60p

Spectrum – Sinclair's new micro reviewed

YOUR COMPUTER

JUNE 1982

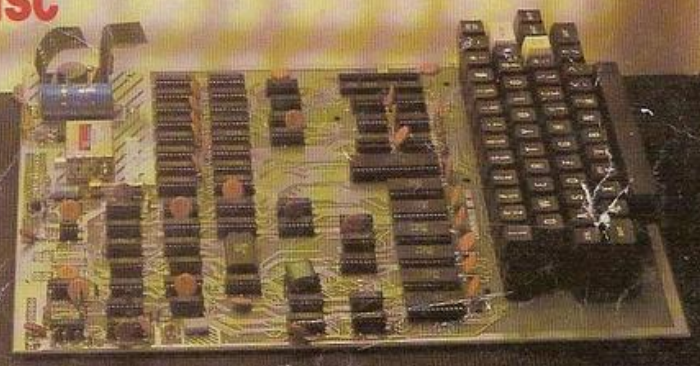
Vol3 No6

Free ZX game on flexi-disc
Full story inside

BBC programming

Sinclair monitor

Vic space game



Win an Arfon expansion board for the VIC-20

RSONAL CO

LONELY Genie I Microcomputer, early eighties, with large peripheral family but currently unattached, would like to meet interesting, attractively packaged software, Genie or Tandy specification, for programming, problem solving, entertainment and long-lasting friendship. Reply in confidence. Box No RS232.

ANSWERING MACHINES

ingenious ...but lonely!

Buying your first Genie I microcomputer is just the start of a long and enthralling adventure, for it won't be long before you will want to expand your system with some of the wide range of peripherals which make up the complete Genie System.

Firstly there is the **Expansion Box,** which immediately expands your Genie's capacity to 32K RAM, and up to 48K RAM if required. It can be connected to 4 disk drives, a printer, RS232 interface or S100 cards.

Then there is the **Printer,** a compact unit with 80 column, 5 x 7 matrix print-out, which connects to your Genie through the Expander, or via the Parallel Printer Interface.

The **Disk Drive** gives you greater storage capacity and full random access file handling, with the option of double-density through a special adapter.
New Dual Disk Drive now available!

Finally, there is Genie's very own **12" Monitor,** a must if you want to let the rest of the family watch their T.V. in peace!
Available in B & W or green tube.

The supreme advantage of the Genie I system is its compatibility with the TRS 80, which means that literally 1000's of pre-recorded programs are already available, just waiting to be plugged into your Genie!

The recent improvements in the Genie system, including Extended Basic, sound unit and machine language monitor, make it the ideal system for the committed hobbyist, and an excellent and easy-to-use educational tool.

SPECIAL TECHNICAL GENIE HOT – LINE ON 0629 4995

for all your technical advice and service back-up on any aspect of the Genie system direct from the experts!

Please send me FREE, 16 page colour brochure on the Genie Computer System. I enclose 25p postage.

Name _____

Address _____

_____

Telephone _____ YC·82

LOWE electronics

Chesterfield Road,
Matlock,
Derbyshire DE4 5LE.
Telephone: 0629 4995.
Telex: 377482 Lowlec G.

YOUR COMPUTER

Cover photograph by Stephen Oliver.

Oracle turntable supplied by Ricardo Firanaffovici.

Editor
TOBY WOLPE

Assistant Editor
BRENDON GORE

Staff Writer
BILL BENNETT

Sub-editors
MEIRION JONES
JOHN LIEBMANN

Editorial Secretary
LYNN COWLING

Editorial: 01-661 3144

Advertisement Manager
PHILIP KIRBY 01-661 3127

Advertisement Executives
BILL ARDLEY 01-661 3127
PETER RICE 01-661 3127

Midlands Office
DAVID HARVETT 021-356 4838

Northern Office
RON SOUTHALL 061-872 8861

Publishing Director
CHRIS HIPWELL

Your Computer, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.
Typesetting by In-Step Ltd, London EC1.
Printed by Riverside Press Ltd, Whitstable, Kent.
Subscriptions: U.K. £8 for 12 issues.

ISSN 0263-0885

Published by IPC Electrical-Electronic Press Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500 Telex/grams: 892084 BIPRESG.

EDITORIAL

THE SPECTRUM'S arrival on the microcomputing front line will decimate the ranks of prospective Vic, BBC Micro and Atom users, but will the ZX-81 be its first victim? Undoubtedly even before their expectant fingers have had a chance to grapple with the Spectrum's complex shift-key system, many ZX-81 owners will find the prospect of low-cost colour, sound and memory a lure too strong to resist. But with substantial ZX-81 price reductions in the air — £50 for the basic machine — the 81 will still be in a very strong position to offer the young or the penurious beginner an ideal point of departure into computing.

Some of the 180-odd companies which have sprung up to service the ZX-81 with software, hardware and peripherals have already reported a drop in trade since Sinclair announced his new colour computer. ZX users are clearly waiting for a sight of the new micro before deciding to shell out more on expanding their existing systems. But the attractions of the Spectrum will reach out beyond current micro owners to those who decided against making the ZX-81 their first machine when they saw its flickering screen and heard about its capricious loading.

The Vic was aimed at those first-time users. Now one can only speculate on what Commodore's response will be to Sinclair's latest venture: it will have to be strong if it is to save the Vic-20 from an ignominious end to a brief career. At £180-plus for a 2.5K low-resolution colour computer, the Vic has overnight became a radically less attractive proposition when compared with the £175 needed to secure a 48K high-resolution Spectrum. Drastic price cuts seem the only answer. Commodore's £100 Ultimax might have had some say in the matter, if it had not been shelved for the immediate future.

In any case the Spectrum will not have it all its own way. The BBC Micro, despite its higher price, still has features that Sinclair's colour micro cannot rival — a real keyboard, sound synthesiser and composite video, for example. Furthermore the Electron, Acorn's still-secret weapon, could present the Spectrum with some very tough competition.

Perhaps the last variable in the micromarket equation is Sinclair's Microdrive. Coupled with the power of the Spectrum, the appeal of 100K mass storage for £50 may add up to a renewed period of the Sinclair domination which started with the announcement of the ZX-80 in January 1980.

The projected new price for the ZX-81 is £80 with the 16K RAM pack. That should be enough to ensure steady sales in the U.K., and continued success worldwide. At the same time, the cost of the ZX printer has discreetly risen to about £70. Sinclair has made it clear that he will not stop ZX-81 production. In any case, unlike programs loaded into a wobbly RAM pack, the 350,000 ZX-81s already sold will not just vanish into thin air. ■

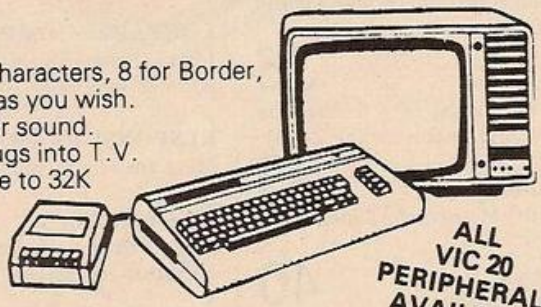
CHROMASONIC electronics

48 JUNCTION ROAD, ARCHWAY LONDON N19 5RD 100 yds FROM ARCHWAY STATION & 9 BUS ROUTES
TELEPHONE: 01-263 9493/01-263 9495 TELEX: 22568.

YOUR SOUNDEST CONNECTION IN THE WORLD OF COMPUTERS

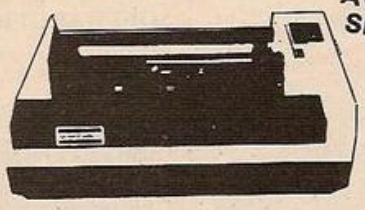
VIC 20

* 24 Colours, 8 for Characters, 8 for Border, 16 for screen mixed as you wish.
*3 tone Generator for sound.
*Uses Pet Basic *Plugs into T.V.
*Memory expandable to 32K
*VIC complete with T.V. Modulator and Power Supply
ONLY £165.00



VIC Cassette Deck
ONLY £38.00

Available soon
VIC Dot Matrix Printer
80 Column, 30 CPS, Tractor Feed
ONLY £199.95



ALL VIC 20 PERIPHERALS AVAILABLE SEND FOR LIST

UK101

DOWN IN PRICE

UK101 Kit **inc 8K memory**	**£125**
Ready Built **inc 8K memory**	**£175**
Complete in case	**£199**
4K Expansion 8x2114	**£10**
Parallel Printer Interface	**£24.50**
Cases	**£19.95**
Chromasonics Sound Kit	**£24.50**
Colour Kit	**£69.95**
NEW NEW NEW	
32K Dynamic Memory Board only	**£89.95**
P.I.O. and Eprom Programmer Kit only	**£24.50**

APPLE II PLUS

AUTOSTART "EUROPLUS"
48K Apple Computer **649.00**
Disc Drive with Controller **349.00**
Disc Drive without Controller **299.00**
Colour Card **69.00**
Silentype Printer **199.00**
Graphics Tablet **425.00**
TV Modulator **14.00**

A range of Apple Accessories and Software are available

PET

4016 16K RAM	**445.00**
4032 32K RAM	**569.00**
8032 32K RAM	**755.00**
8096 96K RAM	**960.00**
4040 Disk Drive	**585.00**
8050 Disk Drive	**755.00**
4022 Printer 80 Col	**357.00**
8024 Printer 132 Col	**975.00**
8026 Printer/Typewriter	**835.00**
8027 Daisy Wheel	**735.00**

A range of Pet Accessories and Software are available

PRINTERS

INTERFACES AND CABLES FOR APPLE II, PET, TRS80, RS232, UK101, SHARP SUPERBOARD — ALL AVAILABLE.

EPSON MX80 £359
Dot-matrix printer with Pet graphics interface. Centronics parallel and serial. Pet and Apple compatible. True bidirectional, 80 cps.

EP80 MX82 £389
As MX80 plus high Resolution Graphics

EPSON MX80 FT/1 £399
Dual single sheet friction and tractor feed, 9 wire head, true descenders.

EPSON-MX80 FT/2 £440
An FT/1 with high resolution graphics.

SEIKOSHA GP80A £199
Dot matrix 5 x 7, 80 columns, 30 cps graphics, double width characters.

JUST PHONE FOR FURTHER DETAILS

VIDEO GENIE

£299 EG3003

Utilises Z80, 12K level II Basic, Integral Cassette Deck, UHF O/P, 16K RAM, all TRS80 features. Simply plugs into monitor or UHF TV. With V.U. Meter.

PARALLEL PRINTER INTERFACE INC CABLE	£38.00
CHROMASONICS **PROGRAMMABLE** SOUND KIT	£24.50
SOUND KIT (FITTING EXTRA)	£8.20
LOWER CASE KIT (FITTING EXTRA)	£29.80
COLOUR KIT (FITTING EXTRA)	£36.00
EXPANSION BOX INC 16K RAM	£199
16K/32K RAM BOARD	£94/ £129
NEW GENIE II NOW AVAILABLE	£310

TANTEL

PRESTEL BY TANTEL
COMMUNICATIONS AT YOUR FINGERTIPS FOR BUSINESS & HOME. UP TO DATE INFO

180,000 pages of information on Travel, News, Investment, Holidays, Hotels Etc., Etc.

£159

TANTEL IS POST OFFICE APPROVED. SEND FOR DETAILS.
DEMONSTRATION AVAILABLE AT OUR SHOWROOM.

MONITORS

9" Green Screen	**£99.00**	HITACHI PROFESSIONAL	
12" Green Screen	**£125.00**	9"	**£99.95**
12" BMC Green Screen	**£159.00**	12"	**£149.00**

ALL ITEMS CARRY A ONE YEAR GUARANTEE

BARCLAYCARD VISA

Please add VAT 15% to all prices. Postage on computers, printers and cassette decks charged at cost, all other items P&P 30. Place your order using your Access or Barclaycard (Min. tel. order £10). Export enquiries welcome. Official orders welcome.

ANGLO AMERICAN SOFTWARE CO

BBC – TRS-80 – ATARI – PET – APPLE – VIC – ZX81

We know what it is like out there, because that's where we came from. Before we decided to become software entrepreneurs, we were just like you enthusiasts searching through magazines for the ideal mail order software source. What we hoped to find was a single entity that offered an ultra-wide selection for our micro-computer. That pre-selected only the best of many similar sounding programs that reached the market every month. That could give us personal assistance with the purchase-decision process, and that stood behind its products. When we couldn't find it we decided to become it. So ANGLO-AMERICAN SOFTWARE CO WAS BORN.

Please state clearly the program(s) you require. Include your name, address & machine type + memory size. Prices include VAT, postage & packing.

OIL TYCOON

What would it be like to be an oil producer. Find out with this action packed simulation as you try to become an oil tycoon. Explore for new wells get reports, name your own price for oil – but don't get too greedy or beware. The game involves strategy and chance. You could end up as one of the wealthiest men in the country or the bankrupt victim of too many oil spills. You will find OIL TYCOON both challenging and exciting.

PRICE £9.95
CASSETTE

DUNGEON OF DEATH

Your quest is to search for the Holy Grail where you descend through 12 levels, find the Holy Grail and return to the surface. The Grail is guarded by SMAUG the most fearsome monster of all and ten lesser breeds. You can only survive by using all the powers at your command. You can cast magic spells, drink potions that may or may not help you find items to help you fight the monsters. Step softly in the darkness. Treasure or sudden death is only a footfall away in the DUNGEON OF DEATH.

PRICE £10.75
CASSETTE

MASTER DIRECTORY

Wasn't it yesterday you threw the cat into the washing machine because you couldn't find where you had put the last Adventure game you had saved or was it that you gave your mother in law the leftover curry because your three year old had mixed up all your data disks and now you don't know which one is which. Well cheer up MASTER DIRECTORY is here. The M.D. is a storage program that reads the files on your disks, stores the name, extension and even records the free space on each disk. All you do is number your disks. You can use it alphabetically or search for name and ext search for free space. Store 5000 files or 320 disks.
Requires one disk drive.

PRICE £21.00
DISK

THE FLYING CIRCUS

Is a package covering biplane to modern day planes. These seven programs offer you the daring realism of flight.
1. AIR FLIGHT
2. NIGHT FLIGHT
3. AIRMAIL PILOT
4. MOUNTAIN PILOT
5. O'HARE (air traffic controller)
6. APPROACH RADAR
7. JET FIGHTER PILOT

A great combined flying package. Try to master the lot.

PRICE £25.00
DISK

AIR FLIGHT SIMULATION

Instrument takeoffs and landings are no picnic ask any pilot. This computer simulation is sure to keep you on the edge of your seat. You begin with a full tank of fuel and a flight plan to learn simple take-offs and landings. Pay attention to your instrument panel too steep a bank and your air speed – will drop like a stone. . . so will your plane. It's about as close to the real thing as you can get this side of the runway. Fun for all the family when you learn to do acrobatic manouevres.
PRICE £9.95
CASSETTE

SANTA PARAVIA & FIUMACCIO

Fancy being a MRS THATCHER well with this program you will come as near to it as you will ever be. Perhaps I should acquaint you with the domain. It is not a wealthy Area but riches and glory are there for the aware. You will have to worry about the serfs requesting more grain if they don't get it they may flee. There is the weather as well if it is good so will the crops be. You may find you have to increase the tax. You may also wish to build a new palace to measure your progress the official cartographer will draw you a map so as to see how to plan your strategy. A very entertaining game.

PRICE £10.50
CASSETTE
PRICE £14.25
DISK

SEND 75p FOR FULL CATALOGUE
Refundable against purchase

Dealer Enquiries Welcome

✸ PROGRAM OF THE MONTH ✸

SPACE SHUTTLE
Save £4.50
5.3 million pounds of thrust sent the space shuttle COLUMBIA into orbit. Now on-board computers will help to bring her safely and gracefully back to earth. SPACE SHUTTLE puts you in the command pilot's chair of the first reusable space vehicle and until commercial flight becomes available this is the closest you will get. We feel this is one of our best programs.
PRICE £17.00 Special offer price of £12.50 CASSETTE.

ANGLO AMERICAN SOFTWARE CO.

138a Stratford Road
Sparkhill
BIRMINGHAM B11 1AG
021-771 2995

24 hour ansaphone

MICRO GEN QUALITY PRODUCTS

ZX81 A/D CONVERTER BOARD

This 4 channel analogue to digital converter, originally developed for joystick control, can be used for such applications as measurement of voltage, temperature, light intensity etc.
The board fits in between the RAM pack and the ZX81. (No skill is required to make this connection, and it actually improves the stability of the RAM pack).
Price now only £18.50.

JOYSTICKS FOR THE ZX81 only £9.60 each

*The most exciting add-on ever for the ZX81, free yourself of that dead, unresponsibe keyboard.
*1 or 2 joysticks may be connected via our A/D board.
*Turns your ZX81 into a true programmable games machine.
*Extends the capability of the ZX81, imagine the tremendous variety of games and applications that now become possible.
*Details supplied on how to use the joysticks in your own programmes.

Please note that you cannot connect conventional analogue joysticks directly to the digital input ports found on most I/O boards, an A/D convertor such as ours is required.

A free copy of ZX AMAZE plus any one of the games listed below when ordering a joystick and an A/D board.

PROGRAMS AVAILABLE

ZX SPACE INVADERS. You've tried the rest, now try the BEST. This program has many features including an ever increasing rate of play (they'll get you in the end).
only £3.95

ZX BREAKOUT. Quite simply the best breakout on the market. Features seven bat angles, (you won't find this one easy). only £3.95

ZX NEW YORK. A very addictive arcade game. Bomb and shoot your way out of trouble, otherwise you are doomed to crash. Generates a different pattern, for a different game each time you play. On the reverse of the cassette is ZX REFLEX, find out how fast you really are.
now only £3.95

ZX CHESS. The original and still the best. * Graphic display of chessboard * 6 levels of play. * Displays record of your moves and the computers. * Board can be set up to any position. * Has ability to change sides or level in mid-game. * PLUS * CHESS CLOCK on reverse side, records time taken by each player. * Resetable function. * Single key entry.
NOW ONLY £6.50

DISASSEMBLER & MONITOR. Allows you to enter and run your own machine code. Relocates to top of memory to allow you to load other programs and find out how they work. Block move. Byte search. Load display and alter all CPU registers. Window on memory facility, uses standard mnemonics, an absolute necessity if learning machine code
Only £3.95

All our games are written in machine code, and can be used with joysticks or keyboard, (except chess, keyboard only). Supplied on cassette with library case.

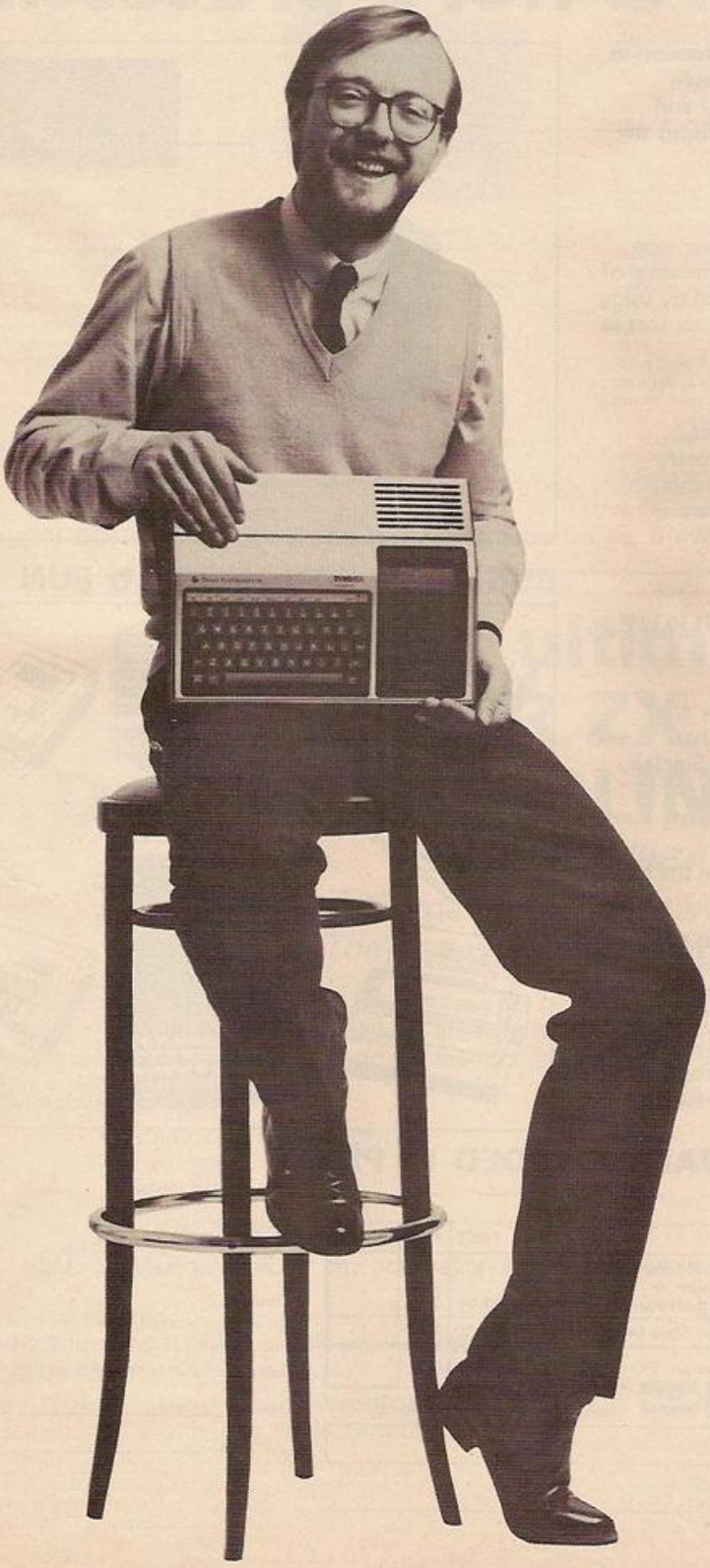
To allow you to prove to yourself that our products are second to none, MICRO GEN offers the following terms to our customers.
14 DAYS FREE APPROVAL ON ALL PRODUCTS
All money will be refunded if goods are returned in good condition within 14 days of despatch.
If you write a program which is exceptional, please submit it to us. We will offer a royalty if it is suitable.

Cheques + POs Payable to MICROGEN 24, Agar Cres, Bracknell, Berks.

TEXAS INSTRUMENTS HOME COMPUTER STOCKISTS

ABERDEEN Dixons **ALTRINCHAM** Boots **ASHFORD** Rumbelows **BARNET** Rumbelows **BASILDON** Rumbelows **BASINGSTOKE** Boots **BATH** Boots, Microstyle **BEDFORD** Carlow Radio, Rumbelows, Boots, Comserve **BILLERICAY** Rumbelows **BIRKENHEAD** Dixons **BIRMINGHAM** Dixons, Comet, Hewards Home Stores, Boots **BLACKPOOL** Boots **BLETCHLEY** Rumbelows **BOREHAMWOOD** Rumbelows **BRADFORD** Ackroyd Typewriters **BRAINTREE** Rumbelows **BRENTWOOD** Rumbelows **BRIGHTON** Gamer, Boots **BRISTOL** Dixons **BROMLEY** Rumbelows, Boots **BROMYARD** Acoutape Sound **CAMBRIDGE** Rumbelows, Dixons, Heffers **CANTERBURY** Rumbelows, Dixons **CARDIFF** Boots, Dixons, Computer Business Systems **CARLISLE** Dixons **CHELMSFORD** Dixons, Rumbelows **CHESTER** Boots **CHINGFORD** Rumbelows **COLCHESTER** Rumbelows **CORBY** Computer Supermarket **CREWE** Midshires **CROYDON** Boots, Dixons, Allders **DARTFORD** Rumbelows **DERBY** Datron Microcentre, Boots **DORRIDGE** Taylor Wilson **DUNSTABLE** Rumbelows **EASTBOURNE** Rumbelows **EDINBURGH** Robox, Esco, Texas Instruments, Dixons, B.E.M. **ENFIELD** Rumbelows **EXETER** Peter Scott, Boots, Dixons **GLASGOW** Boots, Esco, Robox, Dixons **GT. YARMOUTH** Rumbelows **HANLEY** Boots **HARLOW** Rumbelows **HATFIELD** Rumbelows **HEMEL HEMPSTEAD** Rumbelows, Dixons **HITCHIN** Rumbelows **HODDESDON** Rumbelows **HULL** Radius Computers, Boots, Dixons, Peter Tutty **ILFORD** Boots **IPSWICH** Rumbelows **KINGSTON** Dixons **LEEDS** Dixons, Boots, Comet **LEICESTER** Dixons, Boots **LEIGHTON BUZZARD** Computopia **LETCHWORTH** Rumbelows **LINCOLN** Dixons **LIVERPOOL** Dixons, B.E.C. Computerworld **LONDON: Balham** Argos **Bow** Rumbelows **Brent Cross** Dixons, Boots **Camden Town** Rumbelows **City Road** Sumlock Bondain **Clerkenwell** Star Business Machines **Curtain Road** Eurocalc **Ealing** Adda Computers **EC1** Argos **Edmonton** Rumbelows **Finchley Road** Star Business Machines **Fulham** Mondial **Goodge Street** Star Business Machines **Hackney** Rumbelows **Hammersmith** Dixons **Hendon** Futurtronic **Holborn** Dixons **Hounslow** Boots **Kensington High Street** Video Palace **Knightsbridge** Video Palace, Harrods **Loughton** Rumbelows **Marble Arch** Star Business Machines **Moorfield** Dixons **Moorgate** Star Business Machines **New Bond Street** Dixons **NW1** Mountaindene **Oxford Street** Selfridges, H.M.V., Dixons **Regent Street** Star Business Machines **Tottenham Court Road** Landau, Eurocalc **Victoria Street** Army & Navy **Wandsworth** R.E.W. **Wood Green** Boots, Rumbelows **Woolwich** Rumbelows **LUTON** Dixons, Rumbelows **MAIDSTONE** Dixons, Boots, Rumbelows **MALDON** Rumbelows **MANCHESTER** Orbit, Boots, Dixons **MIDDLESBROUGH** Boots, Dixons **MILTON KEYNES** Rumbelows, Dixons **NEWBURY** Dixons **NEWCASTLE** Boots, Dixons **NORTHAMPTON** Dixons **NORWICH** Dixons, Rumbelows **NOTTINGHAM** Bestmoor, Dixons, Boots **ORPINGTON** Rumbelows **OXFORD** Science Studio **PETERBOROUGH** Boots **PLYMOUTH** J.A.D., Dixons **PORTSMOUTH** Boots, Dixons **POTTERS BAR** Rumbelows **PRESTON** Dixons **RAMSGATE** Dixons **RAYLEIGH** Rumbelows **READING** Dixons **RENFREW** Comet **ROMFORD** Rumbelows, Dixons **RUSHDEN** Computer Contact **SANDY** Electron Systems **SCARBOROUGH** Video+ **SHEFFIELD** Datron Microcentre, Dixons, Video+, Wigfalls **SITTINGBOURNE** Rumbelows **SLOUGH** Boots, Texas Instruments **SOUTHAMPTON** Dixons, The Maths Box **SOUTHEND** Rumbelows, Dixons **ST. ALBANS** Rumbelows **STEVENAGE** Dixons, Rumbelows **STRATFORD** Rumbelows **SUDBURY** Rumbelows **SWANSEA** Dixons **TONBRIDGE** Rumbelows **WALTHAM CROSS** Rumbelows **WALTHAMSTOW** Rumbelows **WARE** Rumbelows **WARRINGTON** Boots **WATFORD** Computer Plus, Computer Centre, **WELWYN GARDEN CITY** Rumbelows **WETHERBY** Bits & Pieces **WOLVERHAMPTON** Dixons **WOODFORD** Rumbelows

With the Home Computer from Texas Instruments, you can converse in the five major languages: BASIC, PASCAL, TI-LOGO, ASSEMBLER and it speaks English!



When you compare the TI-99/4A Home Computer to its competition, you'll find it is a truly remarkable machine. For a start, it enables you to use the most important programming languages. Something that is difficult to find on other comparable computers. What's more, it has a large 16 K Byte RAM memory capacity, expandable to 48 K Byte. With the addition of certain peripherals and a Solid State Software® Module a total combined RAM/ROM capacity of 110 K Bytes is available. The TI-99/4A Home Computer plugs into an ordinary TV set and can be expanded into a complete computing system with the addition of peripherals such as two ordinary domestic cassette recorders, remote control units, disk memory drives, speech synthesiser, and thermal printer. Via an RS 232 interface option, other peripherals such as communication modems, impact printers and

plotters can be attached. With it's high resolution graphics with 32 characters over 24 lines in 16 colours (256 x 192 dots), three tones in five octaves plus noise, and BASIC as standard equipment and options such as other programming languages – UCSD-PASCAL, TI-LOGO and ASSEMBLER – and speech synthesis, you'll find that the TI-99/4A Home Computer more than compares with competition. Especially when the starting price is £340 or less. When you want to solve problems there are over 600 software programs available worldwide – including more than 40 on easy-to-use Solid State Software® Modules.

After all, from the inventors of the microprocessor, integrated circuit and microcomputer, it's only natural to expect high technology at a realistic price.

The TI-99/4A Home Computer: another way we're helping you do better.

We'll help you do better.

TEXAS INSTRUMENTS

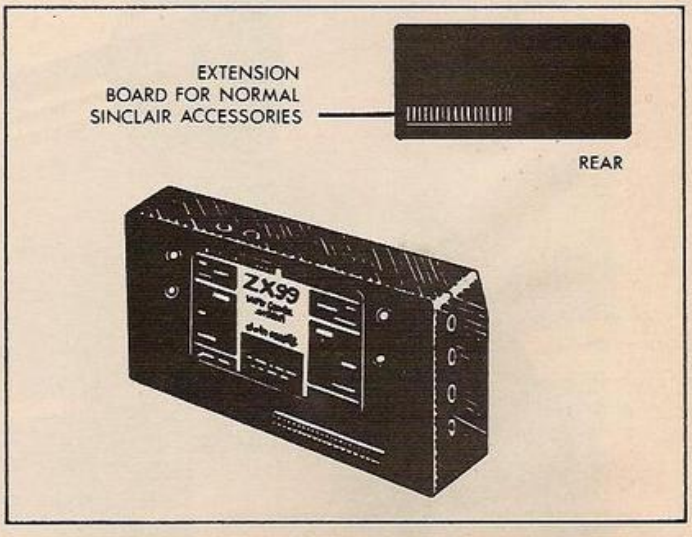
* Registered Trade Mark Texas Instruments

ZX99 AUTOMATIC TAPE CONTROL

The logical extension for the Sinclair ZX81 giving data retrieval & word processing

£59.95 plus P&P

The ZX99 Tape Control system is a sophisticated extension to the Sinclair ZX81 Microcomputer, providing remarkable additional capabilities, which allow both the beginner and expert access to a professional computing system without the expected expense.



✸ DATA PROCESSING

The ZX99 gives you full software control of up to four tape decks (two for loading and two for saving) allowing 'mixing' of data files to update and modify them. This is achieved by using the remote sockets of the tape decks to control their motors as commanded by a program.

✸ PRINTER INTERFACE

The ZX99 has a RS232C interface allowing you direct connection with any such serial printer using the industry standard ASC11 character code (you can now print on plain paper in upper and lower case and up to 132 characters per line.)

✸ MANY SPECIAL FEATURES

There are so many different features that it is difficult to list them all:
For example:

AUTOMATIC TAPE TO TAPE COPY: You can copy any data file regardless of your memory capacity (a C90 has approx 200K bytes on it) as it is loaded through the Sinclair block by block.

TAPE BLOCK SKIP without destroying the contents of memory.

DIAGNOSTIC INFORMATION to assist in achieving the best recording settings.

The ZX99 contains its own 2K ROM which acts as an extension to the firmware already resident in your ZX81'S own ROM. The ZX99's ROM contains the tape operating system, whose functions are accessed via Basic USR function calls. Each function has an entry address which must be quoted after the USR keyword. All of the functions can be used in program statements, or in immediate commands (i.e. both statements with line numbers and commands without them).

BUSINESS, EDUCATION & FUN

COMPREHENSIVE USER MANUAL INCLUDED IN PRICE

COMPUTER CASSETTES	QTY	PRICE	TOTAL
C5		35p	
C10		37p	
C12		38p	
C15		39p	
C20		41p	
C25		43p	
C30		44p	
C15 Leaderless		£1·00	
Add min £1·50 or 10% P & P			

ITEM	QTY	PRICE	P&P	TOTAL
ZX99 Automatic Tape Controller + Super Software		£ 59·95	£ 2·95	
E312 Cassette Tape Drive		24·00	1·00	

Cheque/PO payable to Storkrose Ltd.
or
Charge my Access/Visa card no:

SIGNED _____

ORDER FORM TO:
data-assette®
Dept: YC2
44 Shroton Street,
London NW1 6UG Tel: 01-258 0409
Telephone enquiries welcome

NAME _____
ADDRESS _____

ZX81 HEWSON CONSULTANTS ZX81

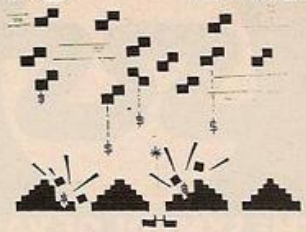
HINTS & TIPS for the ZX81 **£4.25**
by ANDREW HEWSON
"Good value and quite fascinating . . . a very inexpensive way of acquiring months of programming experience" *Your Computer* Nov 1981
"Excellent . . . very good value for money" SYNC
80 pages explaining how to squeeze a computing quart out of a Sinclair pint pot.
Saving Space — vital reading for all ZX81 users.
Understanding the Display File — using the display file as memory, clearing a part of the display, using tockens in PRINT statements. Converting ZX80 programs — explaining simply but comprehensively how to convert the hundreds of published ZX80 programs. Chaining programs — revealing techniques for passing data between programs, calling subroutines from cassette and establishing data files. Machine Code Programs — all you want to know about Z80 machine language. Explaining how to write, load, edit and save machine code and how to debug your routines. Routines and programs are scattered liberally throughout the text and the final chapter consists of 12 useful, interesting and entertaining programs such as LINE RENUMBER, BOUNCER, SHOOT, STATISTICS, etc.

16K RAM **£37.50**
A top-quality add-on memory, simply plugs into the back of your Sinclair computer. Can be used in conjunction with the ZX printer. Neatly packaged in a black plastic shell to match your ZX81. Supplied with one year's guarantee.
ZX81 **SPECIAL OFFER** FREE COPY OF OUR SUPER 'SPACE INTRUDERS' CASSETTE with ANY order for the 16K RAM received by 23.5.82. One copy per customer.

64K MEMORY **£79.00**
Developed by Memotech this amazing 64K RAM needs NO extra power supply. Simply plugs neatly and firmly into the rear port of your ZX81. Can be used with the ZX printer and other add-on hardware. Just look at these features . . .
*8-16K can be switched in and out in 4K blocks to leave space for memory mapping.
*12-16K can be protected against overwriting during loading from cassette.
*directly addressable and user transpartent.
*up to 15K of basic program.
*32K or more of variable area.

Z80 OP CODES **£1.45**
A must for the beginner and the experienced programmer alike. This handy ready reckoner lists all the 600 plus Z80 machine code instructions in decimal and hexadecimal with their mnemonics. Each Op Code is succinctly explained and cross-referenced. Supplied in a protective transparent wallet for easy reference and durability.

16K SOFTWARE



SPACE INTRUDERS **£5.95**
Not to be missed. All action display. 40 alien ships in each squadron. Automatic option — the machine plays itself. Squadron after squadron of aliens attack your position. Three laser guns. Full score display. Written in machine code for super fast fun.

PROGRAMMERS TOOLKIT **£6.50**
Are you writing your own programs for your ZX81? Then use our TOOLKIT to do the donkey work. Copy into RAM before you start work and then you will have it at your fingertips. Comprehensive LINE RENUMBER including GOSUBS and GOTOS; LOAD, EDIT and RUN machine code programs; INSPECT the ZX81 system routines; COPY them into RAM and PATCH and/or EXTEND them; FIND a given piece of BASIC code and replace all occurrences of it; move blocks of Basic lines with EDIT.

LANGUAGE DICTIONARY **£3.75**
Now you can construct your own English/French, English/Anything dictionary with our LANGUAGE DICTIONARY. UPDATE the entries, SEARCH for a word, CREATE a new dictionary and save it on tape.

1K SOFTWARE

MINI INTRUDERS for the 1K machine **£3.95**
An incredibly fast moving game, dodge left and right to avoid falling missiles. Fire Salvo after Salvo at the attacking alien squadron, more aliens join the squadron all the time. Count how many lazer bases you lose before you have cut them down.

PLANET LANDER **£3.75**
Four programs:
i) Planet Lander; ii) Space Docking; iii) Stopwatch; iv) Clock.

STATISTICS **£3.75**
Three programs:
(1) (I) Statistics; prints the current mean and standard deviation after each value is entered. (II) Regression; prints the current mean and standard deviation of the y values, the x values and the intercept and slope of the regression line. (III) Trend; prints the current mean and standard deviation of the y values; the x values and the intercept and slope of the trend line.
(2) Chi square test calculates the value of the chi square statistic for comparing observed and expected values.
(3) Graph plot; plots a graph of data entered from the keyboard.
Special offer
Mini Intruders and Planet Lander £5.00. Offer closes 23.5.82.

Cheque with order or quote access number to:
HEWSON CONSULTANTS, Dept. YC, 7 Grahame Close, Blewbury, Oxon OX11 9EQ. Tel: (0235) 850075

The ultimate SINCLAIR ZX 81 (16K) DATABASE FILING SYSTEM

by DALE HUBBARD

Fed up with boring games — make your ZX81 work for you!
The one you've been waiting for!!

Cassette based
Clear "menu" operation
Facilities include sort, search, list, delete, change, total numeric field, save and load file, line print, etc.
Complete with demonstration file and full instruction/application leaflet.
Requires 16K Ram pack.
Applications: Recipe file
Stamp/coin collections
Inventory Control
Employee Data
Record Collections
Magazine article catalogue
May be used for any application where fast access is required to stored information

Access accepted
Send cheque or P.O. or credit card number to:
GEMINI MARKETING LTD.
Quay House, Quay Road, Newton Abbot, Devon TQ12 2BU
OR telephone us with your credit card order
on Newton Abbot (0626) 62869

DESPATCH BY RETURN

ONLY
£5.95 FULLY INCLUSIVE!

Special Officer FREE
Computerised decision-making program with every order received before July 15th 1982!

YOUR LETTERS

UNBEATABLE LOSER

Tony Poulter claims his noughts and crosses program, in February's *Your Computer*, is unbeatable. This is only true if you play logically. If you play X and arrive at this position:

```
0 0 3
5 × 7
9 × B
```

by playing 6, then A, your logical move is 3 to block the computer's winning line, but play 9 instead and the computer ignores the chance to win and tries to block you by playing B, leaving you to win with 3.

Paul Blythe's Brahma in April's *Your Computer* works on the ZX-81 1K but only by changing line 140 to:

```
LET A(D,E-1)=A(C,B)
```

to stop rings disappearing. Also, you do not need extra memory to have more rings. By replacing all numbers in with Code"Chr$n" except for 0, 1 and 3 which can become Sin Pi, Sgn Pi and Int Pi and renumbering lines 70, 75, 80 as 61, 62 and 63 you can have up to nine rings with room to make an illegal move or two.

Jack Betteridge's Prime Numbers program in April's *Your Computer* has a misprint in line 200 which should be:

```
IF P=0 THEN GOTO 250
```

Line 110 can be changed to:

```
IF C<> Y THEN GOTO 140
```

It also needs some changes to run on the ZX-81:

```
150 IF A=INT (A/2)*2
    THEN LET A=A+1
160 FOR Y = A TO B STEP 2
180 LET R = INT (Y/Q)
Delete 250
```

To stop 1 being reprinted when A=1, add:

```
145 IF A=1 THEN LET A=2
```

Although mentioned in the Sinclair manual on page 74, I have not seen a Software File program using Goto as a conditional expression. One could be used in B T Jeeves's Satellite Plot, April, making the following changes: Delete lines 50, 60, 70, 100.

```
55 CLS
65 GOTO (10 AND A<>1 AND
   A<>2)+(75 AND A=1)+
   (105 AND A=2)
```

K Feary,
Wendover,
Buckinghamshire.

PORT POINTS

With reference to Stephen Adams' recent review of ZX-81 Ports, we would like to clarify the following points concerning our 16K RAM and I/O board. Our board is usually supplied complete with 0.5A power unit for £53, but is available without for users who already have a suitable unit. The board will not work without a separate power-supply unit as its +5V and −5V are derived on board from the 12V. Data sheets for the 8255 cost 50p with the board or 60p separately. General data will be sent on receipt of a stamped, addressed envelope.

The edge connector is included in the price, although we can supply it separately for £3.20. The kit is not available, but we can supply the bare printed-circuit board with constructional data for £10.75.

We recommend that the board be cased not because of hazard to the user, but to protect the board from accidental short-circuit or mechanical damage.

K Reeman,
Ground Control,
Hullbridge,
Essex.

MISADVENTURE

There are a few minor errors in my Adventure program published in April. In lines 2904 and 3110 the number 10 should be the variable IO, the index of the object entry. Second, I have now amended lines 2420 and 2430 which should be as follows:

```
2420 IF X$<>"INIT"
     THEN GOSUB 6700
2430 IF X$<>"INIT"
     THEN GOTO 1000
2440 GOTO 70
```

This is necessary because the ZX-81 does not Save the Gosub stack. With this amendment a Saved game will automatically recommence after Loading.

Graham Thomson,
Northwich,
Cheshire.

STRING LENGTH

Graham Thomson's Adventure, in April, is an example of the intellectual satisfactions the ZX-81 can offer. His method of storing data in a single long string is a fascinating technique.

However, after spending much time in keying in Thomson's program and debugging my keying errors, I came to the conclusion that it, rather painfully, reinvents the wheel. In indexing a single long string one is almost writing a fresh ROM when the Sinclair ROM with its multi-dimensioning of strings already supplies a ready-made and clear index to vast numbers of strings.

My own attempt to write a *Dr Who* adventure, anticipating a visit from my grandson, employs a four-dimensional string, i.e., P$(X,Y,X,20), the initialisation being

```
10 DIM P$(2,3,5,20)
```

Inkey$ is used to change the values of X, Y and Z. Thus a Go North instruction, press key N, is programmed to add 1 to Z; depressing key S subtracts 1. East or westwards moves are achieved by moving across the third dimension, by changing the value of Y.

Journeying into outer space or a new time zone is achieved after discovering *Tardis*, by using the U key to alter the value of X when a whole new hierarchy of places are opened up to north, south, east or west movements.

Object discovery is very simple. Arrival at a place for the first time causes the program to Gosub when the object and its score are digested, the object being put into an 0$ string at a predetermined place:

```
LET 0$(23 TO 28)="GOLD:"
```

Objects held are printed to the screen constantly, simply by calling a print of 0$, without dimension. No loader was necessary. Indeed I found it simple to write the program straight from the keyboard with only a hazy plan of the outcome. As long as the main program is located at a high line number such as 2000, and plenty of space is left between lines in this main part to allow for plenty of conditional Gosubs such as

```
IF X=2 AND Y=3 AND Z=4 THEN
GOSUB (attack by Daleks)
```

the program can be elaborated ad lib.

G J Langford,
Ickenham, Middlesex.

PURE ARTISTRY

The Genie program Top Drawer, in *Your Computer* April, has one slight bug. No matter which key is pressed, the values of XX and YY will be unaffected, as the program always returns to line 20, before lighting the pixel. Therefore the values of XX and YY are reset to their respective initial values. To cure this rewrite lines 20 and 150 and insert a line 25 as follows:

```
20 XX = 62: YY = 24
25 SET (XX,YY)
150 GOTO 25
```

Here is a Genie drawing program, which requires less than 1K of memory and allows you to control the movement of a line by using the four arrow keys. Each key moves the spot in the direction of the arrow marked on the key. In addition, diagonals may be drawn by pressing two keys together, so if up arrow and left arrow are both pressed, then the line drawn will be to the upper left-hand corner.

As Peek is used instead of Inkey$, movement continues as long as keys are held down, rather than one place moved per press.

John Marshall,
Acomb,
York.

TIGHT WRITING

Silent Running in the March issue is a good piece of very tight writing to fit into 1K. However it is easily run in the expanded machine without removing the RAM pack by simply lowering RAMtop. I Poked 16388,0 and 16389,73. This leaves over 2K usable so that the machine code runs properly and there is still plenty left to add a time delay and automatic rerun at the end. I have also added a high-score and some instructions.

Les Simpson,
Elm Park,
Essex. ■

Pure artistry program

```
10  CLS
20  X=62: Y= 24
30  SET(X,Y)
40  Z=PEEK(14400)
45  IF Z=0 GOTO 40
50  IF Z<8 OR Z>80 THEN 40
60  IF Z = 8 THEN 65 ELSE 70
65  Y=Y-1 : GOTO 150
70  IF Z = 16 THEN 75 ELSE 80
75  Y = Y + 1: GOTO 150
80  IF Z = 32 THEN 85 ELSE 90
85  X = X - 1 : GOTO150
90  IF Z = 40 THEN 95 ELSE 100
95  X =X-1: Y = Y-1:GOTO 150
100 IF Z = 48 THEN 105 ELSE 110
105 X =X-1 : Y= Y + 1: GOTO 150
110 IF Z = 64 THEN 115 ELSE 120
115 X = X + 1: GOTO 150
120 IF Z = 72 THEN 125 ELSE 130
125 X = X + 1: Y = Y - 1: GOTO 150
130 IF Z = 80 THEN 135 ELSE 140
135 X = X + 1: Y = Y + 1: GOTO 150
140 GOTO 40
150 IF X<0 THEN X = X + 1
ELSE IF X> 127 X = X - 1
160 IF X<0 THEN Y = Y + 1
ELSE IF Y> 47 Y = Y -1
170 GOTO 30
```

Sharp colour prints from 3.5K pocket-computer system

THE PC-1500 pocket computer launched by Sharp has 16K ROM and 3.5K RAM, a seven-by-156 programmable dot-matrix liquid-crystal display and a tone generator. The RAM can be extended by an optional 4K CE-151 module to 7.5K. A C-MOS eight-bit CPU allows fast data processing.

Other features include a standard QWERTY typewriter keyboard and an ASCII character set with upper and lower case. A memory safeguard prevents accidental erasure of programs by ensuring that programs are retained even when the power is switched off. Its extended Basic provides two-dimensional arrays, variable strings, program chaining and graphics commands. Power is supplied by either four dry batteries or from the mains via a Sharp adaptor.

A CE-150 four-colour graphics printer and cassette interface is also available as an option. Virtually any drawing can be printed in red, black, green and blue, from pie charts to column graphs. The printer is capable of automatic program, data and calculation printing. Both the character size and the lines can be varied with the lines ranging from four to 36 digits in length. The cassette interface enables the PC-1500 to be connected to two cassette recorders, which allows information to be stored and retrieved on tape. Sharp is currently working on further options for the PC-1500, including an RS-232C interface and a software board to act as input keys in graphs or pictures previously drawn on a template.

A cassette of 15 applications programs is available, together with an applications guide, for £15. The programs include multiple regression analysis, simultaneous equations, numerical integration and conversion between decimal and base-P systems. The cassette also includes two games programs, Slot Machine and the nautical game Destroyer v. Submarine.

The PC-1500 pocket computer costs £179.95 including VAT; the CE-150 graphic printer/cassette interface costs £149.95 including VAT; and the 4K RAM CE-151 module costs £49.95 including VAT. All are available from Sharp Electronics (U.K.) Ltd, Sharp House, Thorp Road, Manchester M10 9BE. Telephone 061-205 2333.

Text editing

ZTEXT and LText are word-processing packages for the ZX-81 which include a text editor and a formatter/printer. The text editor allows you to type text in and edit it while the formatter/printer puts the text on the screen or ZX printer, and justifies and formats it according to commands embedded in the text.

ZText just uses upper-case letters, but LText caters for both upper- and lower-case characters. Both programs, together with a detailed manual, are available for £7.50 the pair, including VAT and post and packing, from Oasis Software, Lower North Street, Cheddar, Somerset BS27 3HH. Telephone 0934 743409.

Vulcan alert

VIC-20 manufacturer Commodore has linked up with Hendon-based electronics distributor Vulcan in a bid to make the Vic-20 available in a wide range of department stores and independent outlets. Commodore's Vic-20 is already sold in all Rumbelows, Laskys, Currys and Debenhams stores and will also be on offer in Dixons shops and 80 branches of Boots. Vulcan will be responsible for supplying the Vic-20 to all other retailers not covered by Commodore's present distribution network.

"Vulcan's role on behalf of Commodore will be to give new outlets a chance to experiment with the Vic-20 and learn how to sell this type of product", says Vulcan's managing director Robert Stein.

Winners of the national software competition for schools were presented with their prizes at Barclays Bank's head office in London by general manager Humphrey Norrington — third from the left. The senior competition was won by Roy Coote, Alan Tomkins, Dean Dennison and Michael Costin from Robert Clack Comprehensive School, Dagenham, Essex, with a program designed to assist an interior-design company. Winner of the junior competition was Truro schoolboy Paul Clark, 15 — second from the left — with a computer system for use in nurseries and garden centres. The winners of each competition were awarded £400 and a Kent Software Trophy to be held for one year. The winners' schools were presented with £1,000 worth of computing equipment. The competition is run by the University of Kent and is designed to foster an awareness among schools of the industrial and commercial uses of computer systems.

Viewdata on your micro

TELESOFT Tantel, a viewdata adaptor with RS-232 computer interface, has been launched by Tandata Marketing in association with Prestel. Software necessary for up- and down-loading the Prestel Telesoftware database has been commissioned by Prestel for the Apple, ZX-81, TRS-80 and Pet.

The software will be provided free to all buyers of the Telesoft Tantel adaptor except for Pet owners. The Telesoft Tantel costs £190 plus VAT from Tandata Marketing Ltd, Clyde House, Reform Road, Maidenhead, Berkshire SL6 8BU. Telephone: 0628 74661.

Lander EPROM

THE LM-124 EPROM programmer from Lander Microsystems is designed for use with the TRS-80 Model 1 Level II 16K Microcomputer. Housed in a plastic case, it is supplied complete with an integral power supply and a 20-page users' manual. No personality modules are required and all EPROMs can be fully programmed in one pass.

The LM-124 software includes a 256-byte page display, single interpage keystroke and full cursor control. The system is compatible with EDTASM, the TRS-80 editor/assembler.

Although designed for the TRS-80, the LM-124 hardware can be used with other microcomputers, provided they have suitable software and the necessary control signals are accessible. Adaptors and software are currently being developed to allow the LM-124 to be used with the TRS-80 Model 3 and Genie 1.

As an introductory offer, the LM-124 is available for £57.50 until June 12 when the price goes up by £10 to £67.50. More details from Lander Microsystems, 32 Clockhouse Lane, Collier Row, Romford, Essex RM5 3QJ. Telephone: Romford 26325.

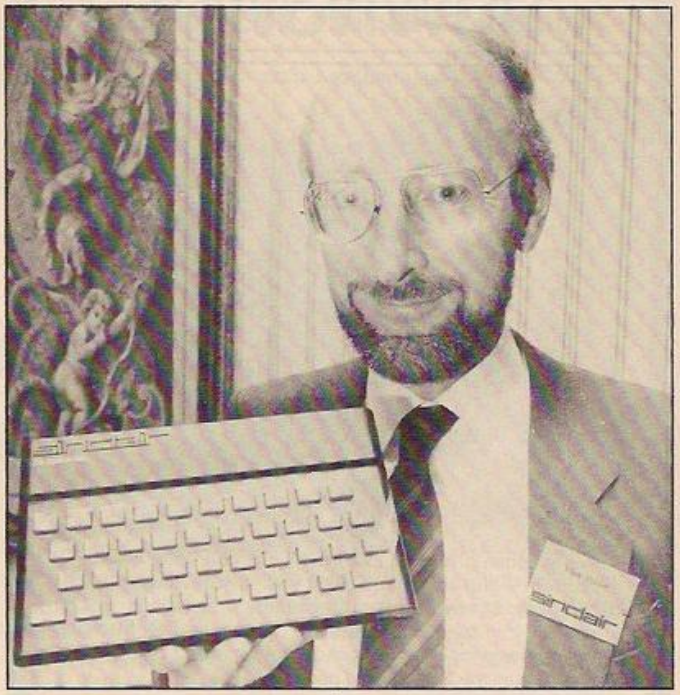
Restaurant in the sky

THE TAKE-OVER of British Airways is the objective of Airline, one of two business games for the 16K ZX-81 developed by Cases Computer Simulations. To take-over British Airways you must build up your capital by running your own airline at a profit.

Autochef is similar to Airline, but the objective of this game is to build up your company so that you can take-over Trust House Forte in the shortest possible time.

Airline and Autochef cost £4.75 each and are available from Cases Computer Simulations, 14 Langton Way, London SE3 7TL.

Sinclair softens up the cassette market



HOT ON THE heels of the launch of Sinclair's new ZX Spectrum — see Tim Hartnell's review on page 20 — Clive Sinclair has announced a new range of software for its predecessor the ZX-81. The 26 new cassettes will be available from Sinclair Research by mail order from May.

Nineteen of the new cassettes have been developed for Sinclair by ICL, the Government-backed computer firm. The remaining seven cassettes were developed by specialist software house Psion.

The Fun to Learn series consists of eight cassettes covering English literature I and II, geography, history, mathematics, inventions, spelling and music. Each cassette costs £6.95 including VAT. An additional eight cassettes, costing £4.95 plus VAT each, make up the latest set of Sinclair Research ZX-81 Super Programs series of games, quiz and conversion programs.

Other cassettes include Biorhythms, a six-level chess program and Space Raiders and Bombers. Flight Simulation puts you in the cockpit of an aircraft and judges your response to the controls and the outside world.

All the cassettes need the 16K RAM pack except for five of the Super Programs series which only need 1K. These cassettes are available from Sinclair Research Ltd, 6 King's Parade, Cambridge CB2 1SN. Sinclair has lowered the price of its 16K RAM pack from £49.95 to £29.95 including VAT. Sinclair says the reduction was caused by a major fall in chip costs. But rising production costs have caused Sinclair to up the price of its printer from £49.95 to £59.95 plus VAT.

Record 38,000 queue to visit Fair

OUR 1982 COMPUTER FAIR, held at London's Earls Court exhibition centre on April 23-25, attracted more than 38,000 people over the three days. This was the largest attendance ever at any personal computer fair in Britain. The Sinclair stand was rushed off its feet after launching the new Sinclair ZX Spectrum on the first day of the Fair.

The ZX Village was also very busy with microcomputing enthusiasts keen to discover the latest developments in ZX-80/81 hard- and software. Next year's exhibition will again be held at Earls Court on June 16-18.

Colour board wins £3,500

KEITH PURKISS, the 19-year-old who developed the first colour board for the Sinclair ZX-81, has won the £3,500 first prize in the *Daily Express*/Philishave "Get Up And Go" awards scheme.

The £17,000 award scheme was launched in January to encourage 16- to 21-year-olds to come forward with their own ideas for a workable business or project.

Keith Purkiss set up his own business — Haven Hardware — in July last year to design and market a range of computer hardware. The company's products include a programmable character generator, rotating key module, I/O port, memory expansion unit and a full-size keyboard for the ZX-81. Purkiss is currently working on nine more boards, including an inverse video for the ZX-81.

Thumper bites the dust

THE BRITISH HEAT of the Euromouse Maze Contest, held at the Computer Fair, was an absorbing battle. The pre-match favourite Thumper was beaten into fifth place by Alan Dibley's T3, Yet another Theseus, which found its way to the centre of the maze in a best time of one minute and 13 seconds.

David Woodfield's Thumper, which was credited with unofficial practice times of one minute dead and one minute and 13 seconds, mistook a piece of white tape for a wall and failed to reached the centre of the maze. First prize consisted of a trip to Haifa, Israel, in September, to represent Britain in the Euromouse Maze final. Second prize was a Sinclair ZX Spectrum won by Alan Dibley's Son of Theseus in a time of three minutes and 21 seconds. Phil Yeardley of Sheffield halted Alan Dibley's run of success by taking third place with Brainy Bricks in a time of four minutes and 53 seconds. He was awarded the latest Armdroid Robot.

Tony Porter's Maisymouse finished fourth, Alan Dibley's original Theseus came sixth while David Buckley's Marvin ended up in seventh place. All the contestants received one year's free subscription to either *Practical Computing* or *Your Computer*.

Alan Dibley watches anxiously as T3 storms to victory.

DOWNSWAY

ELECTRONICS (UK) LTD

Now, you can give your ZX81 more memory than a 48K Spectrum — for less than £50! If you already have a 16K RAM pack, of any make and regardless of condition, you can trade it in for **£12.50** against a Downsway 64K Memory, bringing the price down to only £47.45 (plus £2 p&p), compared to the Spectrum's price of £175!

Without trade-in, the Downsway 64K Memory costs just £59.95 plus p&p — still incredible value!

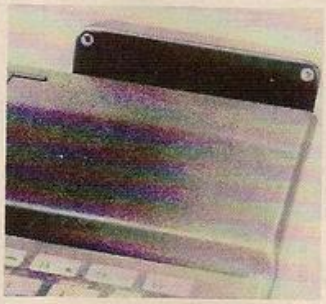
The 64K Memory gives 56K of available memory, and simply plugs into the ZX81 without needing an additional power supply, or adding any extra load to the internal 5V regulator.

Should you only need 16K of memory for your ZX81, the Downsway 16K RAM Pack offers the same benefits of high standards and low price at ony £24.95 plus p&p.

The slim, "low-profile" styling of both memories compliments the ZX81, and a special foam cushion provides added mechanical stability.

Naturally, Downsway add-on memories are fully tested and guaranteed, but should you be dissatisfied for any reason, just return the memory within 14 days for a full refund (and your old 16K RAM pack, where appropriate).

Please allow up to 28 days for delivery.



Order Form

To: Downsway Electronics (UK) Ltd
Downsway House, Epsom Road,
Ashtead, Surrey.

Please send me:

Qty	Item	Price	Total
	64K Memory at special trade-price (my old 16K RAM pack is enclosed)	£47.45	
	64K Memory at normal price without trade-in	£59.95	
	16K RAM Pack	£24.95	
Post and Packing			£2.00
Total			£

My cheque/P.O./Money Order is enclosed

NAME: _____

ADDRESS: _____

_____

_____

YC6

ZX81 16K

ZX-MC

- **ELIMINATE MACHINE CODE PROBLEMS** with ZX-MC — a new machine code debug/monitor for the ZX81 16K.
- **ENTER, RUN & DEBUG** your machine code programs independently of Basic commands. ZX-MC resides in RAM, and leaves you 12½K of memory to work with.
- **SAVE & LOAD** your machine code programs **AT DOUBLE SPEED.** At last you are freed from storing your M/C in arrays or REM lines.
- **REGISTERS DISPLAY & BREAK POINTS** to make de-bugging easier — PLUS many more useful commands.
- **A MUST FOR BEGINNERS & ADVANCED USERS** — concentrate on your M/C programs, not on how and where to store them.
- **ZX-MC** is supplied on a high quality cassette, with a 36 page operating manual.

£7.50 Incl. VAT & P+P (C.W.O.)

SAVE & LOAD DATA FILES AT DOUBLE SPEED

SCREEN KIT 1

A suite of machine code routines for use in Basic programs, to enhance your screen display, and create DATA FILES on cassette. Screen Kit becomes part of your Basic program.

- **DATA FILES** — Save & Load, at double speed, just the Basic variables. Load different variables into the same program, or exchange variables between programs.
- **DRAW A BORDER**
- **KEYBOARD SCAN + FLASHING CURSOR**
- **CLEAR PART OF SCREEN**
- **LOAD ANY CHARACTER TO WHOLE SCREEN**
- **INVERT VIDEO OF PART OF SCREEN**
- **MEMORY LEFT**
- **CLEAR SCREEN BY SCROLLING UP, DOWN, LEFT OR RIGHT**
- Supplied on cassette with instructions.

£5.70 Incl. VAT & P+P (C.W.O.)

Send SAE for more details. Allow up to 14 days for delivery.

Programs available mail order only. Please make cheques/PO payable to:

PICTURESQUE **6, Corkscrew Hill, West Wickham, Kent BR4 9BB.**

Educational Software for
ZX81 — BBC — ZX82

Programs for learning at home and at school.

- Written by teams of teachers and programmers.
- Primary — secondary — FE.
- English, French, geography, maths, sciences, etc.
- Excellent reviews.

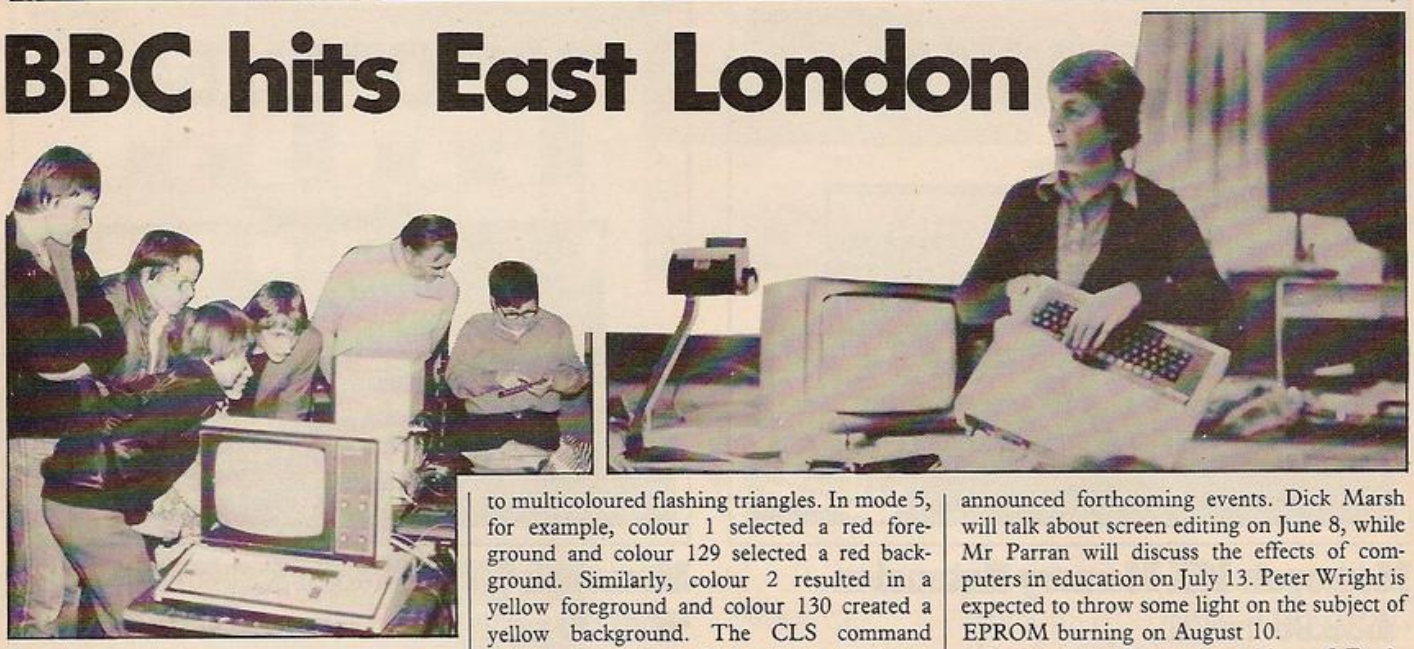
Send s.a.e. for details to:

AVC SOFTWARE
PO Box 41S
BIRMINGHAM B17 9TT

COMPUTER CLUB

Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. Each month we will devote the page to new ideas from local clubs. We would like to hear of anything which has made a club a success, or of any projects or programs you are developing.

BBC hits East London



The books' days are numbered at Harrow Green library. On the second and fourth Tuesday evenings of every month, local micro enthusiasts gather there to develop their expertise. Brendon Gore went along to check out the East London Amateur Computer Club.

JANET CORNISH, one of the 12 who founded the club in 1978, introduced the BBC Microcomputers, and pointed out that the Model B had eight display modes, while the Model A only allowed modes 4,5,6 and 7.

The three Model Bs at her disposal proved that Acorn is finally clearing some of its backlog. Janet Cornish used different colour modes to create a variety of shapes from a simple map to multicoloured flashing triangles. In mode 5, for example, colour 1 selected a red foreground and colour 129 selected a red background. Similarly, colour 2 resulted in a yellow foreground and colour 130 created a yellow background. The CLS command cleared the screen to the background colour.

The Draw command, which can be used in modes 0,1,2 and 4, enables you to draw a line from the pre-set cursor position to the specified x and y values. Thus Move 300,200 and Draw 1000,1000 sets the cursor position and draws a line to the required spot on the screen. The screen is addressed as x, points 0-1279 and y, points 0-1023, she noted.

Character redefinition

VDU can be used to redefine the character set, change the colours in different modes and to set up your own text windows. VDU 4 separates the text and graphics cursors, enabling you to operate both inside and outside the text window, while VDU 5 reverses the process.

The talk was warmly received by the 40 members present. Club chairman Fred Linger announced forthcoming events. Dick Marsh will talk about screen editing on June 8, while Mr Parran will discuss the effects of computers in education on July 13. Peter Wright is expected to throw some light on the subject of EPROM burning on August 10.

A previous talk on the subject of Forth, given by Mike Curtis of the Willesden College of Technology, spawned a Forth interest group inside the club. Other club activities include a library of books and programs, and a monthly newsletter edited by Ed Lepley and Jim Turner. The newsletter carries information about the club and its members, tips on hardware and software problems and lists future events. A monthly puzzle, for club members only, is also a popular item.

Mode	Graphics	Colours	Text
0	640 by 256	2	80 by 32
1	320 by 256	4	40 by 32
2	160 by 256	16	20 by 32
3	—	2	80 by 25
4	320 by 256	2	40 by 32
5	160 by 256	4	20 by 32
6	—	2	40 by 25
7	Teletext	2	40 by 25

BBC graphics mode.

The March puzzle consisted of writing a Basic program to input any two numbers and print them in ascending order of value. To make it a little more difficult entrants were not allowed to use Calls to machine code, USR, Peek, Poke, Data statements or calls to other monitor routines. In addition, entrants were not allowed to use Basic comparative commands such as If — Then or On — Goto or Gosub.

The simplest solution to the puzzle, published in the club's April newsletter, consisted of the following program:

```
10 INPUT "Enter 2 numbers";A,B
20 PRINT (A+B-ABS(A-B))/2
30 PRINT (A+B+ABS(A-B))/2
40 GOTO 10
```

Club membership costs £4 a year for adults and £2 a year for students and old-age pensioners. More information is available from the club's publicity officer Jim Turner, 63 Millais Road, London E11 4HB. ■

Local society news

Laserbug

LASERBUG IS THE London and South East Region BBC Microcomputer Users' Group. A newsletter edited by Trevor Sharples aims to share ideas and discoveries about the BBC Microcomputer. Laserbug also hopes to encourage the setting up of local groups under its banner. A year's subscription to Laserbug costs £12. For further details write to Laserbug, 4 Station Bridge, Woodgrange Road, Forest Gate, London E7 0NF.

Vic-20 User Group

MATTHEW STIBBE of The Lawn, Lower Woodfield Road, Torquay, South Devon, hopes to start a Vic-20 user group and software library. Anyone wishing to borrow or contribute programs for the Vic-20 should contact Matthew Stibbe at the above address.

Norwich BBC User Group

MEETINGS OF THE Norwich and District BBC Microcomputer User Group are usually held twice a month at the Norwich City College. They consist of either a computer workshop or a talk about some specific area of microcomputing. For more details contact Paul Beverley at Room 12a, Norwich City College, Ipswich Road, Norwich, Norfolk, NR2 2LJ.

North Wiltshire Club

NORTH WILTSHIRE Computer Club meets at Holt village hall on the second and fourth Wednesdays of each month. Everyone is welcome, from the absolute beginner to the expert, on payment of 50p entrance fee. More information from Matthew Jones, Pinhills, Bowood, Calne, Wiltshire, SN11 0LY.

Memotech's New Memory System for the ZX81

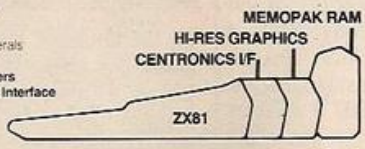
It grows as you progress

Memopak 16K Memory Extension - £39.95 incl.VAT

It is a fact that the ZX81 has revolutionised home computing, and coupled with the new Memopak 16K it gives you a massive 16K of Directly Addressable RAM, which is neither switched nor paged. With the addition of the Memopak 16K your ZX81's enlarged memory capacity will enable it to execute longer and more sophisticated programs, and to hold an extended database.
The 16K and 64K Memopaks come in attractive, custom-designed and engineered cases which fit snugly on to the back of the ZX81, giving firm, wobble-free connections.
See below for ordering information.

Coming Soon...

A complete range of ZX81 plug-in peripherals
Memotech Hi-Res Graphics
Centronics Interface and Software Drivers
Memotech Digitising Tablet **RS232 Interface**



All these products are designed to fit 'piggy-back' fashion on to each other, and use the Sinclair power supply.
WATCH THIS SPACE for further details. We regret we are as yet unable to accept orders or enquiries concerning these products – but we'll let you know as soon as they become available.

How to order your Memopak.

By Post: Fill in the coupon below and enclose your cheque/P.O./Access or Barclaycard number.

By Phone: Access/Barclaycard holders please ring Oxford (0865) 722102 (24-hour answering service).

Memopak 64K Memory Extension - £79.00 incl.VAT

The 64K Memopak is a pack which extends the memory of the ZX81 by a further 56K, and together with the ZX81 gives a full 64K, which is neither switched nor paged, and is directly addressable. The unit is user transparent and accepts basic commands such as 10 DIM A(9000).

BREAKDOWN OF MEMORY AREAS

0–8K . . . Sinclair ROM
8–16K . . . This section of memory switches in or out in 4K blocks to leave space for memory mapping, holds its contents during cassette loads, allows communication between programmes, and can be used to run assembly language routines.
16–32K . . . This area can be used for basic programmes and assembly language routines.
32–64K . . . 32K of RAM memory for basic variables and large arrays.
With the Memopak 64K extension the ZX81 is transformed into a powerful computer, suitable for business, leisure and educational use, at a fraction of the cost of comparable systems.

Unique 3 month trade-in offer!

When your programming needs have outgrown the capacity provided by 16K RAM, and you find it necessary to further extend your ZX81's capacity, we will take back your 16K Memopak and allow a discount of £15.00 against your purchase of our 64K model.*

**We reserve the right to reject, for discounting purposes, units which have been either opened or damaged in any way.*

Please make cheques payable to Memotech Limited
Please debit my Access/Barclaycard* account number

*Please delete whichever does not apply.

SIGNATURE _____ DATE _____

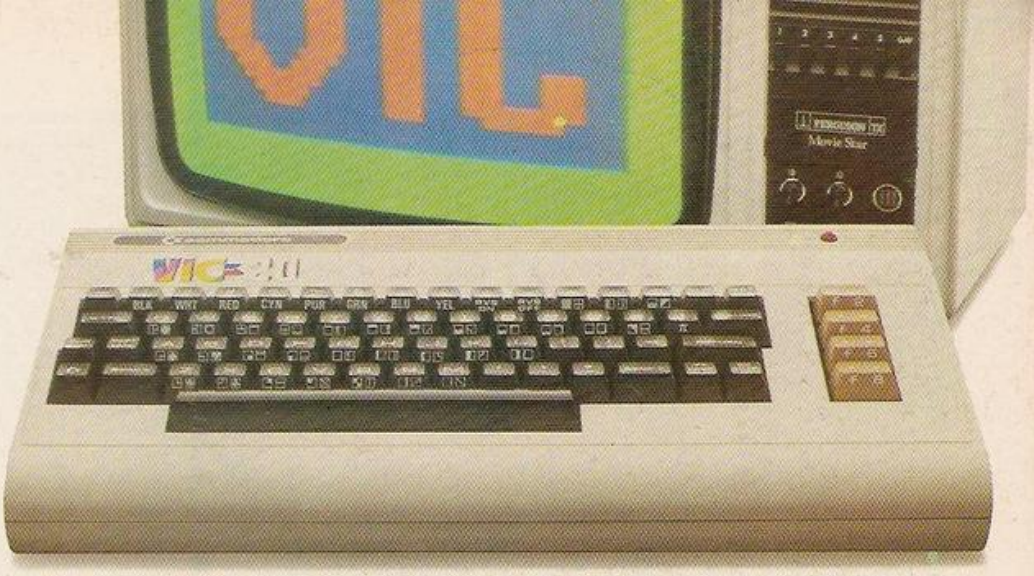
Please send me:

	Quantity	Price	Total
16K RAM, Assembled		£39.95	
64K RAM, Assembled		£79.00	
		Postage	£2.00
		Total Enclosed	

NAME _____ ADDRESS _____

We want to be sure you are satisfied with your Memopak – so we offer a 14-day money back Guarantee on all our products.

Memotech Limited, 3 Collins Street, Oxford OX4 1XL, England Telephone: Oxford (0865) 722102/3/4/5



"Give me one good reason why I should choose a VIC 20 home computer."

1. VIC is outstanding value for money. No other colour home computer can give so much for under £200.

2. Total standard memory 25K made up of 20K ROM and 5K RAM.

3. Fully expandable to 32K of user RAM.

4. Microsoft Basic interpreter as standard.

5. Accessible machine language as standard.

6. Connects direct to monitor or standard television.

7. Full size typewriter-style keyboard.

8. Full colour and sound.

9. All colours directly controllable from the keyboard.

10. 62 predefined graphic characters direct from the keyboard.

11. Full set of upper and lower case characters.

12. 512 displayable characters direct from the keyboard.

13. High resolution graphics capability built into the machine.

14. Programmable function keys.

15. Automatic repeat on cursor function keys.

16. User-definable input/output port.

17. Machine bus port for memory expansion and ROM software.

18. Standard interfaces for hardware peripherals.

19. VIC 20 is truly expandable into a highly sophisticated computer system with a comprehensive list of accessories (see panel below).

20. Full range of software for home, education, business and entertainment on disk, cassette and cartridge.

21. Books, manuals and learning aids from Teach Yourself Basic to the VIC programmers' reference guide (a must for advanced programmers).

22. Full support for VIC owners – their own magazine 'VIC Computing' as well as a national network of VIC user groups.

23. National dealer network providing full service and support to VIC owners.

24. Expertise and experience – Commodore are world leaders in microcomputer and silicon chip technology.

25. Commodore is the leading supplier of micro-computers in the UK to business, schools, industry and the home.

26. VIC 20 is the best-selling colour home computer in the UK.

How many reasons was it you wanted?

Accessories include:

- Cassette tape unit.
- Single drive 5¼" floppy disk unit (170 K bytes capacity).
- 80-column dot matrix printer.
- 3K, 8K and 16K RAM expansion cartridges.
- Programming aid packs; machine code monitor cartridge, programmers' aid cartridge, high resolution graphics cartridge.
- Plug-in conversion box for a full 32K, 40-column x 25 lines VIC including Prestel compatability.
- Prestel/Tantel interface package.
- RS 232C communication cartridge.
- Memory expansion board
- IEEE/488 interface cartridge.
- Joysticks, light pens, paddles and motor controllers.

commodore

VIC 20

The best home computer in the world.

FOR MORE INFORMATION ON THE VIC 20, TELEPHONE OR WRITE TO: COMMODORE INFORMATION CENTRE, BAKER STREET, HIGH WYCOMBE, BUCKS. TEL: SLOUGH 79292.

REVIEW

SINCLAIR ZX

The new Sinclair has arrived at last — a book-sized micro-computer with colour and sound and an extended version of ZX Basic. It came through its test well ahead of the competition but, as Tim Hartnell found, even Sinclair Research cannot work miracles.

LAUNCHING THE SPECTRUM, Clive Sinclair confessed that there had been considerable disagreement within his organisation over the name of the new computer. "At one point", he said, "we thought of calling it 'Not the BBC Micro'". In March last year, Sinclair unleashed an angry tirade against the BBC for giving Acorn the right to make the computer for the TV series, saying that he had told the BBC he could produce a computer — within their specifications — for just over £100. The ZX Spectrum is the fulfilment of that promise.

The Spectrum has eight colours, a built-in sound generator and loudspeaker, and the closest Sinclair Research has come to a "real" keyboard. Its specifications exceed those of the Model A BBC machine, and come close to the Model B in many areas. At just £125 for the 16K model, the Spectrum is the same price as a ZX-81 with 16K pack when first launched. With 48K the Spectrum costs £175.

The Spectrum uses a "superset" of ZX-81 Basic, and any ZX-81 program can be typed in with the minimum of changes; ZX-81 tapes cannot be loaded into the Spectrum. The new computer loads and saves much more quickly than does the ZX-81, at 1,500 baud as against around 250, and the upward compatibility of listings should mean a lot to organisations like Muse which are building up a library of educational ZX software. Publishers of ZX literature or ZX software breathed a sigh of relief on hearing that ZX-81 listings could be entered directly.

The Spectrum works in upper- and lower-case letters, and does so like a typewriter: capital letters appear only when you use the shift key. The computer does not differentiate between upper and lower case when naming variables — so A$ is the same as a$ — and will ignore spaces in variable names.

The range of characters is standard, and symbols such as ! and # are available on a ZX machine for the first time. There is a range of three different curly brackets and a cute little © copyright sign.

The © sign, and the words "Sinclair Research Ltd" appear on the screen in black letters on a white ground when you first turn it on. Pressing New LList or Copy produces some remarkable flashing-border displays, and in Save and Load you are treated to a lollypop-striped screen in reds, blues and yellows.

The error codes are fascinating, and in English rather than the odd little numbers and letters of the ZX-80 and ZX-81. If all goes well in a Load, a Save, a program execution or whatever, the computer prints "OK" at the bottom of the screen. If you manage to make it swallow an incorrect line or parameter — which is difficult to do, because all lines are checked for syntax before being accepted into the main body of the program — the computer prints the delightful line

Nonsense in BASIC.

Whoever wrote the ROM had a sense of humour.

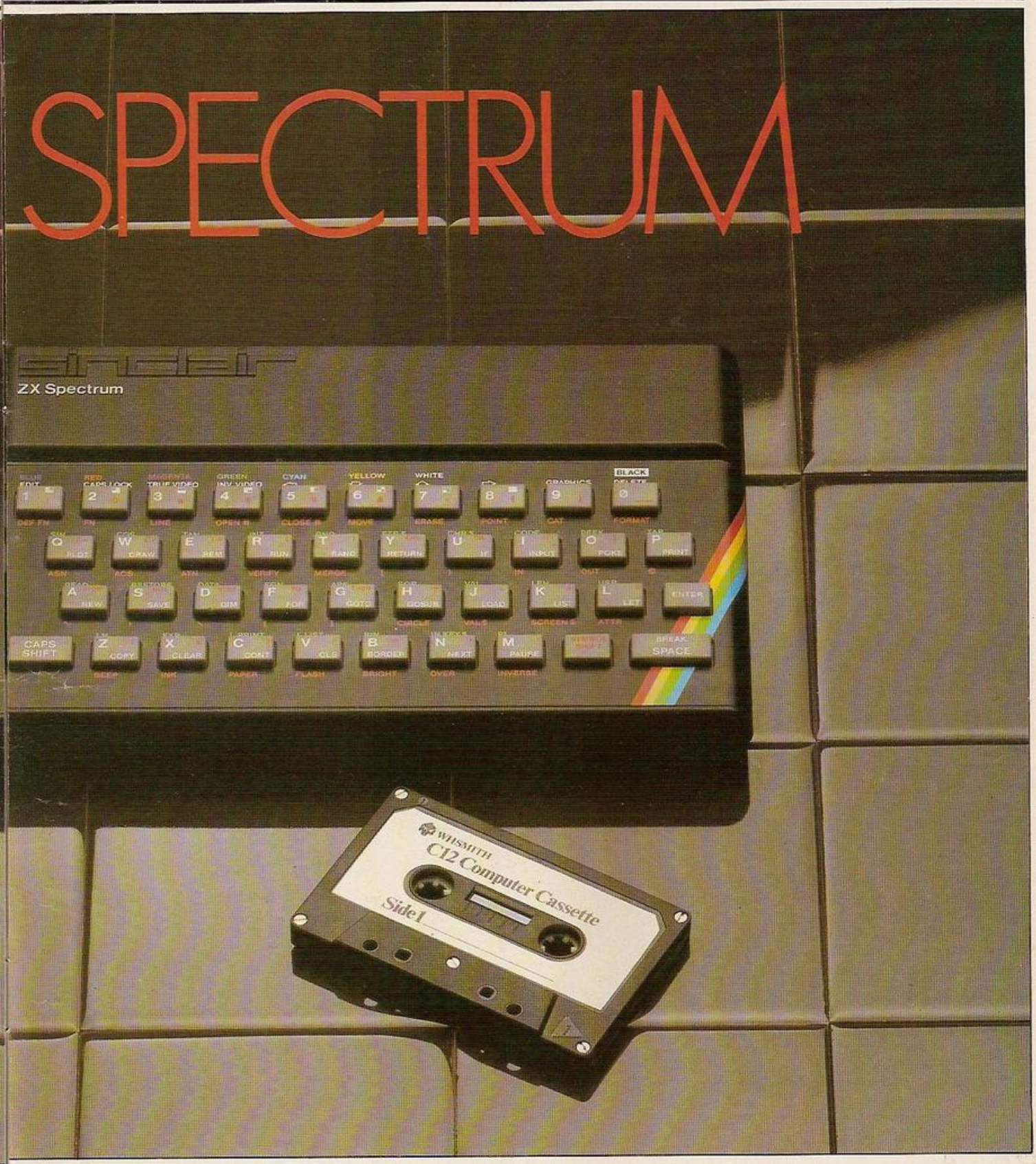
There is much in Spectrum Basic to tempt you to enhance your programs. It includes Beep, a single-channel "music" command with both duration and pitch under user control, Ink to determine the colour of the Print output and Paper for the background colour. The Border command allows the area round the main display to be independently coloured and changed, Flash sets all Printed material flashing into its inverse colour, and Bright intensifies the colour of selected pixels.

All commands can be put into a Print, or Input statement, such as

PRINT PAPER 4;INK2;AT 10,10;"hi there"

for red letters on a little green strip just underneath the letters, or can be entered within the program to alter everything that comes afterwards. A line reading Ink 1 followed by Paper 6 will make all printed matter blue, and the whole screen yellow; Border 2 puts a bright red frame around the screen. The colours are easy to use, and the keys are clearly marked, with the colours they represent.

The screen is memory-mapped and the computer runs as fast as the ZX-81 does in Fast mode, but with a rock-steady permanent display. Nevertheless, the ZX Basic is considerably slower than BBC Basic. High-resolution graphics of 256 by 192 can be achieved, and the Plot command works on a grid this size, but the control is not available to



the same resolution. Colour works on a grid of 32 by 22, the same grid as for letters. Read, Data and Restore are available, as well as Def FN and FN, and enhance the capabilities of the computer considerably.

It is obvious that Sinclair has listened to those who have criticised some shortcomings of the ZX-80 and ZX-81. The Load and Save procedures on the earlier machines, in particular, left a great deal to be desired. The Spectrum Loads in blocks, sets the record level automatically and suppresses noise. Once you think you have a program successfully on tape — and before you New it from the computer — you can play it back into your computer using the Verify command, to make sure it is there safely. The very first program I attempted to save on the Spectrum Saved, Verified and Loaded successfully at first attempt.

The new Load and Save, along with the fact that the memory can be relied on not to drop out unexpectedly, make working with the ZX Spectrum a pleasure. The awful fear that your carefully keyed-in program is about to vanish into thin air has been banished. The 16K or 48K memory is permanently fixed inside the Spectrum. You cannot use the ZX-81's 16K pack, though the new computer does operate the ZX printer.

The ZX Spectrum is small and flat, rather wider than the ZX-81 but not as deep. The

(continued on next page)

(continued from previous page)
keys are rubbery, and appear to press on to a standard ZX keyboard. You can use them without looking at the keyboard, once you know your way around it, and a touch-typist will soon feel at home. The key action is positive — although you need to squeeze the keys rather than press them — and there is no need to keep checking the screen to see that each keystroke has been entered.

All keys have auto repeat, which is a boon for running out parts of lines or for moving the cursor along the long line you wish to edit. The Spectrum makes a clicking noise while auto repeat is working. If you start the auto repeat with a key which requires Shift such as Delete you can take one finger off the Shift and just leave it on the Delete key once the auto repeat is underway. The Edit facility is the simplest to use of any computer on the market, it is better than that on the BBC Micro, except that you cannot join together parts of separate program lines.

Symbols and keywords

The keys on production models are to be light-blue, with the alphanumeric symbols and keywords marked in white. Function symbols such as ?, At, Then and + are in red.

Sinclair invented the "one-touch key" system for the ZX-80, which ensured that the computer knew that the first key pressed after a line number, or after the word Then, would produce a keyword, such as Let, Print, Poke or Goto. This meant that programming was fast and positive. The ZX-81 demanded a sequence of key presses — such as Shift, then Function, then a key — to get the results you wanted. Sinclair is obviously wedded to the one-touch entry system, but it is really not suited to the Spectrum. The sequence of key presses required for Ink and Atn, for example, requires the same number of key presses as would be needed to type the word in directly.

There are now two Shift keys, a white one and a red one. The white one works like the standard shift key on a typewriter, turning lower-case letters into capitals and, in the Graphics mode, producing the graphic rather than the number from the keys 1 to 8. The red Shift key, on the bottom right-hand corner of the keyboard, is used for words such as At, Or, And, Then and Step, along with the full stop, the colon for multi-statement lines, and the $ sign. The = sign is also accessed by using this shift, then pressing L, but as these are next to each other, you will soon find yourself pressing both keys at once with your right hand to enter the = sign.

You must press both shift keys at once, followed by another key press, to enter words such as Int, Rnd, Chr$ and Codes. Other commands, such as Ink, Paper and Beep, require both shift keys to be pressed at once, then the red one to be held down while the relevant key is pressed.

Unfortunately, the command New is as easy to access as Print and Goto — no Shift keys or juggling needed. This is sure to result in programs being wiped accidentally, especially as New lies between Copy and Plot. By contrast, the harmless Stop command, on the same key, needs two key presses. Designing the New like this suggests that not enough thought has been given to human behaviour.

Other aspects of the keyboard show more care in their design. The Then and Goto are on the same key, as these are often accessed one after the other; the same goes for For and To. There is a single apostrophe — a wise lesson learned from Atom and BBC Basic — to move the Print statement down a line, so

```
PRINT ' ' "HI"
```

will skip two lines before printing the word "HI".

The List command takes some getting used to. Pressing List will give you a page of program, then the message

```
scroll?
```

will appear in the bottom left-hand corner. Pressing any key except "n" allows the listing scroll to continue, page by page. The current-line cursor, an inverse > symbol on the ZX-81, has been replaced by the same symbol displayed in normal mode. It is not particularly easy to see, and you can spend a lot of time running your eyes up and down the column after the line numbers to find it. Using List n to find a line you have requested is almost comically difficult.

The Beep command is simple to use, and the volume from the internal speaker is adequate. The sound output can be tapped from both the Mic and Ear sockets at the back, to drive an earpiece or to feed into an amplifier. The word Beep is followed by two parameters. The first is the duration of the tone in seconds — fractions of a second, such as .05 or 17/36, are also accepted — followed by a comma, followed by the frequency. Middle-C is a 0, so

```
Beep 1,0
```

will play middle-C for one second. Higher numbers produce higher notes, with negative numbers for notes below middle C. There is a range of around 130 semitones, and fractions of a tone are accepted.

The graphics are a development from those of the ZX-81. All the standard ZX symbols are there, made from quarters of a character square, with black and grey, along with their inverses. The new Draw command draws a remarkably fine line from the co-ordinates of the Plot command and can therefore be used as a substitute for Move. The Draw command can also be used to draw parts of circles by adding a third parameter, the angle to be turned through. The Circle command — naturally enough, it draws a circle — needs three parameters: the x and y co-ordinates of the centre, and the radius. The circles drawn appear very close to true circles, especially if a fairly large radius is used.

Lower-case letters

The lower-case letters, formed on an eight-by-eight character grid, are fairly good, although the descenders only go down one pixel.

You can define up to 21 of your own characters, using a remarkable function called Bin — for binary — which allows character shapes to be Poked into position. The new character can be assigned to any key. Chr$8, is a back-space which does not erase the character, and you either overprint, using the command Over, or underline. Far more sophisticated than on the ZX-81, the Spectrum graphics will prove a boon for improving screen and printer output, although they will also be more difficult to master.

It is good that Sinclair has decided not to kill the ZX-81 as it is still the ideal first computer. Those who know how to program a ZX-81 will find they can gain reasonable facility with the Spectrum within a couple of hours. After countless hours staring at the black, greys and whites of the dumb ZX-81, the brilliant colours and the Beeps from the Spectrum will ensure that even your dullest programs at least look interesting.

CONCLUSIONS

- With powerful colour and sound commands, the ZX Spectrum is a remarkable computer, exceeding the BBC Model A in specification.
- Its use of a Basic very similar to that of the ZX-81 provides a ready-made source for software, though ZX-81 tapes cannot be loaded into the Spectrum.
- Programs can be saved and loaded without the problems which plague the ZX-81. Built-in memory means that sudden program loss should no longer be a problem, but ill-considered keyboard design means that programs could still be lost by inadvertently keying New.
- The moving-key keyboard is an improvement on the touch-sensitive board.
- The one-touch entry system, retained from the ZX-81, is not suitable for the Spectrum and leads to complicated multi-shift operations when keying some functions. It should have been discarded.
- Despite minor faults, the Spectrum is way ahead of its competitors. There is certain to be a rush for orders. ■

ZX81

16K PACK 123

Pack 1, 2 & 3 include all of:
AIR TRAFFIC CONTROL: Animated radar screen of busy airport shown. You must bring planes into land; INVADERS SELFPLAY; PHONEBOOK — keep friends' and relatives numbers on cassette. COMPUTER DATING, who will it pick for you and those around you for a laugh. ADVENTURE ATLANTIC: you may become very rich or marooned forever. BREAKOUT: SQUASH: LANGUAGE TRANSLATOR: translates any European language to any other. COMPUTAPUNT: predict horse races and football pools with you ZX. INDISCO, video roadracer. DRAUGHTS computer chequers, with kings. BATTLESHIPS, nautical naval battle at home. MASTERMIND: brain teaser, see if you can beat a microelectroic mind.
THIS MASSIVE PACK OF SOFTWARE IS ONLY **£5.00**

NEW ZX ADVENTURE

A brand new release, this package of adventures written in Basic and Machine Code are the best value and quality available. Just compare them with others!

1. GOLF: one or two players have a matchplay off with handicaps and progress around an 18-hole course which is superbly detailed with bunkers, lakes, trees, bushes and greens. We think you will agree this game has the best graphics available for the ZX81.

2. DAMSEL IN DISTRESS: you are the knight in shining armour, your quest is to ride to a vast castle and rescue your princess and release her from the clutches of an evil witch. You must dream up a spell to destroy the old witch and collect enough gold to bribe the guards. A very Bewitching Adventure program.

3. STORM THE TOWER: as the General of a medieval army you must deploy your arms and men so you can attack an enormous castle with a huge tower. You must build armaments and prepare for the correct hour to attack but beware of rearguard action and consider intelligence reports with care!

ADVENTURES £8.00

ZX BUSINESS SYSTEM

Now installed in many businesses, comes with PURCHASE, SALES LEDGER for 100+ entries per week, does daybook analysis, VAT incl. and excl., totals, password protection plus many more excellent features. You also get a STOCK CONTROL, MAIL LIST and PHONEBOOK. Easy to use, designed for everyday small businesses. Includes instruction book and tape. **£17.00 incl. VAT.**
And does the job of systems costing hundreds of pounds.

ZX AUTOCODER

Writing machine code?
Some love it, some hate it but AUTOCODER just gets on with it. Helping you produce machine code programs from BASIC. Easy to use and very helpful. Converts PRINT, PRINTAT, IF THEN, GOTO, GOSUB, LET INKEY$, POKE, PEEK, CLS, etc.

ALL £5.00 incl.

MORE DEALERS ARE INVITED

VIC

VIC SOFT 7 includes all of:
DEATHRACE 2000: You must runover as many old men and dogs as you can without crashing into parked cars.
MOROIDS: The Asteroids will try to crash into your Astronaut, you must keep him alive — very fast graphics.
WARLORDS: Defend your castle against a giant boulder that is crashing around destroying enemy forts.
BREAKOUT: The noisiest and most colourful you've seen.
SQUASH: Features on-screen scoring, and test your reflexes.
SOUNDS: Menu driven sound synthesizer program.
MASTERMIND: Can you beat a multicolour microelectronic mind.
ALL programs use the full sound and colour capabilities of the VIC to the utmost.

ALL FOR £6.00

ATOM

ATOMSOFT 4 includes all of:
ASTRO BATTLE ZONE: You view the earth below your space, suddenly UFOs come at you, the engines roar as you climb to the stars.
DEFENDER: Thrust, laser, climb, fire at enemy. Superbly detailed.
TRIDENT: A superb game, you are a sub-commander. Realistic sonar sound effects, and the 30 graphics of enemy ships appear, you must fire torpedos.
STAR TREK: Best version available. Sound effects in animated battle sequences. You need a 12K ATOM as all use Hires memory area.

ALL AT £7.00

BBC NOW AVAILABLE

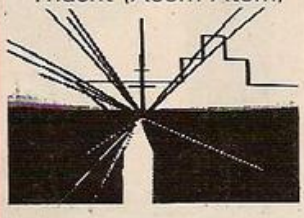
Countryside £7.00
EARLY WARNING, BBC computer version of missile command £7.00
Business Systemm £17.00. Disassembler £5.00

All prices incl. VATR and p&p. Please send to:
CONTROL TECHNOLOGY, 39 Gloucester Road, Gee Cross, Hyde, Cheshire SK14 5JG (061-368 7558).

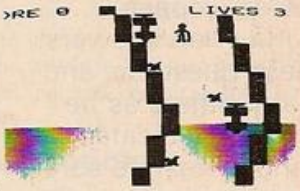
SUPER SOFTWARE
AVAILABLE FROM
CONTROL TECHNOLOGY

NEW RELEASE

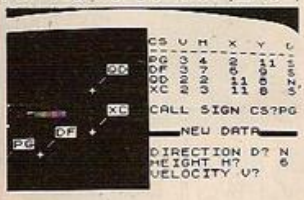
Trident (Acorn Atom)



Death Race 2000 (Vic 20)



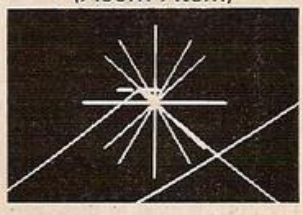
Air Traffic Control (ZX81)



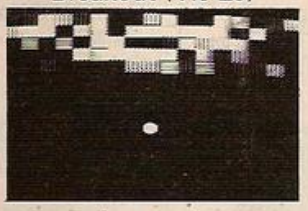
Warlords (Vic 20)

Moroids (Vic)

Astro Battle Zone (Acorn Atom)

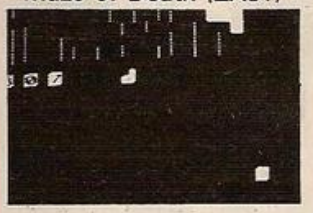


Breakout (Vic 20)



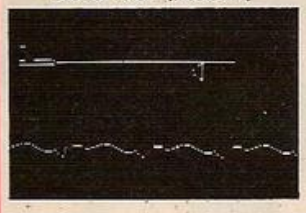
Draughts (ZX81)

Maze of Death (ZX81)

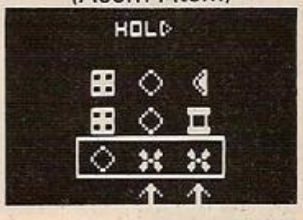


Breakout (ZX81)

Defender (Acorn)



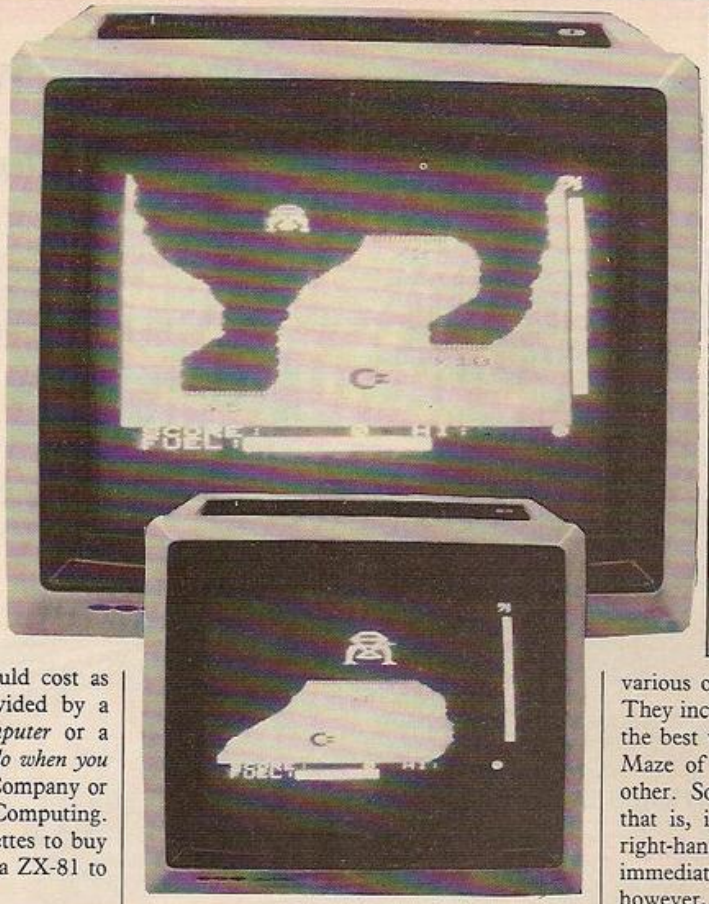
Fruit Machine (Acorn Atom)



Please send me as soon as possible the following:
☐ _____ £_____
☐ _____ £_____
I enclose a Cheque/P.O. for the total £_____
NAME _____
ADDRESS _____
_____ POSTCODE _____

VIC–20 SURVEY

Which breakout bat moves too slowly to catch the ball? Which version of space invaders is so tinny that it has become known as "the massacre of the saucepans"? Boris Allan answers these questions and many others as he and his dedicated band of testers sort cassette and cartridge programs for the Vic into the good, the bad, and the ugly.



A FEW PROGRAMS on cassette could cost as much as the 300 programs provided by a year's subscription to *Your Computer* or a book of listings such as *What to do when you hit return* by People's Computer Company or *Basic computer games* by Creative Computing. At about £6, it takes only 22 cassettes to buy another Vic, and 10 or 11 to buy a ZX-81 to extend your experience.

Assessing true value

The cost of most of these programs is even more surprising when one considers that some very good disc-based Adventure programs for larger microcomputers cost only £15 — and some of those programs have really excellent graphics. Given the quality of the majority of programs tested, and taking into account the cost of the cassette, and postage and packing, to sell them at more than £1.50 could reasonably be viewed as expensive.

Obstacle or Maze is probably the most popular games variant. These are games in which you have to find your way through a maze or a minefield where you must dodge various obstacles which are fixed or moving. They include Bug-Byte's Vicmen, in our view the best version, at one extreme and Abacus' Maze of Death, the least impressive, at the other. Some programs had wrap-around — that is, it was possible to disappear on the right-hand side of the screen only to appear immediately on the left. It was not possible, however, to disappear at the bottom to reappear at the top. This wrap-around often seemed uninentional, and is easily explained if you study the way the screen is organised on the Vic.

On the Vic, the screen is arranged in 23 lines of 22 characters, and each location on the screen is given a number. For four lines of four characters, the numbers might be:

32	33	34	35
36	37	38	39
40	41	42	43
44	45	46	47

So, moving along the top line from left to right, to go to the right of the top-right location, 35, is to move to position 36, which is on the second line down, on the left. To move upwards in a straight line one subtracts 4, 45, 41, 37, 33, and so one does not wrap-around at the bottom. This facility is used to greatest effect in Vicmen.

Variations on a theme

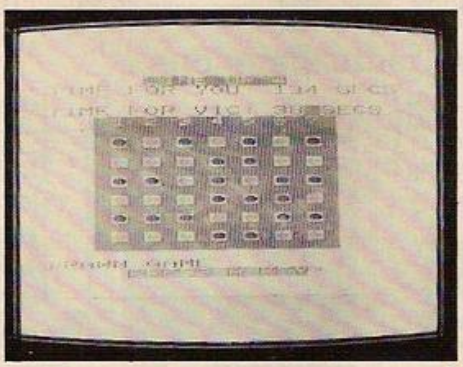
Breakout programs are variations on the "knock bricks out of a wall" theme, and none of the ones tested is an improvement on a game in Integer Basic for the Apple II — though that game uses paddles or joystick. Most of the programs in this category strive for originality in many ways, but why change from the best version? All these programs used keys, and in at least one case — Blastout 1 from Neme Software — the bat moved so slowly that it could not catch up with the ball.

The breakout style of program uses real-time control, as do some of the maze or obstacle programs: real-time control is where the user has to manoeuvre in a continuously varying situation. This category includes various types of road race, landing a spaceship safely by use of a visual display — not to be confused with an older type of program called Lem in which the only useful information is height, speed, and fuel. Perhaps the best of this category is the Commodore cartridge Road Race and the worst is probably Monaco GP from Abacus.

In the space invaders or war games category we have all the many variants of space invaders, and the various other shooting games — some played against the computer and some against an opponent. In our view, by far and away the worst program was Bridge Software's Vic Invaders — it was suggested by one of the test panel that it be renamed "The massacre of the saucepans" — while dK'tronics' Rox and the Commodore cartridge Avenger seemed to be the most popular.

One of the cassettes in the intelligent games section, Line Up 4 from Terminal Software, made the most favourable impression because it consistently won a test of intellectual skill — it is a simulation of the popular game where you have to connect four counters in a row. An intelligent game is one such as chess which requires thought and not dexterity. If a noughts and crosses program is supposed to be at all intelligent, a good trap is to play top right. It will then play in the middle, and so you choose bottom left: most programs will then move to either top left or bottom right, and so lose — both Noughts 1 and Noughts 2 from Neme do.

The logic and mathematics programs



include number guessing games, or games of logic such as Mastermind. None of the programs tested provided the player with any real challenge. They were the Neme Mastermind and Save Sum City, Abacus' Petals Around The Rose, Mastermind from Control Technology, and the PR Software Logic and Pickup Game.

Some of the programs are best considered as demonstrations of what you can do with your micro: for some we cannot think of any other reason for their existence. The Commodore cartridge Super Slot, for example, is an ostensibly tiresome slot-machine program but which has graphics effects that we had to admit were good. Many of the programs on the Commodore cassette Introduction to Basic Part 1, are demonstrations, and some like Hangman and Speedtype were enjoyed for themselves.

We shall now consider some of the most highly recommended programs. The first is Vicmen which was supplied by the Byte Shop, Manchester. Vicmen is produced by Bug-Byte and costs £7. It is a version of an arcade game called Puckman, and is a real-time maze program with excellent graphics. Vicmen is a skilful game which consists of trying to gobble spots before being caught by ghosts, though at times you can chase the ghosts to turn them into eyes. The reason it is so successful is that it is different, not too complex, and fun to play.

Simple addiction

Blitz might be classed as a space invaders or war game, because it consists of a bomber flying over a town again and again. At every pass, it reduces aititude, until it runs into a building. To stop it crashing you must flatten the buildings by dropping bombs, but only one bomb is allowed in the air at one time. It sounds simple, but it becomes almost as hypnotic as Vicmen. Blitz is produced by Commodore and costs £4.99 — a very good example of how you do not have to be complex to be addictive.

Line Up 4 is definitely an intelligent game. It is a simulation of a game of Connect 4 — if you are not wary, or not sufficiently good, it will win. An interesting extra are the timings of how long you took, and how long the Vic took. It beats you, and then boasts about how quick it is. A well-presented program with good, clear instructions from Terminal Software.

These are far and away the best games, but there are others which are reasonable — we felt, however, that a program had to be exceptional to command the prices being asked. These three programs were the only ones for which there was unanimous acclaim, and it is worth asking why they had this universal popularity.

They are successful because:

- They are very simple in conception, with no gratuitous complications.
- They are not like any of the other games.
- Because listings of these games are not easily available, their themes are not hackneyed.
- There are no bugs in the programs; they were not too simple to play nor were they too difficult.

One can also learn from the games we felt to be the least successful. Bridge Software's Vic Invaders, for example, at £6.50 is too easy, the invaders do not advance, there are no mystery ships, the base at the bottom zips along at rocket speed, and the invaders do not speed up when only a few remain.

Fiendishly clever

Petals Around The Rose is a number guessing game with a difference — it does not tell you the rules. Consequently the user can never be sure if the game is fiendishly clever because he can never know what he is supposed to be doing. At £6.95 from Abacus Programs, it might not seem worth the effort.

At the end of the review of the Games Package from Neme Software — £5.50 for five programs, or £9 for the set of 10 — was

(continued on next page)

(continued from previous page)
written "Keep Clear". This becomes understandable when you discover that the program Pontoon does not recognise pontoon. We were unable to tell the difference between Noughts 1 and Noughts 2, and the bat seemed incapable of catching up with the ball in the Neme version of Breakout. It can be seen that the programs were trivial and, what is worse, poorly de-bugged.

We would advise anybody buying programs either to see them demonstrated first, or to obtain a written undertaking that the program can be returned if unsatisfactory.

Company	Program	Category	Comments	Price
Neme Software	Games Package: Pontoon, Mastermind, Shell Game, Noughts 1, Noughts 2, Clocks, Black Holes, Save Sum City, Blastout 1, Blastout 2, Sonic Patterns	D, L/M, D, IG, IG, D, O/M, L/M, B, B, D	Trivial and poorly de-bugged	Five for £5.50 10 for £9
	High resolution /character package	D	Fair	£7.50
	Songmaster music package	D	Fair	£6.50
Commodore	Blitz	I/W	Brilliant	£4.99
	Basic Intro: 1 Cartridges	D	Fair	£14.95
	Super Slot	D	Tiresome	£19.95 each, plus VAT.
	Super Lander	RTC	Fair	
	Avenger	I/W	Good	
	Road Race	RTC	Good	
Bridge Software	Vic Invaders	I/W	Avoid	£6.90
Terminal Software	Panic Driver	RTC	Fair	
	Line up 4	IG	Brilliant	
Abacus Programs	Splotter	O/M	Tiresome	£6.95 each, or £12.95 for two
	Space Docker	O/M	Fair	
	Guzzler	O/M	Good	
	Defender	I/W	Fair	
	Petals Around The Rose	L/M	Avoid	
	Monaco GP	RTC	Bad	
	Lunar Lander	RTC	Fair	
	Maze of Death	O/M	Bad	
	Minefield	O/M	Fair	
Bug-Byte	Vicmen	O/M	Brilliant	£7
	Another Vic in the wall	B	Good	£7
dK'tronics	Rox	I/W	Good	
	Deflex	I/W	Tiresome	
	Tanx	I/W	Unreliable	
	Space Zap	I/W	Fair	
Control Technology	Vicsoft 7 package: Moroids	RTC	Moronic	£5.95 for seven
	Death Race 2000	RTC	Bad	
	Mastermind	L/M	Bad	
	Breakout	B	Avoid	
	Warlords	B	Avoid	
	Squash	RTC	Tiresome	
	Sounds	D	Fair	
PR Software	War	I/W	Good	£7.50 for six
	Smashout	B	Fair	
	Blackjack	D	Good	
	Logic	L/M	Fair	
	Pickup game	L/M	Poor	
	Alarm Clock	D	Fair	

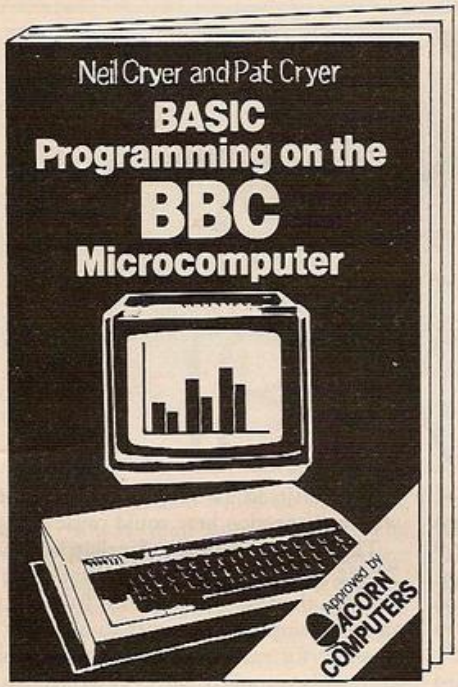
Notes: In the category column the following abbreviations have been used: O/M, obstacle or maze game; B, break-out type game; RTC, game with real-time control; I/W, space invaders-type or war game; IG, intelligent games; L/M, logic or mathematical programs; D, demonstration programs. ■

May-June

Prentice-Hall computer books event

During May and June new and bestselling computer books published by Prentice-Hall and its associated imprints—Reston, Reward and Spectrum—will be on display in bookshops throughout the country.

Featuring—the book you've been waiting for . . .



BASIC Programming on the BBC Microcomputer

Neil Cryer and Pat Cryer

For beginners with no experience of computers, this comprehensive book has been written with particular reference to the BBC Microcomputer. It provides a step-by-step course on BASIC and teaches you how to write programs using the BBC's enhanced version of BASIC. Every program included has been tested on a production model of the BBC micro.

£5.95 paperback 208 pages 13-066407-3 March 29th

Approved by ACORN COMPUTERS

. . . and many other outstanding titles, such as

Apple BASIC for Business For the Apple II
£13.45 hardback 400 pages 8359-0228-5
£11.20 paperback 8359-0226-9 1981

The ATARI Assembler
Don Inman and Kurt Inman
£9.70 paperback 270 pages 8359-0236-6 1981

Prices and publication dates are correct at the time of going to press but may be subject to change.

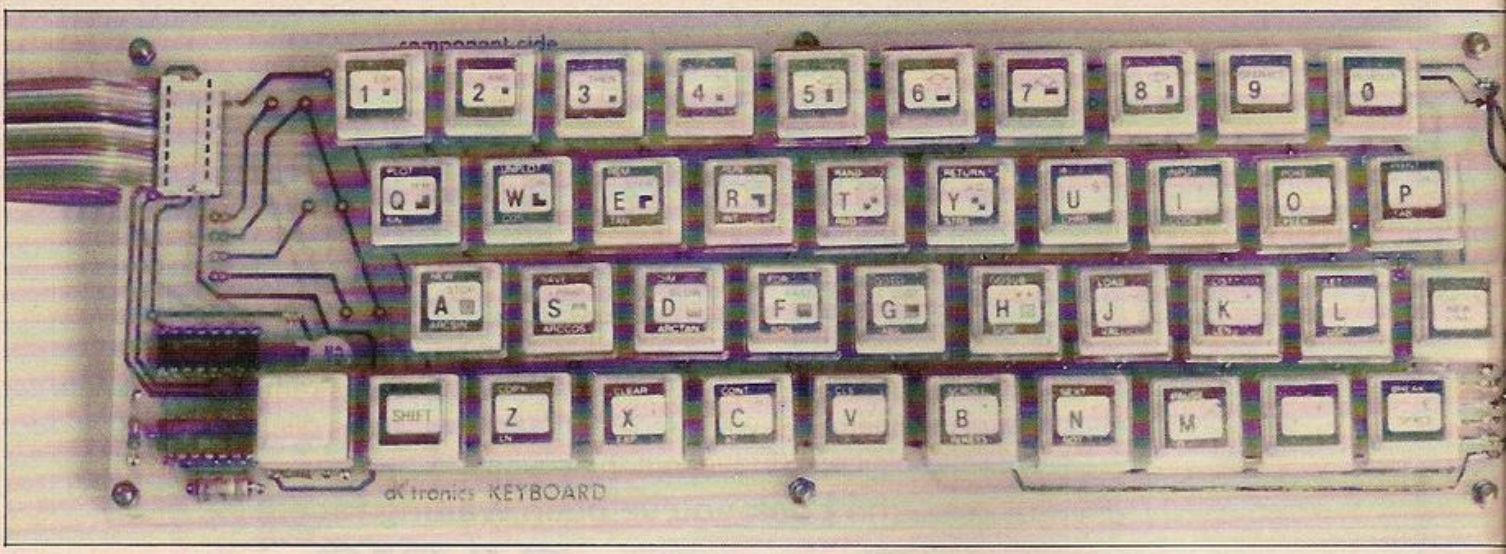
Microcomputer Data Communication Systems
A Guide to Modems, Terminals, Electronic Bulletin Boards . . . for Users of TRS-80, Apple II, Heath-89 and Other Systems
Frank J. Derfler
£9.70 paperback 128 pages 13-580712-3
April 1982

The PET Personal Computer for Beginners
Seamus Dunn and Valerie Morgan
£7.50 hardback 240 pages 13-661835-9
£4.95 paperback 13-661827-8 1981

Starting FORTH
Leo Brodie
£14.95 hardback 384 pages 13-842930-8
£11.95 paperback 13-842922-7 1981

Prentice/Hall International

66 Wood Lane End, Hemel Hempstead, Hertfordshire HP2 4RG, England



SURVEY
KEYBOARDS FOR ZX-81

Do you find the only drawback to your Sinclair is that slow, awkward keyboard? Stephen Adams examines the solutions offered by a number of manufacturers and finds that a new keyboard could cost you as little as £20 or as much as another ZX-81.

THE MOST COMMON complaint about the ZX-81, or for that matter its predecessor the ZX-80, is its keyboard. The keyboard on both machines is made from three layers of plastic. The top layer contains the keyboard symbols on the outside and a metal track on the inside. This metal track forms one side of a switch.

The bottom layer is the same, but with a metal track on the inside facing the top layer. Between these two metal tracks is a plastic membrane which keeps them separate. Beneath each key position the membrane has circular holes though which the top and bottom metal tracks connect when the top layer is pressed.

The whole keyboard is only 1/8th in. thick so it can be difficult, without watching the screen, to tell if you have pushed hard enough to make contact. As a result users tend to push far harder than necessary and often for far too long. The increase in speed that results from replacing the ZX-81 keyboard with push-button keys can mean a 50 percent saving on the time taken to input information.

The keys on the Sinclair keyboard are arranged in the form of a matrix, with eight input wires, or address lines, and five output wires, or keyboard data (KBD) lines. Each switch is connected to one address line and one KBD line and when pressed makes contact between them. By checking the KBD lines affected when an address line is altered, the ZX-81 can tell which key has been pressed.

Easy to fit

For instance, the shift key will have been pressed if the address line A8 was affecting output wire KBDO. Therefore the only wires that need to be connected to the keyboard are the eight address wires and the five KBD lines.

These appear on two sockets mounted inside the ZX-81, so all that is required is to remove the plastic tails which connect up the ZX-81 keyboard, and insert the leads from the new one. There is a hole between the 0 and the 9 key through which the old keyboard tails pass.

As this hole cannot normally be seen, you must push down on the top of the keyboard in order to push through the flat ribbon cable.

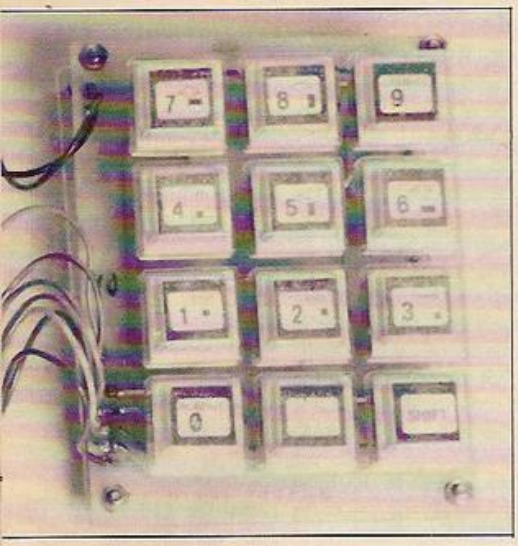
The best instructions are those supplied with the Redditch keyboard. They contain six drawings showing how to open the ZX-81, remove the keyboard tails and attach the new ones from the keyboard. The Fuller, Redditch and Computer Keyboards are the only ones which do not require soldering of the keyboard leads to the ZX-81 even though, as d'Ktronics point out, little damage can be done by making a wrong connection.

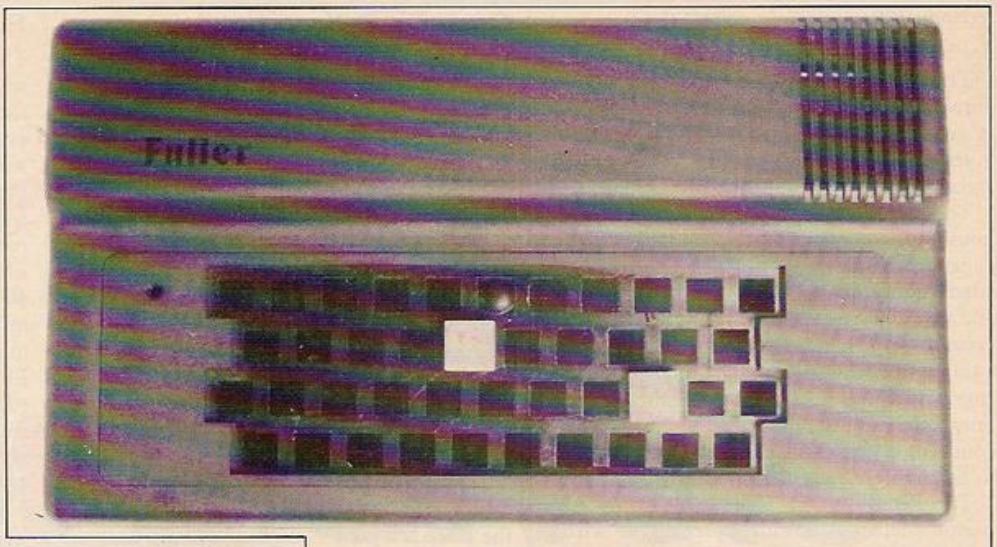
The other keyboards all require a connection to the +5V and 0V supplies on the ZX-81. A wrong connection here could cause damage.

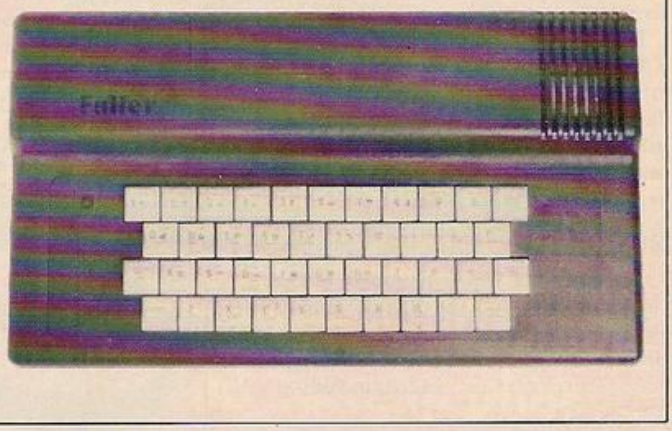
There are 40 standard Sinclair keys on the ZX-81 and although they can have more than one use, they are all controlled from software, so only a single-contact push-to-make switch is required for each key. All of the keys on the keyboards supplied were designed for this purpose and you should find no problems in using them. They have, however, different key-tops and layouts.

Angle of attack

The Crofton and the Fuller keyboards lay their keys flat, parallel with the surface on which they rest, and so are not as easy to use for someone accustomed to a typewriter. The rest of the keyboards are tilted to an angle of







30° by either the case in which they fit or the stand on which they are mounted. The Computer Keyboards keys also rise from one row to the next giving a better spacing and less chance of hitting two keys at the same time. All of the keyboards apart from the Computer Keyboard — which uses a standard QWERTY typewriter layout — adopt the Sinclair layout with extra keys added to each end.

Fuller's extra keys consist of an additional shift key next to the 0 key making it easy to press the two keys to give Rubout and " , and an extra Newline key next to the A key allowing you to press the shift and Newline together to give Function. As these are in use all the time, this could prove most useful.

Crofton has provided 11 extra keys marked with Break, Edit etc., to save you hunting for them. They still have to be used with shift otherwise they just produce their normal code. The Crofton and the Computer Keyboards are the only ones with space bars, but the Crofton one is rather small.

Additional keys

The Computer Keyboards product has six spare keys which could be used to duplicate another key, but because they are the same type as the rest of the keys they cannot be used as on/off switches.

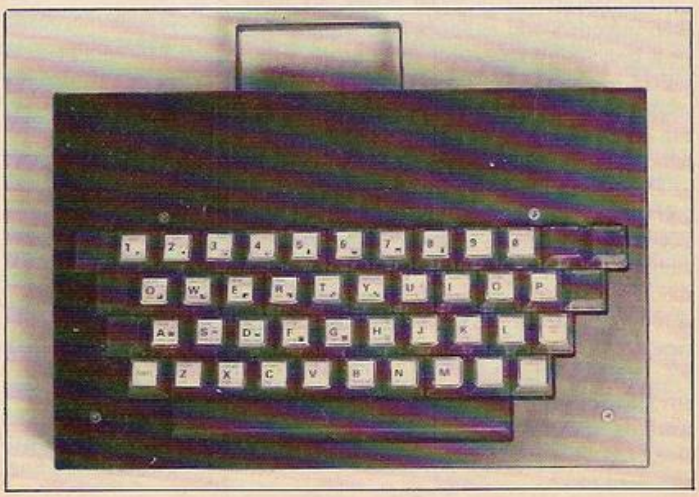
The Kayde and d'Ktronics keyboards provide a repeat key which interrupts the output lines from the keyboard five times a second. To the ZX-81, this looks as though you are pushing the keys on/off very quickly, even though you have the key down permanently. This requires components to be mounted on the keyboard which need a power supply from the ZX-81.

The cases supplied with the keyboards were all big enough to hold the ZX-81 printed-circuit board. Redditch does not, however, recommend that this be done with its version.

The ZX-81 fits tightly into the Computer Keyboards matt-black, aluminium case and a metal strap is even provided at the back to hold the 16K RAM pack in position.

The Crofton case does not hold the ZX-81 printed-circuit board at all and it is attached only to the keyboard. This causes even more vibration to the 16K RAM pack than usual. There are pillars which could have been used to mount it more firmly, but the holes have

(continued on next page)



(continued from previous page)

not been drilled in the case to take the screws.

The Crofton board also supplies a video amplifier output for a monitor and although it is good for those who think that a monitor gives a better picture, it degrades the TV signal so much that it cannot be used.

The Fuller keyboard's case can be used to house a complete system which can be expanded as desired with up to four internal edge connectors, 64K RAM, power supply and two 250V mains power-supply sockets for cassette or TV. All of this is contained in a 14in.-by-8in.-by-3in. injection-moulded plastic case, which has a LED power indicator. The only reservations I have are about the edge connectors, which only allow boards 2in. high to be connected to them.

The Peter Furlong Workstation is an ABS plastic shell which will house all the wiring associated with a ZX-81 and tilt the TV at an acceptable angle.

The plinth houses the ZX-81 and 16K RAM pack in a well at the front and the wiring to the Sinclair disappears through the side of the plinth to reappear at the back. If you are still using the original Sinclar leads for the cassette and TV, then additional holes will have to be cut at the side.

Crofton

A flat steel box which houses a keyboard, a video amplifier and the ZX-81. It is of little use unless you need to operate with a video monitor and can secure the 16K RAM pack in some other way. Cost: £42.70 including VAT and postage.

Kayde

The keyboard is heavy compared with most and will soon have a case which should prove a great improvement. The key symbols are attached with adhesive, and can fall off very easily. The repeat key is an attraction, but the instructions for soldering the keyboard cable need to be clearer. Cost: £27.95 ready-built.

Protos

The Protos system 40-key keyboard is mounted on a heavy steel plate. The keys have removable tops, which cover multicoloured versions of the Sinclair symbols. The green and brown backgrounds do not make the symbols easy to see, particularly if you are colour blind.

The case arrived in seven pieces, six more than intended, and although it is supposed to be a heavy-duty keyboard, some of the nylon pillars had snapped. The keyboard was well wrapped to protect it from the postman so I can only assume it was the heavy steel plate which did the damage.

The ZX-81 must be removed from its case and placed inside. The edge connector of the ZX-81 plugs into a suitable connector via ribbon cable to another printed-circuit board mounted on the case. This board appears through the slot at the right-hand side. All the tape connections are plugged into the ZX-81 via holes at the back. Although it looks attractive I cannot see this Frome system working well with the ZX-81 as it is expensive, £67.75 including post and VAT, and awkward to use.

Computer Keyboards

As the firm's name suggests, the ZX-81 is not the only computer for which it produces a keyboard. It is properly tilted, and has a ZX-81 type QWERTY keyboard with space bar. Even when not mounted in a case it is at the correct angle and the stepping of the keys lends it a professional finish. The connection to the ZX-81 is via copper-coated strips which plug into the ZX-81 sockets. The case contains the ZX-81 and a strap has been provided to stop RAM wobble. This, in my view, is the best of the keyboards reviewed, so probably worth the extra expense. Cost: kit, £28.95; ready-built, £31.40; case, £15.

Work-station

This is useful when you have to keep all the cables out of the way, in a position reserved for the ZX-81. The TV might prove too near the eyes for some, and the Sinclair printer needs to have modifications made to the plinth. Cost: £18; power switch, £3; cassette change-over switch, £3.50; aluminium floor, £4. All prices include VAT and postage.

Fuller FD System

The keyboard for this system provides a cheap start to forming a quite comprehensive layout for the ZX-81. The keyboard is not the best available, but it has some useful facilities. I would recommend this as a portable system for demonstration use, as all the equipment required, apart from the TV and cassette recorder, can be packed in one case. Cost: kit, £19.75; ready-built, £25.75 for the plain 40-key version; £35.45 for the 42-key version in the case; £43.45 for a ready-built model; motherboard with two edge connectors, £16.75; three edge connectors, £21.75; four edge connectors, £26.75, all of which are ready-built; 64K RAM Pack, £45; 16K version which can be upgraded to the 64K version, £35.95; both are ready-built; 9V power-supply unit, £6.75; 12/5V for £13.95. Various other switches and sockets are available. There have been reports of considerable delays in delivering this keyboard so, before ordering it, it is worth ensuring that you have written confirmation of an acceptable delivery time.

Clockwise from top; Dean Electronics Computer Keyboard; Fuller FD System; Redditch; d'Ktronics; Kayde; and Crofton Adaptakit. Centre; Peter Furlong Work-station.

d'Ktronics

A pleasant keyboard, mounted at the correct angle, with repeat facility. The instructions are clear with a section on faults that can occur. The keyboard has to be soldered to the ZX-81. A numeric pad can be connected next to the keyboard on the right as shown in the accompanying photograph. Cost: £27.95; numeric keypad, £10.

Redditch

An easy-to-use 40-key keyboard, less expensive than most, but requiring a case to make it tilt to the correct angle. The connection to the ZX-81 is via two plugs, and very clear, simple diagrams make it easy for those concerned about harming the computer. Cost: kit, £20.50; ready-built, £27.75; £10.30 for the case.

ADDRESSES

Suppliers

Crofton Electronics Ltd: 35 Grosvenor Road, Twickenham, Middlesex TW1 4AD. Telephone: 01-891 1923/1513.

Kayde Electronics Systems: 48/49 Exmouth Road, Great Yarmouth, Norfolk NR30 3DP. Telephone: 0493-55253.

Redditch Electronics: 21 Ferney Hill Avenue, Redditch, Worcestershire B97 4RU. Telephone: 0527-61240.

d'Ktronics: 23 Sussex Road, Gorleston, Great Yarmouth, Norfolk. Telephone: 0493-602453.

Computer Keyboards: Glendale Park, Fernbank Road, Ascot, Berkshire. Telephone: 0347-4731.

Peter Furlong Products: Unit 4, South Coast Road Trading Estate, Peacehaven, Sussex.

Fuller Micro Systems: The ZX Computer Centre, Sweeting Street, Liverpool 2. Telephone orders: 051-236 6109.

Frome Computing: 20 Ashtree Road, Frome, Somerset BA11 2SF. Telephone: 0373-71435. ■

the vic centre

Big savings for starters

If you're looking for a home computer, you'll already know that the VIC does it all. To help you get started, we have put together this attractive cost-saving package.

VIC-20 Colour computer

+ Cassette Deck
+ 10 Blank Cassettes
+ Introduction to Basic Part 1
+ User Manual
+ 12 months warranty
+ Fitted 13 amp plug

for only **£212**

(price plus VAT £243.80)

NEW

Convert your VIC to a 40 Column 32k machine with this exciting new add-on

32k RAM Expansion + 40 column screen format **£199.95** plus VAT

40 column screen format only **£99.95** plus VAT

Dot Matrix Printer

Tractor feed, 80 characters per line at 30 characters/seconds. **£199.96** plus VAT

Memory Expansion Board

Multi-slot unit used to accept memory and/or game and program cartridges **£85.00** plus VAT

Plug-in Memory Expansion Cartridges

3k – **£26.04,** 8k – **£39.09,** 16k – **£65.17** plus VAT

Single Drive Floppy Disk Unit

£395.00 plus VAT

The standard features of the Vic are: ★ 5K RAM expandable to 32K ★ 16 screen colours ★ 8 character colours ★ 3 tone generators, each of 3 octaves – plus white noise generator ★ Screen display 22 characters×23 lines deep ★ Full PET type graphics ★ High resolution graphics capability ★ 8 programmable special functions.

Goods required — Price

Add £4.00 post, packing and insurance for special deal and £1.00 post, packing and insurance for all other items. Add 15% to all prices for VAT

Total £

Name:

Address:

MAIL ORDER to: Adda Home Computers Ltd. FREEPOST, London W3 6BR or telephone your order (24 hours a day) to 01-992 9904 quoting your Visa, Access or American Express number.

*I enclose a cheque, made payable to Adda Home Computers Limited for £.....

*Please charge my Visa/Access/American Express account. My acount number is

*Please add my name to your mailing list

*Delete as applicable

Date .....

SHOP ADDRESS: Adda Home Computers Ltd. 154 Victoria Road, Acton, London, W3. (near North Acton tube station) Tel 01-992 9904 OPEN: 10am–6pm (Tuesday-Friday), 10am–5pm (Saturday).

TERMS AND CONDITIONS: All goods sold subject to Adda terms and conditions of sale. Full details available on request, but include: 7 day money back guarantee, Adda 12-month hardware warranty. Please allow 21 days for delivery. Allow 7 days for personal cheques to be cleared. Quoted prices are exclusive of VAT.

adda

Sleeve notes

■ Although the flexi-record is a new way of distributing software, you should remember at all times that the fundamental principle involved is the same as when a program is stored on tape. That is, the electronic binary signals are enshrined in a physical form to be replayed at a later date. It makes no difference to the computer what medium the signals are stored on when it receives them.

■ With this in mind, there are two ways you could load your flexisoft disc. The first is to record the disc on to tape, and use the tape just like any other ZX tape. The second method is to load directly from the record player. The first method is best for most people as it requires little or no change in the ordinary tape-loading procedure. Though you will have to experiment with the recording levels as you would with any commercial cassette.

■ The best setting on an ordinary music centre is treble zero. If you have to move it, move it up, bass zero, though if you move the bass, move it down — but not too far. I did not use Dolby when recording the disc, but if you do, ensure that Dolby is on when you load the tape. I turned the left channel right down, and set the level of the right-hand channel to zero dB using a level meter. If you do not have any meters, you will have to judge the correct volume either by ear, or by guesswork. It is a matter of courtesy not to play the record too loud as it makes a real din.

■ Loading the program directly from the record player should be fine. However you will have to watch that you do not damage your computer. This is easily done if too high a volume is put into the machine. If your record player has a headphone socket or an earphone socket use it. The software does load, although sometimes minor mistakes occur as information is misread. Because of that we reproduce the program listing here for anyone who experiences this problem.

■ Remember the program is for an expanded ZX. It will definitely work with the 16K RAM pack and it should be possible to run on an 8K ZX-81. It loaded into a 3K ZX-81, but left no space for the variables.

ALL IN THE

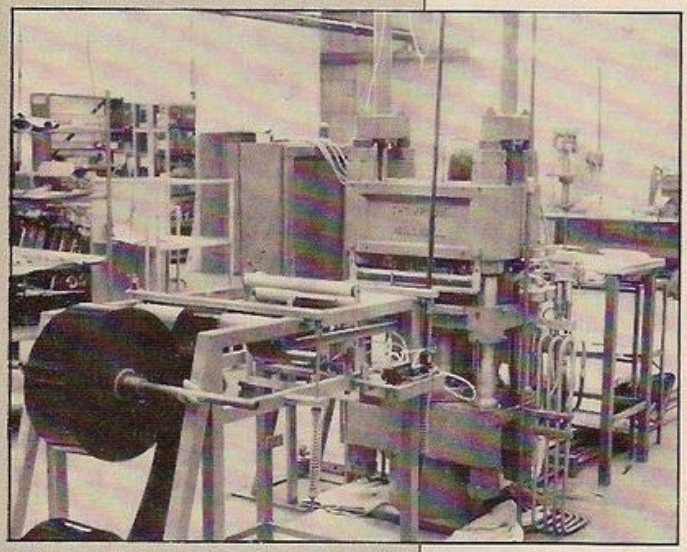
This month's *Your Computer* cover could reduce the cost of recorded software from pounds to pennies. That thin slice of plastic will cause tremors in the software industry. Bill Bennett explains how we put Othello on a flexidisc.

ABOUT 16 MONTHS' talk of distributing software commercially by the new and revolutionary method of putting programs on a flexible disc was temporarily shelved when it was discovered that the then most popular machine, the Pet, did not lend itself readily to the idea.

Then the Sinclair ZX-80 and 81 arrived on the scene. These machines totally changed the face of microcomputing and at the same time transformed the software market. At more or less the same moment as the launch of the Sinclair ZX-81 *Your Computer* appeared on the book-stands, a computer magazine which has always thrived on the volume and quality of correspondence from its readers.

One morning I came across a letter in the *Your Computer* post from Bernard Beeston. He suggested putting some ZX-81 software on to one of "those flexi-record things". At first I just filed the letter for reply. That night I thought about it again and in the morning discussed it with my colleagues.

In short, it was a brilliant idea. Bernard Beeston is a collector of free flexidiscs and on seeing the *Tomorrow's World* television trans-



A roll of black vinyl feeds into the press to be stamped with the program cut into squares and stacked.

Othello program listing

```
 0 REM OTHELLO2 INTERFACE DEC
81 P13 AMENDED BY ROY EASTWOOD
  10 FAST
  20 REM INITIALIZE ARRAYS
  30 DIM B$(2,2)
  40 DIM C$(2,2)
  50 DIM A$(2,200)
  60 REM DRAW BOARD
  70 LET F$="
  80 LET G$="
  90 LET K$="
 100 LET H$="
 110 LET J$="■2 3 4 5 6 7 8 9 ■"
 120 LET A$(1) =H$+"■"+F$+"■"
+G$+"■ "+F$+" ■ "+G$+"■"+F
$+" ■ "+G$+" ■ "+F$+"■"+G$+
" ■"+J$
 130 LET A$(2) =J$+"■1"+F$+"1■2"
+G$+"2 ■ 3"+F$+"3 ■ 4"+G$+"4 ■5"
+F$+"5■6"+G$+"6 ■7"+F$+"7 ■8"+G$
+"8 ■"+K$
 140 LET A$(1,89 TO 92)="■ ■"
 150 LET A$(2,89 TO 92)="■ ■"
 160 LET A$(1,109 TO 112)="■ ■"
 170 LET A$(2,109 TO 112)="■ ■"
 180 LET D$="BCDLNVWX"
 190 LET E$="■ FAST THEN ■ASN 10
STOP SGN LN STEP ATN ■INT X■
SIN LPRINT ■"■ LLIST LN TAB EXP
■VAL ■ACS ■LEN **■SGN■CHR$ OR
■SGR ■T NOT USR ■12 SLOW ■ TO
<=STR$ ■ AND ■"
 200 PRINT AT 1,6;
 210 FOR A=1 TO 161 STEP 20
 220 FOR D=A TO A+19
 230 PRINT A$(1,D);
 240 NEXT D
 250 PRINT TAB 6;
 260 FOR D=A TO A+19
 270 PRINT A$(2,D);
 280 NEXT D
 290 PRINT TAB 6;
 300 NEXT A
 310 PRINT AT 8,0;"ME:■";TAB 26;
"YOU:■ ";TAB 3;"■";TAB 30;"■"
 330 SLOW
 340 REM DECIDE WHO IS TO MOVE
 350 IF RND>.5 THEN GOTO 690
 360 REM COMPUTERS MOVE
 370 LET B$(1)="■ "
 380 LET B$(2)="■"
 390 LET C$(1)="■"
 400 LET C$(2)="■"
 402 PRINT AT 21,0;"
                    "
 410 FOR K=1 TO 60
 420 LET B=CODE E$(K)-140
 430 IF A$ (1,2*B)<>"■" AND A$(1,
2*B)<>"■" THEN GOTO 650
 440 LET H=0
```

GROOVE

mission of the ZX program, he hit on the idea of putting ZX software on flexible records.

Not long after receiving the letter from Beeston, another event occurred which pushed the idea further forward. I discovered that the signals used by the Sinclair computers to store information on tape were not only in the audio range, but exceptionally well suited to recording on flexidisc. We simply had to go ahead and test the idea.

Simple method

The ZX-81 — and for that matter the ZX-80 — uses a particularly simple method of storing information on cassette. The zeros and ones that make up the binary codes used by the computer are stored as simple sine waves. A zero is represented by a sine wave of a given number of cycles; a one is stored as a wave of another number of cycles. Between the individual bits is a short blank, which is about as long as the one-bit sine wave in time.

This information is stored serially on a cassette, and is loaded simply and relatively quickly into the memory of the micro at 300 baud. The signals are recorded on ordinary cassette tape, in exactly the same way as a musical signal would be. This is very helpful because in the same way that, for example, a pop group would record their music initially on tape before transferring it to disc, the ZX-81 software can be transferred from cassette to disc.

In fact, the practice is somewhat more complicated than the theory, as I discovered when I went along to the cutting studios. The studio where we made the initial software record looked like the bridge of the Starship Enterprise. Around the side of the room were all kinds of cassette players, recorders and amplifiers. In the middle was a desk, covered with mixers and various pieces of noise-reduction equipment.

Among the hyper-modern hardware was an apparatus which resembled a microcomputer — in fact it was an audio analyser, which projects a display of the audio spectrum on a screen. Each frequency band within that spectrum is represented by a vertical bar, which waxes and wanes with the quantity of that frequency present in the sound.

Like dancing spirographs

In addition a cathode-ray tube display showed Lissajous figures. These are rather interesting displays which show the relation between two harmonically varying signals. They look rather like dancing spirograph drawings. All this equipment was very impressive but it was there for a reason: it told us that superimposed on the ZX-81's output signal were a number of other signals.

These signals normally do not make any difference to the loading of programs on the ZX-81 as there is a very wide tolerance. However, with the recording of software on to disc, we were entering unexplored territory and had to be careful.

The computer signal sits somewhere in the ordinary audio spectrum, at around 3kHz to 4kHz. Being a sine wave, it should not have any other frequency components. The sine wave, if pure, does not contain any other components because it is the fundamental component itself. If it is amplified too much, the peaks are clipped and the wave begins to look like a square wave — which, incidentally, is how a guitar fuzz-box works.

The reason this is important to microcomputers is that when a sine wave is distorted into a square wave, other frequency components are introduced which confuse the computer. This is what sometimes happens when a ZX program is Saved or Loaded too loudly.

There were two main sources of sound present on the master tape of the text program, other than the computer signal wanted. This master tape was made by recording directly from the program cassette to a reel-to-reel tape recorder. These sources of extraneous sound are referred to as "noise" by audio engineers.

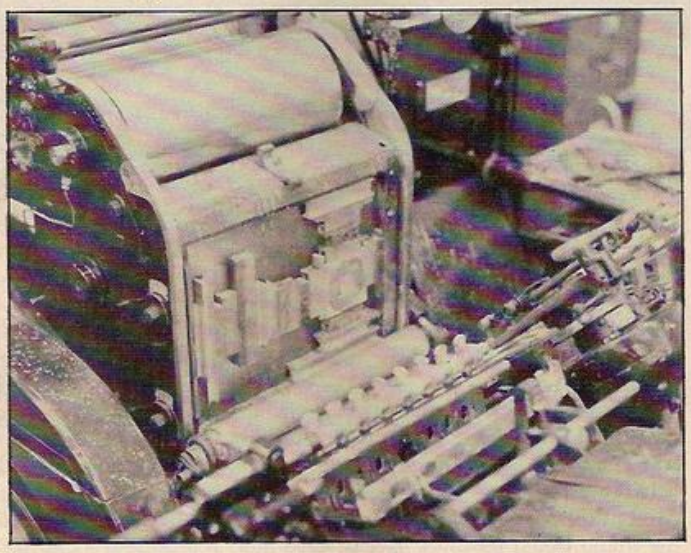
Two types of noise

The original flexidisc test tape had two types of noise on it. Later, I discovered that more or less all Sinclair tapes have these types of noise because of certain factors associated with low-cost tape recorders, and we all know that the chaper tape recorders work best with the Sinclair.

The first type of noise was the background noise of the cassette itself. I do not want to become too involved with the technicalities, but cheap, standard, cassette tape has a background hiss, which is mainly at the higher end of the audio spectrum.

The other noise was one picked up from the recorder itself, probably due to the motor.

(continued on next page)



The squares are trimmed into discs and the Your Computer *labels are then printed directly on to them.*

```
 450 FOR X=1 TO 8
 460 LET N=CODE D$(X) -50
 470 LET E=0
 480 LET F=B
 490 IF A$(1, (F+N)*2) <>B$(1,2) T.
HEN GOTO 530
 500 LET E=1
 510 LET F=F+N
 520 GOTO 490
 530 IF A$(1,(F+N)*2) <>C$(1,2)O
R E=0 THEN GOTO 630
 540 FOR A=B*2 TO F*2 STEP N*2
 550 LET A$(1,A-1 TO A) =C$(1)
 560 LET LINE=1+2*INT ((A-1)/20)
 570 LET COL=4+A-20*INT ((A-1)/20)
 580 PRINT AT LINE, COL;C$(1)
 590 LET A$(2,A-1 TO A) =C$ (2)
 600 PRINT AT LINE+1, COL;C$(2)
 610 LET H=1
 620 NEXT A
 630 NEXT X
 640 IF B$(1) ="▀▀" OR H=1 THEN GOTO
660
 650 NEXT K
 660 IF B$(1) ="▀▀" THEN GOTO 370
 670 IF H=0 THEN GOTO 780
 680 REM HUMANS MOVE
 690 LET B$(1)="▀"
 700 LET B$(2)="▀"
 710 LET C$(1)="  "
 720 LET C$(2)="▀▀"
 722 PRINT AT 21,0; "ENTER MOVE E.G.
19 (0 FOR SCORE)"
 730 INPUT B
 740 IF B=0 THEN GOTO 780
 750 IF A$(1,B*2)<>"▚" AND A$(1,B*2)
<>"▚" THEN GOSUB 1010
 760 GOTO 440
 770 REM CALCULATE SCORE
 780 LET CP=0
 790 LET HP=CP
 800 FOR A=23 TO 177 STEP 2
 810 IF A$(1,A)= "▀" THEN LET CP=CP+1
 820 IF A$(1,A)= "▄" THEN LET HP=HP+1
 830 NEXT A
 840 PRINT AT 10,0;CP;TAB 27;HP
 850 IF CP+HP<64 THEN GOTO 690
 860 IF CP>HP THEN PRINT AT 21,0;"
          I WIN                 "
 870 IF CP<HP THEN PRINT AT 21,0;"
          YOU WIN               "
 880 IF CP=HP THEN PRINT AT 21,0;"
          DRAW                  "
 890 STOP
1000 REM INVALID MOVE
1010 PRINT AT 13,0;"CHEAT*";TAB 0;
"IF YOU";TAB 0; "DO IT"; TAB 0;"
AGAIN"; TAB 0;"I WONT";TAB 0;"PLAY"
1020 LET B=0
1030 RETURN
```

(continued from previous page)

Another source of noise is the stretching of the tape and a fourth could be due to mechanical imperfections on the cassette itself.

The random-noise part of the signal — that is, the background hiss — was reduced by a Dolby system. The lower tones associated with the tape drive were harder to eliminate, but the worst of it was removed by a graphic equaliser. The original test tape was recorded in stereo, but the flexi-record you will have received with this copy of *Your Computer* was recorded in mono.

This treated signal was then stored on a length of open-reel tape. The beginning of the program and the end were marked on the tape by cutting it at the relevant point and then inserting a short stretch of yellow tape. The whole was then reloaded on to the tape deck ready to cut the disc.

Disc-cutting machine

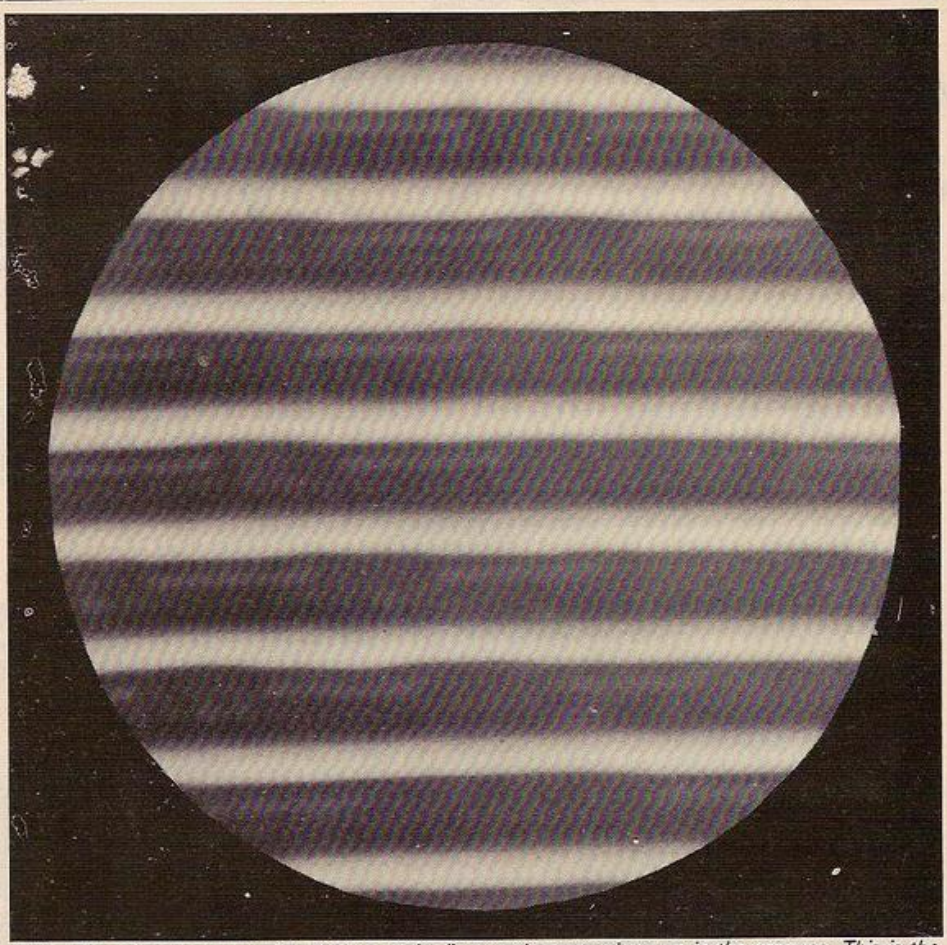
The disc-cutting machine looks just like a record player — one of the very expensive stereo variety. Yet, unlike the machine that it so closely resembles, it does not play records but cuts them. This is done by making the stylus vibrate in the disc material as it tracks towards the centre of the disc. The process is just like playing records, but in reverse.

The material that the disc is cut into is called an acetate. It looks just like an ordinary black 12in. record, except it has neither label nor groove — at least to begin with. The turntable is rotated at the set speed, with the acetate firmly clamped to it. The initial "run-in" groove is cut, and the turntable stops. Then the tape machine is cued to the beginning of the software. At the same moment as the tape machine begins to play, the record cutting starts automatically.

It is possible to set an adjustment that governs the pitch of the grooves, that is the amount of material that is left between the gaps. Ordinarily the more of this, the better the quality of the recording. This is because the stored sounds of one groove can impose themselves on another if the walls between them are not sufficiently wide. Of course, the optimal setting of this adjustment is one which utilises all the available material between the edge of the record and the point where the stylus picks up.

The acetate platter which has the record cut into it is 12in. across, but the record is only the 7in. in the middle. Once the acetate is cut, a label is stuck on the middle, and the acetate disc can be played just like an ordinary record. To test the process, this is just what I did.

I decided the best thing to do would be to tape the program on the disc and play it just like an ordinary piece of software. I made a number of different recordings, some in stereo, some in mono, some with treble turned full on and some with the settings all at zero. The software loaded, but not when it was recorded in stereo; the flexidisc you have is in mono.



Under the microscope a series of short white lines and spaces show up in the grooves. This is the form in which the binary digits are encoded on the flexidisc.

The master, which is another name for the acetate disc, for the *Your Computer* flexidisc was cut at Pye recording studios in London between takes of the new Tight-Fit record. Most of the pop stars wandering in and out of the studio would probably have covered their ears in disgust if they heard the disc. Listen for yourself and hear what it sounds like. However, to the ears of Tony Bridge, the engineer who cut the disc, the sound was music because he is a ZX-81 user. It was very useful having someone who understood computers working on the disc.

Once the master disc is cut it is plated in metal. The metal plates are then pulled away and become the stampers that are used in the flexi-record factory. The flexi-record factory at Charlton, south-east London, turns out records by the hundreds, usually of pop music, or maybe an advertising message. They have even made records for use in by-election campaigns.

The process used to make the records was explained to me by managing director John Moon. One of the most important features of producing flexi-records is the vinyl on to which the discs are stamped. This is available in a number of different thicknesses and colours — it can even be metallic gold or silver. Black is, however, the usual choice because it looks like ordinary records.

A special design

The vinyl is held in huge reels which are mounted on an axle behind the flexi-record press. The press is of a special design, built and designed by the directors of Flexi-records themselves.

Normally the stampers push out four discs at a time. The key to making good flexi-records is the hole in the middle, which is punched out at the same time as the actual stamping. The records are then cut, and stacked on a spike. At this point the records are still square.

They are loaded, a bundle at a time, on to a cutter, which works in the same way as a pastry cutter. The last stage in the process is when the labels are printed directly on to the flexi-record. This is done with a Heidelberg printer, which is a pleasure to watch.

Of course, a large sample of the flexidiscs were tested, and they all worked. So all that remained for us to do was to put the discs into the magazine and distribute them throughout the country. I hope you manage to beat the computer at Othello or Reversi. ■

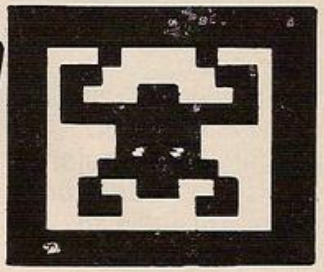
How to play Othello

Othello, which was originally called Reversi, is a board-game for two players, played on a conventional chessboard with eight-by-eight squares. The pieces are double-sided, coloured black on one side and white on the other. Any of the opponent's pieces in a straight line between the last piece played and another of the player's pieces is "captured", that is to say turned over, to convert it to the player's colour. The game finishes when the board is covered with pieces or when neither player can move, and the winner is the player with the most pieces at that stage.

If the program has loaded correctly then a grid of eight-by-eight squares will appear, just like a chessboard. Along the top will be the numbers from two to nine and down the side one to eight. There are two possible states at the beginning, either it is your go first or the computer's. If it is your go first the computer will prompt you with the message: "Enter Move EG 19 (0 for score)". If the computer is to move first the screen will be dark for a while.

When moving remember to enter the ROW first followed by the column number. Sometimes you can cheat and get away with it. Be warned, if you do the game will finish. Entering a zero will give you the score, do this at the end of the game.

MAZOGS



A MAZE ADVENTURE GAME FOR sinclair ZX81

MAZOGS is a brand new game for the 16K ZX81, unlike any other game you've seen on the ZX81. This is without doubt the best game available for this computer, and if you don't believe us, ask somebody who has seen it, or go down to your local computer shop and ask for a demonstration.

MAZOGS is a maze adventure game with very fast-moving animated graphics. A large proportion of the program is written in machine code to achieve the most amazing graphics you have ever seen on the ZX81.

You will be confronted by a large and complex Maze, which contains somewhere within it a glittering and fabulous Treasure. You not only have the problem of finding the treasure and bringing it out of the maze, you must also face the guardians of the maze in the form of a force of fearful Mazogs. Even if you survive their attacks you could still starve to death if you get hopelessly lost. Fortunately, there are various ways in which you can get help on this dangerous mission.

There are three levels of difficulty, and the game comes complete with comprehensive instructions. The cassette on which the game is supplied is of the highest quality, and loading is guaranteed.

Mazogs is available from Bug-Byte and most good computer shops at £10.00 inclusive.

Please send me

Qty	Item	Price
	Bug-Byte "MAZOGS" Cassette For £10.00 inclusive	

I enclose cheque/P.O. ☐

OR Please debit my:

Access 5224 ☐☐☐☐☐☐☐☐

Barclaycard 4929 ☐☐☐☐☐☐

Expiry Date_____

Name_____

Address_____

_____

_____ Code_____

Dealers Discounts Available.
ACCESS/BARCLAYCARD ORDERS WELCOME ON 24-HOUR ANSA PHONE 051-227 2642

YC·6·82

BUG-BYTE SOFTWARE

100 The Albany, Old Hall Street, Liverpool L3 9EP

INTERVIEW

ADDED EXTRA FOR

Ron Bissell has been in on the explosion in microcomputers from the start. With fellow director Ken MacDonald he has built Macronics up into one of the major ZX soft- and hardware houses. He talks to Brendon Gore.

RON BISSELL first came into contact with computers while in the sixth form. A trip to Wolverhampton Polytechnic introduced him to an early U.S. computer.

"We were allowed to write programs for it, punched on paper tape", says Bissell. "It was a whole wall full of entertainment with flashing neon lights and chattering relays".

After leaving school, Ron Bissell went to Queen Elizabeth College, London in 1962 to do a general-science degree. Unfortunately, he failed his first-year exams, which he attributes to the disruptions caused by leaving home, moving to London and trying to settle down to college life.

Nothing daunted, he found himself a job in the electronics industry with Contactor Switchgear (Electronics) Ltd. He worked in the company's development laboratory building prototype timers, logic circuits and remote-control TV units from schematics. It was very useful experience, he says with just a touch of understatement.

After a year in industry, he sat his first-year exams at Chelsea Town Hall. He remembers it as being surprisingly easy, a pleasant week with beautiful weather. He was a little surprised when he passed, as he was weak in mathematics. But he drew small sketch graphs in answer to most of the questions, and thinks that they must have done the trick.

Having graduated, Bissell started working for British Steel. He was assigned to work with the O/M (Operations and Methods) department on the problem of cutting up steel bars into precise lengths with minimum wastage. He looked at a Fortran program the O/M department had written to solve the problem, and decided that Fortran was not that difficult a language to learn.

A year after joining British Steel, Ron Bissell left the company to join the West Midlands Regional Health Authority. Officially he was part of an O/M department, but within months he was put into the O/R (Operational Research) division. This entailed considerable work with computers.

"I was involved with the setting up of an emergency bed bureau in east Birmingham", says Bissell. "The idea was to stop some hospitals from being swamped with patients while other hospitals had empty beds.

"We had to produce computer forecasts of the likely number of patients expected on any particular day of the year. By combining the seasonal and weekly patterns of admissions, we were able to produce a table of the likely number of patients to be admitted to hospital in the West Midlands on any day of the year".

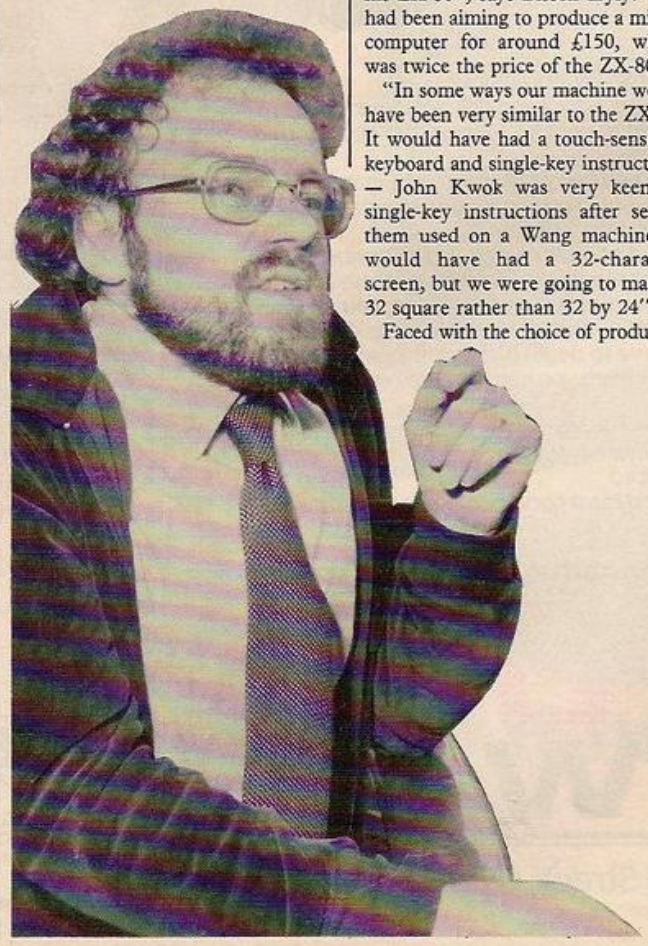
The origins of Macronics lie in the West Midlands Regional Health Authority. Ron Bissell, Ken MacDonald and John Kwok all worked for the WMRHA, and they were all quick to spot the potential of microcomputers. In 1979 the three of them decided to try and design a cheap alternative to the semi-professional machines they had been working with. However, it became the computer that never was.

'Memory-mapping ZX screens was thought impossible'

"We made the decision to abandon our computer after Sinclair launched his ZX-80", says Bissell dryly. "We had been aiming to produce a microcomputer for around £150, which was twice the price of the ZX-80.

"In some ways our machine would have been very similar to the ZX-80. It would have had a touch-sensitive keyboard and single-key instructions — John Kwok was very keen on single-key instructions after seeing them used on a Wang machine. It would have had a 32-character screen, but we were going to make it 32 square rather than 32 by 24".

Faced with the choice of producing a comparable machine to the ZX-80, but at twice the price, they decided to drop it and concentrate on producing software for the ZX-80: "There were so many limitations in the ZX-80 that there was obviously a need for programs to get round them".



Ron Bissell's first program for the ZX-80 was a memory-map screen display. "Everyone had been saying you could not memory-map the Sinclair screen", explains Bissell. "In fact it was simply a matter of setting it up with blanks on all sides and knowing where it was in memory. This allowed you to Poke to any part of the screen that you wanted, which in turn meant that you could run the kind of games programs that everyone else was running on other machines".

The memory-map program sold for around £1 a listing, says Bissell. For the first six months they sold around 30 listings a week, which was not bad for the first program. But they did have the advantage of not having any competition.

John Kwok had dropped out of the team by this point. "He was more interested in the concept than the actuality", says Bissell. "Besides, he had been made head of the authority's microcomputing development project and he was putting his main efforts into that".

A natural division of responsibilities evolved between the remaining partners. Ken MacDonald looked after the marketing and financial side of Macronics while Ron Bissell took charge of the technical and software side.

The next Macronics program to hit the market was the active-display program. This was designed to get round the fact that the ZX-80 screen was static, so that nothing happened unless a key was depressed. But, by this time the competition was starting to arrive.

"We got our active-display program out at about the same time as Ian Logan produced his version", says Bissell. "The difference between the programs was that his version involved copying whole sections of the Sinclair ROM into memory. That worked well, but it used up a good deal of memory. In our version, we copied the necessary parts of the Sinclair ROM into our program, but without the extras. This meant it needed very little memory. There was some screen

ZX-81

flicker between displays, but at least they would change and update by themselves".

This program went on sale for about £5. It was part of Macronics strategy to sell techniques as well as games, playing on the "look what you can do with your ZX-80 that nobody else can" idea.

The price of the program was something Macronics had learnt through experience. "£5 or £6 was the optimum price for a program", says Bissell, "and it still is. You cannot sell anything for much less because people will think it is rubbish, and you cannot sell anything for much more because people do not have the money. It does not really matter what is in the program — that is the price for it".

'Our micro was to be similar to the ZX-80'

Macronics sold a number of copies of the active-display program, but they were a little disappointed that sales were not higher.

"We do not seem to be reaching the market for some reason. I remember estimating once that we were reaching, at a maximum, two percent of the total number of Sinclair users, which seemed an abysmally low figure".

One possible reason for this lack of early success was the Macronics policy of selling listings rather than cassettes. Bissell and MacDonald felt that listings were cheaper to produce than cassettes and avoided loading problems.

"We did not discover we were wrong in this until we went to a micro show in September 1981. All the people there were asking for cassettes. Purely for psychological reasons, people would rather buy something they could use directly. Through mail order you could sell listings reasonably well, but at shows there was just no way".

Macronics was also writing software for the ZX-81. The first four programs included Dragon Maze and Planetoids. They were conventional Basic programs with little machine code.

"The only machine code I wrote then was a reverse-scroll routine which scrolled down the screen rather than up", says Bissell. "There are problems with the Sinclair scroll in that it changes the length of lines at the bottom of the screen. If you have an array memory which falls above the display file, every time you add something to the bottom line of the screen the whole array memory has to shunt up which takes forever.

"This means you cannot do any fast graphics programs while you have a large amount of data in the variable area. To overcome that I had to write a machine-code routine which did the scrolling but kept the screen its normal size so that nothing was moved around".

But the software market for the ZX-81 seemed less attractive than it had been for the ZX-80: "We saw that there was not much we could do in the way of software that other people could not do equally as well. So we looked at what was coming next, which was hardware".

Macronics first hardware project involved a printer interface. Ron Bissell built a £199 Seiko printer and interfaced it to the ZX-81. The printer interface went on display at another micro show, but although there was some interest in it he has decided to shelve the project for the time being.

"It soon became obvious that the main interest was going to be in an alternative storage method", explains Bissell. "People were producing enormous programs that took the best part of 15 minutes to load,

'Storage media were clearly of major interest'

with no guarantee that they would load, so a different system of storage seemed the thing to concentrate on".

The result was Fiz, which is not a new type of cola but a Floppy Interface for the ZX-81. Fiz consists of a disc drive, power supply and motherboard. The motherboard is fitted with edge connector slots so that the system can be expanded.

"There is a slot in the motherboard for plugging in the ZX-81 processor card, but this entails an external keyboard with the usual external leads", says Bissell. "Many users have external keyboards and that is the best way of doing things.

"The RAM pack also plugs on to the motherboard, but there is no need to use a RAM pack bigger than 16K. Other slots are available for a printer inteface, disc interface, network interface and a high resolution VDU card".

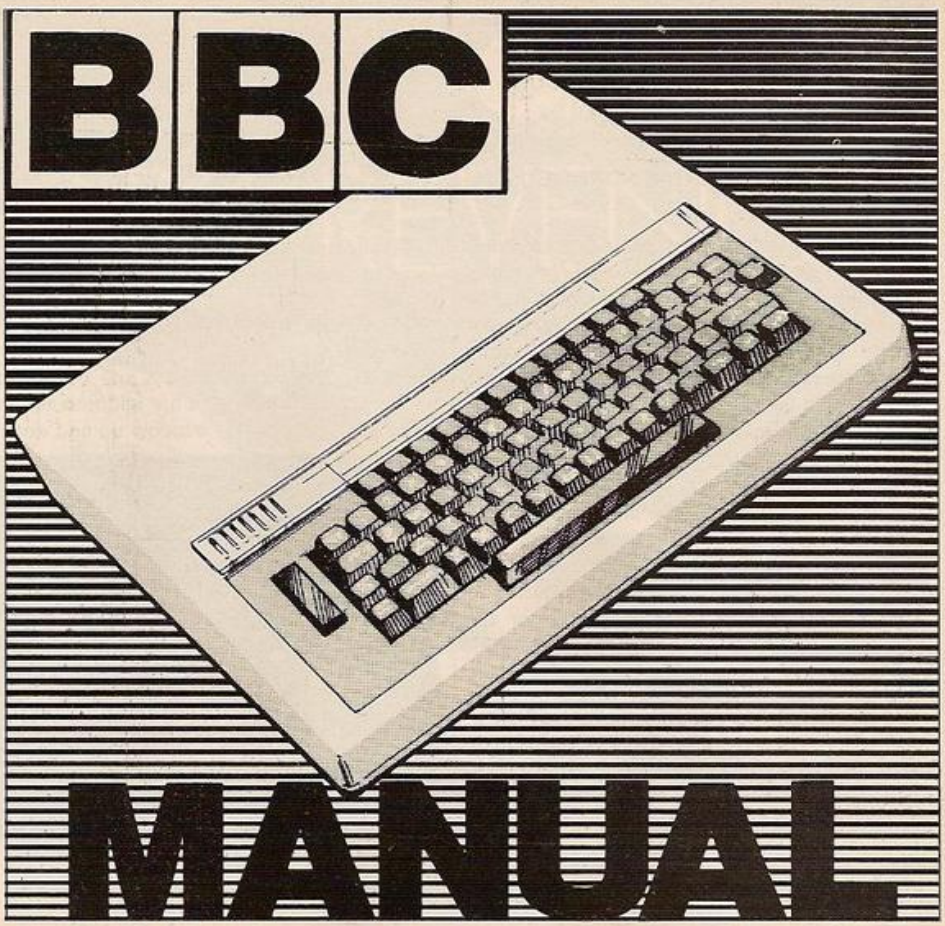
With the Fiz costing £259 plus VAT, it is possible to buy a complete disc system for less than £350. Ron Bissell admits that no one is likely to buy his disc system from scratch, but he thinks there is a market among schools and small businesses that have already bought a ZX-81.

"If you are buying a disc system as a disc system, the last thing you would buy is a ZX-81. You would buy something like a Zerox. But if you already have a ZX-81 and have bought £400 worth of hardware and programs, as many people have done, then you do not want to let go of it. That is the demand we are supplying." ■

BBC MANUAL

FILLING IN THE GAPS

Ben Baruch leads you out of some of the manual's dead-ends and towards the centre of the maze of mysterious BBC functions.



YOU ARE TRAPPED in a labyrinth called the BBC Microcomputer. You have no previous experience of this or any other labyrinth, and so have only two possible means of escape: get up and walk away — that sounds easy, but most find it impossible in practice; alternatively you work out how to write programs which look as good as Kingdom and Keyboard — two of the best programs in the manual.

You begin perhaps to write programs with pretty pictures in Mode 5, which seems — according to the *Guide* — to be the only way to obtain multicoloured graphics on the Model A. Yet as soon as a program becomes interesting, you run out of memory. You then may start to find ways of compressing the program — putting as many instructions as possible on one line is a help — but that takes you little further and, besides, now you cannot even follow your own program. Kingdom is much longer than anything you have written, so how does that fit into the labyrinth?

Kingdom and Keyboard are written in Mode 7, which gives you five times as much memory to play with and Mode 7 has colours and graphics and special effects. To obtain colours type:

```
PRINT TAB(5,10)CHR$(&81) "This is red"
```

Press return — and red it is. The instruction

```
PRINT CHR$(&8x)
```

will affect everything on that print line — x is the logical colour. To set up a second colour change in the line, use +. Thus

```
10 PRINT TAB(1,10)CHR$(&81)"This is red"
   +CHR$(&83);
20 PRINT "and this is not"
```

will give you red and yellow in the same line.

Chr$(141) will give you half of a double-size character. So

```
10 PRINT TAB(5,1)CHR$(141);CHR$(&83)
   "Hallo there"
20 PRINT TAB(5,2)CHR$(141);CHR$(&83)
   "Hallo there"
```

will give you a cheery greeting when you Run.

Mode 7 graphics are produced by using Chr$(&9x) instead of (&8x). Upper-case characters will be printed in colour, but in place of lower-case characters, numbers and other symbols — except " and @ and small arrows — you will obtain block graphics in the colour chosen. The letter space becomes a grid of six cells, two wide and three high, and each character fills in one or more of the cells. Chr$(&FF) fills all six. Thus for example,

```
PRINT CHR$(&92)"5"
```

will print a rectangle one character high, half a character wide and coloured green, which is logical colour 2. A list of what each character does is shown in figure 1.

Since provisional users are left in silence by the guide, try:

```
SOUND 1,-10,450,7
```

1 is the sound generator to be used; there are four, numbered 0 to 3: 0 gives a kind of white noise, the others give pure tones; -10 is the volume which can be anything from 0 to -15; 450 is the frequency; and 7 is the duration of the note.

For a chord, each note must be preceded by &a0, where a is the number of other notes in the chord. For example,

```
SOUND &201,-10,300,7
SOUND &202,-10,320,7
SOUND &203,-10,340,7
```

will give a three-note chord. ■

1	2
3	4
5	6

This is how a letter-space is treated by MODE 7 graphics

To fill cells	6,1	6,2	6,2,1	6,3	6,3,1	6,3,2	6,3,2,1	6,4	6,4,1	6,4,2	6,4,2,1
Print	a	b	c	d	e	f	g	h	i	j	k
To fill cells	6,4,3	6,4,3,1	6,4,3,2	6,4,3,2,1	6,5	6,5,1	6,5,2	6,5,2,1	6,5,3	6,5,3,1	
Print	l	m	n	o	p	q	r	s	t	u	
To fill cells	6,5,3,2	6,5,3,2,1	6,5,4	6,5,4,1	6,5,4,2	6,5,4,2,1	6,5,4,3	6,5,4,3,1			
Print	v	w	x	y	z	¼	|	¾			
To fill cells	6,5,4,3,2	5	5,1	5,2	5,2,1	5,3	5,3,1	5,3,2	5,3,2,1	5,4	5,4,1
Print	÷	0	1	2	3	4	5	6	7	8	9
To fill cells	5,4,2	5,4,2,1	5,4,3	5,4,3,1	5,4,3,2	5,4,3,2,1	4	4,1	4,2	4,2,1	
Print	:	;	<	=	>	?	(	)	*	+	
To fill cells	4,3	4,3,1	4,3,2	4,3,2,1	3	3,1	3,2	3,2,1	2,1	1	
Print	,	–	.	/	$	%	&	'	£	!	

Figure 1. The full list to explain the function of each character on the BBC Micro.

Wreak a terrible revenge on the Martians who dared attack Earth when you launch your counter-attack with Paul Edmond's Vic-20 space game in Basic for the unexpanded machine.

MARS IS AN arcade-type game for an unexpanded Vic. Aliens, in the form of club signs, build up from the bottom of the screen and by moving your ship at the top of the screen and firing, these aliens can be exterminated, scoring two points each. Time and score are displayed at the bottom of the screen under the baseline. Missiles are occasionally launched by the swarming aliens; these can be hit for a bonus of five. However, you must dodge from their path quickly — they are indestructible and can steal 20 points from your score.

Owners of the 3K RAM expansion cartridge will be able to unleash their artistic talents to create their own graphics characters for the aliens and missiles by using the high-resolution graphics explained in the October issue of *Your Computer*.

A handy Peek for the Vic is Peek(653). It can be used to detect whether the shift, Commodore, or control keys are being depressed. For example,

10 B = PEEK(653)

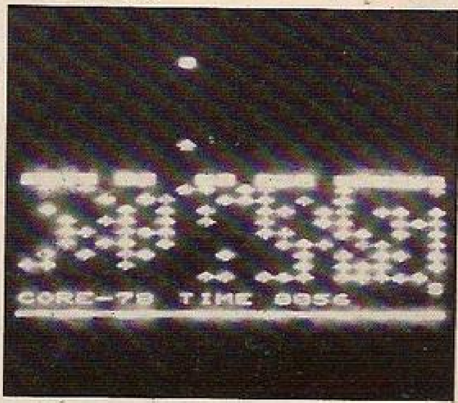
SHIFT KEY; B = 1   COMMODORE KEY; B = 2
SHIFT + COMMODORE KEY ; B = 3
CONTROL KEY ; B = 4

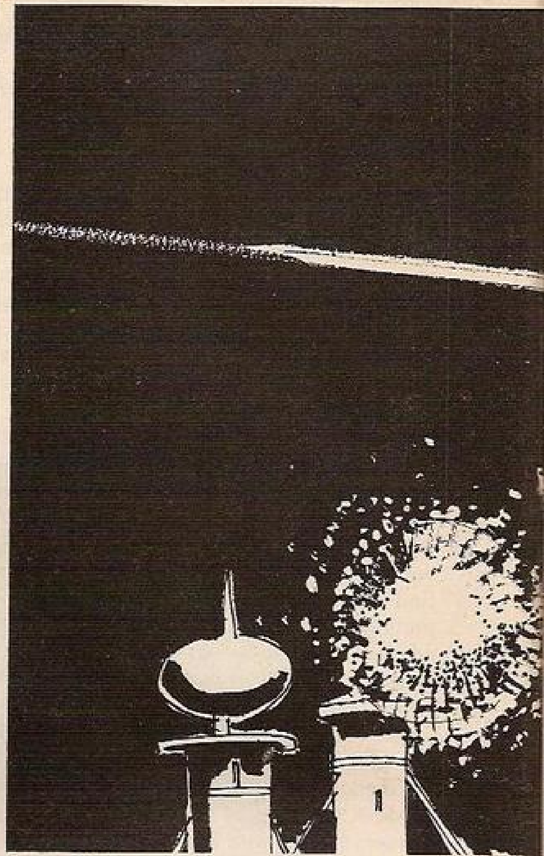
Since this is independent of Peek(197) — used for the rest of the keyboard — it enables some keys to be used for left/right motion through Peek(197) and the shift key for, say, acceleration through Peek(653) without the two sets of controls interfering.

Try adding this to line 430, reduce the M loop to 7 and fit in the Poke statement as shown:

430 FOR M = 1 to 7: POKE 36865,
35+RND(1)*6 :NEXT M,T

36864 and 36865 control the X and Y positions of the screen window. This addition to line 430 simply jiggles this window up and down.





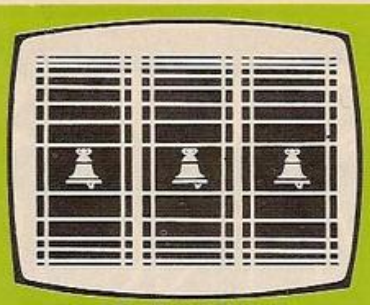
```
READY.

 1 TI$="000000":POKE36878,15:POKE36879,8
 2 DIMA(22):GOSUB800
 3 Z1=7680+19*22
 5 PRINT"":Z=7680:PRINT""
 6 FORI=1TO22:A(I)=1:POKE7680+22*22+I-1,121:NEXTI
 7 PRINT"HANG ON!"
 8 FORY=0TO505:POKE38400+Y,INT(RND(1)*7)+1:NEXTY
 9 POKE36879,8:PRINT"                 "
 10 G=PEEK(197):RT=0
 11 IFRND(1)<.3THEN19
 12 D=INT(RND(1)*22):RT=RT+1:IFRT=4THEN19:IFA(D)=0THEN12
 13 A(D)=0:R=R+1:IFR=15THENZ1=Z1-22:FORI=1TO12:A(I)=1:NEXTI:R=0
 14 POKEZ1+D,88
 19 IFTI$>"000130"THEN200
 20 IFG=29THENX=X-1
 21 POKE36877,0
 22 IFR/2=INT(R/2)THENPOKE36877,220
 23 IFL>0THEN300
 24 IFRND(1)>.9THEN300
 30 IFG=37THENX=X+1
 31 IFX<0THENX=0
 32 IFX>21THENX=21
 40 POKEZ+X1,32:X1=X
 50 POKEZ+X,81
 59 IFG=32THEN80
 60 PRINT"                                   SCORE"SC"TIME "RIGHT$(TI$,
4)
 61 GOTO10
 80 FORI=1TO19
 81 POKE36876,244-I*4
 85 IFPEEK(Z+X+I*22)=88THENSC=SC+2
 86 IFPEEK(Z+X+I*22)=65THENSC=SC+5:POKE36879,0:FORP=1TO80:NEXTP:POKE36879,8
 90 POKEZ+X+I*22,93
 100 IFI>1THENPOKEZ+X+I*22-22,32
 110 NEXTI:POKE36876,0
 120 POKEZ+19*22+X,32:GOTO60
 200 POKE36877,0:FORR=1TO5:PRINT"   YOU SCORED"SC
 210 FORU=1TO80:NEXTU
```

GAMES

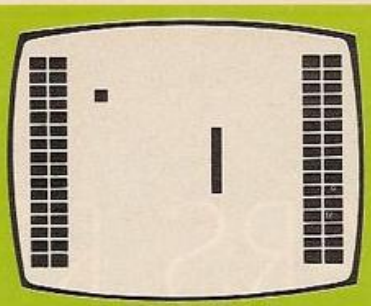
MARS REVENGE


```
220 PRINT"    YOU SCORED"SC
230 FORU=1TO80:NEXTU
240 NEXTR
250 PRINTCHR$(142):FORU=1TO100:NEXTU:POKE197,64:RUN
300 IFL=0THENQ=X
311 POKE36875,128+2*L
320 IFPEEK(Z+22*20-L*22+Q)=81THEN400
330 IFL>1THENPOKEZ+22*23-L*22+Q,32
340 POKEZ+22*19-L*22+Q,65
350 IFL>18THENL=0:POKEZ+Q,32:POKE36875,0:GOTO30
355 POKE36875,0
356 L=L+4
360 GOTO30
400 POKEZ+Q,42:POKE36877,220:POKE36879,0
410 FORT=15TO1STEP-1
420 POKE36878,T:POKE36879,8
430 FORM=1TO80:NEXTM,T:POKE36878,15:POKE36877,0:SC=SC-20:GOTO330
800 PRINT"   WANT INSTRUCTIONS?
810 GETA$:IFA$=""THEN810
820 IFA$="N"THENPRINTCHR$(142):GOTO3
825 PRINTCHR$(142)
830 IFA$<>"Y"THEN810
831 POKE36879,8
835 PRINT"ALIENS WHICH ATTACKED EARTH HAVE RETREATED  TO MARS.
"
840 PRINT"YOUR TASK IS TO KEEP  THEM THERE UNTIL      FURTHER HELP A
RRIVES."
850 PRINT"WATCH OUT FOR THE     DEVIOUS MISSILES!"
860 PRINT"      HIT ANY KEY"
870 GETA$
871 IFA$<>""THEN875
872 FD=FD+FT:IFFD>9THENFT=-1
873 IFFD<1THENFT=1
874 POKE7680+5*22+FD-FT,32:POKE7680+5*22+FD,88:GOTO870
875 PRINTCHR$(142)
880 PRINT"K-MOVES YOU LEFTD-MOVES YOU RIGHT'SPACE BAR -FIRE"
890 PRINT"  '•'-IS YOUR SHIPHELP ARRIVES IN 90SECONDS"
900 PRINT"       HIT ANY KEY"
910 GETA$:IFA$=""THEN910
920 POKE36879,8:GOTO3
```



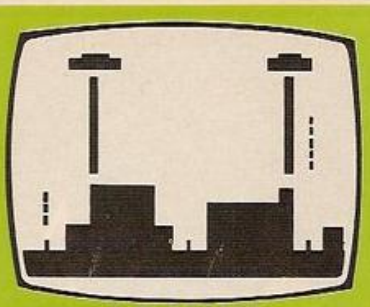
1. FRUIT MACHINE:

This is a computer version of the popular "one armed bandit", with three reels, Nudge reel, and Hold, Nudge and Gamble functions. Incorporating the VIC's normal graphics, colour and sound, it requires an expanded VIC (3/8/16K).



2. BRICKDOWN:

A variation on the game "BREAKOUT"; using the keyboard or a joystick controller manoeuver the bat to try to break through the right hand wall, while protecting the left wall. Requires basic or 8K VIC.

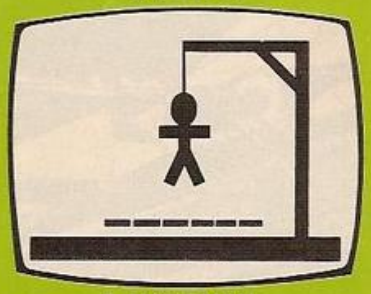


3. BLOCKADE:

Using joystick or keyboard, control your missile base to destroy incoming enemy missiles and protect your fuel dumps. Game ends when you are hit or all fuel dumps destroyed. Uses defined graphics, colour + sound. Runs in basic VIC only.

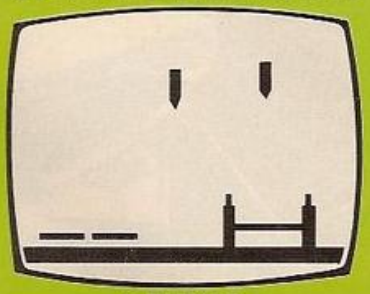
4. ROULETTE:

Complete with accurate full colour "MONTE CARLO" roulette table, you can break the bank without risk of personal loss! Complete with list of odds and allowed bets, you are given £5,000 to play with. Game ends when you lose your shirt. Runs in any VIC, with colour and sound.



5. HANGMAN:

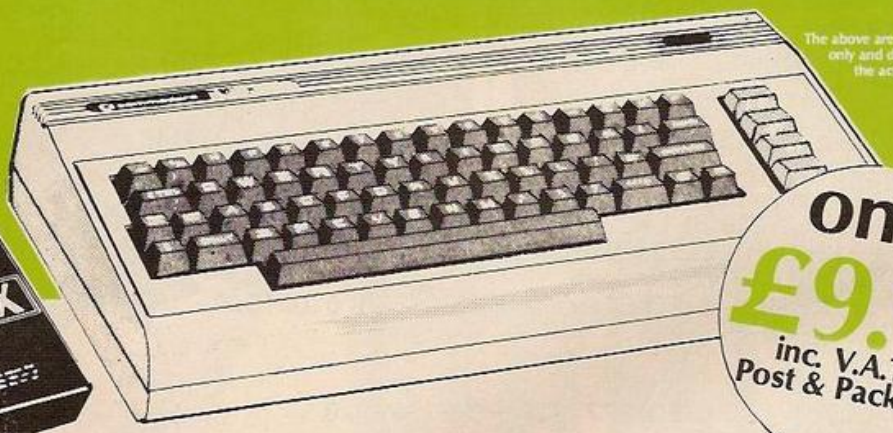
Play the computer at this version of the popular pen + pencil game. The VIC has a built-in vocabulary of 50 words, to which you can Add, Delete or Replace your own words. Addictive, with colour + sound. Runs in any VIC.



6. TARKUS:

With the joystick or keyboard, control the stretcher bearers to pick up the wounded men, and return them safely to the red cross base. If you are hit by an enemy missile, however, you join the wounded, on the field! Challenging and addictive, with defined graphics, colour + sound. Runs in basic VIC only.

NEW!



The above are artists impressions only and do not represent the actual displays.

only £9.95 inc. V.A.T. & Post & Packaging

BEELINES VIC 6 SIX VOL 1

The Games System in a Cassette!

At last! A really professionally produced piece of games software that will guarantee you hours of fascinating thrills on your VIC computer.

The first volume of the 'Beelines VIC 6' gives you exciting colour, arcade quality games that make full use of the power and display quality of the VIC.

The 'VIC 6' is attractively priced so that no VIC user need be without it, and it is available exclusively from Beelines. Just send £9.95.

So fill in the coupon, or phone us with your credit card number, and the 'VIC 6' will be yours within days!

BEELINES (Bolton) LTD
FREEPOST (No stamp required) Bolton BL3 6YZ
Ansaphone (0204) 385299

Reg. office: 124 Newport St., Bolton BL3 6AB.
Dealer enquiries welcome.

Please send me:

Qty.	Item	Price
	Beelines 'VIC 6' Vol. 1 at £9.95	

I enclose cheque/P.O. ☐
OR Please debit my:

Access 5224 ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Barclaycard 4929 ☐☐☐☐☐☐☐☐☐☐☐☐

Expiry Date _____

Name _____

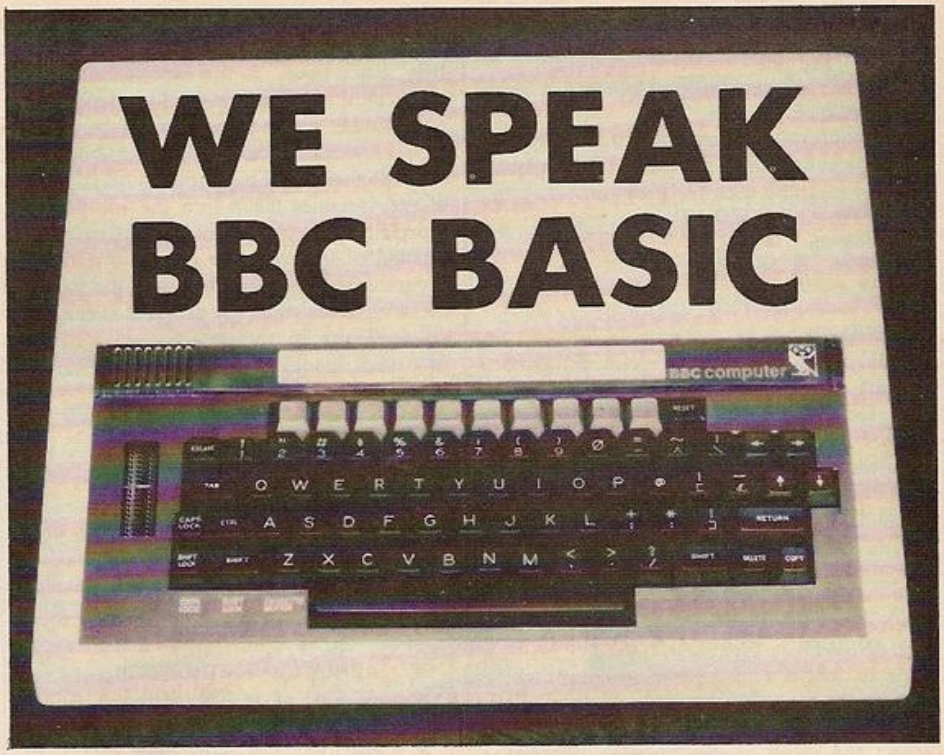
Address _____

_____ Code _____

Tel. (day) _____

Official orders welcome –
we will ship to approved account holders on receipt of firm order.
Delivery free within mainland UK
Access and Barclaycard welcome.
Telephone answering machine for 24hr/7 day credit card orders **0204 385299**
Freepost: **Beelines, FREEPOST, Bolton BL3 6YZ**
YC/6/82

WE SPEAK BBC BASIC



If you need to translate BBC Basic into other Basics or are just interested in the development of computer language Tony Edwards' introduction to translation and portability will be invaluable. Although Basic dialects appear so different that they might be separate languages in their own right they share many of the same concepts.

THE BBC COMPUTER, and hence its language, has its origins in the Proton, the Acorn machine which reached the prototype stage but was never produced commercially. The BBC Micro's language is, however, closer to Microsoft Basic than is that of its ancestor the Acorn Atom, and should cause little difficulty in translation.

The commands, statements and functions acceptable to the BBC interpreter are split into two groups: the common-core and the extensions. The idea is that the extensions should not be used if a program is to be transportable: the common core should be close to other Basics and most interpreters should swallow it without too much indigestion. On first sight, however, the extensions seem alien to users of other Basics and contain such additional statements as Repeat-Until and Local.

The range of statements found in the common-core subset of the language should cause few problems in translation to other Basics as they are all reasonably familiar. There are, however, some pitfalls. Not least among them are variable names. BBC Basic allows unlimited length of variable names and all characters are significant. Thus the line

```
10 IF INCOME < INFLOW THEN GOTO 100
   ELSE PRINT WARNINGS
```

may look acceptable, but if your Basic evaluates only the first two letters of a variable name you may be in trouble. Another problem with variable names is that BBC Basic accepts reserved words if they are lower case or embedded in another variable name. Hence the variable Poor may suit the BBC interpreter, but yours may not like it if Or is a reserved word.

Punctuation can also cause trouble so you should be on your guard. The well used and almost universal question mark as an abbreviation for Print does not appear in BBC Basic. Instead ?16000 returns the contents of address 16000 as would Peek(16000) and ?16000=10 puts 10 into address 16000 — that is, it serves as a Poke16000,10. This should not surprise Atom users, but those who use other machines may be disconcerted. Also left over from Atom Basic is " ' ", but in BBC Basic it is no longer a Rem, but a carriage return. Thus

```
PRINT"USE","THE","NEXT" ' "LINE
```

returns:

```
USE THE NEXT
LINE
```

The remainder of the common-core should be familiar to most Basic programmers and if some of the functions it contains do not work like those in your Basic, you should be able to mimic them with little difficulty.

The statement ASC(A$) returns the ASCII character value of the first character of A$, which should not surprise any one. If, however, A$ is a null string, it returns the value –1 which may not be so obvious. Inkey/Inkey$ and Get/Get$ are similar functions which read the next character from the keyboard. With the $, they expect a string — without it a common variable. Most Basics do not have a Get or Inkey but this can easily be mimicked using Val. For example, in the place of

```
10 N=GET
```

we would use

```
10 N$=INKEY$ : N=VAL(N$)
```

Inkey is different from Get in that the former waits a set time only for input — 10 ms for each figure after the function. This, too, is easily mimicked. The line

```
10 N=INKEY(100)
```

can be translated as:

```
 0 B$=INKEY$
10 FOR I=0 to 1000
20 A$=INKEY$
30 IF A$=""THEN 50
40 A=VAL(A$):I=1001
50 NEXT : IF A=0 THEN A= -1
```

This routine scans the keyboard for a fixed period — you must adjust the length of the loop to suit your processor — and returns the value of any numerical key pressed in that time. If no key is pressed, it returns the value –1. The line 0 may be necessary to alter the buffer of keys pressed before the loop starts.

If you are trying to mimic Inkey$ you will not need the Val function in line 40 nor the If-Then in line 50. There is a better way of doing this with a Repeat-Until loop but more of that later.

The BBC Basic's Restore statement is standard, but an additional feature is the facility to restore partly with Restore (line number). This is not possible in most other Basics and is a very useful facility. Unfortunately it is difficult to imitate.

A direct answer is to adjust the Data pointer. As a program is run the address of the next Data line is held in protected RAM. The Restore statement alters this so if you do not have a partial Restore facility you must alter this yourself with Poke statements. You should first find from your instruction books or other sources where this address is stored and then Poke a suitable new value into it.

For instance, on the Genie or TRS-80 the most significant byte is in memory address 16640 and the least significant one is in 16639. Thus a partial restore statement on these machines is

```
10 POKE16639,10 : POKE16640,200
```

To find out what values to Poke, Run your program with

```
?PEEK(16639) : ?PEEK(16640)
```

in front of the Read statement which first reads the line to which you wish to Restore. This will then print out two values close to those you need — close because any changes to the program in lines with lower numbers than the Data statements, including deleting the temporary Peeks, will change the address of the target Data line. You will have to change the Poked values until the program runs as you wish, remembering which address holds the most significant byte.

This is the most elegant solution once it is working. If, however, you think it too complex you could start your program by Reading all Data values into an array. Then call the various values as the contents of array elements as and when you need them, thus avoiding Restore altogether. This method uses a good deal of memory and causes the program run to pause while the Data is placed in the array.

There are a number of complex statements in BBC Basic such as

```
FOR N=1 TO VAL(A$)
```

or If-Then-Else which should be understandable even if your Basic does not have them. You must split them into smaller steps for your Basic. In the case of If-Then-Else you

(continued on next page)

(continued from previous page)
will have to use a complex net of Gotos. As an example, the line

```
10 IF A$="."THEN END ELSE IF A$=""THEN
   A$="0" ELSE A$="X"
```

is probably comprehensible to you even if your machine cannot understand it. Explain it to your machine with the program:

```
 10 IF A$="." GOTO 100
 20 IF A$="" GOTO 40
 30 A$ = "X" GOTO 50
 40 A$ = "0"
 50 . . .
100 END
```

BBC Basic includes user-defined functions as part of the common-core. Those without this facility will have to use subroutines instead. To see how to do this consider the following program in BBC Basic.

```
 10 DEF FNSECANT(A,R) =
    1/(COS(A+R*PI/2)
.
.
.
.
.
100 ANSWER = FNSECANT(200,Z)
```

Line 10 defines a function called Secant which returns the secant of the angle A plus R right angles, and line 100 uses this function to assign the result of this function to Answer when the angle is 200 plus Z right angles. Note the use of Pi as a dedicated constant equal to π. This is simulated in other Basics with:

```
 10 B = 1/COS(A+R*3.14159/'') : RETURN
.
.
.
.
.
100 A = 200 : R=Z : GOSUB 10
110 ANSWER = B
```

In this program the subroutine in line 10 has fixed the variables A and R. Before the Gosub the required values are assigned to these variables for use in the subroutine. On return from the subroutine, the result in variable B is assigned to the required variable Answer.

The BBC Basic extensions have been added to standard Basic in an attempt to improve it. These extensions are extra facilities which cannot be translated directly into other dialects. However, if we understand what they do, it is possible to simulate them in our own dialect.

The Repeat-Until loop is probably the most useful of these extensions. It allows a loop to be repeated a number of times until some predetermined condition occurs which terminates it. It is permissible to leave the loop with a Goto and re-enter it later, and a single Repeat can serve as multiple Untils.

When faced with such a function to translate we must use some type of For-Next loop. This is, however, full of dangers. Consider this subprogram using Newton's Theorum of Successive Approximations to solve an algebraic equation:

```
10 REPEAT
20      Y1 = A*X^P + B*X
30      X1 = X - (Y1-Y)/(P*A*X^(p-1) + B)
40      X3 = X : X = X1
50 UNTIL ABS (X-X3)<0.001
```

This sub-program makes repeated estimations of the root of the equation $ax^p + bx = y$ for given values of a,b,p,x and y. The root is returned as X3.

When successive estimates differ by less than 0.001, the program continues. Note that BBC Basic uses ^ as the exponentation operator where you may use **, ↑, or [. When the programmer writes this section of the program he has no idea how many times the loop would be implemented. This depends on the values of the variables taken into the sub-program, especially the accuracy of X the first approximation of the root. We can assume that the programmer has no control over the values of these variables when the program is run. How do we do this in a less sophisticated Basic? A first effort would be:

```
10 FOR I  = 1 TO 100
20      Y1 = A*X[P + B*X
30      X1 = X - (Y1-Y)/(P*A*X[(P-1) + B)
40      X3 = X : X = X1
50      IF ABS (X-X3)<0.001 THEN 70
60 NEXT I
```

That looks relatively easy, but in line 50 the program jumps out of a For-Next loop without reaching the next. Will your Basic allow this? If it does, how many times can you do it in one Run? The problem is that the machine, not having encountered a Next, thinks it is still within the loop so at the next occurrence of For it starts a new loop nested within the first — the result is often disastrous.

BBC Basic	Equivalents
X = ASN(A)	X = ATN(A/SQR(1-A*A))
X = ACS(A)	X = ATN(SQR(1-A*A)/A)
X = DEG(A)	X = A*57.2958
X = RAD(A)	X = A/57.2958
X = EXP(A)	X = 2.71828 ↑ A

Note that "↑" means "to the power of"

Table 1.

A further programming error is in line 10. Why put 100 as the upper limit of the loop? Why not 1000 or 10? If you reach the upper limit before ABS(X-X3)<0.001, the program leaves the loop with an inaccurate root in X3. The answer is to use the biggest number possible, but what is the largest limit your Basic will accept, and what is the maximum number of loops you will ever need?

Consider the program:

```
10 FOR   I = 0 TO 0 STEP 0
20      Y1 = A*X[P + B*X
30      X1 = X - (Y1-Y)/(P*A*X[(P-1) + B)
40      X3 = X : X = X1
50        I = NOT (ABS (X-X3)<0.001)
60 NEXT
```

This works but is not clear just what it does. This, in my view, spoils one of the best points of Basic. Nevertheless, at times we must write opaque programs when it is expedient.

When we work through this program to see what it does, it becomes apparent that line 10 does very little. It assigns 0 to the variable I, incrementing it by 0 each cycle of the loop until it is less than 0. That seems like a dead loop. Lines 20 to 40 are the sub-program as before. In line 50, I is set to some non-zero value if the escape criterion is reached, so line 60 will terminate the loop.

If the program will not run on your machine some small adjustments will be necessary. If line 50 is not acceptable to your compiler, replace it with a more direct test:

```
50 IF ABS(X-X3)<0.001 THEN I = -1
```

If your Basic does not leave the loop, test to see if your compiler thinks 0 is positive or negative — mine thinks it is negative. So, with a step of 0, it looks for a value less than the limit to escape. You may have to assign a positive number to I to escape.

If you use a ZX unit, the Repeat-Until loop is easily simulated as follows:

```
10 (start of loop)
12      .
14      .
16      .
18 GOTO (Condition)*10 + 10
```

On running, if the condition is false the jump is to 0 × 10 + 10 = 10. If the condition is true, the jump is to 1 * 10 + 10 = 20.

You now not only have a translation for the BBC Basic's Repeat-Until loop, but also an efficient extra function to use in your own programming. One word of warning: if the escape criterion is not reached for some reason, line 10 will loop forever. The Repeat-Until loop also has this problem so unless you are looking for a program with infinite running time, I suggest it would be good programming to add a loop counter which aborts the loop with a suitable error message after a reasonable time.

Armed with this new function you may like to refer it back and find a better way to mimic the Inkey function.

There are a number of useful trigonometrical functions in the extensions which are not usually found in other Basics. They can be mimicked directly using existing Basic functions. Table 1 shows a selection of these.

A more exotic addition is the Defproc-Endproc statement. The first statement will be followed by a number of parameters in brackets. You will have to assign a separate subroutine to handle the operation of the procedure and ensure that the variables used in your subroutine are assigned the correct values prior to the Gosub. Here the BBC Basic code will help you as the variables to be used in the procedure are those in brackets after the Defproc statement.

A word of warning: BBC Basic allows the local use of variables within procedures and functions. Where you see the statement Local, the variables that follow it will be treated as different from earlier variables having the same name. You should react to this by placing a marker in front of the local variables — that is, by calling the program variable XX %XX. Alternatively, if you do not use double-letter variables in your programming, double the first letter when local values are used so that the variable Time becomes TTtime. If you do this remember your compiler may not differentiate between TTime and TTop.

As a final warning this month I draw your attention to the BBC Basic function Div. The BBC computer has full floating-point arithmetic, but it also supports this integer division function. It is used regularly in programming, especially in games. If your computer does not have floating-point arithmetic all is well as it already believes that 5 ÷ 2 = 2. If, however, you do have this facility, remember that 5Div2 does not equal 2.5, so you must substitute A = B DIV C with A = INT(B/C) or A% = B/C if you can use % as an integer marker.

Next month we shall look at graphics — the major problem in the translation of programs from one Basic to another. ■

Complete Sinclair ZX81 BASIC Course

At last, a comprehensive text for your Sinclair ZX81! The complete BASIC Course is a manual which will immediately become an indispensible work of reference for all your ZX81 programming.

Whether you have never done any programming or whether you are an experienced microcomputer user, the Complete BASIC Course will provide an invaluable aid.

Not Only 30 Programs for the Sinclair ZX81: 1K —

Not only over 30 programs, from arcade games to the final challenging Draughts playing program, which all fit into the unexpanded 1K Sinclair ZX81 but also notes on how these programs were written and special tips! Great value!

Machine Language Programming Made Simple for the Sinclair —

A complete beginner's guide to the computer's own language - Z80 machine language. Machine language programs enable you to save on memory and typically give you programs that run 10-30 times faster than BASIC programs.

ZX81 ROM Disassembly Part A

This book is for the programmer that needs complete answers about the ZX81. Dr. Logan has examined all routines in the ROM and here he comments on each one. It covers all ROM locations from OOOOH to OF54H, and includes all functions except for the routines used in the floating point calculator.

Understanding Your ZX81 ROM

A brilliant guide for more experienced programmers by Dr. Ian Logan, this book illustrates the Sinclair's own operating system and how you can use it.

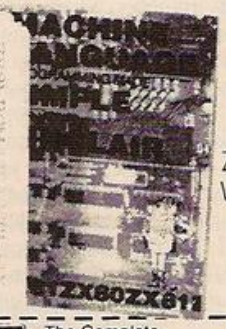
SPECIAL OFFER!
FREE BLANK CASSETTE
WITH EVERY BOOK
OFFER EXTENDED TO 30 JUNE 1982

The Essential Software Company

NEWS

We are pleased to announce the opening of our new shop at the TECHNICAL LEISURE CENTRE, 1, GRANGEWAY, KILBURN, LONDON, NW6.

GRAND OPENING - 29th 30th & 31st MAY.



Come and see our exciting range for ZX81, TRS80 VIDEO GENIE

OUR GREAT NEW CATALOGUE IS NOW AVAILABLE

SEND S.A.E.

Order Form:

Orders to
The Essential Software Company, Dept BT
(Visconti Ltd.)
47 Brunswick Centre, London WC1N 1AF

NAME: .....

ADDRESS: .....

.....

..... **Postcode** .....

The Complete Sinclair ZX 81 BASIC Course Basic Course	£17.50 ☐
Programs on Cassette	£ 2.50 ☐
Sinclair ZX 81 ROM Disassembly Part A - 0000H-OF54H	£ 7.00 ☐
Not Only 30 Programs/Sinclair ZX 81:1K	£ 6.95 ☐
Machine Language Programming Made Simple	£ 8.95 ☐
Understanding Your ZX 81 ROM	£ 8.95 ☐
Postage and Packing	£ 0.70
Remittance enclosed	_____

TRS80 VIDEO GENIE

3D-Adventures

3-D means that as you wander through the mazes and buildings, a full screen graphic display constantly shows your position in a perspective format as though you were actually there! This "rat's eye" view adds an entirely new dimension to adventure.

English language commands can be entered at any time to manipulate your environment. The command sets are extensive and sophisticated.

Deathmaze 5000 and Labyrinth allow the traditional one and two word commands. Asylum incorporates our Advanced Language Interpreter (ALI), which allows full sentence input. Deathmaze and Labyrinth consist of over 550 locations! Asylum tops 1200 locations!

Deathmaze 5000 places you on the top floor of a five storey building. Each floor is a maze of twisting passageways. Floors are connected by elevators and open pits. You have but one goal. **ESCAPE ALIVE!** Where is the only door out of this nightmare? Monsters, bats, mad dogs, hunger, and many more horrors plague your every step as you struggle to escape. TAPE £10.95

Asylum places you on a cot in a small room. Periodically, a janitor lobs a hand-grenade through the window of your locked door. What you do next could mean survival and escape! It could also mean permanent residence in the home for Deathmaze survivors! To leave, you will have to deal with guards, fellow survivors, doctors, the infamous Crazed Carpenter, and much, much more. Don't expect to get out any time soon! TAPE £12

Labyrinth places you in a maze of gigantic proportions. But you are not alone! A minotaur searches for you, seeking a grisly meal. You must find weapons, spells, and treasures. You must deal with ghosts and cave gnomes. You must avoid the minotaur until the moment is right for the final battle. TAPE £10.95

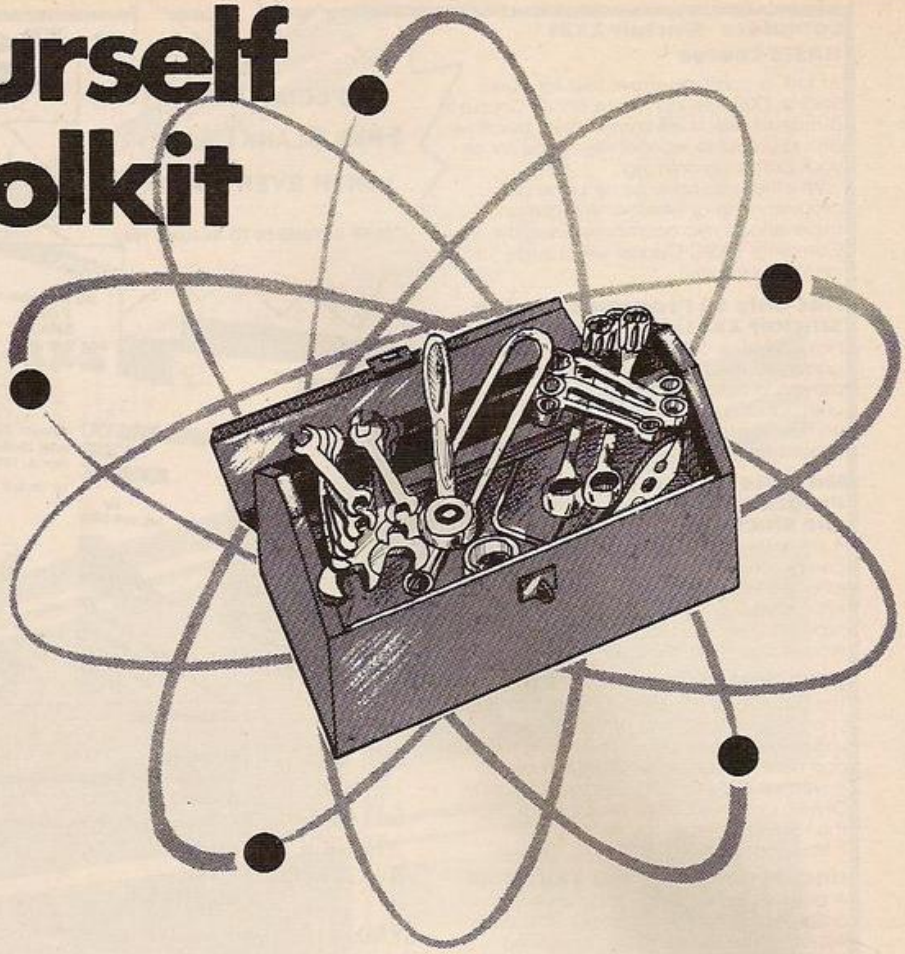
THE ESSENTIAL SOFTWARE COMPANY
(Viscounti Ltd.)
47 Brunswick Centre, London WC1N 1AF

I have a _____ microcomputer
Please send me your software catalogue. I enclose a stamped self addressed envelope.
Please send me _____
I enclose a cheque postal order for £ _____
(plus 70p post & packing)

Signature _____
Name _____
Address _____
Postcode _____
My ACCESS No is _____

Do-it-yourself Atom toolkit

David Berry shows how to implement a toolkit of mainframe utility routines on an Atom.



UTILITIES ARE routines which operate on programs, either to modify them or to assist in their construction. The microcomputer fraternity often refer to them as toolkits, and the word "tool" is a very apt description. Like all tools, a utility should be easy to use and unobtrusive — a natural, unfussy, and above all useful device, which can be picked up, used and put aside again easily and quickly.

The utilities I shall describe all occupy little-used areas of Atom RAM, they auto-run, and return control after use to the base address of the program being modified. Most make use of sound output to indicate the stage of processing the machine has reached, and employ machine-code routines for maximum speed.

Programs are stored on the Atom in a very simple text format. Each program line is bounded by carriage returns which have the ASCII code 13 or 0D hexademical. The Atom always assumes that the first two memory locations after a # 0D contain the high and low bytes of a program line number. The whole program is always terminated with the hexadecimal number FF, which appears in the location immediately after the last # 0D carriage return.

Saving bytes

You may have realised by now that the first byte of any given program must therefore be # 0D, and the last byte, at TOP-1, # FF. You can check this, next time you switch your machine on, by Peeking # 2900 and # 2901, where you will find # 0D and # FF respectively. Now type a line number, try 000255, followed by a return, print &Top and you will find that you have used only three bytes — not the seven you may have expected.

This explains why you cannot used these utilities on programs containing the line number 255. The decimal 255 is FF in hexadecimal, and while the Atom is clever enough not to be fooled at finding the program terminator in a line-number position, the memory-moving routines in these utilities are not. So, if line 255 is present, the utility will terminate prematurely. The same applies to any line number which puts FF into the second location after a # 0D, i.e., the decimal equivalents of # 1FF, # 2FF, # 3FF, and so on.

The machine-code routines for auto-running and memory-moving usually sit directly on top of the Basic text. This means that when you copy the programs you must put spaces only where I put them, and check that you obtain the same value for Top as those quoted.

I made a major assumption when I started writing Auto: that given a set of 26 labels, no-one would ever use line numbers as targets in Goto, Gosub and similar commands, and so this program totally ignores them.

Every time the program is run it renumbers the program at which it is pointed. Secondly, once renumbering is complete, or if the text area is empty, it automatically generates line numbers.

Auto is designed to live in the lower text space between # 2800 and # 2900 — # 2900 is where Basic programs normally start.

Program 1 gives the Auto listing, the value of Top you should strive for, and the *Save addresses. Before you type in the program remember to enter ?18 = # 28 first or you will end up in the wrong RAM.

Address prompt

When you run the program it will prompt for the most-significant byte of the address of the first byte of the program to be renumbered or entered. This will most often be # 29 — do not forget the # . To terminate the run enter a return against the last line number generated.

The next two utilities need to be able to move large amounts of memory quickly. By that I mean that the contents of the memory has to be moved from one location to another. This is achieved by a machine-code routine which, in its assembler source-code form, is shown in program 5.

Program description

Line 10: Initialise the program and input the target program address.

Line 20: A points at memory locations occupied by the target program. If the second location contains the program terminator, # FF, the renumber routine is skipped.

Line 30: Subroutine b increases the line number count by 10, Pokes the new line number into its two locations, prints it and moves pointer A past it. Subroutine c moves the pointer past the string — program line — following the line number. The sequence is repeated until the program terminator is found.

Program 1. Auto.

```
Ready machine


?18=#28
NEW


Enter program
10B=0:P.#12;IN."MSB"A:C=A:@=32
20A=A*#100:A=A+1:IF?A=#FF:G.a
30D0GOS.b:GOS.c:U.?A=#FF
40a@=0:GOSb:IN.#A
50IF?A=#D:A=A-2:?A=#FF:?18=C:E.
60GOS.c:G.a
70bB=B+10:?A=B/#100:A?1=B:P.B:A=A+2:R.
80cA=A+LENA+1:R.


Check value of Top equals #28CF
Enter auto run routine
P=#28CF:[:LDA@#28:STA18:STA6:LDA@0:STA5:JMP#C2F2:]


Save Program
*SAVE"AUTO"2800 2900 28CF
```

Line 40: Start of generation of new line numbers. The number is printed by subroutine b as before, but now a program line is input and stored.

Line 50: If the string is empty, move A back two locations, Poke the program terminator into that address, reset the pointer in location 18 and terminate.

Line 60: Continue the endless loop a.

Memove itself is not a utility, but is simply a means to an end and all it does is roughly the equivalent of:

DO ?M=M?1; M=M+1; U.?M=#FF

It just does it very, very quickly.

It is useful to enter Memove into the graphics RAM starting at #8200, where it is clear of both the utilities and any test programs you may later enter at #2900. So, type ?18=#82 and enter the program. For this you can put spaces and lines anywhere you like, with one exception: line 30 must not be altered or added to.

For the adventurous

The more adventurous among you will have tried using Auto to enter this program and, even now, may be tearing out handfuls of hair. In the interest of good will, to all readers: enter:

!#8200=#FF0D

and try again.

Dele is short for "delete", which is exactly what this routine does — it deletes blocks of lines from the target program. It is also intended to fit between #2800 and #2900, so Poke #28 into location 18 before you start typing. Enter the program exactly as it appears in program 2 and check that your value for Top is the same as the quoted one. Now enter the auto-run routine as a direct command — that is, with no line number. This assembles the auto-run routine immediately on top of the Basic text. Next, assuming Memove is still at #8200, follow the sequence of commands given which will change line 30 of Memove causing it to be assembled into memory starting at address #28D8 — just above the auto-run routine. *Save Dele using the addresses given.

When you use Dele, you will be asked for the most-significant byte of the target program, and a start line number, SL=, and end line number, EL=. Both start and end lines are deleted together with all the lines between them.

Squash is a compactor. It removes all the spaces from the target program. Then, at the user's option, removes all Rem statements also. It is worth emphasising that it removes all spaces. In some cases spaces are required for the correct interpretation of Atom Basic statements, and you should check chapter 10 of the manual if you find that your program refuses to run properly after all the spaces have been removed.

It is, however, clever in its handling of Rem statements and can deal correctly with all variations. Rems may be preceded by a line number, label or semicolon. All of these possibilities are catered for.

Like Dele, Squash has to move large amounts of memory to fill the gaps left by the spaces and Rems it removes. To do this it uses Memove and, since Squash and the machine-code version of Memove add up to about 0.5K, it is too large for the usual RAM area between #2800 and #2900. Since I rarely use graphics mode 4, I decided that Squash could best be entered from address #9600 — that is the top 0.5K of upper text space — and the information given in program 3 is based on that decision.

You can, of course, put it anywhere you like. For example, you may be happier to use the top 0.5K of lower text space. If so, replace #96 and #97, wherever they appear in the frame, with #3A and #3B respectively.

Follow the sequence in program 3 and you will enter the program, assemble the auto-run routine and, provided Memove is still at #8200 — if it is not, load it now — assemble it on top of the rest of the code. Do not forget that your value of Top must equal the quoted one or you will overwrite the end of the Basic text.

When you run Squash it will prompt you for the most-significant byte of the target program start address. Then it will remove all the spaces in that program and, if the shift key is being held down when the bell rings, will continue on to remove the Rems too.

Edit is unusual — it modifies itself as it is running. It is a technique which will be useful in a number of situations such as computed Gotos using labels, or subroutine parameter passing.

One of the useful things about interpreters is that line number N+1 is not read until line number N is finished with. This allows line N to modify line N+1, and this is the concept used twice in Edit. In the first instance, line 40 changes the question marks in line 60 to exclamation marks in order to speed up the matching of long strings. Then, line 130 changes the From/To loop parameters in line 140.

Edit provides a facility for the global replacement of strings. That is, it takes a string entered from the keyboard and replaces every identical string in the target program with a second string entered at the same time. For example: it can replace every Print with P.; every In. with Input and so on.

You can also delete every occurrence of any particular string simply by entering a null replacement string — that is, just a return. But be careful, you must make your search string long enough to be specific to the string you want replaced.

If you want to replace variable name E with B and use as your search string only the letter E, the program will replace every letter E in the text. Next will become Nbxt, Let will become Lbt, "Enter E" will change to "Bntbr B", and so on.

Again this routine is too large to live at #2800 and it, too, was entered at #9600, but you can change this to suit yourself. The whole process for entering and saving Edit is shown in program 4.

Because Edit modifies itself by Poking characters into its own program line, extra care is necessary, when you enter the program, to copy the listing exactly. Every character and space must be in the correct position or the program may not run.

Speed comparison

When you run Edit you will be prompted for the usual most-significant byte and for two strings: $S= for the search string — the one to be replaced; and $R= for its replacement. This program does not use a machine-code routine for moving the memory contents and is thus much slower than the last two utilities. It may interest you to compare the speed of removing spaces with Edit and Squash. By my watch, Edit is no less than 40 times slower than Squash.

To run any of the utilities, all you have to do is mount the right tape and type

*RUN"name"

and the chosen routine will load and run automatically. When it has finished control is returned to the address given by

MSB * #100

Program description

Line 10: Input most-significant byte, calculate the first memory location of the target program and input the start and end line numbers.

Line 20: Find the start of a program line, subroutine b sets Q equal to the next line number which is then checked against the start line number S.

Line 30: Link to Memove until ?M becomes equal to #D, use subroutine b to find out whether the end line number has been exceeded — if not: repeat.

Line 40: Terminate the run.

Program 2. Dele.

```
Ready machine
?18=#28
NEW

Enter program
10 IN."MSB"M;N=M;M=M*#100;M=M-1;IN."SL="S;IN."EL="E
20aDO M=M+1;U.?M=#D;GOS.b;IFQ<S;G.a
30cDO !#80=M;LI.#28D8;U.?M=#D;GOS.b;IF 0<=E G.c
40 ?18=N;E.
50b0=M?1*#100+M?2;R.

      Check value of Top equals #28AC
Enter auto-run routine
P=#28AC;C;LDA@#28;STA18;STA6;LDA@0;STA5;JMP#C2F2;□

Change 'Memove' line 30 and run.

?18=#82
OLD
30 P=#28D8
RUN

Save program
*SAVE"DELE"2800 2900 28AC
```

Program 3. Squash.

Program description

Line 10: Input most-significant byte and calculate the first memory location of the target program. Subroutine a jumps the pointer over text enclosed in quotation marks and line numbers, and searches for the program terminator.

(continued on next page)

```
Ready machine
?18=#96
NEW

Enter program
10IN."MSB"M;R=M;M=M*256;DOGOS.a
20IF?M=#20;!#80=M;LI.#97D0;M=M-1
30M=M+1;U.E;P.$7
```

(listing continued on next page)

(continued from previous page)

Line 20: If M points to a space, link to Memove to remove it.
Line 30: Continue the Do loop until E is true.
Line 40: If the shift key is not pressed: terminate.
Line 50: Reset pointer M to start.
Line 60: Start of loop b, Gosub a then check E to see whether the program end has been reached.
Line 70: If M is not pointing at a Rem statement, increment it. The FF in the ! command masks out the character following Rem.
Line 80: If a Rem is found, run along it until the statement terminator — either ; or # 0D — is found. S then contains the number of characters in the statement.
Line 90: If this Rem starts with a line number and ends with a # D, adjust M and S so that the line number is removed also.
Line 100: If this REM starts with a ; and ends with a # D, adjust M and S so that ; is removed.
Line 110: If this Rem starts with a label and ends with # D, M and S are adjusted so that line number and label are preserved.
Line 120: In all other cases, increment S to include the line terminator.
Line 130: Remove all characters in this line by linking to Memove.
Line 140: Subroutine e.

(listing continued from previous page)

```
40IF?#B001=#FF;?18=R;E.
50M=R*256
60bGOS.a;IF E;?18=R;E.
70IF!M▯#FF000000<>#FF4D4552;M=M+1;G.b
80S=0;DOS=S+1;U.M?S=#3BORM?S=#D
90IFM?-3=#DIFM?S=#DM=M-3;S=S+3;G.c
100IFM?-1=#3BIFM?S=#DM=M-1;S=S+1;G.c
110IFM?-1>#60IFM?-1<#7BIFM?S=#D;G.c
120S=S+1
130cF.Q=ITOS;!#80=M;LI.#97D0;N.;G.b
140aE=0
150IF?M=#22;DOM=M+1;U.?M=#22
160IF?M=#DM=M+3
170IFM?1=#FF E=1;R.
180R.
```

```
Check value of Top equals #97B2
Enter auto-run routine
P=#97B2;[;LDA@#96;STA18;STA6;LDA@0;STA5;JMP#C2F2;]
Change 'Memove' line 30 and run
?18=#82
OLD
30 P=97D0
RUN
Save program
*SAVE"SQUASH"9600 9800 97B2
```

Program 4. Edit.

Program description

Line 10: Input and store the search and replacement strings.
Line 20: Check that the strings do not overflow into the Basic work area.
Line 30: Input the most-significant byte and calculate the first byte address of the target program.
Line 40: Change the ? in line 60 to ! if the search string is longer than three characters.
Line 50: Start searching the target program; jump over line numbers.
Line 60: If the first, or first four, characters of the search string match those being examined, Gosub c; reset the start of the search and replacement strings on return from c.
Line 70: Repeat until the program end is reached, reset location 18.

Subroutine c:

Line 80: Return if there is a mismatch between the search string character and the one being examined.
Line 90: Move along one character; if this is not the end of the search string, go back to line 80.
Line 100: Subroutine e generates a noise; the rest of this line finds the program-end location.
Line 110: Is the search string longer, as long, or shorter than the replacement string? D holds the difference in lengths.
Line 120: If D is positive, K becomes +1; if D is negative, K becomes −1.
Line 130: Change line 140 to read O to M or M to O depending on the value of K.
Line 140: Move the memory contents forward or backwards by D bytes to eliminate or make room for the difference in string lengths.
Line 150: Move the memory pointer backwards to the start of the string. If the replacement string is null, miss the next line.
Line 160: Insert the replacement string into memory.
Line 170: Go back one byte then return.

```
Ready machine
?18=#96
NEW
Enter program
10aP.$12;S=#21C;IN."$S=";T=LENS;R=S+T+1;IN."$R=";P=LENR
20IFR+P+1>#23F G.a
30IN."MSB"M;Q=M;M=M*#100
40!#96B5=#3F3D533F;IFT>3;!#96B5=#213D5321
50M=M+1;DOM=M+1;IF?M=#D M=M+3
60IF?S=?M GOS.c;S=#21C;R=S+T+1
70GOS.e;U.?M=#FF;P."END";?18=Q;E.
80cIF?M<>?S R.
90M=M+1;S=S+1;IF?S<>#D G.c
100O=M;DOGOS.e;O=O+1;U.?O=#FF
110D=P-T;IFD=0G.d
120K=((D▯#++)-#7+)/#80
130?#9782=#4E+K;?#9787=#4E-K
140F.L=N TO N S.-K;D?L=?L;GOS.e;N.
150dM=M-T;IFP=0G.+
160DO?M=?R;M=M+1;R=R+1;U.?R=#D
170+M=M-1;R.
180e?#B002=?#B002:4;R.
Check value of Top equals #97F1
Enter auto-run routine
P=#97F1; ;LDA@#96;STA18;STA6;LDA@0;STA5;JMP#C2F2;
Save program
*SAVE"EDIT"9600 9800 97F1
```

Program 5. Memove.

```
Ready machine
?18=#82
NEW

Enter program
10 DIM LL2
20 FOR Q=0 TO 1
30 P=#97D0
40[
50:LL0 LDY #80:LDA @0:STA #80:INY
60:LL1 LDA(#80),Y:DEY:STA(#80),Y:STA #B002
70 CMP @#FF:BEQ LL2:INY:INY:BNE LL1
80 INC #81:LDA(#80),Y:DEC #81:DEY
90 STA(#80),Y:INC #81:INY:INY
100 JMP LL1
110:LL2 RTS
120]
130 NEXT Q
140 END
Save the program
SAVE "MEMOVE"
```

"Best explanation I've seen . . . this is a must" *

"Best independent software package for the ZX81" ★

MACHINE LANGUAGE MADE SIMPLE FOR YOUR SINCLAIR

Syntax * Magazine said: "It's the best explanation of Machine Language for Machine Language beginners I've seen. Its friendly style is painless reading and simple analogies help make this language clear. This introduction is a must."

Available as a quality paperback, 160 pages, £9.75 including post, pack and V.A.T.

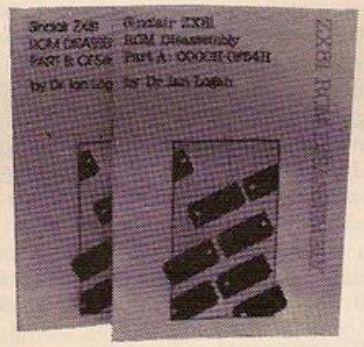
UNDERSTANDING YOUR ZX81 ROM by Ian Logan

Dr. Ian Logan was the 1981 winner of the Rosetta Stone Award★, given to the best independent product, software package or application for the Sinclair ZX80 or ZX81, for his perceptive insights into the way the ZX81 ROM operates.

This book explains ZX80 Machine Language in terms of the ZX81 ROM, giving numerous examples of routines from the ROM, and explains the structure and organisation of the ROM, including routines from the ROM you can use yourself.

A special section explains how to use machine code routines in your own BASIC programs.

Available as a quality paperback, 164 pages, £9.75 including post, pack and V.A.T.



ZX81 ROM DISASSEMBLY PARTS A & B

Dr. Logan is also the author of these two titles (see above) which are an invaluable source of information for the serious ZX81 Machine Language programmer.

Part A lists all locations and subroutines in the ROM from OOOOH to OF54H and covers all the operating functions of the ROM except the floating point calculator.

Part B lists all locations from OF55H to 1DFFH and covers all the routines involved in the 'evaluation of an expression' and a detailed explanation of the 'floating point calculator'.

Part A, 30 pages, £7.80 including post, pack and V.A.T.
Part B, 84 pages, £8.80 including post, pack and V.A.T.

Other titles available:

Not only 30 programs for the Sinclair ZX81: 1K

Not only over 30 programs, from arcade games to the final challenging Draughts playing program, which all fit into the unexpanded 1K Sinclair ZX81 but also notes on how these programs were written and special tips! Great value!

120 pages, £7.75

Complete Sinclair ZX81 Basic Course

The Complete Basic Course is a 240 page in-depth comprehensive text for complete beginners and experienced programmers. Over 100 programs and examples illustrate the use and possibilities of the Sinclair ZX81. This is an invaluable reference guide for all ZX81 owners.

256 pages, £18.30

Special Discount for ordering more than 1 title

If you order more than one title at a time, you get a discount of 80p per additional title: If you order 2 books, deduct 80p from the total; order 3 books and deduct £1.60; order 4 books and deduct £2.40!!

Orders to Melbourne House Publishers, 131 Trafalgar Road, Greenwich London SE10
Correspondence to Glebe Cottage, Station Road, Cheddington, Leighton Buzzard, BEDS LU7 7NA

Name.....

Address.....

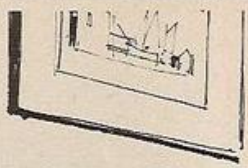
.....Postcode.....

The Complete Sinclair ZX81 BASIC Course	£18.30	☐
Basic Course Programs on Cassette	£3.30	☐
Not Only 30 Programs/Sinclair ZX81:1K	£7.75	☐
Machine Language Programming Made Simple	£9.75	☐
ZX81 ROM Disassembly Part A	£7.80	☐
ZX81 ROM Disassembly Part B	£8.80	☐
Understanding Your ZX81 ROM	£9.75	☐

Remittance enclosed £.....

Less Special Quantity Discount £.....

MACHINE CODE



THE MISSING MONITOR

The ZX-81's monitor lacks the facilities to alter, search, set, save and display memory and copy the screen to printer without clearing it. John Sylvester's ZXMinbug, a machine-code monitor, remedies those shortcomings.

THIS PROGRAM provides the ZX-81 with a machine-code monitor. It is 609 bytes long, and resides in a Rem statement at the beginning of the Basic program. ZXMinbug offers the user what I consider to be the minimum number of functions necessary in a monitor, and is relatively simple to operate. The method of entering the necessary code into the Rem statement is left to you.

The first of the functions available is Alter Memory. It means that the contents of any RAM memory location can be inspected and modified as required. The monitor runs in this mode except when performing one of the required functions.

Search Memory performs a search for two specified bytes. If the search is successful, an automatic dump is made to the screen, starting at the location of the specified bytes.

Table 1.

0 to 9 and A to F are used for data entry
Newline is the field delimiter
H allows the user to set the parameters to execute a subroutine
K allows the user to set the parameters to initiate a search
L allows the user to set parameters to move or set a block of memory
P allows the user to set parameters to do a hex dump to screen
R resets the cursor to the start of the input line
S saves the memory on cassette
Z gives a return to Basic

A block of memory can be relocated anywhere in RAM with Move Memory, and Set Memory enables you to set a block of RAM to any value. The Save function ensures that data in memory can be saved on cassette for future loading.

Memory can be displayed on the screen in hexadecimal code with Display Memory. The display can be either static or dynamic. A static display is not updated should any of the locations dumped be changed. However, the dynamic display shows all changes as they occur.

The Copy function is really a return to Basic, but on return the screen is not cleared and so allows a copy of the screen to be output to the printer. The user, by specifying the start location, can execute a program and return from the program to monitor is by means of a Ret instruction. The keys used in the monitor are shown in table 1.

When run either manually or automatically, the display will clear and then present the location 0000 and the contents of that location on the first line. The cursor is shown as a reverse character.

Pressing Newline will move the cursor to the contents field. If you then press it again, the memory location will be incremented by one and the contents of the new location will be shown; the cursor remains in the contents field. If any changes are made to the contents, the new value will be stored in the location shown when Newline is pressed.

If R is pressed, the cursor is moved back to the location field and a new location can be typed. Note that all locations must be typed in full — for example, for location 0120, 0120 must be typed and not 120.

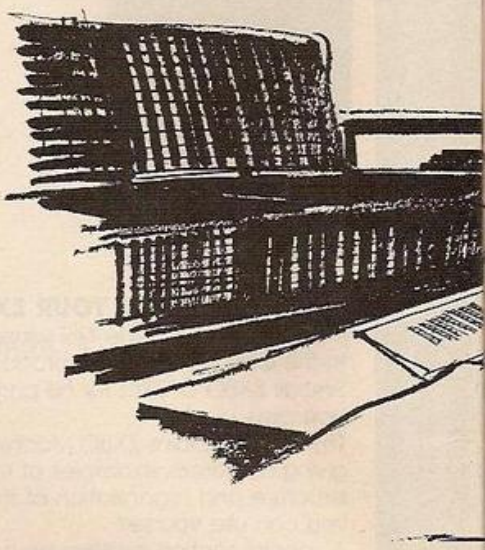
Pressing Newline now will display the contents of the selected location and the cursor will be in the contents field ready to modify the contents if required. When the R key is pressed, if the cursor is in the location field, any changes will be removed and the address will be set to its original location where it resided before any changes were made. If the cursor is in the contents field, the cursor is moved to the start of the location field and the original value for the address shown will be displayed — if, that is, any changes have been made.

When entering an address or contents, the cursor is moved to the start of that field when the last character is typed. No changes are made until Newline is pressed.

To operate the functions, press the required key. Pressing Z will immediately return control to Basic. Depending on how long you press Z, an error code will be shown or Copy will be displayed. The error code can be ignored.

Pressing S will start to save data on the cassette. If the Break key is pressed, the save will be aborted and Basic will be entered. To re-enter the monitor, just type Run and the monitor will carry on as it was, except that the location displayed on the input line will be set to 0000. If a screen dump had been active this will resume.

If you press H, which executes the program, the location 40AC will be displayed and the cursor will be in the contents field. Enter the least-significant byte of the address of your routine and press Newline; then enter the most-significant byte of the address and press Newline. The next location is the flag, so enter 01 and press Newline. The monitor has four flags and constantly checks them. As soon as it sees that the flag has been set, the routine will be executed. The flag is automatically reset.



If K is pressed for a search, the address 409E is displayed. Set as shown in table 2. The search will be carried out — it takes between three and four seconds to search 65,535 bytes. If the search is successful, an automatic dump is done regardless of whether a dump is active or not. If a dump is in progresss, the search dump will be dynamic. If a dump had not been active, the dump will not be dynamic. The flag is automatically reset when the search is done. No indication is given should the search fail.

P, which dumps memory to screen, will display location 409B. Enter the following:

409B: least-significant byte of the location at which dump is to start
409C: is the most-significant byte
409D: the flag, set to 01

The dump will take place. The flag in this instance is not reset and so the dump always remains active, not showing any change in memory until the user resets the flag. Pressing L, to move or set memory, displays location 40A5. Set as shown in table 3.

The L function can work in two ways: the first is to move a block of memory, and the second is to set a block of memory. In the first case, it is essential that the address to which data is to be moved does not fall inside the area covered by the start address together with that covered by the block size.

Table 2.

409E: least-significant byte of the address from which to start searching
409F: most-significant byte of address
40A0: least-significant byte of the amount to search
40A1: most-significant byte of the amount
40A2: enter the second byte to be searched for
40A3: enter the first byte to be searched for
40A4: is the flag, set to 01

Table 3.

40A5: least-significant byte of address from which data is to be taken
40A6: most-significant byte
40A7: least-significant byte of address to which data is to be stored
40A8: most-significant byte
40A9: least-significant byte of amount of data to be moved
40AA: most-significant byte of the amount of data to be moved
40AB: the flag, set to 01

In the second case, to set a block of memory, enter into the first location of the block the value to which the block is to be set. Enter the parameters given, but in location 40A7/8 set the address as that set in location 40A5/6, incremented by one. That is the address of the second location of the block. Set the amount to the size of the block decremented by one. An example is to clear — that is, to set to zero — the block of memory between locations 4700 hexadecimal to 4800 hexadecimal.

Location	Value	
4700	00	first location block to be set, is set to 00.
40A5	00 47	enter address of the start of block.
40A7	01 47	enter address of the second location of the block.
40A9	FF 00	enter the block size minus 1.
40AB	01	set flag.

The locations 4700 hexadecimal and 4800 hexadecimal will now be set to zero. The flag is reset automatically.

Locations 4084 hexadecimal and 4091 hexadecimal in the main program contain the addresses of the parameters for the various functions: 4097 hexadecimal to 409A hexadecimal hold the variables used by the monitor; 409B to 40AE are the parameters of the various functions; 40AF to 40B6 contain the table of control-key codes; 40B7 to 40C6 are the routine address tables and correspond to the control-key table; 40C7 to 40EF contain the routine to initialise the monitor. This sets up the input- and display-area addresses, displays the first location on screen and reads the keyboard for future keyboard testing.

40F0 to 4122 holds the main routine. This places a cursor on the screen then checks the keyboard for an input. If a key has been pressed, it then checks to see if the key is the same as the previous key; if so, it ignores it. If the key is different, the cursor is removed and the character is found and then checked to see if it is a data character or control character.

If the key is neither, it is ignored. If it is a data character it is then displayed and the cursor is placed in the next position. If it is a control character, execution is started at location 4141, and the address of the selected function is calculated from the ATable and KTable and control passed to that function.

4123 to 413F is the flag-check routine. This is used when an invalid character is entered, if no key is pressed or if the key pressed is the same as that pressed previously. Each flag is checked and if set the corresponding routine is executed, if no flags are set, execution is passed back to location 40F3.

The hexadecimal loader.

```
    1 REM ** HEX LOADER FOR ZXMIN
BUG
   10 PRINT "ENTER EACH BYTE IN
 HEX THEN N/L"
   20 FOR X=16514 TO 17122
   25 FAST
   30 SCROLL
   40 LET X1=X-16384
   50 DIM H$(4)
   55 LET H$(1)="&"
   60 FOR P=2 TO 0 STEP -1
   70 LET X2=INT (X1/(16**P))
   80 LET H$(4-P)=CHR$ (X2+28)
   90 LET X1=X1-(X2*(16**P))
  100 NEXT P
  105 SLOW
  110 PRINT H$,
  120 INPUT A$
  130 LET H=(CODE A$(1)-28)*16+(C
ODE A$(2)-28)
  140 POKE X,H
  150 PRINT A$
  160 NEXT X
```

Program 1.

1 REM MACHINE CODE IS HELD IN THIS REM STATEMENT. THIS SHOULD BE COMPOSED OF 609 CHARACTERS
2 RAND USR 16583
3 GOTO 2
4 SAVE "ZXMINBUG"
5 GOTO 2
POKE 16510,0 (This gives the Rem line a line number of zero, to prevent accidental deletion).
RUN 4 (This saves the program and allows automatic run on loading).

Notes: line 3 is needed to prevent a Save function occurring when loading a program saved by the save function in ZXMinbug. To load a program saved by ZXMinbug enter LOAD"".

4165 to 414B contain the routine to display data on the screen; 417C to 4183 set or reset the cursor; 4184 to 41A3 are the hexadecimal to display code conversion routine; 41A4 to 41CE is the display code to hexadecimal conversion routine; and 41CF to 41F3 are the initialisation routines for the flag-operated functions.

The remaining locations are the actual function routines. The keyboard is read automatically by the ZX-81 during its display routine and the monitor keeps checking location 4025 to see if a key is pressed. If a key is kept pressed, then the code remains in that location. Therefore, to prevent the keyboard repeating, a check is necessary to see if the same character is present. If so, that character is ignored until a different one is sensed or it is set to FFFF, indicating that no key is pressed.

This means if the A key is pressed and kept pressed, only one A is accepted, but as soon as the key is released it will be sensed. This will set 4025 to FFFF, so the same key can be pressed again and it will register. If this was not done, the character would be printed on the screen so fast and so many times that it would be impossible to set any data up.

Should you write a program in an address greater than that specified in location 4014/5, it will not be saved. I therefore recommend that as usual, a Rem statement is created holding enough characters for your program. Having done this, run the monitor and search for the Rem code and the code of the first character used in the Rem statement.

It is advisable that the first two locations of the Rem statement be filled with 76 (Newline) to prevent a listing when back in the Basic mode. The reason is that should the Rem statement be listed, it may be bigger than the screen and the ZX-81 will keep trying to fit it on the screen. This results in the machine hanging up.

The program can only operate on a ZX-81 equipped with a memory larger than 3.5K. This is because it requires an expanded display file.

If your ZX-81 has the new ROM, then the addresses given in the listing as 40CA and 426D, contents CD 28 0E, should be amended to CD 2B 0F. Also address 4267, contents CD 20 0F, should be changed to CD 23 0F.

(continued on page 53)

ZX81 SOFTWARE FROM VIDEO SOFTWARE LTD 1K & 16K

16K SOFTWARE

	PRICE £
VIDEO-SKETCH (ZX81 only). Move the cursor to any part of the screen. Draw or rub-out as you move it. Mix in text or graphics. Save picture in memory. Save picture sequence on cassette.	7.95
VIDEO-PLAN (ZX81 only). Performs the function of an analysis book. Arithmetic functions include addition, subtraction, multiplication. Printer options.	£7.95
VIDEO-AD. Rotating display of 16 pages of advertising material. Set-up your own pages and change them as and when required.	£7.95
VIDEO-GRAPH. Planning and design aid. Create pictures/charts/graphs and store within the program. Save on cassette. Combine pictures like an 'identikit'.	£5.95
VIDEO-VIEW. Do it yourself teletext. Create pages of data. Store them within the program. Save on cassette. View on demand.	£5.95
VIDEO-MAP (ZX81 only). Educational game based on maps. Navigate your plane to its destination. Bomb the target and return to base.	£5.95
FORCE-FIELD (ZX81 only). Animated bombardment game. You control the force-field which protects your city against hostile UFOs.	£3.95
SPACE-RACE (XZ81 only). Party game for eight players. Rockets race to build stations in space. Winners gradually take over losers until only one winner remains.	£3.95
TEST-MATCH. Realistic simulation of a test match series. Dynamic scoreboard. Give each player your own ratings for skill, technique, etc.	£3.95
FOOTBALL-LEAGUE. Realistic simulation of an entire season. Every match played and results shown with progressive league table. You give teams ratings for skill, effort, etc.	£3.95
STOCK-MARKET (ZX81 only). An exciting game of skill and judgement. Buy and sell stocks and shares as prices change in response to world events.	£3.95
PACK 1 — VIDEO-PLAN + VIDEO-AD	17.95
PACK 2 — VIDEO-VIEW + VIDEO-GRAPH	13.95
GAMESET — VIDEO-MAP + 5 GAMES	19.95

1K PARTY TRICKS (ZX81 ONLY)

If you don't have a 16K RAM this set of programs is for you. Ten separate programs — some games, some more serious. All completely original, all ten programs included in the price. **4.95**

WHAT DO YOU RECEIVE

1. Instruction manual.
2. Two copies of program on side A.
3. Audio commentary on side B. (16K only).
4. Built in demonstration. (16K only).

Cash with orders please.
Prices include VAT.
Mail order customers add £1.00 per order.
Allow 28 days for delivery.

NEW VIDEO-INDEX NEW

Q. How do you store 57000 characters in a 16K RAM.
A. Use VIDEO-INDEX.

Catalogue your cassettes, your record collection, references to magazine articles. Amazingly versatile. Capacity for 1000 individual references each of which can generate 57 characters of text. Powerful search facilities once the index has been created.

How is it done? The system cannot really fit 57000 characters in a 16K RAM. It gives the illusion of doing so by eliminating duplicates. For instance in an index of articles in computer magazines about the ZX81 certain words occur time and again. VIDEO-INDEX detects these duplications and thereby conserves space.

What do you get?

1. A machine code master program which sits at the top of RAM. This is initially loaded like a BASIC program.
2. A demonstration index containing 1000 references to articles about the ZX81 in the popular magazines.
3. A detailed instruction manual.

You may then proceed to create your own catalogues and indexes and save them on cassette.

This program is fast, efficient and ingenious and is by far the best product we have introduced for the ZX81.

N.B. There isn't room for a commentary on this cassette so you'll have to read the manual.
ZX81 or ZX80 + 8K ROM.
ZX printer is useful but not essential. Price **£9.95.**

New Packaging.

We have discontinued our de-luxe boxed programs except for PACK 1, PACK 2 and GAMESET. All programs are now supplied in resealable "minigrip" plastic wallets.

SUPPORTED SOFTWARE

A new catalogue of software produced by named authors is in course of preparation. Watch this space.

STONE LANE,
KINVER,
STOURBRIDGE,
WEST MIDLANDS,
DY7 6EQ,
ENGLAND.

Tel: KINVER 2462.
Std. 038-483-2462.

VIDEO SOFTWARE LIMITED

Directors: P. Smith, B.A., D. J. Smith (Director and Secretary). Registered Number: 1085829 England. V.A.T. Reg. No. 278 0603 51

Personal callers welcome during office hours.
Send s.a.e. for further details.

(continued from page 51)

```
LOCN   CODE        LABEL     MNEMONIC          REMARKS
4082   76                    HALT              PREVENT LISTING
4083   76                    HALT
4084   9B 40       #DLOC     HEX   409B        ADDRESS OF DLOC
4086   9E 40       #SADD     HEX   409E        ADDRESS OF SADD
4088   A5 40       #MADD     HEX   40A5        ADDRESS OF MADD
408A   AC 40       #EXECL    HEX   40AC        ADDRESS OF EXECL
408C   AF 40       #KTABLE   HEX   40AF        ADDRESS OF KTABLE
408E   B7 40       #ATABLE   HEX   40B7        ADDRESS OF ATABLE
4090   F0 40       #CON      HEX   40F0        ADDRESS OF CURSORON
4092   00 00       LOCN      HEX   0000        ADDRESS TO WHICH INPUT IS BEING DONE
4094   00          VALUE     HEX   00          CONTENTS OF ADDRESS IN LOCN
4095   00 00       INPUT     HEX   0000        CURSOR POSITION
4097   00 00       DLINE     HEX   0000        START ADDRESS OF SCREEN DUMP AREA
4099   00 00       FSTART    HEX   0000        START ADDRESS OF INPUT FIELD
409B   00 00       DLOC      HEX   0000        FIRST ADDRESS TO DUMP ON SCREEN
409D   00          DFLAG     HEX   00          DUMP FLAG
409E   00 00       SADD      HEX   0000        START ADDRESS OF BLOCK TO SEARCH
40A0   00 00       AMTS      HEX   0000        LENGTH OF BLOCK TO SEARCH
40A2   00 00       WORD      HEX   0000        DATA TO SEARCH FOR
40A4   00          SFLAG     HEX   00          SEARCH FLAG
40A5   00 00       MADD      HEX   0000        START ADDRESS OF BLOCK TO MOVE DATA FROM
40A7   00 00       DADD      HEX   0000        START ADDRESS OF BLOCK TO MOVE DATA TO
40A9   00 00       AMT       HEX   0000        LENGTH OF BLOCK
40AB   00          MFLAG     HEX   00          MOVE FLAG
40AC   00 00       EXECL     HEX   0000        ADDRESS OF USER SUBROUTINE
40AE   00          EFLAG     HEX   00          EXECUTE FLAG
40AF   76          KTABLE    HEX   76          CONTROL KEY TABLE
40B0   35                    HEX   35
40B1   30                    HEX   30
40B2   31                    HEX   31
40B3   2D                    HEX   2D
40B4   38                    HEX   38
40B5   3F                    HEX   3F
40B6   37                    HEX   37
40B7   84 42       ATABLE    HEX   4284        CONTROL ROUTINE ADDRESS TABLE-FUNC
40B9   CF 41                 HEX   41CF        DUMP
40BB   E6 41                 HEX   41E6        SEARCH
40BD   EB 41                 HEX   41EB        MOVE
40BF   F0 41                 HEX   41F0        EXEC
40C1   67 42                 HEX   4267        SAVE
40C3   D9 42                 HEX   42D9        COPY
40C5   7D 42                 HEX   427D        NLINE
40C7   CD 2A 0A    INIT      CALL  0A2A        CLEAR SCREEN
40CA   CD 28 0F              CALL  0F28        ENTER SLOW MODE
40CD   2A 0E 40              LD    HL,(DF-CC)  GET START OF DISPLAY FILE
40D0   22 95 40              LD    (INPUT),HL  SET CURSOR POSITION
40D3   22 99 40              LD    (FSTART),HL SET START OF INPUT FIELD
40D6   01 42 00              LD    BC,0042
40D9   09                    ADD   HL,BC
40DA   00                    NOP
40DB   22 97 40              LD    (DLINE),HL  SET START OF DISPLAY AREA
40DE   01 00 00              LD    BC,0
40E1   ED 43 92 40           LD    (LOCN),BC   SET LOCATION TO DISPLAY
40E5   0A                    LD    A,(BC)      GET CONTENTS OF LOCATION
40E6   32 94 40              LD    (VALUE),A   SET VALUE TO DISPLAY
40E9   CD 65 41              CALL  DLOCX       DISPLAY LOCATION AND CONTENTS ON SCREEN
40EC   2A 24 40              LD    HL,(LAST-K) GET KEYBOARD CODE
40EF   E5                    PUSH  HL          SAVE ON STACK
40F0   CD 7C 41    CURSORON  CALL  CURSOR      PUT CURSOR ON SCREEN
40F3   ED 4B 25 40  TKEY      LD    BC,(LAST-K) GET NEW KEYBOARD CODE
40F7   E1                    POP   HL          GET OLD KEYBOARD CODE
40F8   C5                    PUSH  BC          SAVE NEW KEYBOARD CODE
40F9   B7                    OR    A           CLEAR CARRY FLAG
40FA   ED 42                 SBC   HL,BC       IS NEW CODE SAME AS OLD CODE
40FC   28 25                 JR    Z,FLAGTST   YES - IGNORE AND GO TEST FLAGS
40FE   51                    LD    D,C         TEST IF CODE IS FFFF
40FF   14                    INC   D
4100   28 21                 JR    Z,FLACTST   NO KEY PRESSED GO TEST FLAGS
4102   CD 7C 41              CALL  CURSOR      CLEAR CURSOR FROM SCREEN
4105   CD BD 07              CALL  07BD        GO GET CHAR. CODE ADDRESS
4108   7E                    LD    A,(HL)      GET CHAR. CODE
4109   FE 1C                 CP    1C          IS IT LESS THAN "0"
410B   38 34                 JR    C,CONTROL   YES
410D   FE 2C                 CP    2C          IS IT GREATER THAN "F"
410F   30 30                 JR    NC,CONTROL  YES
4111   2A 95 40              LD    HL,(INPUT)  GET CURSOR POSITION
4114   77                    LD    (HL),A      STORE CHARACTER ON SCREEN
4115   23                    INC   HL          INCREMENT CURSOR POSITION
4116   7E                    LD    A,(HL)      TEST FOR END OF FIELD
4117   FE 00                 CP    0
4119   20 03                 JR    NZ,NWRAP    NOT END OF FIELD
411B   2A 99 40              LD    HL,(FSTART) RESET TO START OF FIELD
411E   22 95 40    NWRAP     LD    (INPUT),HL  SAVE NEW CURSOR POSITION
4121   18 CD                 JR    CURSORON    PUT CURSOR ON SCREEN
4123   3A 9D 40    FLAGTST   LD    A,(DFLAG)   GET DUMP FLAG
4126   B7                    OR    A           CHECK PARITY
4127   E4 F5 41              CALL  PO,DUMPM    IF PARITY ODD CALL ROUTINE TO DUMP
412A   3A A4 40              LD    A,(SFLAG)   TEST SEARCH FLAG
412D   B7                    OR    A
412E   E4 17 42              CALL  PO,SEARCHS
4131   3A AB 40              LD    A,(MFLAG)   TEST MOVE FLAG
4134   B7                    OR    A
4135   E4 45 42              CALL  PO,MOVES
4138   3A AE 40              LD    A,(EFLAG)   TEST EXEC  FLAG
413B   B7                    OR    A
413C   E4 5B 42              CALL  PO,EXECS
413F   18 B2                 JR    TKEY        GO CHECK KEYBOARD
4141   2A BC 40    CONTROL   LD    HL,(#KTABLE) GET START OF KEY TABLE
4144   01 08 00              LD    BC,0008
4147   ED B1                 CPIR              SEARCH FOR KEY
4149   20 A5                 JR    NZ,CURSORON KEY NOT VALID
414B   ED 4B BC 40           LD    BC,(#KTABLE) CALCULATE POSITION OF ADDRESS
                                                IN ADDRESS TABLE
414F   B7                    OR    A           CLEAR CARRY FLAG
4150   ED 42                 SBC   HL,BC
4152   ED 6A                 ADD   HL,HL
4154   ED 4B 8E 40           LD    BC,(#ATABLE)
4158   09                    ADD   HL,BC
4159   2B                    DEC   HL
415A   2B                    DEC   HL
415B   5E                    LD    E,(HL)      PUT ROUTINE ADDRESS IN DE
415C   23                    INC   HL
415D   56                    LD    D,(HL)
415E   EB                    EX    DE,HL       PUT ADDRESS IN HL REGISTER
415F   ED 5B 90 40           LD    DE,(#CON)   GET RETURN ADDRESS
4163   D5                    PUSH  DE          SAVE RETURN ADDRESS ON THE STACK
4164   E9                    JP    (HL)        CALL ROUTINE
4165   2A 92 40    DLOCX     LD    HL,(LOCN)   GET ADDRESS TO DISPLAY
4168   7E                    LD    A,(HL)      GET CONTENTS OF ADDRESS
4169   32 94 40              LD    (VALUE),A   SAVE CONTENTS
416C   ED 5B 0E 40           LD    DE,(DF-CC)  GET START OF INPUT LINE
4170   CD 84 41              CALL  ADDS        DISPLAY ADDRESS
4173   13                    INC   DE          INCREMENT SCREEN ADDRESS
4174   3A 94 40              LD    A,(VALUE)   GET CONTENTS
4177   6F                    LD    L,A
4178   CD BC 41              CALL  DATA        DISPLAY CONTENTS
417B   C9                    RET               RETURN TO CALLER
417C   2A 95 40    CURSOR    LD    HL,(INPUT)  GET CURRENT POSITION
417F   7E                    LD    A,(HL)      GET CONTENTS
4180   C6 80                 ADD   A,80        SET/RESET BIT 7
4182   77                    LD    (HL),A      PUT RESULT ON SCREEN
4183   C9                    RET               RETURN TO CALLER
4184   7C          ADDS      LD    A,H         GET HIGH ORDER BYTE
4185   CD 95 41              CALL  MSD         ISOLATE MSD
4188   7C                    LD    A,H         GET HIGH ORDER BYTE
4189   CD 91 41              CALL  LSD         ISOLATE LSD
418C   7D          DATA      LD    A,L         GET LOW ORDER BYTE
418D   CD 95 41              CALL  MSD         ISOLATE MSD
4190   7D                    LD    A,L         GET LOW ORDER BYTE
4191   E6 0F       LSD       AND   0F          ISOLATE LSD
4193   18 0A                 JR    DISP        PUT ON SCREEN
4195   E6 F0       MSD       AND   F0          ISOLATE MSD
4197   CB 3F                 SRL   A           SHIFT REGISTER A RIHT 4 TIMES
4199   CB 3F                 SRL   A
419B   CB 3F                 SRL   A
419D   CB 3F                 SRL   A
419F   C6 1C       DISP      ADD   A,1C        CONVERT TO DISPLAY CODE
```

(continued on next page)

(continued from previous page)

```
41A1 12          LD   (DE),A    STORE ON SCREEN
41A2 13          INC  DE        INCREMENT SCREEN ADDRESS
41A3 C9          RET             RETUIRN TO CALLER
41A4 CD C1 41 ADDSX CALL LOAD    GET DISPLAY CODE
41A7 CD C4 41    CALL MSDX      CONVERT TO HEX MSD
41AA 67          LD   A,H       STORE MSD IN H
41AB CD C1 41    CALL LOAD      GET DISPLAY CODE
41AE D6 1C       SUB  1C        CONVERT TO HEX
41B0 84          ADD  A,H       ADD MSD TO LSD
41B1 67          LD   H,A       STORE RESULT IN H
41B2 CD C1 41 DATAX CALL LOAD    GET DISPLAY CODE
41B5 CD C4 41    CALL MSDX      REPEAT FOR LOW ORDER BYTE
41B8 6F          LD   L,A
41B9 CD C1 41    CALL LOAD
41BC D6 1C       SUB  1C
41BE 85          ADD  A,L       FORM LOW ORDER BYTE
41BF 6F          LD   L,A       STORE IN L
41C0 C9          RET             RETURN TO CALLER
41C1 1A          LOAD LD   A,(DE) GET CHAR FROM SCREEN
41C2 13          INC  DE        INCREMENT SCREEN POSITION
41C3 C9          RET             RETURN TO CALLER
41C4 D6 1C       MSDX SUB  1C    CONVERT TO HEX
41C6 CB 27       SLA  A         SHIFT REGISTER LEFT 4 TIMES
41C8 CB 27       SLA  A
41CA CB 27       SLA  A
41CC CB 27       SLA  A
41CE C9          RET             RETURN TO CALLER
41CF 2A 84 40    DUMP LD   HL,(PBLOC) GET ADDRESS OF DUMP PARAMETERS
41D2 22 92 40    SETLOC LD  (LOCN),HL
41D5 CD 65 41    CALL DLOCX     DISPLAY ON SCREEN
41D8 2A 0E 40    LD   HL,(DF-CC) SET CURSOR AND INPUT POSITION TO START
                                 OF CONTENTS FIELD
41DB 01 05 00    LD   BC,5
41DE 09          ADD  HL,BC
41DF 22 95 40    LD   (INPUT),HL
41E2 22 99 40    LD   (FSTART),HL
41E5 C9          RET
41E6 2A 86 40    SEARCH LD  HL,(PSADD) GET ADDRESS OF SEARCH PARAMETER
41E9 18 E7       JR   SETLOC
41EB 2A 88 40    MOVE LD   HL,(PMADD) GET ADDRESS OF MOVE PARAMETERS
41EE 18 E2       JR   SETLOC
41F0 2A 8A 40    EXEC LD   HL,(PEXECL) GET ADDRESS OF EXEC PARAMETER
41F3 18 DD       JR   SETLOC
41F5 2A 98 40    DUMPM LD  HL,(DLOC)  GET FIRST ADDRESS TO DUMP
41F8 ED 5B 97 40 LD   DE,(DLINE)  GET SCREEN POSITION
41FC 0E 14       LD   C,14      SET LINE COUNT
41FE CD 86 41    DUMPX CALL ADDS  DISPLAY FIRST ADDRESS OF LINE
4201 06 05       LD   B,5       INC SCREEN BY 5 SPACES
4203 13          RIGHT INC  DE
4204 10 FD       DJNZ RIGHT
4206 06 08       LD   B,8       SET COLUMN COUNT
4208 7E          NBYTE LD  A,(HL) GET BYTE TO DISPLAY
4209 23          INC  HL        INC MEMORY ADDRESS
420A E5          PUSH HL        SAVE ADDRESS ON STACK
420B 6F          LD   L,A
420C CD BC 41    CALL DATA      GO PUT BYTE ON SCREEN
420F 13          INC  DE        INC. SCREEN ADDRESS
4210 E1          POP  HL        RETRIEVE MEMORY ADDRESS
4211 10 F5       DJNZ NBYTE     IF COLUMN COUNT IS NOT ZERO DISPLAY
                                 NEXT BYTE
4213 0D          DEC  C         DECREMENT LINE COUNT
4214 C8          RET  Z         IF LINE COUNT IS ZERO RETURN TO CALLER
4215 18 E7       JR   DUMPX     DISPLAY NEXT LINE
4217 3E 00       SEARCHS LD  A,0 RESET FLAG
4219 32 A6 40    LD   (SFLAG),A
421C 2A 9E 40    LD   HL,(SADD) GET FIRST ADDRESS OF BLOCK
421F ED 4B A0 40 LD   BC,(AMTS) GET LENGTH OF BLOCK
4223 ED 5B A2 40 LD   DE,(WORD) GET DATA
4227 7A          NEXTL LD  A,D  GET FIRST BYE OF DATA
4228 BE          CP   (HL)      IS IT EQUAL TO DATA
4229 28 09       JR   Z,EXTND   YES - CHECK SECOND BYTE
422B 23          INCHL INC  HL  NO - GET NEXT ADDRESS
422C 0B          DEC  BC        DEC SEARCH COUNT
422D 3E 00       LD   A,0       CHECK IF COUNT IS ZERO
422F B0          OR   B
4230 B1          OR   C
4231 20 F4       JR   NZ,NEXTL  NO - CONTINUE SEARCH
4233 C9          RET             YES - SEARCH FAILED
4234 7B          EXTND LD  A,E  GET SECOND BYTE OF DATA
4235 E5          PUSH HL        SAVE MEM LOCN
4236 23          INC  HL        GET NEXT LOCN
4237 BE          CP   (HL)      IS IT THE SAME
4238 28 03       JR   Z,SUCC    YES
423A E1          POP  HL        NO - RESTORE MEM LOCN
423B 18 EE       JR   INCHL     CONTINUE WITH SEARCH
423D E1          SUCC POP  HL   GET ADDRESS IN WHICH FIRST BYTE WAS FOUND
423E 22 98 40    LD   (DLOC),HL SAVE FOR DUMP
4241 CD F5 41    CALL DUMPM     DO DUMP
4244 C9          RET
4245 3E 00       MOVES LD  A,0  RESET FLAG
4247 32 A8 40    LD   (MFLAG),A
424A 2A A5 40    LD   HL,(MADD) GET ADDRESS OF SOURCE BLOCK
424D ED 5B A7 40 LD   DE,(DADD) GET ADDRESS OF DESTINATION BLOCK
4251 ED 4B A9 40 LD   BC,(AMT)  GET BLOCK LENGTH
4255 ED B0       LDIR           MOVE DATA
4257 C9          RET
4258 18 09       EXECS JR  SAVPC PUT PC ON STACK FOR RETURN
425A 3E 00       EXEC1 LD  A,0  RESET FLAG
425C 32 AE 40    LD   (EFLAG),A
425F 2A AC 40    LD   HL,(EXECL) GET ADDRESS OF USER ROUTINE
4262 E9          JP   (HL)      CALL USER PROGRAM
4263 CD 5A 42    CALL EXEC1
4266 C9          RET
4267 CD 20 0F    SAVE CALL 0F20 SET FAST MODE
426A CD F5 02    CALL 02F5      SAVE DATA
426D CD 28 0F    CALL 0F28      SET SLOW MODE
4270 C9          RET
4271 00          NOP
4272 00          NOP
4273 00          NOP
4274 00          NOP
4275 00          NOP
4276 00          NOP
4277 00          NOP
4278 00          NOP
4279 00          NOP
427A 00          NOP
427B 00          NOP
427C 00          NOP
427D 2A 0E 40    NLINE LD  HL,(DF-CC) GET START OF INPUT LINE
4280 22 95 40    LD   (INPUT),HL RESET INPUT POSITION
4283 22 99 40    LD   (FSTART),HL SET START OF FIELD TO LOCATION FIELD
4286 CD 65 41    CALL DLOCX     DISPLAY LOCATION AND CONTENTS
4289 C9          RET
428A 2A 99 40    FUNC LD   HL,(FSTART) GET START OF FIELD
428D ED 4B 0E 40 LD   BC,(DF-CC) TEST IF IN LOCATION FIELD
4291 B7          OR   A         CLEAR CARYY FLAG
4292 ED 42       SBC  HL,BC
4294 20 1C       JR   NZ,FVAL   NOT LOCATION FIELD
4296 ED 5B 99 40 LD   DE,(FSTART)
429A CD A4 41    CALL ADDSX     GET HEX ADDRESS FROM INPUT
429D 22 92 40    LD   (LOCN),HL SAVE IN LOCN
42A0 7E          LD   A,(HL)    GET CONTENTS
42A1 13          INC  DE        INC. SCREEN ADDRESS
42A2 ED 53 99 40 LD   (FSTART),DE SET START OF INPUT FIELD TO VALUE FIELD
42A6 ED 53 95 40 LD   (INPUT),DE SET CURSOR POSITION TO START OF FIELD
42AA 32 94 40    LD   (VALUE),A SAVE VALUE
42AD 6F          LD   L,A
42AE CD BC 41    CALL DATA      DISPLAY VALUE ON SCREEN
42B1 C9          RET
42B2 ED 5B 99 40 FVAL LD  DE,(FSTART) GET START OF VALUE FIELD
42B6 CD B2 41    CALL DATAX     GET HEX VALUE
42B9 7D          LD   A,L
42BA 2A 92 40    LD   HL,(LOCN) GET LOCATION
42BD 77          LD   (HL),A    PUT VALUE IN LOCATION
42BE 23          INC  HL        INC MEMORY ADDRESS
42BF 22 92 40    LD   (LOCN),HL SAVE NEW ADDRESS
42C2 ED 5B 0E 40 LD   DE,(DF-CC)
42C6 CD 86 41    CALL ADDS      PUT NEW ADDRESS ON SCREEN
42C9 13          INC  DE        INC. SCREEN ADDRESS
42CA 7E          LD   A,(HL)    GET CONTENTS OF NEW ADDRESS
42CB 32 94 40    LD   (VALUE),A SAVE CONTENTS
42CE 6F          LD   L,A
42CF CD BC 41    CALL DATA      DISPLAY CONTENTS
42D2 2A 99 40    LD   HL,(FSTART) GET START OF FIELD
4265 22 95 40    LD   (INPUT),HL SET CURSOR TO SRAT OF FIELD
42D8 C9          RET
42D9 CF          COPY RST  8    RETURN TO BASIC
42DA 00          NOP
42DB 00          NOP
42DC 00          NOP
42DD 00          NOP
42DE 00          NOP
```

```
42DF 00  NOP
42E0 00  NOP
42E1 00  NOP
42E2 00  NOP
```

ZX81 OR SPECTRUM
JOIN
ZX-GUARANTEED

(Club is devoted exclusively to the ZX81 . . . and Spectrum when available)

All games/progs are guaranteed error free. ZX-guaranteed is not just games, it is intended to be educational to the user. Includes articles on BASIC, PEEK, POKE, MACHINE CODE, FLICKER FREE PROGRAMMING, HINTS & TIPS, etc. etc.

Membership is April to April. If joining late, all current year's back issues sent. Membership £5 per year. (Overseas £6.50. Outside Europe by air £11).

For sample back issue send £1 plus SAE

Send to: **G.A. BOBKER, 29 CHADDERTON DRIVE, UNSWORTH, BURY, LANCS. BL9 8NL**

Please enrol me as a member of ZX-GUARANTEED. I will complain like mad if errors found.

I enclose Cheque/P.O./Sterling draft for _____

NAME _____

ADDRESS _____

BARGAIN BYTES

FOR THE 16K ZX81
UNBEATABLE VALUE!
CASSETTE OF 8 PROGRAMS (50K+)

One cassette of 8 programmes
50K Plus, all these for only £5

DEEP SEA ADVENTURE (14K). Discover the treasure chest before you run out of gold or strength. Levels of play from "difficult" to "downright impossible". Also has "Save Game" feature.

BANK ACCOUNT (13½K). Invaluable for controlling your finances. Produces detailed statements and can also keep track of credit card spending.

UNDERGROUND ADVENTURE (6½K). Battle against monsters and obstacles underground. A very difficult and challenging task.

DEPTHCHARGE (2½K). A skilful moving graphics game. Fire your depthcharges to blow up enemy submarines before they destroy your ship.

HANGMAN (11½K). The old family game based on a library of 500 words. Excellent graphics.

LOAN (2½K). Calculates repayments, time, sum borrowed or interest. For Bank Loans or Mortgages.

CODEBREAKER (2K). You have ten guesses at the four digit number held by the computer.

FOREIGN CURRENCY (3K). How many dollars is £110? How many Francs is $38? See what your money will buy around the world!

ORDER NOW!

For convenience simply quote YC4 and your name and address on the reverse of your cheque/postal order, and your software (on TDK cassette) will then be despatched, first class post, complete with comprehensive instructions.

Send to:
Richard Shepherd, 22 Green Leys,
Maidenhead, Berkshire, SL6 7EZ.
Telephone: (0628) 21107. **Trade Enquiries Welcome**

FREE Software

INSTANT INTERACTIVE GRAPHICS ON ZX81

LIGHT PEN SET for the RD 8100 **£49.50**
(includes VAT & P&P)

- *DRAW complex graphics with ease on your TV screen and avoid tedious line by line programming.
- *Revise your display and SAVE on cassette, while your program runs.
- *Push pictures points and pixels with a poke of the Pen and a program PEEK. Try our VIDEO-TIDDLYWINKS!
- *MENU SELECTION — without keyboard entry.

The RD 8100 LIGHT PEN SET consists of the RD 8101 'MICRO-MUM' MOTHERBOARD, the RD 8180 LIGHT PEN with MODULE, and the RD 8100 SYSTEM MANUAL. Plug into your ZX81 — and LOAD, from the FREE RD 8100 SOFTWARE CASSETTE (1K and 16K), or write your own BASIC programs.

All orders are acknowledged, with a firm delivery date. Send just £49.50 (VAT and postal charges are included) to:

R D Laboratories
5 Kennedy Road, Dane End, Ware, Herts.
SG12 0LU (0920 84380)

For details of the Full RD 8100 SYSTEM of ZX81 interfaces, including Logic I/O, Analogue Input, Analogue Output, 8-Channel Analogue Multiplexer, Buffered Motherboard, send us a stamp.

PROJECT

HAVE MICRO, WILL

John Dawson argues the case for portability. He shows that the idea of a micro in a suitcase — or in this instance, a camera case — need not be the preserve of relatively costly machines such as the Osborne.

PORTABILITY AND communications are becoming important trends in micro-computing. The Information Technology revolution that is going on at the moment will create a demand for information away from orthodox outlets such as Telex machines, VDUs attached to mainframe computers and static microcomputers.

The Osborne 1 microcomputer exemplifies one approach to portability — considerable processing power with large-scale data storage in a man-portable pack. In the early photographs advertising the Osborne 1 a comparison was made between two men, one with an ordinary briefcase containing sandwiches and papers, and the second with the computer. Leaving aside the advertising claims I was always fascinated by the white knuckles of the man carrying the computer — just how much did it weigh?

The other approach is a genuinely portable terminal with limited storage but with the capability to access huge databases by way of the public telephone network. The IXO telecomputing system described in the April 1982 edition of *Byte* magazine is a fine example of the shape of things to come.

Pocket terminal

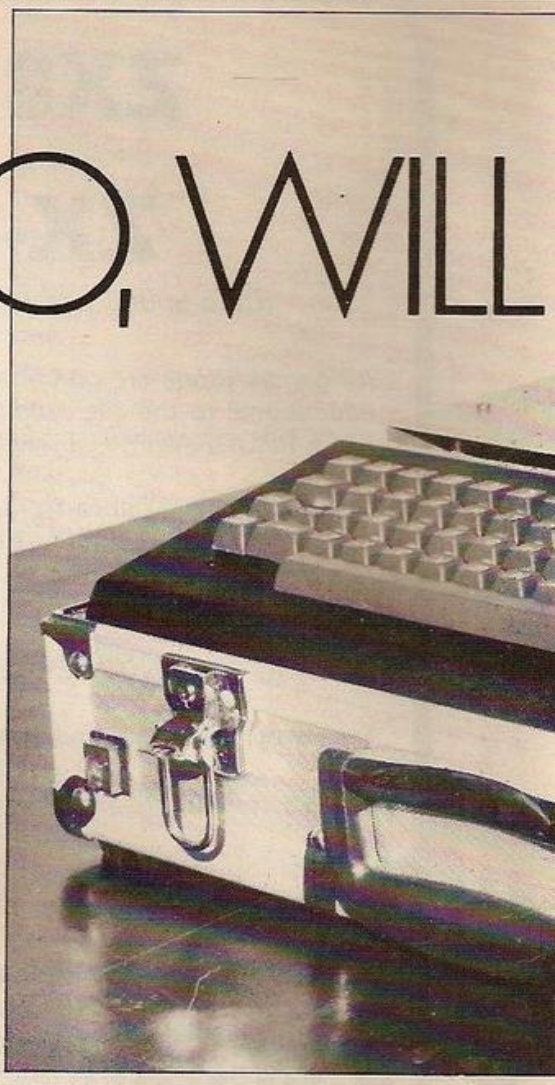
The IXO terminal is about 6in. long by 4in. or 5in. deep, is truly user-friendly, with excellent ergonomic design, and has a single-line liquid-crystal display with a QWERTY keyboard. There is a telephone Modem inside, good security protection to make it difficult for an unauthorised person to use your terminal, or their own, to access one of your files on the main computer, and the protocol you require to access a database can be stored automatically in CMOS RAM.

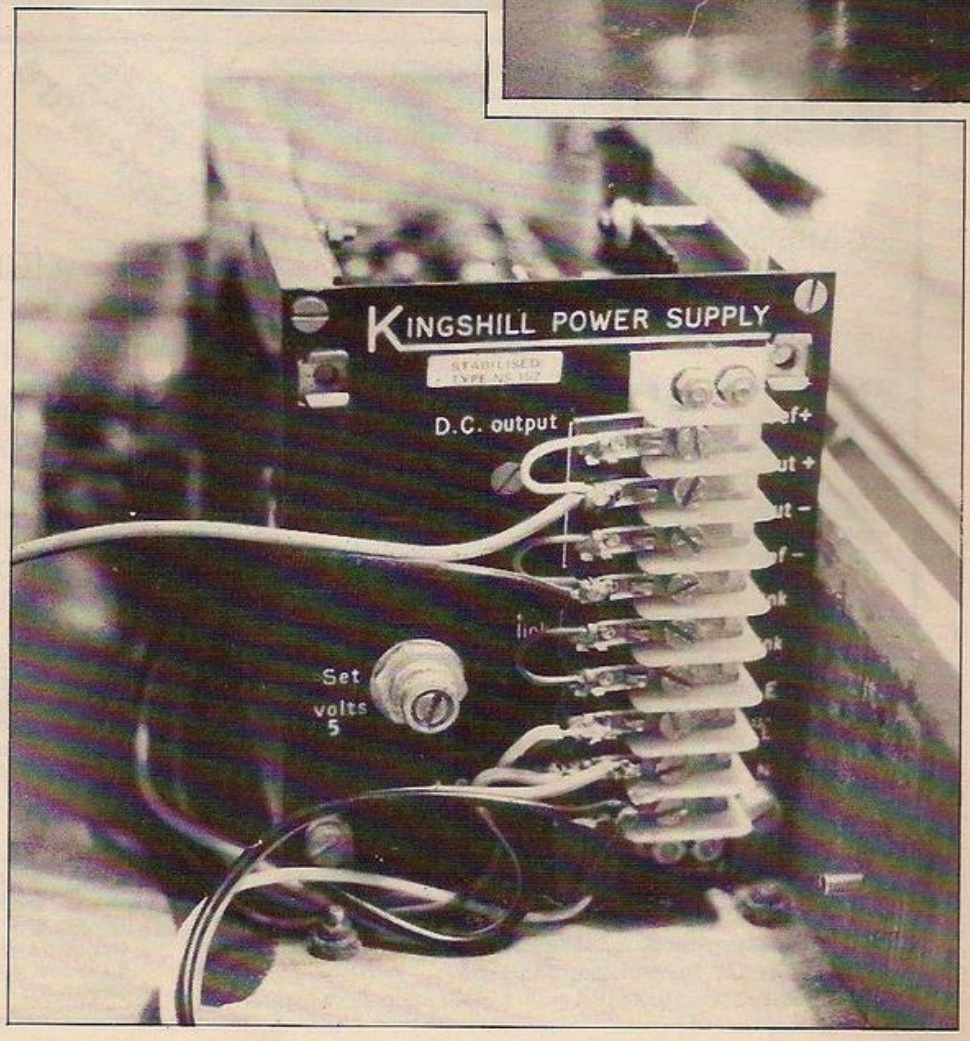
EPSON is launching the HX-20 in the States, a portable computer working on Nicad batteries with a four-line liquid-crystal display 24 characters wide which will display upper- and lower-case letters as well as the rest of the ASCII set.

These new computers and devices are not just marketing gimmicks. The ability to utilise the power of a computer in several places has already been shown to be very valuable. For example, Government officials with terminals coupled to a main computer by an acoustic coupler have been helping farmers in the U.S.A. for years.

Doctors in this country have used portable data capture units for analysing the electrical activity of the heart for some time, and when you couple a computer, rather than a dumb terminal, to a central store of information, the sky's the limit.

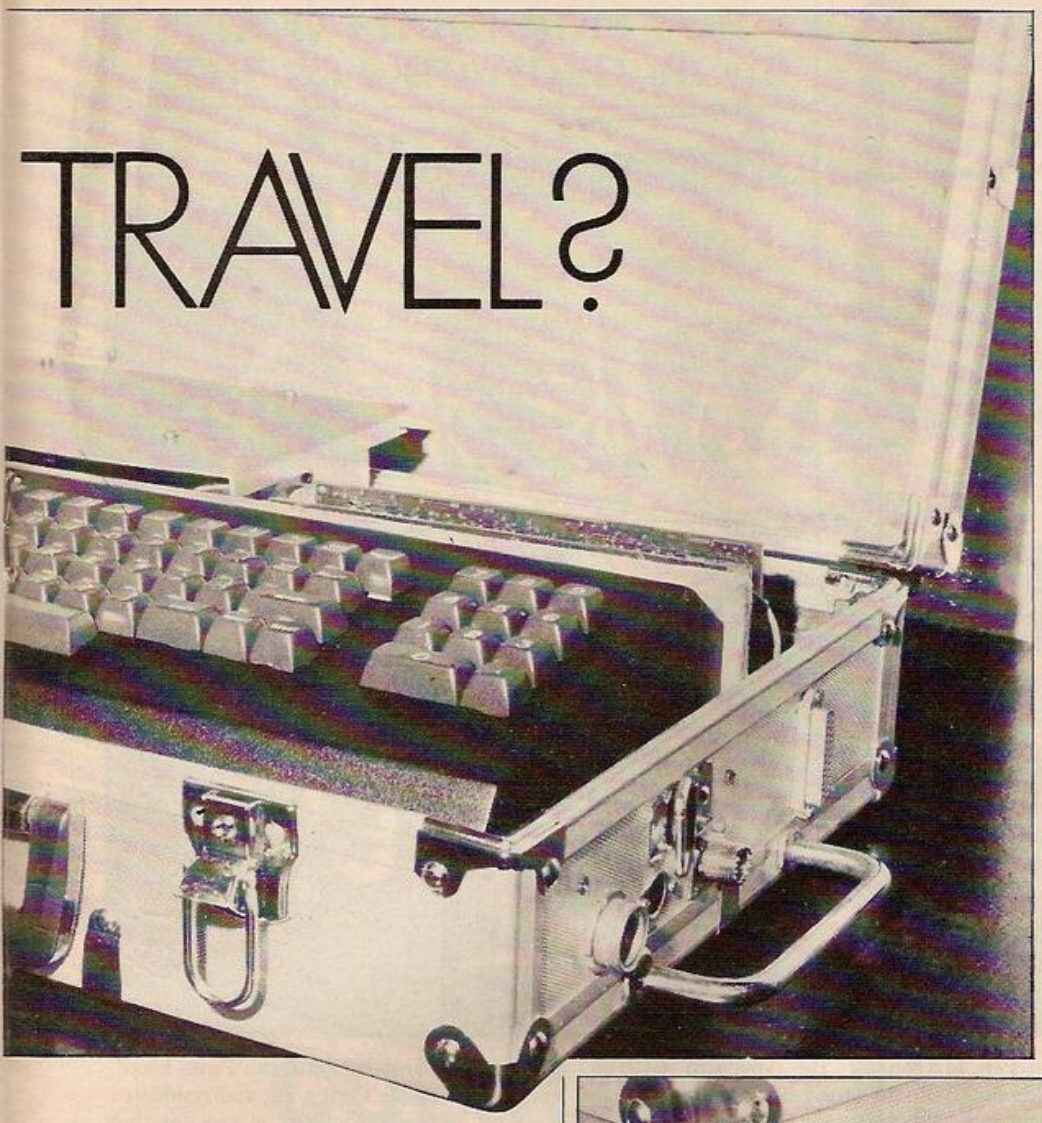
Having just finished writing Asimov, a word-processing package for the Tangerine Microtan, I wanted to be able to work on papers and reports both at the office and at home. I could have bought another Microtan solely for the office and it would have been fixed there with the same trailing wires; but at the same time someone at work said that she wanted a word processor for articles, press releases and a book.





Below, the 5V PSU mounted inside the camera case. Right, the micro that fits so neatly into the case is mains-powered but could run for several hours off a battery pack. Far right, the connections to the word processor.

TRAVEL?



It seemed a good opportunity to share the use of a portable word processor. The main photograph on this page shows the result of a weekend's work putting a new computer into a portable case.

When I planned the project it seemed reasonable to assume that a television would be available wherever the machine would be used. There is a TV in most homes, colleges, conference centres and hotel rooms for someone who is travelling. Consequently, there is no VDU built into the unit.

Railway work-station

If you want to use it on a train, you will need a battery pack for the computer, like the Osborne 1, and a battery-powered TV. Printers are still expensive so I decided that it would be an acceptable compromise to prepare material on the portable work-station, store the text on to tape and then print the text on my own computer at home.

The text would be transported either as a finished cassette tape or electronically along a telephone line. This is essentially the same method as a remote work-station in an office preparing text and then printing the final document on a central printer.

I like the Tangerine keyboard very much and I wanted to incorporate it into the unit without modification, so the computer case had to be wide enough to take the keyboard in its steel plinth. After rummaging through several luggage shops I found a version of the case I finally bought but it seemed over-expensive.

The same case is sold by Dixons camera shops as the Chinon Corniche, costing £29.95. The Corniche is about 17in. wide inside and is 5.25in. deep, about 0.75in. taller than the Microtan boards.

Asimov can manipulate about 7,500 words when used with a fully-expanded Microtan — or approximately 900 words with a full Tanex board — and I wanted to leave room for a TanRAM card in addition to the central processor unit and the several Tanex boards.

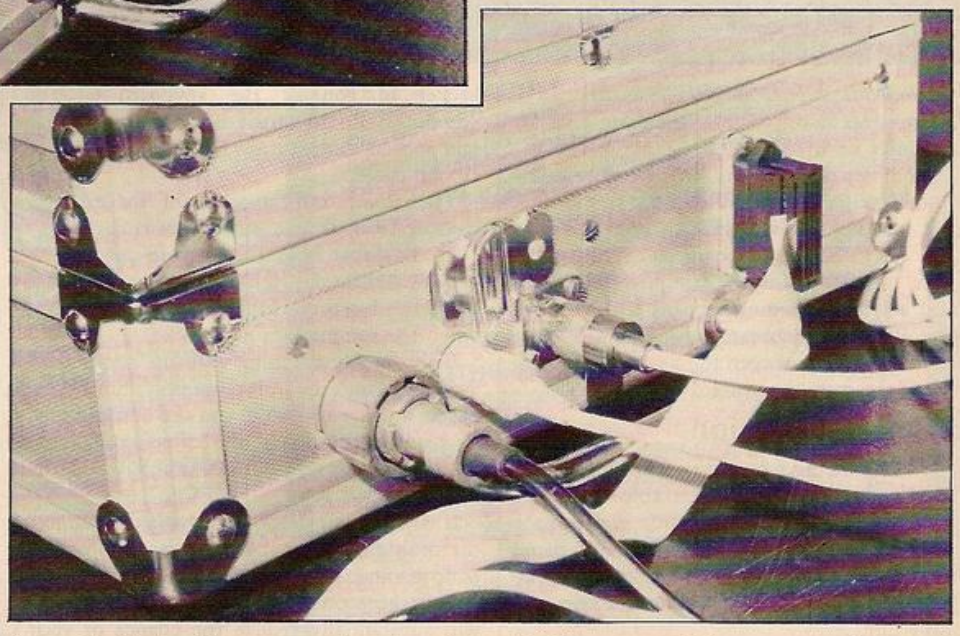
Furthermore, Microtanic Software which is marketing Asimov, is also bringing out a high-resolution board that will give a screen 64 characters wide by 25 lines and I wanted to take account of that in the space left for future expansion.

The case shown in the photographs has a number of features that are particularly well suited to this purpose. It is constructed out of plywood with a thin aluminium veneer on the outside and is quite rigid. Plugs and sockets can be mounted directly on to the case and the metal skin can be connected to the mains earth without difficulty. The plywood is strong enough to support a surplus mains power pack for the computer. Indeed, fixing the power pack in three places to two different panels strengthens the case.

I stripped out the fancy foam padding and ribbed side decoration and when I had secured the power-supply unit, I played with the computer boards, the keyboard and the tape recorder for some time.

Was there an advantage in having the boards lying flat, and stacking one on top of another? What effect would that design have on the ventilation of the boards? Did the keyboard fit over the tape recorder and, if so, was that an efficient use of space, leaving room for the connecting cables?

What about electrical safety? Could I bring mains power round to the right-hand side of the case, close to the signal wires, without inducing mains noise and corruption on the cassette and keyboard leads?



I only constructed the computer after a good deal of thought. Destroying the guarantee on £30's worth of case by drilling holes in it is always rather an anxious business, but it turned out well.

The keyboard rests on two side steps when it is in the case and the steps are deep enough to support the keyboard sufficiently clear of the National Panasonic Slimline tape recorder to store some cassette tapes between the two.

The mains input is on the left-hand side of the case and a lead is taken underneath the left-hand step to a neon light on the front surface.

(continued on next page)

(continued from previous page)

There is no on/off switch; when you plug the computer in, it is on.

I completed the mains wiring before doing anything else, bringing a lead out to the right side for the tape-recorder power. The next step was to fit the keyboard and measure the space remaining for the computer boards. I used a spare mini-motherboard and mounted the CPU and Tanex cards upright and as close to the partition between the keyboard and the rest of the case as possible.

Screen expansion

By hand-wiring a bus to two or more Eurocard sockets, I expect to be able to fit the TanRAM and big screen boards in the space at the back of the case. The aluminium panel separating the power-supply unit from the computer is bolted to the back of the case and to the unit.

It is carefully earthed both to act as a Faraday screen and to protect the computer should a mains lead come astray from the input to the power-supply unit.

The 16-pin dual-in-line plugs and sockets were never designed for frequent connection and disconnection; if you do not believe me look at the amount of metal in the Military Specification socket shown in photograph 9 and remember that it was designed to cope with salt water, mud, vibration and parachute drops.

Accordingly, I cut the keyboard cable on the Microtan and used a 25-way D plug and socket to connect the keyboard to the computer. Radio Shack has plastic D plugs and sockets with fittings to couple directly to ribbon cable.

The clamp on the back of the plug is comparatively fragile and it is easy to break the side arms that hold the back in place. The chrome bar on the right-hand side of the case is intended to protect the sockets from damage when the computer is moved.

Before doing anything with the computer I switched on the power-supply unit and checked the mains volts and the output volts. Remember to switch off before going anywhere near mains voltages — at 230V AC, the mains can kill you.

If you want to check mains voltages connect the multimeter and then switch on to obtain your reading. If it is impossible to do that then at least keep one hand in your pocket which will substantially reduce the chance of your receiving a shock through both hands across your heart.

The output socket from the modulator on the Microtan protruded too far and I removed the socket, soldering a coaxial lead directly to the unit. When I plugged the central-processor unit board into the motherboard and switched on, it worked. When I plugged the Tanex board in beside the CPU card and switched on it functioned until I added a full set of RAM chips.

Then it worked for just half a second before failing completely. There was no time to see an organised pattern on the VDU and then the screen went blank. I checked the Tanex board, which I had made from a kit, and resoldered many of the joints, looking always for thin whiskers of solder that might short out the power supply. Nothing obvious, even under a magnifying glass.

Eventually I connected a low resistance across the power-supply unit with a multimeter in series to measure the current the unit would put out before it shut down. After adjusting the current limiting variable resistance to allow the supply to give at least 1.5A, I reconnected the computer and the Tanex boards. This time it worked; it was just coincidence that the difference in current drawn by the Tanex board with the full complement of RAM was sufficient to shut down the power-supply unit.

CONCLUSIONS

- The whole case weighs about 10 kgm. when it is packed.
- Asimov is easy to use, and the VDU sits comfortably on top of the computer case — the facility to do work on a word processor and to take the machine with you at night or at the weekends is splendid.
- If flat screens are developed to the stage where they are cheap and reliable in the near future I shall be tempted to mount one in the lid of the computer case so that I can write on the commuter train.
- The final touch would be an acoustic coupler to transmit and receive text down a telephone line. ■

YOUR COMPUTER

is your magazine — every issue is full of articles specially written for the home computer enthusiast.

Reviews of personal computers; Programs; Surveys of software available on the market; New application ideas for your computer; Computer Club — news from your clubs; Calculator page; Letters; Answers to your problems and pages and pages of computer games and program listings.

All for only 60p

Ensure your copy each month, take out a subscription NOW!

SEE THE SUBSCRIPTION ORDER FORM BETWEEN PAGES 90 & 91 IN THIS ISSUE

ARTIC moving ahead with ZX software

ZX CHESS & ADVENTURES

PROGRAMS FOR THE ZX81/80 INCLUDING –

ZX CHESS I reduced to £6.50
Very popular machine code program, with six levels of play and an analysis option. Unbeaten except by:

ZX CHESS II now only: £12.99
A new improved version, wtih a faster response time, seven levels of play, and in addition a recommended move option.

ADVENTURES

ADVENTURE 'A' £6.00
Exciting machine code games with instant response, choose from the range below. You find yourself stranded on an alien planet. Can you reach your ship and escape?

ADVENTURE 'B' £7.00
In a jungle clearing you come across an Inca temple. You must break in, collect treasure and escape alive. Beware. Includes a cassette save routine.

ADVENTURE 'C' £8.00
You are unfortunate enough to be drawn to an alien cruiser. Can you reach the control room and free yourself or will they get you first? Includes a cassette save routine.

GALAXY WARRIOR £3.00
Fast and exciting interactive animated graphics game. Hunt clingons and go through black holes . . .

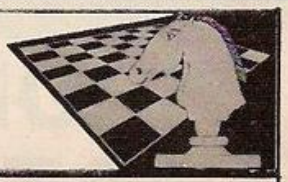
1K GAMES PACK £6.00
and many more. For a catalogue giving full details, please send a S.A.E. to:

GALAXIANS £6.50
All the features of the arcade game in a fast machine code program. Swooping attackers, explosions and personalised scoring.

ZXBUG £7.00
A 30 in 1 machine code tool and disassembler, allows access to registers and search through and modify memory; with cassette routines.

Artic Computing,
396 James Reckitt Avenue Hull, HU8 0JA

ZXCHESS



TWO GREAT ZX81 16K CHESS GAMES

ZXCHESS (ENHANCED)

- Written totally in machine code.
- Full graphic display of Chess board.
- Six levels of play: Two play within competition time limits.
- Option to play Black or White.
- Plays all legal moves including castling and en-passant.
- Cassette routines for saving unfinished game and returning to later.
- Displays moves of game on screen or printer for analysis.
- Print a copy of the Chess board onto the printer.
- Board can be set up in any position, you can even swap sides midgame.
- Clear whole board with one command: for end game analysis.

£6.50

ZXCHESS II We believe the strongest ZX81 Chess game as no other has beaten it!!

- All the features of ZXCHESS plus:
- Book of 32 opening moves.
- Seven levels of difficulty: FOUR play within competition time limits.
- A move is suggested by the ZX81 if wanted.
- Optional Full Graphic version using the QS CHRS Board.

£12.99

2 copies supplied on cassette with full instructions.
Cheques and postal orders payable to:

ARTIC COMPUTING
396 JAMES RECKITT AVENUE,
HULL HU8 0JA

RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

IS IT WORTH IT?

■I own a 1K ZX-81 and want more memory. Is a Vic-20, BBC Micro or Acorn Atom worth the extra money when compared with expanding the ZX-81? If so, do they run on Pet, or similar, Basic?

Edward Hogarth,
Preesall, Blackpool.

THE REAL ANSWER must begin "it all depends". It all depends on what you want to do with your microcomputer. Certainly, if you want music, colour, reliable Load/Save and Pet Basic, the Vic-20 is worth the money. If you want a computer with high-resolution graphics that you are unlikely to outgrow for years, the BBC Microcomputer is worth the money. Certainly if you do not mind working in what Clive Sinclair once called an "arcane" version of Basic, and you want a good reliable machine, which positively begs you to experiment with assembler, the Acorn Atom is worth the extra money. Sinclair's new Spectrum, reviewed on page 20, may also be worth considering. First, determine exactly what you need to make the most of your microcomputer, then examine the computers you can afford.

WHAT PRICE FAME?

■I write Basic programs, and I imagine — like the majority of others — partly for their applications, but mostly for the fun of it. However, there are occasions when, having spent many evenings writing, testing, and debugging a program, one thinks that it would be good to earn a little cash for one's labours — perhaps to buy a printer. Do you think it would be possible for *Your Computer* to provide some information on the possibilities which are available, assuming that one does not want to get involved in setting up one's own business? For example, can one sell programs to the many small software firms which advertise monthly in *Your Computer*, and what is the situation regarding copyright?

Terry Peppard,
Redhill, Surrey.

THE EASIEST thing to do is to give software companies the right to duplicate and distribute the programs on your behalf. We would suggest you approach the bigger companies first — such as Bug-Byte, Artic or Premier Publications — as they are most likely to have a well-structured arrangement in existence to cater for such situations. You automatically have the copyright for any original work — be it a musical composition, a book, a computer program, or whatever — but you cannot expect to have the rights to some program you have merely adapted from a published listing. It is best, in terms of financial return, to sign a rights deal only, rather than sell a program outright. *Your Computer* also pays £6 for every Software File contribution published and £35 a page for articles in the main section of the magazine.

THINK OF A WORD

■I have had a Vic-20 for some weeks now and am pleased to see that *Your Computer* is devoting more and more space to the Vic. I wish to write a program in which the Vic thinks of a word, rather than a number, but I cannot work out a way to make the Vic think of a different word, short of having all the words in one string, and having the computer select a part of the string. I would be very grateful if you could suggest a way for me to do this.

S Harnwood,
Irvine, Scotland.

IF YOU HOLD the words in Data statements, you just need to have:

```
FOR J = 1 TO INT(RND(1)*X)
```

where X is the number of words in the list

```
READ A$, NEXT J
```

This will move through the list a random distance, ending with one word equal to A$. Of course, if you decide to find another word at random during the same game, you will need to add a Restore statement before the opening of the J loop.

IT WAS THIS BIG

■I own a 16K Sinclair ZX-81, and wonder if you could suggest a short program telling me how much free memory I have left in my machine while I am entering a program.

J Taylor,
Askam-in-Furness, Cumbria.

A ONE-LINE program which will help you assess free memory is

```
9999 PRINT PEEK 16396 + 256 * PEEK
     16397 - 16509
```

Just enter Goto 9999 when you want to find out how much memory your current program has used.

EASY AS ABC

■Having just acquired a ZX-81, I looked through numerous computer magazines and found you are the most interesting and helpful, and I have ordered a copy every month. I have been looking for a program which I can use which would take a random list of items and put them in alphabetical order. So far I have had no success, and I wondered if you could help me with such a program. I am building a library of records, and am now using my ZX-81 to list them, but it would be of great help if the list appeared in order.

C N McPherson,
Harrow.

THE FOLLOWING program should suit your needs. It will run in one 1K, although you will only sort a limited number of items with that small memory. If you would like it to list items in the opposite order to the one it now uses, change line 175 to

```
FOR T = Q/Q TO Q
```

Thank you very much for the comments on *Your Computer.*

```
 1 REM ALPHASORT
 2 PRINT "NO. TO BE SORTED?"
 3 INPUT Q
 4 CLS
40 DIM A$(Q+1,10)
50 FOR T=Q/Q TO Q
60 INPUT A$(T)
70 NEXT T
80 FOR Z=Q/Q TO Q
90 FOR T=Q/Q TO Q
100 LET B$=A$(T)
110 IF A$(T+T/T)>=A$(T)
    THEN GOTO 130
120 GOTO 150
130 LET A$(T)=A$(T+1)
140 LET A$(T+1)=B$
150 NEXT T
160 NEXT Z
175 FOR T=Q TO Q/Q STEP
    -Q/Q
180 SCROLL
190 PRINT A$(T)
200 NEXT T
```

1K ADVENTURE

■I am 12 years old and have recently bought a Sinclair ZX-81. In countless magazines I have seen adventure games for higher-memory computers. As you know, this standard machine only has a 1K RAM, and I have never seen an adventure game for a 1K ZX-81. My money resources will probably never expand to buying a Sinclair 16K RAM. Could you possibly tell me where I can find a program of adventure for a 1K computer?

Lee Jolly,
Preston, Lancashire.

THE SHORT ANSWER is no. There is no way you can fit an adventure into 1K. The longer answer is made up of three possibilities:

- ■You buy cheaper expansion memory. 3K packs are available for around £15.
- ■Alastair Gourlay's book *34 Amazing Games for the ZX-81* has a 1K Wumpus game in it which, although necessarily limited, is possibly of interest.
- ■You take advantage of the fact that the ZX-81 can store variables such as

```
LET A$ = "A BIG BAD BOOGY"
```

when entered directly, and these can be used in a game if you use Goto 1, rather than Run.

BBC GAMES

■I have written a board game for my BBC Microcomputer, and although the display — using full stops, the letter H for the human piece and C for the computer piece — is satisfactory, I would like it to place each piece in a particular colour. How can I do this?

John O'Rorke,
West Ruislip.

IF YOU USE the line:

```
F = - 130*(M=67)  133*(M=72)
  - 134*(M=46)
```

and you are working in Mode 7, you can follow it, if M is the code of the piece, with the line

```
PRINT CHR$(F);CHR$(M);
```

to obtain purple Hs, green Cs and light-blue full stops. Change the numbers before the brackets in the first line given to produce different colours for the pieces.

IS VIC THERE?

■I read about the Super Vic in *Your Computer*. I was about to buy a Vic-20, but now I am worried that the Super Vic will replace the Vic-20 in the same way as the ZX-81 did the ZX-80. Could you tell me more about the Super Vic and if the Vic-20 is expandable for a similar price?

M P Eaglen,
Wroxell, Isle of Wight.

THE SUPER VIC provides 40 characters per line, and more on-board memory than the Vic-20. Although this is much better than the Vic-20, the standard Vic is available now, and it is possible to obtain high-resolution graphics through a software routine. You may be waiting a long time for the Super Vic to be available in the U.K. Therefore, there seems little point in delaying your purchase. More information about the whole Commodore computer range, including the new Ultimax, can be obtained at the Commodore show in June.

HEAVY KEYBOARDS

■I am looking for a heavy-duty keyboard that will house my ZX-81. The two that have attracted my attention are the Fuller FD system and the Protos keyboard, both recently advertised in *Your Computer*. I was wondering which one of these is the better, or if there is a better one on the market. My price range is £70.

Simon Tyler,
Warrington, Cheshire.

YOU HAVE NOT specified what you mean by heavy-duty so it would be difficult to recommend a particular keyboard. For a detailed account of ZX-81 keyboards read Stephen Adams' article in this issue. ■

ZX81 users

I need more memory!
please rush me within
10 days, the fully assembled,
tested and guaranteed

'BYG BYTE'

16K RAM

Name .....

Address .....

Make all cheques & PO's payable to:
Phoenix Marketing, Oaklands House,
Colartron Road, Farnborough, Hants.
Tel (0252) 514990

FULLY INCLUSIVE PRICE

£34.95

MICROCOMPUTER COMPONENTS

LOWEST PRICES - FASTEST DELIVERY

MEMORIES AT UNBEATABLE PRICES

2114 Low Power 200ns	**0.84**	4116 200ns	**0.70**
2708 450ns	**2.93**	4116 150ns	**0.84**
2716 450ns (+5v)	**2.49**	4118 200ns	**3.38**
2716 350ns (+5v)	**3.59**	4164 200ns	**4.65**
2716 (3 rail) 450ns	**5.95**	4516/4816 100ns	**3.25**
2732 450ns	**3.90**	5516 200ns	**9.38**
2732 350ns	**4.40**	6116 200ns	**5.10**
2532 450ns	**3.90**	6116LP 200/150ns	**7.61**

BBC MICROCOMPUTER UPGRADE KITS

BBC 1 RAM Upgrade Kit	**26.00**
BBC 2 Printer User I/O Kit	**9.50**
BBC 4 Analogue I/P Kit	**9.50**
BBC 5 Serial I/O and RGB Kit	**11.45**
BBC 6 Expansion BUS Kit	**7.95**
Connectors for BBC 4	**2.25**
Connectors for BBC 5	**0.80**

The above kits make up the full Model 'A' to Model 'B' Upgrade for the BBC Microcomputer
Special price when bought complete **62.00**

OFFICIAL ORDERS WELCOME — VISA — 24 HOUR TELEPHONE SERVICE FOR CREDIT CARD USERS — QUANTITY DISCOUNTS AVAILABLE

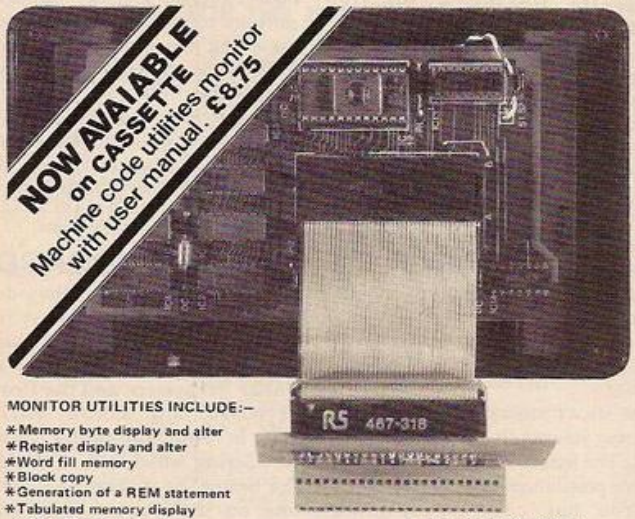
★ Free Reply Paid Envelope with every order ★
★ All prices exclude VAT & P & P (0.75) (Free on CWO's over £10) ★
★ All orders despatched on day of receipt with full refund on out of stock items if requested ★

MIDWICH COMPUTER CO. LTD.

DEPT YC. HEWITT HOUSE, NORTHGATE STREET,
BURY ST. EDMUNDS, SUFFOLK IP33 1HQ
TELEPHONE: (0284) 701321 TELEX: 817670

SOMETHING REALLY NEW FROM
TAURUS COMPUTER DESIGN
FOR ZX81 USERS

The *unique* TAURUS 16K RAM PACK supplied with powerful EPROM Machine Code utilities monitor which contains 16 software routines giving far reaching control over writing and de-bugging of machine code.

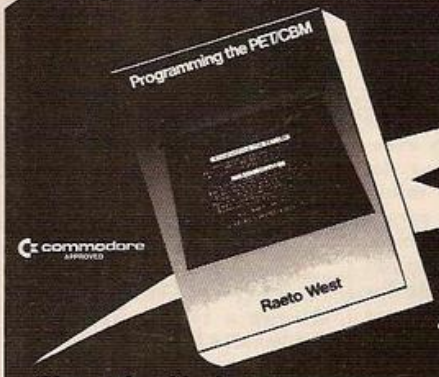


MONITOR UTILITIES INCLUDE:–
- Memory byte display and alter
- Register display and alter
- Word fill memory
- Block copy
- Generation of a REM statement
- Tabulated memory display with addresses
- Viewable user screen separate from monitor display screen
- Hex to decimal and decimal to Hex converter
- Routine to enable user to write his own utilities in RAM
- Facilities to run machine code and set breakpoints

Other reasons why you should consider our design in front of all others:
- Flexible stripline connector eliminates movement and memory wipeout.
- Low Power CMOS RAM (switchable 16K RAM or 14K RAM and 2K EPROM)
- Socketed EPROM for permanent programs
- Comprehensive user manual

ALL THIS FOR
£54.95 inc.
16K RAM PACK WITHOUT MONITOR £45.95 inc.
Make cheques payable to:
TAURUS
COMPUTER DESIGN,
47 HIGH ST., BALDOCK,
HERTS. SG7 6BG

NEW
Programming the **PET/CBM**



'This book is excellent.'
- Jim Strasma

'Unquestionably the most accurate and comprehensive reference I have seen to date.'
- Jim Butterfield

Bestseller — comprehensive teaching and reference book on all software aspects of Commodores 2000, 3000, 4000 and 8000 microcomputers and peripherals.

Many programs, charts and diagrams. 17 chapters, appendices, and index. iv + 504 pages. 19 x 26 x 2½cm. Paperback. ISBN 0 9507650 0 7. Price in UK and Europe £14.90 each (incl. post and heavy-duty packing). LEVEL LTD., PO Box 438, Hampstead, London NW3 1BH. Tel: 01-794 9848.

Cut out or copy coupon, or write to:
LEVEL LTD., PO Box 438, Hampstead, London NW3 1BH.

Send ..... copy/ies of *Programming the PET/CBM* at £14.90 (post free)

I enclose cheque/P.O. for £.....or official order.
NAME .....
ADDRESS .....
.....

Fast Service — same day despatch YC582

FINGERTIPS

Fingertips is our regular calculator column covering calculator news, programming hints and examples of unusual applications. The column is written and compiled by calculator enthusiast David Pringle who is glad to hear of any of your ideas. *Your Computer* pays £6 for each of your contributions published.

WITH AN enhanced 12K ROM Basic, six new programmable function keys and an advanced four-colour graphic printer the Sharp PC-1500 is a new, super-improved version of the PC-1211. This newly-released machine, which we hope to review fully next month, set me thinking about what we really wanted from the next generation of pocket calculators. Is it really to be a quest for a mini-microcomputer, or will improved Basic with better array and string handling suffice? Indeed, do we want Basic at all? What about memory capacity, peripherals and keyboard layout? If you have any opinions on these matters write in to *Your Computer*, Fingertips.

Dale Cass of Stafford has an interesting program for writing banner messages with the Casio FP-10 printer. To operate, the user simply enters the codes of the letters of the heading into memories M00 to M03. Five letters may be stored in each memory, and each is represented by a two-digit number corresponding to its position in the alphabet. For example, the message *Your Computer* would be entered as

```
25 . 15 21 18 27   in M00
03 . 15 13 16 21   in M01
20 . 05 18         in M02
```

Note the decimal point after the first two-digit code.

This is the only method for entering letters as the calculator has no string-handling facilities. When the numbers have been entered — and terminated by a zero in M03 in this case — p0 is pressed and the message will be printed.

The program works by using Indirect indirect addressing. This simply means that each code number sends the program pointer to a specified memory, in which is stored another 10-digit number. The program reads this number and splits it up into five two-digit numbers. Each of these is interpreted as the indirect address for yet another memory which will contain seven digits: either a 0 or a 1.

Finally, these seven digits are printed as a column with a zero representing a blank and a one representing a block. Hence each code number is interpreted as five columns of seven rows — a five-by-seven matrix for each letter.

As an example, let us take the letter H. The code number under this scheme is simply 08 — the eighth letter of the alphabet. The program now looks for the indirect address, code number +43, which is memory 51 in this case. The memory list shows that M51 contains the number 40.10101040.

The first two digits are split off by the use of the INT function in the program, leading to the indirect address of M40. This memory contains seven ones and is thus printed as a full vertical line. Similarly, the next two digits are split off

INT(100 × FRAC(M51))

and lead to the memory location containing 0.001000. It is now transparent that we will be forming a letter of the form shown in figure 1.

The character codes are stored in the 27 memories from M44 for A to M70 for a large space. It should be noted that if we worked with a smaller matrix, say, five by six, there would be no need for codes greater than 63 ($2^6 - 1$) and we could simply use one series of indirect addressing instead of two.

If you own a Micro and spend much of your time using machine code you will find the following program from Brendan Kelly of Nottingham most useful. It is a simple program for the Casio FX-3500P to convert to or from any numerical base, he writes. I found it particularly useful while developing machine-code routines for a TRS-80 to which I had limited access and no assembler.

The best way to initialise the program is to key in the following:

MODE 0	Kin 5
INV KAC	0.499999999
1	Kin 6
Kin 3	INV PCL
2	MODE 7 0
Kin 4	P1
10	

Then key in the program itself:

Kin 1	X
−	Kout 3
Kout 4	=
Kin ÷ 1	Kin +2
Kout 6	Kout 5
Kin −1	Kin X 3
Kout 1	Kout 1
INV RND	INV X>0
Kin 1	1
X	Kin 3
Kout 4	Kout 2
=	Kin −2

Leave LRN mode:

MODE•

As initialised, pressing P1 will

(continued on next page)

Sharp's PC-1500 hand-held computer with four-colour printer — is this the right kind of progress?

Program list.

```
M00-70,F-6F 104steps  "; "
                      LBL5
*** P0                MR3F FRAC x 10 =
1 +/- MinF            Min3F GOTO3
LBL9                  LBL7
1 M+F                 "; "
IND MRF x=0 GOTO0     SAVE invEXE
Min1F                 MR2F FRAC x 100 =
LBL1                  Min2F x=0 GOTO8
43 M+1F               GOTO2
IND MR1F Min2F        LBL8
LBL2                  " "
IND MR2F Min3F        SAVE invEXE
LBL3                  MR1F FRAC x 100 =
MR3F x=0 GOTO7        Min1F x=0 GOTO9
INT x=0 GOTO4         GOTO1
";■■"                 LBL0
GOTO5                       ...095steps
LBL4
```

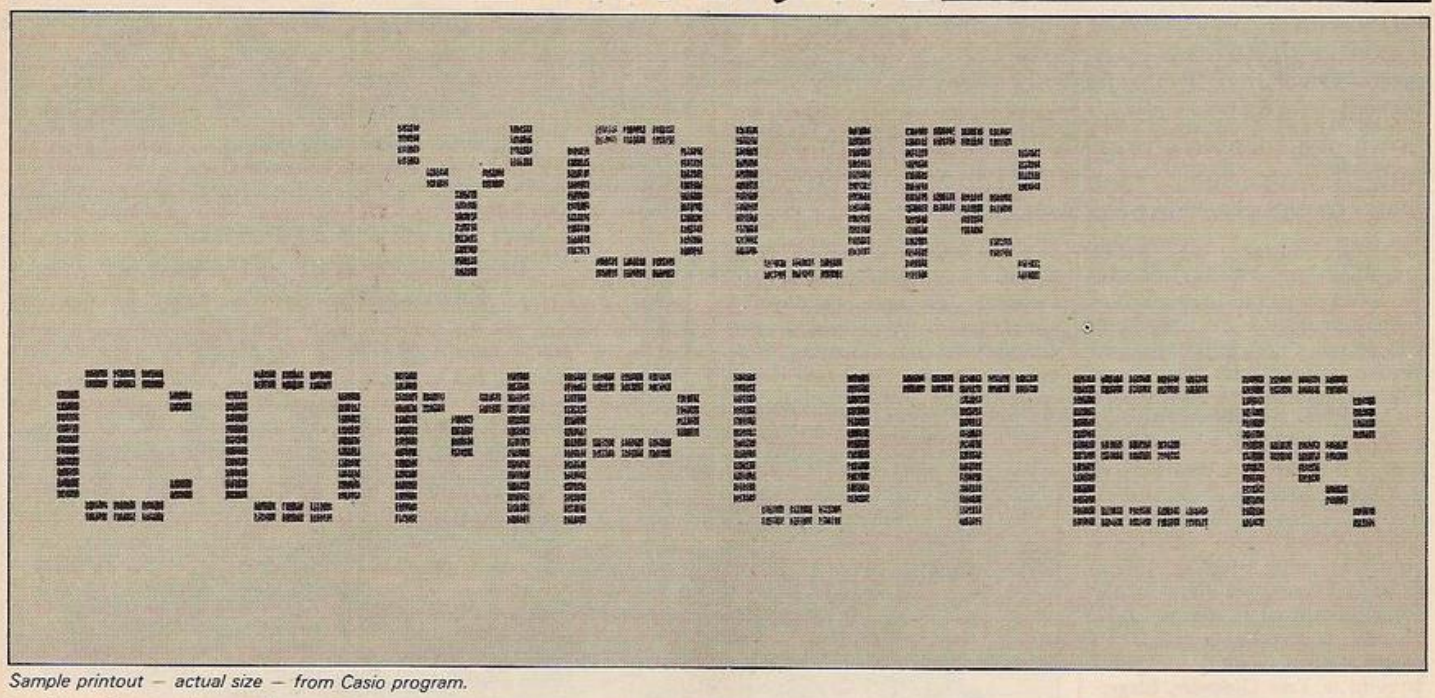
Memory list.

```
M00-70,F-6F 104steps
M00=-25.15211827
M01=  3.15131621
M02=     20.0518
M03=          0.
M04=          0.
M05=          1.E-06
M06=          1.E-05
M07=        1.1E-05
M08=          1.E-04
M09=        1.1E-04
M0F=          3.
M10=          1.E-03
M11=       1.001E-03
M12=        1.1E-03
M13=          0.01
M14=        0.0101
M15=           0.011
M16=       0.011001
M17=          0.0111
M18=       0.011111
M19=             0.1
M1F=              0.
M20=       0.100001
M21=        0.10001
M22=        0.10011
M23=       0.101001
M24=        0.11011
M25=        0.11101
M26=        0.11111
M27=       0.111111
M28=              1.
M29=       1.000001
M2F=              0.
```

(listing continued on next page)

Figure 1.

```
10001   .   .
10001   .   .
10001   .   .
11111 or, more clearly .....
10001   .   .
10001   .   .
10001   .   .
```



Sample printout — actual size — from Casio program.

(continued from previous page)

cause the displayed number to be converted to binary. For example, enter 25, press P1 and after a short pause 11001 will be displayed. The program can then be reused by again pressing P1: reinitialisation is only necessary if the calculator is switched off when Mode 7 0 will have to be re-entered or if the contents of K1 to K6 are inadvertently changed when the values will have to be re-entered.

Obviously, conversion to bases greater than 10, e.g., hexadecimal, cannot be carried out so simply as each digit of the required base, i.e., nybble, will have to be represented by more than one digit of the display.

For example, as the FX-3500P has a purely numerical display, each nybble of hexadecimal will have to be displayed by two digits. Thus 3CFOH would be displayed as 3121500 which could mentally and at a glance be recognised as 3 12 15 00 and if necessary 0 to 15 could be replaced by 0 to F.

To accommodate this method of display not only must the base to which we are converting be stored in K4, but 10^n must be stored in K5 where n is the number of display digits required per digit of the specified base.

The contents of K4 and K5 for conversion to useful bases can be summarised:

	Binary	Hexadecimal	Base 256
K4	2	16	256
K5	10	100	1000

Conversion to base 256 is useful for splitting addresses into their least- and most-significant bytes. For example, 32767 will be converted to 127255.

The main point not so far covered is conversion from rather than to a specified base. This could hardly be simplier and is accommodated by exchanging the contents of K4 and K5. This should cause no added difficulty as long as the strict format of entry is adhered to. That is, 3CFO hexadecimal must be entered as 3121500 not 312150, and 64 0 base 256 must be entered as 64000.

Once this program is understood it can be simply adapted for almost any programmable calculator which uses an algebraic hierarchy, has at least six memories and a conditional jump. The instructions which may require explanation are:

Kin 4	store in memory 4.
Kout 4	recall in memory 4.
Kin + 2	sum to in memory 2.
INV X>0	return if x, the display, is greater than 0 to the first program.
P1	causes execution from the first program step.
INV RND	rounds the internally stored number to that displayed — fixed to 0 decimal places.

A simple, but pleasing, timing program for the Sinclair Enterprise Programmable comes from John Lewis of Llanelli. This is a much shorter program than is supplied in the Sinclair applications books, he writes. When run, it will time accurately over long or short period timings, giving a readout in seconds.

Before each run, you should first key in 0 Sto 0. This sets the timer to zero, as subsequent readings will be stored in Mem 0. Again, after each run, RCL 0 should be keyed in to provide a reading in seconds.

Pre-execution: 0 STO 0

KEY	STEP
= /EE	01
2	02
6	03
M+	04
0	05
GOTO	06
0	07
1	08

Post-execution: RCL 0

Finally, Douglas McGibbon of Edinburgh writes in with two short points on the HP-41C. He writes: the first item is a small program designed to eliminate the laborious task of manually deleting various memory registers when you cannot use the CLRG function because you want to keep some of the registers intact.

The program itself only occupies 24 bytes of memory space and uses the X and Y stacks to hold the limits of the memory clear. Once the program has been loaded and assigned to a key, all that need be done is to enter the upper limit of the memory wipe into the Y stack and the lower bound into the X stack and then execute the program. For example,

8 ENTER 3 R/S

will delete registers 3 to 8 inclusive.

```
01 LBL αMOPα
02 LBL 00
03 STO IND X
04 ST- IND X
05 X=Y?
06 STOP
07 1
08 +
09GTO 00
10 END
```

Secondly, in the manual it is stated that memory modules should always be inserted in the correct order, so I moved my sole memory module from port 1 to port 2. After a little experimentation I discovered that I had a block of memory that could be used as memory registers only and not as program registers.

As to be expected these registers were numbered in the conventional pattern as if there was a module in port 1 also. That is, from a cold start with a module in port two, the new block of registers is numbered 81 to 144. The most interesting finding was that although the statistical registers can be assigned to this block, the shifted set of registers is not affected by the CLRG function. This provides another use for my program.

This immunity is apparently because of the fact that when the CLRG function is executed, the calculator only checks the first port for extra modules. On finding none, it assumes no extra modules are plugged in and stops where it is. It is also possible to store something in a register, move the module to a different port and recall it by using the new register number. ■

(listing continued from previous page)

```
M30=     1.000011    M40=     1.111111    M50= 26.29333325    M60= 26.29342035
M31=     1.000101    M41=      0.11001    M51=  40.1010104    M61= 40.11162332
M32=      1.00011    M42=           0.    M52=  4.29402904    M62= 22.33333341
M33=     1.001001    M43=           0.    M53= 19.28292705    M63=  5.05400505
M34=     1.010001    M44= 39.11111139    M54= 40.10142129    M64= 27.28282827
M35=      1.01111    M45= 40.33333324    M55= 40.28282828    M65= 18.19281918
M36=     1.100001    M46= 26.29292921    M56=  40.0612064    M66=  40.1915194
M37=     1.100011    M47= 40.29292117    M57=  40.0810134    M67= 37.14101437
M38=        1.111    M48= 40.33333329    M58= 26.29292926    M68=  7.08380807
M39=      1.11111    M49= 40.11111105    M59= 40.11111109    M69=  36.3433313
M3F=           0.    M4F=           0.    M5F=           0.    M6F=           0.
                                                             M70=  4.04040404
```

SPOCK: "Computer! Calculate the value of Pi to ten thousand decimal places"
COMPUTER: "Working . . ."

CAN YOUR COMPUTER SPEAK?

The WIDEBAND SPEAKEASY speech synthesiser adds voice response to any computer with a parallel port including PET, APPLE, expanded ATOM, HORIZON etc.

for Only £69 + VAT

- ⁂ **UNLIMITED VOCABULARY**
- ⁂ **EASY TO PROGRAM**
- ⁂ **LOW MEMORY OVERHEAD**
- ⁂ **COMPLETE MANUAL WITH DICTIONARY, SAMPLE SOFTWARE AND TUTORIAL ON SPEECH PRODUCTION.**

Also includes high flux speaker and power supply, all housed in high quality wood cabinet with volume control and rear pitch control.

Programmed with simple phonetic codes. Apart from the obvious applications of voice response in manufacturing, testing, blind terminals etc., this product also teaches a great deal about linguistics and speech production.

Software is available in BASIC and Z-80 and 6502 assembly for direct input in PHONETIC SPELLING closely related to the ARPABET international phonetic alphabet.

For your nearest dealer contact:

WIDEBAND PRODUCTS, CAMBRIDGE RD., ORWELL, ROYSTON, HERTS. TEL: 0223 208017

A subsidiary of Sands-Whiteley Research and Development

ZX81 HARDWARE

40 KEY KEYBOARD. Kit £20.95. Built £25.75 (RE77)
- Proper typewriter style keys.
- All legends and graphics in two colours.
- No soldering required to ZX81. Plugs in. (RAM/Printer not affected)
- Complete with all parts, connectors, feet and comprehensive instructions.

24 LINE IN/OUT PORT. Kit £16.95. Built £18.95 (RE98)
- Each line either in or out.
- Controlled by BASIC.
- Allows printer/RAM to be used without a motherboard. (Motherboard version kit £13.50. Built £14.50)

3 CHANNEL SOUND/TIMER BOARD. Kit £16.95. Built £18.95 (RE161)
- 3 independent channels.
- Controlled by BASIC.
- Full range of notes.
- Complete instructions with examples provided.
- Can be used as a sophisticated timer/counter.

MOTHERBOARD. Kit £15.75. Built £18.50 (RE82)
- Two connectors on board.
- Six connector board. TBA.

CONNECTORS & PLUGS
- 23 Way female connector for ZX80/81. (RE80) £2.95.
- 23 Way male connector. (RE87) £1.30.
- 23 Way male connector to fit two female connectors together. (RE90) £1.60.
- 30 Way ribbon cable. £1.40 metre.
- RAM pack connector. Allows RAM pack to be remote from ZX80/81. RE170. £6.95 built.
- In/out connector and sound board connector. (RE78B) £2.95.

BOOKS AND TAPES
Getting acquainted with ZX81. £4.95.
Mastering machine code. £5.95.
Programming for real applications. £6.95.
Tape for real applications book. £11.44.

Send SAE 5" × 7" for free illustrated catalogue.

All products available ex stock (allow 7 days extra for built products.

PAYMENTS: Cash with order or ACCESS/BARCLAYCARD. Official order welcome. Dealers write for rates.

All prices include p&p and VAT. Overseas add £1.80.

REDDITCH ELECTRONICS, DEPT. YC
21 Ferney Hill Ave., Redditch, Worcs. B97 4RU
Tel (0527) 61240.

SOFTWARE

for ZX-81(1K & 16K) or BBC Micro

New maths programs – improve your maths and programming skills by playing Simon maths **Games**.
Choose your own level of difficulty – suit ages 10-16.
10 programs on each tape – most incorporate **Moving Graphics** and are fun to run.
Let your computer help you to pass your exams.

Maths 1	Number, Area, Fractions, Decimals, Money, Length, Number, Estimation, Test 1, Game 1.
Maths 2	Volume, Ratio, Percentages, Perimeter, Bases, Time, Number, Estimation, Test 2, Game 2.
Maths 3	Directed Number, Co-ordinates, Angles, Scale, Probability, Density, Temperature, Estimation, Test 3, Game 3.
Maths 4	Square Roots, Indices, Circles, Inequalities, Statistics, Number, Fractions, Angles, Test 4, Game 4.
Maths 5	Equations, Directed Number, Statistics, Probability, Circles, Equations, Pythagoras, Simultaneous Equations, Test 5, Game 5.

Simon Software

Quality tapes copied at normal speed for better reproduction.
Cassettes £4 each (inc.VAT).
Printed Programs £1 (inc.VAT).
Please add £1 p&p.
FREE! blank tape with each **set** ordered.
Send cheque/PO to: Simon Software, Freepost, New End, Redditch.
(State ZX-81(1K),(16K) or BBC)

NEW PRODUCT

ZX81 BLEEP

Wouldn't it be great if your keyboard provided some sort of feedback to let you know whether or not you had pressed the right spot hard enough?

Ordinary keyboards provide this feedback by means of mechanical movement, but of course this is lacking in your touch keyboard, hence you need constantly to refer to the screen to check that each item typed is present and correct. The ZX81 Bleep provides a short audible sound as feedback, thus typing programs takes less time and involves fewer errors.

We have kept the installation as simple as possible. *No soldering is necessary;* this means that 12 infrequently used characters (out of a total of 210) do not bleep. In practice this tends not to be a problem unless of course you plan to make frequent use of such characters as inverse £!

You can easily fit the bleep inside your ZX81 in a matter of minutes using only a screwdriver. Everything else is provided including full installation instructions.

Ready assembled and fully tested only £9.95.
Kit form only £7.95. Prices include post and packing.

FULCRUM PRODUCTS

HILLSIDE, STEEP LANE, FINDON, WORTHING, WEST SUSSEX BN14 0UF

SOFTWARE FILE

Software File gives you the opportunity to have your programs, ideas or discoveries published. We will accept contributions for any personal computer and will group programs for like machines together in the file. Please double-check your listings before sending them, and specify the memory they require. Mark your letter clearly for *Your Computer.* We will pay £6 for each contribution published.

Code transfer

Nick Goodwin,
Eyemouth,
Berwickshire.

ZX-81

IF YOU ARE experimenting with machine-code programming on the ZX-81 the moment will arrive when you want to incorporate a machine-code routine, which you have in one program, into another program. This can present a problem, since machine codes are often long and laborious to enter. The following process, however, enables machine code to be transferred from one program to another with a minimum of effort, and error-free.

First, RAMtop must be set at some convenient level. I generally set it at 32000 for this kind of work, which gives 768 bytes to play with, while leaving well over 15K for Basic listing, display file and variables.

The following routine enables RAMtop to be set easily at any desired level:

```
10 INPUT X
20 LET Y=INT (X/256)
30 LET X=X-256*Y
40 POKE 16388,X
50 POKE 16389,Y
60 NEW
```

Run the program, enter the number to set RAMtop, press Newline. The program promptly disappears — line 60. If you want to check that you have set RAMtop correctly, the following command will print the number you entered:

```
PRINT PEEK 16388 + 256*PEEK 16389
```

Now load the program containing the machine-code routine which you want to isolate and transfer. I assume here that the machine-code routine is stored in a Rem statement in line 1, but the program can easily be adapted by adjusting the initial value of J in line 9030. This should be the address prior to the address at which the machine-code routine commences.

Add the following lines to your listing. I have chosen to number them from 9000 but that is not important — simply slot them in where you can.

```
9000 FAST
9010 LET RAMTOP=PEEK 16388+256*PEEK
     16389
9020 LET X$=" "
9030 LET J=16513
9040 LET J=J+1
9050 IF PEEK J=118 THEN GOTO 9080
9060 LET X$=X$+S TR$ PEEK J + "(inverse
     space)"
9070 GOTO 9040
9080 FOR J=1 TO LEN X$
9090 POKE RAMTOP+J, CODE X$(J)
9100 NEXT J
9110 STOP
RUN 9000
```

When that has finished a few seconds later, load the program to which you wish to transfer the machine-code routine. Again, I assume that you want to Poke the routine into a Rem statement in line 1, but this can be changed by altering the initialising value of J at line 9010 to the address prior to that at which you want the machine-code routine to start.

First, you must reserve some space in the normal way:

```
1 REM XXXXXXXXXXX . . .
```

Note that, using this routine, it is not critical that you enter the correct number of Xs at the first attempt. If you are short, the program will stop and tell you, so you can add some more. If you enter too many, it is a simple matter to edit them out afterwards.

```
9000 FAST
9010 LET J=16513
9020 LET R=PEEK 16388+256*PEEK 16389
9030 LET X$=" "
9040 LET R=R+1
9050 IF PEEK R=128 THEN GOTO 9090
9060 IF PEEK R=0 THEN STOP
9070 LET X$=X$+ CHR$ PEEK R
9080 GOTO 9040
9090 LET J=J+1
9095 LET X=VAL X$
9100 IF PEEK J=118 THEN GOTO 9130
9110 POKE J,X
9120 GOTO 9030
9130 PRINT "INSUFFICIENT SPACE —
     EXTEND LINE 1 THEN GOTO 9100"
9140 STOP
```

Run 9000, or Goto 9000 if you have data to preserve. When it is done, List; there is your machine-code routine safely lodged in line 1. If you want to tidy the program, edit any surplus Xs from the line.

You may be tempted to simplify this program, by simply copying the Rem statement data as it stands into a literal string and Poking that over RAMtop. However, be warned; that does not always work. Characters that are printed as a ? in the Rem statement are reduced to code 15. Thus, although the line may look identical to the original, it will not, in fact, work as a machine code.

Peek at Pokes

S J Ridgway,
Wheathampstead,
Hertfordshire.

VIC-20

I OWN A Vic-20 but I have used a Pet before, so I have many programs for the Pet. The main problem with converting Pet programs to Vic are the Poke numbers. So I have made a list that I think will be very useful to many Vic owners which shows the Pet's Poke numbers against the Vic's Poke numbers. The chart also shows the Vic Poke numbers when your machine has more than 8K of memory.

PET MAPPING	VIC MAPPING	VIC COLOUR	VIC 8K+ MAP	VIC 8K+ COL
32768 - 32807	7680 - 7701	38400 - 38421	4096 - 4117	37888 - 37909
32808 - 32847	7702 - 7723	38422 - 38443	4118 - 4139	37910 - 37931
32848 - 32887	7724 - 7745	38444 - 38465	4140 - 4161	37932 - 37953
32888 - 32927	7746 - 7767	38466 - 38487	4162 - 4183	37954 - 37975
32928 - 32967	7768 - 7789	38488 - 38509	4184 - 4205	37976 - 37997
32968 - 33007	7790 - 7811	38510 - 38531	4206 - 4227	37998 - 38019
33008 - 33047	7812 - 7833	38532 - 38553	4228 - 4249	38020 - 38041
33048 - 33087	7834 - 7855	38554 - 38575	4250 - 4271	38042 - 38063
33088 - 33127	7856 - 7877	38576 - 38597	4272 - 4293	38064 - 38085
33128 - 33167	7878 - 7899	38598 - 38619	4294 - 4315	38086 - 38107
33168 - 33207	7900 - 7921	38620 - 38641	4316 - 4337	38108 - 38129
33208 - 33247	7922 - 7943	38642 - 38663	4338 - 4359	38130 - 38151
33248 - 33287	7944 - 7965	38664 - 38685	4360 - 4381	38152 - 38173
33288 - 33327	7966 - 7987	38686 - 38707	4382 - 4403	38174 - 38195
33328 - 33367	7988 - 8009	38708 - 38729	4404 - 4425	38196 - 38217
33368 - 33407	8010 - 8031	38730 - 38751	4426 - 4447	38218 - 38239
33408 - 33447	8032 - 8053	38752 - 38773	4448 - 4469	38240 - 38261
33448 - 33487	8054 - 8075	38774 - 38795	4470 - 4491	38262 - 38283
33488 - 33527	8076 - 8097	38796 - 38817	4492 - 4513	38284 - 38305
33528 - 33567	8098 - 8119	38818 - 38839	4514 - 4535	38306 - 38327
33568 - 33607	8120 - 8141	38840 - 38861	4536 - 4557	38328 - 38349
33608 - 33647	8142 - 8163	38862 - 38883	4558 - 4579	38350 - 38371
33648 - 33687	8164 - 8185	38884 - 38905	4580 - 4601	38372 - 38393
33688 - 33727				
33728 - 33767				

Test of character

Peter Vasey,
East Boldon,
Tyne and Wear.

BBC

A BRIEF EXPLORATION of the BBC Micro's character set reveals no built-in graphic characters other than some inverse spaces and a weird set of characters which appear to be concerned with controlling the teletext printout. For example Chr$(141) in conjunction with a two-cycle For-Next loop prints double-height letters. For example:

```
10 MODE 7
20 FOR A%=2 TO 3
30 PRINT TAB(5,A%) CHR$(141) "Hello"
40 NEXT
```

This is very useful for headings and titles. Fortunately the provisional guide has a well-documented section on the use of certain aspects of the VDU command, including the generation of special characters. The command is VDU23,XXX,a,b,c,d,e,f,g,h where XXX is the Chr$ reference, normally restricted between 224 and 255, and the rest of the line is eight eight-bit bytes — the numbers from 0 to 255.

This very useful command can be programmed to generate any required character, but unless one is very familiar with binary numbers or has a full table of numbers from 0 to 255, the programming of each character using graph paper can be very tedious. So I

(continued on page 69)

(continued from page 67)

wrote this program to assist in designing graphic characters. I have left in spaces and not-used multi-statement lines in the interest of clarity and readability, but approximately 50 bytes can be saved by compressing the listing.

Lines 40 and 50 set function keys 0 and 1 to these numbers to aid speed of entry of the binary-number strings, and a character can be entered in about 30 seconds. Line 220 enters the character into memory and line 230 displays it. The correct VDU statement for generation of the character in question is also given — lines 250 to 290.

```
BBC CHARACTER SET

10  DIM B(7)
20  @%=000010
30  MODE 4
40  *KEY0    0
50  *KEY1    1
60  CLS
70  PRINT TAB(5) "SPECIAL CHARACTER SET PROGRAM"
80  PRINT '"Eight x 8 digit Binary nos. are required. Use
    function keys 0 and 1 for inputs"'
90  FOR X=0TO7
100 INPUT A$
110 A=0
120 PRINT TAB(15,X+5);
130 FOR A%=7 TO 0 STEP-1
140 A=A+(2^A%)*(ASC(A$)-48)
150 IF ASC(A$)=49 THEN PRINT CHR$(240); ELSE PRINT "  ";
160 A$=RIGHT$(A$,A%)
170 NEXT
180 B(X)=A
190 PRINT A
200 NEXT X
210 *KEY1 RUN|M
220 VDU23,250,B(0),B(1),B(2),B(3),B(4),B(5),B(6),B(7)
230 PRINT '"Character is : ";CHR$(250)
240 @%=000001
250 PRINT'"Statement is : "
260 PRINT'"VDU23,XXX,";
270 FOR A%=0 TO 7
280 PRINT B(A%);",";
290 NEXT
300 PRINT''"Press Function Key 1 to rerun"
```

Assault craft

C J Young,
Farnborough,
Hampshire.

ZX-81

THIS PROGRAM for the 16K ZX-81 could be easily converted to machine code, but the Basic version is still very fast, very exciting and flicker-free.

The program uses the full screen of 24 lines of 32 columns as instructed in Timothy Gilbert's February Software File article, by Poking location 16418,0. It also uses the idea expressed by Loll Holt in his November 1981, Software File article on an efficient way to move an object in two directions which is shown in lines 270 and 280.

The aim of the game is to score as highly as possible by destroying the alien ships which travel along any of seven lanes. You have three ships initially, only one of which is ever used at the same time, and every time an alien eludes you, one of your ships is lost.

However, you win a bonus ship when your score exceeds 1,000 and other bonus ships when you survive six attack phases. An attack phase is eight alien ships and at the end of each attack phase the lanes are reduced in length which means you have less time to destroy the ships.

Your score for the destruction of an alien is calculated by how far along the lane the alien was — the nearer to your ship, the lower the score which can be obtained — and what attack phase you are in.

You move your ship up and down by keys Q and Z respectively with the firing of a missle by key 0. You have one missile per alien.

Great care has been taken as to the screen presentation with your spare ships indicated, plus your score and attack phase. My high score on this game was 6,060. As a piece of advice, watch out for aliens on the last lane because, for some unknown reason, they travel approximately twice as fast as any other.

```
ZX ASSAULT (1

10  LET P = 0
20  LET SC = 0
30  LET T = 3
40  POKE 16418,0
50  FOR A = 0 TO 19 STEP 3
60  FOR B = 18 TO 0 STEP -2
70  PRINT AT A,B; "■"; AT A + 2, B; "■"
80  NEXT B
90  PRINT AT A,26; " * "; TAB 26; " * "
100 NEXT A
110 FOR A = 1 TO (T-1) * 2 STEP 2
120 PRINT AT A, 28; "■"
130 NEXT A
140 PRINT AT 23, 6; "■■■■■■0"; AT 23, 16; "■■■■■1"; SC
150 LET U = 1
160 LET X = 0
170 LET S = 10
180 LET N = -2
190 LET N = N + 2
200 FOR A = 1 TO 8
210 LET B = INT (RND * 7) * 3+1
220 FOR C = N TO 24 STEP 2
230 PRINT AT B,C; "■"
240 IF X <> 0 THEN GOTO 510
250 IF INKEY$ = "0" THEN GOTO 490
260 PRINT AT S, 22; " "
270 LET S = S + ((INKEY$ = "Z") *3) - ((INKEY$ = "Q")*3)
280 LET S = S + ((S = - 2) *3) - ((S = 22) *3)
290 PRINT AT B, C; " "; AT S, 22; "■"
300 NEXT C
310 PRINT AT U, 28; "  "
320 LET U = U + 2
330 LET T = T - 1
340 IF T = 0 THEN GOTO 700
350 NEXT A
360 FOR A = 0 TO 21
370 PRINT AT A, N; "  "
380 NEXT A
385 PRINT AT 23, 12; N/2
390 IF N<> 12 THEN GOTO 190
395 POKE 16418,2
400 CLS
410 PRINT AT 10, 0; "WELL DONE, ATTACK WAVE DEFEATED"
420 PRINT "YOU GET A BONUS SHIP"
430 PRINT, , "HIT A KEY TO CONTINUE"
440 IF INKEY$ ="" " THEN GOTO 440
450 CLS
460 LET T = T + 1
470 POKE 16418, 0
480 GOTO 40
490 LET X = 22
500 LET S1 = S
510 PRINT AT S1, X; " "
520 LET X = X - 2
530 IF X = N THEN GOTO 680
540 IF (X = C OR X + 2 = C) AND S1 = B THEN GOTO 570
550 PRINT AT S1, X; " - "
560 GOTO 260
570 LET X = 0
580 PRINT AT S1, C; "   "
590 LET SC = SC + (N/2) * 10 + (20 - C)
600 PRINT AT 23, 22; SC
610 IF SC > 1000 AND P = 0 THEN GOTO 640
630 GOTO 350
640 POKE 16418,2
645 CLS
650 PRINT AT 10, 0; "WELL DONE, YOUR SCORE WAS > 1000"
660 LET P = 1
670 GOTO 420
680 LET X = 0
690 GOTO 260
700 PRINT AT 10, 5; "ANOTHER GO?"
710 POKE 16418,2
720 IF INKEY$ = "Y" THEN GOTO 750
730 IF INKEY$ = "N" THEN STOP
740 GOTO 720
750 CLS
760 RUN
```

Pascal triangle

M R Tolun,
Canterbury,
Kent.

ZX-81

PASCAL TRIANGLE evaluates and prints several rows of the well-known Pascal triangle. As a reminder to those who are not familiar with mathematical expansions, Pascal triangle is simply formed of the coefficients of the binomial expansion — that is, $(1+x)^n$ where $n=0,1,2,etc.$

The triangle has a number of interesting properties. First, it is symmetrical with respect to its bisector. In other words, if you cut along the central column, triangles on the left- and right-hand sides contain the same terms. Secondly, the sum of the squares of the terms of any line is always equal to a number present in the triangle. Thirdly, the sum of the numbers in the nth Pascal line is equal to 2^n.

When the program is run it produces a numerical table, triangular in shape, in which the sides are formed of unities. Any other number is generated as the sum of two numbers in the row above which are positioned at the left- and right-hand sides with respect to that number and this procedure is repeated for every pair of numbers on the same line.

One advantage of the Pascal triangle is that it can readily be employed in generating a polynomial of nth order without actually

(continued on next page)

(continued from previous page)
becoming involved in the difficulty of multiplying the appropriate coefficients. It is also worthwhile pointing out that these coefficients are formed according to the addition method described and hence the complexity of numerous multiplications is avoided.

Run the program and you can observe these properties. For a 1K machine the number of rows should not exceed eight. With the expanded memory, it is not advisable to go beyond 54 rows.

```
PASCAL TRIANGLE

 10  LET N=9
 20  DIM P(N,N)
 30  FOR I=1 TO N
 40  FOR J=1 TO I
 50  IF J=1 OR J=I THEN GOTO 80
 60  LET P(I,J)=P(I-1,J-1) + P(I-1,J)
 70  GOTO 90
 80  LET P(I,J)=1
 90  NEXT J
100 NEXT I
110 PRINT "PASCAL TRIANGLE:-"
120 PRINT
130 FOR I=1 TO N
140 IF I=6 THEN GOTO 170
150 PRINT TAB 14-I;
160 GOTO 180
170 PRINT AT I+2;14-I;
180 FOR J=1 TO I
190 PRINT P(I,J);" ";
200 NEXT J
210 NEXT I
220 STOP
```

Memory table

Gwyneth Pettit,
Otley,
West Yorkshire.

BBC

THOSE WHO HAVE received their BBC Micro may find the lack of explicit machine-code facilities a hindrance in developing machine-code routines. This program will tabulate an area of memory, giving addresses and contents in hexadecimal, which is also useful for eavesdropping on the Basic interpreter and the machine-operating system. If decimal output is required, the symbol ~ can be deleted from lines containing the Print statements.

```
 10 INPUT "Start address "S%
 20 INPUT "Finish address "F%
 30 @% = &020004
 40 PRINT "'"Hex"""Address"
 50 IF S%MOD8<>0 PRINT '~S%" ";
 60 REPEAT
 70    IF S%MOD8 = 0 PRINT'~S%" ";
 80    PRINT~?S%;
 90    S% = S% + 1
100    UNTIL S%>F%
110 PRINT
120 END
```

The symbol ' may be unfamiliar to Basic users — it forces output of a carriage return in BBC Basic; & prefixes a hexadecimal constant, @% controls output format and ~ forces hexadecimal format in printing. The ? in line 80 is the BBC equivalent of Peek. For the purist, no check is made on F% being larger than S% on input, but our working version, which includes hexadecimal input, hexadecimal options and full error checking, is rather long.

```
>RUN
Start address 3584
Finish address 3781
E00     D   0   A  1A  20  E8  22  53
E08    74  61  72  74  20  61  64  64
E10    72  65  73  73  20  22  53  25
E18    20  20   D   0  14  1A  20  E8
E20    20  22  46  69  6E  69  73  68
E28    20  61  64  64  72  65  73  73
E30    20  22  46  25   D   0  1E   F
E38    20  40  25  3D  26  30  32  30
E40    30  30  34   D   0  28  17  20
E48    F1  20  27  22  48  65  78  22
E50    27  22  41  64  64  72  65  73
E58    73  22   D   0  32  19  20  E7
E60    20  53  25  83  38  3C  3E  30
E68    20  F1  27  7E  53  25  22  20
E70    20  22  3B   D   0  3C   6  20
E78    F5   D   0  46  18  20  E7  20
E80    53  25  83  38  3D  30  20  F1
E88    27  7E  53  25  22  20  20  22
E90    3B   D   0  50   E  20  20  20
E98    20  F1  7E  3F  53  25  3B   D
EA0     0  5A   C  20  53  25  3D  53
EA8    25  2B  31   D   0  64   C  20
EB0    FD  20  53  25  3E  46  25   D
EB8     0  6E   6  20  F1   D   0  78
EC0     6  20  E0   D  FF  20
This is a tabulation of the program given above.
From this it is possible to work out the way the
B.B.C. BASIC interpreter works.
```

Organic tunes

G N Owen,
Leamington Spa,
Warwickshire.

ZX-81

THIS PROGRAM for the ZX-81 enables the computer to function as an electronic organ. The sound produced can be heard using your cassette recorder's monitor facility or by turning the TV's volume up and tuning it slightly off the normal setting.

When Run pressing 1 sounds the highest note and Y the lowest, although this can be easily extended by adding lines 1700 onwards and the appropriate lines 9041 to 9088. This program occupies less than 2K.

Try this example tune

5-5-7-6-5--6---7---8-8-9-8-7-9--

where the gap between each note represents the duration of the note.

```
100  SLOW
110  FAST
190  IF INKEY$<>"1" THEN GOTO 9000
191  GOTO 100
200  SLOW
210  FAST
290  IF INKEY$<>"2" THEN GOTO 9000
291  GOTO 200
300  SLOW
310  FAST
390  IF INKEY$<>"3" THEN GOTO 9000
391  GOTO 300
400  SLOW
410  FAST
```

```
490  IF INKEY$<>"4" THEN GOTO 9000
491  GOTO 400
500  SLOW
510  FAST
590  IF INKEY$<>"5" THEN GOTO 9000
591  GOTO 500
600  SLOW
610  FAST
690  IF INKEY$<>"6" THEN GOTO 9000
691  GOTO 600
700  SLOW
710  FAST
790  IF INKEY$<>"7" THEN GOTO 9000
791  GOTO 700
800  SLOW
810  FAST
890  IF INKEY$<>"8" THEN GOTO 9000
891  GOTO 800
900  SLOW
910  FAST
990  IF INKEY$<>"9" THEN GOTO 9000
991■ GOTO 900
1000 SLOW
1010 FAST
1090 IF INKEY$<>"0" THEN GOTO 9000
1092 GOTO 1000
1100 SLOW
1110 FAST
1190 IF INKEY$<>"Q" THEN GOTO 9000
1191 GOTO 1100
1200 SLOW
1210 FAST
1290 IF INKEY$<>"W" THEN GOTO 9000
1291 GOTO 1200
1300 SLOW
1310 FAST
1390 IF INKEY$<>"E" THEN GOTO 9000
1391 GOTO 1300
1400 SLOW
1410 FAST
1490 IF INKEY$<>"R" THEN GOTO 9000
1491 GOTO 1400
1500 SLOW
1510 FAST
1590 IF INKEY$<>"T" THEN GOTO 9000
1591 GOTO 1500
1600 SLOW
1610 FAST
1690 IF INKEY$<>"Y" THEN GOTO 9000
1691 GOTO 1600
9000 LET I$=INKEY$
9010 IF I$="" THEN GOTO 9000
9020 LET V=1*(I$="1")+2*(I$="2")
+3*(I$="3") +4*(I$="4")+5*(I$="5")
+6*(I$="6")+7*(I$="7")
9030 LET V=V+8*(I$="8") +9*(I$="9")
+10*(I$="0")+11*(I$="Q")+12*(I$="W")
9040 LET V=V+13*(I$="E")+14*(I$="R")
+15*(I$="T")+16*(I$="Y")
9089 IF V=0 THEN GOTO 9000
9090 GOTO 100*V
```

Deep-space attack

James Holland,
Stockport,
Cheshire.

MZ-80K

SPACE ATTACK will run on a Sharp MZ-80K. The instructions are contained in the program. The Print "C" in lines 2, 16, 43 and 50 is the clear-screen character. Usr(62) makes a beep noise. The enemy is printed on the screen in the following manner: ■▬.

Lines 1 to 14 print the instructions.

Lines 15 to 23 set up the variables and print the gun and enemy on the screen.

Lines 24 to 32 wait for instructions from you and move the gun up and down.

Lines 33 to 36 count how many of the enemy have passed you and position the enemy randomly on the screen.

Line 37 produces a space-invader noise.

Lines 38 to 42 calculate if you have hit the enemy — if you have, it blots it out — and adds it to your score.

Lines 43 to 50 tell you how many of the enemy you have destroyed and asks you whether you want another go.

Here are some useful Pokes for the MZ-80K. Poke 6637,80 disables the Break key and Poke 6637,30 re-enables it. Poke 10680,1 makes a program unlistable and unsaveable. This can be cancelled by Poke 10680,0. Poke 59555,0 will blank the screen; Poke 59555,1 will restore the video. Programs will run automatically if, before saving, you enter Poke 10682,1.

```
SPACE ATTACK

1  REM COPYRIGHT ***JAMES HOLLAND***(14)***
2  PRINT "C"
3  PRINT" (14 SPACES)  SPACE ATTACK"
4  PRINT" (14 SPACES)                "
5  PRINT:PRINT:PRINT"The object of the game is to destroy as"
6  PRINT:PRINT"many of the attacking fleet as you can"
7  PRINT:PRINT"before five escape your fire."
       8  PRINT:PRINT"KEY:"
9  PRINT" (8 SPACES) D=go up (7 SPACES) Your gun=<"
10 PRINT:PRINT" (8 SPACES) A=go down"
11 PRINT:PRINT" (8 SPACES) S=Fire your gun (3 SPACES) The enemy =■■▬"
12 PRINT:PRINT:PRINT:PRINT:PRINT"(8 SPACES) PRESS ANY KEY TO START"
13 USR(62)
14 GET A$:IF A$ "" THEN 14
15 USR(62)
16 PRINT"C":K=0
17 POKE 10167,1:C=0
18 P=10
```

SINCLAIR
ZX81 SOFTWARE

ZX 81 SOFTWARE
ALTERNATIVE PROGRAMS (1-16K)
FOR THE MORE DISCERNING ENTHUSIAST!

CASSETTE 1
MATHS ONE (16K)
ATTENTION ALL PARENTS! Prompted by an article in Practical Computing (Jan 81) or inferior maths software, we decided to produce a program that would give your child more than the boring reply: "sorry you are wrong, try again!"
MATHS ONE will give your child sums in the normal way and actually show your child where he/she has gone wrong. Note the whole sum is printed on the screen just as the child would do with pen and paper!
MATHSKATA (16)
See whose rollerskater can reach the post first but beware the sums become more and more difficult!
Maths one + Mathskate . . . £3.95

CASSETTE 2
LANGUAGE TRANSLATOR
Having difficulty with foreign text? Then this is the program for you! Fast word for word translation, from 600 words in seconds. Words can easily be changed and SAVEd on tape. Please state language choice.
WORD TEST
For the very junior members of the family-WORD TEST will give children partially completed words. Second trys are allowed and the score out of ten with correct answers are shown.
Language Translator + Word Test . . . £3.95

CASSETTE 3
BANK ACCOUNT (16K)
Why wait for a statement when you can have your own personal banking system! Accepts standing orders in the usual way and will tell you when your balance is below the free banking limit, then actually charge you for it! Just like the bank! Statements can be backdated and up to 70 transactions can be stored!

HOME BILLS READY RECKONER
Want to know if your electricity/telephone/net pay are correct?
Bank Account + Ready Reckoner . . . £3.95

PLEASE NOTE: Our Software is of the very highest and stands to compare with the very best from the Sinclair stable and even if we say so ourselves exceeds that standard.
No knowledge of computing required, just load and run!

YOUR ORDER IS RECEIVED AT 8.30 AND IS DESPATCHED BY 12.30 THE SAME DAY. 14 DAY MONEY BACK GUARANTEE IF NOT SATISFIED + 6 MONTH REPLACEMENT GUARANTEE.

Make cheques, PO, etc. payable to:

FUTURESOFT
38 PENSHURST ESTATE, PRINCE OF WALES ROAD, LONDON NW5

ZX81 Workstation...

. . . is a stylish and ergonomic plinth for the ZX81. It raises and tilts the TV to avoid eyestrain, holds the 16K RAM in place and hides the wiring and power supply. This very professional unit costs £15, a built-in power switch is £3, plus postage at £2.00, inc. VAT.
Peter Furlong Products, Unit 5, South Coast Road Industrial Estate, Peavehaven, Sussex BN9 8NA.

SOUND with ZX~81!

MAKE AMAZING SOUND EFFECTS WITH YOUR ZX-81

£25.95 incl p&p & V.A.T. **THE ZON X-81**

- The ZON X-81 SOUND UNIT is completely self-contained and especially designed for use with the ZX-81. It just plugs in — no dismantling or soldering.
- No power pack, batteries, leads or other extras.
- Manual Volume Control on panel — ample volume from built-in loudspeaker.
- Standard ZX-81 — 16K Rampack or printer can be plugged into ZON X-81 Sound Unit without affecting normal ZX-81 operation.
- Huge range of possible sounds for games or: Music, Helicopters, Sci-Fi, Space Invaders, Explosions, Gun-shots, Drums, Planes, Lasers, Organs, Bells, Tunes, Chords etc., or whatever you devise!
- Uses 3-channel sound chip giving programme control of pitch, volume of tones and noise, all with envelope control.
- Easily added to existing games or programmes using a few simple "BASIC" lines.

FULL instructions with many examples of how to obtain effects and the programmes, supplied. Fully Guaranteed.

BI-PAK Dept YC6, P.O. Box 6, 63A, High Street, Ware, Herts.
Access & VISA accepted
Ring 0920 3182 for immediate despatch.

GET SLANTED!

TOUGH SMOKE BROWN PLASTIC

SPACE ALLOWS COOLING AIR TO CIRCULATE

MAKES YOUR ZX-81
EASIER TO SEE
EASIER TO USE

FIXED IN SECONDS WITH DOUBLE SIDED STICKY PADS—SUPPLIED *FREE*

Send cheque/cwo to:
ONLY £3.20
(includes VAT/P&P)

MAEILL ORDER MARKETING LTD
DEPT A, SCHOFIELDS WAY,
BLOXHAM, BANBURY, OXON

```
19 S=10
20 FOR T=2 TO 28
21 POKE 4466,S:POKE 4465,T:PRINT" ■ ■ ■ "
22 POKE 4466,P:POKE 4465,25:PRINT"<"
23 V=0
24 GET AA$
25 IF PEEK(17828)=68 THEN V=-1
26 IF PEEK(17828)=65 THEN V=1
27 IF AA$="S" THEN 37
28 POKE 4466,P:POKE 4465,25:PRINT" "
29 P=P+V
30 IF P=-1 THEN P=0
31 IF P=23 THEN P=22
32 NEXT T
33 C=C+1
34 IF C=5 THEN GOTO 43
35 S=INT(20*RND(5))+1
36 GOTO 20
37 FOR TT=1 TO 15: POKE4514,TT : USR(68):NEXT TT:USR(71)
38 IF P=S THEN 40
39 GOTO 24
40 POKE 4466,S:POKE 4465,T:PRINT"(5 SPACES)"
41 K=K+1
42 GOTO 35
43 PRINT"C"
44 PRINT:PRINT:PRINT:PRINT"(5 SPACES) YOU DESTROYED";K;" OF THE ENEMY"
45 TEMPO 4:MUSIC"#B1A1R4A1#A1-C-AR1-A3-F3R5"
46 PRINT:PRINT:PRINT:PRINT"WOULD YOU LIKE ANOTHER GAME ?"
47 GET Q$:IF Q$="Y" THEN CLR:GOTO 12
48 IF Q$="N" THEN 50
49 GOTO 47
50 PRINT"C":END
```

Reading speed

Iain Weeks,
Prescot,
Merseyside.

MICROTAN

THE PROGRAM, which is for a Microtan 65, is a subroutine to add to a main program that uses a large list of instructions — for example, adventure-type games. The idea is to display the instructions slowly on the screen at normal reading speed.

The routine will function in its own right so it is possible to see how it operates before fitting it to a game. The routine can easily be added to any program that uses instructions by putting those instructions in the array H$(N) where N — see line 10010 — is equal to the number of array statements used. There are 10 in the case of my sample program. The line lengths will have to be adjusted to suit computers using a different screen format.

Make sure the main program does not contain any variables H$(I) or N. If it does, change the letters in the subroutine. Lines 11 to 13 are probably already in the main program so just alter the instruction If A$ = "Y" to suit.

Data statements would have been easier but I decided not to use them for, if the main program contains Data, then reading data would require amending. The speed of the printout is controlled by Line 11030 and Print Chr$(12) is the clear-screen instruction on the Microtan.

The program could be used as a reading aid for youngsters, using a simple story and gradually increasing the speed of printout as the child becomes more proficient at reading.

```
PRINTOUT

1       REM **** PRINTOUT ****
2       REM ** BY IAIN WEEKS **
10      PRINT CHR$(12)
11      PRINT"Do you want instructions (Y/N)"
12      GET A$
13      IF A$ ="Y" THEN GOSUB 10000
14      REM CONT. MAIN PROG.
9999    END
10000   PRINT CHR$(12)
10010   N =10:DIM H$(N)
10020   H$(1) ="This is a demonstration of slow printing to make pages
of"
10030   H$(2) ="instructions more interesting and easier to read. The
speed"
10040   H$(3) ="of the display can of course be altered by adjusting
the"
10050   H$(4) ="timing loop."
10060   H$(5) ="The addition of this routine to the main program is
simply a"
10070   H$(6) ="matter of putting the instructions in a 'GOSUB' and"
10080   H$(7) ="assigning each line to a 'DIM' array, then reading each
letter"
10090   H$(8) ="of the array and printing it out slowly."
10100   H$(9) ="   Easy isn't it"
10110   H$(10) ="  And it looks good!!"
11000   FOR I = 1 TO N
11010   FOR J = 1 TO LEN(H$(I))
11020   PRINT MID$(H$(I),J,1);
11030   FOR T = 1 TO 50:NEXT T
11040   NEXT J:PRINT"":NEXT I
11050   RETURN
```

Key to functions

C J Cattenach,
Welwyn,
Hertfordshire.

VIC-20

THE FOLLOWING TIP allows one to use the four functional keys on the right-hand side of the Vic-20. These offer a total of eight functions when used with the Shift control, yet very little information is available on their use. The users' hand-book, supplied with the machine, simply says that these four tan coloured keys may be assigned functions from within the applications that you create, but no detail is given to help the newcomer to the machine who may be trying to learn Basic for the first time.

```
10 GET A$
15 IF A$ = "" THEN 10
20 IF A$ = "f1" THEN PRINT "THE USE OF
   THESE BUTTONS IS EASY"
25 IF A$ = "f2" THEN PRINT "WHEN YOU
   KNOW HOW"
30 IF A$ = "f3" THEN PRINT "AND THE
   OTHERS"
35 IF A$ = "f4" THEN PRINT "ARE ALL
```

(continued on page 75)

(continued from page 73)

```
    USED IN THIS WAY."
40 GOTO 10
45 END
```

Run and press Return. From now on, one can enter the information by pressing the function buttons, and without even having to press the Return button. Line 15 ensures that the pressing of any unassigned buttons does not have any effect.

One further tip: Not all may be aware that memory locations change as a result of inserting a 16K memory expansion cartridge. This is remedied by preceding one's program with the short section of Basic code that follows.

```
2 SC=7680 (Rem set screen for 5K or 8K)
3 CL=38400 (Rem set colour for 5K or 8K)
4 FOR I= 0 to 506
5 POKE SC + I,160 (160 is a space)
6 POKE CL + I,1 (1 colour white)
7 NEXT
```

Multiplier effect

Raymond Lloyd Vickers, Crewe.

PET

DEVELOPED ON a 32K Pet, this program is designed to teach students of economics the concept of the multiplier.

The multiplier is, at its simplest, the effect on the economy of a change in investment. For example, if £1 million is invested in new machinery, then the machinery makers receive this sum, spend some of it and save the rest. Those who benefit from the spending also spend and save their income, so that the effect of the initial investment is multiplied.

Technically, the multiplier is the reciprocal of the marginal propensity to save (MPS) which is itself defined as the proportion of any increase in income which is saved. If the MPS is 0.33 then, out of every extra £1 earned, 33p is saved, 67p spent, and the multiplier is 1/0.33 = 3. So, every £1 investment will create £3 worth of money income.

In the simple model, there is no government sector so, no taxation and no foreign trade, all investment immediately produces new output in a 1:1 ratio. There is an initial limit of £3 million of productive capacity (P) while National Income (Y) is also £3 million. The MPS (S) is 0.333 so the multiplier is 3.

The initial level of investment in the economy is £1 million. If the extra investment causes money incomes to rise above the economy's productive capacity then inflation will occur, while too little investment will cause a slump. The economic model and the program are simple, but the program works and can be used as a basis for more sophisticated programs incorporating foreign trade, investment lags, and so on.

```
SIMPLE MULTIPLIER PROGRAM

10  PRINT"SIMPLE MULTIPLIER PROGRAM"
20  PRINT"GNP IS 3 MILLION"
30  PRINT"PRODUCTION IS 3 MILLION"
40  PRINT"CAPITAL OUTPUT RATIO IS 1:1"
50  PRINT"MULTIPLIER IS 3"
60  PRINT"TRY TO ENSURE STABLE GROWTH"
61  PRINT"INPUT THE INVESTMENT YOU THINK"
62  PRINT"NECESSARY.  (MILLIONS)"
65  PRINT"YOU MUST INVEST AT LEAST $100"
70  Y=3*10↑6
80  P=3*10↑6
90  I=1*10↑6
100 S=0.333
110 INPUT A:A=A*10↑6
120 CY=(I-A)/S
130 Y1=Y-CY
140 PRINT"NEW INCOME IS";Y1
150 P=P+A
160 PRINT"NEW PRODUCTION LEVEL IS";P
180 IF Y1>P GOTO 220
190 IF Y1<P GOTO 230
200 IF Y1=P GOTO 210
210 PRINT"GOOD. STABLE GROWTH"
215 GOTO110
220 PRINT"INFLATION. DECREASE INVESTMENT"
225 GOTO110
230 PRINT"SLUMP.INCREASE INVESTMENT"
235 GOTO110
READY
```

Tape directory

S Robinson, Leeds, Kent.

ATOM

TYPE IN any program title in the list on the screen, press Newline, start the tape recorder playing and it will be loaded automatically for you.

When you run the program you first input the amount of programs you want on the list — up to 16 with line 60 removed — then enter all of those program titles. When you reach the last title, start the tape recorder recording before entering it. So, when you load Dir it will run automatically.

When you Save the programs that are in the directory on that tape, ensure that you save the correct program name.

```
DIRECTORY
1   REM  DIRECTORY
2   INPUT A
3   INPUT B
4   PRINT" TAPE DIRECTORY "
5   DIM A$(A,B)
20  FOR C=1 TO A
30  INPUT C$
40  LET A$(C)=C$
50  PRINT ,A$(C)
60  PRINT
70  NEXT C
80  PRINT" INPUT GAME "
90  SAVE "DIR "
100 INPUT H$
110 PRINT ,,,,," START TAPE"
120 PAUSE 20
130 LOAD H$
```

Cypher breaker

G L Billington, Bebington, Wirral.

ZX-81

THIS SHORT program, which runs in 1K, allows you to rapidly code or decode messages. X at line 20 is the code number and shifts the ZX code value of each character. The string array at line 35 accepts the coded message. Line 60 does the coding, while ignoring spaces between words; line 65 keeps spaces, question marks, commas and all full stops as they are.

To use the program, run it, and enter a suitable value for X. To start with, try a value between −1 and −9. Type in your message, but remember it must not exceed one line of 32 characters due to the Dim statement at line 35. Press Newline and in about five seconds the coded message will appear on the screen. If you have a printer, enter 00 and Newline to escape from the program, and Copy. If not, copy the coded characters by hand. For long messages, this process may be repeated as often as required.

To decode, give X the same value but of opposite sign. If you have more memory than 1K, the program can be considerably refined. As well as increasing the size of the array, the code number X can be changed several times

(continued on page 76)

(continued from page 75)

during the encoding procedure. For example, start with X = −8, then change it to say, −4 by adding a line 58:

IF N>16 THEN LET X = −4

The basis of the code thus changes about halfway through the line, making it more uncrackable. As long as the recipient of the message knows the relevant numbers, decoding is no problem.

Try using X = 160, and you will obtain a very interesting result indeed. When using other values, check that characters are not shifted into the unused range, or you will obtain question marks which cannot be decoded.

```
10 CLS
15 PRINT "CODE NO.?"
20 INPUT X
25 CLS
30 PRINT AT 0,0;X
35 DIM C$(32)
40 INPUT A$
45 IF A$="0" THEN GOTO 10
50 IF A$="00" THEN STOP
55 FOR N=1 TO LEN A$
60 IF A$(N)< >" " THEN LET C$(N)=CHR$
   (CODE A$(N)+X)
65 IF A$(N) = " " OR A$(N) ="?"
   OR A$(N)="," OR A$(N)="." THEN
   LET C$(N)=A$(N)
70 NEXT N
75 PRINT
80 PRINT C$
85 GOTO 40
```

Contents display

Gerard Leblanc,
Seraing,
Belgium.

ATOM

THIS MACHINE-CODE program displays the contents of a cassette and allows you to tune the cassette recorder better. Basic programs saved on cassette can be viewed in the upper half of the screen. This display can be stopped at any time, by pressing any key except Brk, Esc, shift and Ctl. It can be restarted in the same way. Characters # 00 to # 1F are displayed as inverted letters.

Line 35 clears the screen and line 36 requests you to have the cassette at the ready. Press a key as for *Cat command. Line 40 reads a byte from cassette. Lines 45 to 75 convert ASCII characters to video code, put it in the right position in video memory and black out the 10 oldest bytes. Line 80 checks for the key pressed to stop or restart the display.

This program is executed by Link # 2800. Another location could be used by changing line 25 and the address in Link.

```
  DISPLAY ATOM

10      DIM NN(6)
15      FOR I=0 TO 6;NN(I)= -1;N. I
20      P.$21
25      FOR I=1 TO 2;P=#2800
30[
35      LDA @#0;STA #80;LDA @#0C;JSR #FFF4
36      JSR #FC38
40:NN0  JSR #FBEE
45      CMP @#20;BCS NN1;ADC @#B0;JMP NN3
50:NN1
52      CMP @#40;BCC NN3;CMP @#5F;BCS NN2
54      SEC;SBC @#40;JMP NN3
60:NN2  CMP @#E0;BCS NN3;ADC @#20
65:NN3  LDX #80;STA #8000,X;INX;LDA @#C0;LDY @#0A
70:NN4  STA #8000,X;INX;DEY;BNE NN4
75      LDX #80;INX;CPX @#00;BCS NN5;LDX @#00
80:NN5  STX #80;JSR #FE71;BCS NN6;JSR #FE94
85:NN6  JMP NN0
90]
100     NEXT I;P.$6;END
```

Artful dodge

P Marco,
Romford,
Essex.

ZX-81

ART LETS you draw your own pictures on the TV screen. Instead of the usual four directions — up, down, left and right — this program has eight directions. Not only can you draw pictures but you can also rub them out.

The program starts in Draw mode. It can be put into Rubout mode by pressing W. It can be returned to Draw mode by pressing Q. The directions are:

10 to 20 Starting place of blob.
30 Puts blob into "Draw" mode.
40 Checks for mode key.
50 to 80 Stops blob from leaving the screen.
90 Moves blob left and right.
100 Moves blob up and down.
110 to 140 Moves blob diagonally.
150 to 160 Blinks blob.
170 Gives Q Draw mode and W Rubout mode.
180 Return to main loop.

The program will fit into 1K and a reasonable picture can be obtained. A larger and better picture can be obtained within the 16K RAM pack fitted.

If you have a 16K RAM pack, you will be able to save the picture on tape by deleting line 180 and adding these lines:

180 IF INKEY$ = " " THEN SAVE INKEY$
190 GOTO 40

The picture will be saved under the letter placed in between the inverted commas.

```
10  LET x = 28
20  LET y = 22
30  LET R$ = "Q"
40  IF INKEY$ = "Q" OR INKEY$ = "W" THEN LET R$ = INKEY$
50  IF x>= 60 THEN LET x = 60
60  IF y>= 40 THEN LET y = 40
70  IF x<= 0 THEN LET x = 0
80  IF y<= 0 THEN LET y=0
90  LET x = x + (INKEY$ = "3") - (INKEY$ = "7")
100 LET y = y - (INKEY$ = "5") + (INKEY$ = "1")
110 LET x = x + (INKEY$ = "4") - (INKEY$ = "8")
120 LET y = y - (INKEY$ = "4") + (INKEY$ = "8")
130 LET x = x + (INKEY$ = "2") - (INKEY$ = "6")
140 LET y = y + (INKEY$ = "2") - (INKEY$ = "6")
150 PLOT x,y
160 UNPLOT x,y
170 IF R$ = "Q" THEN PLOT x,y
180 GOTO 40
```

Hex convert

Paul McGowan,
Atherton,
Manchester.

ZX-81

MY PROGRAM will be of interest to those who have to use a hexadecimal loader. It simply converts hexadecimal into Basic. For example, if you type F5, the computer will reply:

F5 = PRINT IN BASIC

and then ask for another input. If you type a non-existent command, say, H2, the computer replies:

H2 DOES NOT EXIST IN HEX

then ask for another input to be given.

```
   HEX TO BASIC

 10  SCROLL
 20  INPUT A$
 30  IF A$=" " THEN RUN
 40  IF LEN A$ = 1 THEN GOTO 100
 50  LET A = ( 16 * ( CODE A$ (1) - 28 ) +
     (CODE A$ (2) - 28 ))
 60  SCROLL
 70  IF A> 255 OR A< 0 THEN GOTO 100
 80  PRINT A$ ; " = " ; CHR$ A ; "IN BASIC"
 90  GOTO 10
100 PRINT A$ ; " DOES NOT EXIST IN HEX. "
110 GOTO 10
```

Over the moon

A Cockburn,
Warrington,
Cheshire.

BBC

FOR MY VERSION of the popular Lunar Lander for a Model A, BBC Micro, first you input your fuel allowance and then your flight commences. The lander is dropping out of orbit in the top left-hand corner of the screen. You apply upward and horizontal thrust to bring it to a soft and happy landing on the base pad.

On the right-hand side of the screen you have your instruments. Alt gives the altitude in metres; V-V gives the vertical velocity or descent rate; H-V gives the horizontal velocity or drift. Fuel gives an indication of how much fuel is left; bearing indicates horizontal distance from the landing pad.

From the instruments you can tell exactly where you are even if you are off the screen and it is possible to do blind landings. When you have used three-quarters of your fuel, a warning flashes and when all fuel is used the display flashes red. Assuming you have successfully landed, the computer then passes comments on your performance.

As the program is run in Mode 4 it takes up all but 90 bytes of the user RAM. I have used multi-statement lines to the full to eliminate the need for subroutines and to save memory. Line 10, which is intended to bring the program back to the beginning when the escape key is pressed, is best omitted until the program is running correctly.

```
LUNA LANDER

10  ON ERROR RUN
20  MODE 7
30  PRINT TAB (15) "LUNA LANDER"''"PRESS 'U' FOR UPWARD THRUST"''"PRESS
'R' FOR REVERSE THRUST"''"PRESS 'F' FOR FORWARD THRUST"''''
40  INPUT"FUEL ALLOWANCE",F''
50  IF F> 500 PRINT"YOU CAN'T AFFORD THAT MUCH!"'':NOWTIME=TIME:REPEAT:
UNTIL TIME=NOWTIME+200:GOTO10
60 IF F<100 PRINT"NOT EVEN BUCK ROGERS IS THAT GOOD!"'':NOWTIME=TIME:
REPEAT:UNTIL TIME=NOWTIME+200:GOTO10
70  PRINT ''"HIT ANY KEY TO START":Z=GET
90  MODE 4
90  MOVE 0,0
100 DRAW 1280,0
110 MOVE 600,4
120 DRAW 680,4
130 FORG=0 TO 200:PLOT 69,RND(1280),RND(1024):NEXT
140 E=0:A=9770:V=0:H=27:K=F:AL=0
150 PRINTTAB (35,4)"ALT"
160 PRINTTAB (35,8)"V-V"
170 PRINTTAB (35,12)"H-V"
180 PRINTTAB (35,16)"FUEL"
190 PRINTTAB (33,20)"BEARING"
200 E=E+H:A=A-V
210 B=INT((E-640)/6.4)
220 A=A+24:GCOL 0, 1:MOVE E-20,A:MOVE E+20,A:PLOT 85,E,A+20:MOVE
E-20,A:
DRAW E-20,A-16:MOVE E+20,A:DRAW E+20,A-16:A=A-24
230 PRINTTAB (28,5)A
240 PRINTTAB (28,9)V*4
250 PRINTTAB (28,13)H
260 PRINTTAB (28,17)F
270 PRINTTAB (28,21)B
280 IF A<0 A=0:GOTO 490
290 D=H:I=V
300 IF F<3:F=0:GOTO 360
310 C$=INKEY$ (0)
320 IF C$="F" H=H+1:F=F-3
330 IF C$="R" H=H-1:F=F-3
340 IF C$="U" V=V-2:F=F-3
350 *FX 15,0
360 IF AL>2:AL=0
370 IF F<K/4 AND AL<2 PRINTTAB (34,24)"ALARM":AL=AL+1:IF F=0:VDU
19,1,1,
0,0,0:PRINT TAB (15,15)"NO FUEL"
380 IF AL>1 PRINT TAB (34,24) "      ":AL=AL+1:IF F=0:VDU 19,1,7,0,0,0
390 IF F<K/4 PRINT TAB (35,28) "FUEL" TAB (33,29) "WARNING"
400 IF D<>H OR I<>V:SOUND 0,-10,4,10
410 IF I<>V GCOL 0,1:MOVE E,A+24:DRAW E,A-30:MOVE E,A+24:DRAW E-8,A-30:
MOVE E,A+24:DRAW E+8,A-30:GCOL 0,0:MOVE E,A-30:MOVE E,A+24:DRAW
E-8,A-30:
MOVE E,A+24:DRAW E+8,A-30
420 IF D>H GCOL0,1:A=A+24:MOVE E+20,A:DRAW E+60,A:MOVE E+20,A:DRAW
E+60,A-4:
MOVE E+20,A:DRAW E+60,A+4:GCOL 0,0:MOVE E+20,A:DRAW E+60,A:MOVE E+20,A:
DRAW E+60,A-4:MOVE E+20,A:DRAW E+60,A+4:GCOL 0, 1:A=A-24
430 IF D<H GCOL0,1:A=A+24:MOVE E-20,A:DRAW E-60,A:MOVE E-20,A:DRAW
E-60,A-4:
MOVE E-20,A:DRAW E-60,A+4:GCOL 0,0:MOVE E-20,A:DRAW E-60,A:MOVE E-20,A:
DRAW E-60,A-4:MOVE E-20,A:DRAW E-60,A+4:GCOL 0,1:A=A-24
440 V=V+1
450 NOWTIME=TIME:REPEAT:UNTILTIME=NOWTIME+10
460 A=A+24:GCOL 0,0:MOVE E-20,A:MOVE E+20,A:PLOT 87,E,A+20:MOVE E-20,A:
DRAW E-20,A-16:MOVE E+20,A:DRAW E+20,A-16:A=A-24
470 IF AC 50 GCOL 0,1: MOVE 0,0:DRAW 1280,0:MOVE 600,4:DRAW 680,4
480 GOTO 150
490 VDU 30;19,1,7,0,0,0
500 IF V<5 AND K-F<300 AND ABS (B)<5: PRINT "HELLO BUCK ROGERS"''
510 IF ABS(B)<6 AND V<5 AND (K-F)>299:PRINT"GOOD BUT EXTRAVAGENT!!"''
520 IF V<5 AND H<5: PRINT"SMOOTH!"''
530 IF V>4 OR H>9:FOR A=0 TO 255 STEP 7:SOUND1, -15,A,0:NEXT:FORY=-15
TO 0:
SOUND0,Y,4,2.5:NEXT:GCOL 0,1:MOVE E,0:DRAW E-100,100:MOVE E,0:DRAW
E,100:
MOVE E,0:DRAW E+100,100:PRINT"YOU CRASHED!!!" ' GOTO 570
540 IF V<5 AND H>4 AND H<10 PRINT "BUMPY!"''
550 IF ABS(B)>3:PRINT"BUT YOU ARE ";ABS(B);"METRES FROM
BASE."''"WALK!"''
560 PRINT "YOU USED ";K-F" FUEL UNITS"''
570 PRINT ''''''''"HIT SPACE BAR TO CONTINUE":REPEAT A$=GET$:UNTILA$="
"
580 GOTO 20
```

Tunnel vision

D M Jones,
Mold,
Clwyd.

VIC-20

THE PROGRAM prints a random maze and the player takes the form of the diamond at the top of the screen. The object is to reach the circle at the bottom of the maze, without colliding with a wall, in the least number of moves.

On most mazes that the computer forms, it is impossible to reach the circle without pressing the nought key. When this key is pressed the walls immediately above, below, to the left, and right of your diamond are demolished and disappear. However, using this feature increases your number of moves by four.

When you reach the circle you are told your score and the lowest number of moves the maze has been completed in so far. The program itself is fairly basic and sound and colour could be added for the 3.5K machine.

```
  0 REM*MAZE*
 10 PRINT"□":S=100000
 20 V=0:M=0
 30 E=INT(22*RND(1)+7702)
 40 H=INT(22*RND(1)+8164)
 50 PRINT"*********@MAZE*********"
 60 PRINT"    2:-DOWN     4:-UP"
 70 PRINT"    6:-LEFT     8:-RIGHT"
 75 PRINT"         0:-DEMOLISH"
 80 PRINT"**********************"
 90 FORU=0TO5000:NEXTU:PRINT"□"
100 POKE36879,0
110 FORA=1TO250
120 B=INT(462*RND(1)+7724)
130 POKEB,91
140 NEXTA
150 POKEH,81:GETA$
160 POKEE,90
170 IFA$="2"THENG=22:GOTO250
180 IFA$="4"THENG=-22:GOTO250
190 IFA$="6"THENG=-1:GOTO250
200 IFA$="8"THENG=1:GOTO250
210 IFA$="0"THENGOSUB1000
220 GOTO150
250 M=M+1
260 POKEE,32:E=E+G
270 IFPEEK(E)=91THEN550
280 POKEE,90
290 IFE=HTHEN600
300 GOTO150
550 POKE36879,27:PRINT"□YOU HIT A WALL"
560 INPUT"ANOTHER GAME(Y/N)";G$
570 IFG$="N"THENSTOP
580 PRINT"□"
590 GOTO20
600 POKE36879,27:PRINT"WELL DONE!YOU MADE IT!"
610 PRINT"IN "M" MOVES."
620 IFM<STHENS=M
630 PRINT"LEAST MOVES= "S
640 GOTO560
1000 IFV<3THENGOTO1020
1010 GOTO150
1020 POKEE+1,32:POKEE-1,32
1030 POKEE+22,32:POKEE-22,32:V=V+1:M=M+4
1040 RETURN
```

SHARP MZ-80K MZ-80A MZ-80B

FUNCTION CASSETTE SOFTWARE

by DALE HUBBARD

BUY 2 at £19.95 – TAKE 1 at £5.95 FREE!!!

All programs in Standard Sharp Basic for 4SK RAM upwards.
All programs supplied with exhaustive and attractively bound documentation.

DATABASE

The program that everyone needs. Facilities include sort, search, list, delete, change, totals, save file, line print if required, etc., etc. Can be used in place of any card index application. **£19.95**

STOCK CONTROL

All the necessary for keeping a control of stock. Routines include stock set up, user reference no., minimum stock level, financial summary, line print records, quick stock summary, add stock, delete/change record, and more. **£19.95**

MAILING LIST

A superb dedicated database to allow for manipulation of names and addresses and other data, with selective printing to line printer. Features include the facility to find a name or detail when only part of that detail is known. Will print labels in a variety of user-specified formats. **£19.95**

INVOICES AND STATEMENTS

Ideal for the small business. A complete suite of programs together with generated customer file for producing crisp and efficient business invoices and monthly statements on your line printer. All calculations including VAT automatic and provision for your own messages on the form produced. **£19.95**

THE CATALOGUE

This dedicated database is ideal for use in any situation where a catalogue could be utilised, e.g. stamp collections, coins, photos, slides, books, records, etc. **£19.95**

HOME ACCOUNTS

Runs a complete home finance package for you with every facility necessary for keeping a track of regular and other expenses, bank account, mortgage, h.p., etc., etc., etc.! You'll wonder how you ever managed without it. **£19.95**

CHOPIN – LES ETUDES

Six beautiful studies from Opus 10 and 25, performed by you live by Mr Sharp – spellbinding!! **£5.95**

MOTOR ACCOUNTANT

Find out exactly what that car is costing you and keep a data file with all your expenses therein! **£5.95**

RECIPE FILE

Let all those computer widows have a bash! The wives will really enjoy the fun of this program designed to keep all her recipes. Will even suggest a menu for a day/week! Excellent value. **£19.95**

SPECIAL HARDWARE OFFER!!
Mail order only
MZ-80A PLUS ANY 3 PROGRAMS
£477 + VAT
Limited stocks. Hurry!

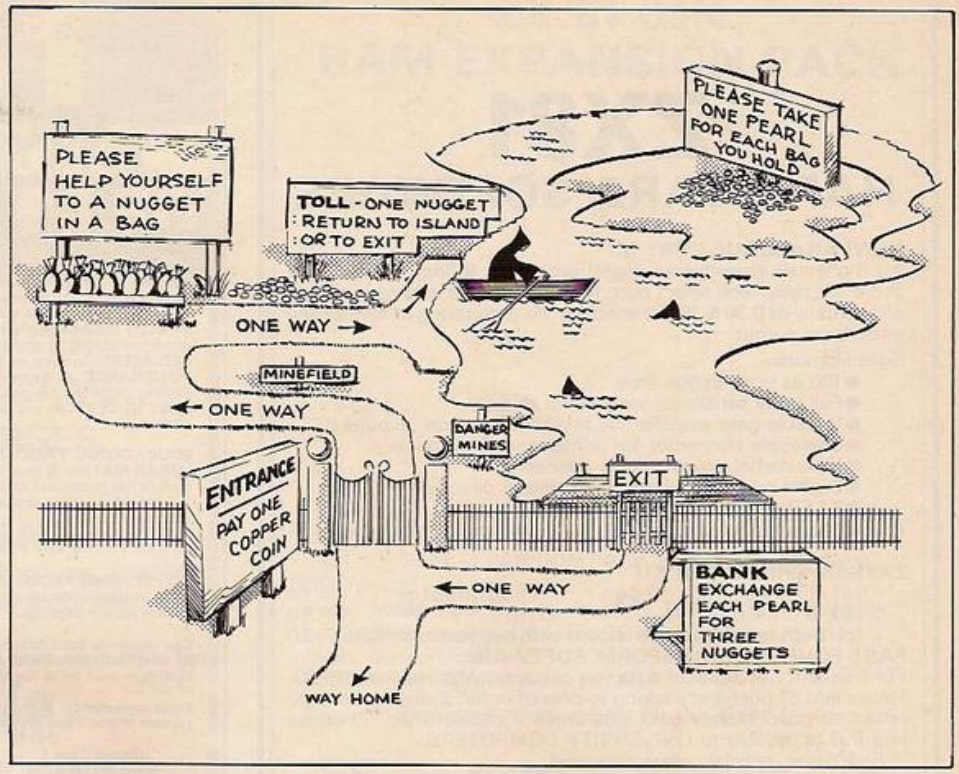
Access welcome. Send cheque, P.O. or cash (registered) or credit card number to: Gemini Marketing Ltd., Dept. PCW(3), Quay House, Quay Road, Newton Abbot, Devon TQ12 2BU or telephone us with your credit card order on (0626) 62869.
All orders despatched BY RETURN – no waiting. All prices include VAT and post and packing except Hardware. Full range of Sharp peripherals available – please phone for quotations. Please state machine type (A, K or B) when ordering software.

Golden nugget

BY ANTHONY ROBERTS

HERE IS THE PLAN of Old Swan adventure park. You pay a coin to enter, help yourself to a nugget in a bag, use it to pay the blind ferryman to ferry you to the exit, and leave. You could pay the ferryman to take you to the island and pick up a pearl — but it would do you little good as you then would not be able to leave the park. However, the Wizard One-eye has a plan: when you help yourself to a nugget in its bag substitute a stone for each nugget before you reach the ferryman who is too old and blind to notice — provided there is only one stone per bag of course. If the Wizard One-eye starts with enough copper coins to keep on re-entering the park he would finish up with a fortune, because of the steadily-increasing number of bags he would be carrying to the island — especially as the stone in each bag buys its own trip to the island — except for the final one to reach the exit on each trip.

The Wizard has arrived with a bag of coins, and leaves with the maximum number of nuggets he could obtain — curiously, 32K or 32,768. How many coins did he start with?



Competition prize winners

THERE WERE 400 entries for the Memotech 64K RAM pack competition in April. Once again, most were correct, making the task of choosing a winner difficult. After some discussion, the 64K RAM pack was awarded to N Fuller of 5 Southbourne Avenue, Emsworth, Hampshire PO10 8BB, for his "I need a 64K RAM pack because . . . absence makes the mi-cro founder".

Other notable entries included M White's "with 16K, the answer to the ultimate question comes out 4/2000" and R Whitaker's "the monsters in adventure programs need plenty of byte". B Buck of Northampton was quick off the mark with "this will open up a whole new 'spectrum' of programming possibilities" while John Mallon revealed a musical bent; "she's only 16 but I'll love her even more at 64".

Stephen Dunning echoed a number of readers' sentiments with "it drives me up the wall to see report code four" while Mark Kirkby waxed lyrical with "I wanna do decent progin' without the RAM pack wobblin' ". K Rawkins concluded "then I would be able to answer the $64,000 question" and Graham Newcombe decided "1K is K.O.'d, O.K.?". Last word on the subject went to P Blenkinsop who revealed that "playing one-roomed adventure is becoming a real bore."

The Klingon death competition also drew a large response. The problem was to find the defuse button which turned off the automatic defences which guarded the Klingons' treasure. Every button, except for the defuse button, could be pressed in a closed loop sequence where every button was identical to the previous button in three of its four symbols.

One solution was to write a program to look for the sequence and thus work out the defuse button. But the easy method was to write a program which looked for a button which did not have three symbols which were identical to two other buttons — because it cannot be part of a circular loop of buttons. The only button which fits this description lies in row 4, column 2 of the control panel:

Δ■
Δ●

The winning solution was sent in by Geof Cheyne of Kirkhouse Lodge, Traquair, Innerleithen, Peebleshire EH44 6PU. The letters in his program stand for the following symbols, A = a black circle, B = a black square, C = a black triangle and D = a white triangle.

Solution to the April crossword.


```
KLINGON DEATH  -  ZX81

10  DIM A$(64,4)
15  FOR X=1 TO 64
20  INPUT A$(X)
25  NEXT X
100 FOR X=1 TO 64
105 LET B$=A$(X,1 TO 3)
110 LET C$=A$ (X,2 TO )
115 LET D$=A$(X,1)+A$(X,3 TO )
120 LET E$=A$(X,1 TO 2)+A$(X,4)
125 LET C=0
130 FOR Y=1 TO 64
135 IF (Y<>X AND B$=A$(Y,1 TO 3))
    OR (Y<>X AND C$=A$(Y,2 TO  ))
    OR (Y<>X AND D$=A$(Y,1)+A$(Y,3 TO ))
    OR (Y<>X AND E$=A$(Y,1 TO 2)+A$(Y,4))
    THEN LET C=C+1
140 NEXT Y
145 IF NOT C>1 THEN PRINT A$(X)
150 NEXT X
```

ZX81
HARDWARE/ SOFTWARE

NEW! ANALOGUE PORT II
An 8 channel analogue to digital converter, 8 line digital output and 6 line peripheral select port. Measure up to 8 voltage inputs to an accuracy of 0.30% (8 bit) enabling the monitoring of almost any transducer output.

Specifications:
- 100 us converstion time
- Full scale sensitivity variable up to 5.0V
- Variable gain amplifier for mV sensitivies on channel 0
- Stackable connector for printer and RAM pack
- No external power supply needed
- Digital outputs will drive reed relays directly
- 3 LED's on board

Assembled and tested £29.95 16 pin DIL header plugs £1

ZX81 EXPERIMENTER KIT
(a) 23+23 Edge connector £4
(b) Stacking strip £1.50
(c) Both (a), (b) and veroboard with suggested circuits £7.50

FAST FOURIER TRANSFORM SOFTWARE
For frequency analysis of data; on cassette, with manual £15.20
Please add £1 post and packing to cost of order. Delivery normally return of post. Money back guarantee if not satisfied. Cheques and P.O.'s payable to UNIVERSITY COMPUTERS.
Bulk order, official orders accepted.

UNIVERSITY COMPUTERS
5, ST. BARNABAS ROAD,
CAMBRIDGE CB1 2BU

AMAZING VALUE

QUALITY
VIC-20 GAMES
With full colour and fantastic sound effects

GAMES TAPE 1 (now enhanced) for the unexpanded Vic. 6 great games on one cassette.
GRAND PRIX: Drive the formula one car along the twisting road avoiding the boulders. A game not to be missed: very addictive with incredible Hi-Res graphics.
BANDIT: A fabulous version of this famous fruit machine game. You may have lost in the past but this one's a winner. You won't be disappointed.
APOLLO DISASTER: Fast shooting and a cool head are needed for this outstanding game (mindblowing graphics).
RED ALERT: Can you save the earth in the face of the evil chemical "Vicoric Acid"?
RIFLE RANGE: At home on the range you are faced with the big shoot out. An exciting game for two players.
ACEY DUCEY: Can you outwit the computer in this great card game. Great all round effects.

EDUCATIONAL PACKII for the Vic + 3K expansion
LUNAR MATHS: A must for youngsters up to the age of 7. To get the Apollo space craft to the moon and back you must answer 10 selected maths questions.
Big bold graphics, simple touch key entry make this an easy game for any youngster to use.

3K RAM PACKS ARE AVAILABLE ON REQUEST AT £29.95 + £1.05 P&P

ADVERTISING PACKS (dealers only)
Shop window advertising/demonstration programs undertaken on request. We already have a large stock (standard) waiting for your order. Phone for more details.

Can you write Basic/Machine Code games and educational programs for the Vic. If so send them on cassette to the address below, or give us a ring. 15% royalty or a lump sum paid on all accepted programs.

Basic consultancy. If you have a business with problems or need advice on computer matters phone Titan Programs now!

Games Tape 1	**£5** (fully inclusive)
Lunar Maths	**£6** (fully inclusive)
3K RAM packs (required for Lunar Maths only)	**£29.95** + £1.05 p&p

For instant despatch send cheque or PO to:

TITAN PROGRAMS
83 Ashwood Road, Rudloe, Corsham, Wiltshire SN13 0LG
Telephone: Chippenham (0249) 55854, Hawthorn (0225) 810132

At last 16K ZX81
ASTRO-INVADERS
Just look at these features ...
... then look at the price!

- Superior machine code programming
- Explosive on-screen kill effect
- High-scoring saucers
- Manoeuvring array of 54 attacking aliens
- Photon-torpedoes with rapid fire facility
- Accelerating attack rate
- On-screen kill count with high-score update
- Destructable defence shields
- Fast action space-graphics
- A new dimension in ZX81 value

Astro-Invaders is yours on cassette with **FOUR BONUS GAMES**:
ARCADE GRAND PRIX — drive four levels of machine code skill.
PENALTY — get ready for Spain '82; defend your goal against the sharp-shooting ZX81.
GOLF — judge shot-strength, angle, bunkers ... and maybe hole in one!
plus machine code fun with
SWAT — war on the insect world!
5 Amazing games on one cassette for **ONLY £3.65** (post free in UK). Order yours from:

JOHN PRINCE,
29 Brook Avenue, Levenshulme,
Manchester, M19.

ZX81 owners
have you seen
The Cambridge Collection
A book of
30 PROGRAMS
For Only **£4.95**

NO MEMORY EXPANSION NEEDED
Each program has been designed to fit into 1K of RAM

TEACH YOURSELF PROGRAMMING
Comprehensive explanations of each listing will teach you many techniques of **ZX81** programming.

HOURS OF AMUSEMENT
With titles such as FORTRESS, BALLOON, and ODD MAN OUT, you could easily become a **ZX81** addict. Plus, entirely new implementations of well-known favourites; LUNAR LANDING, MASTER CODE, ORBITAL INVADERS, and many others.

CASSETTE AVAILABLE TOO!
If you order the book you can also buy the programs on a quality cassette for only £4.95 extra.

Please send me:
copies of the book at **£4.95** each
copies of the book and cassette at **£9.90** pair

Please send your orders with cheques/PO's to:
Richard Francis, Dept.YC A/S
22 Foxhollow, Barhill,
Cambridge, CB3 8EP.

ZX81

SOFTWARE FOR THE 1K USER

12 PROGRAMS £3.50

9 for 1k plus 3 expanded for 16k

Including:

- BIORYTHMS PLOTTER
- MOON LANDING GAME
- TELEPHONE CHARGES
- ESP TESTER
- LOANS & MORTGAGES

Games and Household Management programs written in BASIC and machine code. Recorded both sides. Please allow 10–14 days for delivery.

YC 6

Micromania
1/2 Wilson St., Bristol BS2 9HH.

Please send me ___ cassettes at £3-50
I enclose a cheque/postal order for £___
Name: _____
Address: _____

ZX 81 64K RAM EXPANSION PACK

Quite simply good value for money at £58.65 including VAT plus £1.50 P&P. Contained in a specially designed plastic case.
ZX81 16K RAM EXPANSION PACK also available as above £32 inc VAT + £1.50 p&p.
Junior Maths Pack One to run on 1K RAM ZX81 — five helpful programmes on cassette for £3.75 inclusive. Logic, Sums, Nimb, Division & Money.
12 MONTHS GUARANTEE. DELIVERY 14 DAYS

See our April issue advertisement for Vic 20 Product details

CEL CUSTOMISED ELECTRONICS LIMITED
Winker Green Mills, Stanningley Road, Armley, Leeds LS12 3BB. Telephone 0532 792332
155 Marton Road, Middlesbrough, Cleveland TS4 2EN. Telephone 0642 247727

NEW ZX81
16K SOFTWARE

THE DIGGLES KITCHEN
RECIPE CASSETTES
CELEBRATION DINNERS TO SIMPLE SUPPERS

VOLUME 1

50 pages of world wide recipes
£4.99 (inc. p&p and VAT)

VOLUME 2

50 pages of European recipes
£4.99 (inc. p&p and VAT)

SPECIAL OFFER — both volumes for only £9.00 inc. p&p and VAT
More volumes to follow
Mail Order Only — please specify which volume(s)
Send remittance to:

MICRO COMPUTER SOFTWARE
Unit D6, Pear Industrial Estate, Stockport Road, Lower Bredbury, Stockport SK6 2BP Tel: 061-494 2441

YOUR COMPUTER

is your magazine — every issue is full of articles specially written for the home computer enthusiast.

Reviews of personal computers; Programs; Surveys of software available on the market; New application ideas for your computer; Computer Club — news from your clubs; Calculator page; Letters; Answers to your problems and pages and pages of computer games and program listings.

All for only 60p
Ensure your copy each month, take out a subscription NOW!

SEE THE SUBSCRIPTION ORDER FORM BETWEEN PAGES 90 & 91 IN THIS ISSUE

THE ZX81 COMPANION

ISBN 0 90721 01 1
Price £7.95 incl. UK P&P

If you have a Sinclair ZX81 and want to use it to its full potential then, as the experts have all agreed, this is the book for you. It contains detailed guidelines and documented programs in the areas of gaming, information retrieval and education, as well as a unique listing of the 8K ROM for machine code applications.

'Far and away the best . . . once again Linsac has produced the book for the serious end of the market'. — *Your Computer, November 1981.*

'The ZX81 Companion is a most professional product . . . with many good illustrative programs, tips and warnings'. — *Education Equipment, October 1981.*

'Bob Maunder's attempt to show meaningful uses of the machine is brilliantly successful . . . thoughtfully written, detailed and illustrated with meaningful programs . . . To conclude — the book is definitely an outstandingly useful second step for the ZX81 user'. — *Educational ZX80/81 Users' Group Newsletter, September 1981.*

Send you cheque for £7.95 to:

LINSAC (YC) **68 Barker Road, Linthorpe Middlesbrough TS5 5ES**

ELECTRIC PENCIL COMPANY

PRESENTS

ZX ASTEROIDS©

AUTHOR Robert J Wray
(c)EPC 1982

- FEATURES -

1 100% Machine code 5k.
2 Carefully designed graphics
3 Full screen ship control
4 'Smart' hunter-killer UFO
5 5 speeds 5 high scores
6 On screen scoring & status
7 1 or 2 players
8 Multi fire laser cannon
9 Speed increases during game
10 Money back guarantee

£4.95

EPC 1 MOUNTVERNON BILTON N. Humberside
All Trade equiries welcome

WELCOME, SPECTRUM!

RD Laboratories are pleased to continue supplying Realtime Interface Modules for economic micro control and instrumentation — suitable for all ZX Computers. Including Clive Sinclair's brilliant new ZX Spectrum!

The RD 8100 Modules can be used in many applications: —

- DATA LOGGING
- CONTROL
- AUTOMATIC TESTING
- INTERACTIVE GRAPHICS
- GAMES AND LEISURE ACTIVITY

The RD 8100 Module range consists of Logic Input/Output Port; Analogue Input Port; Analogue Multiplexer/Amplifier; Analogue Output Port; Light Pen Module.
For full details of the RD 8100 System, please send a stamp and your address to Department CY at RD Laboratories.

R D Laboratories

5 Kennedy Road, Dane End, Ware, Herts. SG12 OLU
(0920) 84380

WHAT CAN I DO WITH 1K?

If your answer is not much, then you must read Roger Valentine's book "What Can I Do With 1K? (40 programs and routines for the 1K Sinclair ZX81)".

". . . a splendid book and one which will repay your investment time and time again." (ZX Computing).

Book £4.95.
Also available on cassette £4.95.

NEW

WHAT CAN I DO WITH 16K?

The companion volume to the above, containing complete program listings for 16K.

Book £4.95.
Cassettes available individually — ask for list.

ZX81

Probably the best ZX program ever written for the serious business user.
Cassette £10.00. Full maintenance contract available.

V & H Computer Services
182c Kingston Road
Staines
Middlesex
Tel: Staines 58041

Wida Software

Specialists in Educational Software For Schools and Colleges

WORDPACK

NEW ZX81 NEW

EDUCATIONAL SOFTWARE
AUTHORING PROGRAMS
FOR TEACHERS AND STUDENTS

- Write and Solve your own tests
- Write and Play your own word games
- Write and Solve your own puzzles

Wordpack 1
Wordpack 2 **£4.50**

Wordpack 3
Wordpack 4 **£5.00**

All for ZX81 with 16K
** payment by cheque or credit card*
Send s.a.e. for catalogue of educational software for Apple II, PET, ZX81

All prices incl. VAT:

WIDA SOFTWARE 2 Nicholas Gardens, London W5 5HY. Tel: 01-567 6941

MASTERMIND CHALLENGER

ZX81 16K

- Competes against you to find your secret number before you deduce its secret number.
- Operates on 5 digit numbers.
- Handles any number of repeats of one or more digits.
- Maintains a record of all tries and scores during a game.
- Validity checks on entries.

Supplied on cassette £4.95 inc. p&p

Cottage Software
2 Tilmans Mead
Farningham, Kent DA4 0BY

A & F SOFTWARE

FOR
ATOM & BBC
USERS

ADVENTURE

First £50 Prize

COMPETITION

PLUS 10 RUNNER UP PRIZES

By following the clues and overcoming the obstacles can you solve the mystery of the "DEATH SATELLITE" and unlock its secrets???

Your ATOM will require 12K RAM. (F.Point NOT Required)

Full competition details supplied with all orders

PRICE 6.00

CYLON ATTACK

In this 3D all action game, hi-resolution graphics are used to simulate the pilots view of space from the cockpit of his Starfighter.
Your instruments are constantly displayed and include - Long range scanner - Laser energy status - and fuel status. Score and Hi-score also displayed

Written in m/c for the ATOM using 5K text 6K graphic

PRICE 4.95

OTHER ATOM TITLES

POLECAT	+ 4.95	EARLY WARNING	+ 4.95
MINEFIELD	++ 4.95	ROBOT NIM	++ 3.95
ATOMIC CUBE	+ x 4.95	POLARIS	+ 3.95
MISSILE COMMAND	+ 4.95	PONTOON	+ 3.95

\+ = 5K text 6K graphics ++ = 5K text 1/2 graphics
x = Floating Point Required

ATOM SUPERCOS

Tired of waiting for your programs to load? SUPERCOS is a low cost HIGH SPEED (1200 baud) COS you will be able to save/load 5 times faster than normal. In addition SUPERCOS provides visible load, program test verifying, plus 8 other commands. Req's 1·25RAM only 5·95

BBC MICRO

Two popular games from our Atom range converted and enhanced to run on BOTH MODEL A & B MICRO's

EARLY WARNING Destroy the attacking waves of ICBMs using a radar tracking system and intercept missiles. 48 Levels - Each one harder than the last 6.00

POLECAT Find your way through the warren onto the surface and return to your burrow with winter supplies. Easy!!! — BEWARE THE POLECATS — 6.00

SPECIAL OFFER Deduct 1.00 per additional cassette when you order 2 or more programs

WE PAY 25% ROYALTIES ON YOUR PROGRAMS

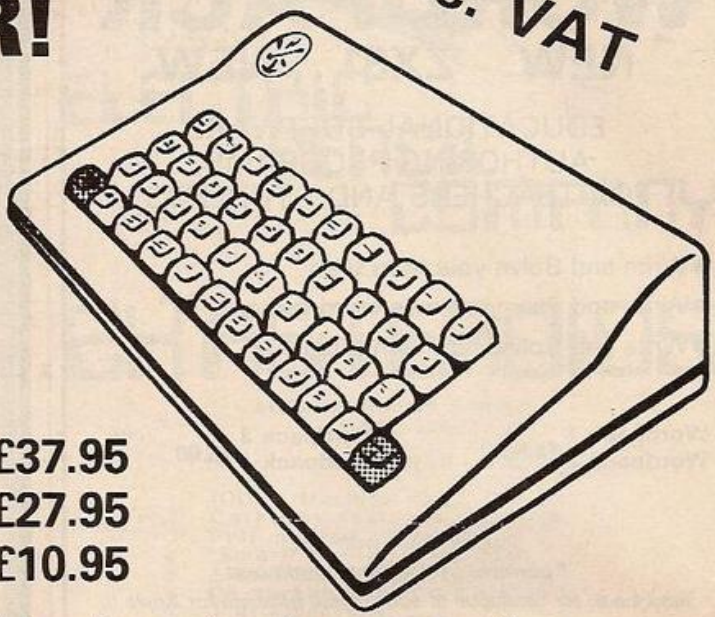
ORDERS TO A&F SOFTWARE 10, WILPSHIRE AVE, LONGSIGHT, MANCHESTER, M12 5TL [Access/Barclay card on (061) 320 5482]

ZX80/1 WAR!

£37.95 inc. VAT

Price

ZX KEYBOARD FULLY CASED WITH REPEAT KEY



Fully CASED KEYBOARD	**£37.95**
Uncased KEYBOARD	**£27.95**
KEYBOARD CASE	**£10.95**

This is a highly professional keyboard using executive buttons as found on top quality computers. It has a repeat key and comes complete in its own luxury case. This is a genuine professional keyboard and should not be confused with toy keyboards currently available on the market.

16K RAMPACKS

MASSIVE ADD ON MEMORY

WHY WAIT TO PAY MORE
FAST IMMEDIATE DELIVERY

£32.95 inc VAT

Post to
Dept. YC2
KAYDE Electronic Systems
48/49 Exmouth Road
Great Yarmouth
Norfolk NR30 3DP
Tel: (0493) 57867

All products include VAT and are fully built and tested and come with a complete money back guarantee.

Please send me .....RAM Packs £32.95 each
Please send me .....Cased Keyboards £37.95 each
Please send me ....Uncased Keyboard £27.95 each
Please send me .....Keyboard Case £10.95 each

I enclose £.....

Name.....

Address.....

.....

.....

Please add £1.50 p&p and make cheques payable to Kayde Electronic Systems.

NOW IN STOCK

THE NEW & EXCITING TRS80 MODEL III

EXTENDED GUARANTEE BY COMPUCARE

48K **£599** + VAT

The Radio Shack TRS-80™ Model III is a ROM-based computer system consisting of:

- A 12-inch screen to display results and other information
- A 65-key console keyboard for inputting programs and data to the Computer
- A Z-80 Microprocessor, the "brains" of the system
- A Real-Time Clock
- Read Only Memory (ROM) containing the Model III BASIC Language (fully compatible with most Model I BASIC programs)
- Random Access Memory (RAM) for storage of programs and data while the Computer is on (amount is expandable from "16K" to "48K", optional extra)
- A Cassette Interface for long-term storage of programs and data (requires a separate cassette recorder, optional/extra)
- A Printer Interface for hard-copy output of programs and data (requires a separate line printer, optional/extra)
- Expansion area for upgrading to a disk-based system (optional/extra)
- Expansion area for an RS-232-C serial communications interface (optional/extra)

All these components are contained in a single moulded case, and all are powered via one power cord.

Disc Drives Kit with 2x40 Track Drives — **£599** + VAT
Disc Drives Kit with 2x80 Track Drives — **£729** + VAT

HITACHI PROFESSIONAL MONITORS

EXTENDED GUARANTEE BY COMPUCARE

9" — ~~£129~~ **£99.95**
12" — ~~£199~~ **£149**
+ VAT

- **Reliability** Solid state circuitry using an IC and silicon transistors ensures high reliability.
- **500 lines horizontal resolution** Horizontal resolution in excess of 500 lines is achieved in picture center.
- **Stable picture** Even played back pictures of VTR can be displayed without jittering.
- **Looping video input** Video input can be looped through with built-in termination switch.
- **External sync operation** (available as option for U and C types)
- **Compact construction** Two monitors are mountable side by side in a standard 19-inch rack.

NEW

ACORN ATOM

UNIQUE IN CONCEPT — THE HOME COMPUTER THAT GROWS AS YOU DO

Fully Assembled **£157.50** + VAT inc. PSU

EXTENDED GUARANTEE BY COMPUCARE

Special features include
- Full Sized Keyboard
- Assembler and Basic
- Top Quality Moulded Case
- Optional High Resolution Colour Graphics
- 6502 Microprocessor

THE EPSON MX SERIES

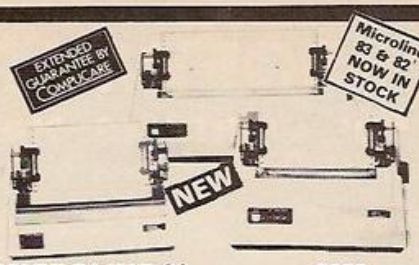
EXTENDED GUARANTEE BY COMPUCARE

- 80/132 Column
- Centronics Parallel
- Bi-directional
- Upper & lower case
- True Descenders
- 9x9 Dot Matrix
- Condensed and Enlarged Characters
- Interfaces and Ribbons available

MX80T £339 + VAT
MX80F/T £389 + VAT

EXTENDED GUARANTEE BY COMPUCARE

Microline 83 & 82 NOW IN STOCK



NEW

MICROLINE 80 £289 + VAT

- 80 cps Uni-directional
- Small size: 342 (W) × 254 (D) × 108 (H) mm.
- 160 Characters, 96 ASCII and 64 graphics
- 3 Character sizes: 40, 80 or 132 chars/line
- Friction and Pin Feed
- Low noise: 65 dB
- Low weight: 6.5 kg

INTRODUCING THE NEW SHARP MZ-80B

NEW

EXTENDED GUARANTEE BY COMPUCARE

£999 + VAT.

- 4 Mhz Z-80 CPU
- Dynamic RAM
- 2K ROM
- BASIC is provided
- High Resolution Graphics
- 9" High Focus Green Display
- Upper and Lower Case
- 80/40 Characters x 25 line display
- Electro Magnetic Cassette Deck included
- ASC11 Keyboard
- Numeric Keypad
- Sound Output
- Built-in Clock and Music.

Available Soon-Discs, Printers and other Accessories.

DUE TO IMMENSE POPULARITY SALE CONTINUED

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER

COMPUKIT UK101

★ 6502 based system — best value for money on the market. ★ Powerful 8K Basic — Fastest around ★ Full Qwerty Keyboard ★ 1K RAM Expandable to 8K on board. ★ Power supply and RF Modulator on board. ★ No Extras needed — Plug-in and go ★ Kansas City Tape Interface on board. ★ Free Sampler Tape including powerful Dissassembler and Monitor with each Kit. ★ If you want to learn about Micros, but didn't know which machine to buy then this is the machine for you.

KIT ONLY **£99.95** + VAT
Fully Assembled — **£149** + VAT
} PLUS **£4.60** Post & Packing

WE ARE NOW STOCKING THE APPLE II AT REDUCED PRICES

AUTOSTART EURO PLUS

EXTENDED GUARANTEE BY COMPUCARE

48K **£649** + VAT

Getting Started APPLE II is faster, smaller, and more powerful than its predecessors. And it's more fun to use too because of built-in features like:

- BASIC — The Language that Makes Programming Fun.
- High-Resolution Graphics (in a 54,000-Point Array) for Finely-Detailed Displays.
- Sound Capability that Brings Programs to Life.
- Hand Controls for Games and Other Human-Input Applications.
- Internal Memory Capacity of 48K Bytes of RAM, 12K Bytes of ROM; for Big System Performance in a Small Package.
- Eight Accessory Expansion Slots to let the System Grow With Your Needs.

You don't need to be an expert to enjoy APPLE II. It is a complete, ready-to-run computer. Just connect it to a video display and start using programs (or writing your own) the first day. You'll find that its tutorial manuals help you make it your own personal problem solver.

INTRODUCING THE NEW GENIE

Ideal for small businesses, schools, colleges, homes, etc. Suitable for the experienced, inexperienced, hobbyist, teacher, etc.

EXTENDED GUARANTEE BY COMPUCARE

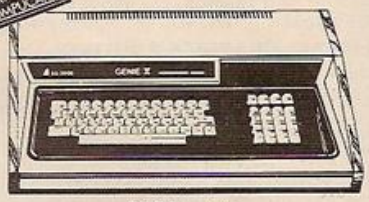
GENIE I

STILL ONLY **£279** + VAT

NOW **INCLUDED:** Sound, Upper and lower case, Extended BASIC and Machine Code enabling the Writing and Execution of Machine Codes Programming direct from Keyboard.
16K RAM. 12K Microsoft BASIC
Extensive Software Range.
Self-Contained PSU UHF Modulator Cassette. External Cassette Interface. Simply plugs into TV or Monitor. Complete and Ready to Go. Display is 6 lines by 32 or 64 Characters Switchable. 3 Mannuals included, Users Guide, Beginners Programming and BASIC Reference Mannual. BASIC Program Tape Supplied. Pixel Graphics.

EXTENDED GUARANTEE BY COMPUCARE

GENIE II



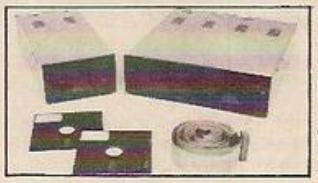
£299 + VAT

The **NEW GENIE II** an ideal Business Machine. 13K Microsoft BASIC in ROM. 71 Keyboard. Numeric Keypad. Upper & Lower Case. Standard Flashing Cursor. Cassette Interface 16K RAM Expanded externally to 48K.

GENIE I & II EXPANSION UNIT WITH 32K RAM £199 + VAT

PARALLEL PRINTER INTERFACE CARD
£35.00 + VAT

TEAC DISK DRIVES



EXTENDED GUARANTEE BY COMPUCARE

- TEAC FD-50A has 40 tracks giving 125K Bytes unformatted single density capacity.
- The FD-50A can be used in double density recording mode.
- The FD-50A is Shugart SA400 interface compatible.
- Directly compatible with Tandy TRS80 expansion interface.
- Also interfaces with Video Genie, SWTP, TRS80, North Star Horizon, Superbrain, Nascom, etc, etc.
- Address selection for Daisy chaining up to 4 Disks.
- Disks plus power supply housed in an attractive grey case.

40 TRACK
Single Disk Drive **£225** + VAT — Double Disk Drive **£389** + VAT

77 TRACK
Single Disk Drive **£299** + VAT — Double Disk Drive **£499** + VAT

COMPSHOP

"Europes Largest Discount Personal Computer Stores"

Delivery is added at cost. Please make cheques and postal orders payable to **COMPSHOP LTD.**, or phone your order quoting **BARCLAYCARD, ACCESS, DINERS CLUB** or **AMERICAN EXPRESS** number.

MAIL ORDER AND SHOP: **CREDIT FACILITIES ARRANGED** — send S.A.E. for application form.
14 Station Road, New Barnet, Hertfordshire, EN5 1QW *(Close to New Barnet BR Station — Moorgate Line).*
Telephone: 01-441 2922 (Sales) 01-449 6596 Telex: 298755 TELCOM G
OPEN (BARNET) — 10am - 7pm — Monday to Saturday

NEW WEST END SHOWROOM:
311 Edgware Road, London W2. Telephone: 01-262 0387
OPEN (LONDON) — 10am - 6pm — Monday to Saturday
IRELAND: 19 Herbert Street, Dublin 2. Telephone Dublin 604165

TELEPHONE SALES
OPEN 24 hrs. 7 days a week
01-449 6596

BARCLAYCARD VISA — AMERICAN EXPRESS — DINERS CLUB INTERNATIONAL — Mercantile Credit

ZX80

JRS SOFTWARE

19 WAYSIDE AVENUE, WORTHING, SUSSEX, BN13 3JU
TELEPHONE WORTHING 65691 (Evenings and Weekends only)

ZX81

CASSETTE professionally recorded by SOUND NEWS STUDIOS

GAMES PACK – ***Beat this for value! 5 × 16K programs PLUS 2 × 1K programs*** **£4.95 ($9.90)**

3-D Battle (M/code-1K) – Fast moving space battle with continuous count down of energy units left

City Bomb (M/code-1K) – Destroy the buildings and land your plane. Your fuel has nearly gone and you circle the city lower and lower

Warp Wars (Basic & M/code-16K) – Features realistic space craft moved by M/code for instant response (previously sold at Microfair with Sweet Tooth for £4.95)

Snake (Basic-16K) – A game of thought and skill. Pass through all the marked squares without crossing or doubling back on your path, but watch out for the expanding black blob (previously sold at Microfair for £3.95)

Sweet Tooth (Basic & M/code-16K) – M/code routines used to move your fat face round the screen and gobble the sweets

PLUS Slalom and Black Holes (previously sold together for £4.95)

An ESSENTIAL addition to your 1K RAM ZX81 (or ZX80 8K ROM)
(please state which when ordering)

TOOLKIT (written by PAUL HOLMES)

Provides the following additional facilities

Line renumber – you state starting number and increment value
Search and replace – changes every occurence of a character as you require
Free space – tells you how many free bytes you have left

SPECIAL GRAPHICS ROUTINES

Hyper graphics mode – graphics never seen on a ZX81 before
Open – instantly sets up as many empty print lines as you require. (1K version only)
Fill – used in conjunction with OPEN fills your screen instantly with your specified character
Reverse – changes each character on your screen to its inverse video

TAPE ROUTINE – provides a system **WAIT** condition until a signal is received in the cassette ear jack – many uses !

All these routines are written in machine code and together take up only 164 BYTES of your precious RAM – an incredible achievement!!

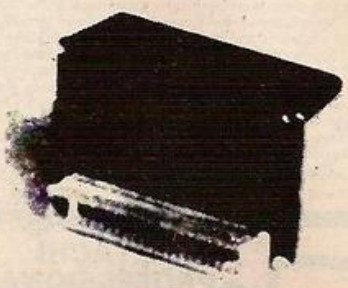
The price is incredible too! ONLY **£3.95 ($7.90)** for cassette, including FULL instructions and example programs.

ALSO available 16K version ONLY **£4.95 ($9.90)** which includes all the above PLUS GOTO's and GOSUB's included in line renumber.
Search for and list every line containing specified character. **16K VERSION**

As reviewed in *'YOUR COMPUTER'* March 1982

16K RAM PACK £35 ($69.95)

WHY PAY MORE



Fully built, tested and guaranteed. No additional power supply required, black case

No wobble problems – fully compatible with printer etc, etc

(Please send large S.A.E. + 50p for a copy of *'YOUR COMPUTER'* RAM pack reviews (March 1982) – Refunded when you purchase the RAM pack). Please allow 21 days for delivery

STOP PRESS

NOW AVAILABLE – 64K RAM pack (56K useable) **£75** inclusive

NEW

GRAPHICS TOOLKIT

(Another masterpiece by PAUL HOLMES)

22 exciting MACHINE CODE routines that give you control over your screen as never before !

(ZX81 - 16K RAM ONLY)

DRAW/UNDRAW draws or deletes your multi-character shape which is defined in a REM statement. You may define as many different shapes as you like and draw or undraw each at will at whichever screen position you choose

FOREGROUND ON/OFF use this to 'protect' existing characters on your screen. When on new shapes will appear to slide behind and re-emerge from other shapes

BORDER/UNBORDER Draws a border round the edges of your screen area. Edit lines can be used if required. Your border is protected when foreground is on

FILL Fills any number of lines you specify, starting at any line you specify, by your chosen character

REVERSE Converts all characters to their inverse video, control as in FILL

PRINT POSITION CONTROLS
UP
DOWN
LEFT
RIGHT
} After your next PRINT position in the direction indicated

EDITPRINT Moves next PRINT position to first edit line

SCROLL facilities
UPSCROLL
DOWNSCROLL
RIGHTSCROLL
LEFTSCROLL
} Scroll your screen in the direction indicated

ONSCREEN/OFFSCREEN turns your screen on or off

BACKGROUND ON/OFF
Fills your screen by your specified character. When foreground is on existing information is unaffected and shapes will appear to pass in front of your background, without deleting it

SEARCH AND REPLACE will search the screen for every occurence of the character you specify and replace it with your new character

SQUARE draws a square or rectangle from your specified co-ordinates

ALL these routines are in machine code for SUPER-FAST response ! Simply load GRAPHICS TOOLKIT, which repositions itself at the end of your RAM, and then your own program (or key in a new one). GRAPHICS TOOLKIT uses only 2K of your RAM and that includes space to load the programmers TOOLKIT described above (16K RAM version)

ALL FOR ONLY £5.95 ($11.90)

(amazing value from JRS)

This includes a cassette with 2 copies of the program plus a comprehensive instruction booklet with examples

NOTE: All prices are fully inclusive – send cheque or P.O. to JRS Software at above address

OVERSEAS CUSTOMERS PLEASE NOTE Payment may be made in Sterling (Money Order available at your bank) ou $U.S. (U.S.A. customers only). | Prices quoted above are also export prices and include AIRMAIL postage

When you outgrow your personal computer that's the time you'll wish you'd bought a DAI.

Very low priced personal computers can leave you feeling very low, after the initial novelty has worn off. Having learned what the computer can do, you then find out what it can't do. Unless you expand the system. And that can set you back a few hundred pounds for items such as extra RAM and serial interface. In fact, more than you paid in the first place!
So when you've done all the sums, you'll realise that the DAI personal computer offers incredibly good value for money.
Just look what you get for the all-in price.

1. 48K RAM.
2. 24K ROM-based software that includes a fast BASIC interpreter, scrolling screen editor, machine code utility program, twin cassette tile handling, and disc support.
3. A full duplex RS232 serial interface allowing direct connection of a printer (with resident software support) and other peripherals.
4. A parallel interface for connection of the CP/M compatible DAI disc unit and other user devices.
5. Superb 16-colour high resolution graphics (256 x 336).
6. Sound commands for music generation.
7. Standard TV interface via aerial socket.

These standard features pave the way for a whole new vista of personal computing possibilities.
Find out more by completing the coupon today.
Large range of "Dainasoft" software available, e.g. viewdata, word processing, educational, games . . .

only £595.00 + VAT
Disc unit extra

Please send me further details about the DAI Personal Computer.
My interest areas are .....

.....

☐ Please send me a list of dealers

NAME: .....

ADDRESS: .....

..... TEL. NO.: .....

Send to DAI, 16B Dyer Street, Cirencester, Glos. GL7 2PF

a DAI sets you up for life

DAI

Data Applications (UK) Ltd.
16B DYER STREET, CIRENCESTER,
GLOUCESTERSHIRE GL7 2PF
TELEPHONE:
CIRENCESTER (0285) 61828 or 2588
TELEX: 43605 BECHAM G

Sinclair ZX81 Personal Comp
the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

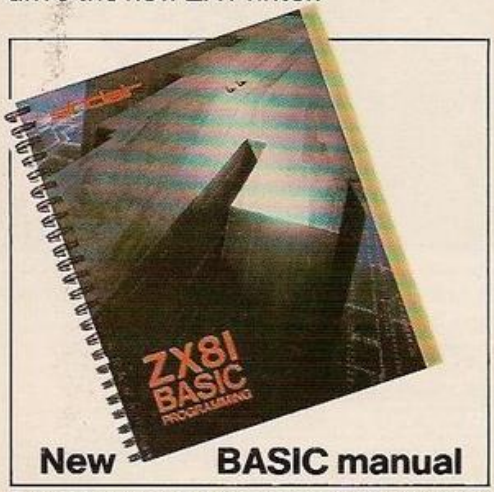
In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability
With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.



New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

Built: £69.95

Kit or built – it's up to you!
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 700 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.

uter-

Available now- the ZX Printer for only £59.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics *and* highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

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 computer – using a stackable connector so you *can* plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81

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, Access, Barclaycard or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option. 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 ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (700 mA at 9V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	29.95	
	Sinclair ZX Printer.	27	59.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

☐ Please tick if you require a VAT receipt TOTAL £ _____

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £ _____

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

*Please delete/complete as applicable. _____

Please print.

Name: Mr/Mrs/Miss _____

Address: _____

FREEPOST – no stamp needed. YOC 06

sinclair

ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

Make the most of your Sinclair ZX Computer...

Sinclair ZX software on cassette.

£3.95 per cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack is described below. And the description of each cassette makes it clear what hardware is required.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 *and* the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

Cassette 6 – Family Quiz

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack.

Four different quizzes, each consisting of 10 questions suitable for the whole family. There's a target time for each quiz, and at the end you're told how long you took to answer the questions – and how many you got right. The quizzes cover a range of topics – including maths, English grammar, and general knowledge.

How to order

Simply use the order form below, and either enclose a cheque or give us the number of your Access, Barclaycard or Trustcard account. Please allow 28 days for delivery. 14-day money-back option.

sinclair

ZX SOFTWARE

Sinclair Research Ltd, 6 Kings Parade, Cambridge, Cambs., CB2 1SN. Tel: 0276 66104.

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

Please send me the items I have indicated below. *Please print*

Qty	Code	Item	Item price	Total
	21	Cassette 1 – Games	£3.95	
	22	Cassette 2 – Junior Education	£3.95	
	23	Cassette 3 – Business and Household	£3.95	
	24	Cassette 4 – Games	£3.95	
	25	Cassette 5 – Junior Education	£3.95	
	26	Cassette 6 – Family Quiz	£3.95	
	17	*8K BASIC ROM for ZX80	£19.95	
	18	*16K RAM pack for ZX81 and ZX80	£29.95	
		*Post and packing (if applicable)	£2.95	
			Total £	

*Please add £2.95 to total order value only if ordering ROM and/or RAM.

I enclose a cheque/PO to Sinclair Research Ltd for £ _____

Please charge by Access*/Barclaycard/Trustcard no.

_____

*Please delete as applicable.

Name: Mr/Mrs/Miss _____

Address: _____

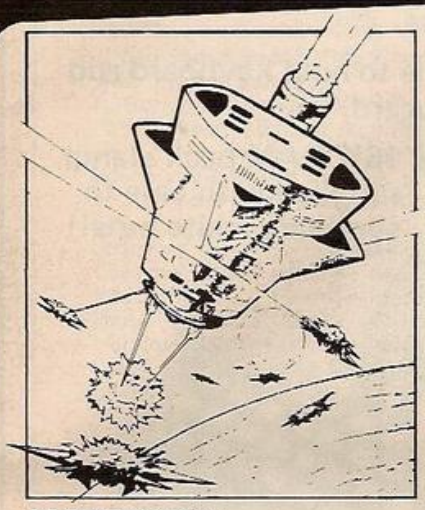
_____ SOF08

LEADERS IN COMPUTER GAMES

FIRST CHOICE FOR ZX: SUPPORT:

ZX-81

ZX-80



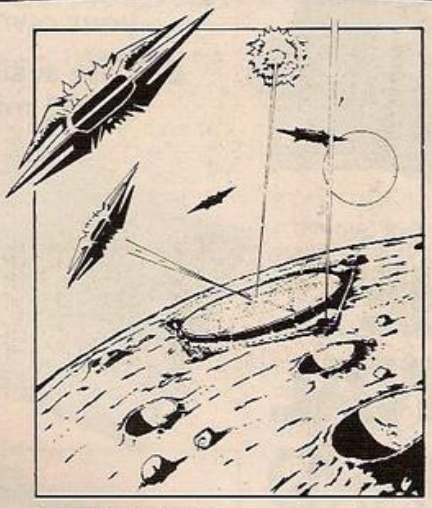
QS DEFENDER.
UP – DOWN – THRUST – FIRE
First and only full screen display. Software to drive QS SOUND BD. Moving Planetary surface. Up to 84 fast moving characters on screen at once. On screen scoring. Ten missiles at once. Increasing attack patterns. Requires 8K ROM, and 4K min of RAM. **£5.50.**

QS SOUND BD.
A programmable sound effects board using the AY-3-8910. 3 TONES; 1 NOISE; ENVELOPE SHAPER: + TWO 8 BIT I/O PORTS. Easily programmable from BASIC, the AY chip does most of the work leaving your computer free for other things. Signal O/P via 3.5 mm Jack socket Ports O/P via a 16 pin I.C. Socket. **£26.00.**

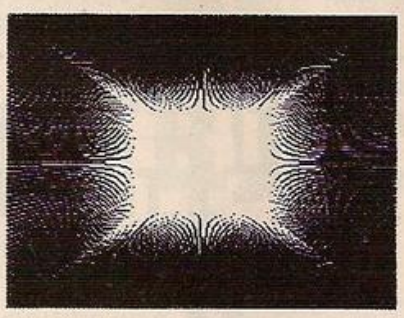
QS CHRS BD./
A programmable character generator giving – 128 SEPARATELY PROGRAMMABLE CHARACTERS. ON/OFF SWITCH. 1K ON BOARD RAM. Enables creation and display of your own characters to screen or printer. Demo cassette of fast machine code operation routines and lower case alphabet included. See below for ZX PRINTER listing. **£26.00.**

QS – LOWER CASE

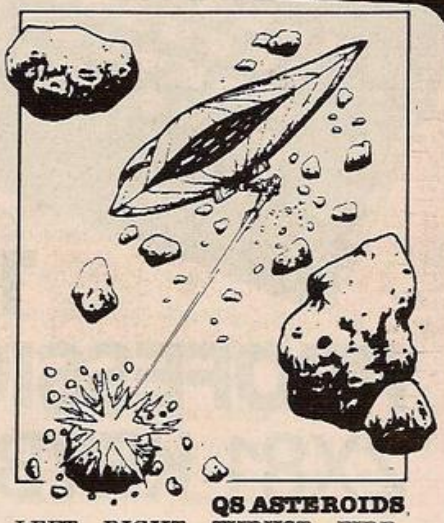
a b c d e f g h i j k l m n o p q r s t u v w x y z



QS INVADERS.
LEFT – RIGHT – FIRE
13×7 INVADERS; High score; 3 levels of play; RND saucers; Bonus base; Drives Sound bd. & CHRS bd. Requires 7K RAM, 8K ROM + Slow. **£5.50.**



QS HI-RES BD.
A Hi-res graphics board giving – 256×192 PIXELS. 6K ON BD. RAM. SOFTWARE SELECT/DESELECT. MIXED TEXT AND GRAPHICS. 2K ON BOARD ROM. Resident fast machine code graphics software (in ROM) provides the following HI-RES Commands. – MOVE x, y; PLOT x, y; DRAW x, y; BOX x, y; UP; DOWN; LEFT; RIGHT; PRINT A$; SCROLL; BLACK; WHITE CLEAR COPY. See above for ZX PRINTER listings using COPY. **£85.00.**



QS ASTEROIDS.
LEFT – RIGHT – THRUST – FIRE
Software to drive QS SOUND BD. Multiple missiles firing in 8 directions. On screen scoring. Increasing number of asteroids. Full mobility of ship to all areas of the screen. Two asteroid sizes. Bonus ship at 10,000 points. Requires 8K ROM, 4K min of RAM + SLOW function. **£5.50.**

QS 3K RAM Bd.
An extremely reliable static RAM Bd. which combines with the computer's memory to give 4K total. Plugs direct in to the rear port on your ZX Computer. **£15.00.**

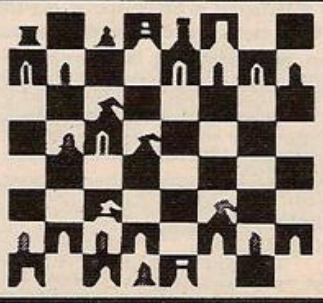
QS MOTHER BOARD BD. & QS CONNECTOR.
A reliable expansion system allowing a total of any RAM pack plus two other plug in boards to be in use at once. On board 5V regulator drives all external boards. Fitted with two 23 way double sided edge connectors. Connector is 2×23 way edge conns soldered back to back. Expansion can operate in two ways – (1) COMPUTER ↔ CONNECTOR ↔ Any QS add on bd. (but no extra RAM pack). (2) COMPUTER ↔ CONNECTOR ↔ MOTHER BD ↔ ANY RAM PACK. (2 bds to fit in mother bd.) Mother board **£12.00** Connector **£4.00.**

Special offers & news

(1) QS Mother bd. + connector + CHRS bd. + The special Graphics version of **ARCTIC COMPUTING'S ZX CHESS 11. £45.00.**
The strongest chess program with 7 levels of play.

(2) QS MOTHER BD + CONNECTOR + either SOUND or CHRS bd. **£40.00.**

We will be at the following shows . . . Come and see us . . .
THE COMPUTER FAIR, Earls Court, 23rd to 25th April
3rd ZX MICROFAIR, Central Hall, Westminster.
30th April & 1st May



POSTAL AND MONEY ORDERS TO: ALL PRODUCTS FULLY GUARANTED.

QUICKSILVA: 95, UPPER BROWNHILL RD. : MAYBUSH : SOTON : HANTS : ENGLAND.

Please state Type of machine, Which ROM, Memory size, when ordering.

MICHAEL ORWIN'S ZX81 CASSETTES

CASSETTE ONE for 1k ZX81

"I had your Invaders/React cassette . . . I was delighted with this first cassette."
P. Rubython, London NW10.
"I have been intending to write to you for some days to say how much I enjoy the games on 'Cassette One' which you supplied me with earlier this month. Please let . . . into the secret of your first time load every time!"
E.H., London SW4.
Just two out of over 30 unsolicitied testimonials.
Cassette One 1k machine code programs:
React, Invaders, Phantom aliens, Maze of death, Planet lander, Bouncing letters, Bug Splat. 1k Basic programs: I Ching, Mastermind, Robots, Basic Hangman PLUS Large screen versions of Invaders and Maze of Death, ready for when you get 16k. Cassette One costs £3.80.

CASSETTE TWO

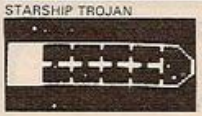
Ten games in Basic for 16k ZX81

Cassette Two contains Othello, Awari, Laser Bases, World mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.
Cassette Two costs £5.

CASSETTE THREE

8 programs for 16k ZX81

STARSHIP TROJAN



Repair your Starship before disastor strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

STARTREK This version of the well known Space adventure game features variable Klingon mobility, and graphic photon torpedo tracking.

PRINCESS OF KRAAL An adventure game. .

BATTLE Strategy game, for 1 to 4 players.

KALABRIASZ World's silliest card game, full of pointless complicated rules.

CUBE Rubik Cube simulator, with 'Black step' facility.

SECRET MESSAGES If you are spying for the KGB, why not throw away those incriminating code books, and buy this innocent looking cassette? This message coding program is txlp qexi jf.

MARTIAN CRICKET A simple but addictive game (totally unlike Earth cricket) in machine code. The speed is variable, and it can run very fast.
Cassette Three costs £5.

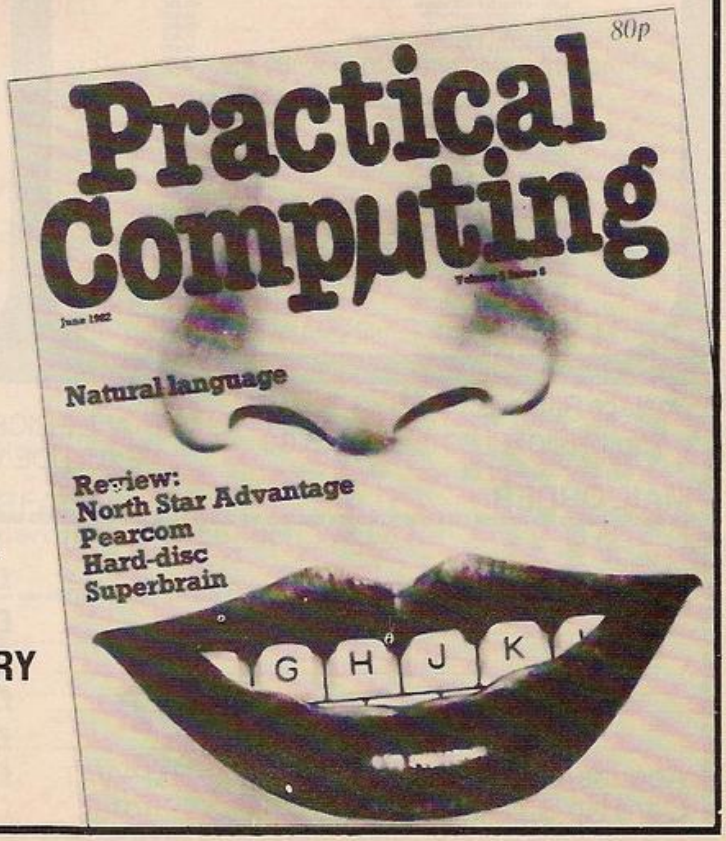
Recorded on quality cassettes, sent by first class post, from:
Michael Orwin, 26 Brownlow Rd., Willesden, London NW10 9QL (mail order only please)

MIND YOUR LANGUAGE

...it's computer language we're talking about. Getting people to understand it is hard enough—but getting computers to understand **our** language...! We've got two features on aspects of computer communication—plus reviews of Pearcom (an Apple lookalike) and two powerful business machines, a description of how a garage computerised its business...

...and that's just a sample of Practical Computing, together with advice for users of Pet, Apple, Tandy and Sinclair ZX 80/81 computers. Buy Britain's leading personal computer magazine.

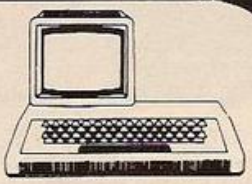
JUNE ISSUE ON SALE NOW
80p AT YOUR NEWSAGENT'S—BUT HURRY



Superior Systems Ltd.

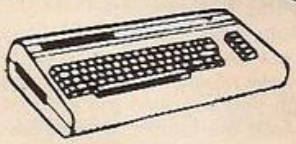
178 West St, Sheffield S1 4ET. Tel.(0742)755005

ACORN



ACORN ATOM 8K rom, 5K ram, P.S.U. & COLOUR BOARD	199.00E
ATOM DISK PACK, 96K SINGLE DISK DRIVE	299.00E
ATOM COLOUR BOARD	39.00C
ATOM GAMES PACK 1-11	10.00A each
WORD PACK ROM	26.00A
FORTH	10.00A
FORTH THEORY & PRACTICE	6.95A
BUSINESS	10.00A
BUSINESS BOOK	6.95A
SYNTHESISER	10.00A
LIFE PACKAGE	10.00A
DESK DIARY	10.00A
DATABASE	10.00A
UTILITY PACK 1	10.00A
SOFT V.D.U.	10.00A
PEEKO COMPUTER	10.00A
MATHS PACKS I & II	10.00 each
WORD TUTOR	10.00A
ADVENTURES	10.00A
ATOM CHESS	10.00A
FLOATING POINT ROM	20.00A
B.B.C. ROM PACK	PHONE
MAGIC BOOK	7.95B
B.B.C. BASIC PROGRAMMING BOOK	5.95B

VIC 20



VIC 20 COMPUTER	PHONE
VIC CASSETTE DECK	39.09O
VIC PRINTER	200.00E
SINGLE DISK DRIVE	344.35E
PROGRAMMERS AID CARTRIDGE	30.39B
MACHINE CODE CARTRIDGE	30.39B
3K RAM CARTRIDGE	26.04B
8K RAM CARTRIDGE	39.09B
16K RAM CARTRIDGE	65.17B
JOYSTICK	6.52B
PADDLES	11.74B
INTRO TO BASIC PART I	13.00B
VIC REVEALED	10.00B
GETTING ACQUAINTED WITH THE VIC 20	7.95B
VIC PROGRAMMERS REFERENCE GUIDE	14.95B
VIC GAMES ROMS, VARIOUS FROM	17.35B
CASSETTE SOFTWARE	
PACK MAN (high resolution)	7.50A
SUBMARINE	7.50A
GUNMAN (high resolution)	7.50A
NAVAL BATTLE	7.50A
SPACE INVADERS	7.50A
FIRE TREK	7.50A
ALIEN WARS	7.50A
HEAD ON	7.50A
VIC CUBE	7.50A
CRAZY BALLOON	7.50A
MOLE ATTACK	7.50A
BALLOON BOMBER	7.50A
SKIER	7.50A
TREASURE CARRYING	7.50A
SUPER MOON LANDER	7.50A
SLOT MACHINE	7.50A

SHARP

MZ80K (48K)	PHONE FOR BEST PRICE
MZ80A (48K)	
MZ80B (64K)	
MZ80 P3 PRINTER FOR MZ80K	360.00E
MZ80 I/O INTERFACE UNIT FOR MZ80K	95.00E
MZ80 FB DUAL FLOPPY DISK FOR SHARP COMPUTERS	550.00E
MZ80 EU INTERFACE UNIT FOR MZ80B	46.00B
MZ80 P6 PRINTER FOR MZ80B	409.00E
PC 1211 POCKET COMPUTER	69.50D
PC 1500 POCKET COMPUTER	139.00D
CE 121 CASSETTE INTERFACE FOR PC 1211	11.26B
CE 122 PRINTER INTERFACE FOR PC 1211	60.83D
CE 150 4 COLOUR PRINTER FOR PC 1500	125.00D
CE 151 4K UPGRADE FOR PC 1500	39.13B
SOFTWARE	
WORDPRO WORD PROCESSOR (tape)	39.50B
WORDPRO WORD PROCESSOR (disk)	79.95B
APOLLO WORD PROCESSOR (tape)	34.95B
DATABASE (cassette based)	29.50B
MZ80 CALC II	34.50B
ZEN EDITOR ASSEMBLER	19.50B
ZEN MOD (modifies Zen)	10.50A
ZEN DOS (editor assembler disk)	37.50B
ZEN DISSASEMBLER	10.50B
PROGRAM FILING INDEX	5.50A
LUNAR LANDER	5.50A
MAP OF ENGLAND	5.50A
CHESS	10.50A
TANKWARP	5.50A
SPACE INVADERS	5.50A
HEAD ON	5.50A
RACING	5.50A
SHOWJUMPING	5.50A
FIREBALLS	5.50A
MONKEY CLIMB	5.50A
FOOTBALL MANAGER	5.00A
COMBAT	5.00A

VIDEO GENIE

COMPOSER	5.00A
BANK ACCOUNT	4.00A
ADDRESS BOOK	4.00A
MZ80K DUST COVER	5.00A
P3 PRINTER DUST COVER	5.00A
GENIE I COMPUTER	295.00E
GENIE II COMPUTER	295.00E
EG 3014 EXPANSION UNIT	199.00E
EG 3015/16 16K RAM CARD	91.50C
EG 3015/32 32K RAM CARD	128.80C
EG 400 SINGLE DISK DRIVE	215.00E
EG 400AT DUAL DISK UNIT	375.00E
COLOUR BOARD FOR GENIE I/II	35.00B
SK2 SOUND KIT	7.50A
DUST COVER FOR GENIE I/II	5.00B
EG 602 GENIE PRINTER	210.00E
SOFTWARE	
AQUIRE BUSINESS GAME	11.27B
BI NUCLEAR BOMBER PILOT	9.53B
CONFLICT 2500	9.53B
MIDWAY CAMPAIGN	9.53B
NORTH ATLANTIC CONVOY	9.53B
NUKEWAR	9.53B
PLANET MINERS	9.53B
TANKTICS	13.88C
ADVENTURES (various titles)	11.97B each
ADVENTURE SAMPLER	8.75B
ALIEN ARMADA	8.75B
ANDROID NIM	8.75B
ASTEROIDS	8.75B
ACCEL II BASIC COMPILER	39.95C
BATTLE OF BRITAIN	13.50B
COPYSIS PROGRAM COPIER	11.25B
CUBE HUNT	9.00B
DATABASE	25.00B
DUEL-N-DROIDS	9.50B
EDITOR ASSEMBLER PLUS	21.70B
INVADERS	13.00B

Postage Rates
a.75p b.1.00 c.1.50 d.2.50 e.5.00

ALL PRICES EXCLUDE VAT

Prices and offers were prepared many weeks before publication of this magazine, and whilst every possible effort will be made to meet our offers, in some cases prices may fluctuate and we would advise you to confirm by telephone before ordering.

MAIL ORDER

Please Supply _____ £ _____

_____ £ _____

_____ £ _____

_____ £ _____

_____ £ _____

Access/Barclay/Cheque P&P+VAT £ _____

Card No. _____ Total £ _____

Name _____

Address _____

_____

_____

_____

Code _____ Tel _____

ZX Users' Club

JOIN YOUR USERS' GROUP — AND MAKE THE MOST OF YOUR MICROCOMPUTER

Join the National ZX80 and ZX81 Users' Club, by subscribing to the official monthly club magazine INTERFACE.

( ) Please send me the next 12 issues of INTERFACE, containing many programs for each machine in each issue, plus hints, tips, software, hardware and book reviews, plus special offers for members. I understand you will be able to help me with problems regarding my computer, and let me know of any local branches of the club in my area. I enclose **£9.50** (UK), **£12.50** (Europe) or **£16.00** (elsewhere).

Please send me the following books:

( ) GETTING ACQUAINTED WITH YOUR ZX81 — by Tim Hartnell — **£5.95**. This great ZX81 book contains over 80 programs in its 128 pages. Takes you from the first steps of programming your ZX81 to quite complex programs such as WORD PROCESSOR, DRAUGHTS and LIFE. You'll find a host of programs to get your ZX81 up and running with worthwhile programs, right from day one. Other programs include SPACE BOY, ROLLER-BALL, CHEMIN DE FER, GRAFFITI, MICRO-MOUSE, POGO, TOWERS OF HANOI, BLOCKOUT, SALVADOR, BANDIT and DODGE CITY.

As well as programs, there are sections to explain the use of PLOT, UNPLOT, PRINT AT, MAKING THE MOST OF 1K, ARRAYS, WRITING PROGRAMS, BIO-RHYTHMS, ARCADE GAMES, RANDOM NUMBERS, PEEK AND POKE, HOW TO CONVERT PROGRAMS, USEFUL ADDRESSES, SPECIFICATIONS, THE NEW ROM.

( ) THE GATEWAY GUIDE TO THE ZX81 AND ZX80 — by Mark Charlton — **£6.45**. Explains ZX BASIC from first principles. 180 pages, more than 70 programs. Recommended by Creative Computing.

( ) MASTERING MACHINE CODE ON YOUR ZX81 OR ZX80 — by Tony Baker — **£7.50**. Warmly welcomed by the computer press, this book has continued to attract praise, because it does exactly what it claims to do in the title.

( ) 49 EXPLOSIVE GAMES FOR THE ZX81 (and 29 for the ZX80) — edited by Tim Hartnell — **£5.95**. Every game you need: DRAUGHTS, GALACTIC INTRUDERS, STAR TREK, DEATH MAZE, 4-IN-A-ROW and an 8K ADVENTURE-type program SMUGGLERS BOLD.

( ) 34 AMAZING GAMES FOR THE 1K ZX81 — by Alastair Gourlay — **£4.95**. All programs dumped from the printer and guaranteed to run. This book is the key to making the most of 1K.

( ) GETTING ACQUAINTED WITH YOUR VIC20 — by Tim Hartnell — **£6.95**. This book is the ideal one for first-time users of the VIC 20, with over 60 programs.

( ) SYMPHONY FOR A MELANCHOLY COMPUTER and other programs for the VIC20 — **£6.95**. A great collection of 24 great games — all dumped direct from the printer — for the VIC20.

( ) GETTING ACQUAINTED WITH YOUR ACORN ATOM — by Trevor Sharples and Tim Hartnell — **£7.95**.

( ) 39 TESTED PROGRAMS FOR THE ACORN ATOM (the best of INTERFACE) — **£6.45**.

( ) PASCAL FOR HUMAN BEINGS — Jeremy Ruston — **£6.45**.

ATOM
VIC

INTERFACE,
44-46, Earls Court Road, Department YC, London W8 6EJ.

Please send me the indicated items. I enclose £----------.

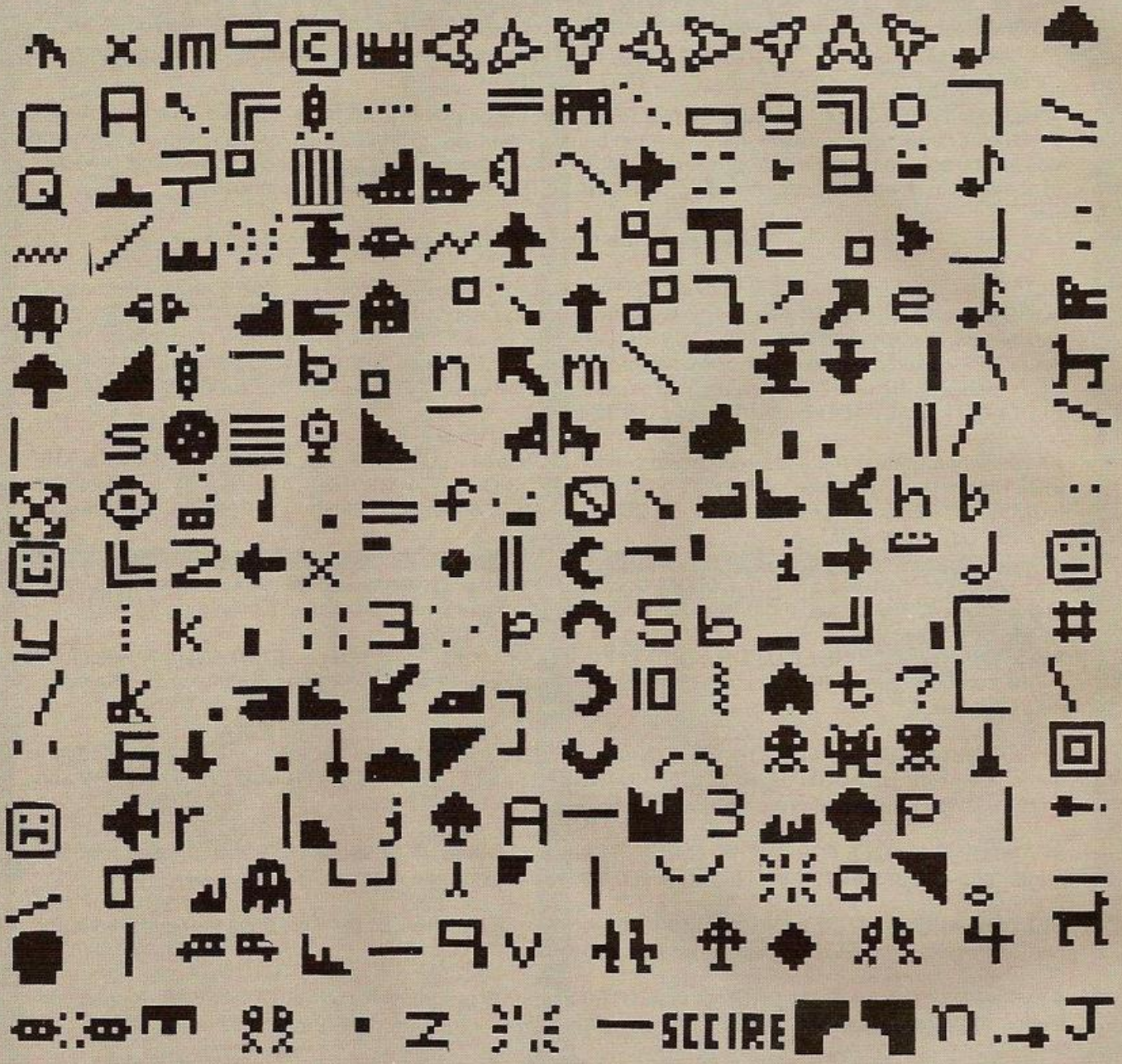
Name ----------

Address ----------

---------- YC

dK'tronics ZX 80/ 81

4K GRAPHICS ROM



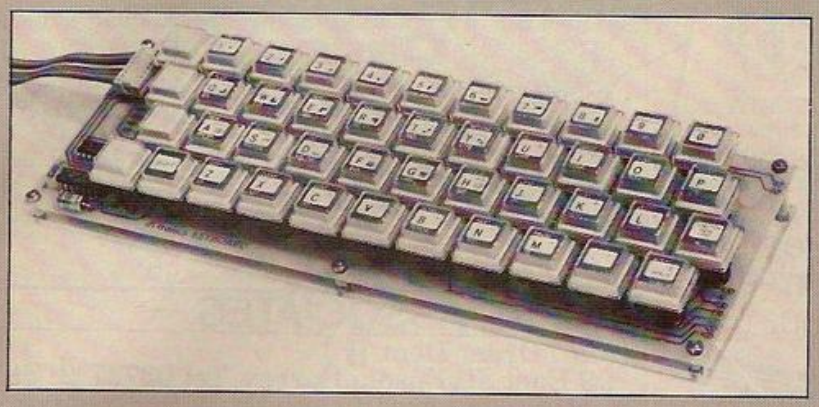
SOME OF THE GRAPHICS NOW POSSIBLE ON THE ZX81

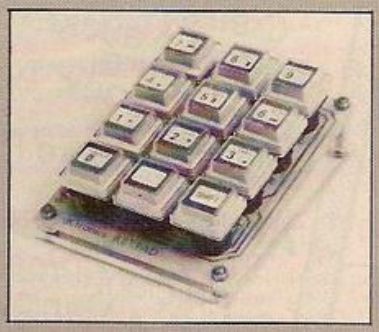
The dK Graphic module is our latest ZX81 accessory. This module, unlike most other accessories fits neatly inside your computer under the keyboard. The module comes ready built, fully tested and complete with a 4K graphic ROM. This will give you 448 extra pre-programmed graphics, your normal graphic set contains 64. This means that you now have 512 graphics and with there inverse 1024. This now turns the 81 into a very powerful computer, with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders graphics and that only accounts for about 50 of them, there are still about 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there; it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K RAM and can be used for user definable graphics so you can create your own custom charactor sets. **£29.95.**

HARDWARE/ SOFTWARE

ZX KEYBOARD

Now with repeat key and facilities to add numaric pad. The keyboard has all the 80/81 functions on the keys.
The keyboard has been specially designed for the Sinclair computer and is supplied ready-built. It also has facilities for 3 extra buttons which could be used for on/off switch, reset, etc. **£27.95.** Numaric add on **£10.**





MEMORY 80/81
16K RAM MASSIVE ADD-ON MEMORY
for 80/81 ONLY £25.00

81 SOFTWARE

CENTIPEDE
This is the first implementation of the popular arcade game on any micro anywhere. Never mind your invaders, etc., this is positively stunning, the speed at which this runs makes ZX invaders look like a game of simple snap. £4.95.

3D/ 3D LABYRINTH
You have all seen 3D Labyrinth games, but this goes one stage beyond; you must manoeuvre within a cubic maze and contend with corridors which may go left/right/up/down. Full size 3D graphical representation. £3.95.

TOOL KIT
An extremely powerful tool kit for use with the 16K 81 uses 4K of memory space. £6.95.

GRAPHIC ROM SOFTWARE
Centipede. The graphic rom version of our popular centipede game. £4.95.

SPACE INVADERS
Is the only real version of space invaders on the ZX81. £4.95.

ASTEROIDS
New for the Graphic Rom, a brilliant version of the arcade asteroid game. £4.95.

dK'tronics

23 Sussex Road, Gorleston,
Great Yarmouth, Norfolk.
Telephone: Yarmouth (0493) 602453

THE ZX81 POCKET BOOK

A STACK OF GAMES AT YOUR FINGERTIPS

BOOK

136 PAGE BOOK

Programs
- *ZX81 ADVENTURE.
  - City of Alzan
  - Create your own
- BALL AND BUCKET
- PAINT-A-PIC
- DIGITAL CLOCK
- *SKI RUN

Plus 20 more Programs

Articles
- Using machine code
- Efficient Programming
- String Manipulation
- Plus more

ONLY £5.95 inc P.P

*REQUIRE 16K RAM

Also available

TAPE

ZX81 *Adventure
- GREEDY GULCH
- MAGIC MOUNTAIN
- PHARAOHS TOMB

ALL 3 for £5.00 inc vat & P.P

***ZX81 Pocket book Cassette**

All programs & subroutines from the book on 1 tape

£5.00 inc vat & P.P

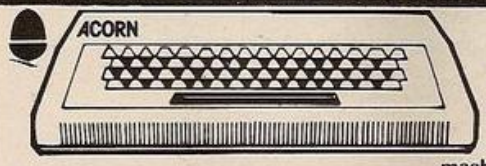
BARCLAYCARD VISA

Access

PHIPPS ASSOCIATES
(Mail Order Dept B)
99 East St, Epsom Surrey, Tel 03727 21215
quoting your credit card No, 24hr phone service
Air Mail Europe plus 70 p Elsewhere plus £1.70

MICROAGE ELECTRONICS

LONDON'S BIGGEST ACORN STOCKIST



OFFICIAL BBC STOCKIST

Working BBC machine in stock. Call in for 'hands — on' experience.

ATOM KITS
In our books the best computer kit available. Build yourself an Acorn Atom for **only £135.** plus £2.50 p+p

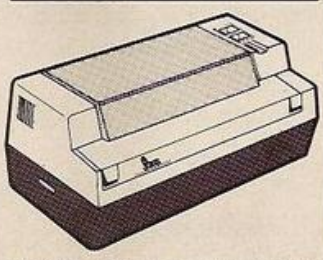
New Software from Acornsoft.
Come and get them all including Atom Chess • Desk Diary • Adventures • Interactive Teaching • FORTH • Atomcalc • Database LISP • Game Packs 1 — 11 • From £11.50 + 30p p&p

BBC ROM
Update your Atom to the BBC operating system.

Atom Discpack. £345
5¼ discpack only £345, operating manual, cables. plus £2.50 p+p

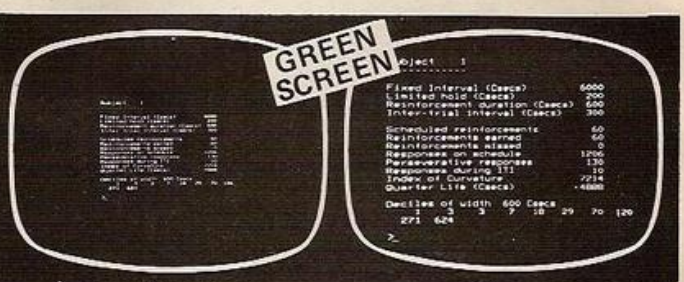
The BBC Cassette Recorder £28
As chosen by the BBC, but cheaper! £2.50 p+p

ORDERS TAKEN NOW FOR BBC MACHINE



THE GP - 80A dot matrix printer.
LOWEST EVER PRICE
ONLY £199 £4.50 p+p
Dot Matrix, Full 96 ASC11 character

New! Just arrived.
The fantastic GP100A printer. Full printing width.



FROM THIS —— TO THIS AT THE FLICK OF A SWITCH

With the new ZENITH Monitor. Choose between small or large format depending on what you're doing. Small format for definition, large format for display. Full 12" GREEN screen. Only £85 while stocks last. It doesn't change the output from your computer, just changes the size of the display. Ideal for VIC 20, TRS 80, Atom, BBC, + Genie machines. £4.50 p+p

Blank Cassettes 40p each, **£3.50 for 10.** 70p p+p

Also available:
2114 IC's, Paper for most printers, Enormous selection of Books, Leads, etc, etc, etc,

RACOMM COLOUR MONITOR
Absolute high resolution. 700x300 pictals 12" £350 + £5 p+p Atom BBC, & Genie machines.

DAI Personal Computer. £684
48K RAM 24K ROM

If it's not in the advertisement, send for our mail order lists.

We accept company/ institutional orders.

ALL PRICES INCLUDE VAT ABSOLUTELY NO MORE TO PAY.

MICROAGE ELECTRONICS
135 HALE LANE EDGWARE MIDDLESEX HA8 9QP
TEL: 01-959 7119 TELEX 881 3241

30+ PROGRAMS FOR THE BBC MICROCOMPUTER

This Book contains program listings, with explanations and tips on using the BBC Micro
GAMES UTILITIES EDUCATIONAL GRAPHICS & MUSIC
'ASTRO RUN' 'SCREEN PLAY' '3D GRAPHICS' . . .
Most programs will run on Models A & B
Edited by C.J. Evans, various Authors. April 82
£5.00 inclusive of p&p

CARRYING CASES FOR MICROS

Fibreboard cases for: ZX81: BBC Micro: Acorn Atom: Vic: Apple: 2 Apple Disks: Atari 400 or 800 £18.50 p&p £2.50
For ZX81 only, COMPACT BLACK ABS CASE £21.00 p&p £2.50

Cases are foam padded with cutouts for: Micro, PSU & Cassette Recorder. ZX81 Cases also have room for RamPack & Printer. Apple cases have room for Micro only. Fibreboard cases can be supplied modern suitcase style or robust old fashioned style with strengthened corner pads.

Cassette leads for the BBC Micro
The BBC Micro comes with an incomplete lead

7Pin Din to 7Pin Din		£4.65 p&p 35p
7Pin Din to 5Pin Din & 2.5mm minijack		£4.65 p&p 35p
7Pin Din to 2×3.5mm & 1×2.5mm minijacks		£4.65 p&p 35p
7Pin Din PLUGS	Two for	£0.65 p&p 35p
PRINTER CABLE (Centronics type)		£17.00 p&p 50p

RAM CHIPS

4816 As used in the BBC Micro 8 Chips gives 16k	£5.00 each
2114 As used in the Acorn Atom 20 Chips gives 10k	£1.30 each
6116 As can be used to replace the Ram chip inside the ZX81 to give 2k internal Ram	£7.50 each

p&p Ram chips 50p per order

Programs & Hardware designs for the BBC Micro wanted.
VAT INCLUDED WHERE APPLICABLE
Send SAE for full Price List

C.J.E. Microcomputers
25 HENRY AVENUE, RUSTINGTON, W. SUSSEX BN16 2PA (09062) 74998

CARNELL SOFTWARE

ZX81 ADVENTURE SPECIALISTS

C2: VOLCANIC DUNGEON/HANGMAN £4.50

A) VOLCANIC DUNGEON: Rescue if you can, the Elfin Princess. Mythical monsters, pits, firey caverns, diminishing strength and water make your quest anything but easy.
FULL 16K PROGRAM** SAVE GAME ROUTINE** SINGLE KEY ENTRY**
"Volcanic Dungeon is terrific value and I would recommend it to anyone." *Mrs. Thomas, Cornwall.*

B) HANGMAN: Deluxe version of the classic game. Play against an opponent, or the computers 400 word vocabulary. Good graphics.

C3: ALIEN INTRUDER/HIEROGLYPHICS £5.00

A) ALIEN INTRUDER: You awaken to find you are the only survivor on the Explorer Class 3 Starship. Can you escape before you also fall victim to the Alien monstrosity that devoured the crew? There are many ways to end this adventure but only one way to survive!
FULL 16K PROGRAM** INTERACTIVE GRAPHICS**
SAVE GAME ROUTINE**

B) HIEROGLYPHICS: Decode the ancient 39 symbol alphabet in time to save the famous explorer, "Wullie Makeit" from a sandy grave.
FULL 16K PROGRAM** ANIMATED GRAPHIC DISPLAY**
RANDOM CODE**

C4: WUMPUS ADVENTURE/MOVIE MOGUL £5.00

A) WUMPUS ADVENTURE: **FOR 1 TO 4 PLAYERS!** Seek the famous creature in the most dangerous Wumpus hunt ever. All the usual features are there SUPERBATS* PITS* TREMORS* SWAMPS* MAGIC ARROWS**
PLUS Exciting new features: EVIL GOBLINS that will try to sacrifice you to the Wumpus. GIANT SERPENTS* WUMPUS MUCK* MAGIC SPRINGS**
FULL 16 PROGRAM** RANDOM & PRESET CAVE PATTERNS**
YOU CONTROL THE LEVEL OF DIFFICULTY** GREAT FUN FOR YOU AND YOUR FRIENDS**

B) MOVIE MOGUL: Guide your film through the often hilarious traumas of production. Use your budget wisely and you may make a fortune. Success depends on many factors and not just luck.
FULL 16K PROGRAM***

ORDERS: Plus 50p P&P or large S.A.E. for list to:
CARNELL SOFTWARE,
4 STAUNTON ROAD, SLOUGH, BERKS. SL2 1NT.
The above are also available from:
BUFFER MICROSHOP, STREATHAM, LONDON.

OAKLEAF COMPUTERS LTD

Education Hobbyist & Small Business Computers

Dimensions: H 8½", W 26¾", D 12"
Aperture: H 4½", W 17½"

ITS NOT JUST ACORNS THAT LOOK BETTER ON AN

OAKTREE WORKSTATION

THE UNIT SUITS BBC A&B APPLE PET ZX81 VIC 20 TRS 80 ETC.

JUST RELEASED

TWIN USER JOYSTICK INTERFACE
£12.95 ALL INCLUSIVE

Protect the keyboard of your fully expanded Atom by interfacing Atari joysticks to it. The joysticks plug into the interface which in turn simply plugs to the 64 way bars, (available at £3.99 inc. if ordered with the unit). Now two people can successfully play games or one person can have more control over the Atom. Full software supplied. Some conversions are given for the more popular Atom software packages including Bug Byte, Program Power and Acornsoft.

With a built in accessory drawer, this smart unit turns your set up into a professional and business-like system. The drawer holds up to 50 diskettes or your tape collection and leads etc.

£19.95 ALL INCLUSIVE

Order by telephone quoting your card number or write enclosing your remittance to:

121 DUDLEY ROAD, GRANTHAM, LINCS NG31 9AD
Tel: (0476) 76994

ACORN SPECIALISTS

BBC SOFTWARE

Wordwise

The Word Processor for the BBC Micro Computer.

Word processor for the Model B Micro. Supplied in ROM and therefore leaving about 27K for text, over 4000 words. All the usual word processor features plus several unusual ones like a fully automatic word count. Available soon for £65.00 + £1.50 p&p + VAT. Ask for leaflet describing WORDWISE in more detail.

RAM UPGRADE kit to increase Model A to 32K RAM. Run Model B programs and graphics. Supplied with instructions — around £30.00 + VAT. Phone or write for latest price and availability.

CASH waiting for any good programs to add to our range. We pay excellent royalties or cash.

COMPUTER CONCEPTS

DEPT YC1
16 WAYSIDE
CHIPPERFIELD
HERTS WD4 9JJ
(09277) 62955

HILDERBAY LTD
PROFESSIONAL SOFTWARE

If you don't believe that the Sinclair ZX81 can do real work, come and see us at the Computer Fair Exhibition, Earls Court (23rd-25th April) and the ZX Micro Fair, Central Hall, Westminster, London SW1 (30th April-1st May).

ZX81 & 16K SOFTWARE: Reviewed in "Your Computer" (Feb. 1982).

- ★ **Payroll** for up to 30 employees. Meets all regulations £25.
- ★ **Stock Control** Fast, big, and versatile £25.
- ★ **Budget** £15.
- ★ **Critical Path Analysis** Up to 500 activities £15.
- ★ **VAT & Mortgage & Loan** £8.
- ★ **GOLD:** A really good adventure; together with the intriguing "Pick a Word". £8.
- ★ RELIABLE 16K RAM Pack for the ZX81 £42.
- ★ **BEAMSCAN:** Beam analysis for architects and engineers £25.
- ★ **APPLE II** Payroll: £35.
- ★ **HEWLETT PACKARD 9845B:** Superspline (general purpose interpolation and tabulation).
- ★ **MEMOTECH** 64K Memopak £79.

DO YOU HAVE DIFFICULTY LOADING TAPES! We have the answers; and for well under £10.
Contact us for more details.

CROFTON PROFESSIONAL KEYBOARDS, MONITORS, VDU's
Prices include VAT, Post & Packing. COD Orders £2 extra.

TAPE HINT: Don't use the first 20 seconds of your cassettes — most tape problems are found near the ends of the tape.

HILDERBAY LTD
8/10 PARKWAY, REGENTS PARK
LONDON NW1 7AA

Enquiries for Hilderbay Ltd. will now be handled by HOLDCO LTD. Tel. 01-251 3090

ALSO ON ZX81 + 16K

Financial Budget/ Cash Flow Forecast: The program allows thirteen columns (12 months + total). The forecast can be changed and a "WHAT IF?" possibility can be examined on the screen. £25.

Sales Day Book: keeps a record of all invoices, with nett, VAT, zero rated and total. £18.

Purchase Day Book: keeps records of all purchases and VAT. £18.

Petty Cash Book: Keeps a record of all petty cash expenses and allows for VAT to be calculated from total if unknown. £18.

Cash Sales Day Book: as sales day book but with the additional "Method of payment" feature, incl. cash, cheque, postal order, Access, Barclays, sundries and unpaid. £18.

Cassette Recorders: individually tested for ZX81 and supplied with a test tape for loading. £22.

Barcharts for Architects: a simplified version, takes away the tedious task of manually handling the problem £25.

Bank Account: calculate your bank charges whilst keeping your account £5.

Architects Programs: Barchart with S-curve/Dewpoint calculations N.B.S. on computer/Structural programs/etc. etc.

All programs now also available for ATARI and SHARPE

HOLDCO LTD.
14, BRITTON STREET
LONDON EC1M 5NQ
Tel: 01-251 3090

FOOTBALL MANAGER

Addictive Games

for
ZX81
ZX80
TRS80
VIDEO GENIE

JUST LOOK AT THESE FEATURES

★ AS MANY SEASONS AS YOU LIKE ★ 4 DIVISIONS ★
★ PROMOTION & RELEGATION ★
★ FULL LEAGUE TABLES ★
★ TRANSFER MARKET ★
★ INJURIES ★
★ 7 LEVELS OF PLAY ★
★ SAVE GAME FACILITY ★
★ MANAGERIAL RATING ★
★ PICK YOUR TEAM FOR EACH MATCH ★ F.A. CUP ★

This is NOT a mere simulation. This is an exciting and highly enjoyable game in which you play the part of a Football Manager coping with the problems and decisions involved in running your club. There are so many features it is impossible to list them here but included are form (top teams NORMALLY win), giant-killings, wage bills to pay, and you can even be sacked! It is a game requiring a great deal of skill, and people play it for literally hours on end (we have proof!).
WE GUARANTEE that this is one of the best computer games you've ever played!
BUT BEWARE, this game is extremely addictive!

FOOTBALL MANAGER - IS SUPPLIED WITH INSTRUCTIONS - OCCUPIES THE ENTIRE 16K RAM

HARDWARE REQUIRED	
ZX81/ ZX80	TRS80/ Video Genie
8K ROM 16K RAM	LEVEL II 16K RAM

To Order send Cheque/P.O. for £7.95 *made payable to:* ***ADDICTIVE GAMES*** *at:* ***Dept. Y.C. P.O. Box 278 CONNIBURROW MILTON KEYNES MK14 7NE***
PLEASE STATE COMPUTER

COLOUR ON A ZX!

From **Ellanbee** (Graphics)

Now you can add a coloured background to your displays with high quality P.V.C. in either blue or green.

ONLY £2-95 + p.p. per pack*

- * No loss of clarity
- * Cuts eye strain considerably
- * Easily removed
- * Strong flexible P.V.C.
- * Each sheet measures 15" x 12" (Larger sizes available on request)
- * Fits most b/w TV's up to 19" screen
- * Full instructions provided

Send cheque/P.O. to:-
Ellanbee (Graphics)
MICHAEL HOUSE, NORTH BURNS
CHESTER-LE-STREET
CO. DURHAM DH3 3TF
Tel: (0385) 886987

* Pack contains 1 Blue & 1 Green
Please allow 28 days for delivery
Postage & Packing 0.55p *

PUT YOUR MICRO TO WORK!

YOUR MACHINE

CONTROL MACHINES, ROBOTS, FACTORY OR HOME

Have you ever wanted your MICRO to control a machine for you, or manage your house? If so, the MDR 'MICROCOMPUTER CONTROL INTERFACE' will give you isolated channels of OUTPUT (8A @ 250 volts) and switch sensing INPUTS.

Available now for connection to PET USER, PORT, RS232 and IEEE488, allowing expansion up to more than 900 channels.

Supplied complete with connecting cables, full data and guarantee from £12.54 per channel. Complete preprogrammed systems or individual components available. Write or phone for details.

M D R (INTERFACES) LTD.
Little Bridge House, Dane Hill,
Nr. Haywards Heath, Sussex RH17 7JD.
Telephone: 0825-790294.

THE

BUFFER MICRO SHOP

(NEXT TO STREATHAM STATION)

NEW SOFTWARE SHOP EXCLUSIVELY FOR

ZX81

PROGRAMS, GAMES, "ADD-ONS"

MOST OF THE MAIL ORDER ITEMS ADVERTISED IN THIS MAGAZINE AVAILABLE OVER THE COUNTER

LOADING PROBLEMS? TRY OUR INTERFACE
BUSINESS & TECHNICAL DATA HANDLING PROGS;
PROPER KEYBOARDS; CONSOLES; VDUs

The BUFFER Micro Shop,
374a Streatham High Road,
London SW16
Tel: 01-769 2887

ZX81 GAMES

FED UP WITH BEING RIPPED OFF?
HAVE YOU BOUGHT
BORING/WORTHLESS/RUBBISH GAMES?
DON'T DESPAIR, TRY THESE!

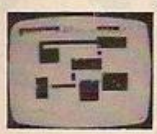
GAMESTAPE 1, for 1K **only £3.95**
10 games incl. ASTEROIDS, UFO, CODE, BOMBER, GUILLOTINE, ETC.
PROBABLY THE BEST VALUE 1K TAPE AVAILABLE!
We've done in 1K, games that some of our competitors required 16K to do!

ASTEROIDS

STARFIGHTER

GAMESTAPE 2, for 16K **only £4.95**
*STARFIGHTER . . . You are fighting at the end of the universe, how many enemy can you destroy? A graphic simulation.
PYRAMID . . . Can you move the PYRAMID? Make a mistake and it will collapse! A thinkers game.
ARTIST . . . become an ARTIST, then use the 10 memories to store your drawings. Incl. SAVE, COPY, etc.

GAMESTAPE 3, for 16K **only £4.95**
*CATACOMBS . . . A Multi-Level Graphics Adventure. You are alone and lost in the CATACOMBS. How long can you survive? Before you starve to death, or one of the many MONSTERS gets you! Can YOU discover the secrets of the CATACOMBS.



3D MONSTER MAZE GAMESTAPE 4, for 16K only £5.95
Unbelievable Graphics! Can you find your way through the Maze? The EXIT is there somewhere, but then so is a T.REX and its after YOU! All in 3D, you've never seen anything like this before!

*GAMES MARKED * incl. Machine Code*

J. K. GREYE SOFTWARE

Dept. YC, 16 PARK STREET, BATH, AVON BA1 2TE

Trade enquiries welcome

Bridge Software

RAM Packs

FOR THE ZX81 — with FREE BS software

Both RAM packs use same neat black ABS plastic case (only 27 × 47 × 76 mm.)
Supplied with foam strip connector to improve mechanical stability
Fully compatible with ZX Printer

* 16k RAM now only £32-50!
NEW! 64k RAM (54k user-addressable) £75-00

0-8k Sinclair BASIC ROM
8-16k Machine code area unaffected by LOAD, SAVE, NEW
16-32k BASIC program area
32-64k BASIC variables and/or machine code

When ordering either RAM choose any one item from our range of software **absolutely FREE**

BS Quality Software

ZX81 GALAXY INVADERS (minimum 4k RAM needed) in machine code
Cassette and instructions £3.00
INVADERS for the unexpanded **VIC20**. Machine code, colour and sound
Cassette and instructions £6.90
ZX81 MULTIGRAPHICS (16k RAM needed) create drawings, advertising displays etc. on screen. Numerous printing styles including lower case. Displays may be SAVEd on tape, printed on your ZX Printer Cassette and 20 page Manual £4.50
ZX81 1k GAMES (5 real-time and educational games)
Cassette and instructions £3.00
ZX81 1k GRAPHICS (Kaleidoscope, Large Print, Medium Print, Draw A Picture)
Cassette and instructions £3.00
Manual only (12 pages containing accurate listings, notes, information and ideas) £3.00
Package of cassette and Manual £4.50
ZX81 1k STATISTICS (4 programs of descriptive and inferential statistics)
Cassette and instructions £3.00
Booklet (8 pages containing listings, test data etc.) £2.00
Cassette and booklet £4.00

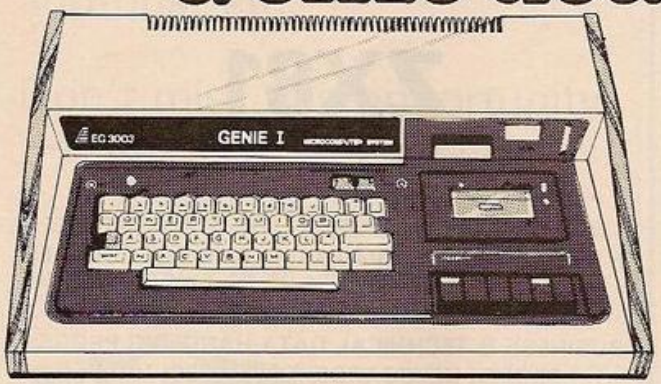
ZX80 software also available

Prices all-inclusive in British Isles
European customers please add 30p per software item; worldwide 70p.
Overseas customers write for details of hardware mailing charges.

BRIDGE SOFTWARE (Y) **Mail order only**
36 FERNWOOD, MARPLE BRIDGE, STOCKPORT, CHESHIRE SK6 5BE
Send s.a.e. for details

STOP PRESS! SPECTRUM software ready soon!!

Wherever you are in the UK there's a Genie dealer nearby



Genie I & II Approved Dealers

AVON Microstyle, Bath, 0225 334659/319705. **BEDFORD** Comserve, Bedford, 0234 216749. **BERKSHIRE** P.C.P., Reading, 0743 589249. Castle Computers (Windsor), 07535 58115. **BIRMINGHAM** Ward Electronics, Birmingham, 021 554 0708. Consultant Electronics, Birmingham, 021 382 7247. A. E. Chapman and Co., Cradeley Heath, 0384 66497/8. **BUCKINGHAMSHIRE** Photo Acoustics, Newport Pagnell, 0908 610625. **CAMBRIDGESHIRE** Cambridge Micro Computers, Cambridge, 0223 314666. **CHESHIRE** Hewart Electronics, Macclesfield, 0625 22030. Mid Shires Computer Centre, Crew, 0270 211086. **CUMBRIA** Kendal Computer Centre, Kendal, 0539 22559. **DORSET** Blandford Computers, Blandford Forum, 0258 53737. Parkstone Electrics, Poole, 0202 746555. **ESSEX** Emprise, Colchester, 0206 865926. **GLOUCESTERSHIRE** Computer Shack, Cheltenham, 0242 584343. **HERTFORDSHIRE** Photo Acoustics, Watford, 0923 40698. Q Tek Systems, Stevenage, 0438 65385. Chrisalid Systems and Software, Berkhamsted, 044 27 74569. **KENT** Swanley Electronics, Swanley, 0322 64851. **LANCASHIRE** Harden Microsystems, Blackpool, 0253 27590. Sound Service, Burnley, 0282 38481. Computercat, Leigh, 0942 605730. BEC Computerworld (Liverpool) 051-708 7100. **LEICESTERSHIRE** Kram Electronics, Leicester, 0533 27556. **LONDON** City Microsystems, EC2, 01 588 7272/4. Wason Microchip, N18, 01 807 1757/2230. Premier Publications, Anerley SE20, 01 659 7131. **NORTH EAST** Briers Computer Services, Middlesborough, 0642 242017. General Northern Microcomputers, Hartlepool, 0783 863871. HCCS Associates, Gateshead, 0632 821924. **NOTTINGHAMSHIRE** Midland Microcomputers, Nottingham, 0602 298231. Mansfield Computers, Mansfield, 0623 31202. East Midland Computer Services, Arnold, 0602 267079. Electronic Servicing Co., Lenton, 0602 783938. **NORFOLK** Anglia Computer Centre, Norwich, 0603 29652. Bennetts, Dereham, 0362 2488/9. **OXFORDSHIRE** Micro Business Systems, Whitney, 0993 73145. Pebbleglow Ltd. (Thame) 084421 5368. **SCOTLAND** Esco Computing, Glasgow 041 427 5497. Edinburgh: 031 557 3937. Computer and Chips, St. Andrews, 0334 72569. Scotbyte Computers, Edinburgh, 031 343 1055. Victor Morris and Co., Glasgow, 041 221 8958. **SHROPSHIRE** Tarrant Electronics, Newport, 0952 814275. **SOUTH WEST** Diskwise, Plymouth (0752) 267000. West Devon Electronics, Yelverton, 082 285 3434. Bits and Bytes, Barnstaple, 0271 72789. **SUFFOLK** Elgelec Ltd., Ipswich, 0473 711164. **SURREY** Croydon Computer Centre, Thornton Heath, 01 689 1280. **WALES** Tryfan Computers, Bangor, 0248 52042. **WEST MIDLANDS** Allen TV Services, Stoke on Trent, 0782 616929. **WILTSHIRE** Everyman Computers, Westbury, 0373 823764. B & D Computing (Swindon), 0793 762449. **YORKSHIRE** Media 5 Ltd; Sowerby Bridge 0422 33580. Advance TV Services, Bradford, 0274 585333. Huddersfield Computer Centre, Huddersfield, 0484 20774. Comprite, Bradford, 0274 668890. Superior Systems Ltd., Sheffield, 0742 755005. Photo Electrics, Sheffield, 0742 53865. Ebor Computer Services (York) 0904 791595. **NORTHERN IRELAND** Business Electronic Equipment, Belfast, 0232 46161. Brittain Laboratories, Belfast 0232 28374.

Sole Importers:

LOWE electronics

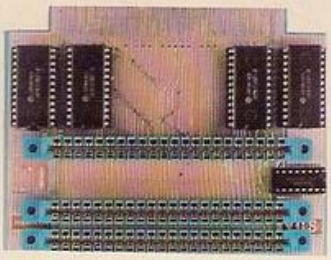
Chesterfield Road, Matlock, Derbyshire DE4 5LE.
Telephone: 0629 4995. Telex: 377482 Lowlec G.

MORE MEMORY FOR MICROS !

look at what we can offer :

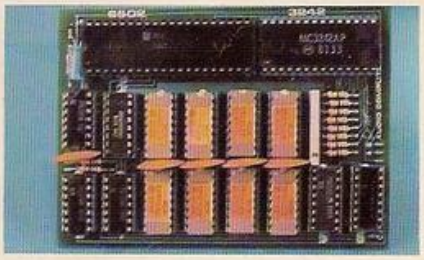
RAMPACKS

for SINCLAIR ZX81



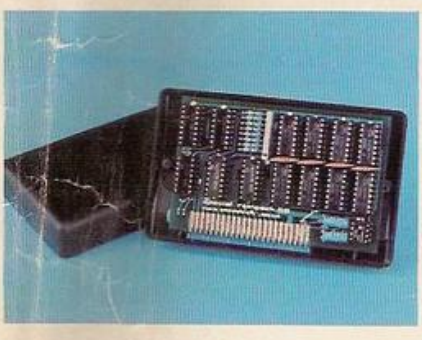
VCS 8K for VIC

8k RAM + 3 slots **£44**



DUO1 for ATOM

64k RAM only **£70**

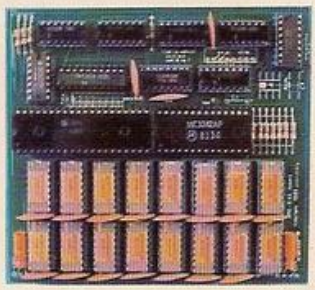


16K - the only upgradable to 56k on the market - £36

add up to 20k RAM + 16k ROM

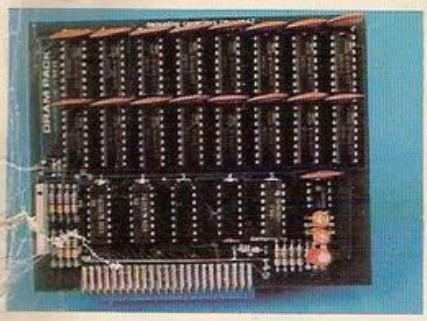
VCR 20 for VIC

4K - £24, 2k increment - £5



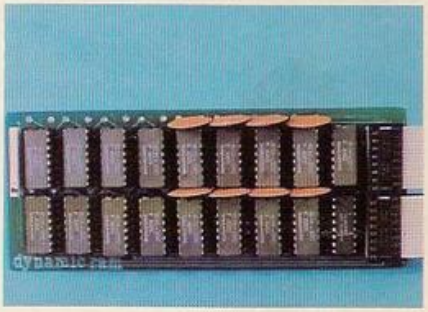
DRC for PET

64K - £80 128K - £130

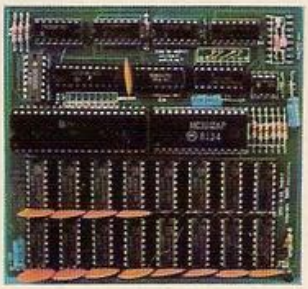


TRS80 - V.GENIE

32K bytes - £54

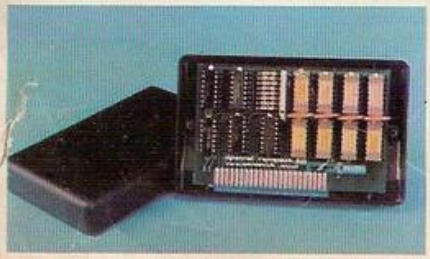


32K add on RAM £46

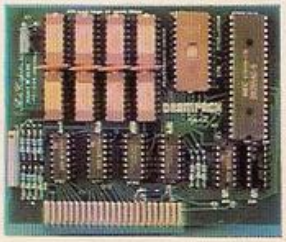


UK101:

32K add on RAM £69



56K - exceptional low power consumption - £60



64K + Eprom programmer & user port - only £79

FOR A FREE BROCHURE, RING LINDA OR SUE ON SOUTHEND (0702) 613081
FOR CREDIT CARD ORDERS, RING JACKIE OR PAM ON SOUTHEND (0702) 618144

CHEQUES AND P.O.'s TO :

AUDIO-COMPUTERS

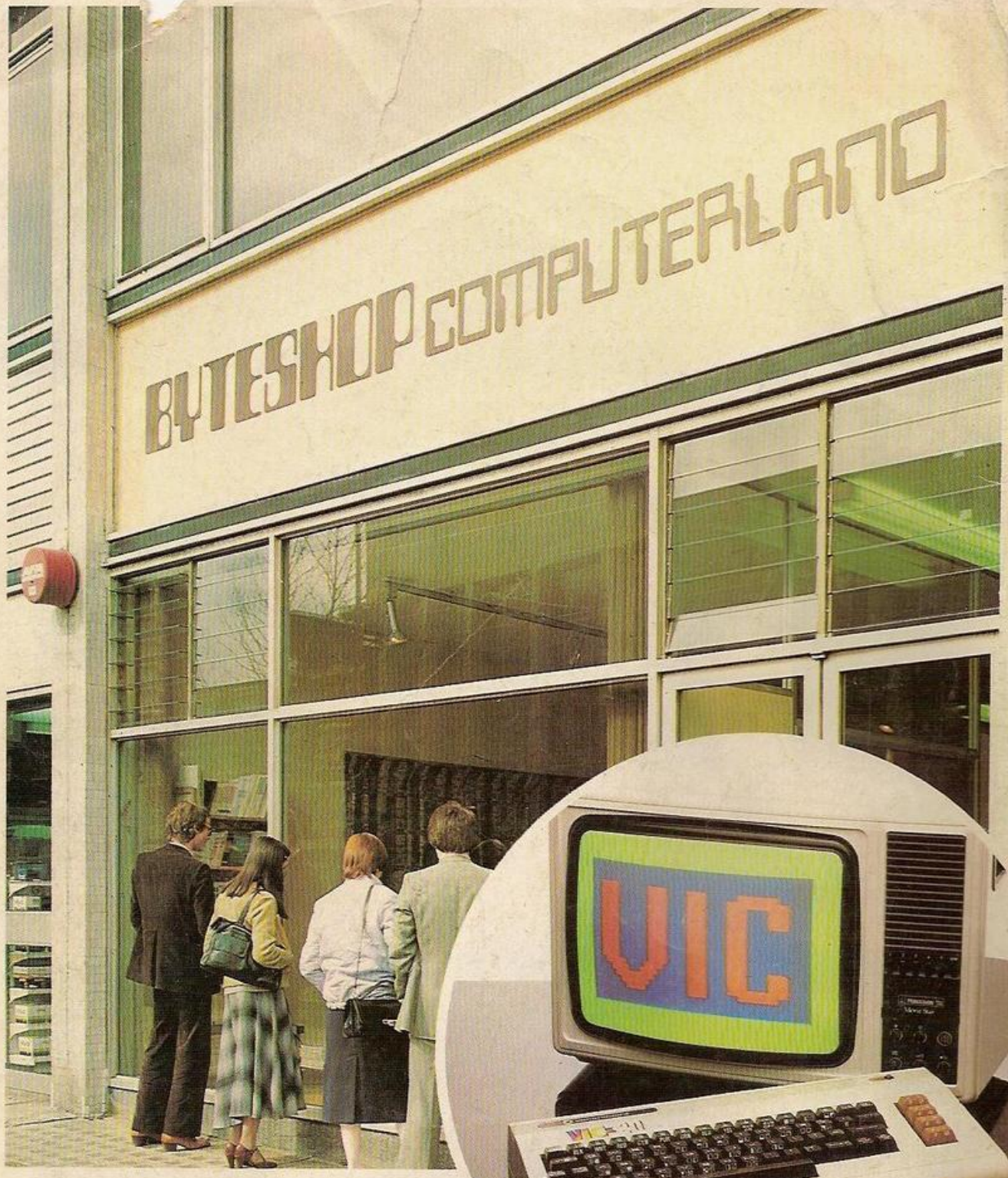
87 BOURNEMOUTH PARK ROAD,
SOUTHEND ON SEA - ESSEX SS5 2JJ

ALL PRICES INCLUDE V.A.T. AND POSTAGE

TELEX 995337 G AUDCOM

A TRADEMARK OF SOLIDISK LTD.

106 HILARY AYR



VIC 20

See it here, buy it now

AT YOUR LOCAL BRANCH TODAY!

Birmingham Byteshop Computerland 94/96 Hurst St, B5 4TD **Tel:** 021 622 7149 **London** Byteshop Computerland 324 Euston Road London W1 **Tel:** 01-387 0505 **Nottingham** Byteshop Computerland 92A Upper Parliament St NG1 6LF **Tel:** 0602 40576 **Manchester** Byteshop Computerland 11 Gateway House Piccadilly Station Approach **Tel:** 061 236 4737 **Glasgow** Byteshop Computerland Magnet House 61 Waterloo St, G2 7BP **Tel:** 041 221 7409

A member of the Comart Group of Companies.