

One of the features which sets these adventures above the rest is the way in which powerful images are conveyed with clarity and brevity. The **Pirate's Cove** adventure starts in a flat in London. You can almost picture it, as if in an old movie – the creaky stairs leading to an attic, with dusty books on a shelf. The scene appears as if on a black and white screen. When you travel to the sunny beaches of the island, it almost seems as though you have burst into Technicolor. All this is

done using a few, very carefully and succinctly chosen words – after all, the whole thing fits into 16K.

Adams also manages to instill a true feeling of suspense. Parts of his games are humdrum, even tedious, as you build up in preparation to what you feel must be a breakthrough. Late at night, by the light of a flickering candle, you creep into the bar room, where you can hear the sounds of music. You are convinced you will find something, when suddenly...! Make no mistake – the suspense really is there, after you have been playing for a few hours, and it matches the chilling feeling you get in your stomach when reading an engrossing novel.

There are often times when you think a breakthrough is in sight, only to suddenly find a barrier in your way. In **Voodoo Castle**, one of Adams' personal favourites, you can get into the chimney in the ballroom, and hear sounds from above. You feel convinced that these sounds would be more audible if you could get closer to their source. Typing LISTEN confirms your belief. But the chimney is dark, and moving in the the dark is hazardous. Then you find a source of light, and rush back to the chimney, heart pounding in expectation of a path through to the end of the tunnel. You retrace your footsteps. You can see the way! And then as you climb the chimney, the sounds get less muffled and louder, as if there is someone else in the chimney above you. You must climb higher. You must get closer. And then, blocking your path, is an iron grate. You strain your ears, but it's no good, you can't hear well enough. The grate is nailed, and you can't remove the nails...yet!

Dejected and despondent, you come back to the fireplace, and back into the castle, where you must search for a way of getting past the grate. When you can do this, your heart will palpitate or even fibrillate, as you retrace your steps again, confident in the knowledge that now, this time, you can discover the source of the mumblings.

Sometimes, teasers like this can end with you drawing a complete blank, and I recall burning the midnight oil chasing a clue, which climaxed in me finding the message BUY ADVENTURE NUMBER 5 – FROM ALL GOOD COMPUTER STORES! Red herrings like this are liable to cause apoplexy. Still, I suppose apoplexy is all part of the fun of adventure games!

PRESENTATION POINTS

Scott Adams adventures now come in a well designed presentation package. There is an illustration of the scene, and the boxes can be kept for storage, fairly attractively fitting on your bookcase. Full marks for this. In contrast, the documentation is singularly vacant. There are instructions for loading, saving, etc, but that is about it. There is no indication of your aim, and not much in the way of hints or clues. Perhaps this is intentional – the only way of discovering is to play the game.

For speed and security, the games are written in machine code. To discourage you from making copies, the programs fill all the memory of 16K machines – the programs aren't 16K long, there's a big hole in the middle to fill the space! This should reduce the numbers of bootleg copies.

Scott Adams hasn't written an adventure himself for over a year. He is a young, bespectacled graduate, who still spends some evenings and weekends programming but most of his day is involved in administration of Adventure International. The company now publishes adventures by other authors, and are involved in arcade games. They intend to publish programs for what they consider the major computers: Apple, PET, TRS-80, VIC-20, Atari and Sorcerer, with more to come. Nobody is working on versions for Sinclair or BBC Micros, which haven't yet impressed the Americans.

All the programs have the same form, with a vocabulary, message strings and interpreter. It came as no surprise to find that all were written using the same Master program. This can now be purchased, and allows you to write your own adventures using the same format and routines that Scott Adams uses. It is not easy to produce one that manages the same standard of plot, suspense and humour, although for the literary genius with no knowledge of assembly language programming, it offers an ideal solution. The manual supplied with the Master program gives some insight into the ways they were written, and may offer profitable lines of thought.

The original versions had no sound effects or graphics. Personally, I don't think these would add anything.

Like radio plays, these stories are quite atmospheric, and their imagery relies on your imagination. I don't think graphics would be an improvement – they'd more likely be the opposite. But if you disagree, Apple owners can buy versions with graphics: not designed by Adams himself. He never felt they were necessary, but bowed to public pressure.

A MAJOR PROBLEM

One of the problems with all adventure programs is that they can only be done once. As with most films, books and meals, going about it a second time loses much of the intrigue and suspense and the only solution is to buy another one. In **Ghost Town**, a bonus scoring system was introduced. Blowing the safe open first time awards you points, and dithering doesn't.

In many ways, these games are like reading a novel. The main difference is that you are intimately involved, and can influence whether it ends happily or in disaster, or simply peters out from lack of interest. This latter doesn't usually happen. There always seems to be one unexplored path, one unused object or one unsolved puzzle, and you are usually convinced that solving this would give you the means to achieve your desired end. Unfortunately, it isn't always that straightforward.

Unlike most novels, you can do things in the order you want. But some things can't be done until others have been achieved. Also, some actions will prevent you from getting any further. If you don't believe me, try dropping your ticket inside the funfair. Bouncers don't believe you ever had one, and once they've thrown you out, you can hardly expect them to believe you left your ticket inside!

The games are numbered in order of their appearance, and also in order of difficulty. The easier ones have many built-in clues, and when you get stuck you can type HELP for a real clue. The later games get much harder, and typing HELP just gives the reply 'Sorry – doesn't work'. There are Hint sheets available, which will give you clues. These aren't a step-by-step guide, but offer suggestions to you when your eyes are glazing.

When playing adventures, you sometimes know what the problem is but don't know how to solve it. More commonly, you don't have a clue what you should be doing, and you wander round in circles, waiting wistfully for a whiff of inspiration. Next month, I shall offer some suggestions to reduce this frustration.

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BUSICALC is just the program for those who need to juggle with figures. You could use it to plan your household finances or your personal tax — but it's equally capable of handling much larger figures. If you've got a printer you'll be able to produce reports that are good enough to put before the board (or the bank manager) — but a printer isn't nevessary, and neither is a disk drive. **BUSICALC** costs just **£39** plus VAT on tape, or **£40.50** on disk; there are versions at the same prices for the PET and VIC-20 (with 16K expansion).

MIKRO ASSEMBLER plugs into the cartridge port of the 64. As PET and VIC owners are already well aware, **MIKRO** makes writing machine code programs almost as easy as Basic, because it is a real assembler with LABELS. To help you write your program MIKRO nad AUTO, DELETE, and FIND commands; to help you debug it there's a machine code monitor; and you can DISASSEMBLE from Basic or in the monitor! The TABLE commands displays or prints an alphabetically sorted symbol table after assembly — which is really fast (**MIKRO** will assemble 2K of code in just 20 seconds). If you are writing more than (say) 4K of code you may have to split your source code into several files, but **MIKRO** will automatically link these together at assembly time, loading them from tape or disk as appropriate. The **MIKRO** module costs **£50** plus VAT; it could be the best investment you ever make.

With **ARROW** installed in your 64 the Commodore cassette unit LOADS AND SAVES PROGRAMS SEVEN TIMES FASTER! Almost as fast as the 1541 disk, in fact. There is however a small difference in price — because **ARROW** costs just **£39** plus VAT. **ARROW** has its own load and save commands, so you can still load and save at normal speed if you should want to. **ARROW** is a tried and tested product that we've been selling on the PET for several years; now 64 owners can also benefit.

Now for the lighter side of our range. **TANK ATTACK**, **KAKTUS** and **MANGROVE** are arcade games with colour and sound; a joystick is recommended, but is not essential. They each cost **£8** plus VAT on cassette or **£9.50** on disk. The **HITCH-HIKERS GUIDE TO THE GALAXY** is an adventure based (with the kind permission of Douglas Adams and Pan Books) on the characters and scenarios in the popular series. If you divide the price of **£12** plus VAT (**£13.50** on disk) by the number of hours you'll spend exploring the galaxy the answer will be a very small number indeed!

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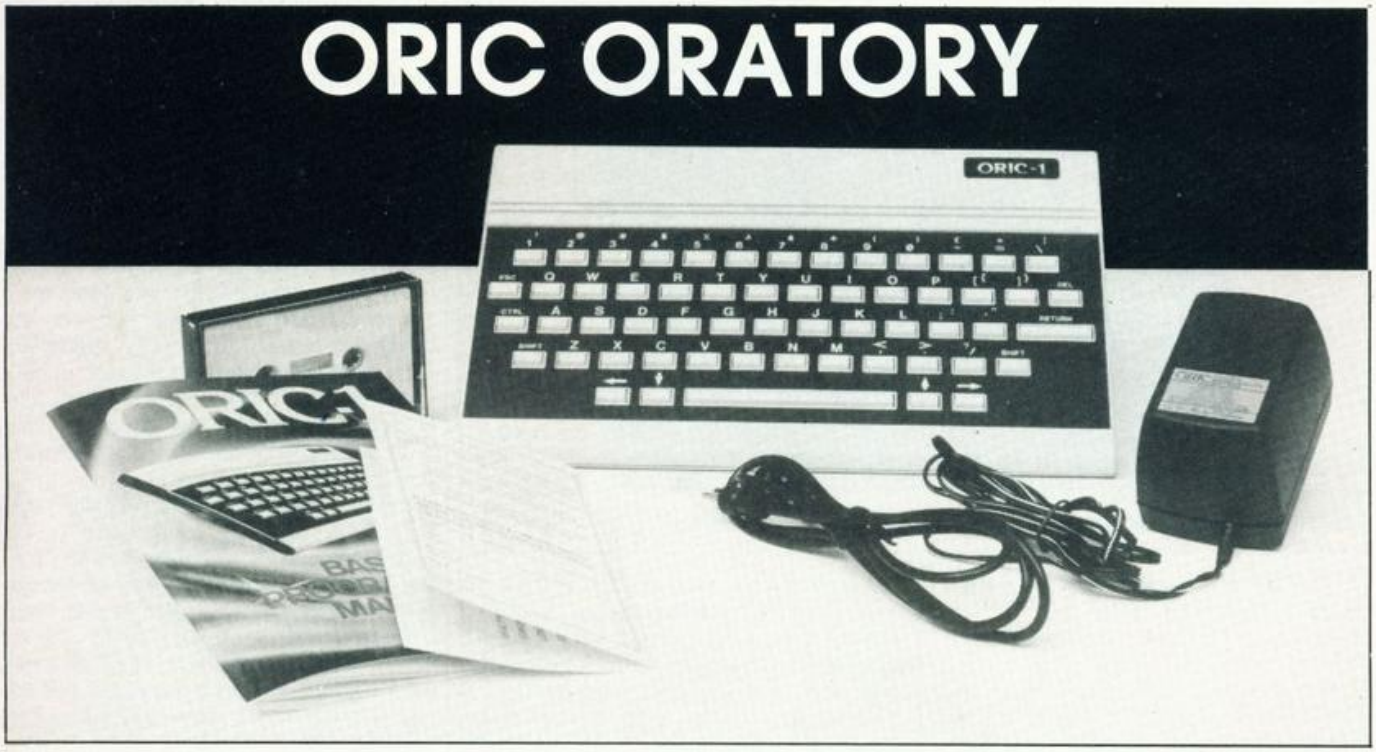


Colour computing for less than £100? The Oric certainly offers this and more as our extensive review shows.

The last year has seen the introduction of a number of highly interesting, low cost microcomputers. Sadly most of them have been announced before the final production models had been thoroughly tested and in sufficient quantity to supply the increasing number of would-be purchasers. The Oric has also had its initial problems and although some writers have suggested that Oric is a derivation of that well known computer aboard the spaceship Liberator its origins actually stem from an anagram of micro (so, they lost an 'm'!). Perhaps it was prophetic as one could have said 'Alas, poor Oric'. Hopefully those days are reaching an end and the distribution of Orics will follow the distribution of the rabbit population.

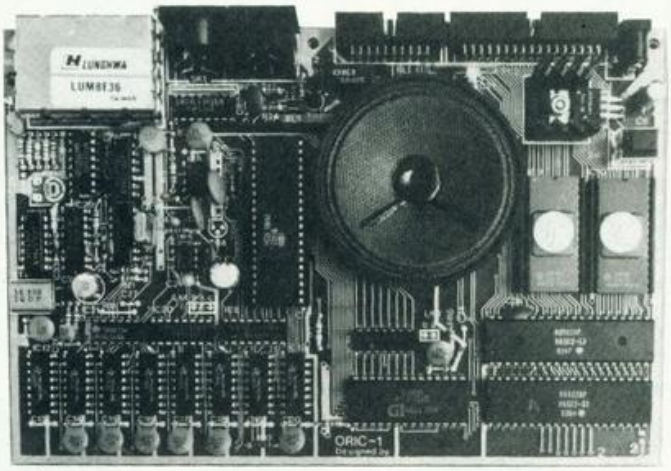
I'm sure Oric Products have done themselves a great disservice in sending out pre-production models for review, as some of the comments I have seen in print are simply not true. Like other micros on the market the Oric does not conform to any standard of operation and one must spend several hours familiarising oneself with its specific operating system. I stress this as most micros are satisfactory within certain limits but no one computer offers all that the experienced user desires and as certain operations are handled in different ways they require getting used to before useful criticism may be made.

HARD FACTS

The Oric comes complete with power unit, TV lead, demonstration cassette and instruction manual. The early Orics had a very poor 32 page provisional manual that has now been superceded by a much better 164 page ring bound tome and the latest Orics are also being supplied with a cassette lead. The Oric's stated measurements are 280mm by 175mm by 52mm and weighs 1.1Kg. It gives the impression of a no-nonsense functional device, the case is made of a heavyweight plastic moulding and is held together by six screws. The keyboard is at a slight angle, being 25mm high at the front and 50mm high at the rear and is clearly labelled and unambiguous. It follows a fairly standard QWERTY layout and the keys have a very positive feel which makes them easy to operate, all keys have auto repeat. The key spacing is similar to a typewriter and touch typing should be perfectly feasible.

General ease of operation is improved by the provision of two Shift keys (at either end of the keyboard), a double size key for Return, a long space bar and individual cursor control keys. On the left hand side are the Escape and Control keys, the Escape key is an enigma as it was only mentioned once in the provisional manual and not at all in the main chapters of the present full manual. Yes...if you press ESC followed by various other keys strange things can happen on the screen but what use can be made of this in 'direct' mode (not within a program) has yet to be explained. Control on the other hand has many uses; eg CTRL 'L' clears the screen; CTRL 'T' toggles from CAPS only to CAPS and lower case; CTRL 'Q' toggles the cursor on and off; CTRL 'C' is a general purpose 'Break' etc, etc. Both Escape and Control are effectively used within programs to perform various functions such as producing double height and flashing characters etc. On pressing any key (except Shift and CTRL) you will get an audible signal (plink!).

The case has four soft plastic feet that effectively stop it slipping across the table...an important point these days with the advent of such small micros. Sockets and ports at the rear of the case are all unmarked and furthermore both the RGB monitor output and the cassette/audio socket will accept the same plug...bad mark Oric. The printer port is for a standard Centronics interface but I have not yet been able to check this. A further expansion port is provided for...to quote the manual "extra memory, games cartridges, joysticks and, of course, the modem, this device will allow the Oric to download Prestel pages or even programs and also to send and receive electronic mail via the Prestel Mailbox system". The ▶



Internally the Oric is well laid out and excellently constructed.

two remaining sockets are for a standard UHF lead and the power supply. Accessible from the underside of the case is the fine tuning control for the UHF modulator and the Reset button. The Reset allows you to break out of an infinite loop or from a program crash without losing your program. I have had to use this facility fairly often and wish that it had been sited somewhere other than on the bottom of the case. Normally if you wish to break out of a program or LISTing CTRL 'C' will work well but...if you have attempted to CLOAD a program and have not been successful (or change your mind) the only way to regain control is to Reset or take out the power plug and start again.

The Oric uses a 6502 microprocessor and a fairly standard form of Microsoft BASIC which includes such commands as IF...THEN...ELSE; REPEAT...UNTIL; DEEK; DOKE; POP; TRON; TROFF in addition to its variants of colour and high resolution commands.

INNER DEPTHS

The Oric had two principal screen display modes; TEXT and HIRES. In TEXT mode the display is 40 characters wide by 27 characters deep with a black border around the TEXT window. The border colour cannot be changed and the line above the window (within the border) is used for system messages ie Loading, Searching, CAPS etc. Although the screen is 40 characters wide, in practice the first two columns are used as control code positions determining PAPER and INK colours for that row. The character set is standard ASCII and all characters may be re-defined as these are downloaded into RAM on power up. Characters may be PRINTed or PLOTted to the screen at specified co-ordinates. Control codes may be used within PRINT or PLOT commands so that colour, flashing and double height characters together with cursor control etc, are all accessed within a program. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. Control codes may also be POKEd or PLOTted anywhere on the screen and will affect all characters on the row to their right unless another control code is encountered. In this way you may have all available colours on the screen at once, the only problem being that with moving characters you must move the control codes too and if you over PRINT (PLOT or POKE) an exsisting control code then those characters to the right of the new 'PRINT' will assume the new characteristics and lose those originally specified. Control codes appear on the screen as a space. PRINT TAB(N) has a peculiar 'bug' in that TAB(1) to TAB(13) all print to the third column, after this TAB(14) to TAB(50) print to columns 4 to 40!

In TEXT mode you have two further options; LORES 0 and LORES 1. These offer either the standard character set (LORES 0) or a chunky graphics character set (LORES 1).

In HIRES mode the screen, again with a black border, is divided into two parts the larger upper part is 240 pixels horizontally by 200 pixels vertically and the lower part gives three rows by 40 (38) columns for normal text or commands and is not affected by the upper display.

Control codes (attributes) occupying six pixels horizontally by one pixel vertically may be POKEd to the display affecting those pixels to their right giving a similar set of options in colour or flashing as in TEXT mode. The same proviso remains that if a control attribute is overwritten then those pixels on that row to the right of this point lose their original attribute.

In HIRES you may set the cursor to any point (pixel) on the upper screen, draw CIRCLEs (rather oval!), DRAW lines from one position to another and alter the pattern of these lines (dots/dashes to your choice). You may also FILL A character cells (six pixels by one pixel) by B rows with N value. N may define a different colour or pattern or alternatively if you choose the wrong value the screen goes absolutely haywire as you try to FILL with some other control attribute! Normal characters, either the standard ASCII or the chunky graphics set, may be displayed on the HIRES screen by using the command CHAR A,B,C: A being the ASCII code; B which character set and C to specify whether the character should be displayed in foreground or background colour.

Oric's sound capabilities seem to be pretty comprehensive and the internal speaker can give a fair volume of sound! Four pre-programmed effects can be called from BASIC: ZAP; PING; SHOOT and EXPLODE. In addition to these there are three sound commands PLAY, MUSIC and SOUND. There are three sound and one white noise generator. SOUND selects channel, period and volume. MUSIC has been designed to give pure tones and allows selection of channel, octave, note and volume. PLAY controls the envelope shape and can control sounds initiated by SOUND and MUSIC.

An output is provided (on the cassette socket) for connection to your hifi. These facilities should give the would-be electronic music composer plenty of scope for experimentation. The only criticism I have of the sound circuitry is that it picks up interference from the rest of the computer and on the internal speaker the ambient buzz and chirr of FOR...NEXT loops etc is slightly disquieting(!).

The cassette interface offers the option of CLOADing or CSAVEing at either 2400 baud or as the manual puts it "super reliable 300 baud". Sadly, although I could CLOAD the demonstration tape at 2400 baud I have been quite unable to CSAVE anything at this baud rate. This could be the fault of my tape recorders (I tried three!) as cassette recorders do vary somewhat...but. Anyway, "super reliable 300 baud" works every time and I am a great one for reliability. The present machines allow you to save entire programs or blocks of memory. If you use this option you need to know the start and end addresses within memory and because

the rest of RAM is unaffected it is possible to load in new character sets, machine code routines, etc, without corrupting the BASIC program. You may also use this technique should you wish to save screen displays on tape. In my opinion one serious omission from the cassette routines is the lack of any sort of VERIFY command. I'm sure I'm not alone in feeling very edgy not knowing whether that valuable program is really saved on tape for posterity...or not! I believe that Oric Products are working on routines (ROM mods?) to enable the saving of arrays, let's hope they also have VERIFY in their minds too!

DOCUMENTATION

Some mention of the instruction manual must be made. As with any new piece of equipment one should always study this first! The full manual is now available and is not bad as manuals go but it suffers from a number of errors and omissions. There is an errata sheet that should go with it...make sure you get yours. There is nothing quite so disheartening as typing in your first program and for it not to work. The errors in program examples are for the most part fairly obvious and provide excellent practice at debugging but even so...

The manual covers most things a beginner would need to know: setting up the computer; BASIC programming; how to get colour onto the screen; how to edit your programs; number crunching; how to handle strings; what to do with Oric's sound and how to save your programs on tape. There is even a chapter on machine code programs (it doesn't tell you much but does suggest that it might be worthwhile learning a bit more). There is also a chapter on using your printer but chapter 15 is probably the most vital to everyone, as this lists Oric's BASIC commands and is going to be looked at before anything else, certainly by those who have used computers before. The manual ends with 11 appendices that cover a variety of useful items.

The principle omissions from the manual are that there is no index (which is infuriating) if a command or topic is not in an index at least you can immediately try elsewhere, in the Oric manual you have to plough through its pages hoping... and also I think that more explanation of the use of those control codes mentioned and those not mentioned together with more information on the use of attributes would have been most helpful, especially as Oric programs will probably use both quite extensively. Some control codes are mentioned, but not all; for instance CHR$(8 to 11) are the cursor control codes and CHR$(30) will home the cursor to the top left hand corner of the screen. I'm sure that the magazine planned for the Oric owner will have all sorts of interesting information within its pages but I wish more had been made available with the machine. One very useful item supplied with your Oric is the demonstration tape! It is a bit slow and boring to watch in action – but is quite a useful reference when you LIST the program and see how various operations were programmed to happen. For instance when you try the double height character program in the manual and it doesn't work...see how it is done on the demo tape!

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
ORIC	2.1	17.8	29.7	32.1	38.7	52.7	78.8	23.6
SPECTRUM	4.9	9.0	21.9	20.7	25.2	68.2	86.7	25.1
ORIC (with keyboard inhibited)	1.6	14.0	23.3	25.1	30.4	41.3	61.6	18.5

Table 1. The results of Benchmark tests.

IN USE

In operation the Oric is an easy machine to use and I found that after some hours at the keyboard there was no indication of fatigue or strain. The error messages are in plain English and seem to make sense. Line numbers up to 63999 are accepted, you need only DIMension an array if it is to have over 10 elements. Variable names may be a single letter or a letter followed by a single integer, numeric variables may be defined as integer variables by the suffix '%'.

Like many other computers, some arithmetic routines can lead to some surprising results: I ran a small routine within a FOR...NEXT loop adding an increment of 0.2 on each pass. I then PRINTed the total and the INTeger. On my total reading 5, I was informed by the computer that the INT (of this number) was 4! Oh well, I never did trust computers to work out my wages...

String arrays may have up to 255 characters and do not need the length of the string to be dimensioned.

It is not very fast in operation, the standard set of 'benchmarks' were used to measure the relative speed of operation and the results are shown in Table 1.

The Oric can be speeded up slightly if you do not need to use the keyboard during a given routine: type in

line no. CALL E6CA

before any routine processing of data and don't forget to type in

line no. CALL E804

after the routine and before you need to access the key board. This inhibits the scanning of the keyboard for any entry so if you forget the second CALL you will not be able to use the keyboard even when the program has finished RUNning! The Benchmark results were similar to the Sinclair Spectrum so I have included these for comparison.

One early program with the Oric was to discover how to EDIT programs. The provisional manual was not very explicit on the matter at all. It required you to use CTRL 'A' and ESC to insert characters in a program line. The full manual puts over editing in a much clearer manner, explaining how you may alter characters within a program line by using CTRL 'A' to copy a line up to the offending character and then typing in the correct character and continuing to copy the rest of the line with CTRL 'A'. So far so good, but what if you want to insert a character or even several characters? It's easy when you know how (isn't everything), again copy over the line using CTRL 'A' until you get to the position where you want to insert additional characters. Now use the cursor control keys to move away from the program line (up or down) type in your insertion and use the cursor control keys to return to where you left the program line. Continue copying the line using CTRL 'A' to the end of the line, press Return and the job's done. Whew...sounds complicated but you very soon get used to it. All this may be done directly over a LISTing or after having typed EDIT (line).

IN CONCLUSION

One cannot escape the fact that in size, cost and capabilities the Oric is bound to be compared with the Sinclair ZX Spectrum. A lot of people are going to be asking 'which one should I buy'?

As is often the case when comparing microcomputers of similar cost, it is difficult to say outright that one is better than another. This has nothing to do with trying to be nice to everyone, it is more a case of one ▶

man's computer is another man's millstone and *vice versa!*

The ORIC has a slightly more versatile BASIC than the ZX Spectrum. On the other hand, the ZX Spectrum will not permit you to Enter a program line that has a syntax error. The ZX Spectrum has such commands as VERIFY and MERGE (to append one program in memory with another from tape).

Both Oric and the ZX Spectrum have a respectable amount of memory available to the user.

Moving graphics are almost certainly going to be easier to implement on the ZX Spectrum. The ZX Spectrum does not have a FILL command from BASIC on the other hand it isn't terribly difficult to find a routine to fulfil a similar function. HIRES colour resolution is six times better on the Oric but don't forget that you have to make allowance for those control codes (six pixels long). The Oric looks as though it will be more readily versatile in its accessibility to the outside world: printers, monitors, modems etc. So far I have not been able to find the 80 characters that the Oric was supposed to have allocated for user defined characters.

The screen format of the Oric (40 by 27) is more normal than the ZX Spectrum's (32 by 22) but the ZX Spectrum's manual is definitely superior to that of the Oric. The Oric has better sound capabilities but the ZX Spectrum has a large amount of software being produced for it (I have no doubt that a number of software houses are already far advanced on software for the Oric). As you can see, nearly all of the comparisons seem to be 'slightly better than' and in an overall decision it is very difficult not to let one's own likes and dislikes cloud the impartial view. I think that the beginner will find the keyword system of the ZX Spectrum very easy to pick up but, in the long term, the Oric could prove to be more versatile. I think that the Oric will certainly be up there with the ZX Spectrum on a great many people's short lists.

FACTSHEET	Oric 1	
CPU	6502A	
ROM	16K	
RAM	16K	
Language	BASIC	
Keyboard	QWERTY; Cursor controls	
Display	Text mode: 28 by 40; Graphics mode: 200 by 240 Eight colours; 80 user definable characters	
Cassette	300 or 2400 baud	
I/O	Parallel port; Printer port Expansion bus	
Sound	Three channels	
Options	64K RAM with 16K overlaid ROM Communications modem Printer Disc drive	
Costs	Oric 1 16K RAM	£99.95
	Oric 1 48K RAM	£169.95
	Communications modem	£79.00
Supplier	Oric Products International Ltd Coworth Park London Road Ascot Berkshire SL5 7SE 0990-27641	

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Space Panic: for the 12K Acorn ATOM (£6.90)
Deadwood: for the Dragon 32 (£6.90)
Zodiac: for the Oric 16K or 48K (£6.90)

(The prices given in brackets are the current retail prices)

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Painter: Frogger: Crazy Balloons: Space Panic: Deadwood: Zodiac: Death Satellite
for the: BBC: ZX Spectrum: Acorn ATOM: Dragon 32: Oric Please delete as necessary.

NAME .....
ADDRESS .....
.....
.....
..... POSTCODE .....
SIGNED .....
NAME (Block Capitals) .....

DEALER .....
ADDRESS .....
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.....POSTCODE .....
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NAME (Block Capitals) .....

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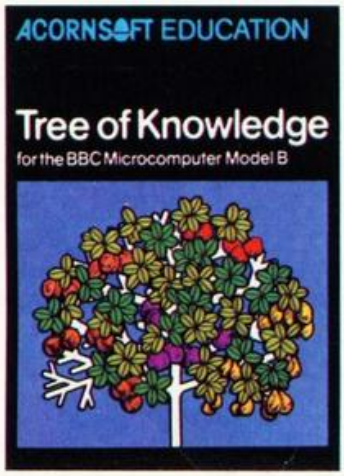
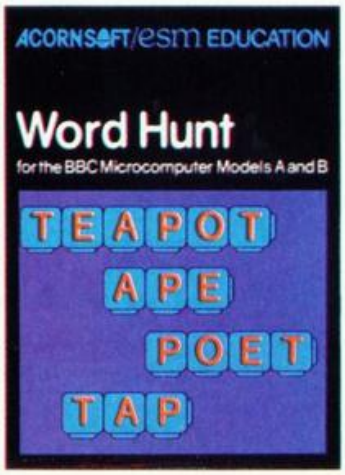
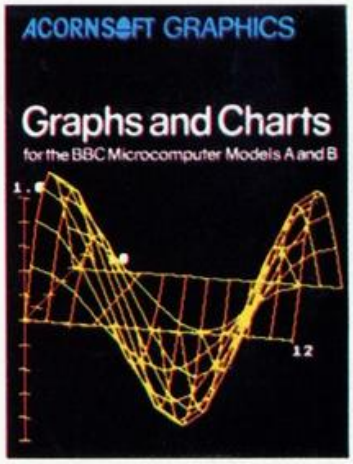
Word Hunt (£11.90) is a set of four programs, each containing a list of nine words. The object of the exercise is to select one word and then try to create as many smaller words as possible from the selected word.

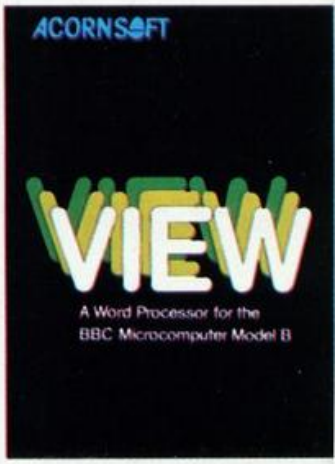




Increase your business acumen.

Graphs and Charts (price £17.45) which includes the book 'Graphs and Charts on the BBC Microcomputer' contains a set of programs to present data graphically in a wide range of applications. The graphs include automatic scaling, labelling of axes and use of colours.

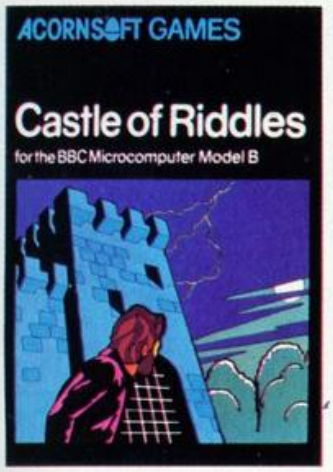


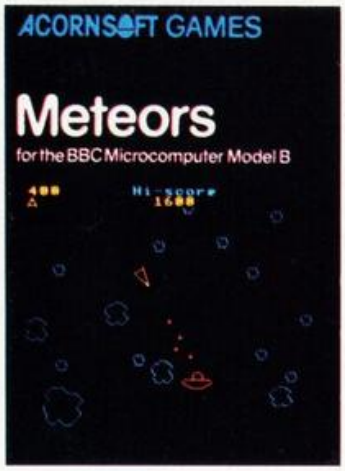


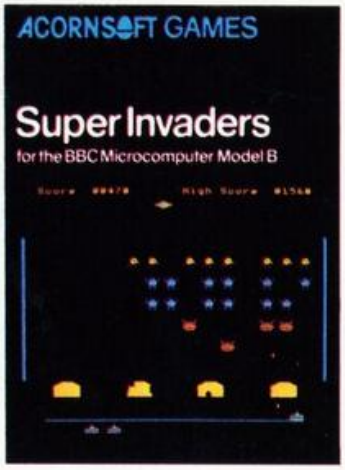
And VIEW (price £59.80) a program that enables your machine, together with a printer, to operate as a fully operational word processor. For convenience the program is in ROM so that it can become a permanent feature of your machine. (It can easily be fitted by your local dealer). You'll find out more by going to your dealer or by sending for the free catalogue.

Mind-boggling games.

Castle of Riddles (price £9.95) is a magical adventure, with wizardry and hocus pocus of all kinds; booby traps and fiendish riddles to be unravelled along the tortuous route to the Magic Ring of Power. Your reward is to keep the







treasure you find along the way.

Meteors (price £9.95) is a game where you have to manoeuvre your laser-ship through a hail of meteors, smashing them with your laser bolts as they hurtle towards you on all sides. Complete with sound effects and table of Hi-Scores.

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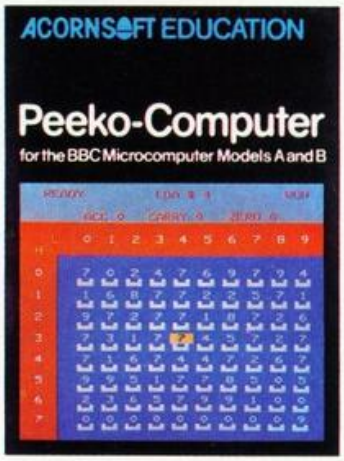

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GOING FORTH AGAIN

With the advent of the first micro to have FORTH as its standard language we delve deeper into this language.

At the beginning of last year, I wrote a short series for *Computing Today* which introduced the language FORTH. At that time, the language had not received a great deal of exposure in this country but, over the last 12 months, we have seen an explosion of interest in it. FORTH packages are now freely available for virtually all micros and there is even one machine, the Jupiter Ace, which has it as its standard language. I like to think that my earlier articles had something to do with the boom, but I'm sure that they didn't.

The time has therefore come to delve a little deeper into this unusual language, and this is the first of two articles intended to do just that. This month, I will investigate how to add features which are missing from most FORTHs, such as random number generators and arrays. The article will also take in the definition of new compiling words and generally probe fairly deeply into some of the language's wierder features. Let me state right now, therefore, that this article is ***NOT*** for the FORTH tyro — it assumes a certain familiarity with the language. If you don't have that, may I recommend that you read my articles in the Jan-Apr 82 issues of *Computing Today*; I'm sure that the back numbers department would be pleased to help you.

You may well know that two FORTH 'standards' exist — in this article, all my programming examples will be written in FORTH-79, as implemented by, for example, Acornsoft's BBC FORTH, and on the Jupiter Ace. I will highlight, where necessary, differences between this and fig-FORTH, which appears on such micros as the VIC-20, the ATOM and the Atari 800. Remember, though, that since FORTH is a re-definable language, it is relatively easy to make fig- look like -79, and *vice-versa*.

Finally, a convention. Since a FORTH word can be almost any combination of characters (other than spaces), there may be times when I need to make them stand out from the text. If so, I will enclose them in square brackets — [ ]. The brackets are not part of the word.

RANDOM NUMBERS

A curious omission from virtually all FORTH systems is a random number generator. This looks doubly odd when one considers that FORTH's speed makes it ideally suited to applications which demand a lot of random numbers, such as games and Monte-Carlo modelling. However, it is quite easy to extend the language to include random numbers.

Before we can do that, though, how do we generate them in the first place? There are many ways, but one of the simplest, which is good enough for most purposes although it might not please a statistician, uses the equation:

```
R(i+1)=(1509*R(i)+41) MOD 65536 (1)
```

This generates a pseudo-random number (R(i + 1)), in the range 0-65535, using the previous number (R(i)) as its starting point. Given R(i + 1), we can then produce a number in the range 0 — (n-1), where (0 =n<65536), by:

```
Rn=INT(R(i+1)*n/65536)          (2)
```

and the more usual range of 1 — n inclusive by:

```
Rn=INT(R(i+1)*n/65536)+1        (3)
```

We are almost there, apart from one snag — FORTH normally treats numbers as 16-bit signed integers; ie they lie in the range − 32768 to + 32767. Although, as we will see, we can do intermediate unsigned arithmetic (number range 0 — 65535), the end result is always signed. Equation (1) will therefore produce negative random numbers half the time. Although we can get around this by:

```
R(i+1)=ABS(1509*R(i)+41) MOD 65536)
                                (1a)
```

we end up with a random number in the range 0 — 32767. Equation (3) must therefore become:

```
Rn=INT(R(i+1)*n/32768)+1        (3a)
```

and n is limited to the range 0 — 32767.

My offering to do these jobs in FORTH is Screen 101 (Listing 1). This contains three main elements:

a. RSEED is defined as a variable, and is used to hold the last number generated. If you are writing in fig-FORTH (or in many versions of -79), the definition should be [0 VARIABLE RSEED].

b. RANDOM generates the random number in the range 0 — 32767, saving the unsigned version (0 — 65535) in RSEED for future use. The number, which is R(i + 1) in equation (1a), is left at top-of-stack (TOS).

c. RND expects to read 'n' at TOS, and outputs a random number in the range 1 — n at TOS.

Both RANDOM and RND use the word [U *], which is a standard FORTH word, to perform the

```
 0:  ( Create a Forth random number generator            Screen 101 )
 1:
 2:  VARIABLE  RSEED                    ( Used to hold seed/last number)
 3:
 4:  ( Generate a random number from 0->32767                        )
 5:  : RANDOM  RSEED @ 1509 U*                  ( DP unsigned multiply)
 6:            41. D+                                    ( DP add)
 7:            DROP                          ( Apply unsigned MOD 65536)
 8:            DUP RSEED ! ABS ;             ( Save it, and leave final)
 9:
10:  ( Generate a random number in range 1->n.    Syntax: "n RND"    )
11:  : RND     RANDOM U* 32768 U/MOD SWAP DROP 1+ ;
12:
13:
14:
15:
```

Listing 1. Creating a FORTH random number generator.

unsigned multiplication of the two unsigned numbers at TOS, leaving a DP (double-precision — four bytes, with the most significant bytes nearest TOS) unsigned answer. RANDOM's [DROP] at line 7 removes the two high bytes of the DP number, effectively performing 'MOD 65536'. The [41. D+] at line 6 performs a DP addition of two DP numbers — putting a decimal point anywhere in a number going onto the stack automatically treats it as a DP integer.

The [U/MOD] in RND is a FORTH-79 word which takes an unsigned DP number at second on the stack (2OS) and divides it by the unsigned 16-bit number at TOS. The remainder (ie the modulus) is output at 2OS and the quotient at TOS. The fig-FORTH word [U/] has an identical action.

The only other thing we need is a starting value for R(0) — if it always has the same value (eg 0), the same sequence of 'random' numbers will occur. Occasionally, this may be what you need but, more normally, it will be a confounded nuisance. We therefore need to emulate BASIC's 'RANDOMIZE'.

If your computer is Z-80-based, the micro's 'refresh register' (R) can be used to provide a sort of eight-bit random number. The standard assembly code for the job would be:

```
RANDOMISE  LD   A,R
           LD   L,A
           LD   H,Ø
           LD   (RSEED),HL
           RET
```

However, the detail of implementing this will depend on your FORTH system's assembler. The easiest way would be to get the contents of R on TOS, and then move this to RSEED by, for example:

```
 CODE R1 R A LD Ø H LD A L LD PSH
: RANDOMISE  R1 RSEED ! ;
```

Not all FORTHs incorporate an assembler, however, but we can get around the problem with the [CREATE] defining word. When used in the [CREATE name] form, it makes a dictionary entry for the word [name], with no specific action associated with it. CREATE can be used to set up a word, and the [,] (and, in fig, the 'character' equivalent [C,]) words used to POKE hand-assembled code into the dictionary:

```
HEX
CREATE  R1 47ED , 26 , C36F , <nnnn> ,
DECIMAL
```

In this, <nnnn> is the address of the FORTH operating system routine which pushes HL onto the stack and returns control to the interpreter.

Things are not quite so easy in a 6502-based system, because that chip does not have anything like the Z-80's R-register. Sometimes, though, there will be a real-time clock in the computer, and you can read the lowest bytes of this as a source of one-off random numbers:

```
: RANDOMISE  clock @ RSEED ! ;
```

Failing everything else, how about:

```
: RANDOMISE CR ." PRESS ANY 2 KEYS"
KEY KEY * RSEED ! CR ;
```

EXTENDING FORTH

In my earlier articles, and so far in this one, we have only skimmed the surface of what FORTH can and cannot do. Let us now have a look at the somewhat esoteric subject of defining defining words. A FORTH system can be thought of as working on four levels:

a. **Level 1**. Using existing words to do their job; for example:

```
17 DUP DUP * * .
```

prints the cube of 17, but adds nothing to the language and is forgotten as soon as it is executed.

b. **Level 2**. Using the standard defining words to add to the system. For instance:

```
: PRINTCUBE DUP DUP * * . ;
```

adds the new word PRINTCUBE to the system. In this case, the defining words(s) is [: . . . ;], but other common defining words are VARIABLE, CONSTANT and CREATE. Level 2 is the normally-used level in most applications and lies at the very heart of the FORTH concept.

c. **Level 3**. Adding new defining words. It is possible to design new defining words which can be used at Level 2 to create whole new families of FORTH words which may, in turn, be used directly at Levels 1 and 2.

d. **Level 4**. Using FORTH itself to create totally new, but normally FORTH-like, languages. This is termed metaFORTH and is beyond the understanding of anyone but academics and 12 year old schoolboys.

For the rest of this article I would like to concentrate on Level 3 operations but, first, a look at what is going on during Level 1 and 2 operations.

FORTH is unusual (surely not?!) in that is both a compiled and an interpreted language. Level 1 operations show it working in its interpreted mode — a word is read, identified and then acted upon immediately. This job is done by the system's 'outer interpreter', which identifies the word, and the 'inner interpreter', which actually executes it. Before any of this is possible, however, the word must be compiled (Level 2) into a form which the inner interpreter can handle. The compilation process generates the nested pointers to successively simpler routines which make up the 'indirect threaded code' of the normal FORTH dictionary.

That compilation is the job of FORTH's defining words. Although it is easy to think of the language as having a single compiler (like COBOL, Pascal, ***et al***), it actually has a whole series of microcompilers, each associated with specific defining words. When you use [: . . . ;], a totally different compiler from the one which VARIABLE, say, uses is called up.

These microcompilers are themselves written in FORTH, and the act of creating them is a Level 3 operation. The usual way of forming a new defining word in FORTH-79 is the [CREATE . . . DOES> . . .] structure while, in fig-FORTH, [<BUILDS . . . DOES> . . .]. is effectively identical and may be used in all the following examples. You should also note that some FORTH-79 systems provide [<BUILDS . . . DOES> . . .]. For the real FORTH experts who may read this, I know that fig and -79 systems handle [DOES>] differently, but this is invisible unless you are probing the darkest depths of the dictionary.

JOB OF [CREATE . . . DOES>. . .]

This structure allows us to define whole groups of new FORTH words which behave in an identical manner to each other, and differently from any other word. If we only want to create one word with the new behaviour, then [: . . . ;] will do the job but, for a whole family, use a new defining word.

As an example, it would not be difficult to set up a variable by way of a colon definition — however, it is much neater to use VARIABLE, saving space and, probably, making the program easier to follow. A FORTH variable is just a

special type of word which behaves in a specific way (ie it has two bytes to receive data and, when used, puts its address at TOS); since it is a special type, it gets its own defining word.

The [CREATE...DOES>...] pair is used as below:

```
: name CREATE compile-time action
DOES> run-time action ;
```

That colon definition will produce the defining word [name]. Whenever [name] is used to define [word], the compile-time action takes place to set up the dictionary entry. Later, when [word] is used, the run-time action part of the definition occurs.

An example would probably be a good idea at this point. The FORTH-79 defining word VARIABLE is used as [VARIABLE vname] to create a 2-byte entry called [vname] which, on being used, puts its address at TOS. VARIABLE could be defined by:

```
: VARIABLE CREATE 2 ALLOT DOES> ;
```

The compile-time action is to reserve two bytes in the directory, and there is no run-time action in this case. Generally, the very act of using any word puts its address at TOS; the word's run-time action then manipulates that address. In the case of variables, all we want is their address at TOS.

The corresponding fig-FORTH definition (and the one in many -79 implementations) uses VARIABLE as [n VARIABLE vword] to initialize vword to the value 'n'. This has the definition (fig, remember):

```
: VARIABLE <BUILDS , DOES> ;
```

where the [,] puts 'n' into the dictionary.

Let's now think of a new sort of variable — one which puts its value at 2OS and its address at TOS, whenever used. It will be set up, using the defining word PVARIABLE, by [n PVARIABLE pvword].

To define PVARIABLE:

```
: PVARIABLE CREATE , DOES>
DUP @ SWAP ;
```

This time, whenever [pvword] is executed, it has the run-time action [DUP @ SWAP] to put its value, as well as its address, on the stack.

ARRAYS IN FORTH

Those were fairly trivial examples. We will now take a look at a classic use of [CREATE...DOES>...], which is to produce words which can define arrays, a data structure oddly missing from FORTH.

We will take two basic cases — a single-dimension (1-D) array, and a two-dimensional (2-D) array — but the method can, naturally, be extended to any number of dimensions. The first case will allow us to create an array [name] with (n+1) cells (0 to n) by using [n ARRAY name], subsequently putting the address of cell 'p' at TOS with [p name].

The 2-D array, of size (x+1)*(y+1), will be set up by [x y 2ARRAY 2 name], with [p q 2name] putting the address of cell (p,q) on TOS.

Note that, in both these cases, the subscripts start from zero and go up to 'x' or 'y' as appropriate. The technique is therefore analogous to BASIC's 'DIM name(x), 2name(x,y)', in that the dimension(s) define the highest permitted subscript(s).

The two new defining words are set up in Screen 102 (Listing 2). The compile-time behaviour of ARRAY is simple — it merely reserves 2*(x+1) bytes in the dictionary for the array. Its run-time behaviour, after DOES>, is nearly as simple, as long as you remember that executing [p name] will, before DOES> gets to work, leave 'p' at 2OS and the address of [name]'s zero cell at TOS. These two are simply swapped, 'p' is doubled, and the result is added to the base address to give the desired address. It's as simple as that.

At first glance, 2ARRAY is rather more complex, but it is not really. At compile-time, before any space is reserved for the array itself, the value of (y+1) is saved at the start of [2name]'s dictionary entry — it will be needed at execution time. The system then reserves an additional 2*(x+1)*(y+1) bytes to hold the array.

At run-time, the first action is to save a copy of the address of [2name] (actually, this is the address where (y+1) is saved) on the stack for later use. The system then extracts the location of cell (p,q) from the formula:

```
(address of [2name])+2+2*(p*(y+1)+q)
```

This formula is necessary because data is stored, from low memory, in the sequence:

```
(0,0),(0,1)...(0,y),(1,0),(1,1)...
(1,y)...(x-1,y),(x,0)...(x,y)
```

You should now be able to see why we had to save (y+1) at compile-time. If you are still a little confused, try sketching out what is on the stack as every word in lines 12-14 of Screen 102 is executed.

Note two things about these two new defining words:

a. They do not initialize an array's contents when it is created.
b. They do no checking of subscript limits.

The first point may or may not be important to you — in any case, it is fairly simple to remedy at compile-time (how?). The second point is consistent with FORTH's philosophy of simple, high-speed, code but could cause real problems. For instance: [50 20 name !] when [name] had been defined as a 15-element array, would hopelessly corrupt the system dictionary by setting a pair of bytes outside the array's bounds to the value 50. At best the result would be confusing, but it would more likely be catastrophic.

However, why not define new defining words ARRAYCHK and 2ARRAYCHK which act exactly like ARRAY and 2ARRAY, with the addition that they check subscripts for validity before doing anything else at run-time?

Screen 103 (Listing 3) does just that for ARRAYCHK. The compile-time action is very similar to that of ARRAY, but also saves (x+1) at the start of the dictionary entry for use in subscript checking.

At run-time, however, the behaviour is much more complex. First of all, the top two items on the

```
 0:  ( Defining words for non-checking arrays              Screen 102 )
 1:
 2:  ( Set up a 1-dimensional array, with cells 0->n                  )
 3:  (       Create with "n ARRAY name"                               )
 4:  (       Get address of cell "p" with "p name"                    )
 5:  : ARRAY   CREATE 1+ 2 * ALLOT          ( Save space in dict.)
 6:            DOES> SWAP 2 * + ;          ( Get address of cell "p")
 7:
 8:  ( Set up a 2-dimensional array, with cells 0->x, 0->y            )
 9:  (       Create with "x y 2ARRAY 2name"                           )
10:  (       Get address of cell "p,q" with "p q 2name"               )
11:  : 2ARRAY  CREATE 1+ DUP , SWAP 1+ * 2 * ALLOT     ( Save space)
12:            DOES> DUP >R              ( Get address of start of array)
13:                  @ ROT * + 2 *              ( Get offset of "p,q")
14:                  R> + 2+ ;             ( and work out its address)
15:
```

Listing 2. Setting up new defining words for non-checking arrays.

stack ('p' and the address of [name]) are duplicated; having done that, (x+1) is pulled out of the dictionary entry and checks are made that 'p' is less than zero, and not more than 'x' (line 12). If the subscript is OK, line 11 extracts the address of cell 'p'. If, however, a fault occurs, an error message is printed; ABORT then clears the calculation and return stacks and shuts the system down. As you see, ERMESS uses the values of 'p' and [name]'s address left on the stack to show the fault in detail.

In essence, 2ARRAYCHK, which is defined in Screens 104 and 105 (Listing 4), behaves in just the same way but, inevitably, it is rather more complex. Screen 104 simply sets up the error messages, which report x- and y-subscript errors separately. In Screen 105, 2ARRAYCHK itself is defined. Its compile-time behaviour, defined in lines 2 and 3, is straightforward; (x+1) and (y+1) are saved at the beginning of [2name]'s dictionary entry, and 2*(x+1)*(y+1) additional bytes are reserved for the data which will fill the array.

Lines 4-11 of Screen 105 define the run-time behaviour. First of all, a copy of [2name]'s start address is saved for future use, and then 'p' is checked to ensure that it lies in the range 0-x inclusive. If it does not, an error message (1ERMESS) is invoked at line 10 and the system shuts down. If the x-subscript is OK, line 6 recovers (y+1) from the dictionary entry and tests that 'q' is in the range 0-y inclusive. A failure produces the 2ERMESS error message and, again, shuts the program down.

Finally, if both subscripts are valid, line 7 puts the address of cell (p,q) on TOS, using the formula:

```
(start address of [2name])+4+
2*(p*(y+1)+q)
```

Simple, isn't it? As before, if you cannot quite follow part of the coding, try writing down the stack contents at every stage.

Now we come on to one of FORTH's most dramatic benefits. If a program uses arrays a great deal, the limit checking of ARRAYCHK, 2ARRAYCHK and their ilk will obviously slow it down considerably; furthermore, once the program is fully debugged, the checks are normally redundant. On the other hand, it is vital for your peace of mind to check the subscripts during program development.

The remedy is both elegant and simple. At the start of program development, define ARRAY and 2ARRAY — which will have to be specified at the start of the program anyway — but use the checking code of ARRAYCHK and 2ARRAYCHK. Write and debug the program in the secure knowledge that the system will tell you if a subscript is wrong.

When the program is finally debugged, go back to its start and edit ARRAY and 2ARRAY to the simpler, non-checking, form. Having done that, re-compile the program and all array subscript checking will be eliminated with no further action on your part. Simply by altering the definitions at the start, the whole program behaviour can be altered, since you can define any word to act in any way you like. That change will affect all subsequent definitions which use that word, with no further action on your part. With FORTH, you really can have your cake and eat it.

CONCLUSION

In this article, I have covered two main aspects of using FORTH. First of all, and by way of warming up, I have shown how a random number generator can be added to almost any system in order to increase its usefulness.

I then considered in some detail how to influence the way in which a FORTH system works, by adding completely new classes of words to it, using the [CREATE... DOES>...] (or [<BUILDS... DOES>...] in fig-FORTH) structure. I used the classical demonstration of 1-D and 2-D arrays, but there is no reason why the same approach cannot be used for more complex data structures, or for anything else you may think of. Although FORTH does very little error checking at run-time (certain implementations, such as the Jupiter Ace, can, however, do quite a lot) it is relatively straightforward to add such checking to suit your own needs. Once they have done their job, they can be very simply removed, with benefit to run-time, etc.

Next month, I will survey the state of the FORTH market.

```
 0:  ( Defining word to create a 1-D array, and          Screen 103 )
 1:  ( to check subscript bounds for validity                       )
 2:  ( Use it exactly like "ARRAY"                                  )
 3:
 4:  ( Check that 0 <= 2OS < TOS                                    )
 5:  : +<      OVER > SWAP -1 > AND ;
 6:
 7:  ( Error message for a faulty subscript                         )
 8:  : ERMESS  CR SWAP ." INDEX OF" . ."  NOT PERMITTED.  RANGE: 0 -"
 9:            @ 1- . CR ;
10:  ( Now we can define the defining word                          )
11:  : ARRAYCHK  CREATE 1+ DUP , 2 * ALLOT   ( Save size, make room )
12:              DOES> OVER OVER @ +<        ( Not greater than max?)
13:                    IF SWAP 2 * + 2+          ( OK - get address)
14:                    ELSE ERMESS ABORT     ( otherwise print error)
15:                    THEN ;
```

Listing 3. Defining words for creating and checking 1-D arrays.

```
 0:  ( Defining word to create a 2-D array, and          Screen 104 )
 1:  ( to check both its subscripts for validity.
 2:
 3:  ( Use it exactly like "2ARRAY"                                 )
 4:
 5:  ( Error messages for faulty subscripts                         )
 6:  ( First of all, the common part of the messages                )
 7:  : PRTERR    ." -INDEX OF" . ."  NOT PERMITTED.  RANGE: 0 -" ;
 8:
 9:  ( Out-of-range X-index, disregarding Y-index                   )
10:  : 1ERMESS   CR ." X" PRTERR @ 1- . CR ;
11:
12:  ( Now, an out-of-range Y-index, if X is OK                    )
13:  : 2ERMESS   CR ." Y" PRTERR DROP 2+ @ 1- . CR ;
14:
15:                                                      105 LOAD

 0:  ( Now go on to actually set up the defining word   Screen 105 )
 1:
 2:  : 2ARRAYCHK   CREATE OVER 1+ , 1+ DUP ,    ( Save Xmax and Ymax)
 3:                      SWAP 1+ * 2* ALLOT          ( Save space)
 4:                DOES> DUP >R                  ( Save base address)
 5:                      ROT OVER OVER SWAP @ +<     ( Check X-index)
 6:  ( OK - so Y-index)     IF ROT R> DUP >R 2+ @ OVER SWAP +<
 7:  ( Get address of cell)    IF SWAP R> 2+ @ * + 2 * 4 + +
 8:                            ELSE 2ERMESS ABORT  ( Y-index oversize)
 9:                            THEN
10:                       ELSE 1ERMESS ABORT      ( X-index oversize)
11:                       THEN ;
12:
13:
14:
15:
```

Listing 4. Defining words for creating and checking 2-D arrays.

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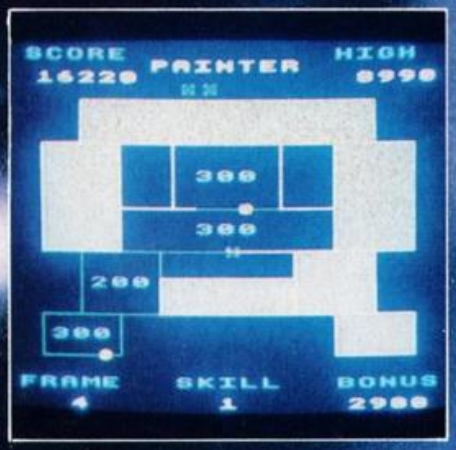

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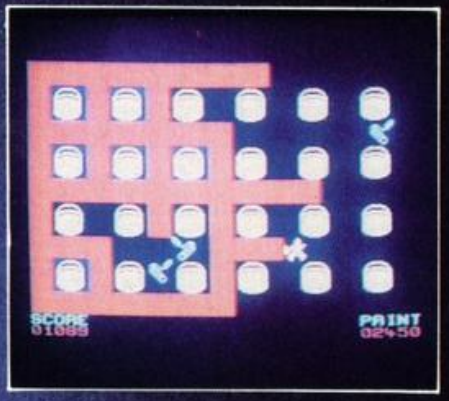

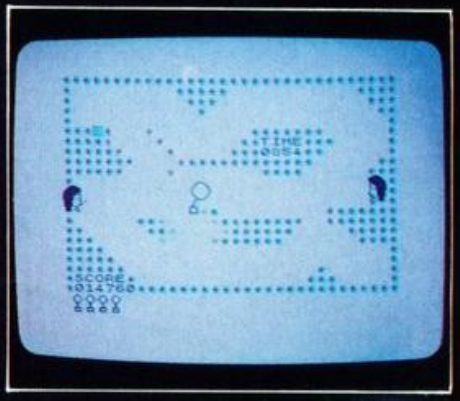

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Owen Bishop

FORTH COMES HOME

We take a close look at the Jupiter Ace and at the FORTH that it uses.

The Jupiter Ace has raised more interest than most other new micros since it was first announced last autumn. Although hardly a month goes by without the launching of at least one low-cost micro, a machine which speaks a different language is a rare novelty.

Despite all the criticism from the pundits of the computing world, BASIC is the resident language of all popular micros and BASIC is the high-level language used and understood by virtually all personal computer programmers. For reasons commercial and otherwise, and despite the pleas of the disciples of Pascal, BASIC rules supreme and seems likely to continue to so so. So who would be so rash as to equip their new product with a tongue which few can understand?

Yet FORTH is not a new language. It was invented over a decade ago by an American astronomer, Charles Moore, for use in controlling astronomical telescopes. It has been widely adopted for that purpose throughout the world. The computer which controls the Mark 1A radio-telescope at Jodrell Bank observatory is a nearby example of the original application of FORTH to astronomy. Though it is very well suited as a language for control applications, FORTH can do most of the things that BASIC can do and a few others besides (such as recursions) which most BASICs cannot do. FORTH scores over BASIC in other ways too. For example, it needs much less memory for program storage and it runs a lot faster.

Jupiter Cantab, the makers of the Ace, claimed in their first advertisements that it is "probably the fastest computer in the Universe". Although it is hard to justify this claim, for a micro programmed in machine code inevitably runs faster than one programmed in any high-level language (even FORTH), the Ace's Z-80A microprocessor, paced by a 3.35 MHz clock ensures that this micro leaves most others far behind with regard to speed of operation.

At this point I can almost hear the reader saying "For goodness sake stop nattering on about FORTH and tell us about the Ace". Well, please bear with me a little longer. The design and probably the fate of this micro is inextricably bound up with it resident language. If you buy this micro, you are 'into' FORTH in no small way. It is wise to find out a little about its language before you buy. You do not need to know how to write a FORTH program but you *do* need to know something about its essential features. The current advertisements for the Ace accurately emphasise the main characteristics of FORTH and there have been articles in *Computing Today* and other magazines which describe it in greater detail (see references). Read these and, if they leave you enthusiastic, feeling as if you want to find out more and to gain some practical experience, treat yourself to an Ace.

EXTERNALS

Although it comes from a different stable, the Ace shows that it has had the same breeding as the ZX Spectrum. Steven Vickers and Richard Altwasser were prominent in designing the Spectrum and then left to set up their own company to design and produce the Ace. The case measures 21.5 cm wide by 19 cm deep. In the keyboard area it is 1 cm high, stepping up to 3 cm high at the rear. It weighs only 425g, its relatively light weight probably being the result of the thinness of the walls of the case. Though its walls are thin, the stepped form of the upper half of the case and the ribbing in the walls of the lower half impart the necessary rigidity to it. It is provided with four non-slip feet.

The micro has a neat yet striking appearance, the case being white, bearing its name in black with some decorative markings in red. In contrast to the general tone of the case, the keys are very dark brown with characters marked in white. The keys are in staggered rows and spaced as on a standard typewriter keyboard. They are of the moulded-rubber type, which is commonly found on low-cost computers. It is a sad fact that it is not possible to produce a cheap yet reliable keyboard with truly movable keys. The rubber keys represent the best solution found to date. Certainly the keyboard of the Ace is reliable, once you get used to placing your fingers centrally on the keys and pushing vertically downward. It is not that the keys are difficult to use, but just a matter of taking more care and going that bit more slowly than with a normal typewriter-style keyboard. Their resilient reaction takes a little getting used to, but you *can* get used to them in a very short time. In any event, you are not likely to be wanting to type in masses of text or to use the Ace as a word-processor, so this is a minor matter. Indeed, since many FORTH words are short, often consisting of only one or two characters (examples are @, !, F/, ."), there is less typing to be done with FORTH than with many other languages. There is auto-repeat on all character keys.

Those who have used a Spectrum will find no difficulty in finding their way around the Ace keyboard, for its layout is almost identical. The main difference is that the Ace does not have such a confusing array of functions associated with each key. In fact, ▶

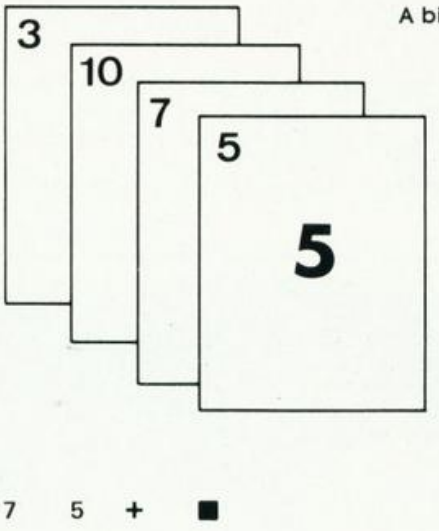
the keys have a maximum of only three functions: lower case, upper case, and symbol. There is a Shift key which operates in the normal typewriter fashion to shift each key to produce upper case. As in the Spectrum, there is a Symbol shift key which produces the symbols instead of letters. The Shift, Symbol shift, Enter and Break/Space keys are positioned just as on the Spectrum keyboard. The symbols are on the same alpha-numeric keys too, except that the Ace has additional symbols ([] ©~\{}). The top row of keys produces numerals when unshifted, and symbols when symbol-shifted. Shifting these keys effects certain commands. Shift-1, for example, deletes the whole of the line currently being entered. The remainder are almost the same as in the Spectrum: Shift-2 is capitals-lock, Shift-4 toggles inverse video, Shift-5 to Shift-8 move the cursor (but the 'up' and 'down' keys are transposed), Shift-9 toggles graphics mode, and Shift-0 deletes the last character typed. Graphics mode allows one of eight graphics blocks to be typed on keys 1 to 8. I have more to say about graphics later.

CONNECTIONS

The Ace comes with a full set of leads. There is a substantial and lengthy (2 m) lead for connecting the Ace to the aerial input of a domestic TV set. This has moulded-in plugs at either end. The cassette lead consists of a moulded pair of wires of adequate length (70 cm), with a pair of moulded-in plugs at either end. Each pair consists of a black plug and a grey plug so that you can easily distinguish input from output. The plugs are standard 3.5 mm jack plugs, so will fit almost any low-cost cassette recorder. As is common with the simpler micros, the Ace does not have a motor-control relay, so there is no lead to the 'remote' socket of the recorder.

The Mains Adaptor looks like an over-sized 13 amp plug. It fits directly into the wall socket and has a light duty lead 170 cm long to carry power to the Ace. The Adaptor requires 240V AC input and produces a DC output of 800 mA at 9 V.

The lead from the Adaptor ends in another 3.5 mm jackplug, which fits into a socket on the left-hand side of the Ace. The output sockets (TV, cassette recorder) are on the right-hand side so there is little difficulty in remembering which goes where. If you do forget, there is a clear label on the underside of the machine.



A bird's eye view of the Ace's insides.

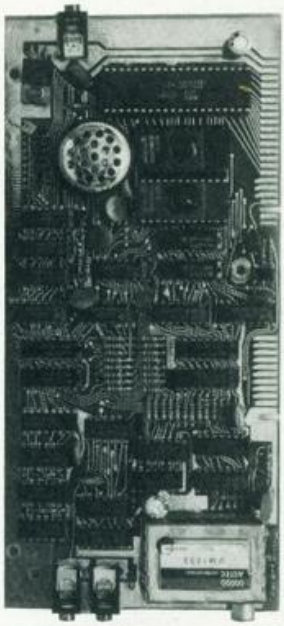


Fig. 1. Typical display of the stack demo.

INTERFACING

At the rear of the case are two apertures. The smaller one reveals an 11-way double-sided edge-connector pad. This is intended for attaching a colour-board which Jupiter Cantab are planning to produce in the future. The addition of colour facilities will enhance the capabilities of this machine appreciably. The larger aperture gives access to a 23-way double-sided edge-connector pad. This carries all the signals required for interfacing external devices to the Ace. Since FORTH has evolved as a language for control applications, this interface port is especially important. The manual shows that it provides all the required connections to the address bus, the data bus, the system clock and the Z-80A control bus, as well as to the 0 V, +5 V and +9 V power lines. The manual outlines some simple circuits which can be connected here and explains how to program them. Although the arrangement of the edge-connector is not the same as that used on the ZX computers, it is a fairly simple matter to wire up an adaptor which will allow some of the ZX peripherals to be plugged on to the Ace. I understand that the ZX Printer and 16K RAMPACK have been used successfully with the Ace by means of such an adaptor.

Those who are keen on interfacing to micros will be glad to hear that Ace FORTH includes two words IN and OUT which operate the Z-80A in port-addressed mode. Some of the port addresses are reserved for use by the Ace's internal use (the handbook explains which ones), but there are plenty to spare for the enthusiastic interfacer.

THE ACE IN ACTION

The manual which comes with the Ace is a 181-page soft-covered book called **'Forth programming'**. Note once again how the emphasis is on the ***language,*** not on the machine. The manual is written by Steven Vickers, who also wrote the Spectrum manual. It is one of the best manuals I have ever read. It explains everything the beginner will need to know and makes few assumptions about the reader's background knowledge. In a light and concise style, it clearly explains the meanings of all computer and programming terms as they are used, and also the meanings of less specialist but nevertheless unfamiliar terms such as 'integer', 'square root', and 'coordinate'. Yet the manual is not limited by its simplicity. It provides an explanation of the structure and applications of FORTH in sufficient depth and detail to interest the more experienced readers, too.

As might be expected, the manual begins by explaining how to set up the computer, how to use the keyboard and how to load programs from tape. I followed their instructions and the Ace worked perfectly. As soon as the power supplies to the micro and to the TV set were switched on, a small square cursor appeared as expected at the bottom left-hand corner of the screen. The display is white on black, as in most micros, though it is easy to use reverse video if preferred. The screen displays 24 lines of 32

characters in upper or lower case. Words or definitions of words appear on the lower line (or lines) of the screen as they are typed in. When you press 'Enter' they are executed (if syntactically correct), and reappear in the upper part of the screen, together with the displayed results (if any) of their execution. These lines are usually followed by the comforting and friendly prompt 'OK', indicating that the computer has been able to carry out your instructions and is waiting for more.

Throughout the introductory chapters and the rest of the book the author's wry sense of humour surfaces from time to time in a refreshing way. On the whole, I do not like instructional books to be funny, particularly those with jokey pictures and that peculiar brand of patronising humour which is so often handed out to the novice, but here the occasional hint of humour helped me pleasantly over some of the more difficult sections.

The manual goes on to introduce the simpler FORTH words. There are plenty of examples and each chapter ends with a few exercises to help consolidate what you have learnt or to introduce some supplementary ideas. At a very early stage you are able to begin writing your own definitions in FORTH. This is one of the delights of FORTH. The language comes with a fairly standard selection of ready-defined words in its dictionary. Ace FORTH has 142 such words. But programming in FORTH essentially consists of using these words to define words of your own choosing. Each word you define normally consists of relatively few operations, for in FORTH it is best if everything is broken down into short easily understood steps. Consequently, word definitions tend to be short and simple. You soon learn enough to start defining new words.

The manual contains dozens of definitions of other useful words which you can add to the dictionary by typing them in, but only if you need them. It is as though you have a fairly limited BASIC but can add whatever commands you want simply by typing them in, rather than having to buy a new ROM, or even a more expensive computer. There is no need to bother about Shifting when typing in words or when defining words. The computer automatically converts all words to upper case before putting them in the dictionary. The only time you need to Shift to capital letters is when you are typing text.

Ace FORTH differs from the FORTH – 79 (the generally adopted standard) in a few respects. It lacks 16 of the standard words, though is contains substitutes for some of these and, if you particularly want one of the missing words, you can easily define it for yourself. For example, the manual gives the definition for COUNT, which is in FORTH – 79 but not in the Ace's dictionary.

The words in Ace FORTH which are not in FORTH – 79, include BEEP which, given two parameters to determine pitch and length, produces a note on the Ace's built-in loudspeaker. The manual lists the values needed to obtain musical notes of any desired pitch, and shows how to program the Ace to play tunes. This turns out to be a very simple undertaking. Another new word is INVIS, which prevents the display of executed lines on the upper section of the screen, keeping the screen clear for graphics displays.

GRAPHICS

There is a special word PLOT which controls pixels on a 64 by 46 grid. PLOT has four modes, so it can either make the pixel white, make it black, leave it unchanged, or change it to the opposite of what it is already. PLOT may be incorporated into the definitions of other words so that you can quickly build up a range of words such as SQUARE, TRIANGLE and the like, according to whatever shapes and effects take your fancy. The displays produced by PLOT and by the block graphics on keys 1 to 8 are decidedly low in resolution, but can be enhanced by user-defined characters. These are eight by eight bit-mapped characters which, in effect, provide 512 by 368 resolution. Any one of the character keys can be defined to produce its own special character in graphics mode. For example, the manual shows how to define key 'A' to print the image of a railway locomotive. This definition can be written into display routines. You can even use such symbols as the names of words! Defining graphics characters is straightforward because you first define a word which takes over most of the chore for you. The all you have to do is enter the bit pattern as a set of eight 8-bit binary numbers. Since the Ace can be made to run in ***any*** number base, you can enter the binary number direct instead of having to convert them to decimal or hexadecimal first as on many other computers.

NUMBER BASES

As mentioned above, you can choose which base the Ace works in. When first switched on, it runs in decimal but, by typing '2 BASE C!', you can make it work in binary (base 2). It can work in hexadecimal too, but this is not all. Type in '37 BASE C!' and it immediately starts working in base 37. This uses the figures from 0 to 9 plus ***all*** the letters of the alphabet from A to Z. If you really want to try to make it throw a fit, try typing '60 BASE C!' to make it work to base 60. But no, it is not worried by such excesses. It takes some of the lower-case alphabet and the punctuation marks into its set of symbols and allows you to perform such additions as:

```
Z + 1 =[
and 3Y + Z7 =]£
```

Perhaps some ingenious reader can design a new game which relies on unusual number bases.

Returning from flights of mathematical fantasy, let us look at some cold hard figures, such as floating point numbers, which the Ace handles just as easily as integers. What is more, it handles these over a range much wider than that of many other micros. The floating point range of the Ace is 1.0E-64 to 9.99999E62 for both positive and negative floating point values. Compare this with 1.0E-38 to 1.0E+38 for Apple II, 1.7E-38 to 1.7E+38 for TRS-80 and 2.0E-39 to 2.0E+38 for the BBC Microcomputer, all of which have very similar ranges to an order of magnitude. Thus the Ace can handle numbers over 5×10^{24} times bigger or smaller than can any of these machines.

CASSETTE RECORDING

When I tried the loading and saving routines described in the manual, they worked perfectly first time. The recorder I used was the CTR-80 as supplied for the TRS-80. Level settings appeared not to be terribly critical. If you ***do*** have trouble, there is a lot of helpful advice in the manual on 'What to do if it doesn't work'.

When you have finished a programming session, the recorder can be used for saving all the words you have defined. Later, you can load more than one set of words from tape, one after the other and the micro accepts these until its memory is full. This means that you can build up a library of words on tapes and then load whichever ones you want for the program you are writing at the moment. It is also possible to save the screen contents to tape, and redisplay it on another occasion. Similarly, you can save the character definitions you have made. ▶

ERRORS AND EDITING

Ace FORTH has a comprehensive set of error messages. When you type in a line, it is compiled and checked for errors. It is rejected if incorrect. A question mark indicates where you need to correct it.

If you want to amend a word you have already defined, it is possible to list it and edit it. This is a feature in which Ace FORTH differs from FORTH-79 and seems to be an improvement. The monitor includes a decompiler which allows a word already defined to be listed. Then by typing EDIT mode you are able to step through the listing, deleting parts of it or adding new commands. Those who are familiar with FORTH may be wondering about 'screens', but Ace FORTH does not use these. LIST and EDIT take over these functions in a way more applicable to a cassette-based system.

MEMORY

The FORTH monitor occupies 8K of ROM and the unexpanded Ace has 3K of RAM. One quarter of a kilobyte from the 3K is used for the 'Pad' where text is stored, the video RAM takes another three-quarters of a kilobyte, and the character set RAM another full kilobyte. This leaves only 1K for newly defined words, the stack and the system variables. This is not a great deal of space for programming, but remember that FORTH is a very compact language so a surprising amount can be held in a small space. The manual sets out the memory usage in full detail, including where to find the important system variables.

Programming in machine code saves memory space and gives fast-running programs but, since FORTH is already very good in both these respects, there is not so much to be gained. However, the Ace provides scope for the machine code programmer with words for calling machine code routines. Obviously the keen user will soon need memory expansion. A 16K plug-on extension memory pack was made available in February 1983, increasing the total RAM to 19K. This should provide sufficient space for really elaborate programs.

SOFTWARE

At the time of writing, there is practically no software available for this machine. If your main interest in using a micro is to type in listings from magazines or using purchased tapes, this computer has little to offer at present. If on the other hand, you are one of those whose main joy is writing programs, you have a clear field open to you. Now is your chance to write a FORTH version of all those popular games which have been done so many times before in BASIC!

Although it is not mentioned in their current advertising, Jupiter Cantab now supply a free cassette of programs with each machine. This Demonstration Tape holds five programs. The first is a utility which displays the stack. The stack is central to the working of FORTH yet it is difficult to visualize. To work it all out on paper is a messy and error-generating manoeuvre. This tape shows the stack as a pile of cards (see Fig. 1). When the program line has been entered the display changes to show what becomes of the stack. In the example illustrated, the top two cards disappear and are replaced by a card bearing the number 12.

The second program ('dictionary file' is the better term, for programs, as such, are not part of the FORTH scene) allows you to play tunes on the Ace. It has two octaves with sharps and flats. You can also record a tune of up to 170 notes for automatic playback. The remaining three file are games: Banner, Worms, and Lunar Lander. The Worms game, in which you steer a worm around the screen, trying to snap up chicken-legs well demonstrates the high-speed graphics capability of FORTH.

At the time of writing this review, Jupiter Ace have promised to start producing their own software 'within a matter of weeks'. We may also hope to see some dictionaries published in *Computing Today* when existing Ace owners or those with FORTH implementations on other computers get around to the job of writing them.

VENTURE FORTH?

Without a viable body of enthusiasts to exchange views with and a sprinkling of articles on the language in the magazines, the FORTH hobbyist could soon become disenchanted, no matter how good the language is for astronomers. Yet I have heard of a young person who bought the Ace simply to be different from all his pals! The point in doubt is to what extent FORTH is likely to prosper in the home computing field over the next year or so. The signs are that it will. There is an increasing number of articles and books on FORTH. Implementations of the language are being produced for most of the popular micros. An interesting indication of the trend is that Cosmic Conquest, the winning entry of the 1982 Byte Game Contest, is written in FORTH. This exciting game will remain a mystery to those who only have BASIC at their command! The author of this game brings out another feature of FORTH in explaining why he chose it for his entry. He explains that when developing the game he wanted to be free to make major changes in its structure. FORTH allows for fundamental changes to be made with minimum fuss, simply by redefining some of the key words. A correspondingly large amendment to a BASIC program requires greater time and effort on the part of the programmer. So, thus encouraged, let us venture FORTH!

FINDING OUT ABOUT FORTH

D S Peckett, **Going FORTH,** *Computing Today,* January-April 1982 — a four-part series which clearly explains the essence of FORTH with plenty of examples.

D S Peckett, **Going FORTH Again,** *Computing Today,* May 1982 — the first of two articles intended to delve deeper into FORTH.

Thom Hogan, **Starting FORTH**, Osborne/McGraw-Hill 1982 — not the best book available and it does not go very far, but it is relatively inexpensive and helps you to find out if you want to go further.

FACTSHEET	Jupiter Ace
CPU	Z-80A
ROM	8K
RAM	3K
Language	Ace FORTH (similar FORTH-79) with 142 words
Keyboard	40 key QWERTY, moulded-rubber
Display	Text: 24 lines of 32 characters, upper and lower case Graphics: block graphics resolution 64 x 46 bit-mapped characters, 512 x 368 White on black
Cassette I/O	1500 baud All Z-80 busses, and power lines; colour board I/O Built-in loudspeaker
Options	16K RAM Centronics printer interface (later) Joystick (later) Colour board (later)
Price	£89.95 (incl. p&p, VAT)
Supplier	Jupiter Cantab 22 Foxhollow Bar Hill Cambridge CB3 8EP

Critical review?

"The sound commands on the Oric 1 are, for a computer of this price, very sophisticated. Three music channels, and one noise channel, mean that you can program some fairly complex sounds."

POPULAR COMPUTING WEEKLY

"Oric is everything you hoped it would be. Alive with colour, and zapping with built-in sound effects, the Oric looks like a match for any machine now selling for less than £200"

YOUR COMPUTER

"The 16k Oric – fighting the 16k Spectrum – is £25 cheaper. It feels a good deal more 'professional' than the home-appeal Sinclair. Oric's sound is extremely versatile, and well up to the standard of the £300 or £400 BBC microcomputer made by Acorn."

WHICH MICRO?

"Oric was over twice as fast as the Spectrum. Surprisingly perhaps the Oric, which initially seemed only faster when performing the simplest of calculations, has come back to beat the Spectrum by a small amount. As the problems get more complex the Oric comes into its own. One final point – in entering the benchmark tests – the Oric was certainly the easiest to handle."

WHICH MICRO?

"This slope coupled with the design of the keys makes the Oric an easy machine to touch-type on. All keys have auto-repeat and there are four keys dedicated specifically to cursor control. It is certainly easier to type on than any of Sinclair's offerings."

YOUR COMPUTER

"Oric will soon be selling a Modem so that Prestel will become available. Owners will be able to accept telesoftware – programs loaded straight down the phone line – eventually electronic mail could come into the home by the same route, and with the addition of a tape recorder the Oric with its Modem could become a telephone answerer and message taker."

YOUR COMPUTER

"One good feature of the Oric is an on-screen reminder in the top right hand corner to show that you've engaged all-capitals mode. So much better than the BB's variety of lights in the corner of the keyboard. The Oric is sound, simple to get along with and offers great expansion potential."

WHICH MICRO?

"When compared to the stogginess of the Spectrum's keyboard this is certainly an improvement. I can't see any Orics failing through bad assembly. If only the £2400 IBM were so easy to use."

WHICH MICRO?

"Instead of the Spectrum's 28 look-up single-character error reports, the Oric has 18 self-explanatory messages. If you actually want to do computing, rather than just exploring the world of off-the-shelf games programme entertainment the Oric will be a better buy."

WHICH MICRO?

"A good speaker and built-in noises get the Oric's sound off to a good start. Typing Zap, Ping, Shoot or Explode produces convincing arcade game noises which can easily be incorporated into any program."

YOUR COMPUTER

"The modem is certainly unusual in a machine of this price. Together with the other peripherals, when finally available, it should make for an attractive package for a small business... surely a match for machines costing much more"

POPULAR COMPUTING WEEKLY

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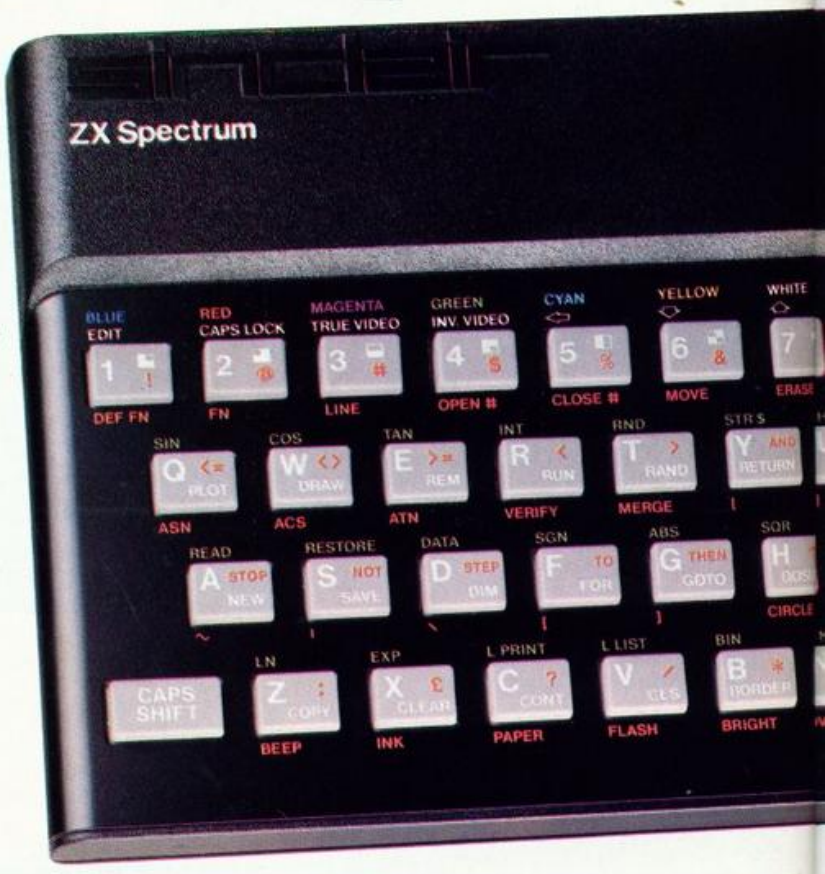
available from... **WHSMITH ● DIXONS ● GREENS**
LASKYS ● MICRO'C' ● MICRO PERIPHERALS
SPECTRUM ● COMPUTERS FOR ALL
And hundreds of independent dealers.

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!



First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

rum

ZX Spectrum software on cassettes – available now

The Spectrum software library is growing every day. Subjects include games, education, and business/household management. Flight Simulation...Chess...Planetoids...History...Inventions...VU-CALC...VU-3D ...Club Record Controller...there is something for everyone. And they all make full use of the Spectrum's colour, sound, and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

ZX Expansion Module

This module incorporates the three functions of Microdrive controller, local area network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

sinclair

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS.
Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

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*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

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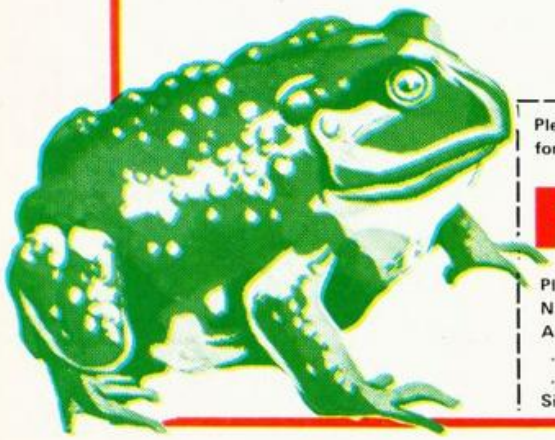

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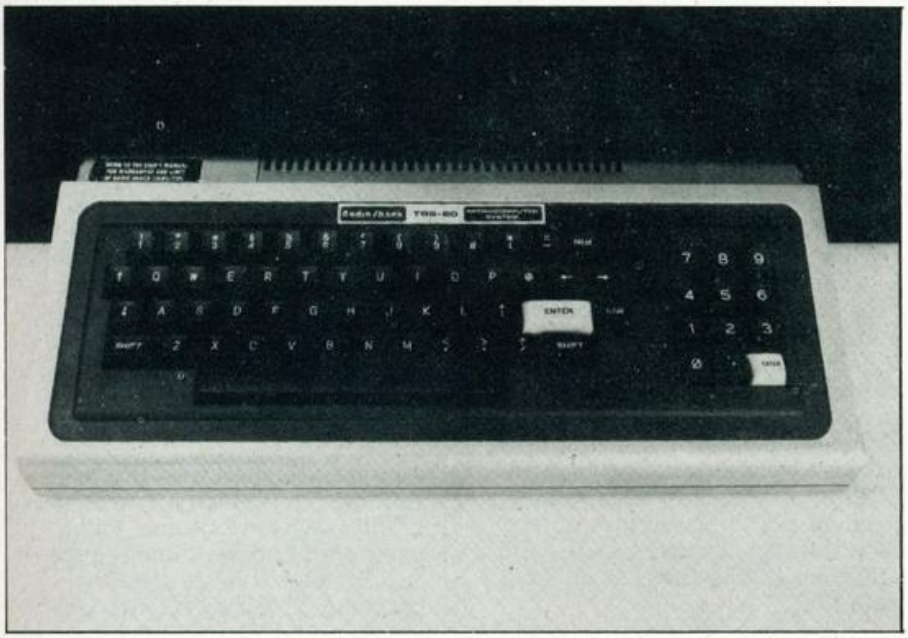
A MICRO DATA BASE

The second part of the article on setting up and retrieving information from a data base.



In the April issue of *Computing Today*, I described a data base management program. As promised then, I now look at the machine code sections of the program.

I will now explain the principle of operation of each USR routine, this section mainly refers to the assembly listing.

THE USR ROUTINES

USR8: This routine calls various DOS routines, and they expect to find a filespec in a buffer area called the DCB, this will have been put there by lines 60 and 70 of the BASIC program. This buffer area (called KBUFF in the assembly listing) is shared with USR's 6, 9, 3 and 1.

A further 256 byte buffer area (PBUFF) is needed, since the DOS I/O routines write sectors into an area specified when the file is opened and this cannot be changed until after the file is closed. The method used, then, is to fill up PBUFF and then block move the data to the desired area, repeating the process until the end of file is reached. The end of file condition is obtained from the open file DCB (the Radio Shack TRSDOS manual describes the structure of an open file DCB).

The routine is designed to be a function called from BASIC so any errors which occur need to be handled by BASIC's error routines, not DOS. This is the reason for the error exit to 63FD Hex rather than the normal DOS exit to 4429 Hex.

USR9: This is very similar to USR8 except that we are writing to disc. Data is moved into PBUFF in 256 byte blocks for each sector write, until the end address of the index is reached. The two disc I/O routines do not return any values back to the BASIC program, and so are terminated with a RET instruction.

USR5: This is the largest of the machine code routines. If a data record is deleted then all references to it in the index also need to be deleted, this routine searches them out, counts and deletes them. There is a facility in this routine for counting record number references without deleting them, but it is not used by the current version of the system.

There is the possibility that if a keyword were only associated with one logical record number then it would become 'isolated' if that record number were deleted. In other words, a keyword would be present but not be followed by any record numbers. The section of USR5 called ACTION detects this and deletes the keyword if it occurs.

Both record number and keyword deletions result in 'holes' in the index, the data following a deletion is moved down to fill the gaps. All of these operations occur very quickly; the user is not aware of anything happening. A count of references deleted is returned to BASIC and displayed.

Note that a data record deletion does not actually delete the record immediately, it removes the index references, making it unavailable to the program. The data record will be overwritten when new records are added.

USR6: This works like a two byte PEEK, it returns an integer unless the address is past the index end, in which case it will return a zero. USR6 is used to obtain logical record numbers from the index.

USR2: This searches the index from the specified location for a match with the ASCII text in KBUFF, which will be a previously inserted keyword (the target keyword). It will either return a zero if no match was found, or the address following the index keyword terminator (OD Hex). The actual logical record number is then extracted using this address as the argument for USR6. This routine will also find index keywords containing the target keyword as a substring. For example, if the target keyword were COM then the following index keywords would be found if present:

COMPUTER
COM
COMMUTATION
COMPLEXITY

If a null is entered then all data records will be displayed. This feature means that some care has to be taken when selecting the keywords for a data record.

USR3: This moves a keyword from KBUFF to the index end and then adjusts the end of index byte pair. ▶

It is called when a record is added to the data base, and the keyword does not already exist. A keyword marker is also inserted. No check is made for memory space, this is done by the BASIC program.

USR7: Used by the DISPLAY KEYWORDS function, it simply prints ASCII characters from memory to video, until a keyword end marker is encountered, and then returns to BASIC with the keyword end address.

USR4: Is used by the ADD A RECORD function. It inserts the logical record number into the index in LSB/MSB form. The data following the insertion is moved up to accommodate it and the index end bytes are adjusted. As with USR3 no memory check is done.

USR1: There is a ROM routine at 05D9 Hex which takes characters from the keyboard and places them into an input buffer. This section 'borrows' that routine and uses it to get keywords into KBUFF.

MACHINE CODE FILE

This is the file which is automatically loaded in by the program and contains the machine code routines described above. As mentioned earlier, the use of an index operated on by machine code routines allows very fast access to the data base records. When I originally wrote the routines, I attempted to load in the object file created by an Editor Assembler via USR8. Complete failure was the result, they loaded into memory but extra bytes were present, they occurred in groups at about 256 byte intervals.

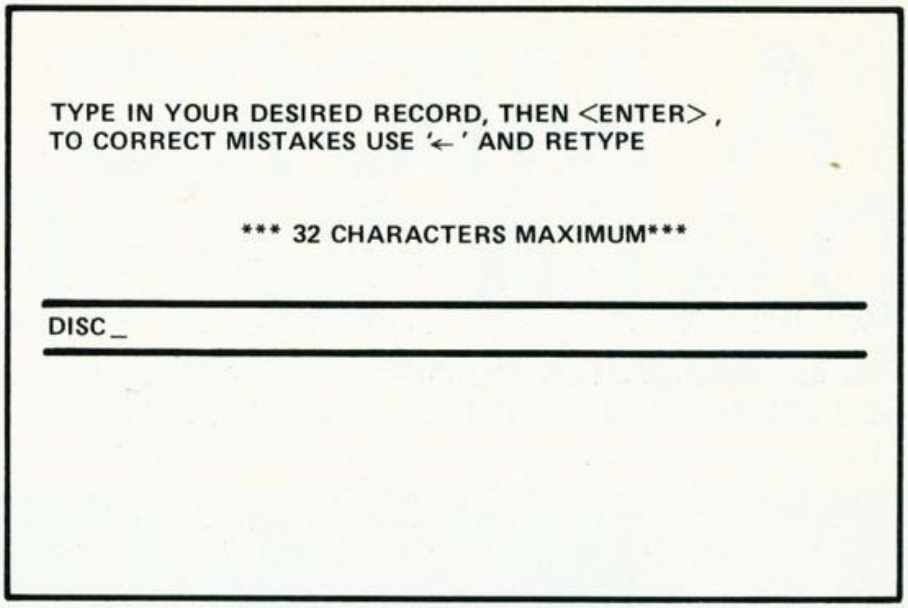


Fig. 5. This is the sort of display you will see when running the program.

Where were they coming from? Well it's obvious now, I mentioned earlier that USR8 loaded exact sector copies into memory. Well, files containing machine code have special loader codes added to them to tell DOS where to put the code in memory. The Editor Assembler produces files of this type, and USR8 was faithfully copying these codes into memory. I solved the problem by loading the routines from an Editor Assembler object file into memory using DOS LOAD and then saving them as an ASCII data file.

This method does need the use of a monitor with disc I/O functions to save the data file, another method would be to write a short BASIC program to PEEK the code and write it into a data file. This assumes that your DOS will allow 256 byte writes (mine doesn't).

Finally you could modify USR9 and use the modified version to save the other routines. Remember, this is a once only operation, after the file has been saved in the correct format it will need no further attention.

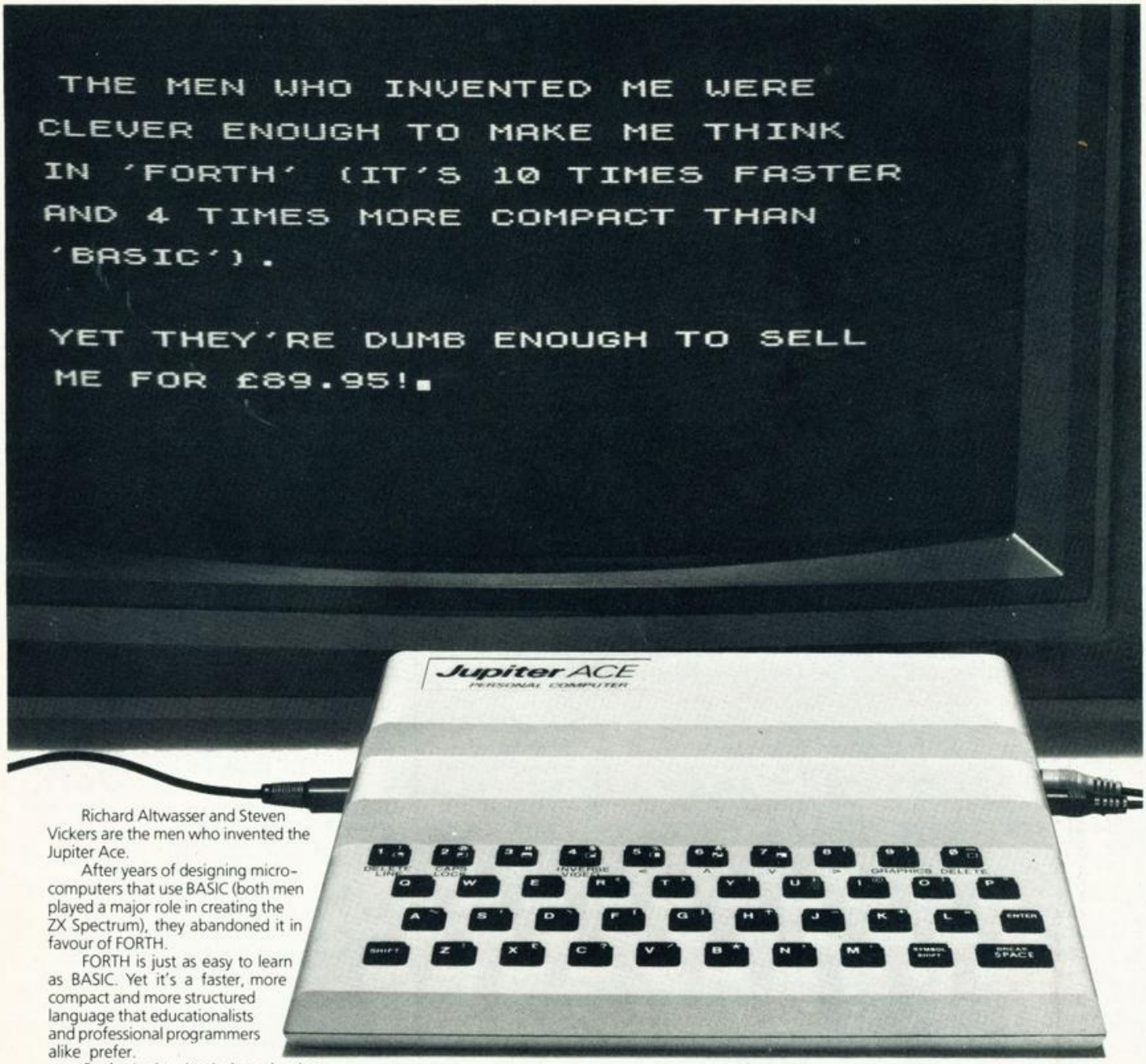
FINALLY . . .

I suggest that you test the USR routines individually, I wrote small BASIC tester programs, and a program to create dummy records and indexes. I have used the program on a TRS-80 with two disc drives and 48K without serious problems for some weeks now. However, the only way that you will get a program that is absolutely bug-free is to pay a lot of money, or spend a long time using it and gradually improving it.

```
0A7F            GETARG  EQU     0A7FH   ;GETS AN INTEGER FROM BASIC
0A9A            RETARG  EQU     0A9AH   ;RETURNS AN INTIGER TO BASIC
8000            PBUFF   EQU     8000H   ;256 BYTE BUFFER DEFINED AT OPEN
63FD            ERR     EQU     63FDH   ;ERROR PROCCESSING VIA L3 BASIC
                ;MEM TO BE RESERVED FROM 8000H, ROOM FOR PBUFF
8100                    ORG     8100H
0020            KBUFF   DEFS    32      ;STRING STORAGE, DCB
                ;********START OF USR ROUTINES**********
                ;THIS IS USR8 IT READS DATA FROM DISK AND LOADS
                ;THE FILE STARTING FROM THE ADRESS PASSED AS THE
                ;ARGUMENT, UP TO THE END OF FILE
                ;IT IS STORED AS DATA STATEMENTS IN THE CALLING
                ;PROGRAM AND POKED IN AT RUN TIME.
8120 CD7F0A     USR8    CALL    GETARG  ;GET LOAD BASE ADRESS
8123 22DD82             LD      (AUX),HL;SAVE IT
8126 210080             LD      HL,PBUFF;READ DATA INTO HERE
8129 110081             LD      DE,KBUFF;USE FOR DCB
812C 0600               LD      B,0     ;LRL=256
812E CD2444             CALL    4424H   ;OPEN FILE
8131 C2FD63             JP      NZ,ERR  ;BASIC'S ERROR TRAP NOT DOS
8134 110081     LOOP8   LD      DE,KBUFF;FOR READ
8137 CD3644             CALL    4436H   ;READ 256 BYTES OF DATA IN
813A C2FD63             JP      NZ,ERR  ;OK?
813D ED5BDD82           LD      DE,(AUX);GET LOAD ADRESS
8141 210080             LD      HL,PBUFF;PREPARE FOR BLOCK MOVE
8144 010001             LD      BC,100H ;TO MOVE 256 BYTES
8147 EDB0               LDIR            ;MOVE THEM TO LOAD POINT
8149 2A0C81             LD      HL,(KBUFF+12);GET ENDING RECORD NO.
814C ED4B0A81           LD      BC,(KBUFF+10);GET NEXT RECORD NO.
8150 B7                 OR      A       ;FOR SBC
8151 ED42               SBC     HL,BC   ;LRN=NRN?
8153 280C               JR      Z,EXIT8 ;CLOSE, BACK TO BASIC
8155 010001             LD      BC,100H ;UPDATE LOAD POINT 256 BYTES UP
8158 2ADD82             LD      HL,(AUX);FOR UPDATE
815B 09                 ADD     HL,BC   ;UPDATE FOR NEXT BLOCK MOVE
815C 22DD82             LD      (AUX),HL;KEEP TRACK OF WHERE WE ARE
815F 18D3               JR      LOOP8   ;GET NEXT RECORD
8161 110061     EXIT8   LD      DE,KBUFF;PREPARE FOR FILE CLOSE
8164 CD2844             CALL    4428H   ;CLOSE THE FILE
8167 C6                 RET     Z       ;BACK TO BASIC IF OK
8168 C3FD63             JP      ERR     ;IF NOT, PROCESS ERROR
                ;
                ;
                ;
                ;
                ;THE REST OF THE ROUTINES ARE LOADED IN BY USR8 AND
                ;START FROM HERE. THE FILE IS A DATA FILE NOT AN OBJECT
                ;CODE FILE, THERE ARE NO EMBEDDED CONTROL CHARACTERS
                ;AND ALL 256 BYTES OF EACH RECORD ARE USED.
                ;CODE DESTINATION IS PROVIDED BY THE CALLING PROGRAM
                ;********USR9 WRITE TO DISK
                ;LOADS TO DISK, START ADRESS IS START OF INDEX
                ;END ADRESS IS OBTAINED FROM FIRST BYTE OF INDEX
                ;FILESPEC OBTAINED FROM KBUFF AREA
816B 21DF82     USR9    LD      HL,INDEX;START THE SAVE FROM HERE
816E 22DD82             LD      (AUX),HL;SAVE FOR UPDATING
8171 210080             LD      HL,PBUFF;MOVE DATA HERE TO WRITE
8174 110061             LD      DE,KBUFF;USE KBUFF FOR DCB
8177 0600               LD      B,0     ;LRL=256
8179 CD2044             CALL    4420H   ;INITIALISE FILE
817C C2FD63             JP      NZ,ERR  ;OK OR NOT?
817F ED5BDD82   LOOP9   LD      DE,(AUX);GET SOURCE FOR BLOCK MOVE
8183 2ADF82             LD      HL,(INDEX);GET END OF SAVE AREA
8186 B7                 OR      A       ;AS USUAL, TO CLEAR CARRY
8187 ED52               SBC     HL,DE   ;AT END YET?
8189 FA6181             JP      M,EXIT8 ;IF DONE USE B'S EXIT
818C EB                 EX      DE,HL   ;GET MEM POINTER INTO HL
818D 110080             LD      DE,PBUFF;GET DESTINATION FOR BLOCK MOVE
8190 010001             LD      BC,100H ;WE WANT TO MOVE 256 BYTES
```

```
8193 EDB0            LDIR            ;INTO THE BUFFER FOR WRITE
8195 110081          LD      DE,KBUFF;DCB FOR WRITE
8198 CD3C44          CALL    443CH   ;WRITE WITH VERIFY
819B C2FD63          JP      NZ,ERR
819E 2ADD82          LD      HL,(AUX);GET MEMORY POINTER
81A1 010001          LD      BC,100H ;TO UPDATE FOR THE NEXT
81A4 09              ADD     HL,BC   ;256 BYTE MOVE
81A5 22DD82          LD      (AUX),HL;FOR NEXT TIME
81A8 18D5            JR      LOOP5   ;HERE WE GO ROUND THE MULBERRY
                ;******RECORD NO. COUNTER
                ;THIS ROUTINE COUNTS OCCURENCES OF A RECORD NO.
                ;IN LSB/MSB FORM AND IF AUX=0 IT DELETES THEM
                ;A CHECK IS MADE FOR REDUNDANT KEYWORDS AND
                ;THEY ARE ALSO DELETED. THE RECORD NO. TO BE COUNTED IS
                ;PASSED AS THE ARG. IN THE USR CALL, DELETE OR NOT IS
                ;PASSED IN THE LOWER BYTE OF AUX
                ;****USR5
81AA CD7F0A     USR5    CALL    GETARG  ;GET RECORD NO. INTO HL
81AD FD21DD82           LD      IY,AUX  ;FOR CHECK LATER
81B1 DD210000           LD      IX,0    ;COUNTER REGISTER
81B5 E5                 PUSH    HL      ;SAVE FOR LATER
81B6 21DF62             LD      HL,INDEX;GET TABLE START
81B9 23                 INC     HL      ;MISS FIRST TWO BYTES
81BA 23         KSEARC  INC     HL      ;FIND KWORD END
81BB 3E0D               LD      A,0DH   ;IS IT A CR? (=KWORD END)
81BD BE                 CP      (HL)
81BE 20FA               JR      NZ,KSEARC;UNTIL END OF KWORD
81C0 23                 INC     HL      ;BUMP ONTO BYTE AFTER 0DH
81C1 AF         NEXT    XOR     A       ;DO WE HAVE A KWORD START?
81C2 BE                 CP      (HL)
81C3 2005               J       NZ,INTAB;IF NOT THEN END OF INDEX?
81C5 23                 INC     HL      ;CONFIRM KWORD MARKER
81C6 BE                 CP      (HL)    ;IS IT?
81C7 28F1               JR      Z,KSEARC;IF SO, PUT PTR TO END OF IT
81C9 2B                 DEC     HL      ;WHAT WAS IT THEN?
81CA ED5BDF82 INTAB     LD      DE,(INDEX);END OF INDEX?
81CE DF                 RST     18H     ;NOT DESTROY HL
81CF 3016               JR      NC,EXIT2;IF HL>=END OF INDEX
81D1 D1                 POP     DE      ;GET SUBJECT OF SEARCH
81D2 D5                 PUSH    DE      ;FOR MORE SEARCHING
81D3 7B                 LD      A,E     ;(HL)=DE?
81D4 BE                 CP      (HL)    ;CHK LSB
81D5 23                 INC     HL      ;GET MSB
81D6 200C               JR      NZ,NEXT1;NOT A MATCH SO GET NEXT NO.
81D8 7A                 LD      A,D     ;MAYBE, SO GET LSB
81D9 BE                 CP      (HL)
81DA 2008               JR      NZ,NEXT1;NOT A MATCH
81DC DD23               INC     IX      ;A MATCH SO COUNT IT
81DE AF                 XOR     A       ;A=0
81DF FDBE00             CP      (IY)    ;DELETE OR NOT
81E2 280A               JR      Z,ACTION;YES SO DO IT
81E4 23         NEXT1   INC     HL      ;TO NEXT REC. NUMBER
81E5 18DA               JR      NEXT
81E7 DDE5       EXIT2   PUSH    IX      ;GET COUNT BACK TO BASIC
81E9 E1                 POP     HL
81EA D1                 POP     DE      ;TO GET CORRECT  RET ADRR.
81EB C39A0A             JP      RETARG
81EE ED5BDF82 ACTION    LD      DE,(INDEX);GET INDEX END
81F2 2B                 DEC     HL      ;T FIRST BYTE O REC. NO.
81F3 E5                 PUSH    HL      ;SAVE CURRENT COUNT
81F4 EB                 EX      DE,HL   ;RIGHT WAY ROUND FOR SC
81F5 ED52               SBC     HL,DE   ;CALC. DIFFERENCE FOR MOVE
81F7 44                 LD      B,H     ;GET HL INTO BC
81F8 4D                 LD      C,L     ;FOR BLOCK MOVE
81F9 62                 LD      H,D     ;GET DE INTO HL
81FA 6B                 LD      L,E
81FB 23                 INC     HL      ;GET HL TWO LOCS. UP
81FC 23                 INC     HL
81FD EDB0               LDIR            ;MOVE THE BYTES
81FF 1B                 DEC     DE      ;COS LDIR EXITS WITH
8200 1B                 DEC     DE      ;DE AT END+2
8201 ED53DF82           LD      (INDEX),DE;UPDATE END OF RECORD
8205 E1                 POP     HL
8206 E5                 PUSH    HL      ;KEEP THIS
8207 2B                 DEC     HL      ;PREVIOUS POSITION
8208 3E0D               LD      A,0DH   ;WAS IT A KWORD END?
820A BE                 CP      (HL)    ;CHECK
820B 200D               JR      NZ,DONE ;IF NOT
820D 23                 INC     HL      ;NEXT POS.
820E DF                 RST     18H     ;MUST CHECK FOR END OF INDEX
820F 3E00               LD      A,0     ;A=0, BUT RETAIN FLAGS
8211 300A               JR      NC,KEYDEL;IF LAST WORD THEN DELETE
8213 BE                 CP      (HL)    ;IS THE NEXT ENTRY A KEYWORD?
8214 2004               JR      NZ,DONE ;NO, SO ALL DONE
8216 23                 INC     HL      ;MAYBE, SO CHECK NEXT BYTE
8217 BE                 CP      (HL)    ;CONFIRMED?
8218 2803               JR      Z,KEYDEL;YES SO THIS KWORD IS REDUNDANT
821A E1         DONE    POP     HL      ;RESTORE THE CURRENT POSITION
821B 18C7               JR      NEXT1   ;CARRY ON
821D E1         KEYDEL  POP     HL      ;WE WANT CURRENT LOC.
821E E5                 PUSH    HL
821F 2B                 DEC     HL      ;POINT TO END OF LAST KWORD
8220 BE         FNDIT   CP      (HL)    ;WE NEED TO LOCATE THE
8221 2B                 DEC     HL      ;START OF THE REDUNDANT KEYWORD
8222 20FC               JR      NZ,FNDIT;THE ONLY '0'S ARE AT THE START
8224 D1                 POP     DE      ;GET SOURCE FOR MOVE
8225 E5                 PUSH    HL      ;SAVE DESTINATION FOR MOVE
8226 B7                 OR      A       ;CLEAR CARRY FOR SBC
8227 2ADF82             LD      HL,(INDEX);END OF TABLE
822A ED52               SBC     HL,DE   ;GET DISTANCE TO END FOR MOVE
822C 44                 LD      B,H     ;IT INTO BC
822D 4D                 LD      C,L     ;FOR MOVE
822E 03                 INC     BC      ;EXTRA MOVE NEEDED IN CASE
822F 03                 INC     BC      ;LAST KEYWORD IS DELETED
8230 E1                 POP     HL      ;DIST. FOR BLOCK MOVE
8231 E5                 PUSH    HL      ;NEW CURRENT LOCATION
8232 EB                 EX      DE,HL   ;RIGHT WAY ROUND
8233 EDB8               LDDR            ;FILL IN THE GAP
8235 1B                 DEC     DE      ;POINT TO LAST BYTE
8236 1B                 DEC     DE      ;OF INDEX
8237 ED53DF82           LD      (INDEX),DE;RECORD THE CHANGE
823B 18DD       END5    JR      DONE
                ;*********END OF ROUTINE
                ;THE NEXT ROUTINE RETURNS WITH THE RECORD NO POINTED
                ;TO BY THE ENTRY ARG. OR 0 IF AT END OF INDEX OR
                ;0 IF A KEYWORD MARKER IS ENCOUNTERED
                ;THIS IS USR6
823D CD7F0A     USR6    CALL    GETARG  ;PUT LOCATION INTO HL
8240 ED5BDF82           LD      DE,(INDEX);FOR END CHECK
8244 DF                 RST     18H
8245 3805               JR      C,GETNUM;GET THE RECORD NO
8247 210000             LD      HL,0    ;IF AT END
824A 1804               JR      EXIT6   ;RETURN TO BASIC
824C 5E         GETNUM  LD      E,(HL)  ;LSB
824D 23                 INC     HL
824E 56                 LD      D,(HL)  ;MSB
824F EB                 EX      DE,HL   ;MUST BE IN HL TO PASS TO BASIC
8250 C39A0A     EXIT6   JP      RETARG  ;PASS IT BACK
                ;*******END OF USR6
                ;THE NEXT ROUTINE SEARCHES THE INDEX FOR A KEYWORD
                ;AND RETURNS WITH AN ARG POINTING TO THE FIRST
                ;RECORD NO. AFTER IT OR 0 IF IT CANNOT FIND A MATCH
                ;ROUTINE STARTS SEARCHING FROM THE LOCATION PASSED
                ;BY THE USR ARG. THIS IS USR 2
8253 CD7F0A     USR2    CALL    GETARG  ;GET LOC. TO START SEARCH
8256 ED5BDF82   KEYFND  LD      DE,(INDEX);CHECK FOR TABLE END
825A DF         KEY     RST     18H     ;END?
825B 3024               JR      NC,NFEXIT       ;YES SO FINISH
825D AF                 XOR     A       ;A=0
825E BE                 CP      (HL)    ;START OF KEYWORD?
825F 23                 INC     HL
8260 20F8               JR      NZ,KEY  ;NO SO TRY NEXT
8262 BE                 CP      (HL)    ;MAYBE
8263 20F5               JR      NZ,KEY  ;FALSE ALARM?
8265 E5                 PUSH    HL      ;GOT ONE
8266 23                 INC     HL      ;CHECK FOR MATCH
8267 110081             LD      DE,KBUFF;WORD TO BE FOUND IS IN HERE
826A 1A         KEYCHK  LD      A,(DE)  ;CHECK BYTE BY BYTE
826B FE0D               CP      0DH     ;END OF TARGET WORD?
826D 280A               JR      Z,GOTIT
826F BE                 CP      (HL)
8270 2803               JR      Z,MAYBE ;UNTIL THE END OF THE WORD
8272 E1                 POP     HL      ;NO, SO CARRY ON LOOKING
8273 18E1               JR      KEYFND
8275 13         MAYBE   INC     DE
8276 23                 INC     HL
8277 18F1               JR      KEYCHK
8279 E1         GOTIT   POP     HL      ;WE DON'T NEED IT NOW
827A BE         POINT   CP      (HL)    ;A=0DH GET HL TO END OF
827B 23                 INC     HL      ;KEYWORD IN INDEX
827C 20FC               JR      NZ,POINT;AT END YET?
827E C39A0A     END2    JP      RETARG  ;IL=FIRST REC NO. AFTER KEY
8281 210000     NFEXIT  LD      HL,0    ;PASS 0 BACK TO BASIC
8284 18F8               JR      END2
                ;*****END OF ROUTINE
                ;THE NEXT ROUTINE ADDS A KEYWORD TO THE END OF THE
                ;INDEX AND ADJUSTS THE INDEX END BYTES
                ;THIS IS USR3
8286 2ADF82     USR3    LD      HL,(INDEX);FIND END
8289 23                 INC     HL
828A 3600               LD      (HL),0  ;PUT IN A KEYWORD MARKER
828C 23                 INC     HL
828D 3600               LD      (HL),0  ;EXTRA BYTE
828F 23                 INC     HL
8290 EB                 EX      DE,HL   ;LDI USES HL AS SOURCE,DE AS DEST
8291 2100b1             LD      HL,KBUFF;GET SOURCE =BUFFER
8294 3E0D               LD      A,0DH   ;FOR END CHECK
8296 BE         LOOP3   CP      (HL)    ;CLOCK FOR END
8297 EDA0               LDI             ;MOVE A BYTE
8299 20FB               JR      NZ,LOOP3        ;GET THE NEXT ONE
829B 1B                 DEC     DE      ;END PTR TO POINT TO END BYTE
829C ED53DF82           LD      (INDEX),DE;UPDATE END PTR
82A0 C9                 RET
                ;******END OF ROUTINE
                ;THIS ROUTINE PRINTS ASCII CHRS TO VIDEO FROM LOCATION
                ;PASSED BY ARG UNTIL AN 0DH IS ENCOUNTERED
                ;VALUE RETURNED IS THE ADRESS OF THE 0DH
82A1 CD7F0A     USR7    CALL    GETARG  ;GET LOC. IN HL
82A4 7E         INC     LD      A,(HL)  ;CONTENTS INTO A
82A5 FE0D               CP      0DH     ;CR?
82A7 CA9A0A             JP      Z,RETARG;GO BACK IF 0DH
82AA CD2A03             CALL    032AH   ;OUTPUT TO DEVICE
82AD 23                 INC     HL      ;FOR NEXT CHR
82AE 18F4               JR      INC     ;GO GET IT
                ;THE NEXT ROUTINE ADDS A RECORD NUMBER IMMEDIATLY
                ;FOLLOWING THE ADRESS POINTED TO BY THE ARGUMENT PASSED
                ;FROM BASIC, AND UPDATES THE END OF INDEX BYTES
                ;THE RECORD NO. TO BE INSERTED IS OBTAINED FROM AUX
                ;THIS IS USR 4
82B0 CD7F0A     USR4    CALL    GETARG  ;GET LOCATION
82B3 00                 NOP     ;FOR NO PARTICULAR REASON
82B4 EB                 EX      DE,HL   ;FOR SBC LATER
82B5 2ADF82             LD      HL,(INDEX);END OF TABLE
82B8 23                 INC     HL
82B9 23                 INC     HL
82BA 22DF82             LD      (INDEX),HL;UPDATE
82BD B7                 OR      A       ;CLEAR CARRY FOR SBC
82BE ED52               SBC     HL,DE   ;HL=DE
82C0 44                 LD      B,H     ;BCP MANY BYTES INTO BC
82C1 4D                 LD      C,L
82C2 2ADF82             LD      HL,(INDEX)
82C5 54                 LD      D,H     ;GET DEST (=NEW INDEX END)
82C6 5D                 LD      E,L     ;HIGH+LOW BYTES
82C7 2B                 DEC     HL      ;MOVE TWO BYTES UP
82C8 2B                 DEC     HL
82C9 EDB8               LDDR            ;MOVE BYTES UP TWO
82CB EB                 EX      DE,HL   ;DE POINTS TO INSERT POSITION
82CC ED5BDD82           LD      DE,(AUX)        ; PUT IN NEW RECORD NO.
82D0 73                 LD      (HL),E
82D1 23                 INC     HL
82D2 72                 LD      (HL),D
82D3 C9         END4    RET     ;NOTHING TO PASS BACK
                ;********END OF ROUTINE
                ;ROUTINE GETS A 32 BYTE MAXIMUM LENGTH STRING INTO KBUFF
82D4 210081     USR1    LD      HL,KBUFF;POINT TO IT
82D7 0620               LD      B,32    ;MAX STRING LENGTH
82D9 CDD905             CALL    05D9H   ;GET THE CHRS IN
82DC C9         END1    RET             ;BACK TO BASIC
                ;******END OF ROUTINES
                ;BUFFER AREAS NEXT
0002            AUX     DEFS    2       ;FOR PASSING EXTRA USR PARAMETERS
                                        ;CAUTION! MUST NOT BE A DEFB 0
                                        ;SINCE LOAD USES THIS LOC. DURING
                                        ;THE LOAD OF THE OTHER ROUTINES
                                        ;A DEFB WOULD OVERWRITE CONTENTS
                                        ;WITH '0'
82DF 00         INDEX   DEFB    0       ;START OF INDEX TABLE
0000                    END
00000 TOTAL ERRORS
```

Listing 2. Assembly code listing for the data base management program.



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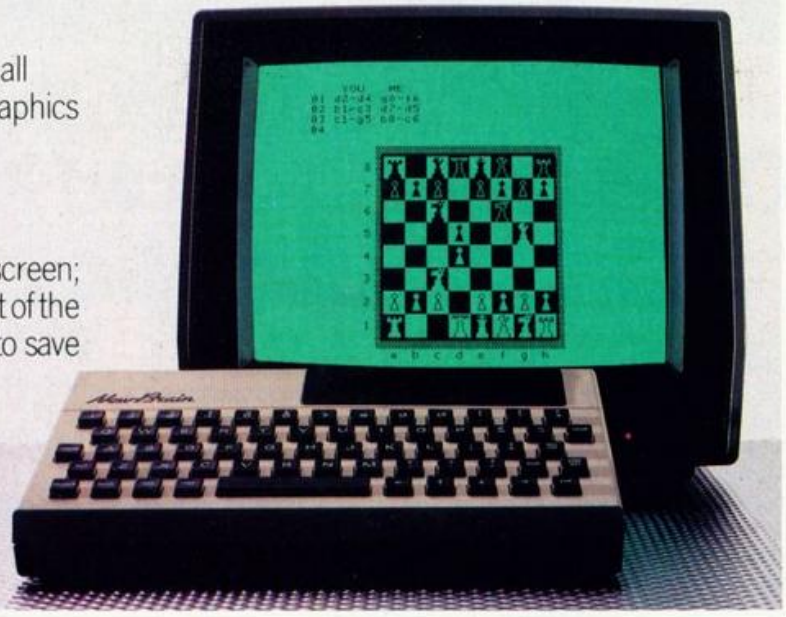

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PRINTOUT

Dear Sir,

I found Henry Budgett's article on PEEK and POKE in the January issue very interesting and useful. However, the programs presented therein could not be run on a Tangerine system without slight modifications. Besides several obvious changes that are needed, there are a couple of hidden ones I would like to point out.

(1) In Listing 1, line 100 (and similar lines in other listings) should change to read:

```
100  FOR I=SP+(LL*(PL-1)) TO
     SP+(LL*PL)-1
```

otherwise a number would be POKEd into location Hex 0400, which happens to be where the BASIC program storage starts. The effect is that the program can only be run once. The subsequent RUN commands are responded by the system with the message ?SYNTAX ERROR.

(2) In Listing 2, line 50 is better changed to read:

```
50  POKE SP+INT(511*RND(1)+1),107
```

to avoid the possibility as explained above.

Both of the above make the point that one should watch out when using PEEK and POKE.

(3) In Listing 4, the ball seems to come out from inside the wall, leaving a hole in the wall. To get rid of this, amend line 140 (also in Listing 5) to:

```
140  OP=SP+((LL*PL)/2)+1
```

According to the Tangerine manual, the GET command is used to receive a single character from the keyboard **without** *displaying it on the screen. However, I found on my Tangerine micro that it did put the character on display. It seemed impossible to run the program in Listing 5 since when the bottom line became filled, the whole screen scrolled up one line, thus spoiling the picture. Could anyone please tell me how to get around this problem?*

Yours faithfully,
C Y Fung
Hong Kong

Dear Sir,

Your review of the Sharp PC-1500 (July 1982) states that PEEK and POKE are not available in PC-1500 BASIC but this is incorrect; both commands ae supported. POKE has been implemented in the form POKE location, value (,value) (,value) . . . which allows alteration of up to 37 consecutive locations in memory with one instruction. For example, POKE 30976,7,0,9,8 will set bytes 30976 — 30979 (the first four bytes of variable A) equal to 7,0,9, and 8 respectively.

Five further commands can be found by inspecting the BASIC keyword table. They are PEEK #, POKE #, CALL, OPN and P_____ (P followed by four spaces). PEEK # and POKE # operate similarly to their counterparts but address an entirely different area of memory, which has not yet been explored. I am still experimenting with CALL, while the purpose of OPN and P_____ remains obscure.

I am investigating the internal workings of the PC-1500 and would like to communicate with anyone working on the same project.

Yours faithfully,
N E Westman
PO Box 375
Pretoria
0001
Rep. of South Africa

PS Mr Ruston (who reviewed the PC-1500) mentions that ON ERROR GOTO is of questionable usefulness as implemented. Quite so. However, PEEK 30875 will provide a running program with the error number, while bytes 30900 and 30901 indicate the line in which the error occurred.

Dear Sir,

While looking over the article on Pascal, I thought to try the BASIC biorhythms program on my Dragon 32. I found it necessary to type in an additional line at the start reserving 3K of memory, or else I would get the message:

?OS IN LINE 200

For the benefit of any other first-timers, I would add that the change is as follows:

15 CLEAR 3000

The CLEAR is typed in letter by letter.

Yours faithfully,
Barry Gowland
Gaston

Dear Sir,

Reference Don Thomasson's article 'PEEKing the Spectrum'.

It is easy to get SCREEN$ to recognise a UDG by POKE 23606,88 : POKE 23607,254. Then follow with your search routine, eg If SCREEN$ (x,y) = CHR$ 32 Then . . . , and finally POKE 23606,0 : POKE 23607,60. (If this is NOT done then on return to printing you will get a wierd set of graphics as the chars. position has been moved). CHR$ 32 will be the first UDG, 33 the second and so on.

Yours faithfully,
B G Cornhill
Aylesbury

Dear Sir,

With reference to the March issue and the Atari BASIC interpreter feature. It is standard practice in computer magazines to print programs only from first copy printout from a working program. It is therefore very annoying to find in the program on page 52 that: Line 20170: the first '+' should be an '' and Line 20120 is really '20210'.*

These errors took me over two hours to find once I had typed in the program!

I dare say that a very large number of your readers will be unable to track down the first error (which is not obvious just by reading the program).

Yours faithfully,
C G Friston
Epsom

(* Humblest apologies for the errors, but I must point out a couple of facts regarding the publication of computer listings in a magazine. Yours truly would love to be able to merely print the original listing but it is no mean feat! Firstly, not all printers produce clear enough copy for direct reproduction, the colour of the paper and of the print seriously

adding to the problem. Then again, the paper and print widths vary greatly and some printers can't cope with some graphics characters!

Needless to say if we can directly reproduce the author's original listing so that you can actually read it, we will do so. However on the many occasions when this is not possible we re-set the listing ourselves and proof it as carefully as possible against the original. Do I not hear the old adage 'To err is human. . .'? Ed.*)

Dear Sir,

Computing Today, *besides being merely a personal computing magazine, is to my colleagues and I, the British personal computing market showroom, and for some manufacturers, the only one.*

As such, I'd be grateful if you would consider the following requests.

1) When introducing new PCs, like the Commodore 64, Oric 1 etc, information about colour graphics is sometimes vague. Why not show one good coloured photograph of the computer screen, exhibiting resolution, number of colours simultaneously available on the screen etc. Since the **Computing Today** *cover is coloured anyway, it looks like it could be done upon it without extra cost.*

2) An important feature of a micro is the bus line's availability for user special applications. If you could just specify the appropriate slot, application preparations could be started while the computer is still 'coming soon'.

3) My letters to some advertisers and to some addresses given in 'Business News' were not responded to. I realise that it is difficult and expensive to correspond with a small potential customer overseas, but if ads could just give rates for such an overseas service I'm sure they would gain a lot of new small customers: I know that many Israelis (at least) upon coming back from a visit in Great Britain would like to bring home a predecided small computer, especially if not represented in Israel, not to mention mail orders.

Yours faithfully,
Guiora Sokolovsky
Israel

Dear Sir,

It was refreshing to read the January issue and find at last, a magazine which is prepared to devote some space to promote Pascal.

Like the author, I was strongly in favour of BASIC and had nothing but criticism for Pascal in the learning stages and very nearly abandoned it. However, having mastered the language, I think it deserves its place as the rightful successor to BASIC.

I would not like to upset your author by describing BASIC as a rotten language. In its day, it was a major breakthrough, but computer technology is a fast moving field both in hardware and software and there can be no doubt that Pascal is a far superior language with the advantage of hindsight of the shortcomings of its predecessors. One might very well ask the question as to whether the diehard BASIC fans who are desperately fighting to save the language from a natural and timely death would be prepared to be travelling about in a Model 'T' Ford which was itself a major breakthrough in its time.

BASIC, the pioneer of high level language, is now an anachronism. It is messy to use, has limited scope for meaningful variables and requires heavy documentation and/or memory penalty for REM (arks) if a stranger is to be able to read it.

Written as a teaching language, Pascal illustrates how well structured programs should be written and all but prohibits sloppily written ones. I hope many of your readers will take the trouble to go more deeply into it and increase the circle of its adherents.

Yours faithfully,
P H Sidwell
Singapore

Dear Sir,

Regards on your article in the September 1981 issue of **Computing Today** *by D S Peckett on a football pools prediction program. I have been running this program since Xmas 1982 on a 16K TRS-80 saving data by tape. Now I have a 48K with two disc drives. As yet I have not been able (I'm a novice computerist) to convert it successfully to run on disc.*
If you could help me in any way I would be most grateful.

Yours faithfully,
Ray Hardy
New Zealand

(* Come on now, I'm sure someone out there has overcome this and can help out. Ed. *)

Dear Sir,

With reference to an omission in my letter published in the February 1983 edition of **Computing Today**, *I would confirm that it is necessary to POKE 5632,0 to ensure successful running of the modified 'Large Screen' program.*

This is best achieved by modifying the new line 10 to read:

```
10  POKE 5632,0:POKE 44,22:RUN
```

which sets the new start of BASIC, sets the first byte to zero, then runs the original program now stored at the new start of BASIC.

Further also to that letter in February, the method outlined for moving the start of BASIC has proved most useful in several other applications, particularly in the use of defined characters.

As these can be used in RAM starting at locations 4096, 5120, 6144 or 7168, it is necessary to raise the start of BASIC above one of these addresses to use this facility. Since the 16K screen is located at 4096 — 4601, and normal BASIC starts at 4608 then user defined characters could start at 5120. A one line program to relocate BASIC is needed:

```
10  POKE 6144,0:POKE 44,22:RUN
```

and this requires bytes 4608 — 4631 leaving bytes 4632 — 5119 available for any machine code routines you may wish to use. If the first character set located at 32768 — 33791 is now copied into RAM at 5120 — 6143, this can be modified to user defined characters as explained in your articles in the January and February editions of **Computing Today**, *or in* **VIC Revealed.** *Bytes 6144 — 24575 are now available for BASIC etc (18432 bytes), is loaded as described in my February letter, and runs by RUNning line 10 above after normal loading.*

When this configuration of program is SAVEd (after a POKE 44,18 operation), the RAM is SAVEd from 4608 to the top of BASIC defined by the program starting at 6144, so that any machine code or defined graphics between 4632 and 6143 are also SAVEd. These are also restored to the same bytes when a program is LOADed, so that once RUN and established, the DATA statements, READ and POKE operations, and any character modifying lines can be deleted from the program, ▶

before SAVEing, and when LOADed and RUN, the start is immediate as graphics and machine code are already available.

Unlike the 'Large Screen' editor program, line 10 is not overwritten and can be recovered at any time by POKE 44,18. Note, this should always be done before saving.

To use the modified character set located between 5129 and 6143, you must POKE 36869,205 and not the normal POKE 36869,253. This is because the other part of the Video Address contained in byte 36869 changes from 240 to 192 when a 16K RAM expansion is added.

If the nominal 488 bytes of RAM is not enough for your machine code requirements, or a larger character set is required, then the one line starter program (line 10) can be modified as follows to give different locations:

```
5120    10 POKE 5120,0:POKE 44,20:RUN
5376    10 POKE 5376,0:POKE 44,21:RUN
5632    10 POKE 5632,0:POKE 44,22:RUN
```

a new start is available every 256 bytes, POKE the starting byte to zero, and POKE location 44 to the start byte number divided by 256.

```
6144    10 POKE 6144,0:POKE 44,24:RUN
7168    10 POKE 7168,0:POKE 44,28:RUN
```

I hope this may be of interest to yourselves and other VIC-20 users who have expanded their machines.

Yours faithfully,
E H Cheers.
Great Haywood

Dear Sir,

I am writing as a postscript to the Spring 1983 issue of **Personal Software.** *Having written a number of articles in that issue, I have been checking it through to see if there were any mistakes in the articles as printed. In fact, I have found three and I thought that your readers should be informed of them as soon as possible.*

The first mistake is one introduced by the publishers of the magazine. In the Hints and Tips article on page 70, section 5 refers to the table of negative INKEY values given on page 275 of the **User Guide.** *It was supposed to have been reproduced in the article, but was unfortunately omitted. The second and third mistakes are ones for which I must take responsibility. The former of these two is on page 69 of the same Hints and Tips article, and occurs in the listing of the Bugpatch program. The memory location jumped to in line 190 should be &F521 and &F21. So line 190 should read:*

```
190.FIX1 PHA:JSR &F521:PLA:RTS
```

The third mistake is in the second section of the Memory Saver 1 article on page 66, entitled A change of range. For the method described to work, the numbers to be stored in one byte must satisfy the condition that only one of them can be non-zero at a time, although the non-zero number can be any one of them.

To illustrate the method let us take a specific example where we have a series of values for eight numbers, which satisfy the condition that only one number in each set of eight values will be non-zero. Further, suppose that the value of each number is zero of a positive integer less than 32 (256/8=32), then we can store the required information we need to store, one is the number (from 1 to 8) of the non-zero element, and the second is the value (from 0 to 31) of that element.

The number to be placed in the byte is calculated as follows: suppose it is the fifth element that is non-zero and that its value is 17 then:

byte = (32 x 5) + 17 = 177

To retrieve the encoded information we need to use the functions DIV (integer division) and MOD (remainder after integer division):

non-zero element number
= byte DIV 32
= 177 DIV 32
=5

element value
= byte MOD 32
= 177 MOD 32
= 17

If you wish to pack more than one number into a byte, but they could all be non-zero at the same time, then other methods can be used but, again, specific conditions have to be met.

Each of the eight bits in a byte can be used to store a number that can only take two values. The values do not have to be 0 and 1, since encoding and decoding routines can transform the actual numbers in 0 and 1, and back again, before and after packing them into the byte. Similarly, one byte can store four numbers, each of which can take only four values, or, indeed, two numbers, each of which can take only 16 values.

If your readers wish to pursue this topic further, there are two useful articles on it by Ian Birnbaum in the magazine **Acorn User,** *pages 16 and 17 of the December 1982 issue and pages 15 and 16 of the March 1983 issue.*

I apologise to your readers for the above mistakes (and to Richard Russell for inadvertent error in his Bugpatch program) and I hope that they have not been inconvenienced by them.

Yours faithfully
Ian Nicholls
Kidderminster

Dear Sir,

Please display this letter in your publication.

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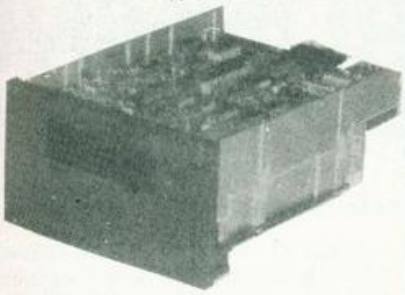

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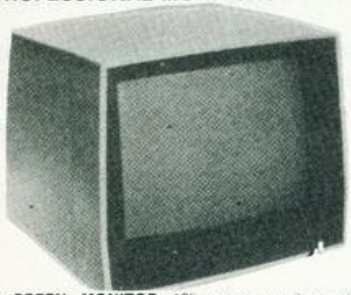

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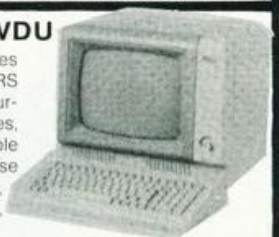

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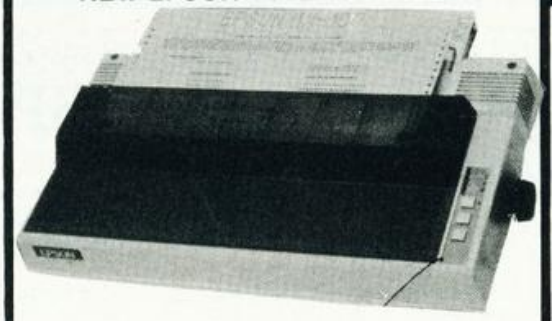

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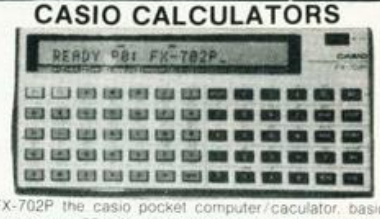

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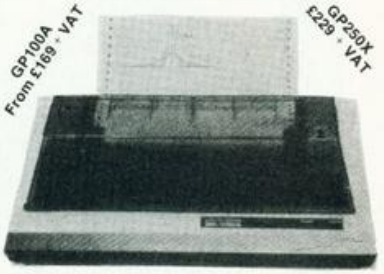

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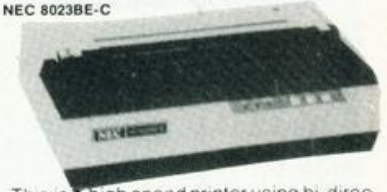
NEC 8023BE-C



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Wendy J Palmer

MARKET SURVEY

Before you rush out and buy your first micro you should read through this guide to make sure you know what's available.

If you are reading this you are presumably toying (even if very seriously) with the idea of buying a microcomputer. In the next few pages we have put together some facts and figures relating to some of the cheaper micros on the market, but you should keep in mind some useful tips before you actually put pen to cheque-book.

The first thing to decide (or at least have given some thought to) is what do you want your computer to do for you? Do you merely want it to play games on, to keep the children quiet (?!) and to save you money at the local arcade? Or do you want to keep track of your household accounts and write a simple piece of accounting software for your small business? The answer to these questions will help enormously when you come to look at the type of micro you might buy. The chances are that you will want a mixture of these abilities in your micro, after all man cannot live by financial software alone!

HELP IS AT HAND

If you have not ever had practical experience on a micro why not go along to a local computer users' group — you don't usually have to own a micro to join — and finding out first hand from existing owners is often worth a lot more than pages of enthusiastic words on an advertising leaflet. Be prepared to listen to a lot of enthusiastic words from the owners though. Also pop into your High Street stores and ask lots of penetrating questions — a lot of micros are being sold across the counter these days. When you actually do buy a machine it will almost certainly come with some documentation and the quantity and quality of this varies tremendously from machine to machine. So it might well be an idea to peruse the shelves of the local bookstore where you will find an abundance of books both general and specifically for the more popular micros. Don't forget too that there are lots of computer exhibitions and courses around and these can yield invaluable information. And of course there are excellent computer magazines around that give reviews of machines and their peripherals as well as programs that you can type in yourself, rather than buying a commercial package.

Well now that you have all the background information you will have to get down to making that decision but let me warn you, you will probably get hooked by micro fever and will want to add all sorts of exciting extras to your basic machine so be prepared!

SPECIFICALLY . . .

The following pages are intended as a quick reference guide to some of the cheaper micros available and as such most of it should be fairly self-explanatory, but here's a little help on some points.

MEMORY The memory sizes are given for the basic machine, and where this can be expanded you will be told in the Notes section.

LANGUAGE This is the language that comes as standard with the basic machine; if other languages are available this will be detailed in the Notes section.

CASSETTE The cassette speed is given in baud where we were able to ascertain it.

DISC At the range of micros covered this is not normally standard on the machine, although many can have this capability added.

KEYBOARD This will tell you whether the machine has a standard QWERTY keyboard, has cursor control keys, a separate numeric keypad and special function keys. Some of the cheaper micros have membrane-type keyboards, this will be mentioned in the Notes section if applicable.

DISPLAY This is fairly self-explanatory but watch out that you don't buy a machine and find that you can't plug it in to your TV!

INTERFACE The presence of parallel and serial interfaces are indicated as well as expansion capabilities (bus interface).

GRAPHICS The type of graphics and maximum resolution are given together with the maximum number of colours that are possible at one time on the screen.

SOUND The number of sound channels is given.

NOTES Since the above information is for the basic machine, this section details other facts, such as the type of microprocessor used, peripherals that are available (printer, joysticks etc) and whether the machine can be expanded. The supplier/manufacturer is given so if you want to know more about the micro please contact them and not us.

IN CONCLUSION

Please note that the information given in this guide is intended as simply that — a guide — and was correct as far as we know at the time of writing. New add-ons and extras are being introduced all the time so more could be available by the time you read this. The prices given are for the basic machine so don't forget that the extras will cost you extra. It is worth shopping around though as many micros are sold quite a bit cheaper through certain outlets.

ZX81 £69.95

MEMORY	1K RAM	8K ROM
LANGUAGE	Sinclair BASIC	
CASSETTE	250 baud	
DISC	☐	DOS
KEYBOARD	QWERTY☑	CURSOR☐ NUMERIC☐ FUNCT☐
DISPLAY	TV☑	MONITOR☐ SUPPLIED☐
INTERFACE	PARA☑	SERIAL☐ BUS☑
GRAPHICS	BLOCK☑	USER☐
	LINE☐	RES 64 by 48
	COLOUR☐	TEXT 24 by 32
SOUND	☐	

Notes. The Sinclair ZX81 is a Z-80A based micro with a touch sensitive keyboard and is also available in kit form for £49.95. It can be expanded up to 64K and the ZX printer may be added. A good machine for beginners and educational purposes, the supplier is **Sinclair Research**, 6 Kings Parade, Cambridge.

SHARP PC-1251 £79.95

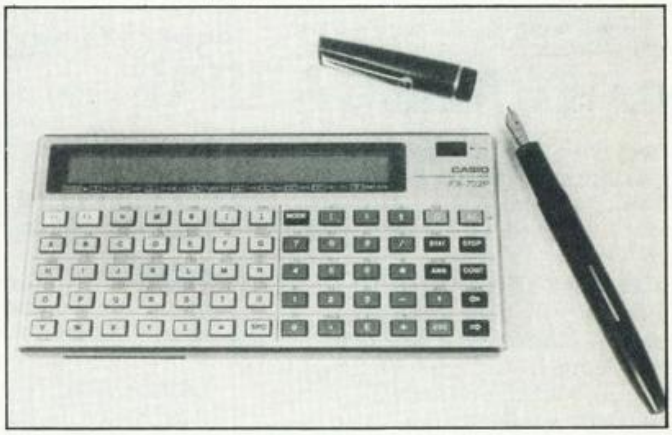
MEMORY	4.2K RAM	24K ROM
LANGUAGE	BASIC	
CASSETTE	Microcassette in optional module	
DISC	☐	DOS
KEYBOARD	QWERTY☑	CURSOR☑ NUMERIC☑ FUNCT☑
DISPLAY	TV☐	MONITOR☐ SUPPLIED☑
INTERFACE	PARA☑	SERIAL☐ BUS☑
GRAPHICS	BLOCK☐	USER☐
	LINE☐	RES by
	COLOUR☐	TEXT 1 by 24
SOUND	☑	

Notes. The Sharp PC-1251 is an eight bit CMOS based micro which is pocket sized. It has a liquid crystal display, an optional integrated printer/microcassette recorder and has battery backup. The supplier is **Sharp Electronics UK.** Thorp Road, Newton Heath, Manchester M10 9BE.

CASIO FX-702P £89.95

MEMORY	1K RAM	K ROM
LANGUAGE	BASIC	
CASSETTE	Yes, (with special adaptor)	
DISC	☐	DOS
KEYBOARD	QWERTY☐	CURSOR☐ NUMERIC☑ FUNCT☑
DISPLAY	TV☐	MONITOR☐ SUPPLIED☑
INTERFACE	PARA☐	SERIAL☐ BUS☑
GRAPHICS	BLOCK☐	USER☐
	LINE☐	RES by
	COLOUR☐	TEXT 1 by 20
SOUND	☐	

Notes. The Casio FX-702P is a hand-held micro with a CMOS microprocessor. The keyboard has A to Z layout and the display is via a liquid crystal display screen. The micro is battery driven and a printer is available. The supplier is **Casio,** Unit 6, 1000 North Circular Road, London NW7.



JUPITER ACE £89.95

MEMORY	3K RAM	8K ROM
LANGUAGE	Ace FORTH	
CASSETTE	1500 baud	
DISC	☐	DOS
KEYBOARD	QWERTY☑	CURSOR☐ NUMERIC☐ FUNCT☐
DISPLAY	TV☑	MONITOR☐ SUPPLIED☐
INTERFACE	PARA☐	SERIAL☐ BUS☑
GRAPHICS	BLOCK☑	USER☑
	LINE☐	RES 512 by 368
	COLOUR☐	TEXT 24 by 32
SOUND	☑	

Notes. The Jupiter Ace is a Z-80A based micro which is fairly new on the market, being unusual in that it does not have BASIC as its standard language. Planned are a Centronics printer, joysticks and a colour board. The manual which comes with the machine goes into detail about programming and using FORTH. Since it is a recently introduced machine there is little software available for it at the time of writing. The suppliers are **Jupiter Cantab**, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP, 'phone 0954-80437.

ORIC 1 £99.95

MEMORY	16K RAM	16K ROM		
LANGUAGE	BASIC			
CASSETTE	300 or 2400 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☑	NUMERIC ☐	FUNCT ☐
DISPLAY	TV ☑	MONITOR ☐	SUPPLIED ☐	
INTERFACE	PARA ☑	SERIAL ☐	BUS ☑	
GRAPHICS	BLOCK ☑	USER 80		
	LINE ☑	RES 200 by 240		
	COLOUR 8	TEXT 28 by 40		
SOUND	3 channels			

Notes. The Oric 1 is a 6502A based micro and is aimed at the ZX Spectrum market. A 48K model is available which has 64K RAM with 16K ROM overlaid. You can attach a printer, communications modem and you can have audio output through your hi-fi. A manual comes with the machine, but make sure that you also get the errata sheet that goes with it. You can buy the Oric by mail order and the supplier is **Oric Products International Ltd.** Coworth Park London Road, Ascot, Berkshire SL5 7SE.

ZX SPECTRUM £125

MEMORY	16K RAM	16K ROM		
LANGUAGE	Sinclair BASIC			
CASSETTE	1500 baud			
DISC	TBA	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☐	NUMERIC ☐	FUNCT ☐
DISPLAY	TV ☑	MONITOR ☐	SUPPLIED ☐	
INTERFACE	PARA ☐	SERIAL ☐	BUS ☑	
GRAPHICS	BLOCK ☑	USER 21 ☐		
	LINE ☑	RES 256 by 192		
	COLOUR 8	TEXT 24 by 32		
SOUND	Single channel			

Notes. The Sinclair ZX Spectrum is a Z-80A based micro with a moulded rubber keyboard. A 48K version is priced at £175. A ZX printer is available and a ZX Microdrive and RS232 interface are expected. Available at High Street stores it is a very popular micro with a wide variety of commercial software to choose from. The supplier is **Sinclair Research,** 6 Kings Parade, Cambridge.

ACORN ATOM £150

MEMORY	2K RAM	8K ROM		
LANGUAGE	BASIC			
CASSETTE	300 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☑	NUMERIC ☐	FUNCT ☐
DISPLAY	TV ☑	MONITOR ☑	SUPPLIED ☐	
INTERFACE	PARA ☑	SERIAL ☐	BUS ☑	
GRAPHICS	BLOCK	USER		
	LINE ☑	RES 256 by 192		
	COLOUR 4	TEXT 16 by 32		
SOUND	Single channel			

Notes. The Acorn ATOM is a 6502 based micro which has a rather unusual version of BASIC. It was one of the first machines that had a built-in assembler. The supplier is **Acorn Computers**, Fulbourn Road, Cherry Hinton, Cambridge.

SHARP PC-1500 £169.95

MEMORY	3.5K RAM	16K ROM		
LANGUAGE	BASIC			
CASSETTE	extra			
DISC	☐	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☐	NUMERIC ☑	FUNCT ☑
DISPLAY	TV ☐	MONITOR ☐	SUPPLIED ☑	
INTERFACE	PARA ☐	SERIAL ☑	BUS ☑	
GRAPHICS	BLOCK ☐	USER ☐		
	LINE ☐	RES 120 by 32		
	COLOUR ☐	TEXT 26 by 1		
SOUND	☑			

Notes. The Sharp PC-1500 is an eight-bit CMOS based micro which is small enough to be easily hand-held with an LCD screen. Various additions are available including a plotter, printer and interface, a casette interface and plug-in chips, allowing the micro to be expanded to 11.5K. An applications and user manual come with the machine and the supplier is **Sharp Electronics (UK) Ltd.** Thorp Road, Newton Heath, Manchester M10 9BE.

VIC-20 £169.99

MEMORY	5K RAM	16K ROM		
LANGUAGE	PET BASIC			
CASSETTE	500 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☐	NUMERIC ☐	FUNCT ☐
DISPLAY	TV ☑	MONITOR ☑	SUPPLIED ☐	
INTERFACE	PARA ☑	SERIAL ☑	BUS ☑	
GRAPHICS	BLOCK ☑	USER ☐		
	LINE ☐	RES 176 by 184		
	COLOUR 16	TEXT 23 by 22		
SOUND	☑			

Notes. The VIC-20 is a 6502 based micro which requires a special cassette recorder. The system can be expanded up to 16K RAM. Programs can also be loaded from cartridges. There is a large amount of software available . The machine comes with a manual. The suppliers are **Commodore,** 675 Ajax Avenue, Trading Estate, Slough, 'phone 0753-74111.

SORD M5 £189.95

MEMORY	4K RAM	8K ROM		
LANGUAGE	BASIC-I, FALC-E			
CASSETTE	extra			
DISC	☐	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☑	NUMERIC ☐	FUNCT ☑
DISPLAY	TV ☑	MONITOR ☐	SUPPLIED ☐	
INTERFACE	PARA ☑	SERIAL ☐	BUS ☐	
GRAPHICS	BLOCK ☑	USER ☑		
	LINE ☑	RES 256 by 192		
	COLOUR 16	TEXT 32 by 24		
SOUND	Three note chords and a buzzer tone			

Notes. The Sord M5 is a Z-80A based micro. The machine comes complete with all necessary leads, power pack, cartridge including BASIC-I, a cassette with two games and a manual on the BASIC and a user's manual. The machine is only just available and will be in High Street stores soon. Memory expansion and a printer are planned, but the machine has a Centronics interface already. The supplier is **Sord,** Samuel House, St Albans Street, Haymarket, London SW1Y 4SQ.

COLOUR GENIE £199.

MEMORY	16K RAM	16K ROM		
LANGUAGE	Microsoft BASIC			
CASSETTE	1200 baud			
DISC	optional	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☐	NUMERIC ☐	FUNCT ☑
DISPLAY	TV ☑	MONITOR ☑	SUPPLIED ☐	
INTERFACE	PARA ☑	SERIAL ☑	BUS ☑	
GRAPHICS	BLOCK ☑	USER 128		
	LINE ☑	RES 160 by 96		
	COLOUR 8	TEXT 40 by 24		
SOUND	3 channels			

Notes. The Colour Genie is a Z-80 based micro capable of expansion via a 16K RAM card. Various accessories are available including a cassette recorder, dot matrix printer, joysticks and a light pen. The machine also includes a music synthesiser. The supplier is **Lowe Electronics,** Chesterfield Road, Matlock, Derbyshire DE4 5LE.

DRAGON 32 £199

MEMORY	32K RAM	16K ROM		
LANGUAGE	Microsoft extended colour BASIC			
CASSETTE	1500 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☐	NUMERIC ☐	FUNCT ☐
DISPLAY	TV ☑	MONITOR ☑	SUPPLIED ☐	
INTERFACE	PARA ☑	SERIAL ☑	BUS ☐	
GRAPHICS	BLOCK ☐	USER ☐		
	LINE ☑	RES 256 by 192		
	COLOUR 8	TEXT 16 by 32		
SOUND	Single channel			

Notes: The Dragon 32 is a 6809 based micro, fairly new and very much in demand. Joysticks and a ROM cartridge are available and the machine comes with a manual and a quick reference guide to the BASIC. The supplier is **Dragon Data Ltd,** Kenfig Industrial Estate, Murgan, Port Talbot, West Galmorgan and it is normally available in the High Street stores.

TI-99/4A £199

MEMORY	16K RAM	16K ROM		
LANGUAGE	TI BASIC			
CASSETTE	Yes (sepcial cable required)			
DISC	extra	DOS		
KEYBOARD	QWERTY✓	CURSOR☐	NUMERIC☐	FUNCT☐
DISPLAY	TV✓	MONITOR✓	SUPPLIED☐	
INTERFACE	PARA☐	SERIAL✓	BUS✓	
GRAPHICS	BLOCK✓	USER✓		
	LINE✓	RES 256 by 192		
	COLOUR 16	TEXT 24 by 32		
SOUND	Three tones plus noise			

Notes. The TI-99/4A is a 9900 based micro which can be expanded to up to 48K RAM. Additional extras include a ROM pack, speech synthesiser, twin joysticks, disc drive, RS232/Centronics interface, printer and peripheral expansion system. The machine comes with a Users Reference Guide and Beginner's BASIC. The supplier is **Texas Instruments Ltd.** Mantorf Lane, Bedford MK41 7PU.

CAMPUTERS LYNX £225

MEMORY	48K RAM	16K ROM		
LANGUAGE	Camputers BASIC			
CASSETTE	1200 baud			
DISC	TBA	DOS CP/M		
KEYBOARD	QWERTY✓	CURSOR☐	NUMERIC☐	FUNCT☐
DISPLAY	TV✓	MONITOR✓	SUPPLIED☐	
INTERFACE	PARA☐	SERIAL✓	BUS✓	
GRAPHICS	BLOCK✓	USER?☐		
	LINE✓	RES 248 by 256		
	COLOUR 8	TEXT 40 by 24		
SOUND	Single channel			

Notes. The Lynx is a Z-80A based micro which is expandable up to 192K RAM. Among the extras planned are disc drives, printers, mono and colour monitors, light pen. Three additional languages are also planned — Pascal, FORTH and COMAL. The suppliers are **Camputers Ltd.** 33A Bridge Street, Cambridge CB2 1UW.

NEWBRAIN £233

MEMORY	32K RAM	18K ROM		
LANGUAGE	NewBrain BASIC			
CASSETTE	1200 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY✓	CURSOR☐	NUMERIC☐	FUNCT☐
DISPLAY	TV✓	MONITOR✓	SUPPLIED☐	
INTERFACE	PARA☐	SERIAL✓	BUS✓	
GRAPHICS	BLOCK✓	USER☐		
	LINE✓	RES 640 by 250		
	COLOUR☐	TEXT 24 by 80		
SOUND	☐			

Notes: The NewBrain is a Z-80A based micro which can be expanded to 512K RAM. It is very small, almost pocket-sized, and both Videotext and battery modules are available. The machine comes with a manual and the supplier is **Grundy Business Systems Ltd.** Grundy House, Somerset Road, Teddington, Middlesex TW11 8TD.

ATARI 400 £245

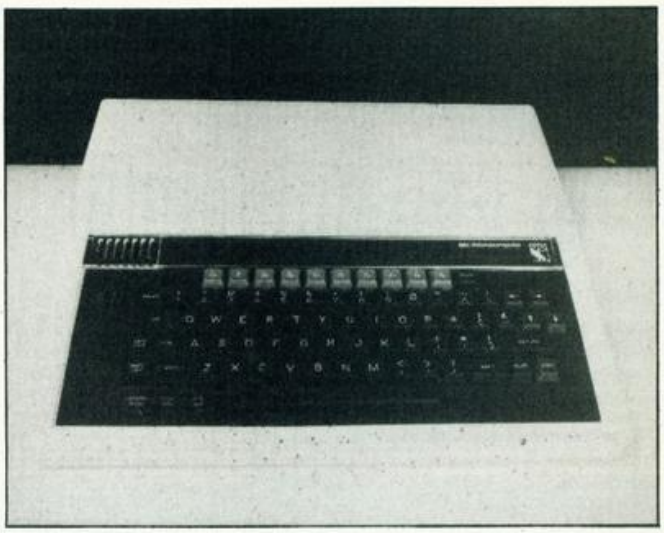
MEMORY	16K RAM	8K ROM		
LANGUAGE	Atari BASIC			
CASSETTE	600 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY✓	CURSOR☐	NUMERIC☐	FUNCT✓
DISPLAY	TV✓	MONITOR☐	SUPPLIED☐	
INTERFACE	PARA☐	SERIAL☐	BUS✓	
GRAPHICS	BLOCK☐	USER✓		
	LINE✓	RES 320 by 192		
	COLOUR 16	TEXT 24 by 40		
SOUND	Three channels			

Notes: The Atari 400 is a 6502 based micro, the lowest in the Atari range. It, like so many of the cheaper micros, has a touch keyboard and the number of colours can be mixed to make a maximum of 256. Joysticks and light pen can be added. Well known as a games machine there are a large number of games cartridges available. The Atari is also a flexible microcomputer, although this fact has not been publicised properly by Atari. The supplier is **Atari (UK) Ltd.** PO Box 59, Alperton Lane, Wembley, Middlesex.

BBC MICRO MODEL A — £299

MEMORY	16K RAM	16K ROM		
LANGUAGE	BBC BASIC			
CASSETTE	300 or 1200 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY ✓	CURSOR ✓	NUMERIC ☐	FUNCT ✓
DISPLAY	TV ✓	MONITOR ✓	SUPPLIED ☐	
INTERFACE	PARA ✓	SERIAL ✓	BUS ✓	
GRAPHICS	BLOCK ✓	USER ✓		
	LINE ✓	RES 320 by 256		
	COLOUR 8	TEXT 25 by 40		
SOUND	3 channels			

Notes. The BBC Micro is a 6502 based micro. Up to four 16K language ROMs may be plugged into the machine at any one time, including Pascal, word processing, computer aided design, and Teletext. Voice synthesis circuits, a cartridge ROM pack interface, various alternative high level languages in ROM, Econet network interface, paddles, cassette recorder, printers and second microprocessors are all available, as are a wide variety of commerical software. The BBC Micro has found particular favour in educational establishments. The supplier is **BBC Micro Computer Systems,** PO Box, 7, London W3 6JY.



COMMODORE 64 — £299

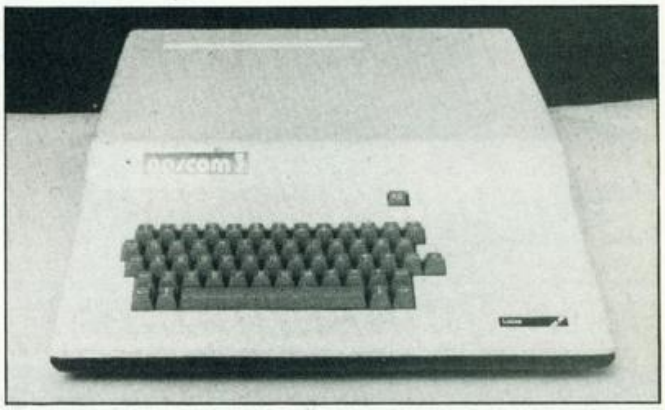
MEMORY	64K RAM	26K ROM		
LANGUAGE	PET BASIC			
CASSETTE	1000 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY ✓	CURSOR ✓	NUMERIC ☐	FUNCT ✓
DISPLAY	TV ✓	MONITOR ✓	SUPPLIED ☐	
INTERFACE	PARA ✓	SERIAL ✓	BUS ✓	
GRAPHICS	BLOCK ✓	USER ✓		
	LINE ☐	RES 320 by 200		
	COLOUR 16	TEXT 40 by 25		
SOUND	Three channels			

Notes. The Commodore 64 is a 6510 based micro that can also use Pascal, COMAL, LOGO, FORTH and PILOT. Programs can be loaded from cassette recorder or disc drives, both extra, or cartridges. The various peripherals include printer, joysticks and games paddles. The sound facility gives a range of nine octaves and three voices. A User Guide is provided with the machine, although its actual value is questionable. The suppliers are **Commodore,** 675 Ajax Avenue, Trading Estate Slough, 'phone 0753-74111.

NASCOM 3 — £376

MEMORY	48K RAM	10K ROM		
LANGUAGE	Microsoft BASIC			
CASSETTE	300 or 1200 baud			
DISC	extra	DOS CP/M or NAS-DOS		
KEYBOARD	QWERTY ☑	CURSOR ☐	NUMERIC ☐	FUNCT ☐
DISPLAY	TV ☑	MONITOR ☑	SUPPLIED ☐	
INTERFACE	PARA ☑	SERIAL ☑	BUS ☑	
GRAPHICS	BLOCK ☑	USER ☑		
	LINE ☐	RES 800 by 256		
	COLOUR 8	TEXT 25 by 80		
SOUND	☐			

Notes. The Nascom 3 is a Z-80 based micro. A second version of BASIC and Pascal are also available, as are a cassette recorder and light pen. The supplier is **Lucas Logic Ltd.** Welton Road, Wedgenock Industrial Estate, Warwick CV34 5PZ, 'phone 0926-497733.

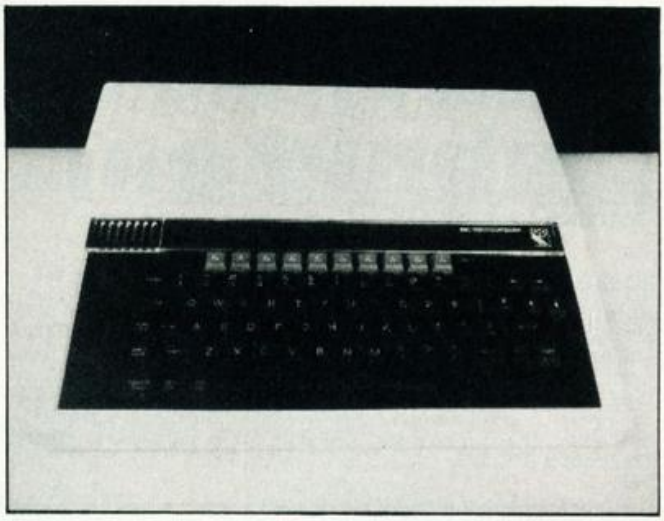


POWERTRAN CORTEX — £395

MEMORY	64K RAM	24K ROM		
LANGUAGE	BASIC			
CASSETTE	Yes (baud rate is user selectable)			
DISC	extra	DOS		
KEYBOARD	QWERTY ☑	CURSOR ☑	NUMERIC ☑	FUNCT ☐
DISPLAY	TV ☑	MONITOR ☐	SUPPLIED ☐	
INTERFACE	PARA ☐	SERIAL ☐	BUS ☐	
GRAPHICS	BLOCK ☐	USER ☑		
	LINE ☑	RES 256 by 192		
	COLOUR	TEXT 40 by 24		
SOUND	☐			

Notes. The Cortex is a TMS9995 based micro which also comes in kit form for £295. All text characters are redefinable and FORTH is expected soon as an additional language. Extras include an RS232 serial interface, an expansion bus parallel interface, up to four disc drives and the possibility of an RGB monitor interface in the future. The supplier is **Powertran Cybernetics,** Portway Industrial Estate, Andover, Hampshire SP10 3NM.

BBC MICRO MODEL B £399



MEMORY	32K RAM	32K ROM		
LANGUAGE	BBC BASIC			
CASSETTE	300 or 1200 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY☑	CURSOR☑	NUMERIC☐	FUNCT☑
DISPLAY	TV☑	MONITOR☑	SUPPLIED☐	
INTERFACE	PARA☑	SERIAL☑	BUS☑	
GRAPHICS	BLOCK☑	USER☑		
	LINE☑	RES 640 by 256		
	COLOUR 8	TEXT 25 by 80		
SOUND	3 channels			

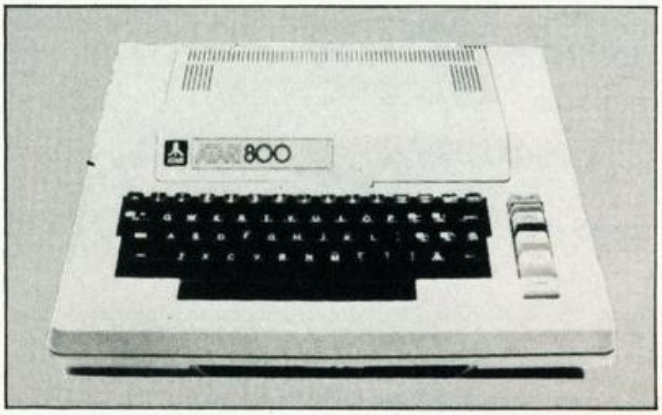
Notes. The BBC Micro is a 6502 based micro, with Model B being an enhanced version of Model A so refer to that for the list of peripherals that are available. In addition on Model B the following are provided: serial interface to RS423 standard, eight bit I/O port, eight bit 'Centronics' type parallel printer port, four 12 bit analogue input channels, extension bus for connection to Prestel, Teletext and other expansion units, and all interface sockets to external peripherals. The supplier is **BBC Micro Computer Systems.** PO Box 7, London W3 6JX.

TANDY COLOUR £449

MEMORY	16K RAM	16K ROM		
LANGUAGE	Extended Colour BASIC			
CASSETTE	1500 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY☑	CURSOR☑	NUMERIC☐	FUNCT☐
DISPLAY	TV☑	MONITOR☐	SUPPLIED☐	
INTERFACE	PARA☐	SERIAL☑	BUS☑	
GRAPHICS	BLOCK☑	USER☐		
	LINE☑	RES 192 by 256		
	COLOUR 8	TEXT 16 by 32		
SOUND	Single channel			

Notes. The Tandy Colour Computer is a 6809E based micro which also comes in a 32K version for £499, or you can buy an upgrade kit. A printer and disc drives may be added, joysticks are available and can be used in effect like paintbrushes. The micro comes complete with an operator's manual, a tutorial manual on Standard Colour BASIC and a tutorial manual on Extended Colour BASIC. The supplier is **Tandy Corporation**, 12th Floor, Tameway Tower, Bridge Street, Walsall.

ATARI 800 £499



MEMORY	16K RAM	8K ROM		
LANGUAGE	Atari BASIC			
CASSETTE	600 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY☑	CURSOR☐	NUMERIC☐	FUNCT☑
DISPLAY	TV☑	MONITOR☐	SUPPLIED☐	
INTERFACE	PARA☐	SERIAL☐	BUS☑	
GRAPHICS	BLOCK☐	USER☑		
	LINE☑	RES 320 by 192		
	COLOUR 16	TEXT 24 by 40		
SOUND	Three channels			

Notes. The Atari 800 is a 6502 based micro which differs from the Atari 400 in two main ways: it has a proper typewriter keyboard and can accept two cartridges simultaneously. It can also be expanded up to 48K RAM. The supplier is **Atari (UK) Ltd.** PO Box 59, Alperton Lane, Wembley, Middlesex.

EPSON HX-20 £499

MEMORY	16K RAM	32K ROM		
LANGUAGE	Extended Microsoft BASIC			
CASSETTE	Built-in microcassette			
DISC	☐	DOS		
KEYBOARD	QWERTY☑	CURSOR☑	NUMERIC☐	FUNCT☑
DISPLAY	TV☑	MONITOR☐	SUPPLIED☑	
INTERFACE	PARA☐	SERIAL☑	BUS☑	
GRAPHICS	BLOCK☑	USER 32☐		
	LINE☐	RES 120 by 32		
	COLOUR ☐	TEXT 20 by 4		
SOUND	☐			

Notes. The Epson HX-20 is a CMOS 6301 based micro which is portable and battery driven, although you can plug it into the mains. The unit incorporates a liquid crystal display screen, full typewriter keyboard, printer and microcassette: a TV display adaptor and acoustic coupler are also available and the micro can be expanded to 64K ROM and 32K RAM. The supplier is **Epson (UK) Ltd.** Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH.

SHARP MZ-80A £549

MEMORY	48K RAM	4K ROM		
LANGUAGE	Microsoft BASIC (on tape)			
CASSETTE	1200 baud (built-in)			
DISC	extra	DOS		
KEYBOARD	QWERTY☑	CURSOR☑	NUMERIC☑	FUNCT☐
DISPLAY	TV☐	MONITOR☐	SUPPLIED☑	
INTERFACE	PARA☑	SERIAL☐	BUS☑	
GRAPHICS	BLOCK☑	USER☐		
	LINE☐	RES 80 by 50		
	COLOUR☐	TEXT 25 by 40		
SOUND	Single channel			

Notes. The Sharp MZ80A is a Z-80 based micro. An expansion unit, printer, floppy disc unit and other peripherals are available. Other languages can also be used such as Pascal merely by loading from tape. With the floppy disc option the machine can respond to higher level software such as Disc BASIC and FDOS (including BASIC compiler). A small range of business and educational software is available. The supplier is available. The supplier is **Sharp Electronics (UK) Ltd.** Thorp Road, Newton Heath, Manchester M10 9BE.

DAI £595

MEMORY	48K RAM	24K ROM		
LANGUAGE	Microsoft BASIC			
CASSETTE	600 baud			
DISC	extra	DOS		
KEYBOARD	QWERTY☑	CURSOR☑	NUMERIC☐	FUNCT☐
DISPLAY	TV☑	MONITOR☑	SUPPLIED☐	
INTERFACE	PARA☑	SERIAL☑	BUS☑	
GRAPHICS	BLOCK☐	USER☐		
	LINE☑	RES 336 by 256		
	COLOUR 16	TEXT 24 by 60		
SOUND	Single channel			

Notes. The DAI personal computer is an 8080 based micro which is CP/M compatible. Joysticks, printer and floppy discs are available and Hi Fi output is possible. The supplier is **Data Applications (UK) Ltd.** Personal Computer Division, 16B Dyer Street, Cirencester, Gloucestershire GL7 2PF.

APPLE IIe £845

MEMORY	64K RAM	16K ROM		
LANGUAGE	Applesoft BASIC			
CASSETTE	Yes			
DISC	Yes	DOS DOS 3.3		
KEYBOARD	QWERTY☑	CURSOR☑	NUMERIC☐	FUNCT☐
DISPLAY	TV☑	MONITOR☑	SUPPLIED☐	
INTERFACE	PARA☑	SERIAL☑	BUS☑	
GRAPHICS	BLOCK☑	USER☐		
	LINE☑	RES 280 by 192		
	COLOUR 16	TEXT 24 by 80		
SOUND	☑			

Notes: The Apple IIe is a 6502 A based micro, an enhanced version of the popular Apple II. It can be expanded to 128K RAM and a large amount of software is available. A wide variety of peripherals can be added. The supplier is **Apple Computer (UK) Ltd.** Eastman Way, Hemel Hempstead, Hertfordshire HP2 7QH.

SHARP MZ-80B £899

MEMORY	64K RAM	2K ROM		
LANGUAGE	BASIC (on tape)			
CASSETTE	1800 baud			
	built-in			
DISC	Extra	DOS		
KEYBOARD	QWERTY☑	CURSOR☑	NUMERIC☑	FUNCT☐
DISPLAY	TV☐	MONITOR☐	SUPPLIED☑	
INTERFACE	PARA☐	SERIAL☐	BUS☑	
GRAPHICS	BLOCK☑	USER☐		
	LINE☑	RES 320 by 200		
	COLOUR☐	TEXT 25 by 80		
SOUND	3 channels			

Notes: The Sharp MZ-80B is a Z-80A based micro. Various other languages can be loaded as the machine is "soft", no language being fitted in ROM. Expansion unit, the MZ-80P5 printer and the MZ-80FB floppy disc drive are also available. The supplier is **Sharp Electronics (UK) Ltd.** Thorp Road, Newton Heath, Manchester.

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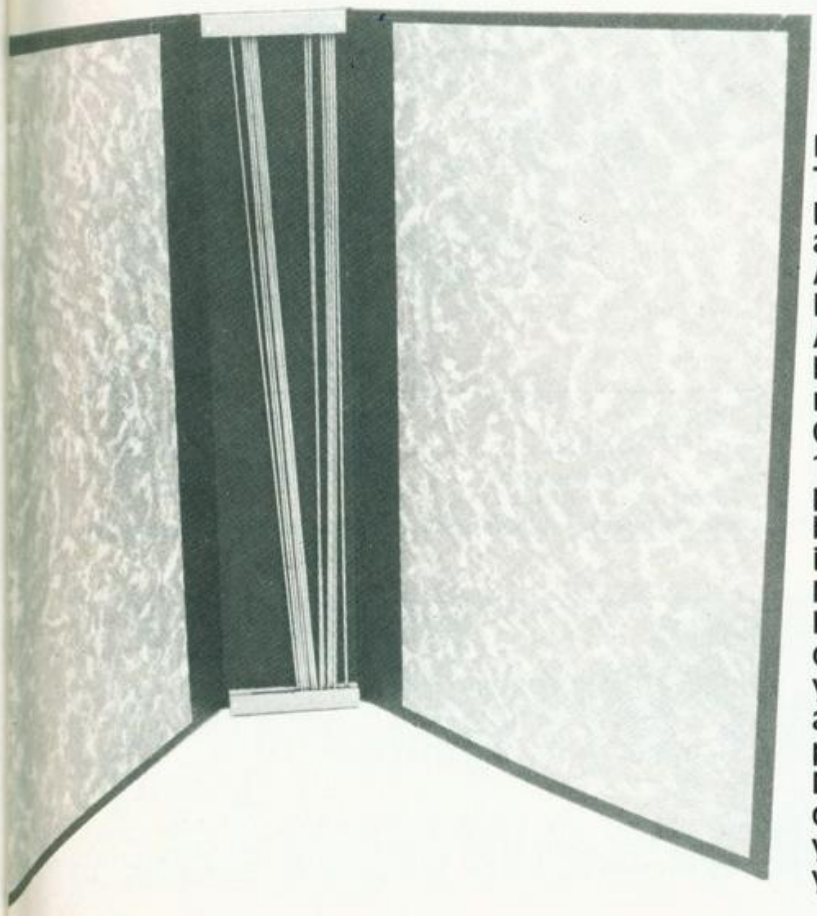

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CLUB CALL

Find out if there's a micro club in your area.

Here is your monthly chance to see if there are other micro users in your area that all get together regularly to help each other out and pick each other's brains. And if you already belong to a group why not pester your club secretary/organiser and make sure they let us know about your club and we'll pass the information on.

DRAGON INDEPENDENT OWNERS ASSOCIATION

Contact: Doug Bourne or Dave Windle
Tel: 0268-778732 or 0268-684682

This association was launched on February 1st and the organisers, Doug and Dave, are confident that it will serve a need amongst Dragon 32 owners. They intend to publish a monthly newsletter which will allow members to share tips and knowledge with their fellows. The Association will also be offering discounted program tapes and will actually accept from members programs for inclusion on these tapes. All programs so used will collect royalties for the author. If membership is sufficient it is hoped to engage a computer expert to act as a consultant to assist members. The newsletter will include news and reviews of software and books and it is hoped that competitions and offers of discounted microware will be included. So all you Dragon owners why not give Doug or Dave a ring?

GRIMSBY COMPUTER CLUB

29 Park View
Cleethorpes
Contact: Jenson Lee
Tel: 0472-42559

The Grimsby Computer Club is not computer specific and meetings are held on alternate Mondays at St James Hall, Grimsby, so regardless of what machine you own or normally have access to you'll be sure of a warm welcome. Membership is £8.00 per year with reductions for schoolchildren, OAPs and father/son joint memberships. Regular features are family nights, basic computer courses and business familiarisation courses and a periodical newsletter is published. The club is also hoping to hold their second Computerfair this year after the terrific response to the first attempt in December 1982. For any further details contact Jenson or the Publicity Officer Ian Fell on 0472-49248 after 6.00pm.

GATESHEAD COMPUTER USER GROUP

Lord Lawson Comprehensive School
Portobello Road
Birtley
Chester-le-Street
Co. Durham DH3 2LP
Contact: David Barrett
Tel: 0632-403511 (9.00 am to 4.00 pm) or 0385-711380 (after 6.00 pm)

If you use either BBC or IBM equipment then this could be the club you've been looking for. Meetings are held every third Monday of the month at 7.00 pm in the Computer Room at the Lord Lawson Comprehensive School. Contact David if you would like to know more.

SKEGNESS COMPUTER CLUB

66 Drummond Road
Skegness
Lincolnshire
Contact: J Gordon
Tel: 0754-3329 or 0754-2798

This is a newly formed club in Skegness for people of all ages who are interested in computers, and let's face it, who isn't? The members already there own a variety of machines, and the club meets once a fortnight at 7.30 pm on Mondays.

RIDGEWAY COMPUTING CLUB

15 Sandringham Road
Didcot
Oxon
Contact: Malcolm Spinks
Tel: 0235-813972

This club meets on the second Tuesday of the month at The Swan Hotel in East Ilsley and new members are welcome at any meeting.

GRAVESEND COMPUTER CLUB

c/o The Extra Tuition Centre
39 The Terrace
Gravesend
Kent DA12 2BA
Contact: Steve Janday (Secretary)
Tel: 0474-50677

This is yet another newly formed club which meets on the first and third Tuesday of every month at 7.30 pm in the School Room of The Extra Tuition Centre at the above address. There are about 50 members at present with a wide variety of machines ranging from the Sinclair ZX81, ZX Spectrum, Dragon 32, Jupiter Ace, TI 99/4A to the VIC-20. Membership is £3.00 for Junior Members (under 18, over 65 and unemployed) and £6.00 for full membership.

THE DRAGON'S DEN

83 Neville Road
Limbury
Luton
Bedfordshire
Contact: Dave Buckingham
Tel: 0582-570125 (after 4.30 pm)

Don't let the name of this newly formed group stop you from being lured in! As you might expect the club is exclusively for Dragon 32 owners. The subscription is £8.00 per annum which entitles members to the use of their software library, a quarterly newsletter and as membership grows the club will be negotiating discounts on hardware, books etc and arranging contacts between groups of members locally (ie forming regional clubs).

LAMBETH COMPUTER CLUB

54 Brixton Road
London SW9 6BS
Contact: Robert J Baker

The club is being formed locally with the aim of promoting the use of computers in Lambeth by the home, school or small business user. Within this scope all kinds of people are welcome – whether you play idiot games on a Sinclair ZX81, run educational software on a ZX Spectrum or accounts on a RML 380Z, have an arcade full of video games (yes, these are computers too!) or even just have an interest in the subject – the club would like to hear from you. The initial plan is to see if there is sufficient response and if so to arrange an inaugural meeting to get formally organised. Once the club gets going they will be affiliated to the Association of

London Computer Clubs, and through them to the ACC, the world's oldest, largest and most respected computer club.

NEW MILLS AND DISTRICT PERSONAL COMPUTER CLUB

Contact: John Eary
Tel: 0663-43870

In just three months this club has outgrown its existing premises at New Mills Youth Centre and from the end of January has started meeting at New Mills school. At the beginning of the year the club had 43 members, and amongst the activities have been two visits to computer exhibitions and talks and demonstrations on assembler code and robotics. The games enthusiast is well catered for and there are competitions to develop programming skills. Computer equipment owned by club members includes Sinclair ZX81s, ZX Spectrums, Dragon 32s, VIC-20s and the BBC Micro. New members, with or without their own computers, are very welcome to join and the club is keen to invite people with practical experience of computers to give short talks and demonstrations.

NATIONAL COLOUR GENIE USER'S GROUP

5a Gregory Street
Lenton
Nottingham NG7 2LR
Contact: Geoffrey Hillier
Tel: 0602-783938

Marc Leduc, Chairman of the TRS-80/Genie Users Group of Nottingham, also mentioned on this page, is also Chairman of the newly formed National Colour Genie User's Group. For full particulars and a sample copy of the club magazine, send a largish SAE to Geoffrey Hillier at the above address.

TRS-80/ GENIE USERS GROUP OF NOTTINGHAM

5a Gregory Street
Lenton
Nottingham NG7 2LR
Contact: Geoffrey Hillier
Tel: 0602-783938

This group has been running as a thriving society for nearly three years and they will be happy to meet users in the area at Wilford Moderns Rugby Club House at any forthcoming meeting. Meetings are generally held on the first and third Wednesday in each month from 7.30 pm. A club magazine, LPRINT, of which Geoffrey is the Editor, is published fairly regularly, so for further information please 'phone or send an SAE to Geoffrey at the above address or contact the Club Chairman, Marc Leduc, at Marcos Software, 30 Waterloo Road, Beeston, Nottingham or on 0602-225165.

If you would like a mention in Club Call please send details of your club (meeting time and place, fees, age specification, machines catered for etc) to me at the following address:

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CT STANDARDS

Our regular page explaining the meaning of the various symbols we use to make programs portable.

It has been very encouraging to see the number of programs submitted using our standard codes for graphics and other non-printable characters. However, it has also become increasingly clear that some of our readers haven't heard of them and this page is intended to set them out once again.

All standards tend to be irksome to adhere to but the ones laid out here are fairly simple and tend to make software easier to maintain by the programmer and simpler to understand for others.

CONTROL THAT CURSOR

Our original standards have now grown with the times. Machines such as the Commodore VIC which have a dual Shift capability can now be incorporated, as can those systems which use Control key functions.

The recently introduced BBC system offers pre-programmed function keys which, we are glad to say, can also be handled by our original coding system. It's nice to see just how well adapted the original standards have become over the last two years! (Indeed, a whole series of books is using them as its ***de-facto*** standard.) The standards for the cursor controls are given in Fig. 1.

[CLS]	CLear Screen
[HOM]	HOMe cursor
[CL]	Cursor Left
[CR]	Cursor Right
[CU]	Cursor Up
[CD]	Cursor Down
[REV]	REVerse video on
[OFF]	Turn it OFF
[SPC]	SPaCe
[CTL]	ConTroL key
[fn]	Function key (BBC)
[G<]	Graphic left (VIC/MZ-80A)
[G>]	Graphic right (VIC/MZ-80A)

Fig. 1. Our extended set of cursor control standards includes four new functions.

To indicate more than one of the above, an optional number can be placed within the brackets; [4 CL], etc.

The use of square brackets has raised one or two queries. The reason for this choice is that ***most*** of the common microcomputer BASICs don't use them for specific functions. In fact, at least one machine provides an added bonus by returning a Syntax Error if they are found, a useful check in case you type them in by mistake.

The code [SPC] was added to the list of cursor control codes to get over the problem of indicating just how many spaces are contained in the gap in the printout. The other common variant of the code for spaces is used by the ZX people. Their choice was '_' and this crops up in the various newsletters they publish.

The code [RVS] has caused a few headaches. This is really specific to the PET where the character set can be displayed in reversed video. On machines which don't have this facility you should either find a character in the set which is the reversed image of the one you want and use that or simply ignore it and use anything else you fancy! Don't forget, you may have to look up and alter the values used elsewhere in the program.

THE GRAPHIC SOLUTION

It soon became obvious that the techniques applied to the confusing cursor controls could also be applied to the graphics symbols. The following standard is now in general use in programs published in *Computing Today*.

If a graphics character or characters are to be displayed in a listing (as opposed to POKE codes or CHR$( ) codes) then they are indicated by the method shown in Fig. 2.

Several people have asked what the relationship between the POKE value for a character and that of its shifted graphic might be. In general the shifted version of any character will be 64 greater than the value of that character. This applies to both PET and MZ-80K systems in all cases.

This can be taken further to include machines which use a pixel graphics set rather than pre-programmed PET-style characters and the series of codes for these is given in Fig. 3. As is nearly always the case there is one machine to which the standard shown in Fig. 3 does not apply — Tangerine's Microtan/Micron. This machine uses a four by two cell structure for its pixel graphics instead of the Prestel/Teletext three by two cell. The method for calculating the value to assign to 'P' is shown in Fig. 4, and is fortunately nice and simple.

MAKING REMARKS

Many people scorn the use of REMs within programs but, during the development at least, they are extremely useful. One of the documentation methods that we use is to keep our back-up copy of our programs on a 300 Baud CUTS tape with all the REMs in place: the working copy, be it on tape or disc, is REMless in order to save space.

It is also good programming 'manners' to give your REMs odd line numbers:

```
3999 REM ** CRASH PROOF INPUT
4000 INPUT "THE NUMBER OF ENTRIES";A
```

A remarkable number of submitted programs have jumps that go not to the relevant point in the program, but to the REM statement. This can cause severe problems when re-numbering after removing the REMs.

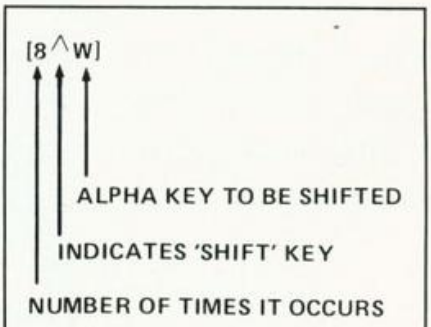

Fig. 2. The way we indicate block graphics on machines like the PET and Sharp. The VIC system of Shift Left and Shift Right is shown in Fig. 1.

1	2
4	8
16	32
64	128

Fig. 4. To convert a Tangerine pixel code into its blocks, simply decode the number into its binary or Hex value and fill in the relevant squares.

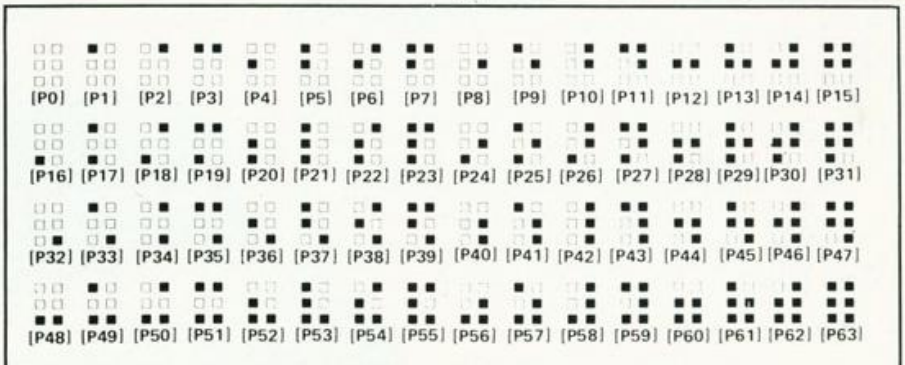

Fig. 3. The standard pixel codes; they will work on most computers which employ this technique as well as for Teletext and Prestel.

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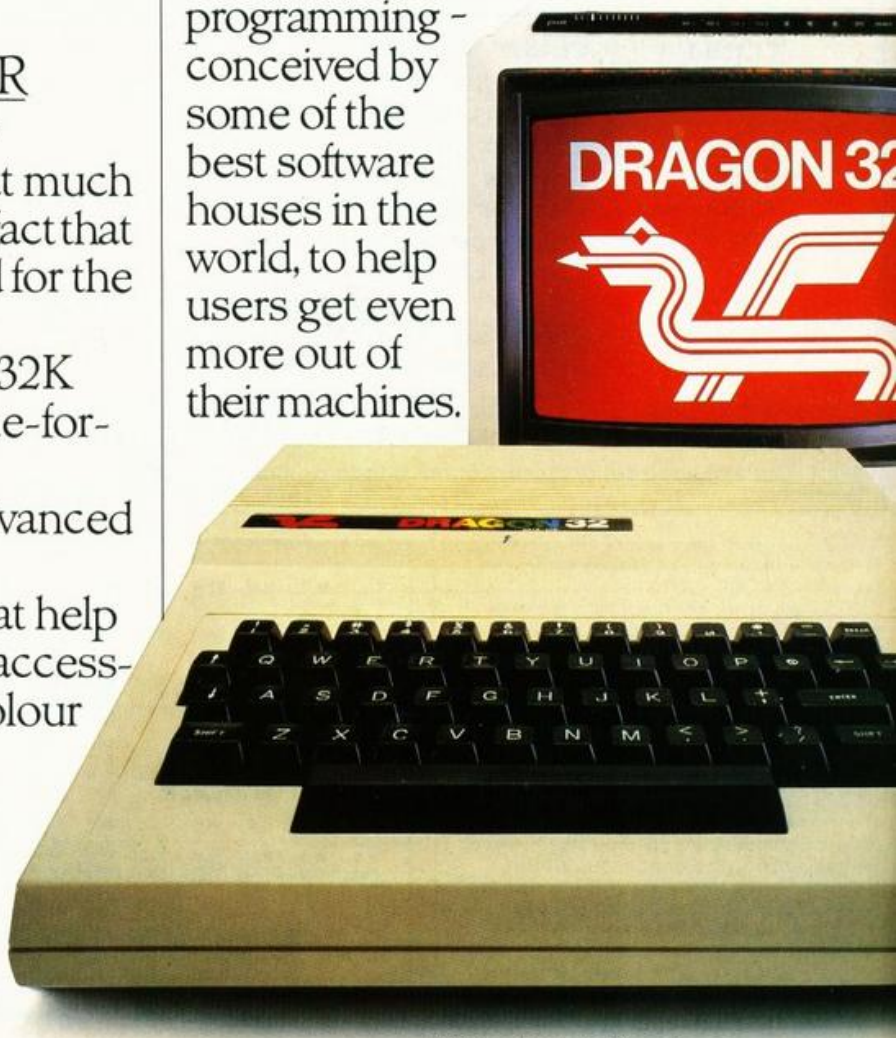

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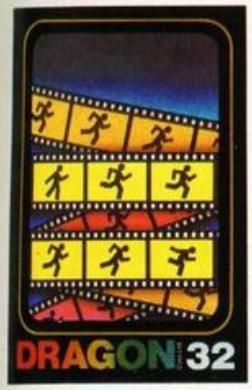

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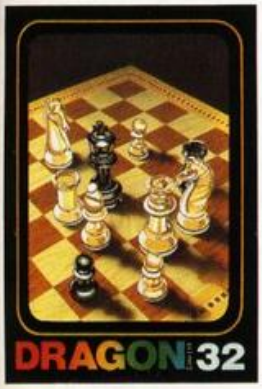

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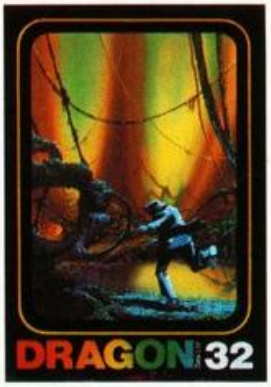

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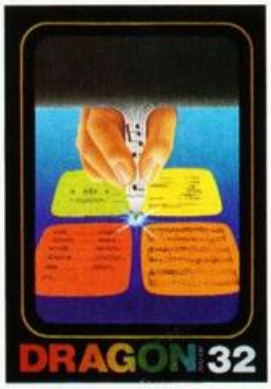

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