

**HARDWARE.....SOFTWARE.....AT HOME.....IN BUSINESS**

# **computing today**

**JANUARY 1982**

ISSN 0142-7210

**70p**

**FOR A PERSONAL  
APPROACH TO MICROCOMPUTING**

## **Programming for the hand-held revolution with Sharp's PC1211**



**Is the Super Brain  
still a challenger in the  
desktop system stakes?**

**Going FORTH,  
a language to mould  
to your own requirements**

**Bring logic to adventure  
with the White Barrows**

**Special Report:  
Two small printers -  
better quality copy?**





# ingenious!

...that's the only word to really describe the superb Genie microcomputer system, the home compatible with the TRS 80, and ideal for enthusiasts, especially the committed hobbyist. Genie has now been upgraded to Genie I, incorporating all of the original, excellent features, but with the addition of:

- Extended BASIC, including RENUMBER and SCREEN PRINT.
- Full upper and lower case, flashing cursor and auto-repeat on all keys.
- An internal SOUND UNIT to add a new dimension to your own programs.
- A MACHINE LANGUAGE MONITOR, with Display, modify, enter and execute (with break points) facilities.

Genie I has all of this, plus the built-in cassette deck, 16K RAM, 12K ROM with BASIC interpreter, full-size keyboard, an extremely wide range of new and updated peripherals, and literally 1000's of pre-recorded programmes available. Yet, almost unbelievably, the price of Genie I is even lower than that of the original Genie.

## Ingenious for business



The Genie II is a major breakthrough for small business computers. Harnessing all the advantages of Genie I, including low price, Genie II adapts perfectly to commercial functions with the following features:

- Numeric keyboard
- Four usable, definable function keys
- Extension to BASIC
- Basic business commands
- Fully expandable with the same peripherals

## New!...12" Monitor

Now, a choice of 2 monitors giving a clear easy to read image. The updated EG101 has a new green phosphor tube.



## New!...Expander

An updated Expansion Box (EG 3014) is a major feature of the new Genie I system, and unleashes all its possibilities, allowing for up to 4 disk drives with optional double density. It connects to a printer, or RS232 interface or S100 cards. There is 16k RAM fitted and it has a new low price!



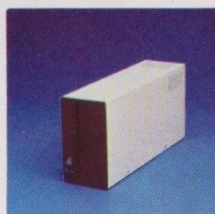
## New!...Printer

The EG 602 printer can be connected to the Genie either through the expander or directly into the computer using the Parallel Printer Interface. It is a compact unit, with an 80 column, 5 x 7 matrix print-out, operating quietly and efficiently at 30 characters per second.



## Disk Drive

As well as the obvious advantage of mass storage, the addition of the disk system to the Genie means much faster access to other languages and full random access file handling. Up to 4 of these 40 track drives can be used on a system.



## 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!

For full details and demonstration of Genie I, Genie II or advice on any aspect of the system, either call in to your local dealer, or write directly to the sole importers at the address below.

# LOWE

## electronics

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



All work for consideration should be sent to the Acting Editor at our Charing Cross Road address.



## ACORN

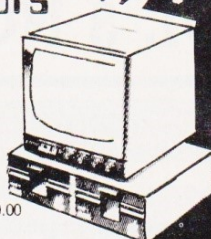
Teachers see the superb Econet Classroom Network now on demonstration.

## ... Monitors & TV's ...

COLOUR TV'S BY FERGUSON, JVC, MITSUBISHI, PANASONIC, TOSHIBA.

PANASONIC TC492 Colour TV 12" £199.00  
MITSUBISHI B/W 12" TV £54.00

JVC 14" colour monitor £330.00



### MONITORS

9" O.P.C. GREEN	£95.00
9" APF B/W	£85.00
9" HITACHI B/W	£112.17
12" BMC	£159.00
12" NEC GREEN	£159.00
12" NEC COLOUR	£579.00
14" DECCA COLOUR R.B.G.	£250.00

(Please add VAT to prices above)

## Mail Order Accessories

All items are available through our fast, efficient mail order service. If you find our prices are not competitive, then we will be pleased to match any genuine offer in this magazine.

P & P Rates: a 0.75 b 1.00 c 1.50 d 2.50

### ACORN

Floating Point Rom	20.00 a
Memory Chips	ea 1.95 a
Magic Book	5.50 c
Printer Drive	9.00 a
Printer Buffer	2.50 a
Utility	10.00 a
VDU	10.00 a
Maths Pack	10.00 a
Games Pack 1 to 7	10.00 a
Word Pack Rom	26.00 a

### APPLE (Please ring for software not listed)

Visicalc (new 16 sector)	111.00 b
Visiplot	100.00 b
Visiend/Visiplot	144.00 b
Visidex	111.00 b
Cisobol	475.00 b
Desk Top Plan	65.00 b
Micro Modeller	425.00 b
APM	121.00 b
Writer	38.00 b
Magic Window	79.00 b

### BOOKS (Send SAE for full list)

Acorn Magic	5.50 c
Microsoft Basic	8.95 c
Basic Basic	8.25 c
Learning Level II	11.00 c
Basic Handbook	11.00 c
Introduction to Pascal	8.75 c
Programming in Pascal	6.95 c
CP/M Handbook	8.95 c
Programming & Interfacing 6502	8.95 c
Programming the 6502	9.10 c
Basic Computer Games	5.50 c
Basic A Unit for Secondary Schools	4.45 c
More Basic Computer Games	6.25 c
Making Most of ZX80	6.95 c
Machine Language from ground up	9.00 c
Getting Acquainted with your VIC 20	5.95 c
Getting Acquainted with your Acorn Atom	7.95 c
ZX81 Companion	7.95 c
ZX81 Pocket Book	4.95 c

### MEMORY CHIPS

4116 (Apple, Sharp)	ea 1.50 a
2114 (Acorn)	ea 1.95 a
4027 (1/2 K Sharp)	ea 0.50 a

### VIDEO GENIE

Sound Mod	7.50 a
Colour Mod	39.46 b
Synthesiser	45.00 b
EQ 3013 Expander	195.00 d
EQ 3013 RS232	215.00 d
Lower Case	35.00 b
Dust Cover	5.55 a
Invaders	13.00 a
Biorhythm	7.50 a

Battle of Britain	13.50 a
Pinball	13.00 a
Pools	13.50 a
Imoni	23.10 a
Sargon II Chess	25.00 a
Startrek	9.50 a
Z Chess 3	14.50 a
Adventure Sampler	6.50 a
Adventure 1 to 9	8.75 a
Hanibal	13.50 a
Android Nim	8.75 a
Tables	6.50 a

### SHARP

CE 121 Cassette Interface	11.50 b
CE 122 Printer Interface	63.90 b
Editor Assembler	36.00 b
Machine Language Pack	17.98 b
Pascal Interpreter (MZ80K0)	50.00 b
Speed Basic	10.00 a
Biorhythm	4.00 a
Autocross	4.00 a
Hanic	4.00 a
Fox & Geese	4.00 a
Four in a Row	5.00 a
Moonlander	5.00 a
Composer	4.00 a
Bank Account	5.00 a
Posidon	5.00 a
Address Book	4.00 a
Anagrams	3.00 a
Dust Cover	5.00 a
P3 Printer Dust Cover	5.00 a
Picture Count	5.00 a
Count & Add	5.00 a
Match the Word	5.00 a
Character Match	5.00 a
Head On	6.00 a
P3 Printer Dust Cover	5.00 a

### SUPERIOR SYSTEMS SOFTWARE - SHARP

Games Pack 1 (5 games on cassette)	10.00 a
Games Pack 2 (5 games on cassette)	10.00 a
CALCUBET-Complete Bookmaker Bet Calculation programme, various versions available. Phone for details.	
MAKE YOURSELF A FORTUNE! CALCUSHAIR - Stock Market program keeps control of upto 50 shares. Traditional buy & sell. Indicators	£50.00

### APPLE

Games Pack 1 (Disc 5 games)	12.50 a
Games Pack 2 (Disc 5 games)	12.50 a

### VIDEO GENIE

Games Pack (5 games on cassette)	10.00 a
Education Pack (3-6 yr. old on cassette)	10.00 a

## SHARP COMPUTERS

PC 1211 POCKET COMPUTER £74.90

MZ80K (48K) COMPUTER PHONE FOR CHEAPEST PRICE

MZ80B (64K) COMPUTER PHONE FOR CHEAPEST PRICE

P3 DOT MATRIX PRINTER £379.00

P5 DOT MATRIX PRINTER £415.00

MZ80 I/O INTERFACE UNIT £82.00

(please add v.a.t. to prices above)

## APPLE II COMPUTER

APPLE II (48K) COMPUTER £695.00

DISK DRIVE WITH CONTROLLER £397.00

DISK DRIVE WITHOUT CONTROLLER £311.00

VLASAK MEGASTOR 1MB DISK DRIVE £177.00

HARD DISK SYSTEMS. PHONE FOR DETAILS

SILENTYPE THERMAL PRINTER £175.00

(please add v.a.t. to prices above)

## Peripherals

### PRINTERS

SEIKOSHA GP80	£195.00
EPSON MX80F/T	£399.00
MICROLINE 80	£299.00
MICROLINE 83A	£799.00
CENTRONICS 737	£395.00
SHARP MZ80P3	£379.00
SHARP MZ80P5	£415.00
EPSON MX100	£575.00
EPSON MX130	P.O.A.
EPSON MX80F/T2	£480.00

### DISK DRIVES

SHARP DUAL DRIVE	£580.00
VIDEO GENIE SINGLE DRIVE	£215.00

### INTERFACE UNITS

A WIDE RANGE OF INTERFACES ARE AVAILABLE EX-STOCK. WESTRA COMPUTER STATION DESKS IN STOCK

(please add VAT to prices above)

### VIDEO GENIE

MK I WITH SOUND AND LOWER CASE	£295.00
MK II BUSINESS COMPUTER (16K)	£335.00
VIDEO GENIE PRINTER	£199.00
EXPANSION UNIT WITH 16K RAM	£185.00
SINGLE DISK DRIVE	£215.00

(Please add VAT to prices above)



# Superior Systems Ltd.



178, WEST STREET, SHEFFIELD S1 4ET TEL: 0742 755005  
ALSO AT: QUADRAPHENIA, 19 BRADFORD ROW, (HALLGATE) DONCASTER  
DN1 3NF TEL: 0302 21215

Business Hours: Sheffield Mon-Sat 9am-5.15pm Doncaster Mon-Sat 10am-5.00pm



# 48K SHARP MZ-80K £345 WITH BASIC AND PASCAL

## ROCK BOTTOM PRICES FROM SHARP'S BIG DEALER

DEAL A	SHARP MZ-80K with full 48K memory, BASIC AND PASCAL	£345
DEAL B	48K MZ-80K, BASIC, PASCAL, AND FORTH - 10 programs	£359
DEAL C	48K MZ-80K, BASIC, PASCAL, FORTH, 10 programs, AND FORTRAN	£379
DEAL D	everything in DEAL C AND MACHINE CODE	£395
DEAL E	48K SHARP, BASIC, PASCAL, FORTH, FORTRAN, MACHINE CODE, 12 programs and the KNIGHT COMMANDER	£410
DEAL F	everything included in DEAL E plus our famous library of 100 PROGRAMS (see separate list)	£425
DEAL G	MZ-80P3 printer complete with interface card	£339
DEAL H	MZ-80ID interface box (takes up to five cards)	£87
DEAL J	MZ-80FD dual disk floppy drive, interface card, all cables	£575
DEAL K	MZ-80P3 printer, PASCAL, FORTH, FORTRAN and KNIGHT COMMANDER	£389
DEAL L	EVERYTHING IN DEAL K, INTERFACE BOX + 100 programs	£499
DEAL M	EVERYTHING IN DEAL J, plus our new DISK COMMANDER	£599
DEAL N	MZ-80FD dual floppy, DISK COMMANDER, FORTH, FORTRAN, + PASCAL	£625
DEAL P	48K SHARP MZ-80K, PRINTER, DUAL FLOPPY, INTERFACE BOX all connecting cables and manuals	£1345

Dear Microfans,

We don't just sell Sharp micros we use them ourselves. We use the Sharp every day in our own business for STOCK CONTROL, INVOICING, generating our mailing labels and even to assist us in servicing TV sets. We also use it for our amateur radio and music hobbies. The Sharp keeps our station log, transmits test cards, sends morse and teletype with our new KNIGHTCOMMS unit, tracks satellites etc. Our articles in the Electronic and Music Maker Magazine detail Sharp microcomms.

Everyone who buys a Sharp from Knights gets free delivery, 12 months guarantee, membership of the International Sharp User Group. We run the group and now have more than 1,400 members in 37 countries thus ensuring our customers are kept up to date with all the latest Sharp developments on a Worldwide basis. Membership costs £3 if you bought your Sharp elsewhere. The latest issue details my visit to Sharp in Japan, the new languages compiler, Double Precision Basic, and masses of information about Sharp which is unobtainable elsewhere.

Our new 4MHz board for the MZ-80K doubles the processing speed, requires no soldering and makes all your K programs really zip along - £95. The Japanese were certainly surprised by our KNIGHT DISK COMMANDER which adds AUTO LINE NUMBER, BLOCK DELETE, DUMP, RENUMBER, REPEAT ON ALL KEYS, TRACE, SINGLE STEP, DEFINED KEYS and a NUMERIC PAD to the SP5015 DISK BASIC without taking any extra memory - it costs £65.

Although we are the largest Sharp micro dealer outside Japan we do give personal service - ring Alec or Graham Knight if you have a query and we will do our very best to help. Ring, write or telex for our latest software lists and hardware offers. We accept ACCESS, BARCLAY, VISA, MASTERCARD etc - ask about our credit and leasing arrangements.

happy computing, 73.88.10.10,

Graham Knight GM8FFX

P.S. I recently had lunch with Timothy Raison M.P. at the House of Commons and along with other fellow RETRA members we are trying to get computers talking to each other via the new legal CB radio. Details in the newsletter.

P.P.S. Remember to add Maggie's VAT to all prices.

## NEW SHARP LANGUAGES

**KNIGHTS WEE PASCAL** commands include: insert/delete lines, find/insert string, move, replace string, VAR, PROC, FUNC, ARRAY, IF... THEN... ELSE, PUT, INP, OUT, OR, XOR, AND, NOT, REMAINDER, RND, INCREMENT/DECREMENT VARIABLES. Supplied with four programs - ideal for PASCAL beginners. On tape for MZ-80K £20

**KNIGHTS FORTH** functions include +, -, \*, /, OR, AND, XOR. Stack operators: STK, CLR, DUP, DDUP, OVER, SWAP, ROT, DROP, MV. Graphics: SET, RESG, LINE, CORDV. Supplied with very fast demo programs rotating cubes, drawing circles, etc and a DISCOMPILER (similar to a disassembler but KNIGHTS FORTH is compiled. On tape for MZ-80K £25

**KNIGHTS FORTH** takes 12K and is supplied with a 32K source program "Monaco Grand Prix" which you can list and learn how to get rapid movement, fast key response and sound all at the same time - impossible in BASIC. Includes MEM, GET, IOC, LOW, MOD, IRND, IABS, ISIGN, ABS, SORT, SIN, ALOG, ATAN, IOR, COS, TAN, EXP, FLOAT, IAND, XOR, IFIX, EDIT, COMPILER ADD, INSERT, DIM, IF, DO, CALL, PAUSE etc. Compiled programs can be saved as machine code and will then load from monitor or be transferred onto disk. On tape for MZ-80K £30

**KNIGHTS MACHINE CODE** for experts only. We have written this so that it can be loaded with BASIC and there are no restrictions on the memory areas which can be dumped and modified. Includes FIND, TRANSFER, HEX/DECIMAL, CHARACTER DUMP/MODIFY, REGISTER DISPLAY/MODIFY, EXECUTE ADDRESS etc. On tape for MZ-80K £25

ALL FOUR ABOVE - KNIGHTS PASCAL, FORTH, FORTRAN and MACHINE CODE £85

**SHARP PASCAL** takes 16K, very comprehensive package which supports full screen editing, case statements etc. Supplied with either KNIGHTS WEE PASCAL (which we recommend if you are a beginner) or with our NUMERICAL INTEGRATION PACKAGE no 216. On tape for MZ-80K £45

**SHARP PASCAL FOR MZ-80B** ("I" DEFINED KEYS, REPEAT etc. Supplied with Numerical Integration PACKAGE which makes full use of the B hi-res graphics for plotting curves. On tape £50

**KNIGHTS EASY ASSEMBLER** written especially for the MZ-80B as Sharp do not have a tape based assembler for the B. £25

**SHARP FDS FOR K OR B** allows writing of machine code interfaced with the disk system. Facilities include ability to handle serial interface, paper tape reader, plotter etc. Includes LINKFILE, ORG, DEBUG, FORMAT, STATUS and HAS ABILITY TO PROTECT DISKS FROM COPYING. Full details in our latest User Group Newsletter. £75

**SHARP COMPILER FOR K OR B** disk based, supplied with our extra instructions and sample programs on disk. £45

**SHARP DOUBLE PRECISION BASIC FOR K OR B** array size is only limited by memory, PRINT USING, 16 digit precision. Supplied with simultaneous linear equation package disk. £39

## MZ-80K TAPE PROGRAMS

No 1	Snake Island, Ten Pin Bowling and Poker	£5
No 2	Cosmic Invasion, Spacefighter + Paper Stone Scissors	£5
No 3	Casino Chips - teaches half life concept, OAWARI + Space Invaders	£5
No 4	Survival, Stamp-Out, Othello - play against the Sharp	£5
No 5	Ski-Slope-30 skill levels, Jumping Balls, Startrek	£5
No 6	3D Maze, Othello, Hyno-Pat	£5
No 7	Major Scales teaches music, Entertainer, + SHARP ORGAN KEYS	£8
No 8	Exploding Atoms great two player game, Startrek, 3D Maze	£5
No 9	CO-ORDINATES teaches co-ordinates, Stamp Out, Spacefighter	£5
No 10	Lion Tamer, Ten Pin Bowling, Othello	£8
No 22	SHARP UTILITIES, DISASSEMBLER, MEMORY DUMPER, BYTE SEARCHER	£5
No 12	TEACH TABLES like a game but very successful in schools teaching young children + six maths programs	£5
No 13	DIRECTED NUMBERS teaches difficult concepts like 5 (-5) using a number line technique + division and Morse Tutor	£10
No 14	RENUMBER FOR SP5025 rennumbers all GOTO, GOSUB, etc	
No 15	INFLATION FORECASTING ACCOUNTS user creates own credit and debit headings, chooses financial year, data entered is displayed in tables, graphs etc. and stored onto tape. Actual income and expenditure can be used to give an inflation linked forecast 12 months ahead	£25
No 16	CRIBBAGE, POKER + BACKGAMMON	£8
No 17	WIZARDS CASTLE ultimate role playing Sharp game, attack monsters, cast spells, find jewels, change sex, choose your weapons and armour, select your intelligence, dexterity, strength, + TOWERS, + GATOR EATER	£5
No 18	ARCADE ROAD RACE 30 skill levels, Lion Tamer, Kamikazi Pilot	£5
No 19	KNIGHT COMMANDER takes no extra memory but adds masses of new commands to SP5025 BASIC including AUTO LINE NUMBER, BLOCK DELETE, RENUMBER PRINT @, TRACE SINGLE STEP, APPEND, PRINT ON SCREEN, DUMP VARIABLES etc.	£25
No 23	FIVE SUM TESTS, MULTIGRID, + FACTORS	£5
No 24	DIVISER/ADVISER, MULTIGRID, TEACH TABLES	£5
No 25	STATISTICS CALCULATES MEAN, VARIANCE, CO-VARIANCE, STD DEV, etc.	£40 (+B)
No 26	CURVE FITTING enter data pairs, calculates intercept, slope, co-efficient and fits data to linear, exponential, log or power curves	£40 (+B)
No 37	INVOICINGG PROGRAM prints neat invoices with your heading, and the user is prompted to enter quantity, size, cost vat, etc. Also generates stock transfer and 'to follow' print outs	£55
No 39	DISASSEMBLER 2 eight modes, including tape output compatible with Sharp assembler	£25
No 48	UFO faster than any other Sharp game-like TARGE-3D BONUS everyone tells us it is too fast but we refuse to slow it down	£8
No 49	SUICIDE RUN retains high score special double points bonus	£5
No 54	MONACO GRAND PRIX SUPER FAST COMPILED Fortran program runs from monitor on any MZ-80K - five skill levels	£5
No 66	MISSILE COMMAND defend your cities enter your initials if you beat the high score. Exclusive to Knights	£5
No 87	New SPACE INVADERS faster, legs wriggle, top score 99,999	£5
No 122	SHADOW ALIEN detect them by their shadows	£5
No 143	KISS THE TEACHER biology was never like this	£5
No 154	SUPER BREAKOUT machine code super fast	£5
No 163	SNAPPER (crash-head on style fast game)	£5
No 165	SUPER BAZOOKA fire at cars, bikes, etc. but avoid the stretcher cases	£5
No 205	SIMULTANEOUS LINEAR EQUATIONS - Gaussian elimination, Choleski's Triangular decomposition method, 16 x 16 matrices, solution vector displays etc.	£25
	Available for K or B on tape or on disk for Double precision K or B Basic	
No 216	NUMERICAL INTEGRATION by Simpson's Rule, Gauss Legendre and Gauss Laguerre. A very comprehensive package including 20 pages of notes. Runs on Sharp Pascal K or B	£25

The latest Sharp software catalogue shows that we have the largest range of programs in the U.K. Write for a copy.

**KNIGHTS TV & COMPUTERS**  
**108 ROSEMOUNT PLACE, ABERDEEN**  
**TELEPHONE: 0224 630526 TELEX: 739169**



# CHRISTMAS SALE for Software & Hardware

Alien	£12.95	*International Grand	
Alien Typhoon	£13.95	Prix	£16.95
American Football	£19.95	Kubic	£9.95
*Apple Panic	£14.95	Mission Asteroid	£9.95
Autobahn	£14.95	Mystery House	£12.95
Bridge	£16.95	Missile Defence	£17.95
Craps	£9.95	Oldorf's Revenge	£11.95
Cribbage	£12.95	*Pegasus II	£17.95
Cranston Manor	£17.95	Pool 1.5	£18.95
Creature Venture	£14.95	Raster Blaster	£16.95
Demon Derby	£12.95	Sargon II Chess	£16.95
Draw Poker	£14.95	Sneakers	£16.95
*Epoch	£19.95	Soft Porn Adventure	£17.95
*Falcons	£16.95	Space Eggs	£14.95
Fast Gammon	£14.95	*Space Quarks	£16.95
Galactic Empire I	£12.95	Star Cruiser	£12.95
Galactic Trader II	£12.95	Star Thief	£16.95
Galactic Revolution III	£12.95	Star Mines	£14.95
Galaxy Wars	£12.95	Tawala's Last Redout	£14.95
*Genetic Drift	£16.95	Tarturian	£14.95
German Whist	£9.95	The Wizard & Princess	£17.95
Golden Mountain	£9.95	*Threshold	£19.95
Gobbler	£12.95	The Warp Factor	£24.95
*Gorgon	£24.95	*Ulysees & the	
Hi-Res Soccer	£22.95	Golden Fleece	£17.95
	*Wizardry		£29.45
	Zork		£24.95

**\*New Program**  
**Special offer Buy 3 deduct 10%.**  
**All prices + V.A.T., Postage & packing free.**

## BUSINESS

### SPECIAL INTRODUCTORY OFFER

Magic Window & Basic Mailer & Lower Case Adaptor	£145.00
---	---------

D. B. Master	£130.00
Typing Tutor	£13.95
Visicalc 3.3	£99.00
Visiplot/Visitrend	£115.00
Wordstar	£175.00

## UTILITIES

Apple Protector III	£60.00
AOPT	£19.95
CRAE-EDITOR	£19.95
BACK-IT-UP	£50.00
EXPEDITOR II	£75.00
LOCKSMITH VER 4.0	£75.00

## BOOKS

BENEATH APPLE DOS	£11.95
Assembly Language	£11.95

### APPLE COMPUTER SPECIAL 5 PIECE PACKAGE DEAL

- 1 APPLE II EUROPLUS 48K
- 1 DISK DRIVE WITH CONTROLLER
- 1 B&W TV MODULATOR
- 2 FREE GAMES

ALL FOR ONLY £999.00 + V.A.T. + P&P.

**S.B.D. SOFTWARE,**  
**15 JOCELYN ROAD,**  
**RICHMOND, SURREY, TW9 2TJ.**

## Home Computer Retailers

### BEDS

Computopia, Leighton Buzzard (376600)  
Conserve, Bedford (216749)  
Electron Systems (Sandy) Ltd. Sandy (81195)

### BUCKS

Texas Instruments Ltd. Supply Division  
Slough (75868)

### CAMBRIDGESHIRE

Intelligent Artefacts  
Cambridge (Orwell 0223 207689)

### DERBY

Datron Micro Centre, Duckworth Square,  
Derby DE1 1JZ, (0332 380085)

### DEVON

JAD Ltd, Plymouth (29038)  
Peter Scott (Exeter) Ltd, Exeter (9076842)

### ESSEX

Boots, 177/185 High Road, Ilford,  
Maplin Electronic Suppliers,  
Westcliff-on-Sea (554000)

### HANTS

The Maths Box, Southampton (22958)  
RDS, Portsmouth (812,78)

### HEREFORDSHIRE

Accutape Sound, Bromyard (3283)

### HERTS

Computer Centre (Watford) (401)  
Computer Plus, Watford (020449)

### HUMBERSIDE

Radius Computers Ltd, Hull (227181)  
Peter Tutty & Co, Hull (41458)

### LEICS

Boots Company Ltd, Leicester (21641)

### LONDON

Adia Computers Ltd, W8 (579-5845)  
Eurocalc Ltd, EC2 (729-4555)  
Land Electronics Ltd, W1 (642-5986)

McDonald Stores, W1 (636-2877)  
Mountaineers Ltd, NW11 (455-9823)  
Selfridges, W1 (629-1234)  
Sumlock Boundain Ltd. EC1 (250-0505)

### NORFOLK

Anglia Computers, Norwich (29652)

### NORTHANTS

Computer Contact, Rushden (56894)  
Computer Supermarket, Corby (61587)

### NOTTS

Bestmoor Ltd, Nottingham (415315)

### OXON

Science Studio, Oxford (54022)

### S. GLAM

Computer Business Systems Ltd.  
Ely, Cardiff (562255)

### W. GLAM

Boots, 17 St. Mary's Arcade,  
Quadrant Shopping Centre, Swansea

### S. YORKS

Datron Interform, Sheffield (585490)

### W. MIDLANDS

Taylor Wilson Systems Ltd,  
Dorridge, Solihull (79404)

### W. SUSSEX

Gamer, Brighton (698424)

### W. YORKS

Ackroyd Typewriters Ltd, Bradford (31835)  
Bits and PCs, Wetherby (63744)

### SCOTLAND

Esco, Glasgow (427-5497)  
Robox Ltd, Glasgow (221-5401)  
Texas Instruments Ltd, Supply Division,  
Edinburgh 225-5132

### IRELAND

Texas Instruments Ltd,  
Supply Division, Dublin (609222)

## Rumbelows Stores stocking Home Computer

### BEDS

Bedford (59339)  
Dunstable (602618)  
Arndale Centre, Luton (414480)

### BUCKS

Bletchley (73505)  
Central Milton Keynes (662120)

### HERTS

Boreham Wood (935-1744)  
Hatfield (64211)

Hemel Hempstead (53223)

Hitchin (59203)  
Hoddesdon (66486)  
Letchworth (71231)  
Potters Bar (58804)

St Albans (532290)  
Stevenage (54303)  
Waltham Cross (22100)  
Ware (2316)

Welwyn Garden City (27125)  
Enfield, Middx. (363-7384)





# The TI-99/4A The Home Computer worthy of the name.

Even if you're new to computers, you'll be using the TI-99/4A within minutes of plugging it into any standard TV set. Because the TI-99/4A is a true computer for the home. Immediately accessible to the whole family. All for around £299.

Just snap in one of our wide selection of Solid State Software\* Command Modules, touch a few keys, and you're ready to go. The 40 modules can sharpen your children's maths, teach you to win at chess or even help you with household financial decisions. And much more besides. In all, over 400 programs are available.

All enhanced by full music capability and 16-colour graphics.

Another development which sets the TI-99/4A apart from the rest, is our optional Solid State Speech\* Synthesiser. Actually reproducing the human voice. With our new Emulator Command Module\*, its vocabulary is unlimited.

For data input/output you can use an ordinary audio cassette recorder. And a full-size professional keyboard makes it easy to use.

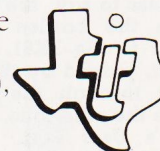
The TI-99/4A comes with TI BASIC built in. Ideal for when you want to learn programming – and to get you started there's our "Beginner's Basic" course, free with each machine – yet powerful enough for even the most experienced programmer.

To help you get the most from the TI-99/4A you can join the independent users' club. And there's a special magazine ("99'er") available through dealers, or on subscription.

So, if you're looking for a home computer, you can't afford to miss the TI-99/4A for versatility, power and value for money.

- \* 16K RAM. Expandable to 48K.
- \* 26K ROM including 14K BASIC.
- \* Command Modules add up to 36K ROM.
- \* 13-digit floating point.
- \* Other languages soon – LOGO, UCSD PASCAL, TMS 9900 Assembler.
- \* Options – Speech Synthesiser, Thermal Printer, RS-232 Peripheral Adaptor, Disk Memory System.

To find your local dealer check the list on the left, or for more information write to Texas Instruments Ltd., (MS.24), Manton Lane, Bedford MK41 7PA.



**TEXAS INSTRUMENTS  
LIMITED**

\*Trademarks of Texas Instruments.



## ZILOG CHIP IN

Into the Single Chip Computer stakes comes a new entry from Zilog designated the Z8671. Based around the Z8601 CPU it has an on-chip BASIC, debug and monitor software and 128 bytes of RAM. Expansion possibilities are up to 62K but usually only 4K would be required for most applications. The chip also features four eight-bit I/O ports, an asynchronous communications port and the two counter timers allowing the possibility of a two-chip personal computer! Clive is probably already plotting his next step in reducing the ZX82 to a single chip at this point! The in-built BASIC is a subset of Dartmouth BASIC, the great granddaddy of them all and, unusually, supports the USSR function. For more information on this amazing little device drop Zilog a line at Babage House, King Street, Maidenhead, Berks SL6 1DU.

## BOOKLIST FOR FREE

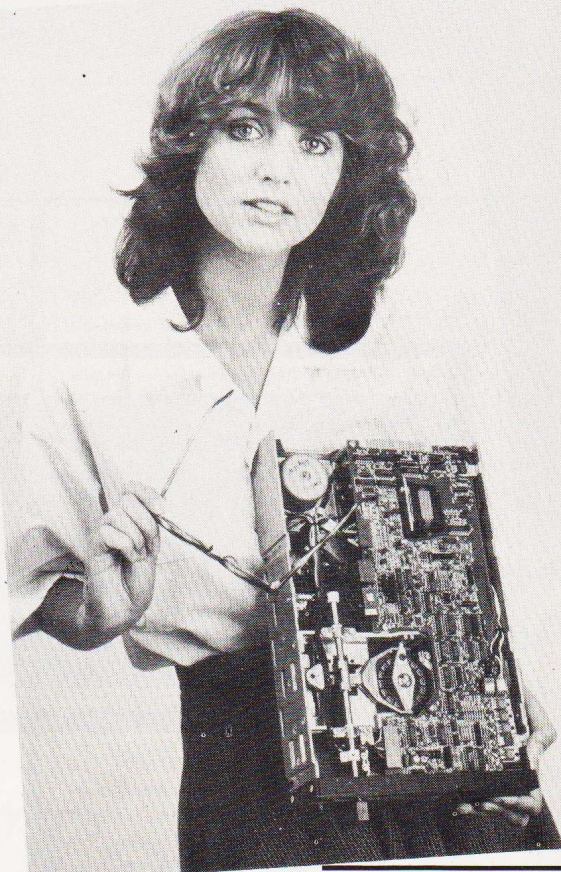
March Communications have published their second Computer Booklist. The 20-page A5 booklet is available free from the company at 7 Victoria Terrace, Liverpool L15 5BH and contains details of over 200 titles all of which are available direct from the company.

## SOUTHWEST GO NORTH

From November 30th all of Southwest Technical Products' UK operations are to be centralised on a new base at 12 Tresham Road, Orton Southgate, Peterborough PE20 0SG. Their new telephone number will be 0733-234433 and it is hoped that with the new central location and better communications, all support and marketing operations can be streamlined and improved. Please address all information requests to the new site after the above date.

## ORIENTAL AGREEMENT

Clive Sinclair's ZX81 will be in the shops by Christmas. Not here, or in Europe, or even in the States, but in Japan. A marketing deal was signed last week between Sinclair and Mitsui and Co, a large Japanese trading company. The current product for export is the ZX81 and the 16K RAM pack with the printer to follow soon. Needless to say the manual has been translated into Japanese, one can only hope that we have made a better job of it than they make of some of their translations from Japanese to English!



## WELCOME BACK! ▲

Those of you with an eye for a lovely lady might well think they recognise this delightful example clutching a new slimline 8" drive to her....er.... chest. Connoisseurs of the female form may well think back to the November issue of this magazine where an extremely similar figure made an appearance on page 12. The burning question is, is it the same lady? The only people who really know are HAL Computers, purveyors of the new drive which is manufactured by Tandon. The drive is only half as thick as previous models enabling you to fit four units where you previously had two. The unit is available in single or double-sided versions and requires only 5V and 24V for operation. For more information on the product (and the true identity of the lady), contact HAL at 57 Woodham Lane, New Haw, Weybridge, Surrey KT15 3ND or ring them on 0932-48346.

## MICROFAIR TWO

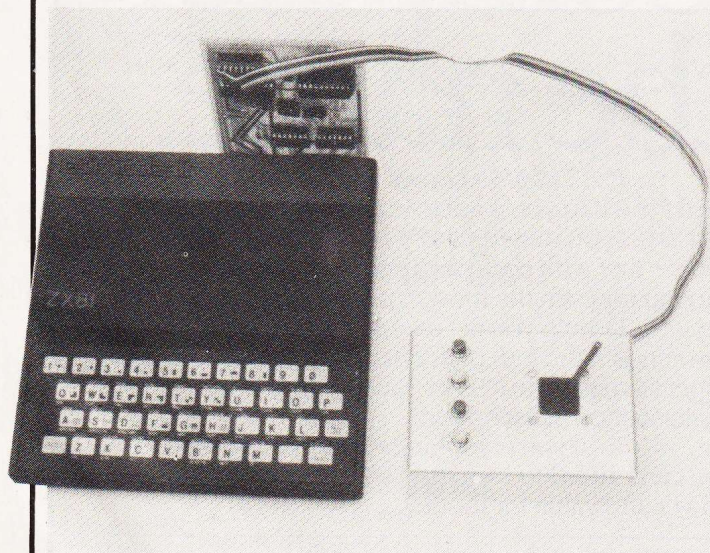
No sooner had we published a report that the second ZX Microfair was to be held in the Spring than we heard that the date has been brought forward and it will now take place on Saturday 30th January. Times have been extended, 10.30am to 8.30pm, and there will be twice the available space. The venue is still the Central Hall Westminster and although the cost to exhibitors has been kept down, it is expected that some nominal charge for entrance will have to be made. For more information contact the organiser, Mike Johnson, at 71 Park Lane, Tottenham, London N17 0HG.

## SOUNDING OUT

A group of ex-ICL engineers have set up their own company specialising in microcomputer add-ons. The first product is a sound board for the Tangerine at £44.85. Based on the General Instruments AY-3-8910 device it features an on-board amplifier and speaker and comes complete with data sheet on the device and a manual on how to operate it. For an extra £10 you can have a second GI chip fitted onto the board for double the noise-making capability. Their next offering is planned to be a high resolution colour graphics board and the expected price is around £170. For further information contact Bulldog Video at 52 Nash Square, Birmingham B42 2EX or at 13 Highway, Crowthorne, Berks. Telephone enquiries should go to 0299-266143.

## MICRO PAY OUT

Somebody was bound to do it, a commercial payroll package for the ZX81. Designed for companies with less than 30 employees the software requires a ZX81 with a printer and an extra 16K of RAM; hardware cost £170, software cost £25! A training package is available if required and software updates can be obtained when the Chancellor juggles the tax. For more information write to Hilderbay Ltd, 8-10 Parkway, London NW1 7AA or ring them on 01-485 1059.



## I/O, I/O IT'S OFF TO ▲ PORT WE GO

The great bolt-on goody race has started once again and, needless to say, the system for which the battles are being fought is the ZX81. First contender, judged by the fact that it got through the letter box before the other one, is Technomatic's User Port. Costing a mere £11.50 it offers an eight-bit input and an eight-bit output port controllable from BASIC or machine code. A book of sug-

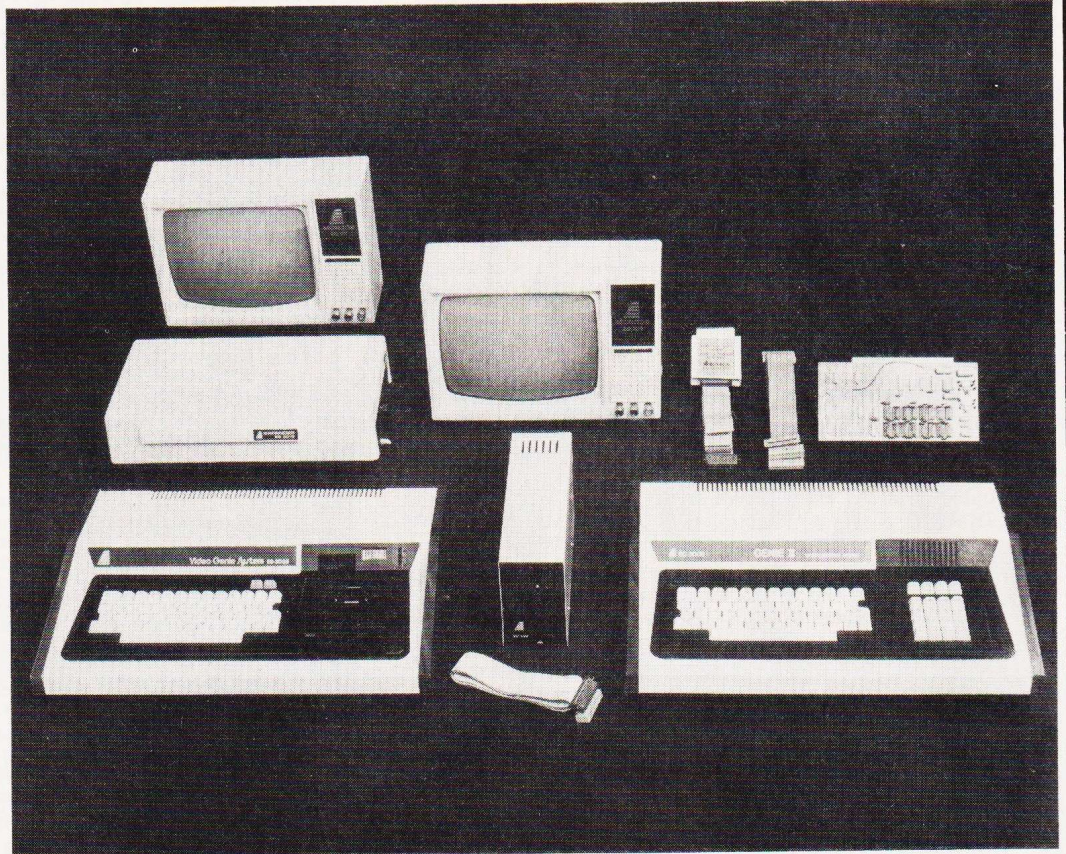
gested applications costs 40p or you could bolt on some of the recent projects in CT. The second contender is the DCP Peripheral Pack which features 4K of extra RAM and a pair of ports. This offering costs £37.95 inclusive, and comes with an instruction and software booklet. Details can be obtained from Technomatic at 17 Burnley Road, London NW10 and DCP Microdevelopments at 2 Station Close, Lingwood, Norwich NR13 4AX respectively.



# CONSUMER NEWS

## ALADDIN'S ASSISTANT►

No sooner had we received the full details of the Genie 2 than we heard about the Genie 3! To take these events in order, the Genie 2 is basically an upgraded version of the original Genie with the same 12K Microsoft BASIC but with a 1.5K extension including full upper and lower case, auto repeat, screenprint, dumb terminal routines and networking capability. The integral cassette deck has been replaced by a numeric and cursor control keypad with four user definable keys. All the existing expansion options can be fitted and a range of business software has been developed by Tridata specifically for the Genie 2. The even newer Genie 3 is a single console system with 800K of disc, 64K of RAM and has the facility to run both Level 2 BASIC and CP/M. It performs this amazing trick by changing the screen format to suit each of the operating systems. At the time of going to press no price was available but an informed estimate would be around £1200. For more information contact the UK distributors, Lowe Electronics, at Chesterfield Road, Matlock, Derbyshire DE4 5LE or ring on 0629-2430.



## NAKED SPEECH

Using a custom technique based on compression of real speech, Triangle Digital Services are offering their Instant Speech chip set for £39.00. No micro is needed (switch closures will do just as well) and the users required vocabulary can be encoded in 48 hours. A basic set of words in an 'average' quality is included in the set and extra ROMs may be added as required. A complete Eurocard system can also be purchased for £97.06 and this can be interfaced to a micro through an RS232 interface or a parallel port. For information on the product drop them a line at 23 Campus Road, London E17 8PG or ring on 01-520 0442.

## ALGOL WITH CLAWS

An interpreting version of ALGOL for the TRS-80 range has been produced by Crab Software of 2 Pondwick Road, Harpenden, Herts AL5 2HG. The 9K implementation is based on Nicklaus Wirth's ALGOL W and runs on 16K Model 1 or Model 3 systems. Included in the facilities are a screen editor, user definable I/O, variable names of any length, recursive functions and a whole host more. The package will cost £75 and is supplied on cassette with a user manual; more information from the company at the address above.

## NORTH OF THE BORDER

Scotland is to get its very own Computer Show. The exhibition will be held at the Albany Hotel in Glasgow between the 16th and 18th of March 1982. The show is aimed at the first time buyer and a number of local firms have already booked stands; the established user and system operator are also catered for. Further details from the organisers, Crouchmead, at 42 Great Windmill Street, London W1V 7PA or ring on 01-437 4187.

## X RATED LANGUAGE

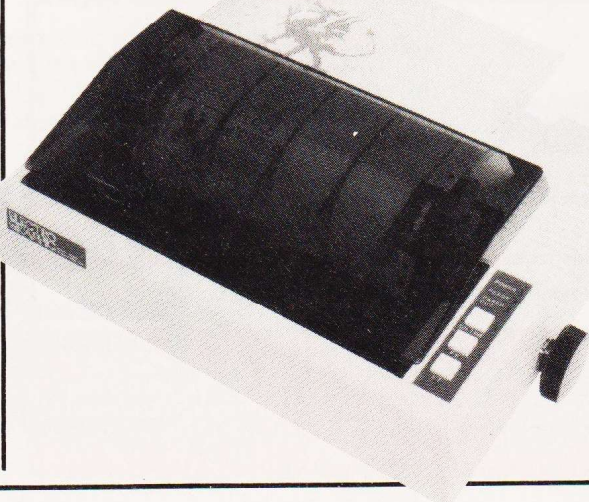
If your system is 8080 or Z80 based and running under CP/M 2.2 or North Star DOS you can take advantage of a new FORTH implementation called X-FORTH. Currently at a special price of £40 it complies with the 1979 standard and includes such utilities as a debugging aid, screen editor and a macro assembler. The same company is also bringing out what Dr Dobb's Journal called 'a revolutionary word processing system' named Amethyst. The package is totally CP/M compatible and sounds exceedingly interesting. Parts of it are written in C and they even throw in the C compiler for the price of £200. For further information contact AIM Research at 20 Montague Road, Cambridge CB4 1BX.

## TAKING APPLE TO TASC

A compiler for the Apple has been introduced by the same software team that wrote the Applesoft Interpreter. The new Microsoft TASC compiler is designed to work directly with the interpreter and offers the added facilities of increased speed, program linking and true integer arithmetic. The compiler writes the object code directly onto disc as it compiles, making it capable of dealing with very large programs. For more information contact Pete & Pam Computers at Waingate Lodge, Waingate Close, Rossendale, Lancs BB4 7SQ or ring them on 0706-227011.

## PRESTEL ON PAPER

Claimed as a 'first' in the field of Prestel hard copy units is a modified version of Electrographic's EG800 matrix printer. The printer's character set is altered to suit the Prestel character and graphics set and a 1K page buffer is fitted. Printing takes place at 80 cps and can be on plain listing paper or continuous roll as required. Data is fed into the system through an RS232 interface at 1200 baud, the standard Prestel transmission speed. For information on this, or any of Electrographic's range, contact the company at Printinghouse Lane, Hayes, Middx or ring on 01-573 1826.▼





## Video Genie

13K ROM  
version  
available



16K  
£275 + VAT

- ★ Latest version with vu-meter & extra keys
- ★ 16K RAM, 12K Microsoft Basic
- ★ Includes software, manuals and leads
- ★ All our machines are fitted with lower case characters as standard
- ★ 32K Ram memory version of Video Genie £329 + VAT

### Optional Extras

- The unique 1K 'BIONIC' Rom £29.50 + VAT
- Sound unit £15 + VAT
- Double joysticks with software £28 + VAT
- Lower case characters with 'E' sign. £20 + VAT

We stock a wide range of Genie accessories for the businessman and the hobbyist, Word processing, stock control, ledgers systems plus games. Refer to catalogue

### BIONIC ROM

The Rom enhancement for your Video Genie will add the following immediately accessible features to your machine:

- Lower case driver
- Keyboard debounce
- Shift lock
- Repeat key routine
- Screen printout
- Cursor select
- Keyboard lock
- Bleeping keyboard etc.

Available only from us. Kit £25 + VAT fitting £4.50

SAVE!



### EPSON MX-80

Letter quality matrix printer, has full software control of 40, 88, 66 or 132 columns 80cps bidirectional, disposable print head. There's lots of printers to choose from, but once you have compared you will find it hard to pass up to the MX-80. £ call

Video Genie interface £35 + VAT  
Other interfaces available.



### 400 & 800 Computer Systems

ATARI 400 £295 + vat  
ATARI 800 £543 + vat

### ACORN ATOM



8K ROM, 2K RAM BUILT £149  
12K ROM, 12K RAM BUILT £229  
Power supply £10.20  
Colour modulator £23 all plus vat

- Available shortly
- The BBC Microsoft basic upgrade
  - 'Plug in' disc drive unit

Phone for availability of VIC 20 Computer

### Q-Tek Systems Ltd.

2 Daltry Close Old Town  
Stevenage Herts  
Tel: (0438) 65385

Send £1 for latest catalogue (refundable). Please add vat to all items. Orders under £50 add 60p p + p otherwise carriage at cost

## SOFTWARE BACKUP

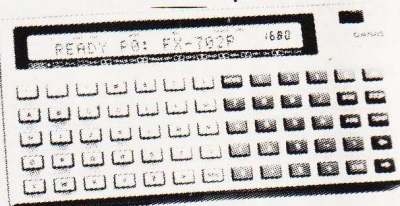
FOR THESE **CASIO** WORLD BEATERS  
World's Most Powerful BASIC Pocket Computer

### FX-702P

RRP  
£134.95

ONLY  
**£119.95**

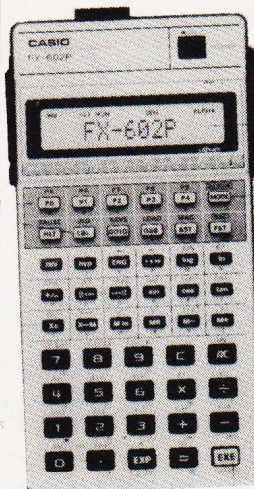
Plus FREE MiCROL Professional Programming Pack\* (RRP £9.95).



### Flattens the Sharp PC1211

Alpha/numeric dot matrix scrolling LCD. Variable input from 1680 steps, 26 memories, to 80 steps, 226 memories, all retained when switched off. Up to 10 programs. Subroutines; 10 levels. FOR: NEXT looping; 8 levels. Debugging and Editing. 55 built-in functions, including Regression and Correlation, all usable in programs. Program/Data storage on cassette via optional FA-2 adaptor (£19.95). Auto Power Off. 17 x 165 x 82mm. 176g.

### World's Fastest Programmable? FX-602P



- LCD alpha/numeric (dot matrix) scrolling display.
- Variable input from 32 program steps with 88 memories, to 512 steps with 22 memories.
- Memory and program retention when switched off.
- Up to 10 pairs unconditional jumps (GOTO).
- Conditional jumps and count jumps. Indirect addressing. Manual jump.
- Up to 9 subroutines, up to 9 levels.
- 50 scientific functions, all usable in programs.
- PAM (Algebraic) with 33 brackets at 11 levels.
- Program and data storage on cassette tape using optional FA-2 remote control adaptor, £19.95.
- Compatible with the FX-501P and FX-502P.
- 9.6 x 71 x 141.2mm. 100g.

ONLY **£74.95** (RRP £84.95)  
Plus FREE MiCROL Professional Programming Pack\* (RRP £9.95)

**FP-10 MINI PRINTER** For FX-702P, FX-602P, FX-502P, FX-501P,  
Available soon. Price and delivery on application

### CASIO FX-702P SOFTWARE

Produced by MiCROL exclusively for Tempus

10% discount on software, if you purchase your hardware from us.

### MICROL 702 USER SUPPORT

**Professional Programming Pack.** Get the best from your FX-702P with: PROFESSIONAL PROGRAMMING — practical 702 programming from the ground up plus 702 REFERENCE MANUAL — definitive guide to every 702 program command — INVALUABLE! **MICROL 702 PPP. Price £9.95**

### MICROL PROCOS for PROFESSIONAL USERS

Now you can create powerful, reliable programs in just minutes, even if you have never programmed a computer before!

**MICROL PROCOS** is an advanced integrated operating system that cuts programming time by 80-90% in most applications areas, saving many hours of valuable time. PROCOS A and PROCOS B are supplied together on a ready-to-run cassette, with a fully detailed User Manual offering features to suit every application. PROCOS A is ideal for complex multi-variable calculations, while PROCOS B provides many of the features of a 'Visicalc' type modelling system — answers 'what if' questions and analyses trends. Both systems feature easy-to-use commands and support FP-10 print options. Brochure on request.

Available late November **MICROL PROCOS (A + B) Price £24.95**

**MICROL 702 Basic: Plus.** Add the power of up to 20 new commands to your programs! Custom-made to ease advanced programming — features include: String — number conversions; single-shot, await, timed KEY with user-controlled return values; programmable RAN // generator; DATA-PACKING — up to 2000 single digit, single name variables; INTEGRATED DISPLAY COMMANDS — display data and test with extra-low memory overheads. Modular design uses minimum memory; easy to customise. Full-detail User Manual plus Program List for direct entry. Available December, 1981. **MICROL 702 B:P. Price £14.95**

**SHORT FORM CATALOGUE** of latest calculators, keyboards and watches available on request. 14p stamp appreciated

\*Only on request, at time of ordering. RRP of 702P/602P versions, £9.95.

Price includes VAT, P&P. Delivery normally by return of post.

Orders received by Dec 18th should be delivered in time for Christmas

Send cheques, PO, or 'phone your Access or B'card number to:

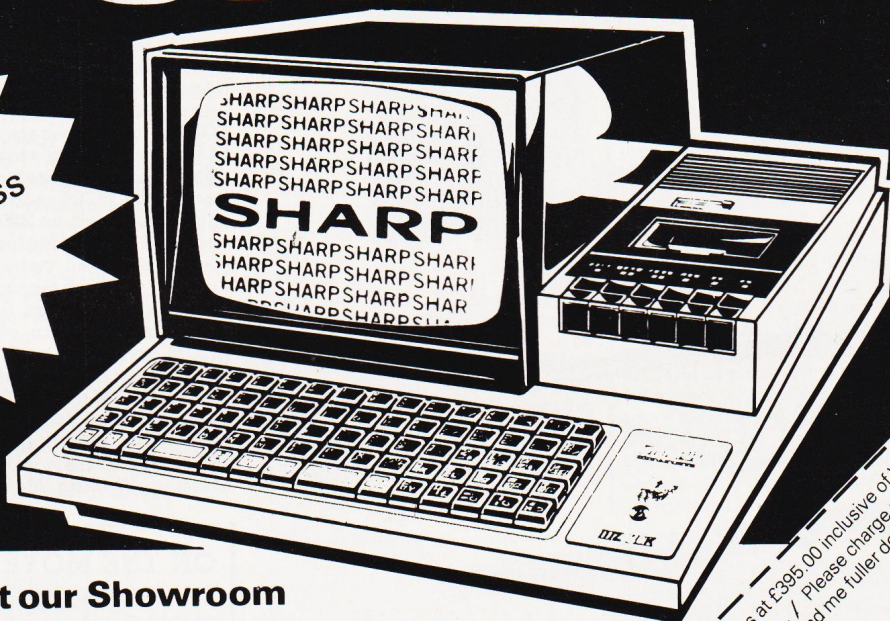
**TEMPUS** Dept CT1/FREEPOST  
164-167 East Road, Cambridge  
CB1 1DB Tel: 0223 312866



# AT BYTESHOP MANCHESTER

# We're keen on SHARP

**SHARP MZ-80K**  
A Complete  
Computer for less  
than £400  
inc VAT!



## Order by post, or visit our Showroom

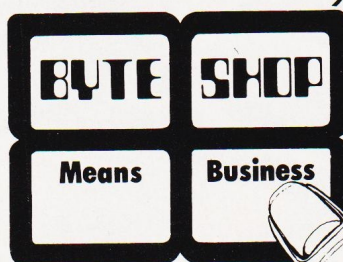
- ★ A Full 48 K Microcomputer with built in cassette drive and video screen.
- ★ A full range of modular expansions including printers, floppy disk drives are also available. Please phone, call or send for fuller details.
- ★ To Order by post, complete the attached Order Form, and send with personal cheque. Allow one week for the cheque to clear.

\*VAT has been calculated at the current rate of 15%. Please make any adjustment for any changes since publication date.


### Byte Shop Computerland

11 Gateway House, Piccadilly Station  
Approach, Manchester M1 2GH.  
Tel: 061 236 4737.

A member of the  Comart Group of  
Companies  
A member of the Computer Retailers Association



Please supply ☐ Sharp MZ-80K Microcomputers at £395.00 inclusive of VAT\*  
My personal cheque No is ..... for £ ..... / Please charge my  
Access/Barclaycard Account (delete as applicable) Yes ☐ No ☐  
on Sharp expansions products and software ..... Yes ☐ No ☐ Please send me fuller details

NAME \_\_\_\_\_ TEL \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
Access Card No. \_\_\_\_\_  
Barclay Card No. \_\_\_\_\_  




## APPLE BEARS FRUIT

The Apple III system has been officially re-launched in the UK just two days before the distributors, Microsense, became Apple Computer (UK) Ltd. The system is now based around a 6502-compatible, custom-built CPU which can address up to 256K of memory. A single 5¼" disc is fitted along with 128K of RAM, serial and parallel interfaces, and a six-bit D to A converter. The keyboard is expanded from the Apple II and that rather dangerous switch has been moved well out of the way. A variety of graphics modes is available and the screen format is basically 80-column, although high resolution (560 by 192) is available for business displays and the like. The

'basic' system with a video monitor, a wodge of business software and the new Sophisticated Operating System will sell for around £2700. If the expansion capability of up to four discs is not sufficient then, for a further £2256, you can purchase the ProFile, a 5¼", 5Mb Winchester disc which is Apple's latest product. Most of the available Apple II software will run on the 'III' under a special emulation package but the more successful products, VisiCalc and the like, have been re-written to make use of the added facilities on the 'III'. For technical product information and prices, contact your local Apple dealer or write direct to Apple Computer (UK) at Finway Road, Hemel Hempstead, Herts HP2 7PS.



## ◀ MORE STORE

LSI Computers of Woking, those regular visitors to these pages with their small business systems, have recently upgraded their M-Three machine to take Shugart's 8" Winchester. Available in five or 10Mb capacities running under CP/M, the prices start at £5,300. LSI have also taken on a distribution agreement for the new OKI IF800 colour graphics system. Based on Z80A with 64K of RAM it also features a built-in printer and twin 5¼" discs giving 560K of storage. Interfacing is through an RS232 serial port and you can also plug in ROM cartridges with up to 4K of program. Pricing will be between £4,500 and £5,000. Further information from LSI Computers, Copse Road, St Johns, Woking, Surrey GU 21 1SX or ring on Woking 23411.

## ON THE MOVE

Almarc, the Vector Graphic people, have upped and offed to new premises in Nottingham. Their new abode is at Great Freeman Street, Nottingham NG3 1FR and they can be contacted on 0602-52657.

## GRAB DEM BYTES ▶

A right quartet of companies have conspired to make sure that the data you capture with one company's portable terminal can interface through a second firm's unit operating under a third company's software running on yet another company's computer! The terminal is the MSI 77 which can be carried around picking up information such as stock levels or order quantities. This is plugged into an interface unit designed by Mektronic Consultants which in turn connects to a Sharp PC 3201 computer running under Sumlock Software's latest package. If all that has got you confused, I'm not surprised. See your local Sharp dealer for help and advice!



## DISPENSING WITH THE PROBLEM

One of the major problems with manual documentation systems is that when overworked they tend to become somewhat illegible. One of the best examples of this can be found in your local High Street where the overworked pharmacist has to produce dozens of labels for the various drugs being dispensed. A company called Microscript has introduced an automatic label printer for dispensing chemists. Capable of handling up to 1,500 different drugs and preparations with up to 300 combinations of dosage, it is based on an Apple with twin discs and a printer. The pharmacist simply enters the abbreviated codes for the drugs and their dosages and the computer searches out the full names and directions from its memory. A facsimile label is then produced on the screen and, if correct, can be printed onto a custom-designed label. The system can also automatically produce warning notices where required and the Apple itself can be used for other purposes such as stock control. For an illustrated information sheet on the product contact Microscript at 6 Pavilion Parade, Wood Lane, London W12 0HQ or ring them on 01-743 9000.

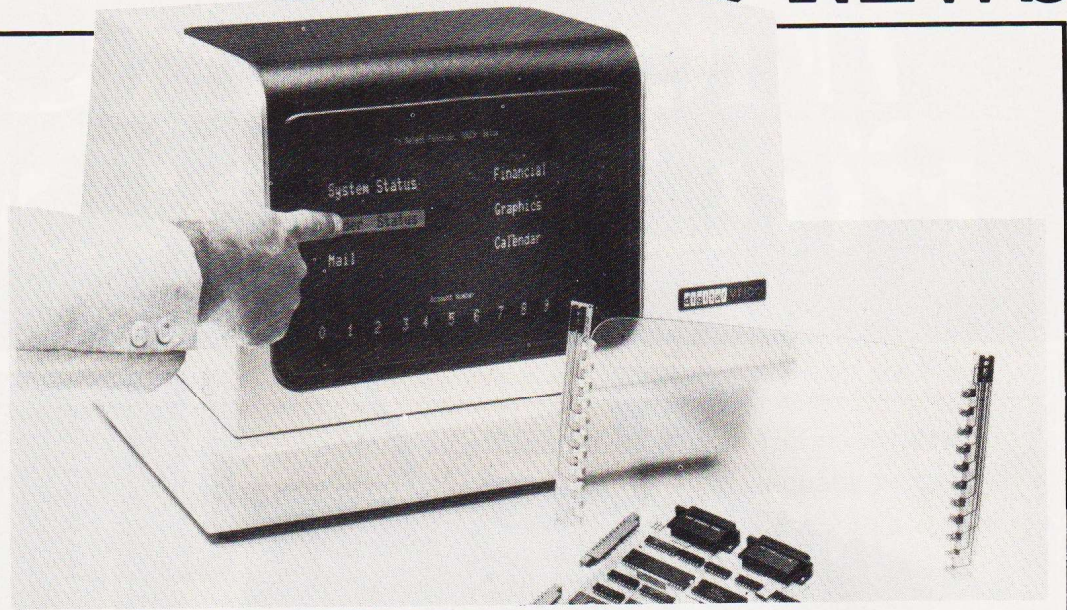
## APIARISTS ARRIVAL

The American VDU makers, Beehive, have signed a distribution deal with Terminal Display Systems of Blackburn. The full range will be available and for technical information you should contact TDS at Philips Road, Whitebirk Industrial Estate, Blackburn, Lancs BB1 5TH. The latest terminals all employ micro technology and offer system emulation and full editing facilities. Details soon in our Buyer's Guide



## FINDE YOR SPELING MISTEAKS

Exidy have introduced a dyslexic's dream, a disc-based dictionary for their word-processing package. The vocabulary consists of some 20,000 words but can be expanded as required to about 50,000; this is limited by the available disc space. The speed of operation is around 5,000 words per minute but there is a minimum time requirement, so short documents will not necessarily process faster. Assuming that you have the hardware requirement of a disc-based Sorcerer the program will cost you £195 and is available from Liveport at The Ivory Works, St Ives, Cornwall or ring 0736-798157 for your local dealer's address.



## CHARACTERS IMPRINT

The possibilities for cracking puns about the formation of a new software publishing house, Caxton, are almost endless! But would one dare make such remarks about people like Dashing Dave Tebbutt, recently Editor of our rival PCW, or Alan Wood, ex of Digitus and Micro Focus, or even Bill Barrow lately of Data Logic? Well, one would, but the photograph they sent us makes them look so much like a certain Organisation that the words freeze in one's vocal tract! Their basic function in life is to establish and promote British software, initially for CP/M and Apple but this will doubtless expand. Indeed, they have already set up a cross-distribution deal with Microsoft in the States where they will distribute Microsoft's CP/M range and Microsoft will distribute Caxton's product in the US. Alan Wood's old company are acting as Technical Consultants for product verification and the intent is to ensure that each product will be crashproof and completely international. For information contact David Tebbutt at Caxton, 10-14 Bedford Street, Covent Garden, London WC2E 9HE.

## WORDS ON WORDS

The latest publication from the National Computing Centre is a book entitled 'Introducing Word Processing'. Priced £8.50 it details the various types of system, the software and necessary background information. The book also shows that the users are as important a link in the chain as the hardware, something few purchasers seem to consider. The publication should be available from specialist bookshops or direct from the NCC at Oxford Road, Manchester M1 7ED.

## MODEL = PRICE

Memory Computers have introduced a new, low-cost, small business computer called the Memory System 2000. Priced at £2000 it is Z80 based with 60K of RAM, twin 5¼" discs giving 400K of storage under CP/M and an integral keyboard/VDU. The recommended printer is the Centronics 737 which they will supply for £400 although other models are available, notably a daisywheel type for word-processing. Language and software support consists of BASIC with FORTRAN, COBOL, Pascal and an Assembler available as extras. The system will be marketed through a national network of 22 distributors who will also supply a variety of software packages. For details contact Memory Computers at Britannia House, 960 High Road, N Finchley, London N12 9RY. ▼

## SURVEY RESULTS FROM US

The results of the sixth annual small business computer survey in the USA have just been published by Management Information Corporation. The results are based on the responses of over 470 companies using some 600 small business systems and nearly 1,000 peripherals running 245 software packages. A total of eight small business computers were awarded the MIC Certificate of User Commendation together with 26 peripherals and six software packages. Copies of the report are available from MIC at 140 Berkley Center, Cherry Hill, NJ 08034 for \$22. Please mention this magazine when contacting them, or indeed any of the overseas companies mentioned in these pages.

## FEEL YOUR VDU ▲

The ultimate in tactile computer interaction must be the touch screen VDU. A new add-on for DEC VT100 terminals allows the user to retrofit a touch panel onto the screen giving some 30 touchable areas. Developed by a Massachusetts-based company called Interaction Systems the product is being brought in by Peripheral Hardware of West Molesey, Surrey and C W Cameron of Glasgow. Alternative formats are available for the Lear Siegler ADM 32 and 42 terminals and can be custom made for most other types. The quoted price of DEC unit is \$945 and the current UK price can be obtained from either of the two companies. Peripheral Hardware are at Armfield Close, West Molesey, Surrey and C W Cameron is at Brunfield Road, Giffnock, Glasgow.





# The MICRO-PROFESSOR ...



MICRO-PROFESSOR is a low-cost Z80 based microcomputer which provides you with an interesting and inexpensive way to get into the microprocessor world. MICRO-PROFESSOR is a microprocessor learning tool for students, hobbyists and personnel. It is also an ideal microprocessor educational tool for teaching in schools and universities. Besides, MICRO-PROFESSOR is more than a learning tool. It provides a wide range of applications such that you will be surprised at its amazing power.

The main object of MICRO-PROFESSOR is for the user to understand the software and hardware of a microcomputer easily and conveniently. Besides

the complete hardware/software system, you have the User's experiment manual available to you. It includes self-learning text with 20 experiments which range from simple software programming to design a complex electronic game.

2K bytes of monitor source program with documentation is also provided in the manual. It shows how to write system programs including system initialization, keyboard scan, display scan, tape write and tape read.

**APPLICATIONS:**  
Learning and teaching tool  
Low cost prototyping tool  
Low cost development tool  
Tester

Process controller  
Electronic game  
Electronic music box  
Master mind  
Timer  
Noise generator  
Home appliance control  
Burglar alarm  
System control simulation  
... and many more.

**Low Price, High Capability  
experimental tool for only**

## £54.95

**POWER SUPPLY** +p and p.  
A 9V, 0.5A Adaptor is provided.

Z80 is a trade mark of Zilog Inc



# solves the 'mystery' of micro-processors.

## TECHNICAL SPECIFICATION

### CPU

Z80 CPU high performance microprocessor with 158 instructions.

### SOFTWARE COMPATIBILITY

Capable of executing Z80/8080/8085 machine language program.

### RAM

2K bytes expandable to 4K bytes.

### ROM

2K bytes of sophisticated monitor expandable to 8K bytes.

### INPUT/OUTPUT

24 system I/O lines.

### MONITOR

2K bytes of sophisticated monitor. It scans the keyboard and executes the command entered immediately after the power is turned on. The monitor includes: system initialization, keyboard scan, display scan tape write and tape read.

### DISPLAY

6 digit 0.5" red LED display.

### AUDIO CASSETTE INTERFACE

165 bit per second average rate for data transfer between memory and cassette tape.

### EXTENSION CONNECTORS

Provides all buses of CPU, channel signals of CTC and I/O port bus of PIO for user's expansion.

### COUNTER TIMER CIRCUITS

Circuits are provided.

### PARALLEL I/O CIRCUITS

Circuits are provided.

### SPEAKER AND SPEAKER DRIVER CIRCUITS

A 2.25" - diameter speaker is provided for user's applications.

### USER AREA

Provides a 3.5" x 1.36" wire wrapping area for user's expansion.

### POWER REQUIREMENT

Single +5V DC.

### USER'S AND EXPERIMENT MANUAL

Complete self-learning text with experiments and applications.

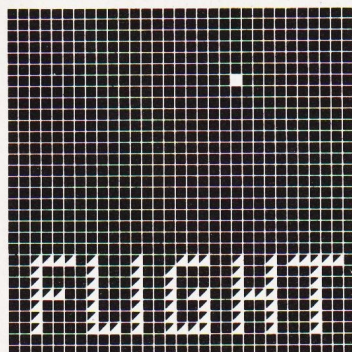
### OPTIONS

Z80 - CTC    EPROM programmer board    Prototyping board  
Z80 - PIO    Breadboard    Audio Cassette

### KEYBOARD

36 keys including 19 function keys, 16 hex-digit keys and 1 user defined key.

Use the unique MICRO-PROFESSOR to truly understand the inside workings of microprocessors. Open up a whole new spectrum of projects in home electronics, or simply use the MICRO-PROFESSOR as a practical learning/teaching aid.



**Flight Electronics Ltd.**  
Tel: (0703) 31323/34003

To receive your MICRO-PROFESSOR Complete the coupon today!

Please send me ..... MICRO-PROFESSOR(S)

I enclose cheque/P.O. for £..... + p and p. £1.95

Name: .....

Address: .....

Please allow 14 days for delivery

**Flight Electronics Ltd. Flight House, Quayside Road,  
Bitterne Manor, Southampton, Hants SO2 4AD.**





## If you are involved in Computer Aided Learning or are considering producing software for schools then you should know about PILOT.

**P**ILOT is a language for computer-assisted learning (CAL). It is a language for writing programs which, when run on a computer, can help the user to learn a particular subject. PILOT programs start a dialogue in which the user participates. Responses are assessed and rewarded if they are correct or, typically, if they are not correct another chance to respond is offered. Thus, the type of CAL offered by PILOT programs is the same in principle as that available from a programmed text. However, when using a computer, successful responses can be rewarded more emphatically with imaginative use of graphics, just as further responses following a wrong answer can be encouraged more effectively. Additionally the opportunity to play with some facility possessed by the computer can be offered if a section is completed successfully or rapidly.

PILOT was designed at the San Francisco Medical Centre in 1973. The original version is referred to as Core PILOT. In its early years it was used in a more or less pure standard form as a flexible language for producing interactive dialogues designed for learning purposes. Subsequently, the language was extended by Professor G Gerhold and L Kheriaty to give what is known as COMMON PILOT. This extended version is a sufficiently powerful and flexible language to deserve to be called an 'author language' for CAL.

Languages for CAL enable microcomputers to be used as educational tools and to be used in such a way that learning is fun. They can be used like this not only in schools and colleges, but also in the home. However, CAL programs written in PILOT are rather greedy for storage, and as a rough estimate, a program which produces five minutes of dialogue requires about 8K of storage.

### Core PILOT

The Core PILOT language has six types of instruction. Each instruction starts with a key letter which indicates its type, and the key letter is followed by a colon. An instruction starting with a 'T' is an output instruction. When executed, it causes the text following the colon to be printed out. An instruction

starting with 'A' is for input, and on execution it causes an input from the keyboard to be accepted. The letter 'M' signals the start of a match instruction, the execution of which causes a flag to be set to 'Y' or 'N' respectively, as the characters following the 'M' match or do not match the most recently accepted input. The instruction starting with 'S' causes program execution to stop.

Instructions may be made conditional by starting them with 'Y' or 'N', in which case they will only be executed if the state of the match flag agrees with the initial conditional letter.

A simple example program to illustrate the use of these instructions, which gives an arithmetic test, is:

```
T : WHAT IS THE RESULT OF 2+3*4?
A :
M : 14
YT: FOURTEEN IS CORRECT
NT: NO. THE ANSWER IS 14
S :
```

This program causes a question to be printed and accepts an answer which it matches with the correct answer before printing an appropriate comment on the answer given.

The remaining instruction is a jump instruction and commences with a 'J'. When followed by a zero, it causes a jump to the preceding input instruction, as illustrated by the following program.

```
T : WHAT IS THE LARGEST COUNTRY
    IN AFRICA?
A :
M : SUDAN
YT: YES, THAT'S CORRECT
YS:
NT: NO. TRY AGAIN
J : 0
```

```
WHAT IS THE LARGEST COUNTRY
IN AFRICA?
```

```
? NIGERIA
```

```
NO. TRY AGAIN
```

```
? SOUTH AFRICA
```

```
NO. TRY AGAIN
```

```
? SUDAN
```

```
YES, THAT'S CORRECT
```

The program requests inputs repeatedly until the correct answer is given.

A jump forward is achieved by using '\*' as a program marker, and then an instruction such as J : 2 causes a branch to the second program marker forward from the jump. This is illustrated by the next program which converts figures to words.

```
T : ENTER THE FIGURE 1, 2 OR 3
A :
M : 1
YJ: 1
M : 2
YJ: 2
M : 3
YJ: 3
T : YOUR INPUT WAS NOT AS REQUESTED
S :
*T: ONE
S :
*T: TWO
S :
*T: THREE
S :
```

### COMMON PILOT

An examination of the example programs already presented reveals a number of shortcomings. For example, the first program expects the answer to be given in figures as '14', but there is nothing wrong with the responses 'FOURTEEN', 'Fourteen', and 'fourteen'. In the second example, the program can loop forever if the correct answer is not given. It is probably desirable to maintain a counter, so that after, say, three wrong attempts the correct answer is given and the program proceeds. Additionally, it is useful to be able to deal with spelling mistakes in answers, for unless spelling itself is being tested repeated rejections of slightly incorrect spellings can be very discouraging.

While some of these problems can be overcome in Core PILOT, the extra features of COMMON PILOT are designed to overcome these and other shortcomings. There are computational instructions which start with 'C' and then take the same form as BASIC assignment statements, for example:

```
C : SC=SC+1
```

Thus, powerful processing features are available in COMMON PILOT. Matching instructions can include lists of possible answers, such as:

```
M : 4 ! FOUR ! FOUR ! four
```

where '!' represents the OR operator. They can also include the items of an



# PROGRAMMING LANGUAGES

answer using the AND operator (&) so that the items can be given in any order and recognised as a correct answer, for example:

M : young & blonde & pretty

This facility gives alternative ways of recognising incorrectly spelt answers, eg:

M : separate ! seperate

or

M : sep & rate

Also, it is easier to create conditional instructions because a condition can be directly attached to any instruction so that it is only executed when the condition is true in the manner illustrated below:

T (NT<3) : Still wrong. Try again

This does not give a complete listing of the features of COMMON PILOT, but a program segment to illustrate the use of the features that have been described is given below.

```
C : SC=0
C : NT=0
T : WHICH COMPUTING MAGAZINE
  IS BEST?
A :
M : COMPUTING TODAY ! CT
C : NT=NT+1
YT: VERY GOOD. IT CERTAINLY IS.
YC: SC=SC+1
YJ: NEXT
J(NT<2): 0
T : YOU'VE HAD TWO TRIES.
  IT'S COMPUTING TODAY
NEXT C: NT=0
T : WHICH COMPUTER HAS ROYAL
  CONNECTIONS?
A :
M : DAI ! Dai ! Di ! DI
C : NT=NT+1
YT: YES, IT'S THE LADY DAI
YC: SC=SC+1
YJ: ON
J(NT<3): 0
T : SORRY, BUT IT'S TOO AWFUL
  TO TELL YOU
ON C: NT=0
```

## Summary And Conclusions

Core PILOT is a small language and I tend to feel that it is easier to write CAL programs in BASIC than with it. However, COMMON PILOT is a much more powerful language and because of its careful design it is more suitable for CAL than BASIC. PILOT programs tend to be rather long if they are to produce substantial dialogues. Also, they are about as easy to read as assembly code programs! However, with practice, lively dialogues can be produced that stimulate the user to follow them and learn from them.

For further reading, High-level

languages for microprocessor projects by D Taylor and L Morgan (NCC, 1980) includes a section on PILOT, while the now-defunct **Computer Age** carried a series on PILOT by Gerhold and Kheriaty in issues 3,4,5 and 8.

Implementations of PILOT are available for all the popular processors. It is actually not too difficult to implement PILOT yourself using BASIC as the implementation language.

Figure 1 gives a flowchart for such an implementation of Core PILOT. While I do not recommend such an implementation for serious CAL work since, among other shortcomings, it would be extremely slow, it does make an interesting project. Additionally, it reveals that there is nothing 'difficult' about system software in general and translators in particular since a language translator is just another computer program.

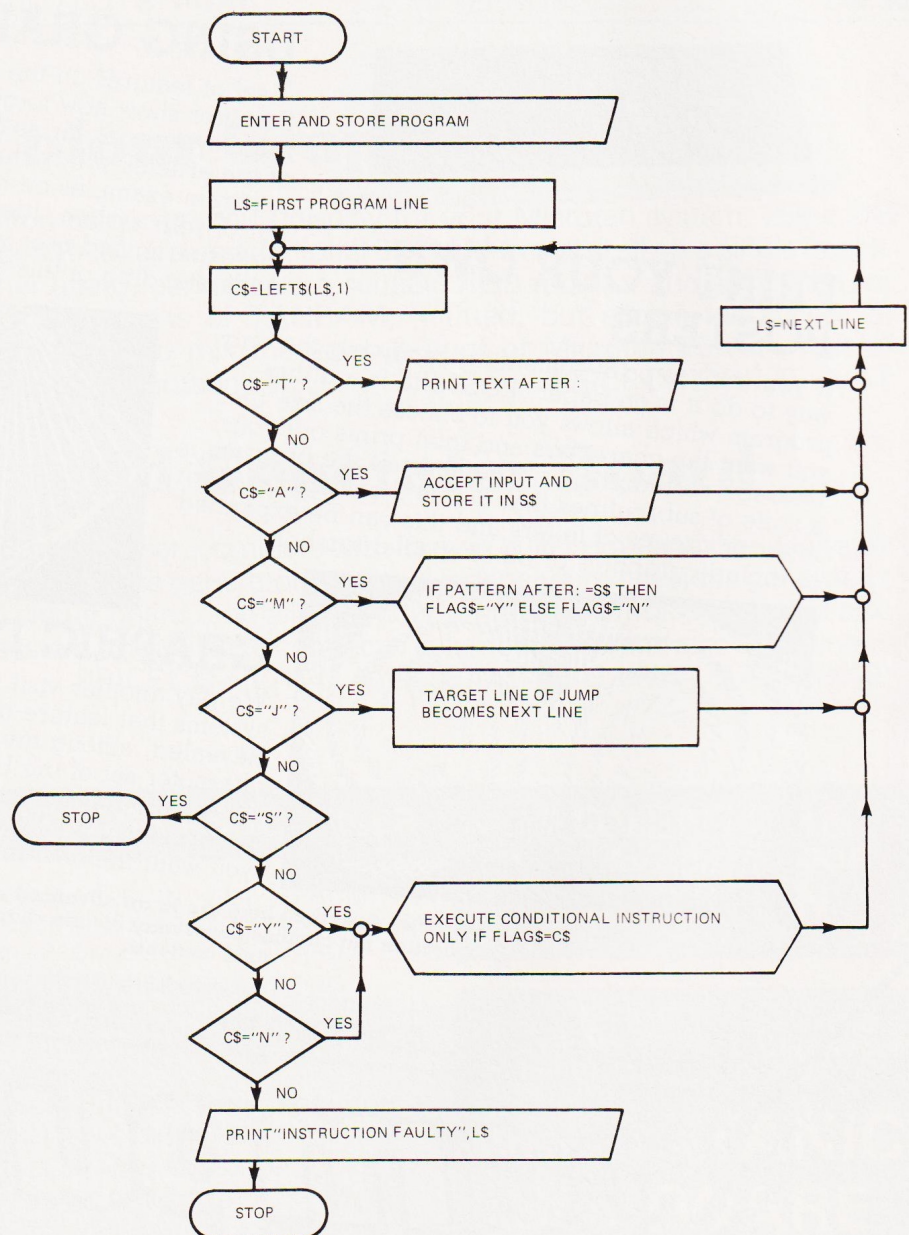


Fig. 1. This flowchart gives the basic requirements for an implementation of Core PILOT.



# NEXT MONTH

## GRAF RITE WRITES GRAPHICS!

User definable graphics are normally associated with systems that contain large amounts of memory. In next month's issue we show you how to define your own characters on the Acorn ATOM system — one of the smaller machines on the market. The techniques are applicable to many other systems that use a defined area of memory for the screen and, although the program is mainly written in machine code, it is fully documented to make conversion easy.

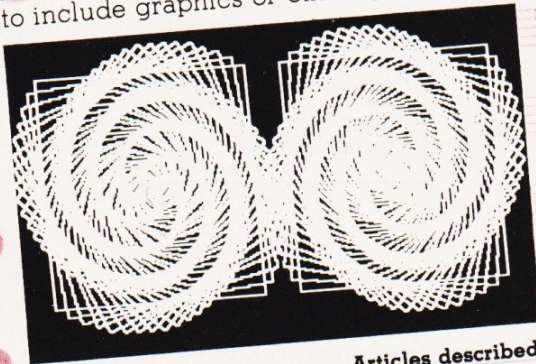
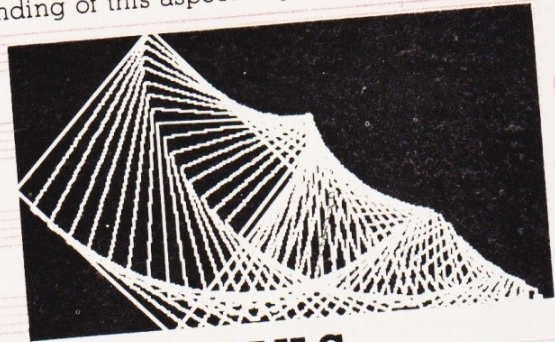


## USING GRAPHICS

A set of features on the Apple, Tandy/Genie and Sorcerer show how to get the best out of each of these systems as far as graphics is concerned. Each of the articles will include numerous hints, tips and program examples on how to get that little bit extra out of your system. Ideal for the beginner or even the experienced user who wants a better understanding of this aspect of programming.

## PRINT YOUR OWN POSTERS

If you want to print something *really* big the only way to do it is on paper. POSTERS is a utility program which allows you to choose the size that you want the characters and then prints out your message on the printer. The heart of the program is a suite of subroutines that define the shapes of each letter or groups of letters and this can be expanded to include graphics or other special symbols.



## GRAPHIC DETAILS

We pay another visit to the hidden secrets of systems that feature graphics in their character sets. Revealed, among the pages, will be the full character set of the UK101 together with its American counterpart, the Superboard. If you are program which allows you to choose the size that you want the characters and then prints out your

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

HARDWARE.....SOFTWARE.....AT HOME.....IN BUSINESS

# computing today

DECEMBER 1981  
\$4.95  
ONLY 79¢

A PERSONAL  
GUIDE TO MICROCOMPUTING

NAME .....  
ADDRESS .....  
Please reserve me a copy of February's Computing Today.  
GIVE THIS TO YOUR NEWSAGENT  
February Issue On Sale  
Friday January 8th



# TANGERINE

## APPROVED SOFTWARE FOR

# MICROTAN

### MICRO TANTEL SOFTWARE

MICRO TANTEL IS A SOFTWARE PACKAGE WHICH INTERFACES TO TANTEL UNITS AND YOUR COMPUTER. THE MOMENT YOU CONNECT YOUR COMPUTER TO THE TANTEL UNIT YOU GET FULL COLOUR FACILITIES WITH A SCREEN SIZE OF 24x40. FETCH AND SAVE PRESTEL PAGES INTO USER RAM AREA. UPDATE AND DISPLAY PAGES IN ANY ORDER AND AT ANY TIME. EPROM OR TAPE . . . . . **£19.95**

### MICROTAN COMPANION BOOK 2ND EDITION

- \* DISCOVER THE INSIDE WORKINGS OF MICROTAN BASIC
- \* PAGE ZERO POINTERS INTO BASIC
- \* NOW LOAD MORE THAN ONE PROGRAM INTO STORE AT ANY TIME
- \* CREATE AND ADD YOUR OWN COMMANDS
- \* DISPLAY THE REGISTERS WHILST YOUR PROGRAM IS RUNNING
- \* IMPROVE DATA RESTORE ROUTINE
- \* FULL VDU MEMORY MAP WITH HEX PLUS DECIMAL VALUES PLUS FULL GRAPHICS CHARACTER CHART

AND LOTS MORE . . . . . **£9.95**

### HIGH RESOLUTION GRAPHICS SOFTWARE

THIS SOFTWARE PACKAGE WILL ENABLE YOU TO USE THE NEW FACILITIES OF THE TANGERINE HIGH RESOLUTION GRAPHICS BOARD. THE PACKAGE CONSISTS OF 38 NEW COMMANDS WITHIN BASIC WHICH WILL ENABLE YOU TO USE THE NEW BOARD WITH EASE. NOW MIX CHUNKY GRAPHICS WITH HIGH RES AND ALPHA. EPROM . . . . . **£16.95**

## Bulldog Colour Graphics Board

RAINBOW provides a high definition colour graphics display for your Microtan system. 256 x 256 point resolution, 8 colours, 24K video RAM and an additional 8K RAM free and all on a single board. Just plug the board into the mother board, connect up a suitable RGB monitor and switch on for brilliant results. Does not affect the contents of TANRAM, if fitted, but allows full access to TANRAM. A special feature is the ability to mix the video output of Microtan 65 with that of RAINBOW — useful for scoring, labelling, annotating etc. **PRICE ONLY £179 + VAT**

## Bulldog Sound Generator Board

SOUND is a powerful sound effects synthesiser, complete with its own built in loudspeaker. Up to six independent tone generators, two white noise generators and two independent envelope generators are made available on one printed circuit board, and all are under program control. The board also provides an output to a stereo hi fi system, the ability to connect a volume control and also two general purpose I/O ports. **PRICE £39 + VAT (1 AY-3-8910) OR £49 + VAT (2 AY-3-8910)**

### TOOLKIT

APPEND LOAD TWO PROGRAMS INTO STORE NOW  
HEX CONVERSION FOR THOSE POKES  
PLOT COMMANDS FOR GRAPHICS  
SINGLE KEY COMMANDS  
FIND AND DISPLAY LINE NOS OF ANY VARIABLE  
AUTO NUMBERING NO MORE TYPING IN OF LINE NUMBERS  
RENUMBER RESOLVES ALL GOTO'S, GOSUB'S, THEN'S, ETC.  
EPROM . . . . . **£22.50**

### 2 PASS ASSEMBLER

AVAILABLE IN 2732 EPROM FOR INSERTION INTO J2 ON TANEX OR OUR 8K EPROM EXTENSION BOARD.

- \* FULL SOURCE CODE EDITING FACILITIES.
- \* CASSETTE ROUTINES FOR SAVING CODE.
- \* ASSEMBLY FROM SOURCE CODE HELD IN STORE OR ON TAPE.
- \* ALL STANDARD 6502 OP CODES + .
- \* LABELS OF UP TO 6 CHARACTERS.
- \* HEX, DECIMAL AND CHARACTER CONSTANTS SUPPORTED.
- \* ASSEMBLY — LABEL — LIST — PRINT
- \* RELOCATABLE ASSEMBLY FOR EPROMS.

FULL DOCUMENTATION . . **£34.95**

### ADVENTURE NOW AVAILABLE FOR MICROTAN

**£5.95**

SEND CHEQUE/POSTAL ORDER PLUS 50p POST AND PACKING TO:

## MICROTANIC SOFTWARE

235 FRIERN ROAD  
DULWICH, LONDON  
or tel 01-693 7659  
PRICES INCLUDE VAT



# YOU MAY HAVE MISSED US ON THE DAY.

If you didn't make it to  
our stand at COMPEC you  
haven't missed the boat.

The offer still stands.

We'd still like to hear from dealers, OEMs and users interested in teaming  
up with one of the world's top four microcomputer manufacturers.

Sophisticated systems based on Zenith's renowned Z89 desk top computer  
together with Zenith monitors, printers and substantial systems and application  
software, are already setting the paces in Britain.

And there's still more – much  
more – to follow.

Zenith Data Systems are  
making a multi million dollar  
investment in tomorrow's hardware  
and software. More than enough to  
embarrass our few serious rivals.

Post the coupon. If you  
have an eye to the future, what  
we have to offer could be very  
much to your advantage.

# MAKE SURE YOU DON'T MISS OUT ON TOMORROW.



## ZENITH

## data systems

**THE QUALITY GOES IN, BEFORE THE NAME GOES ON.**

Bristol Road, Gloucester GL2 6EE. Telephone (0452) 29451

Please tell me more about Zenith microcomputers and your plans for the UK. Dealer/OEM enquiry ☐ User enquiry ☐ (Please tick as applicable.)

Name \_\_\_\_\_

Position \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

Telephone \_\_\_\_\_

SELECTED  
DEALERSHIPS  
STILL  
AVAILABLE



Dual-density  
Model  
ONLY £1,750\*

Leasing and  
Rental  
Facilities  
Available

**SUPERFAST  
DISK COPY  
\*ONLY £25\***



Superb  
Budget-priced  
W.P. System  
FOR ONLY  
£2,995\*

**WORDSTAR FUNCTION  
KEYS NOW AVAILABLE  
MAKES LEARNING AS  
EASY AS ABC!!**

**equals**

# **SPEEDY SOLUTIONS to your unique BUSINESS PROBLEMS**

**We build systems to SUIT YOUR BUSINESS and MAKE IT MORE EFFICIENT!!  
We *don't* ask you to change your business to suit an off-the-shelf package!!**

Our professional consultants using Advanced Software Development Techniques can produce a system to meet your needs for now with the built-in flexibility for tomorrow's expansion.

**All in a fraction of the time it normally takes to develop a "Made-to-Measure System" with corresponding SAVINGS on your software costs.**

For free consultation and demonstration contact:



**VISION BUSINESS SYSTEMS LTD.,  
58 ST. PETER'S STREET, ST. ALBANS, HERTS.  
TELEPHONE: ST. ALBANS (0727) 33744**

\*Prices may be subject to change due to the fluctuation of the dollar rate.



## It's over a year now since we first looked at this twin CPUed desktop computer. To find out how it fared during its twelve months trial you should read on.

**A**bout a year ago the Intertec SuperBrain caused something of a stir. A full microcomputer system — 64K of memory, two double-speed Z80s, a 24 line by 80 character display, built-in twin mini-floppies and CP/M all in one case — and all for less than £2000! At the time it was a breakthrough in terms of value for money, but now it's time to look again. Since the SuperBrain was introduced, the world has changed — now memory costs £8 for 16K and there are machines with similar specifications all in one box, eg the Tandy Model III. If the SuperBrain still has anything to offer it must be on performance as well as price.

### The History

Computer manufacturers have always put as much as they think that the average buyer can afford in to one package. So early on, you bought a CPU with as much memory as you could afford; later, memory became so cheap that it wasn't worth making an issue of it and a full 64K became standard. The Intertec SuperBrain was the first successful machine to bring all of the features of a complete personal computer together in one self-contained package, looking like a slightly large VDU. As it was normal practice at the time, the advertising campaign started a while before any machines were available and after a number of delays (reported to be due to the change from slim-line 5¼" drives which didn't work, to standard size drives which did) the production model SuperBrain appeared. Its impact was immediate — no matter how good it was, it was ideal for many applications — and a large and rambling dealer network sprang up. This situation persists today. Intertec, unlike Apple, have never got round to appointing a single main distributor — perhaps they're not very interested in the UK. This has made getting any definitive information about Intertec's present or future plans difficult, to say the least! Following this rather confused start we now have a range of Intertec products in support of the SuperBrain.

### A User's View

Before we deal with the technical details of the machine, let's examine the impression that the SuperBrain gives in use.

The overall configuration of the SuperBrain can be seen in the photographs. The main points to notice are the large full keyboard, the 12" CRT screen and the pair of 5¼" floppies mounted vertically to the right of the screen. Around the back you find two standard sockets for serial devices. This means that the SuperBrain can only handle serial printers, ie not the standard 'Centronics' type. However, it does mean that the machine can be used as a VDU if required — but more of this later.

In my day-to-day usage of the SuperBrain I have found it pleasant enough. Let me itemize in some detail particular features I like and dislike.

**The Keyboard:** This is precise with no bounce, and has a sensible upper case lock which gives upper case on all the character keys and lower case on all the number keys unless one of the shift keys is pressed. The only complaint that I can level against the keyboard is that it lacks a repeat key. (I know that this is available as an optional extra but it's such a little extra that it should be standard.) A special feature of the keyboard is the two red keys to the far right and left of the bottom row. Pressing either one of these results in nothing, it's only when you press both simultaneously that the system resets itself and tries to reload CP/M. This simple single feature has saved Intertec from being responsible for the loss of countless millions of bytes of data. As any one who has used an original Apple keyboard will tell you, it's all too easy to hit one reset key by accident — but to hit two is much more difficult!

**The Display:** The VDU display is stable and clear. With an 80 by 24 screen it's suitable for business applications but why, oh why, did Intertec use a format for lower case characters without true descenders? Just in case you don't know what a

descenders on the SuperBrain means that a screen full of lower case characters looks very strange with letters all over the place. It's true that you get used to it, but it is a little difficult to explain why the text is so difficult to read to a first time computer user. As in the case of the keyboard, it is possible to make good the defect by buying an add-on, but having true descenders is a basic requirement for a business computer and should not be treated as an extra. add-on, but having true descenders is a basic requirement for a business computer and should not be treated as an extra.

**The Disc System:** The two mini-floppy drives are standard units. The format is either single-sided double-density giving 350K, or double-sided double-density giving 700K total storage. At first I was a little worried about using such high performance discs. On the whole, I would rather have a lower capacity coupled with high reliability and, after the trouble I have had in the past with single-sided single-density discs, I feared the worst. But I am pleased to say that the disc system has proved reliable and, in time, I might even be converted to the viewpoint that double-density works! One small point to mention is that the drive motors run continuously. Generally speaking, it is current practice to leave the motors of 8" drives running, because they take about two seconds to come up to speed but 5¼" drives are sometimes set up to run continuously and other times to turn on and off as required. The pros and cons are that intermittent operation reduces diskette wear and average noise levels, but increases drive wear and access time. Whereas continuous operation increases wear in diskettes and average noise levels, but reduces drive wear and access time. My personal preference is for intermittent operation so the SuperBrain does not entirely satisfy me.

**The Software:** For a non-technical user the only thing that makes the SuperBrain *really* special is that it's all in one box! The Super-



# SUPERBRAIN REVISITED



The SuperBrain reposing in its normal working environment.

Brain typifies the 'music centre' approach to electronic consumer goods. As with hi-fi, if you don't like trailing wires and separate units, there is a lot to be said for it. All you need is a desk, a SuperBrain, and a printer of your choice and you have an ideal business system. Because of this 'no fuss' approach to the electronics of computing we might expect that Intertec would offer a similar approach to the other aspect of computing — the software. The test of how easy it is to use a piece of software depends not only on how well written, but also on how well documented it is. Unfortunately, the SuperBrain fails on both counts. The standard system software is CP/M 2.2 and the best thing that can be said about that choice is that a lot of people use it and there is a lot of software available for it. CP/M is not easy to use at the best of times and Intertec have done nothing to make it any better. The manual supplied is large and impressive but it is simply a re-bound collection of the various software manuals produced by the software houses. It is not a beginner's manual. But, to be fair, there is a section that will tell you how to get started when you first

receive your computer — from then on you're on your own. There is no getting away from the fact that the SuperBrain is a CP/M machine and it is CP/M which governs the way the user sees the machine. The point is, apart from the small hardware problems discussed above, any frustration that the SuperBrain generates is due to CP/M and is shared with every other machine running a standard version of CP/M. My advice to Intertec is that if they want to make the SuperBrain easier to use and hence available to a wider market, they should spend time improving their documentation and, if possible, write (or acquire, as some already exist) a better, but CP/M compatible, operating system. This would be more rewarding than any amount of hardware development. My advice to the average user is to decide if CP/M is the operating system for you, ie do you need the range of software that only CP/M can offer? If it is, then the SuperBrain runs it as well as most!

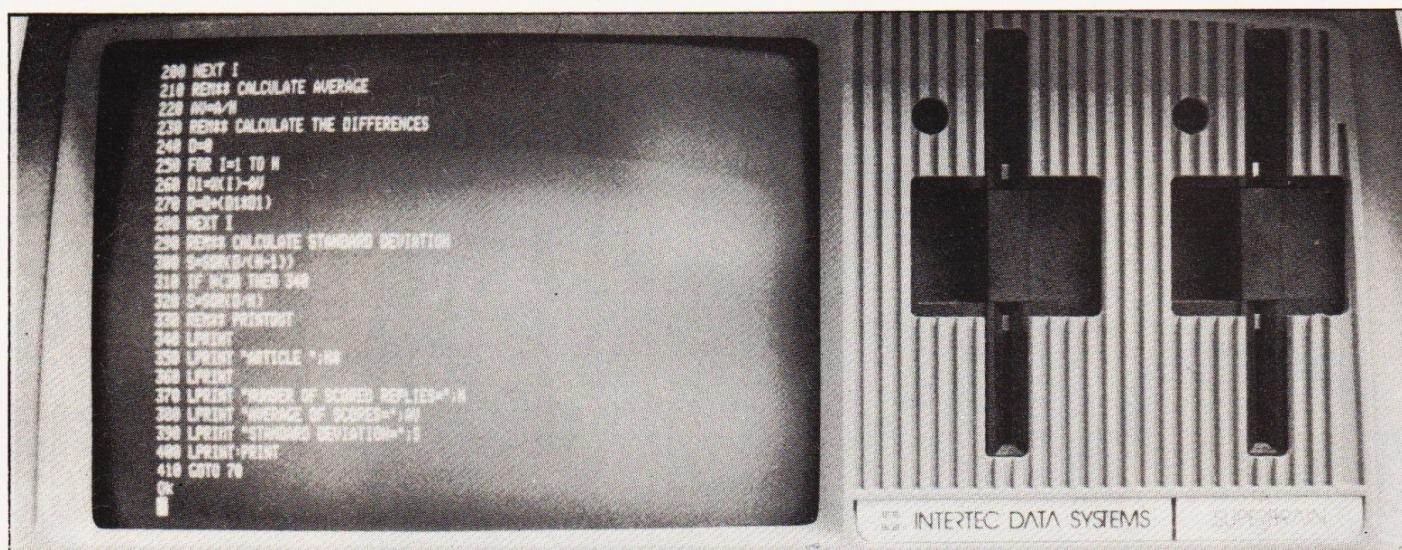
The other software that comes with the SuperBrain includes the excellent MBASIC from Microsoft. There is not much to say here except

that it *is* the standard against which most BASICs are measured. Further offerings include a RAM test program — easy to use but when it finds a fault it fails to tell you where the memory error has occurred — a standard disc formatting program, a system configuration program which allows you to set the baud rate etc of the two serial ports and all the usual standard CP/M utilities, such as ED (editor), ASM (assembler), DDT (machine code debug program) and PIP (copy and data transfer program). The only standard CP/M program that has been modified by Intertec is PIP. This can now be used to send and receive data over the main serial port thus allowing the SuperBrain to be used as a slightly intelligent terminal or even as a simple VDU.

## Technical Details

From a technical point of view, the SuperBrain is a fascinating machine! Most of the advertising literature shouts about its technical virtues in terms like 'Fast Dual Processors', 'twin Z80 design' etc, giving the impression that something special lurks beneath the covers. After a brief study, the technical as





The front view showing the screen and disc drives.



The connection sockets for I/O at the rear.

well as the not-so-technical user is likely to come away with the impression that 'twin Z80 design' implies that things will happen twice as fast — *not so*! Let's clear up this confusion once and for all.

**QUESTION:** Does the SuperBrain's use of two Z80 processors make it faster than an equivalent machine?

**ANSWER:** No! The two processors are used in such a way that when one is doing something the other one is idle!

To find out why the SuperBrain is built in such a strange way we need to examine it in more detail.

**Construction:** The case of the SuperBrain is made from a thick, but brittle, plastic that Intertec refers to as 'Structural Foam'. It is adequate, but remember the term brittle — it will crack under impact so be careful when carrying it about. A cautionary note is clearly printed on the back of the SuperBrain warning, 'removal of cover screws will void your warranty'. This is liable to deter many owners from even a quick peep inside, so perhaps the following revelations will come as news to those of you with access to a SuperBrain as well as those without.

Inside the layout is fairly spacious and divides into three modules:

1) the main logic board carrying the keyboard, all the memory, the two Z80s, the VDU display electronics and the disc interface;

2) the twin disc drives and their analogue circuits;

3) the power supply and the CRT module.

A fan is mounted under the drives and (thankfully) it's quiet. (Or perhaps you can't hear it over the hum of the drives!) Interconnection between the various modules is by ribbon cable and connectors so the whole lot can come to pieces easily. This makes servicing easy if you can find a dealer who will swap faulty modules. One problem with mounting all the modules in one box is that logic circuits don't like either the EHT, or the high frequency noise generated by monitors, and monitors don't like the varying magnetic fields produced by the motors contained in drives. I am pleased to say that the SuperBrain suffers from none of the obvious problems. The monitor is well screened from the motors and the logic board.

**The Power Supply:** This is a switched mode design so there is no large power transformer. Intertec designed a 115 V unit so a stepdown transformer and an extra power switch have to be added for UK use. There is a fair amount of RF interference which comes from the

SuperBrain and it's more than likely that most of it comes from the power supply. So if you're in the habit of listening to a radio while you compute — forget it!

#### The CRT Module And Disc

**Drives:** There's nothing special about either the CRT module or the drives. Both are easy to remove for servicing and should give no problems.

**Main Logic Board:** The main logic board is really the essential SuperBrain — it's where it all happens (er... yeah... Man! Ed.). The printed circuit board itself is not very well mounted and can be flexed with very little pressure. This may not seem to be much of a problem as it's not normal to use a machine while prodding its PCB with a finger, but if it's not well mounted, vibration can be a problem for socketed chips and, in extreme cases, can crack the copper foil. The layout is quite good but on my model there are signs of modifications. Another problem might be caused by the thinness of some of the copper tracks. Thin copper tracks are fine while the unit is working but, if it goes wrong, some poor engineer has to unsolder faulty chips and replace the copper tracks which peel off with wire. You may say that this is a problem for the engineer and of no concern to the

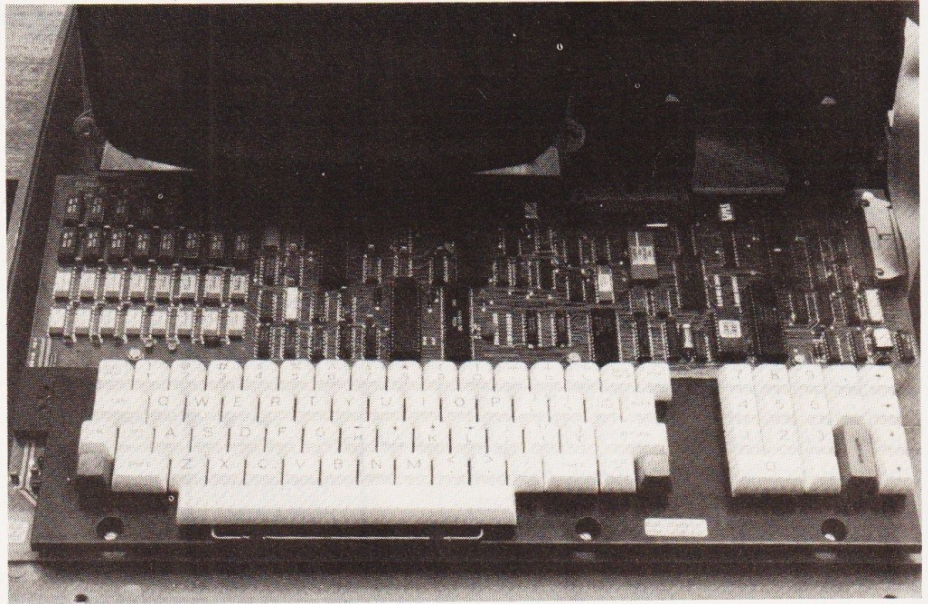


# SUPERBRAIN REVISITED

user, but the more a PCB is cut about the less reliable it is.

The basic design of the SuperBrain can be seen in Fig. 1. The first thing that should strike you is that it's very complicated. Most of this complication comes from the use of the two Z80 processors, each complete with its own RAM. The first Z80 deals with the main memory and the CRT controller and the second interfaces directly to a 1719 disc controller. The 1719 disc controller is a very sophisticated piece of electronics — it's almost a microprocessor in itself and is quite capable of looking after a disc system on its own (as it does in countless other machines). So, why does the SuperBrain need a second Z80? The only possible reason that I can think of, apart from the obvious one that the people at Intertec found it easier to design in two halves, is that the first Z80 is involved in some critical timing operation which would interfere with normal disc operation. When a sector of a disc is being read by the 1719 a stream of bytes is produced which must be taken and stored in memory. If the processor cannot take the bytes fast enough then the 1719 cannot do anything about it and some of the data is lost. So if the first SuperBrain processor was doing something periodically that couldn't be stopped, then this might force the designers to install a second processor especially to read data from the 1719. The problem is, what is the first processor doing? An examination of the circuit diagram shows that the only device which could demand periodic servicing is the CRT controller and the SuperBrain manual confirms that the first Z80 does 'talk' to the controller 25 times per video frame. This certainly explains why the first processor is not available to handle the disc I/O. It doesn't explain why the CRT controller needs attention about every 1/500th of a second. A CRT controller is like a disc controller, almost a microprocessor in its own right, and most can display a screen full of data without any help. The more you examine the SuperBrain the more difficult it becomes to fathom the reasons behind the design!

The main 64K of memory is standard 4116 dynamic RAM refreshed by the first Z80. Not all of this can be used by programs as the top 2K is shared with the CRT controller to provide the 24 by 80 memory mapped screen. So the SuperBrain is



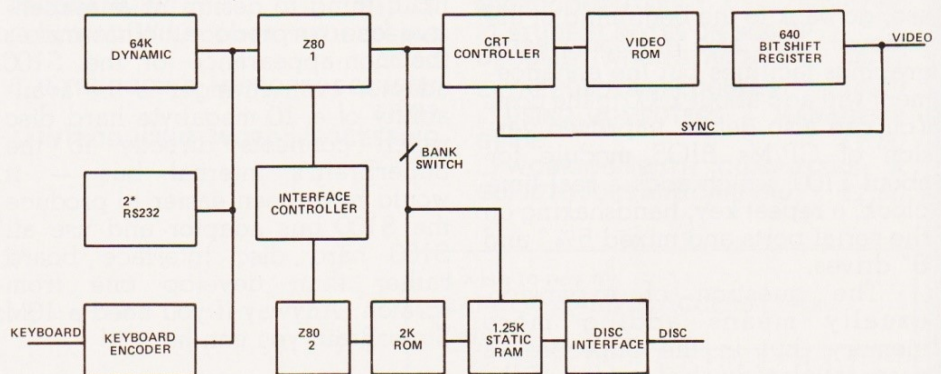
**The SuperBrain is really a single-board computer! The area of chips at the top left of the keyboard is the 64K of RAM.**

really a 62K machine. The second processor has 1.25K of RAM all to itself along with 2K of PROM. The two processors talk to each other through three eight-bit I/O ports and the first processor can read and write the second's RAM and ROM. As the first processor has a full 64K of memory, this is done by switching out the bottom 16K of main memory and replacing it with the ROM, and switching out the third 16K when access to the disc RAM is required. The procedure that the SuperBrain has to go through to read an area of disc is something like: first swap the third 16K of RAM with the disc RAM and set up a number of parameters such as disc, side, track and sector; tell the second processor that there is something for it to do; wait until the second processor has read the sector into the disc RAM; again access the disc RAM and transfer the disc data to the place where it is needed in the memory.

All this must make disc access slower. Most machines use their disc controller to transfer the data directly where it is required, rather than into a special fixed location buffer first.

Another feature of the main board is the integral keyboard. A clever machine like the SuperBrain surely has some special way of coping with the keyboard? But no, we have a standard keyboard encoder chip feeding ASCII characters through an I/O port. Suddenly the reason why the SuperBrain is such a peculiar machine becomes clear — nearly all of the components are very large chips! In my opinion the SuperBrain is the product of designing a computer using nothing but LSI components even if they don't quite go together!

In conclusion of this, admittedly rather technical, look at the SuperBrain, I offer the following observations!



**Fig. 1. This is the basic functional diagram of the hardware.**



# SUPERBRAIN REVISITED

- 1) The SuperBrain is a very interesting machine!
- 2) The odd design is likely to make servicing (other than simple replacement of modules) hell; ie I would not like to service one!
- 3) Apart from the second comment the odd design is not important to a non-technical user.

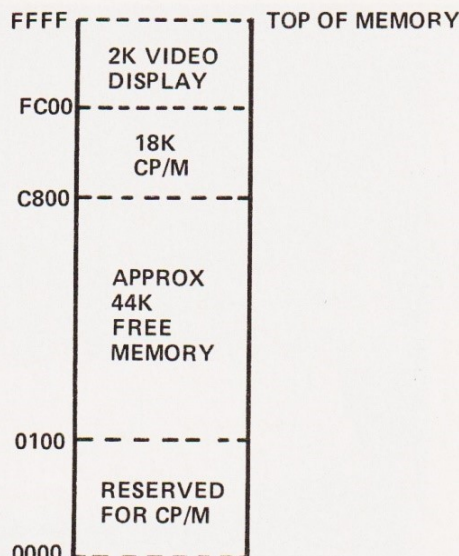
## Documentation

Although I've mentioned documentation before, this review would not be complete without commenting on the lack of any real technical information. The user manual contains a number of nice photos of the interior and a brief, vague description of the workings but not much else. If you follow the offer at the end of the manual and send off for service information, all you'll get is a scroll of circuit diagrams. This is essential service information, true, but it would be nice to get a little more for your money. If you've got a special application in mind which requires detailed information on how the twin Z80 system works, then you'll have to decipher the thing for yourself. One 'plus' is that Intertec have included a listing of the BIOS part of their CP/M. This makes altering the way the peripherals are handled easier.

## Expansion

I've no doubt that by now I've got a lot of SuperBrain dealers up in arms ready to defend their product by telling me how my criticisms can be overcome using this or that add-on. It is true that all sorts of goodies are available to make the SuperBrain into a better machine but these, of course, add to the cost. To get over my main criticism you can buy a chunk of electronics which will give the display true descenders (and if you've forgotten what these are, go back to the beginning of the review!). You also get some extra graphics facilities but the enhancement will add about £300 to the cost. You can also get an improved version of CP/Ms BIOS module for about £100, which adds a real-time clock, a repeat key, handshaking on the serial ports and mixed 5¼" and 8" drives.

The question of expansion usually means adding more memory, but in the SuperBrain's case it already has a full 64K. However, Intertec have made a point of advertising the fact that the SuperBrain is an S100 machine. To be precise it can use S100 cards via



### I/O PORTS

\$50 - KEYBOARD ENCODER

\$40, \$41 - AUX SERIAL I/O

\$58, \$59 - MAIN SERIAL I/O

**The SuperBrain has a very straightforward memory map if you ignore all the strange goings-on with the second processor. Nowhere in the documentation will you find a memory map, so I've had to deduce where everything is. If I've got it right, there is much less user memory available than you would expect. A standard CP/M should only take about 12K.**

an adaptor. The point of this is not to add extra memory but to use S100 interface cards such as A to Ds, 8" disc controllers etc. If you look inside the SuperBrain manual you can even see a photo of the adaptor in use and very neat it looks. The trouble is that I have not been able to get hold of one, nor can I get any word from Intertec about when one might be available! It is true that an alternative is available from UK distributors for £250 but what Intertec are up to advertising S100 capability for so long without producing it, is beyond me. It's not as if it's a difficult thing to design or an expensive one to produce. What makes the non-appearance of the S100 adaptor even stranger is the availability of a 10 megabyte hard disc which connects directly to the SuperBrain's internal bus — it would have been easier to produce the S100 bus adaptor and use an S100 hard disc interface board rather than develop one from scratch. Anyway if you need a 10M SuperBrain you can have it!

## Conclusions

If you've only read the first part of this review — the user's view — then you'll think that the SuperBrain

is not a bad machine. If you've read the whole review then you'll think that the SuperBrain is not such a well-designed machine. There is no contradiction here because the electronics inside a computer affect very little the way it appears to the user. What the electronics does is to determine the machine's limitations, its price and reliability. Because the SuperBrain is a fully expanded system its limitations are shared by all 64K double speed Z80 machines and, because Intertec keep the price low (presumably by high volume production), the design is acceptable. So the only area in which the electronics can affect the user is in reliability and servicing. In my opinion the SuperBrain is reasonably reliable but can be expensive to service. For example if the CRT controller chip fails, a replacement costs £30 without labour! Also, because of its complexity, servicing is not something that can be undertaken by just anyone.

The SuperBrain is still worth considering for most business or number-crunching applications but it would be even better if the lower case character format was improved and if the up-graded BIOS was standard.

## Summary

CPU	Two Z80As
Clock	4MHz
User Memory	Approx 44K
I/O	2 RS232 serial 1 internal bus connector
Keyboard	QWERTY + numeric keypad + 4 cursor control keys
Discs	2 5¼" either SS DD at 350K total or DS DD at 700K total soft sectored, 512 bytes per sector
DOS	CP/M 2.2 18K
Display	12", 24 lines by 80 characters upper/lower case (no true descenders) plus a wide range of special characters
Dimensions	14½" x 21¾" x 23½"
Weight	About 45lb
Price	Varies from about £1700 to £2000



# Specialist Books

## Choosing programs for microcomputers

1980 J E Lane £9.00  
A5 138pp P ISBN 0 85012 255 4  
Looks at application packages for micros describing what they are, the benefits they offer and their use on microcomputers. Guidelines for obtaining packages and for identifying the best product are given.

## Elements of BASIC

1979 R Lewis and B H Blakeley £9.00  
A5 200pp P ISBN 0 85012 118 3  
Introduces the BASIC language, covering the mathematical, non-numeric and data processing facilities. Generally machine independent with supplements to show the effect of a number of different implementations.

## Graphics on microcomputers

1981 J E Lane £4.00  
A5 44pp P ISBN 0 85012 333 X  
Explores the type of graphics becoming increasingly available in low cost systems. Illustrates the facilities available and takes a closer look at graphics picture building techniques.

## Information handling by microcomputers

1981 J E Lane £4.00  
A5 60pp P ISBN 0 85012 334 8  
Examines the field of information handling on microprocessors across the whole spectrum of micro applications. Aims to promote an awareness of current practices and trends.

**NCC**  
The National Computing Centre



## Introducing computer programming

1979 Reprint W G Collin £11.50  
A5 364pp P ISBN 0 85012 210 4  
A machine language independent textbook for the beginner, providing all the necessary basic information needed by someone starting on a computer programming career.

## Introducing data processing

1980 NCC £6.50  
A5 237pp P ISBN 0 85012 245 7  
Covers the requirements of syllabi for introductory courses. Provides a comprehensive and accessible introduction to data processing. Assumes no previous knowledge of the subject.

## Introducing microprocessors

1979 G L Simons £9.00  
A5 177pp P ISBN 0 85012 209 0  
Gives a profile of the microprocessor scene paying attention to typical application areas together with hardware and software information.

## Introducing word processing

1981 G L Simons £8.50  
A5 180pp P ISBN 0 85012 320 8  
Describes the main characteristics of word processing and discusses its advantages over conventional typewriting. Communication, maintenance, security and costs are considered.

## Operating systems for microcomputers

1981 J E Lane £3.50  
A5 77pp P ISBN 0 85012 277 5  
Establishes the requirements of operating systems for microcomputers in both commercial and industrial application areas and examines the facilities provided in a number of current products.

## Student notes on NCC DP documentation standards

1978 NCC £5.50  
A5 100pp P ISBN 0 85012 339 9  
A subset of the full documentation standards for use by students on courses where NCC standards are part of the syllabus.

## The robots are coming

1974 F H George & J D Humphries (eds) £10.00  
A5 188pp P ISBN 0 85012 114 0  
Gives a general background to current developments in artificial intelligence research and looks at where these developments could be leading.

## Using computers — a manager's guide

1980 M Peltu £7.50  
A5 180pp P ISBN 0 85012 241 4  
Intended to help managers implement computer systems effectively in an organisation. Provides an introduction for user management covering the topics of planning and control plus human factors.

## Working with computers: a guide to jobs and careers

1975 £2.50  
A5 86pp P ISBN 0 85012 126 4  
A general introduction to computing as a career for school leavers. Covers how a computer is used, what types of job exist and how to train for them.

**NCC**  
The National Computing Centre



We are now able to offer, in addition to our usual selection of books on computers, a number of specialist titles from the National Computing Centre.  
Rather than taking their entire list of some 110 titles, we have selected those most relevant to the microcomputer market and these are listed with their prices.  
Ordering couldn't be simpler, just tick the boxes in the form below, enclose a cheque or postal order to the total amount (or make use of the Barclaycard and Access facility) and send it all off to:

**SPECIALIST BOOKS,  
COMPUTING TODAY,  
145 CHARING CROSS ROAD,  
LONDON WC2H 0EE.**

If you are using your credit card to order please don't send it, just fill in the number and sign on the dotted line.  
Please allow 28 days for delivery of your books.

- ☐ CHOOSING PROGRAMS FOR MICROCOMPUTERS £9.00  
☐ ELEMENTS OF BASIC £9.00  
☐ GRAPHICS ON MICROCOMPUTERS £4.00  
☐ INFORMATION HANDLING BY MICROCOMPUTERS £4.00

- ☐ INTRODUCING COMPUTER PROGRAMMING £11.50  
☐ INTRODUCING DATA PROCESSING £6.50  
☐ INTRODUCING MICROPROCESSORS £9.00  
☐ INTRODUCING WORD PROCESSING £8.50

- ☐ OPERATING SYSTEMS FOR MICROCOMPUTERS £3.50  
☐ STUDENT NOTES ON NCC DP DOCUMENTATION STANDARDS £5.50  
☐ THE ROBOTS ARE COMING £10.00  
☐ USING COMPUTERS — MANAGER'S GUIDE £7.50  
☐ WORKING WITH COMPUTERS: A GUIDE TO JOBS AND CAREERS £2.50

Name: .....

Address: .....

.....

Amount: .....

Make cheques payable to ASP Ltd.



I wish to pay by  
BARCLAYCARD ☐ ACCESS ☐ tick  
Card No.

.....

Signature: .....



# CASTLE ELECTRONICS COMPUTER SUPERMARKET

Telephone Hastings [0424] 437875

## VIC-20 COLOUR COMPUTER



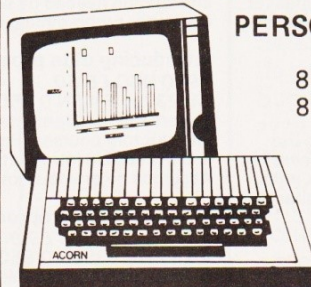
**ONLY**

**£189-95**

- \* graphics character set
- \* plug-in programme/memory cartridges
- \* colour \* sound
- \* programmable function keys
- \* 5K memory expandable to 32K
- \* standard PETBASIC
- \* full-size typewriter keyboard
- \* low-priced peripherals
- \* joystick/paddles/lightpen
- \* self-teaching materials

Cassette Deck now available - £44-95

## Acorn Atom BRITISH DESIGNED PERSONAL COMPUTER



**FROM £140**

- 8K ROM + 2K RAM Kit. . . £140-00
- 8K ROM + 2K RAM Ass. . . £174-50
- 12K ROM + 12K RAM Kit. . . £255-00
- 12K ROM + 12K RAM Ass. . . £289-50
- 4K Floating Point ROM. . . . . £ 23-00
- Colour encoder . . . £ 21-85
- Mains Power Supply. . . . . £ 9-20

FREE POSTAGE AND PACKING ON ALL CASH/CHEQUE/P.O. ORDERS



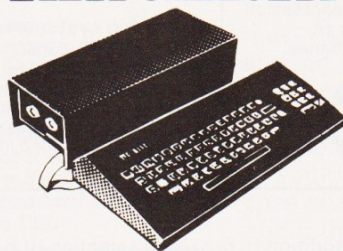
## COMPUTERS FOR PEOPLE



- Model 400 16K. . . . £345-00
- Model 800 16K. . . . £645-00
- Cassette. . . . . £ 50-00
- Disk Drive . . . . . £345-00
- 80 Col. Printer . . . £550-00

Plus All Accessories Available.

## TANGERINE microtan



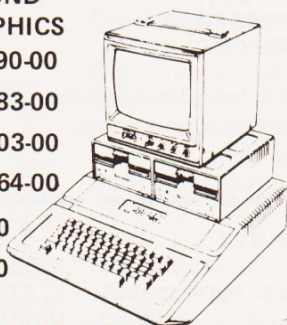
- Microtan 65 Kit . . . £79-35
- Microtan 65 Built . . £90-85
- Tanex Min. Config. Kit. . £49-45
- 20 Way Keypad . . . £11-50

We hold a complete stock of all the Tangerine equipment. Send SAE or 'phone for details.

TANTEL PRESTEL ADAPTER - £199.00

## apple computer BUILT IN SOUND HIGH RES. GRAPHICS

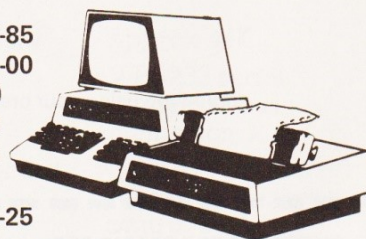
- Apple II Plus 48K . . . . £790-00
- Disc Drive + Controller. . . £383-00
- D.D. without Controller . . £303-00
- Pascal Card. . . . . £264-00
- Eurocolour Card . . . . £ 73-00
- Hitachi 9" Monitor . . . £146-00



We stock all the goodies for the Apple.

## COMMODORE PET

- 8K PET . . . . . £458-85
- 16K PET . . . . . £550-00
- 32K PET . . . . . £699-00
- Dual Disc Drive . . £799-00
- Printer. . . . . £454-25
- External Cassette. . . . . £ 63-25



Complete range PET equipment in Stock.

CASSETTE SOFTWARE: Strathclyde Basic Course, Basic Basic Course, Invaders, Treasure Trove of Games 1 to 10 (10 selections of games), Basic Maths, Algebra, Statistical Packs and lots more!

SPECIAL OFFER - 20% OFF ALL **nascom** PRICES.  
IMP PRINTER NOW £230. PHONE OR WRITE FOR DETAILS.

## C.B. RIGS

MAKE: DNT 27 MHz FM. MOBILE 4 WATTS, 40 CHANNELS. STRICTLY ACCORDING TO GOVERNMENT SPECIFICATION. ONLY £98.25. SEND SAE FOR SPECIFICATION

ALL PRICES INCLUDE VAT.



ACCEPTED. ORDERS NORMALLY DESPATCHED DAY OF RECEIPT.

**Castle Electronics**

Dept. CT  
7, CASTLE STREET, HASTINGS, E.SUSSEX

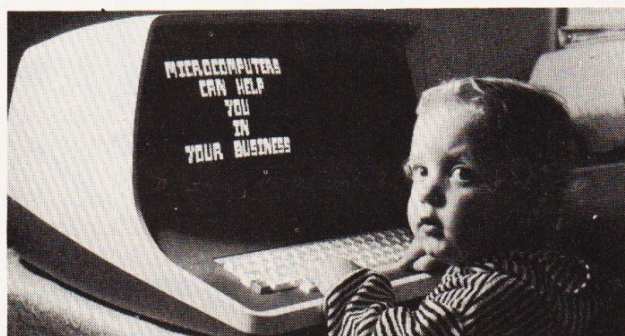
shop hours 09.00~17.30 Mon~Sat

personal callers welcome



# SUPERBRAINS

## FROM THE SUPERBRAIN SPECIALISTS



### SUPERBRAINS AVAILABLE FROM STOCK

DISC OPTIONS 320K — 5M BYTES  
LOW & HIGH RESOLUTION GRAPHICS  
ENORMOUS RANGE OF PRINTERS  
COMMUNICATIONS FACILITIES

PRICES FROM £1900

### MAINTENANCE AND SUPPORT

We have our own team of maintenance engineers. This enables us to provide an unparalleled support service. 24 hour responses contracts are available or service on a time and materials basis. Telephone and onsite assistance is available for software queries. Bespoke Systems designed and Programmed.

### MICRO SOLUTION APPLICATIONS (British software written in CIS-COBOL)

— INTEGRATED ACCOUNTING SYSTEM ..... £1000 — BILL OF MATERIALS ..... £450  
— STOCK CONTROL ..... £450 — PAYROLL ..... from £250

The Accounting System includes:

- Full double-entry accounting
- Sales/Purchase/Nominal Ledgers + VAT
- Sales Invoicing
- Trial Balance/Profit & Loss
- Open Item or Balance Forward
- Up to the minute Enquiry facility
- Alphanumeric Account codes etc.

Stock Control includes:

- Order processing
- Invoice/Delivery Note printing
- Reordering and Valuation reports

Bill of Materials includes:

- Maintenance of Assembly structures
- Multi-level Parts Explosion
- Assembly Component cost calculation
- Requirement Breakdown by period

Payroll System includes:

- Up to 15 Gross and Net pay fields
- Retention of Historical data
- Pension and Holiday pay calculation
- Special Stationery available
- Multi departments
- Up to 9999 employees

### WORD-PROCESSING

SUPERBRAIN is a very cost-effective word-processor. Using the proven WORDSTAR software and a good daisy-wheel printer it's a pleasure to do your paperwork!

### COMPILERS AND UTILITIES

— Microfocus CIS-COBOL compiler .....	£425	— SPELLBINDER word-processing .....	£250
— Microfocus FORMS-2 utility .....	£100	— WORDSTAR word-processing .....	£230
— Micro Solution REPORTER		— Mail Merge option for above .....	£75
(CIS-COBOL Report Generator) .....	£100	— DATASTAR data management .....	£160
— Microsoft MBASIC interpreter .....	£165	— SUPERSORT sort/merge .....	£130
— Microsoft BASIC 80 compiler .....	£200	— BSTAM (CP/M micro file transfer) .....	£75
— Microsoft COBOL 80 compiler .....	£390	— TTY (teletype emulator) .....	£180
— Microsoft FORTRAN 80 compiler .....	£260	— MICROMODELLER financ. planning .....	£645
— Microsoft MACRO 80 assembler .....	£85	— CBASIC compiler .....	£75

### CONTACT:

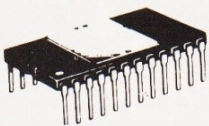


Park Farm House  
Heythrop  
Chipping Norton  
OXFORDSHIRE OX7 5TW

Tel: Chipping Norton (0608) 3256  
ask for: Bill Whaley  
or  
Christine Airey



## NEW LOW PRICES



Micros, memory and support

MC1489	85	74S262	9.95
MC1488	85	74S287	2.50
MC14411	11.95	74S288	2.50
MC14412	11.95	74S471	4.95
1702	6.95	74S472	11.95
2101	2.99	74S474	11.95
2102	99	8T26	1.80
2111	2.32	8T28	1.80
2112	2.32	8T95	1.80
2144L	1.30	8T97	1.80
2142	10.40	8T98	1.80
2376	11.50	SC/MP2	9.95
2513	6.50	8080	5.49
2516(v)	2.95	8085	11.95
2532	7.95	8086	65.00
2708	2.40	8154	11.50
4027	2.95	8155	12.50
4116	1.95	81LS95	1.30
4118	4.95	81LS96	1.30
5204	7.95	81LS97	1.30
57109	12.43	81LS98	1.30
57161	9.95	8212	2.45
6011	4.95	8216	2.50
6116	10.50	8224	2.50
6402	4.95	8228	4.20
6502	7.95	8251	4.95
6520	4.50	8253	10.95
6522	7.95	8255	4.95
6532	8.50	8257	10.95
6545	17.50	8259	11.95
6576	14.95	8678	12.95
6800	7.95	8602	2.20
6802	12.49	96364	10.95
6809	19.95	Z80-2MHz	7.50
6810	3.95	Z80-PIO	6.95
6821	4.50	Z80-CTC	6.95
6845	19.50	Z80-4MHz	8.95
6850	3.95	Z80-PIO	7.50
6852	5.95	Z80-CTC	7.50
74S00	59	Z8000	120.00
74S04	65	ADC0817	14.47
74S201	3.95	DG300	3.60
74S188	2.50	F8	9.95
		F8SMI	9.95

## SOFTWARE

**CP/M** DISK WITH /MAN MANUAL  
Available on 8" IBM format & 5 1/4" for TUSCAN & TRITON

**TCL SOFTWARE**  
TCL Disc Basic £55/£9  
TCL Pascal £120/£9

**MICROSOFT**  
Basic-80 £155/£15  
Basic Compiler £195/£15  
Fortran-80 £205/£17  
Cobol-80 £325/£15  
Edit 80 £45/£10  
Macro 80 £75/£10

**MICROPRO**  
Word Star £255/£15  
Word-Star/Mail-Merge £315/£15  
Data Star £195/£25  
Word-Master £75/£15

**DIGITAL RESEARCH**  
CP/M 2-2 £95/£18  
MAC £55/£10  
SID £45/£10

**OTHERS**  
GENERAL DATABASE £100/£5  
SUPER SORT I £125/£15  
C BASIC 2 £75/£10  
Z80 Dev Pack £50/£12  
ZSID £60/£7

**MEDIA (DYSAN)**  
5 1/4 S/Sided D/D £4.20  
per 10 £37.00  
8" S/Sided D/D £4.90  
per 10 £43.00  
C12 Data Cassettes 50p

## MAIL ORDER

TEL & MAIL ORDERS ACCEPTED



# COMPUTER SYSTEMS

## TUSCAN S100 A Z80 based S100 Computer

All Tuscans have built-in expansion interface, full RS232 serial I/O. Spare parallel output port (Centronics) IEEE 8BIT S100 expansion. Powerful Z80 processor and are expandable to full CP/M system.

### DESIGNED & BUILT IN BRITAIN

16K Tuscan starter kit (inc. P.S.U. & keybd)	£299
16K Home Computer assembled & cased	£499
24K single drive CP/M system (assembled)	£999
60K twin drive CP/M business system	£1449

Also available with double sided drives for 8" and 5 1/4" systems. The Tuscan builds to meet all requirements, 5 spare S100 slots for your plug in boards. Full details on the Tuscan and peripherals is given in our new computer systems catalogue - also see our Software catalogue.



# AND SPARES

## S100 CARDS



NEW

### 64K STATIC /EPROM

Brand new board, takes 2516 eeproms and/or 2K by 8 static CMOS RRMS 150ns access time ultra low power consumption  
Memory kit assm  
64/16K board £153 £162  
64/32K £248 £257  
64/48K £343 £352  
64/64K £438 £447  
Memory upgrades £50/8K  
OEM & Dealer enquiries welcome

### FDC DOUBLE DENSITY

Double Density for 5 1/4" or 8" Drives £ - £195

## FLOPPY DISK DRIVES

We sell all you need cased or uncased. Cables & connectors. Brand new fully guaranteed.

Single 5 1/4 Drive	£155
Single 8" SA800	£365
Dual 5 1/4 PSU	£49.50
Dual 8" PSU	£76
Dual Cabinet & PSU 1x8"	£665
Dual 8" Drive Unit	£1125
Dual 5 1/4 Drive Unit..	£440

## CATALOGUE AVAILABLE

Three new catalogues now available covering the main areas of computing

- Hardware systems
  - Software
  - Spares
- Catalogues are 40p each or all 3 for £1 - free to companies and Govt. bodies when ordered on official letterhead.

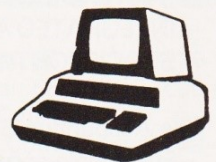
## TCL PASCAL

A British Pascal Compiler  
Ideal Educational Language  
Runs on several machines.  
Educational discounts  
Available for Multi-User Departments  
Officially approved Commodore product

PET  
PET 80 COLM.  
RML 380Z

TUSCAN  
SUPERBRAIN

Price £120. 1 off



## Edge Connectors S100



DIP Switches	Zero Insertion Force Sockets
4 way £1.20	16 way £4.95
7 way £1.75	24 way £6.00
8 way £1.80	40 way £9.50

DIP Plugs	D-Types
14 DIL £.65	25W Male £2.80
24 DIL £2.20	25W Female £3.80
40 DIL £3.60	25W Cover £1.80

### DIP SOCKETS (TEXAS)

Low Prof	Wire Wrap	2x 6 way	1.75
8pin 10p	26p	2x12 way	3.00
14pin 12p	35p	2x15 way	3.20
16pin 13p	42p	2x18 way	3.50
18pin 16p	60p	2x22 way 3 203	65
20pin 22p	90p	2x25 way 3 60	-
22pin 25p	-	2x30 way 4 15	-
24pin 30p	65p	2x36 way 4 753	90
28pin 35p	90p	2x40 way 5 00	-
40pin 40p	1.10p	2x43 way 5 504	60

### Insulation/Piercing Ribbon/Cables

I/OHEADER	PLUG
10 way £2.20	10 way £1.60
20 way £3.40	20 way £2.30
26 way £4.00	26 way £2.70
34 way £4.80	34 way £3.30
40 way £5.40	40 way £3.75
50 way £6.00	50 way £4.60
60 way £6.50	60 way £5.00

### Insulation/Piercing Edge Connectors

10 way £3.60	40 way £5.30
26 way £4.00	50 way £6.00
34 way £4.60	

### Insulation/Piercing DIP Plugs

14 way DIP Plug	£1.30
16 way DIP Plug	£1.50
24 way DIP Plug	£2.80

### Ribbon Cable PRICE/M

Grey	Coloured
10 65	10 90
14 90	14 1.20
16 1.20	16 1.40
20 1.40	20 1.60
26 1.60	26 2.40
34 2.40	34 2.80
40 2.80	40 3.30
50 3.30	50 4.00
60 4.00	60 5.50

## CRYSTALS FOR MICROS

32.768KHz	3.00	4.00MHz	2.70	10.00MHz	2.70
100KHz	3.00	4.43MHz	1.00	10.7MHz	2.70
200KHz	3.70	5.0MHz	2.70	16.00MHz	2.90
1.0MHz	3.60	6.0MHz	2.70	18.00MHz	2.90
1.008MHz	3.50	6.144MHz	2.70	18.432	2.90
1.8432MHz	3.00	7.0MHz	2.70	36MHz	2.90
2.00MHz	1.50	7.168MHz	2.50	48.0MHz	2.70
2.45760MHz	3.05	8.00MHz	2.70	100MHz	2.90
3.276MHz	2.70				

# TRANSDAM

59/61 THEOBALDS RD.  
LONDON WC1  
TEL: 405 5240/2113  
TELEX 24224. REF: 1422  
ALL PRICES EXCLUDE VAT

# TRANSDAM



## A game, it's concepts, planning in implementation for the PET

**T**he program Leapfrog is about a relatively simple but very interesting board game which is often played in pubs with coins. In its usual form there are six coins and seven spots, as shown in Fig. 1.

The purpose of the game is to interchange the two sets of coins, and the rules are very simple:

- 1 The LEFT coins can move only to the RIGHT and the RIGHT coins can move only to the LEFT.
- 2 There are two possible types of move:
  - (a) to an adjoining empty spot;
  - (b) over another coin to an empty spot (like in checkers).

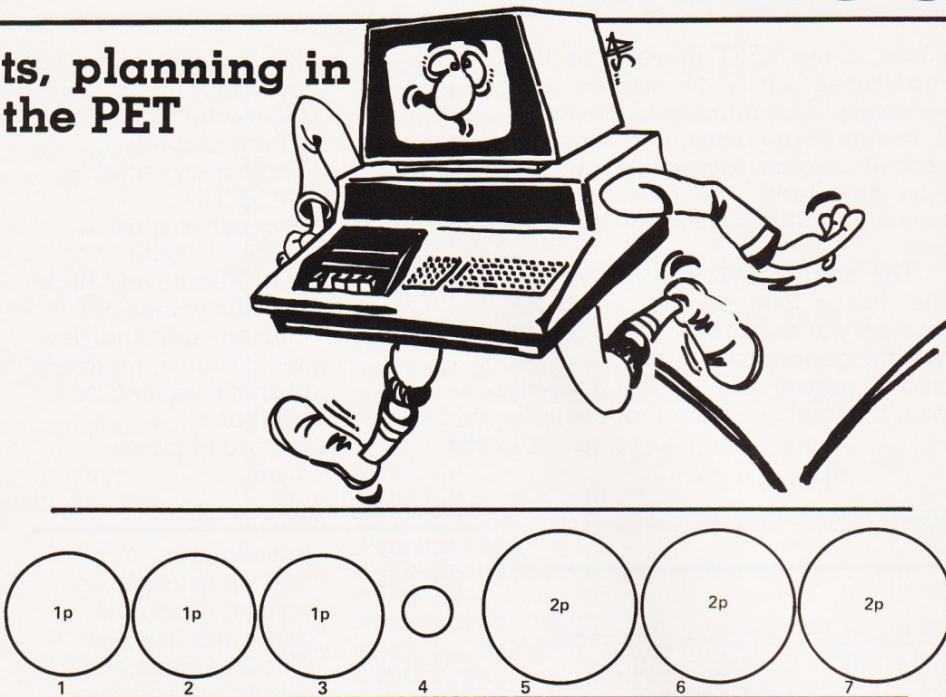
Of course, the number of spots can be any odd number so that, for example, there might be four coins on each side and a spot in the middle making nine spots altogether. The program allows you to choose between three, five, seven and nine spots.

### Game Strategy

There are two distinct advantages to playing the game on a computer VDU. In the first place, the initial stages of becoming clear about just what is permitted in a game are much more easily handled on a computer. Because, while it will obviously allow you to make wrong or foolish moves, it will not allow you to make illegal or incorrect moves. This means that the machine forces you to learn the rule structure of the game very quickly and forces you further into concentrating on strategy.

The second advantage is that it is possible for the computer to keep a record of all the moves made in any particular game. At the end of the game this record can be assessed and studied. In this way wrong moves can be detected, winning patterns become clear and the structure of the game emerges.

Like all games the initial motivation for playing is pleasure, and this should not be minimised in any way. So, at this stage all readers ought to go off, type in the game and play it for a while. But eventually pattern of movements will begin to emerge and curiosity will develop about how the game might be symbolised and its structure analysed. When that stage is reached the educational and, in this case mathematical, aspects of the game

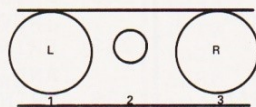


begin to become more interesting and that is the ideal outcome. That is to say, not only is there pleasure to be gained, but eventually there is an educational payoff.

### Program Analysis

This next section is an attempt to analyse and generalise this particular game and the program can be used at each stage to test the results and conclusions. But remember that this is a second-level activity and ought to follow some experience at playing the game. When you have read this next part you will know how to succeed at the game and how to generalise and the interest will be purely academic.

The simplest version of the game looks like this:

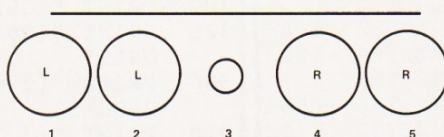


A few quick trials will show that the successful strategy is very simple and can be coded as: LRL (or RLR).

This means:

- First move the L from 1 to 2.
- Then move the R from 3 to 1.
- Then move the L from 2 to 3.

The next version of the game looks like this:



In this case the successful strategy (if you start by moving 2) is coded as: L RR LL RR L. This means:

- First move an L piece.
- Then move two R pieces.
- Then move two L pieces.
- Then move two R pieces.
- Finally move an L piece.

Notice that the number pattern is 1 2 2 2 1. The strategies for versions of the game with three, five and seven spots are as follows:

LRL  
L RR LL RR L  
L RR LLL RRR LLL RR L

Turn these into number patterns as before:

1 1 1  
1 2 2 2 1  
1 2 3 3 3 2 1

and the nine spot version becomes, one would guess,

1 2 3 4 4 4 3 2 1

This means, begin by moving one L piece, then two R pieces, then three L pieces, and so on. You can try this out on the nine spot version on the computer and it does work.

At this stage the pattern is so simple and obvious that it is quite easy to succeed at any version of the game. But its analysis is not quite complete. The general case can be symbolised as the case with  $2N + 1$  spots. That is,  $N$  spots on the left,  $N$  spots on the right, and one spot in the middle. So the pattern of movements can be shown as:

1 2 3 ... N N N ... 3 2 1

That is, one LEFT move, two RIGHT



moves, three LEFT moves and this continues until N moves are necessary. This number of moves, ie N, occurs three times, and then the number begins to reduce by one each time until one move only is necessary. At this stage the game is over.

The final question may well be, what is the total number of moves necessary at each level of the game, and this generalised pattern can be used to answer this. In the general case, the total number of moves is:

$$(1+2+3+\dots+N)+N+(N+\dots+3+2+1)$$

That is,  $2(N+1) = N(N+2)$ .

A\$,B\$,P1,Z\$ Temporary variables  
SP1,SP(N) Screen positions  
C,C1,C2 Counters  
A(N) Record of where spot is, ie Left, Right or Middle

B(N) Record of end status of points for checking  
S Character number for screen display  
P1 Temporary variable for SP(N)  
Z Number of spots in game  
ZL,ZM,ZR Left, Middle and Right specific values of Z  
CS,NS Current spot and New spot. That is, numbers of spot's last and new positions  
R\$ Record of moves made.

**Table 1. The various variables.**

5- 30 Introduction  
35-330 Sets up example on screen, describes game and its rules  
350-480 Chooses game and sets up appropriate screen display  
500-555 Spot to be moved and where to, and checks

600-640  
650-690  
700-710  
750-760

800-810

820-830

840-915

1000

1100

2000

3000

4000

5000

legality of move  
Moves Left to Right  
Moves Right to Left  
Spot is empty message  
Spots too far apart message  
Spot is not empty message  
Wrong direction message  
Checks for solution.  
Makes spots on screen  
Numbers spots on screen  
Removes a large message from top of screen  
Removes a small message from top of screen  
Removes a message from bottom of screen  
Holds screen until key is pressed.

**Table 2. Program sections and subroutines.**

## Program Listing

```

5  A$=" [REV]---LEAPFROG---[OFF]":R$=""
10 PRINT "[CLS]";TAB((40-LEN(A$))/2) A$
15 INPUT "[CD] [5 CR] [REV]DO YOU WANT
   INSTRUCTIONS.[OFF] [2 CR]*[3 CL];B$
20 IF LEFT$(B$,1)="Y" THEN 35
25 IF LEFT$(B$,1)="N" THEN 350
30 PRINT "TRY AGAIN":GOTO 10
35 PRINT "[CD]YOU CAN HAVE 3, 5, 7 OR 9
   POINTS IN"
40 PRINT "[CD]EACH GAME. WE WILL
   DEMONSTRATE WITH 7"
45 PRINT "[CD]AND THEN YOU CAN CHOOSE."
50 GOSUB 5000:PRINT "[CLS]"
65 SP1=33052:REM**SCREEN POSITION 1
70 REM**SET UP SEVEN POINTS
75 FOR C=1 TO 7:SP(C)=SP1+4*(C-1):NEXT
80 FOR C=1 TO 3:A(C)=1:B(C)=2:NEXT:REM**
   LEFT HAND POINTS
85 A(4)=0:B(4)=0:REM**MIDDLE POINT
90 FOR C=5 TO 7:A(C)=2:B(C)=1:NEXT:REM**
   RIGHT HAND POINTS
100 GOSUB 3000
102 PRINT "[HOM]FIRST OF ALL THERE ARE 7
   SPOTS."
105 PRINT "[CD] [4 SPC] [REV]LIKE
   THIS:-[OFF]"
110 S=46
115 FOR C=1 TO 7
120 P1=SP(C)
125 GOSUB 1000:REM**SETS UP 7 POINTS
130 GOSUB 1100:REM**NUMBERS POINTS
135 NEXT C
140 GOSUB 5000:GOSUB 4000:GOSUB 3000
150 PRINT "[HOM]THERE ARE 3 [REV]L[OFF]
   BLOCKS ON"
152 PRINT "[5 CR]THE LEFT,[REV]LIKE
   THIS:-[OFF]"
155 S=12
160 FOR C=1 TO 3

```

```

165 P1=SP(C)
170 GOSUB 1000
175 NEXT
180 GOSUB 5000
185 GOSUB 4000:GOSUB 3000
190 PRINT "[HOM]THERE ARE 3 [REV]R[OFF]
   BLOCKS ON"
191 PRINT "THE RIGHT....[REV]LIKE
   THIS:-[OFF]"
195 S=146
200 FOR C=5 TO 7
205 P1=SP(C)
210 GOSUB 1000
215 NEXT
220 GOSUB 5000:GOSUB 4000:GOSUB 3000
230 PRINT "[HOM]YOUR TASK IS TO MOVE THE
   [REV]L[OFF] BLOCKS TO"
232 PRINT "WHERE THE [REV]R[OFF] BLOCKS ARE
   AND VICE VERSA"
235 PRINT "SO THAT THEY END UP [REV]LIKE
   THIS:-[OFF]"
240 GOSUB 5000:GOSUB 4000
245 S=146
250 FOR C=1 TO 3
255 P1=SP(C)
260 GOSUB 1000
265 NEXT
270 S=12
275 FOR C=5 TO 7
280 P1=SP(C)
285 GOSUB 1000
290 NEXT
295 GOSUB 5000:GOSUB 4000
300 PRINT "[CLS]THERE ARE THREE RULES:-"
305 PRINT "[CD]1. LEFT BLOCKS CAN MOVE
   ONLY"
306 PRINT "[3 CR]TO THE RIGHT AND RIGHT
   BLOCKS"
310 PRINT "[3 CR]CAN MOVE ONLY TO THE LEFT"

```



# LEAPFROG

```

315 PRINT "[CD]2. A BLOCK CAN BE MOVED TO AN"
316 PRINT "[3 CR]ADJOINING SPOT IF IT IS
    EMPTY"
325 PRINT "[CD]3. A BLOCK CAN JUMP OVER AN"
326 PRINT "[3 CR]ADJOINING BLOCK AS IN
    CHECKERS"
330 GOSUB 5000:GOSUB 4000
350 INPUT "[CLS]HOW MANY SPOTS DO YOU WANT
    (3,5,7,9)[2 CR]*[3 CL]";Z
355 SP1=33048:REM**SCREEN POSITION 1
360 REM**SET UP Z POINTS
365 ZL=(Z-1)/2:ZM=(Z+1)/2:ZR=(Z+3)/2
370 FOR C=1 TO Z:SP(C)=SP1+4*C-2*Z+17:
    NEXT C
375 FOR C=1 TO ZL:A(C)=1:B(C)=2:NEXT C:
    REM**LEFT HAND POINTS
377 A(ZM)=0:B(ZM)=0:REM**MIDDLE POINTS
380 FOR C=ZR TO Z:REM**RIGHT HAND POINTS
385 A(C)=2:B(C)=1
390 NEXT C
400 PRINT "[CLS]"
405 S=12
410 FOR C=1 TO ZL
415 P1=SP(C)
420 GOSUB 1000
425 GOSUB 1100
430 NEXT C
435 S=46
440 P1=SP(ZM)
445 GOSUB 1000
450 GOSUB 1100
455 S=146
460 FOR C=ZR TO Z
465 P1=SP(C)
470 GOSUB 1000
475 GOSUB 1100
480 NEXT C
500 GOSUB 3000
502 PRINT "[HOM]IF AT ANY TIME YOU WISH TO
    STOP PRESS 99"
505 GOSUB 5000:GOSUB 4000
506 GOSUB 3000
507 PRINT "[HOM]CHOOSE THE NUMBER OF THE
    [REV]BLOCK[OFF] THAT YOU"
509 INPUT "WISH TO MOVE[2 CR]*[3 CL]";CS:
    REM**CURRENT SPOT
510 IF CS=99 THEN 905:REM**END
515 IF A(CS)=0 THEN 700:REM**SPOT EMPTY
520 GOSUB 3000
522 PRINT "[HOM]CHOOSE THE NUMBER OF THE
    [REV]SPOT[OFF] TO WHICH YOU"
525 INPUT "WISH TO MOVE[2 CR]*[3 CL]";NS:
    REM**NEW SPOT
535 IF NS=99 THEN 905:REM**END
540 IF ABS(CS-NS)>2 THEN 750:REM**MORE
    THAN TWO APART
545 IF A(NS)<>0 THEN 800:REM**SPOT NOT
    EMPTY
550 IF A(CS)=2 THEN 650:REM**RIGHT TO LEFT
555 IF A(CS)=1 THEN 600:REM**LEFT TO RIGHT
600 REM**MOVE LEFT TO RIGHT
605 IF NS<=CS THEN 820:REM**WRONG WAY
607 R$=R$+"L"
610 S=46:P1=SP(CS)
615 GOSUB 1000
620 S=12:P1=SP(NS)
625 GOSUB 1000
630 A(CS)=0:A(NS)=1
635 PRINT "[REV]NOW NEXT MOVE[OFF]"
636 GOSUB 3000
640 GOTO 840:REM**CHECKS IF COMPLETE
650 REM**MOVES RIGHT TO LEFT
655 IF NS>=CS THEN 820:REM**WRONG WAY
657 R$=R$+"R"
660 S=46:P1=SP(CS)

```

```

665 GOSUB 1000
670 S=146:P1=SP(NS)
675 GOSUB 1000
680 A(CS)=0:A(NS)=2
685 PRINT "[REV]NOW NEXT MOVE[OFF]"
686 GOSUB 3000
690 GOTO 840:REM**CHECKS IF COMPLETE
700 REM**SPOT EMPTY
705 PRINT "[REV]THERE IS NO BLOCK ON THIS
    SPOT[OFF]"
710 GOSUB 5000:GOSUB 4000:GOSUB 2000:
    GOTO 507
750 REM**MORE THAN 2 SPOTS APART
755 PRINT "[REV]THE SPOTS ARE TOO FAR
    APART[OFF]"
760 GOSUB 5000:GOSUB 4000:GOSUB 2000:
    GOTO 507
800 REM**SPOT NOT EMPTY
805 PRINT "[REV]THIS SPOT IS NOT EMPTY. TRY
    AGAIN[OFF]"
810 GOSUB 5000:GOSUB 4000:GOSUB 2000:
    GOTO 507
820 REM**WRONG DIRECTION
825 PRINT "[REV]YOU CANNOT MOVE IN THAT
    DIRECTION, TRY AGAIN[OFF]"
830 GOSUB 5000:GOSUB 4000:GOSUB 2000:
    GOTO 507
840 REM**CHECK IF COMPLETE
842 GOSUB 2000
845 FOR C=1 TO Z
850 IF A(C)<>B(C) THEN 860
855 GOTO 865
860 C=7:GOTO 506:REM**NOT COMPLETE
865 NEXT C
870 REM**COMPLETED
875 GOSUB 3000
880 PRINT "[14 CD]CONGRATULATIONS"
885 PRINT "YOU HAVE SUCCEEDED"
887 INPUT "[CD]DO YOU WISH TO SEE YOUR
    SOLUTION[2 CR]*[3 CL]";Z$
888 IF LEFT$(Z$,1)="Y" THEN 895
890 IF LEFT$(Z$,1)="N" THEN 915
891 GOTO 887
895 PRINT "[15 CR][5 CD]";R$
900 GOTO 915
905 INPUT "[17 CD]DO YOU WISH TO SEE YOUR
    SOLUTION[2 CR]*[3 CL]";Z$
906 IF LEFT$(Z$,1)="Y" THEN 910
908 IF LEFT$(Z$,1)="N" THEN 915
910 PRINT "[15 CR][5 CD]";R$
915 END
1000 REM**MAKES SPOTS
1010 FOR C1=0 TO 200 STEP 40
1020 FOR C2=P1 TO P1+1
1030 POKE C1+C2,S
1040 NEXT C2
1050 NEXT C1
1060 RETURN
1100 REM**NUMBERS POINTS
1105 POKE C1+C2+78,C+48
1110 RETURN
2000 REM**CLEARS TOP OF SCREEN, LARGE
2005 FOR C=32768 TO 33007:POKE C,32:NEXT C:
    RETURN
3000 REM**CLEARS TOP OF SCREEN, SMALL
3005 FOR C=32768 TO 32927:POKE C,32:NEXT C:
    RETURN
4000 REM**CLEARS BOTTOM OF SCREEN
4005 FOR C=33688 TO 33708:POKE C,32:NEXT C:
    RETURN
5000 REM**HOLDS SCREEN
5002 PRINT "[HOM][23 CD][5 CR][REV]PRESS ANY
    KEY[OFF]"
5005 GET Z$:IF Z$="" THEN 5005
5010 RETURN

```

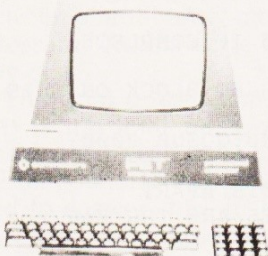


# CHROMASONIC electronics

48 JUNCTION ROAD, ARCHWAY LONDON N19 5RD — 100 yards from Archway Station & 9 Bus Routes  
TELEPHONE: 01-263 9493/01-263 9495

## YOUR SOUNDEST CONNECTION IN THE WORLD OF COMPUTERS

### PET



**4016 16K RAM**  
**4032 32K RAM**  
**4040 Dual Drive Disk**  
**4022 80 column**  
**tracks feed.**  
**3023 80 column**  
**friction feed.**  
**C2N Cassette Unit.**

For the business man we stock the **8000** range inc **8032** and **8050** with daisy wheel printers coming soon.

PHONE FOR MOST COMPETITIVE PRICES WORD PROCESSING AND 32K SYSTEMS PHONE FOR DETAILS

### UK101

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

32K Dynamic Memory Board only **£89.95**  
P.I.O. and Eprom Programmer Kit only **£24.50**

Inc. Demo Tape & Full Documentation Send for details.

DOWN  
IN PRICE

V  
I  
C  
2  
0

### VIDEO GENIE



**£279 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 **£33.00**  
CHROMASONICS PROGRAMMABLE SOUND KIT **£24.50**  
SOUND KIT (FITTING EXTRA) **£7.00**  
LOWER CASE KIT (FITTING EXTRA) **£27.50**  
COLOUR KIT (FITTING EXTRA) **£34.95**  
EXPANSION BOX WITH/WITHOUT RS232 **£215/£185**  
16K/32K RAM BOARD **£94/£129**  
**NEW GENIE II NOW AVAILABLE.....£299**

### APPLE

#### APPLE II PLUS

48K Machines **£595**  
Disk Drive with Controller **£349**  
Disk Drive without Controller **£299**  
Graphic Tablet **£425**  
Colour Card **£69**

Accessory cards, Software  
All available — Phone for Details



### PRINTERS



**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

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

**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 £195**

Dot matrix 5 x 7, 80 columns, 30 cps graphics, double width characters.

JUST PHONE FOR FURTHER DETAILS

### MONITORS

Green Monitor **£99.00**  
Hitachi professional monitors  
9" Black & White **£99.95**  
12" Black & White **£149.00**



### VIC 20

#### Colours

24 total. 8 for characters, 8 for border, 16 for screen mixed as you wish. Basic colours on program keys are black, white, red, blue, light blue, green, yellow and purple.

#### Sound

3 Tone Generator for music, "White Noise" Generator for language and sound effects. Each Generator gives 3 octaves. Reproduction is through TV speaker.

#### Character/Line Display

22 Characters by 23 lines, 64 ASCII characters, pet-type graphic character set.

#### Keyboard

DIN typewriter keyboard with 8 programmable function possibilities via 4 special function keys. Colours are directly addressable from the keyboard.

#### Peripherals/Accessories

VIC Datacassette with special interface to guarantee high reliability read/write quality (PET/CBM compatible).

**Price only £165.00.**

**Cassette recorder £34.75**  
**With 6 sample programmes.**



### TANTEL

#### PRESTEL BY TANTEL

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

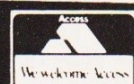
180,000 pages of information on Travel, News, Investment, Holidays, Hotels Etc., Etc.

**£159**

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



Please add VAT 15% to all prices. Postage on computers, printers and cassette decks charged at cost, all other items P&P 30p. Place your order using your Access or Barclaycard (Min. tel. order £5). Export enquiries welcome. Official orders welcome.





# SILVERSOFT

personal computer software

## "ZX81/16K" "STARTREK"\* and now "16K GOLF"

**16K STARTREK:** Graphics, 4-levels of play 8 x 8 Galaxy, Star bases, Klingons, Romulons, Photon Torpedos etc.

**16K GOLF:** 18-Holes, Full graphics PGA rules, Full set of clubs, Bunkers, Hazards etc.

**GAMES PACK 1:** Starwars, Hammurabi, Mastermind, Minefield.

**GAMES PACK 2:** 3D-OXO, Pontoon, Android Nim, Flight Simulator.

Prices £4.95 per cassette or £8.95 for any two.

Programmes wanted S.A.E. for details.

Mail order only.

\*NOW AVAILABLE FOR ZX80 8K ROM

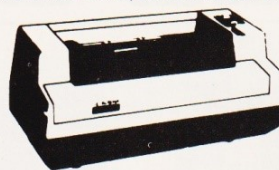
**SILVERSOFT**  
40 Empress Avenue  
Ilford, Essex  
01-518 0877

## SINCLAIR ZX81

**ZX81 built + mains adaptor £68.61 (Post £2.95 extra)**

### PRINTERS

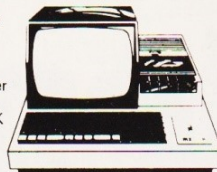
Buy any of the below and get a free interface kit and word processor program for UK101 of Superboard.  
Base 2 800MST £250, Seikosha GP80A £199, Centronics 737 £365, OKI Microline 80 £295, OKI Microline 82A £399, OKI Microline 83A £699, Epson MX70T £259, Epson MX80T £359, Epson MX80F/T1 £399, Epson MX80F/T2 £499, Epson MX100 £575.



### SHARP COMPUTERS

MZ80K 20K £380, 36K £394, 48K £408, PC1211 £82, 46 sample programs for £15.

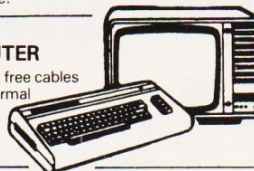
We can supply any Epson printer to run direct from the MZ80K without i/o box for £39 plus printer price.



### VIC 20

#### COMPUTER

£173 with free cables to suit a normal cassette recorder.



### SWANLEY ELECTRONICS

Dept, 32 Goldsel Rd, Swanley, Kent BR8 8EZ.  
Tel Swanley (0322) 64851

### UK101 AND SUPERBOARD

UK101 with 1K and free power supply and modulator built £149. The below accessories suit both the UK101 and Superboard:- Extra ram £2.70 per K. 16K memory expansion complete kit £50, built £58, 32K memory expansion kit £74, built £82. Case £27. Cassette recorder £19, Cegmon £22.50, Wemom £19.95. Assembler/Editor tape £25. Word processor program £10. Centronics interface kit £10. 610 expansion board £179. Cased minifloppy disc drive with DOS £275. Cassette recorder £19. The below suit only Superboard:- Colour adaptor board built £45. Guard band kit £10. Series 1 only 30 lines x 50 characters display expansion kit £14.

### PET, ATOM, UK101 MEMORY REVOLUTION.

Memory expansion boards 16K kit £50, built £58, 32K kit £74, built £82.

### VIDEO GENIE £279

Expansion box without/with RS232 £179/£209. Disc drive £205. 16K/32K ram board £93/£128. Colour kit £34.95. Parallel printer interface £32. Write for free software list.



### 5V POWER KITS

Fully stabilized 5V computer and TTL power kits. Short circuit and over-voltage protection. 1.5A £7.83, 3A £12.17, 6A £20.

Postage £3.50 on computers, £4.50 on printers and 45p on other orders. Lists 27p post free. Please add VAT to all prices. Official credit orders welcome.

## ZX-81 16K SOFTWARE

### PACK 16/1 includes all of:

AIR TRAFFIC CONTROL: Animated radar screen of busy airport shown, you must bring planes into land; INVADERS: INVADERS SELF PLAY: PHONEBOOK; keep friends and relatives numbers on cassette; DATE '81: computer dating program, who will it pick for you?

**ALL ONLY £4.95**

### PACK 16/2 includes all of:

ADVENTURE ATLANTIC: You may become very rich or you may be marooned forever; BREAKOUT: SQUASH PRACTICE: TRANSLATOR: translates any European language to any other, vocab on cassette; COMPUTAPRINT: use this program to predict horse races, or football pools!

**ALL ONLY £4.95**

Both packs come with full instructions, booklets and are saved on cassette ready to run.

## TAPEBOOK 50 version 3

50 PROGRAMS for the IKRAM ZX-81.

The latest version includes: SQUASH, INVADERS, COLUMBIA, SPLAT, INTEGRATION, BANK A/C, CREDIT CARD CALCULATOR AND LOTS MORE.

All on cassette and ready to run now. With full instructions.

Still amazing value at £6.96 the lot.

## The breakthrough you've waited for: PROGRAM THE ZX-81 IN ENGLISH!!

with GAMAL 81, you can now write adventure programs in hours not weeks and with GAMAL 81 you'll have every adventure you'll ever want for the price of one. Comes on cassette with instruction book, **£12.95.** (requires 16K) (£8.00 see below)

# ZX-81

PACK 16/1 + PAXK 16/2	ONLY <b>£5.95</b>	SAVE <b>£3.95</b>
PACK 16/1 + PAXK 16/2 + Tapebooks 50.3	ONLY <b>£9.95</b>	SAVE <b>£6.90</b>

### SPECIAL OFFER TO ZX-81 OWNERS

GAMAL is £8.00 only if you order either offer

## CONTROL TECHNOLOGY

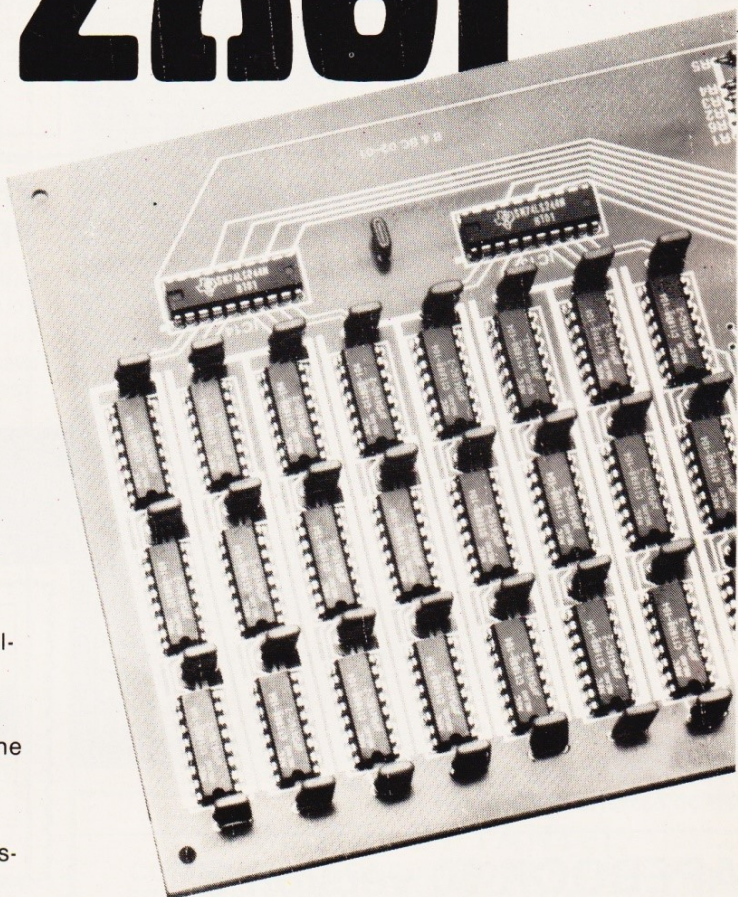
39 Gloucester Rd, Gee Cross, Hyde, Cheshire SK14 5JG  
061-368 7558

C★tech — Big ideas for small computer — all software by return of post!!



# MEMOTECH

## 48K memory extension for the ZX81



The MEMOTECH memory extension board will allow the ZX81 to run 48K BASIC programs which may include up to 16K of assembly code.

The unit contains a genuine 48K of user transparent RAM, and accepts such BASIC commands as: 10 DIM A(9000).

A range of I/O Port boards and A/D, D/A converters is available. The unit is compatible with the ZX Printer, and RS232 interface will be available soon.

The MEMOTECH memory has a fully buffered control-data-address bus with PCB 40 way header plug.

The ZX81 sits on a custom built case which contains the MEMOTECH memory and a power supply which not only powers the MEMOTECH memory, but also the ZX81.

All Leads are provided. The MEMOTECH memory extension board costs: £109.00 + VAT in kit form, £129.00 + VAT assembled. 15% Educational user discounts are available.

Please make cheques payable to:

# MEMOTECH

(Sales Dept.) 103, Walton Street, Oxford. OX2 6EB.



# PC1211 PROGRAMMING

**As manufacturers make computers smaller their facilities tend to get compressed. We show you how, despite their size, to get the most out of the new generation of handheld computers.**

**T**echnology has moved so fast in the last decade that it is now quite common for manufacturers to 'undersell' their products. Often the machines they produce are capable of operating in much more sophisticated ways than anyone would suspect from the accompanying literature.

Whatever the reason may be for this attitude, the manufacturer's literature on the Sharp PC1211 doesn't give more than a tiny fraction of the possible ways of using it. The PC1211 is a remarkable machine, in that it is completely portable (three batteries costing about £1.45 each being the power supply). It enables the user to carry his computer with him wherever he goes — even into the bathroom, where any other machine might be lethal — churning away in his pocket and beeping audibly when it has finished whatever it was programmed to do. The unit costs under £100 and it performs entirely to specification. In this article we shall explore the ways in which the PC1211 can be persuaded to perform *beyond* its specification.

## First A Warning

Having had the use of a PC1211 for a fortnight, I decided that it would only be fair to let someone else have a go. I passed the machine to a colleague who was considering whether to buy a PC1211 — or something similar — for himself. On the Monday morning I expected him to declare his enthusiasm, or at the very least to have forgotten to bring it in with him. On the contrary, I found a curt note on my desk saying that he had had nothing but trouble with the PC1211, which had failed to execute even the simplest program without apparently going into a infinite loop.

What had gone wrong? Basically, he had not read the manual before trying to write a program. No one could blame him, because the documentation is written in that quaint cross between Japanese and English that seems to accompany so much domestic electronic equipment these days. With phrases like 'By all means switch the machine off' (before connecting or disconnecting the cassette interface)



which actually means 'For goodness' sake switch off' because you might blow it up. The manual is not really ideal for the first-time computer-buyer at whom the machine should be aimed.

The first program my friend wrote was roughly like this:

```
10 FOR I=1 TO 10
20 A(I)=1
30 NEXT I
```

This program will cause the PC1211 to go to sleep! If you try it, use BREAK to escape, because otherwise you will just run the batteries down. The AUTO SWITCH-OFF doesn't operate if the computer is churning away uselessly in an infinite loop, as it does in this case.

The reason for this is that the memory A(9) is the same as the memory I, so that I is reset to 1 whenever it gets as far as 9 and thus never reaches 10. The same sort of error will arise for any dummy subscript which resets itself accidentally.

So, for example

```
10 FOR B=1 TO 10
20 A(B)=5
30 NEXT B
```

will skip A(3), A(4) and A(5), and it will leave A(2) as 10.

## Some Space-saving Tricks

The main problem with the PC1211 is that you are limited to 204 memories or, allowing for the 26 memories A-Z which are always available (fixed memories), you have the ability to use the remaining 178 memories either to store data or to store up to 1424 steps of BASIC

program. A simple calculation shows that 8 steps of a program take up the same amount of space as one memory.

Let us look at ways of saving space by writing our programs economically. Luckily there are a few tricks that even Sharp don't seem to have stumbled on, and it is possible to save a large number of bytes by writing compact code.

Each BASIC code-word, like INPUT or GOSUB, etc., takes just one byte (the MEM instruction shows how this happens). Each BASIC line has an overhead of three bytes for the line-number, so that it is cheaper to pack statements together: this costs the one byte for a colon needed to separate the statements. But watch out! It is, of course, impossible to put anything after an IF...THEN statement on the same line.

Each character in a string is stored as one byte. So, if you write

```
10 INPUT "INPUT THE VALUE OF R";R
```

you are using 19 bytes more than if you had been satisfied with

```
10 INPUT "R=";R
```

One neat abbreviation is provided by the fact that as a result of being allowed only single-character variables in BASIC (A or A(1) but not A1 or AB) the machine understands AB as meaning 'the product of A and B'. But, it is not *just* the same as A\*B: AB has priority over both multiplication and division.

AB is processed before A\*B and before A/B but not before A^B. You can always save one byte by writing



A\*B as AB, and often (but not always) you can save three bytes by replacing (A\*B) by AB. This may not seem much, but remember that every time you save eight bytes (steps) you have liberated another 32-bit memory for data storage.

The expression 2A is also understood, instead of 2\*A, but only in RUN mode, not in PROGRAM mode (where 2 would be taken as the line number). A2 gives Error Number 1.

Thus if A = 2, B = 1 and C = 10

```
10 PRINT A/BC GIVES 0.2 IN 8 STEPS
10 PRINT A/(B*C) 0.2 11
10 PRINT AC/B 20.0 8
10 PRINT A/B*C 20.0 9
```

But...

```
10 PRINT ABC^2 200.0
```

## The IF Statement

If you sit down at your microcomputer and enter (A>C), what happens? If, as with the PC1211, you get either a 1 for a 0 according to whether the number A is in fact bigger than the number in memory C or not, then you can use your micro in all sorts of neat (and exciting) ways that can make light of what might be quite intricate programming problems. (To save you doing it with your Apple, you will be pleased to know that it will work exactly as on the PC1211: if you are a Sinclair owner, you get -1 instead of +1 when the condition is satisfied, so everything that follows in this article applies to your machine, but upside-down, as it were).

On large computers the architects went to some trouble to distinguish between the different kinds of variables: real variables (ordinary numbers), string variables and logical or 'Boolean' variables. It was usually made very difficult to convert from one type of variable to the other (you can, for example, go from string to real in most BASICs by using VAL, and vice versa by using CHR\$ — alas, not on the PC1211). The designers of the BASICs for machines like the Apple and the PC1211 either did not bother to distinguish between logical and real variables or they realised that there was no need to distinguish between them. Once the distinctions — and hence the barriers — between real and Boolean variables have been abolished, you can perform calculations with truth values like (A>C) just as if they were real numbers — you can add them, multiply by them, or even raise numbers to the power of them.

You can obtain the truth value of

any statement that could go between IF and GOTO : (A = B), A-2C > = 7DD, etc. etc. You will have to put A = B inside brackets, of course, as otherwise the machine will think you are telling it to LET A = B and behave accordingly.

For the purpose of the IF statement, if the truth value of the expression to be tested is greater than 0, it is taken as true: if it is less than or equal to 0 it is taken as false.

If x is an expression. 1-x will have truth value 0 if the value of x is 1, and vice versa. This means that IF 1-x THEN 15 will be interpreted as IF NOT x THEN 15.

The statement IF NOT is not, however, accepted by the PC1211, so that this represents an extra BASIC instruction.

The following instructions are equivalent:

```
10 IF A>0.0 THEN 25 13 STEPS
10 IF A>0 THEN 25 11 STEPS
10 IF A THEN 25 9 STEPS
```

The value of (A=B)\*(C=D) is 1 if both A=B and C=D, and zero otherwise. This means that \* can be used to mean AND in between logical expressions.

Likewise (A=B)+(C=D) will give a positive number if either of (A=B) or (C=D) is true. This means that + can be used to mean OR between logical expressions. If a,b,c,d,...k are logical expressions then:

IF a\*b\*c\*d...k will be understood as IF ALL ... ARE TRUE

IF a+b+c+d+...+k will be understood as IF ANY OF ... ARE TRUE

IF a+...+k = 3 will be understood as IF EXACTLY 3 OF ... ARE TRUE

IF a+...+k = 3 will be understood as IF AT LEAST 3 OF ... ARE TRUE

It makes life simple to be able to use these operators when you are writing a program to perform complicated sorting operations.

The mixing of Boolean and real numbers permits you to define (in a single BASIC statement) discontinuous functions without using IF...THEN. The following are some examples:

The function

```
10 Y=(X>0)
```

defines the "step" function (Fig. 1)

The statement

```
10 Y=(X>-1)*(X<1)
```

defines the unit function shown in Fig. 2

The statement

```
10 Y=(X>0)*(X<L/2)*2HX/L+2H*(1-X/L)*(X<1)*(X>L/2)
```

defines the triangular wave-form of Fig. 3

## Random Number Generation

The Random Number Generator in the Applications booklet is cumbersome and does not exploit the capabilities of the PC1211.

The instructions

- (1) R=1000\*LOG(137/R)-INT(1000\*LOG(137/R))
- (2) R=1000\*LOG(137/R):R=R-INT(R)

can be stored as a single-line RESERVE program, eg as SHIFT A. Thus SHIFT A will display a random number (actually a pseudo-random number) R between 0 and 1, 'seeded' with the current contents of R.

R must be greater than 0 to start (actually it is best to seed it with a fairly large positive number — the day of the month or hour of the day are suitable).

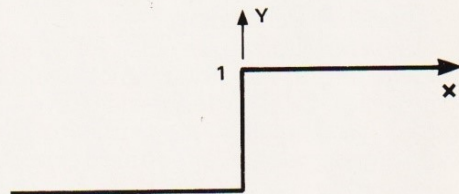


Fig. 1. The step function in graphical form.

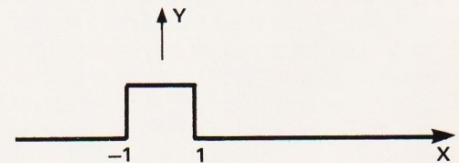
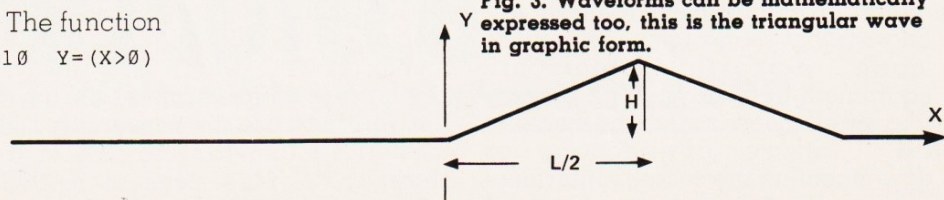


Fig. 2. A step up and a step down gives the unit function.

Fig. 3. Waveforms can be mathematically expressed too, this is the triangular wave in graphic form.





# PC1211 PROGRAMMING

The sequence (ii) returns numbers truncated to a maximum of six places of decimals, while (i) returns the numbers intact. The two sequences diverge noticeably after about four steps.

A fairly complicated program that uses the random-number generator is given below. Most of the uses of random-number generators are connected with games of one kind or another: this particular game is designed to show how you can use the RNG we have designed, and also how you can write quite complicated logical expressions (like line 50) without using up several lines of code.

Line 50 means IF ANY ONE OF E F G and H IS EQUAL TO 800.... line 55 means IF NOT MORE THAN TWO OF E...H ARE EQUAL TO ZERO.... neither of which would be easy to write succinctly using the ordinary BASIC we have been used to.

One significant point (and this is mentioned but not explained in the manual) is that you can speed up your program, especially if it has long loops, by using the 'dummy' variables W,X,Y,Z rather than AB,C,...,V. The reason for this is that the incredibly compact design of the PC1211 requires that every bit (and I mean bit) of available memory is made available to the user. Inside the PC1211 are three 4K-bit RAMs, at the top of which are the reserve program memories, with stacks for the subroutines and the FOR...NEXT pointers at the bottom. Just above these stacks are the memories W,X,Y and Z. The other 22 fixed memories are in the second and third display chips. It will obviously take longer for the information to be fetched from the display chip than from the adjacent memory locations, so that the use of W,...,Z as dummies in FOR...NEXT loops actually saves about 35% of the time taken for the loop (compared with using A,...,V).

The program DICE allows you to gamble with \$200 against three other players, who also have \$200. As it stands, the odds are equal for all the players, but it would not take much ingenuity to fix the odds at line 160 so that the chances of winning were proportional to your stake — or just fixed in favour of one of the players. The subroutine at 270 is, in fact, not strictly written as a subroutine as we want to RETURN to line 140 wherever we called it from. The routine starting at 205 gives a random playing order, which is slightly different from the usual strict rotation and gives the

game extra interest. This trick can be used in many other situations to increase the element of chance in a game: it would certainly make games of Donkey with my children fairer!

```

10 PAUSE "DICE"
15 CLEAR
20 INPUT "ENTER A NUMBER >0";R
25 E=200:F=200:G=200:H=200
30 INPUT "NAME OF PLAYER #1?";A$
35 INPUT "NAME OF PLAYER #2?";B$
40 INPUT "NAME OF PLAYER #3?";C$
45 INPUT "NAME OF PLAYER #4?";D$
50 IF (E=800)+(F=800)+(G=800)+(H=800)=1 GOTO 60
55 IF (E=0)+(F=0)+(G=0)+(H=0)<3 GOTO 65
60 PAUSE "GAME OVER":STOP
65 GOSUB 205
70 T=0
75 FOR W=1 TO 4
80 S=A(12+Q)
85 U=4+S:V=8+S
90 A(V)=0
95 IF A(U)<=0 GOTO 140
100 PAUSE "YOU HAVE $";A(U)
;";";A$(S)
105 IF A(U)<T GOTO 290
110 INPUT "HOW MUCH DO YOU BET?";A(V)
115 IF A(V)<=0 GOTO 140
120 IF A(V)>A(U) GOTO 280
125 IF A(V)<T GOTO 270
130 T=A(V)
135 A(U)=A(U)-A(V)
140 NEXT W
145 R=1000*LOG(137/R)-INT(1000*LOG(137/R))
Q=INT(4R+1)
155 IF A(8+Q)<0 GOTO 145
160 PAUSE "WINNER IS ";A$(Q)
165 FOR W=1 TO 4
170 A(4+Q)=A(4+Q)+A(8+W)
175 NEXT W
180 FOR W=1 TO 4:S=4+W
185 PAUSE A$(W);" HAS $";A(S)
190 NEXT W
195 GOTO 50
200 STOP
205 R=1000*LOG(137/R)-INT(1000*LOG(137/R))
Q=INT(4R+1)
215 M=Q
220 R=1000*LOG(137/R)-INT(1000*LOG(137/R))
Q=INT(4R+1)
225 IF M=Q GOTO 220
230 N=Q
235 R=1000*LOG(137/R)-INT(1000*LOG(137/R))
Q=INT(4R+1)
250 IF (M=Q)+(N=Q) GOTO 240
255 O=Q
260 P=10-M-N-O
265 RETURN
270 PAUSE "MINIMUM BET IS $";T
275 GOTO 100
280 PAUSE "YOUR MAXIMUM IS $";A(U)
285 GOTO 110
290 PAUSE "THE MINIMUM IS $";T
295 PAUSE "SO YOU MISS THIS ROUND"
300 GOTO 140

```

## The variables used in the above game.

A\$(1-4)	Player's names
also in A\$-D\$	
A(5-8)	Player's assets
also in E-H	
A(9-12)	Player's wagers
also in I-L	
A(13-16)	Random order of play

also in M-P	
A(17,18,23)	General purpose
also in Q, S & W	
A(18)	Random number
also in R	
A(20)	Max/Min bet
also in T	
A(21)	4+S
also in U	
A(22)	8+S
also in V	

The program for the gambling game.

## Input And Output

The INPUT statement allows a calculation to be performed. Thus

```

A=1
B=5
10 INPUT N

```

will accept an input of, say, AB-2B and N will then contain -5.

One problem in using the PC1211 is that it is difficult to display information in compact form from within a loop. Each time a PRINT or PAUSE statement is executed, the line is terminated and the next output requires the erasure of the existing line. Moreover, it is not easy to use calculated subscripts: PRINT A(I+1) won't work for more than one variable per PRINT or PAUSE statement.

A useful device is shown in this routine:

```

500 FOR I=15 TO 38 STEP 4
501 USING"###.###"
502 G=I+1:H=I+2:J=I+3
503 PRINT A(I);A(G);A(H);A(J)
504 NEXT I

```

This routine prints output in batches of four numbers, using 24 characters. Note, of course, that we must not alter I or A(9) within the loop. The numbers to be printed must lie between -10 and +10, though this can easily be modified by changing the USING statement.

## Packing It In

If you type in 2\*\*33, the PC1211 will display the exact answer. Try 2\*\*34 and you will notice that the PC1211 rounds the answer and puts it into scientific notation. In effect, this means that the PC1211 has a 33-bit mantissa (the decimal part of the numbers, ignoring the E part) and that you can easily store up to 33 items of information in each memory. If you wanted you could use the exponent part of the memory, but this would require a little more ingenuity. All this assumes, of course, that you don't need anything like the accuracy of about 1 part in 10<sup>10</sup> that the PC1211 gives you. In practice, you would need this kind of accuracy for scientific calculations, but not for game-playing or stock-control



# PC1211 PROGRAMMING

applications, where most problems involve the manipulation of integers rather than real numbers.

For example, if you are writing a card-playing game, you will need to know whether or not a particular card has been dealt. If you have 32K of RAM available you might as well store each piece of information in a separate memory, setting up a 4 by 13 array for the 13 values of each of four suits, and storing a 0 in each memory until the card is dealt when the 0 is replaced by a 1. The owner of the PC1211 faced with the prospect of sacrificing 52 of his precious 204 memories might well give up at this point and regard the situation as hopeless.

However, it is possible to pack these 52 items of information into two memories, as the following subroutine shows:

```
900 R=1000*LOG(137/R)-INT
    (1000*LOG(137/R))
901 E=INT(52*R)
902 GOSUB 910
903 IF F THEN 900
904 S=(E<26)*2^E+S
905 T=(E>25)*2^(E-26)+T
906 RETURN
```

The subroutine at 900 requires a seed other than 0 for R, so that R must, as mentioned previously, be initialised to a positive number. It then generates a number A between 0 and 51. The subroutine at 910 returns C = 1 if the number has been used before and C = 0 if it has not. Then if C = 0 the number A is accepted and a 1 is packed into the location corresponding to A in S if A is between 0 and 25 and in T at the location corresponding to A-26 if A lies between 26 and 51 (all ranges inclusive). If C = 1, the number A is rejected and another one generated from 900.

A suitable subroutine for unpacking binary numbers from decimal ones is as follows:

```
910 F=(E<26)*S+(E>25)*T
911 G=E-(E>25)*26
912 G=F*2^(G+1)
913 F=INT(2*(G-INT(G)))
914 RETURN
```

Similar routines can be used for packing and unpacking several integers into and out of real memories, provided only that we know the size of the largest integer we shall have to handle (here, of course, it is 1). In the extreme case shown here, where we can pack up to 32 numbers into one memory, it would be quite simple to store, say, the presence or absence of up to 5000 items and still leave space for a

reasonable program. The method is particularly useful for storing compactly vast amounts of trivial information on cassette tape — eg students' marks (0-99), of which one could store 800 in a form in which one could load them simultaneously into RAM.

To make the card-dealing program complete, all one needs to do is convert the number A into a card (divide by 13 and take the integer part to find the suit, the remainder being the denomination of the card). The snag (and there has to be one, of course) is that packing and unpacking takes time — about 5 seconds per card dealt. But at least we have shown that it can be done!

In fact you would probably not be wise to let the program run right through to 52: clearly the chances are that it would take 52 times as long to find the last card as it did the first, so you might well have to wait up to four minutes for each of the last few cards. Clearly, this method is useful for games like blackjack/pontoon, where only a few cards are dealt before shuffling the pack. Shuffling the pack is achieved by setting the variables S and T to zero, so that all cards are again treated as available.

There are many other ways of dealing 52 cards in a random order, but most of them will require much more than two memories for storing the information needed. You could, for example, generate 52 random numbers and use a sorting routine like the one below, to deal the cards in descending order of the random numbers associated with them.

A suitable control routine might be something like this:

```
800 INPUT "SEED ";R
805 A$="C":B$="D":C$="H":D$="S"
810 FOR W=1 TO 52
815 GOSUB 900
820 F=INT(E/13)
825 E=E-13F+1
830 PAUSE A$(F+1);E
835 NEXT W
840 RETURN
```

Note one or two space-saving tricks. We have used the memories A-D for the strings 'C', 'D', 'H', 'S', so that we can refer to them simply as A\$(F+1), where F is 0, 1, 2 or 3, according to the suit represented by the card (random number 0-51) dealt. The memory F can be used for the suit value even though it was used to determine whether the card had been dealt before, as this is reset each time we re-enter the subroutine 910. Likewise the memory E is no longer needed after the suit has been

determined at line 820. Instead of the random number 0-51 can now be used for the card value 1-13, generated by line 825. It is not difficult to modify the program to print the string J when E is 11, Q when E is 12 and K when E is 13, with A when E = 1.

## A Few Ideas

Using some of the techniques I have already described, we can write efficient versions of popular routines. Here, for example, is a Bubblesort routine, for sorting numbers in memories 5 to 100 into ascending order.

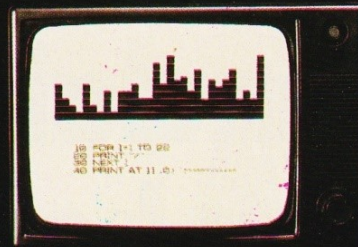
```
5 CLEAR
10 FOR A=5 TO 100
20 INPUT A(A):IF A=999 THEN 40
30 NEXT A
40 C=0
50 FOR B=5 TO A-2
60 D=A(B)>A(B+1)
70 C=C+D
80 IF 1-D THEN 100
    (OR 80 GOTO 100-10D)
90 D=A(B):A(B)=A(B+1):A(B+1)=D
100 NEXT B
110 IF C THEN 40
120 FOR B=5 TO A-1
130 PAUSE A(B)
140 NEXT B
150 STOP
```

The INPUT routine occupies lines 5 to 30, the Bubblesort routine starts at line 40 and ends at line 110, and the OUTPUT routine runs from line 120 to line 150. At line 60 the variable D is set to 1 if A(B) is greater than A(B+1) and zero otherwise. At line 80, if D is zero (the numbers are in correct order) the program jumps to line 100, avoiding line 90, where otherwise the numbers would be swapped over and placed in the right order. The accumulator C is set to zero before scanning the array A from 5 to A-2 to see if the numbers are in ascending order: each time a pair is found that needs to be swapped, the number D is 1, and so C will be greater than zero if any swaps are needed, and equal to zero if none were needed. When C is found to be zero, the scanning process is terminated by line 110. The program is a good example of the neat code that results from the use of the Boolean variables as if they were real numbers (as in the case of the variable D in this program).

Note, however, that we have not used the extra speed we could have had from choosing W, X, Y or Z as our loop dummy rather than B. The code would have been less easy to read, as we should have had to avoid the variable W, say, either by jumping round it whenever we reached A(22), or by starting the loop at A(23) which would look rather silly.



# sinclair ZX81 PERSONAL COMPUTER





# Sinclair ZX81 Personal Computer 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.<sup>95</sup>

### 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.<sup>95</sup>

### 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 – 600 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 £49.<sup>95</sup>

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 instructions.

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 Ltd, FREEPOST 7, Cambridge, CB2 1YY.

Qty	Item	Code	Item price £	Order 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) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	49.95	
	Sinclair ZX Printer.	27	49.95	
	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.

COT01

# sinclair ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.  
Tel: (0276) 66104 & 21282.



# How the ZX81 compares with other personal computers

SYSTEM IDENTIFICATION		ZX81	ZX80	ACORN ATOM	APPLE II PLUS	PET 2001	TRS 80 LEVEL I	TRS 80 LEVEL II
ROM		8K	4K	8K	8K	14K	4K	12K
GUIDE PRICE	Basic unit - inc. VAT	£70	£100	£175	£630	£435	£290	£375
	Unit plus 16K RAM (*12K RAM)	£120	£150	£285*	£630	£530	£360	£375
COMMANDS	LIST, LOAD, NEW, RUN, SAVE	•	•	•	•	•	•	•
STATEMENTS	PRINT, INPUT, LET, GOTO, GOSUB/RETURN, FOR/NEXT IF/THEN	•	•	•	•	•	•	•
	STEP	•		•	•	•	•	•
	TAB	•			•	•	•	•
ARITHMETIC	ABS, RND	•	•	•	•	•	•	•
FUNCTIONS	INT	•			•	•	•	•
	ATN, COS, EXP, LOG, SGN, SIN, SQR, TAN	•			•	•		•
	ARCSIN, ARCOS	•						
		•						
STRING FUNCTIONS	CHR\$	•	•		•	•		•
	LEN	•		•	•	•		•
	ASC(CODE), STR\$, VAL, INKEY\$	•				•		•
NUMBERS	FLOATING PT $\pm 10^{\pm 38}$	•			•	•	•	•
	INTEGERS		•	•	•	•		•
NUMERIC VARIABLES	A-Z			•			•	
	AA-ZØ				•	•		•
	An-Zn, n=any alphanumeric string	•	•					
STRING VARIABLES	A\$ & B\$						•	
	A\$ to Z\$	•	•	•				
	An\$ to Zn\$ n=any alphanumeric character				•	•		•
NUMERIC ARRAYS	SINGLE DIMENSIONAL		•	•			•	
	MULTI DIMENSIONAL	•			•	•		•
DISPLAY	ROWS	24	24	16	24	25	16	16
	COLUMNS	32	32	32	40	40	64	64
	LOW RES GRAPHICS (<7000 pixels)	•	•	•	•	•	•	•
	HI RES GRAPHICS (>40000 pixels)			•	•			
SPECIAL	USR (CALL, LINK)	•	•	•	•	•		•
FEATURES	PEEK, POKE (OR EQUIV)	•	•	•	•	•		•

## Sinclair software on cassette.

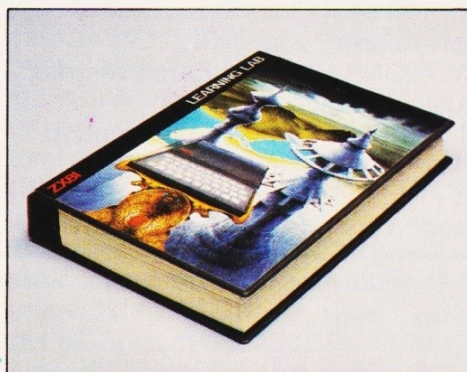


The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

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 others to form single-subject cassettes.

Software currently available includes games, junior education, and business/household management systems. You'll receive a Sinclair ZX Software catalogue with your ZX81 - or see our separate advertisement in this magazine.

## The ultimate course in ZX81 BASIC programming.



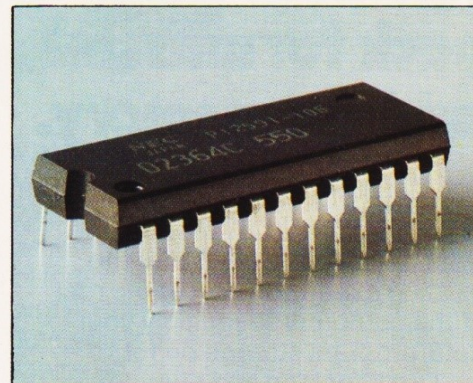
Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

But many have expressed a preference to learn *on the machine, through the machine*. Hence the new cassette-based ZX81 Learning Lab.

The package comprises a 160-page manual and 8 cassettes. 20 programs, each demonstrating a particular aspect of ZX81 programming, are spread over 6 of the cassettes. The other two are blank practice cassettes.

Full details with your Sinclair ZX81.

## If you own a Sinclair ZX80...



The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 - including the ability to drive the Sinclair ZX Printer.

# **sinclair** **ZX81**

6 Kings Parade, Cambridge, Cambs., CB2 1SN.  
Tel: (0276) 66104 & 21282.



**We start a major new series on how to program in this unique language which actually grows with your use of it. Your programs will run faster than they do under BASIC but it's not difficult to use.**

**T**he Great Language Debate over the last couple of years has tended to focus on the relative advantages and disadvantages of BASIC and Pascal. Although the subject is fascinating, it becomes rather academic when, like me, you only have a 16K computer and no discs.

If you are in this position, there is no point in getting worked up over Pascal because you simply can't run any sensible version of it on your micro. Your choice is normally between BASIC, which is easy and interactive but s-l-o-w, and assembly language, which is difficult, not interactive, but very fast.

Recently, though, another possibility has had some publicity — FORTH. It is a very unusual language, originally developed in the USA for such things as the control of astronomical equipment. It is easy to write (not as easy as BASIC, but still easy), interactive and very, very fast. What's more, the compiler, operating system and fairly large programs can all fit together into a 16K cassette-based system.

This is the first of four articles which will introduce FORTH. In this part, we'll see just what FORTH is (and isn't) and examine some of its simpler characteristics.

I should mention at this point that all my specific comments, and the programming examples, are based on the FORTH system which I use. This is a particularly attractive version called MMSFORTH which runs in a 16K TRS-80 or Video Genie. It is available from Miller Microcomputer Services, 61 Lake Shore Road, Natick, MA 01760, USA.

The easiest way to pay is with a Barclaycard (the Americans call them VISA cards) or Access Card (Mastercharge) — simply quote the card number and its expiry date. That's what I did, and I received my system 17 days (including Christmas!) after I posted my letter. How's that for service? I should point out that I have no connection with MMS beyond being a satisfied customer, and that other FORTH systems are available in the UK.

First of all though — why yet another language?

## Why FORTH?

The power of FORTH comes from its unusual philosophy, which allows you to add new functions (called 'words') to the language in order to match it to whatever you want to do. In other words, it is a language that lets you define your own language. Read that again slowly!

FORTH programmers create words to do whatever jobs they need, but once a word is in the language's dictionary, it can be used in any other program, and has the same status as all other FORTH words. In fact, FORTH has no way of distinguishing between the words that came with the original package and those which have been added to it.

An example might be useful here. Suppose you need to take a number and print it *if, and only if*, it is divisible by 3. Easy; type:

```
: 3PRINT DUP 3 MOD 0 = IF .
ELSE DROP THEN ;
```

Then, to test a number, you simply type:

```
<number> 3PRINT <ENTER>
```

and the program prints the number if it is divisible by 3. At this point don't get too worried about what the word actually does — all should soon become clear.

3PRINT looks rather like a subroutine, but it is not — it is a totally new FORTH function. Having defined it, you can then use 3PRINT to define other FORTH words, and so on, *ad* (nearly) *infinitum*. Not only that, but you can use 3PRINT both in a program, and in an immediate mode.

## The Pros...

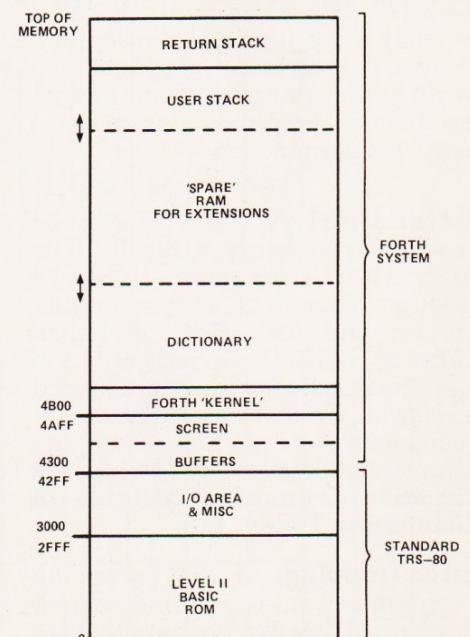
It is this unbelievably flexible approach that gives FORTH its power, and makes it particularly useful as a (I hate the word) hobbyist language. Let's take a closer look at some of its advantages.

**Speed.** FORTH programs run something like 10-20 times faster than equivalent BASIC programs. For reference, Table 1 shows the results I obtained when I ran the standard 'Kilobaud' benchmarks on

my Video Genie. The Table shows the times for floating point and integer BASIC, and for equivalent FORTH programs; as you can see, the increase in speed is dramatic. I could not use a floating-point arithmetic benchmark because my version of FORTH is integer-only (but it does handle them in the range  $\pm 2,147,483,648$ ).

**Interactive.** Although FORTH definitions, like the one for 3PRINT above, are actually compiled into the language when you enter them. The whole process is so fast that the language is just as interactive as BASIC. Once a word has been compiled into the FORTH 'dictionary' it can be used in an immediate mode, without further compilation. This makes program development much faster than with languages like Pascal that need a separate compilation cycle every time a change is made.

**Structured.** FORTH is inherently a structured language, with all the advantages this implies. For example, as far as I can tell, it is impossible to use the GOTO construction in FORTH. That is not to say that you cannot write bad FORTH programs...



**Fig. 1. The MMSFORTH memory map as implemented on a Video Genie.**



**Transportable.** Through the efforts of its developers, Forth Inc. (!) and the International FORTH users Group (IFUG), all the implementations of the language are very similar, and programs can easily be moved from one system to another. After all, when you can define a language to suit your requirements, dialect problems tend to disappear overnight.

**Quick Development.** Program development is very quick with FORTH — once you are used to the language, it is probably faster than writing in BASIC. One of the reasons for this is that the more programs you have written, the more words you have created which you can draw on for further programs.

**Flexibility.** Because of its user-defined nature, FORTH is enormously flexible, and its vocabulary can be matched precisely to a task's requirements.

### ...And Cons

However, nothing is perfect and, inevitably, FORTH has disadvantages. The main ones are:

**Readability.** FORTH programs tend to be very hard to read (but not to write). This is partly because you can do an awful lot with just a few words and partly because the language's syntax is, to say the least, unusual.

**Integer Arithmetic.** Most FORTH systems are integer-only. On the other hand, MMSFORTH supports double-precision integers ( $\pm 2,147,483,648$ ) and its disc-based version has a floating-point option. Actually, how many programs you write are in, or could be in, integer arithmetic? Probably, like mine, a large proportion.

**Unfamiliarity.** FORTH's poor readability is partly a result of its unfamiliar approach. It works through a pair of user-accessible stacks, and uses Reverse Polish Notation (RPN). (Keep reading!). On the other hand, anyone who has used a Hewlett-Packard calculator will immediately be at home with the language, (or those following the **Number Crunching** articles in *Computing Today*, Ed).

**Error-Trapping.** FORTH gives the programmer an astonishing degree of freedom of access to the computer hardware; in this respect it is assembler-like. Unfortunately, this

approach tends to sacrifice some of the language's error-trapping possibilities. Grammar and vocabulary errors are spotted as well as with any other language but if for example you are using an array, you must do your own checks to ensure that you aren't going outside its bounds. The inevitable result of such an error would be a crashed system and, probably, a corrupted program. If you'd rather that the computer did all the checking for you, then read no further — FORTH is not for you.

Although FORTH has been implemented on computers of all types, and a micro version first appeared in 1976, it has only become widely used in the last two to three years, and packages are now available for most microsystems. The basic syntax is controlled to some extent by the International FORTH Standards Teams, although the anarchic nature of the language prevents this control from being more than a guiding hand.

### Basic Philosophy Of FORTH

At the core of any FORTH system is the **DICTIONARY**. This is a list of items, each of which defines a FORTH word. Since most words in the language are specified in terms of other words (the whole system is constructed from a handful of core words), a dictionary entry is essentially a list of pointers to other words. These words point to yet more words, and so on; a dictionary of this type is called a **THREADED LIST**.

Whenever a word is used, the FORTH **INTERPRETER** executes it by following the pointers. It may help if you imagine the execution of each word as being similar to going down a long line of nested subroutines, but don't carry this analogy too far. The secret of FORTH's extensibility is that, when new words are defined, they are **COMPILED** directly into the dictionary, which thus varies in size as the program is constructed. The operations system cannot tell the difference between the original and the new words, and the latter simply become part of the language. Fig. 1. shows a simplified memory map of MMSFORTH, which is a typical system.

Unlike a purely interpreted language such as BASIC, the FORTH code that is executed when the program runs is held in its compiled form. However, unlike FORTRAN, the compiler does not produce machine-code; it produces a dictionary entry which must then be

interpreted. FORTH's operation is thus a mixture of compilation and interpretation, bringing together, amazingly, the advantages of both approaches.

Once a program has been written and compiled into the dictionary, the source code no longer exists within the system, other than on tape or disc. The code is written in **BLOCKS**, the block size varies according to the storage medium and the system, but FORTH actually works on groups of blocks called **SCREENS**. A screen is normally structured as 16 rows of 64 characters — coincidentally very convenient for a TRS-80. In MMSFORTH, blocks are actually the same size as screens, each holding 1024 characters:

Although FORTH's immediate mode by passes the block/screen format, programs are written and loaded by using the system's **SCREEN BUFFERS** (MMSFORTH has two). Implementations of the language generally use a virtual memory system to make sure that a modified or newly-written buffer is saved before it is overwritten by a new one. Cassette-based virtual memory is something to marvel at!

Before you can run a program, its appropriate screens are read in turn into the buffers, from where the **LOAD** word compiles them into the dictionary. With a disc-based system, the detail of the screens is hidden to some extent, although it is all too apparent when you use cassettes.

FORTH's most obvious feature, however, is its **STACK**. All data goes into, comes out of, or is processed in, the system via a Last-In First-Out (LIFO) stack. Before data can be operated on, it must be pushed onto the stack, which leads to the curious (to a BASIC programmer) effect of all words appearing after the data they manipulate.

This is called **Reverse Polish Notation (RPN)** and is very strange at first. Unless a word explicitly does something else, all the operations work on 16-bit data-words; don't get confused with a normal micro's stack operations, which often work on single bytes.

Actually, almost all computers use the stack/RPN approach when they run high-level languages, but the fact is normally hidden from you. In FORTH, however, it stands naked and unashamed. To be honest, this is one of the reasons that FORTH is so fast and undemanding of space — the programmer does the work that other languages' compilers or interpreters do.



# GOING FORTH

The best way to get a proper understanding of RPN is to look at a few examples and try for yourself. It is truer of FORTH than of almost any other language that you must learn by experience.

## Basic FORTH Words

FORTH words can be any size and can use any character available on the keyboard. If you really want to, you can define "!"?6A/+ \$" to mean something. Furthermore, spaces are vital; each word must be separated from the next one by at least one space.

At this point, I will define two conventions. Normally in this series the FORTH words will be quite distinct from the rest of the text, but whenever there might be some ambiguity, I will enclose them between double quotes ". Assuming that there are no typesetting errors, everything between the quotes is FORTH! The second point is that anything that the computer outputs will be underlined — what you type in is not. There is always an implicit ENTER before any output appears.

## Basic Arithmetic Operators

FORTH has the four arithmetic operators familiar to all programmers (+ - /\*), and they have the usual meanings. You must remember, though, that they operate on the top two numbers in the stack, which must be put there BEFORE the operator is used. Thus you can have the sequence

4 5 + OK

The OK is the normal FORTH response which indicates that it has done what you told it to do (which may not be what you meant...).

What happened? A number on its own means "put this number on top of the stack", so first of all '4' was put on the stack, and then '5' was pushed on top of it. The "+" popped them both off, added them, and pushed the answer (9) back on to the stack (Fig.2.).

Multiplication is much the same:

4 5 \* OK

leaves 20 on the stack.

What about subtraction and division, where the sequence of events is vital? The rule is easy: the number on the top of the stack (the last one) is taken away from, or

divided into, the second from top item. The sequences:

12 4 - OK

12 4 / OK

leave 8 and 3 respectively on the stack.

All these operators take the top two items off the stack, replacing them with a single item, which is the result, and they all follow the pattern of Fig.2.

LOW			
MEMORY			
STACK	4	4	9
FORTH	4	5	+

Fig. 2. The addition sequence above is also applicable to the three other maths operations.

You can chain numbers and words together almost indefinitely before you hit ENTER. FORTH tackles them strictly from the left, putting numbers on to the stack and manipulating them with the words, and the language does *not* use a hierarchy of operators (eg "\*" before "+").

For instance, suppose you wanted to calculate:

((7+3\*2)\*6+8)/2

The FORTH sequence

7 3 2 \* + 6 \* 8 + 2 / OK

LOW											
MEMORY											
STACK	7	3	2	6	13	6	78	8	86	2	43
FORTH	7	3	2	*	+	6	*	8	+	2	/

Fig. 3. A rather longer calculation as it would appear in the stack.

LOW												
MEMORY												
STACK	3	7	2	1	8	*	-	5	8	-	/	+
FORTH	3	7	2	1	8	*	-	5	8	-	/	+

Fig. 4. A really involved operation, just try this in algebraic notation!

would do the job, and leave the answer 43 on the stack. Fig.3. shows what is happening all the way through this sequence.

Easy, isn't it? Notice that using RPN means that you never need to bracket anything — the stack operations give an equivalent effect — which is characteristic of the notation.

Here is another example. What is left on the stack after

3 7 2 1 8 \* - 5 8 - / + \* OK

is finished? Try to work out the answer yourself before you look at Fig.4.

So now we can put numbers on the stack and manipulate them once they are there. What we can't do yet is output them. The FORTH word "." (yes, a full-stop) is the answer; its job is to take the top number off the stack and print it on the VDU. You can have examples such as:

7 20 . 20 OK  
7 20 . 20 7 OK  
2 10 + 3 / 4 OK  
2 3 . . . 3 2 STACK EMPTY!

You can see that "." takes no notice of what has gone before — it blindly takes the top number and prints it, removing it from the stack in the process.

In the last example, we tried to print three numbers, but the stack only contained two. The third "." did not find anything and so generated the standard FORTH 'STACK EMPTY!' error message.



# GOING FORTH

That last point leads to a fundamental rule of FORTH programming:

Always make sure that the stack contains enough numbers or data for your word to work on.

Equally, you must not leave unwanted numbers on the stack. Remember that the stack grows *down* to meet the dictionary growing up — if they ever meet, the system crashes! So:

Never leave unwanted numbers or data on the stack.

## Stack Operators

We can now do basic arithmetic on the stack but, to write effective programs, we also need to be able to manipulate the arrangement of the data on the stack directly. FORTH provides a number of words to meet this need.

**DUP.** DUP is used to make a copy of whatever (16-bit word) is on top of the stack, and push it on top of the original. This gives, for instance, an easy way of calculating a square:

```
16 DUP * . 256 OK
```

**SWAP.** One of the secrets of good FORTH programming is to do as much as possible on the stack, and to use the minimum number of named variables. SWAP is a word that makes this much easier by literally swapping the top two numbers on the stack:

```
10 6 - . 4 OK
10 6 SWAP - . -4 OK
```

**OVER.** We can go one better than SWAP by using OVER, which takes a copy of the second item, and puts it on top of the original top item. Thus we could calculate by:

```
(10-6)*10
10 6 OVER SWAP - * . 40 OK
```

Fig.5. shows what is going on here.

**ROT.** The ROTate word takes things even further by rotating the top 3 items on the stack. The third item is removed, and pushed on top of the original top two items to become the new top-of-stack (TOS). Hence:

```
2 3 4 ROT - * . 6 OK
```

If you are confused at this point, Fig 6 may help. Later in this series, we'll see some examples of ROT in use.

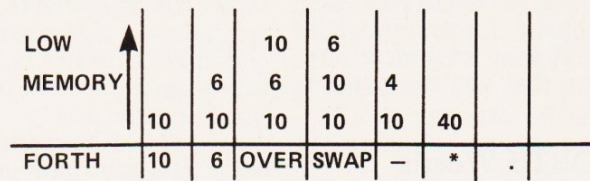


Fig. 5. The SWAP and OVER operations.

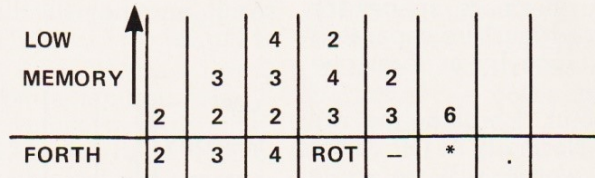


Fig. 6. You can even ROTate the contents.

**DROP.** It is sometimes useful to be able to 'lose' the top item on the stack. DROP does just that — it pops it off and forgets about it.

The examples above are really very trivial, and it may be hard to see the point of the stack operators. However, their value will become obvious when we start to define new words, and try to do more complex things with the language next month.

## Conclusions

That, then, is a first look at FORTH. I've explained that it has many advantages over 'conventional' languages such as BASIC or even (sacrilege!) Pascal. It does, however, need a whole new way of thinking about problems, and you can see that it's not a very easy language to read. You sometimes have to spend a lot of time trying to work out what's on the stack when, and why.

In this month's article, we've only taken a look at FORTH's most fundamental operations: those which

do arithmetic and those which manipulate the stack. All the little bits of code have been in the immediate mode — type them in, press ENTER, and there is the answer.

Next month, we will start to look at the use of constants and variables in FORTH, and the definition of new FORTH words in order to extend the language. We will also look at the way that the language provides the fundamental structures of any real program — decision making and looping.

Later in the series, we will go on to see what a typical FORTH program looks like by using the language to solve the classical computing problem of 'The Towers Of Hanoi'. The program will demonstrate just what is involved in writing a FORTH program, and how the programming techniques might be different from those used in, say, BASIC. The 'Towers' program will also give a convincing display of just how fast the language runs.

BENCHMARK	FP INTEGER		
	BASIC	BASIC	FORTH
FOR Loop	2.6	1.8	0.165
Loop on comparison	11.3	9.5	0.435
Variable Arithmetic	26.6	27.2	3.1
Constant Arithmetic	27.8	27.0	3.2
Constant Arithmetic and Subroutine	31.2	30.0	3.3
Constant Arithmetic and Nested Loop	50.6	45.1	4.2
Constant Arithmetic with Nested Loop and Array Manipulation	78.1	69.3	5.6

Table 1. Timings for the FORTH Benchmarks in seconds



# Make the most of your Sinclair ZX Computer...

# Sinclair ZX software on cassette.

## £3.<sup>95</sup> 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 and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

### 8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80—including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

### 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 Education: 7-11-year-olds

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.

### 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,  
Cams., CB2 1SN. Tel: 0276 66104.

To: Sinclair Research, FREEPOST 7, Cambridge, CB2 1YY

Please print

Please send me the items I have indicated below.

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	
	17	*8K BASIC ROM for ZX80	£19.95	
	18	*16K RAM pack for ZX81 and ZX80	£49.95	
		*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 my Access\*/Barclaycard/Trustcard no.

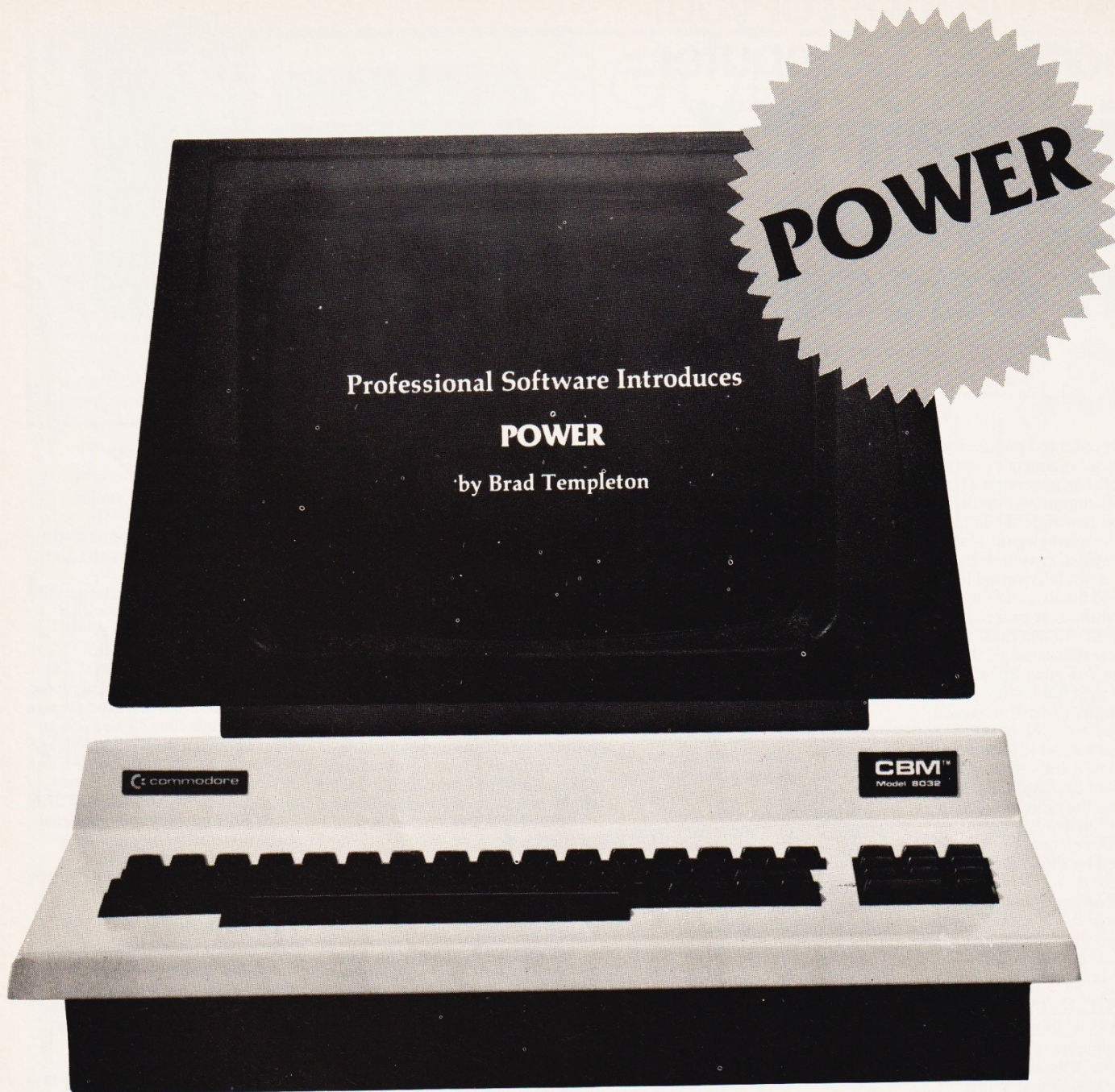
\*Please delete as applicable.

Name: Mr/Mrs/Miss

Address:

COT 01





## ADD POWER TO YOUR COMMODORE COMPUTER

£49

POWER produces a dramatic improvement in the ease of editing BASIC on Commodore's computers. POWER is a programmer's utility package (in a 4K ROM) that contains a series of new commands and utilities which are added to the Screen Editor and the BASIC Interpreter. Designed for the CBM BASIC user, POWER contains special editing, programming, and software debugging tools not found in any other microcomputer BASIC. POWER is easy to use and is sold complete with a full operator's manual written by Jim Butterfield.

POWER's special keyboard 'instant action' features and additional commands make up for, and go beyond the limitations of CBM BASIC. The added features include auto line numbering, tracing, single stepping through programs, line renumbering, and definition of keys as BASIC keywords. POWER even includes

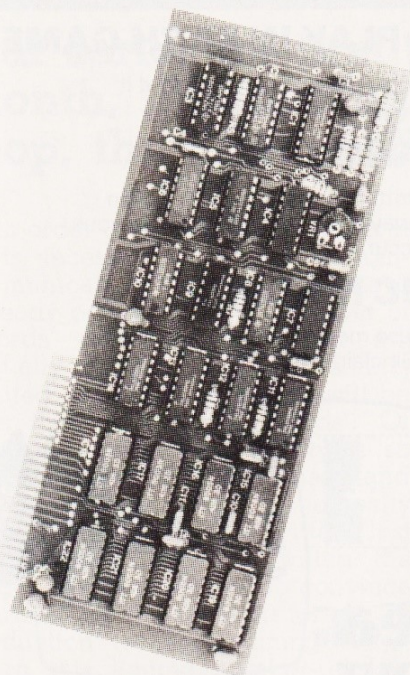
new "stick-on" keycap labels. The cursor movement keys are enhanced by the addition of auto-repeat and text searching functions are added to help ease program modification. Cursor UP and cursor DOWN produce **previous** and next lines of source code. COMPLETE BASIC program listings in memory can be displayed on the screen and scrolled in either direction. POWER is a must for every serious CBM user.

**Call us today, for the name of the Professional Software dealer nearest you.**

**Professional Software, Ltd.**  
155 High Street  
Potters Bar  
Hertfordshire EN6 5BB  
Tel: (STD 0707) 42184/(STD London 77)



# RAMEX 16 £75 16K Ram Board for Apple II



Now you can afford to extend your Apple II without taking up a mortgage. Now you can run Pascal, Fortran, 56K CPM with a Z80 Softcard, Integer Basic, Applesoft and other languages on your Apple. Now you can increase your usable memory for Visicalc.

At just £75.00 this is the cheapest RAM Expansion Card available, but you lose nothing in quality or reliability. The only thing you LOOSE is having to remove a RAM chip from the motherboard as the RAMEX 16 has no strap, its memory re-fresh is integral.

RAMEX has its own MANAGER for giving you even more usable space in your Apple. This is achieved by putting DOS into another RAMEX 16 located in any other available slot, thereby freeing up another 10.5K of memory at a cost of only £20.

Order your RAMEX 16's and the MANAGER by calling (0268) 728484. All major credit cards accepted or send your cheque to - DDP Research & Marketing, 17 Nobel Square, Basildon, Essex. SS13 1LP.

**DDP Research & Marketing**

17 Nobel Sq., Basildon, Essex. SS13 1LP.  
Tel. Basildon (0268) 728484



RAMEX 16 P & P add £1.50p.  
The Manager P & P add £0.50p.

All prices are subject to VAT.

**In a Class of Their Own.**

## SUPERBRAIN® SERVICES IN ALL THE RIGHT PLACES FROM HELISTAR SYSTEMS

### Repair and Maintenance

Your SuperBrain® repaired and maintained on-site through the Helistar contract maintenance service - our own engineers cover Central, North and West London, Bucks, Berks, Oxon, Herts, Northants, Beds, Glos, Warwicks. and Middx. Also repairs carried out at our workshop on a time and materials or contract basis.

### Upgrades and Modifications

Have your SuperBrain disk system upgraded to QD (700Kb) or DQD (1.5 Mb). Benefit from faster disk accessing and 40-track capacity with our FASTROM. Improve the character display with true descenders.

### Add on Hardware

GRAPHICS - 512 x 256 high-resolution graphics with the Micronex PIXELPLOTTER®. PORT-BUFFER® - allows the connection of external devices to the internal Z80 address and data bus.

### Software

Memory-mapped WORDSTAR. This version of WordStar is specially tailored to take advantage of the SuperBrain's memory-mapped video giving faster screen display and smoother scrolling.

Contact us today! Telephone Aylesbury (0296) 630364

**Helistar Systems Ltd.** 150 Weston Road, Aston Clinton, Aylesbury, Bucks. HP22 5EP



**DON'T  
FORGET  
XMAS  
ORDER  
NOW**

# SUPER INVASION ON YOUR ZX80 & ZX81

**1K**

## TOTALLY FLICKER FREE • 3 LEVELS OF PLAY IN EACH GAME

Absolutely no flicker. You don't need to press anything for the display to move!

From easy to dangerously difficult — you'll find it hard to resist the challenge time after time!

## MOVING GRAPHICS • MACHINE LANGUAGE

No hardware modifications are necessary to get moving graphics. Just follow the instructions for cassette loading and off you go, no extra memory needed.

These programs are written in the computer's own language — only this way is it possible for continuous, flicker free action to occur.

## ALL PROGRAMS ON CASSETTE • FITS 1K BASIC MACHINE

Loads just like any other program on cassette. Each tape contains instructions on how best to load the cassette.

Amazing as it is, all these moving graphics programs fit into your basic 1K Sinclair!

### SUPER INVASION

is the machine language game you and your Sinclair have been waiting for. Cruel and crafty invaders have been spotted in battle formation ready to attack with your ship just below them! Quickly and skilfully you shift right and left as you carefully fire your lasers at them. But watch out — they are accurate! 3 levels from easy to almost impossible to beat.

THE ESSENTIAL SOFTWARE COMPANY  
47 BRUNSWICK CENTRE LONDON WC1N 1AF

I have a ZX80 Old ROM ☐ New ROM ☐ ZX81 ☐

Please send me ..... copies SUPER INVADERS and ..... copies DOUBLE BREAKOUT.

I enclose cheque/postal order for ..... plus 50p post and pack

Name .....

Address .....

### ONLY £6 ea. DOUBLE BREAKOUT

You'll be amazed to see how difficult it is for you to break through the ZX80 DOUBLE BREAKOUT and even more astonished to see the exciting game fit into your 1K Sinclair. Try your skill on the easiest level because even with the most skilful bat control you'll find it hard to catch at the fastest level! Breaking through the first barricade is easy but don't be fooled for the second — it's much harder than you think! Two ball angles and curved bat will keep the excitement going for hours!

Access accepted for Mail Order  
or phone 01-837 3154

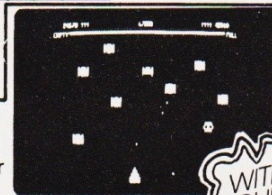
### Video Genie TRS 80

Your fighter appears below a convoy of Aliens! If you destroy them another set appears who seem to be slightly cleverer than before! Soon your space station nears but before you can dock the station comes under attack! Survival is up to you! The excitement is just beginning!!

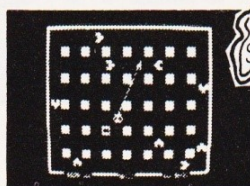
TRS 80 Levels I & II 16K Tape £10  
Video Genie 16K Tape £10

Dodge the alien Ramships and fire missiles to destroy them before they get you. The alien Flagship uses his deadly laser bolt to transform a Ramship into another Flagship or into your ship's double. Look out! Destroy your double and you could destroy yourself.

TRS 80 Level I & II 16K Tape £10  
Video Genie EG3003 16K Tape £10



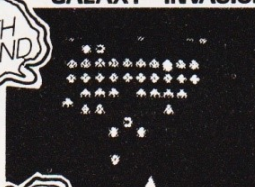
**COSMIC FIGHTER**



**ATTACK FORCE**



### GALAXY INVASION



The newest and most exciting invaders type game yet! Cruel and crafty aliens attack Earth. You are the sole defender. As you fire your laser at the aliens they swoop down and bomb you. Exciting use of graphics! Must be seen.

TRS 80 Level I & II 16K Tape £10  
Video Genie 16K Tape £10

Now the amazing ASTEROIDS arcade game for your TRS 80! Your ship is floating in the middle of an asteroid belt! Your only escape is to destroy them and the crafty alien spacecraft! Blast them with your laser, thrust, rotate or hit hyperspace to survive!

TRS 80 Levels I & II 16K Tape £10  
Video Genie 16K Tape £10



**ASTEROID NOVA**

THE ESSENTIAL SOFTWARE COMPANY  
(Viscounti Ltd.) 01-837 3154  
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 50p post & packing)

Signature .....

Name .....

Address .....

Postcode .....

My ACCESS No is .....

### LABYRINTH & DEATHMAZE

A must for all adventure addicts!

Walk down corridors depicted in full 3-D graphics. Look around to find the objects you need to survive. But beware! Monsters and Incredible Obstacles can lurk round every corner!

**NEW!**  
for TRS 80  
LEVEL II 16K

LABYRINTH TAPE £10

DEATHMAZE TAPE £10





## Our series for first time programmers continues this month, introducing the BASIC equivalent of looping-the-loop, the FOR...NEXT statement.

In order to program a computer it is necessary to be able to communicate with it. As we have already pointed out, the number of 'words' which the computer will initially recognise in BASIC is fairly limited, in all probability it will be less than a hundred 'words'. Of these hundred, some twenty or so represent the most often used and with just these twenty some really good programs can be written. Just look at the programs within the pages of this magazine to convince yourself. Here is the basis for our introduction to programming...first learn this limited number of key words and you are well on the way to writing your own programs.

So far we have looked at PRINT, which enables you to instruct the computer to display information to the user and INPUT, which in turn instructs the computer to obtain information from the user. We will now take a small diversion through FOR...NEXT loops.

### Looping The Loop

The FOR...TO... statement combined with a NEXT statement creates a LOOP so that the portion of the program between these two statements is repeated a specified number of times. Let us look at an example:

```
10 FOR I=1 TO 4
20 PRINT "HAPPY ";
30 NEXT I
40 PRINT "... BIRTHDAY"
50 END
```

If we RUN this program we will see displayed on the screen:

HAPPY HAPPY HAPPY HAPPY ... BIRTHDAY

In line 10 immediately following FOR is variable I, this *must* have a numerical value and may take the form A,B,F1,X3,AA,DL etc. Subscripted (array) variables of the form A(1,2) or B(2,3,5) are *not* acceptable. On reaching line 30 (NEXT I) the computer will loop back to line 10 (FOR I...), increment I by one and execute the loop again. If I has been incremented and its value exceeds the limits for I as set by program line 10 then the program will jump to the statement following the NEXT I; in the above

example, line 40. The starting value and limit for I are set by FOR I = 1 TO 4. In this example the loop is executed four times when I has the value 1,2,3,4. Exactly the same result would have been achieved if line 10 had been FOR I = 9 TO 12 or FOR I = 1999 TO 2002. The variable following FOR will always be incremented by one unless specifically instructed otherwise by using the BASIC command STEP, in which case the variable is incremented by the amount specified. If we replace line 10 by any of the following, the same result is displayed.

```
10 FOR I=1 TO 7 STEP 2
FOR I=234 TO 285 STEP 17
FOR I=8 TO 5 STEP-1
FOR I=1 TO 1.3 STEP 0.1
```

Most versions of BASIC will also accept variables or (formulae) as the defined limits and STEP value so you may be able to use something like:

```
10 FOR I=X TO Z+22 STEP B
```

A FOR...TO statement *must* be followed by a NEXT statement and it is the program area within these two statements that is repeated as the program loops. There are certain rules that must not be broken for this looping to occur (logically).

The following will result in the loop being executed *once* only.

```
10 FOR I=10 TO 5
FOR I=10 TO 10 STEP 0
FOR I=10 TO 15 STEP-1
FOR I=10 TO 10
```

Now I can hear you saying, 'surely no-one would be so dumb as to write a program line like that' ... BUT remember that this line:

```
10 FOR I=A TO B STEP C
```

looks quite reasonable, but what defines the value of A,B, and C? Elsewhere in the program there could be an operation that could bring about 1) — 4) above — be warned.

You may use the variable following FOR within the loop so:-

```
10 FOR K=1 TO 20
20 PRINT K, "OUNCES=" ;K*28.35; " GRAMS"
```

```
30 NEXT K
40 EN
or:
10 FOR K=1 TO 16
20 PRINT "THE SQUARE OF ";K;" = ";K^2
30 NEXT K
40 END
```

But your computer can only recognise one variable named K at a time, so you *must not* alter the value of K within the loop. A line like this:

25 K = K - 1

would really spell disaster to your program. Again remember this is shown here in a very simple and direct fashion and would obviously stand out like a sore thumb, but if you get into the habit of using certain letters as FOR...NEXT variables and then one day you incorporate a standard formulae that also uses a common letter...

```
10 FOR I=1 TO 20
:
:
:
60 V=I/R
:
:
120 NEXT I
```

it can happen!

It is quite common to instruct the computer to jump from one program area to another. (We will come to these instructions at a later date.) You may jump *out* of FOR...NEXT loop but *never* into such a loop. The rules concerning the use of FOR...NEXT loops are all perfectly logical but as programs become more complex it is surprising how often one can fall into one of the traps listed above.

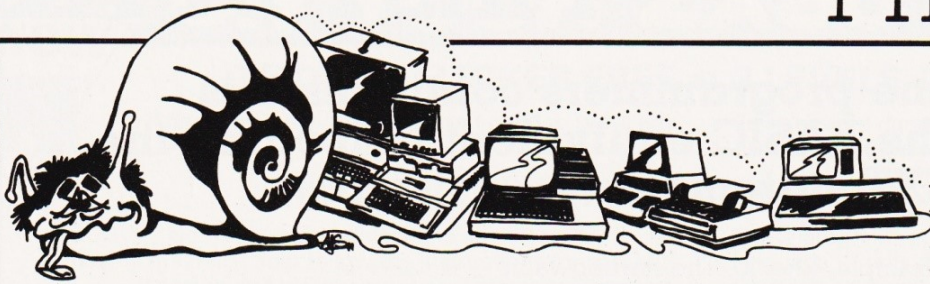
### Nesting Time

It is perfectly acceptable to NEST these loops within other loops, just how many nested FOR...NEXT loops depends upon your type of computer, but regardless of how many they *must* be nested like those wonderful Russian 'Matroshka' dolls — one complete doll within another complete doll within another...and so on:-

```
10 FOR A=1 TO 4
20 FOR B=1 TO 3
30 FOR C=1 TO 3
40 PRINT A+B*C
50 NEXT C
60 NEXT B
70 NEXT A
80 END

10 FOR A=1 TO 4
20 FOR B=1 TO 3
30 FOR C=1 TO 3
40 PRINT A+B*C
50 NEXT A
60 NEXT B
70 NEXT C
80 END
```





## Slowing Things Down

Not only is the FOR...NEXT loop useful for performing a repetitive calculation with progressive alterations of one or more variables — thereby perhaps optimising the value of the result obtained from a calculation — but it can also be used in several simple routines which are seen in program after program. One of the most common uses of the FOR...NEXT loop is as a time delay. When presenting results on the screen it is often best to display one or two results at a time, spaced out so that they may be clearly read and understood. This means that the program will call for PRINTing perhaps a line or two of text, a result, a couple more lines of text and a further result. The screen is then cleared and this little sequence repeated with another set of

results. As the computer can process information and calculations so rapidly, the above procedure could result in the text and results remaining on the screen for too short a time for us mere humans to assimilate. If you insert the following lines before the Clear Screen command, the computer will execute this command taking a time proportional to X. This gives you time to read what you have so carefully programmed the computer to display!

```
200 FOR T=1 TO X
210 NEXT T
```

X may be any numeric value. Each different type of computer will have a different execution speed but as a rule of thumb, start with the assumption that if X = 1000 the time delay

will be in the order 1-3 seconds. Time delays of this nature are also very useful in games and teaching programs, allowing only a fixed time in which to make a decision or answer questions. X in this case may be INPUT earlier in the program, so giving a variation in the required response time.

It is well worth timing your computer for a 1 to 10000 FOR...NEXT loop. Say this took 16.5 seconds, if you assign DL=10000/16.5 it becomes very easy to program accurate delays:

```
10 DL=10000/16.5
:
:
80 FOR I=1 TO DL      1 SECOND DELAY
   FOR I=1 TO DL*10    10 SECOND DELAY
   FOR I=1 TO DL/2     .5 SECOND DELAY
```

Next month we will look at the FOR...NEXT loops used in conjunction with READ and DATA statements as an alternative means of INPUTing information to the computer.

# DOS plus

## At last! A new, powerful and easy-to-operate Disk Operating System for the TRS-80 Model I/III

### SOLE UK DISTRIBUTOR

Compare its most important features:

- Variable Length Records
- Full lowercase support and detection
- Repeating keyboard with debounce
- Execute only protection for BASIC programs
- Track support for 35-77 track drives
- Device I/O handling (\*PR, \*DO, \*KI)
- Built-in Screen Printer
- New Printer Driver (for forms control and pagination)
- Built-in Memory Test
- Free space map of diskette
- Execute any DOS command from BASIC and return to BASIC

- Copy with Variable Length Files
- RS-232 Switch status and UART check
- Create/pre-allocate files from DOS
- Boot with re-setting time/date

### IMPROVED DOS FACILITIES

- New DISKDUMP Sector display/modify (real time)
- New BACKUP (more reliable, no pack ID Check)
- New FORMAT (no need to bulk erase first)
- CLOSE improved/No more closing killed files
- Significantly faster I/O
- No BREAK key death from DOS

### DEALER ENQUIRIES INVITED

### NEW DISK UTILITIES

- SINGLE DRIVE COPY
- RESTORE dead files
- PURGE unwanted files
- CLEARFILE (destroys data)
- TRANSFER (all files disk-to-disk)

Normal Price £76.75

Special Introductory Price **£59.95**

including VAT and Post & Packing

I'm Convinced! Rush me my new DOS plus.

My System is ☐ Model I single density  
☐ Model I double density  
☐ Model III

(tick one)

Name \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_ (Day/Evg)

(Cheque enclosed/My credit card number is

--	--	--	--	--	--	--	--	--	--

# CALISTO

COMPUTERS LIMITED

SPECIALISTS IN MICROCOMPUTER HARDWARE/SOFTWARE  
119 John Bright Street  
Birmingham B1 1BE  
Phone: 021-632 6458





AT LAST!

# THE COMPLETE SINCLAIR ZX 81 BASIC COURSE

At last, a comprehensive text for your Sinclair ZX 81! The complete BASIC Course is a manual which will immediately become an indispensable work of reference for all your ZX 81 programming.

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

The Complete BASIC Course is designed to teach you to write and develop BASIC programs for the Sinclair ZX 81 – no other books or aids are necessary. All is revealed in our easy step-by-step guide with programs and "test yourself" exercises all the way through.

As you become more proficient with computing, the Complete BASIC Course will continue to be an essential guide, giving you finger tip references, numerous advanced programming techniques and memory saving devices specifically for the Sinclair ZX 81.

## HOW TO WRITE PROGRAMS:

Even if the idea of writing programs is completely mystifying to you, the Complete BASIC Course will show you just how easy it is. In no time you will be able to write and enjoy complex programs for whatever use you desire.

Using the proven "TOP-DOWN" approach, the Complete BASIC Course will show you systematic and simple ways to write programs. Even experienced programmers will benefit from this Course, making programs easier to write and less prone to error!

## NUMEROUS EXAMPLES:

Every concept, every function is fully described by simple programs that you can enter on your Sinclair ZX 81 in minutes.

The Complete BASIC Course contains over 100 programs and examples! These programs illustrate the use and possibilities of the Sinclair ZX 81:

- Home use
- Financial analysis and planning
- Educational applications
- Games
- Mathematical applications
- Displays of 'Artificial Intelligence'

## EVERY FUNCTION COVERED:

No matter what your application, what your confusion about any function, you will find it covered in the Complete BASIC Course.

A full and detailed discussion is included of even traditionally taboo topics such as USR, PEEK and POKE.

A handy alphabetical summary section lists all functions, and provides a short description and example programs of all topics.

## A PERMANENT WORK OF REFERENCE:

The Complete BASIC Course is an excellent reference work for experienced programmers (including tips on using special techniques) as well as a comprehensive step-by-step guide for complete beginners.

The Complete BASIC Course has over 240 pages filled with information in an attractive durable ring binder – this is a lay-flat work of reference that deserves a place next to every Sinclair ZX 81 microcomputer.

## OTHER TITLES AVAILABLE:

Melbourne House is the world's leading publisher of books and software for the Sinclair ZX 81.

The following titles are also available if you wish to expand your horizons:

## BASIC Course Programs on Cassette -

All major programs in the BASIC Course are available pre-recorded in this set of cassettes. This is a valuable adjunct to the Course, saving you time and effort.

## Not Only 30 Programs for the Sinclair ZX 81: 1K -

Not only over 30 programs, from arcade games to the final challenging Draughts playing program, which all fit into the unexpanded 1K Sinclair ZX 81 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.

## Understanding Your ZX 81 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. Includes special section on how to use machine code routines in your BASIC programs.

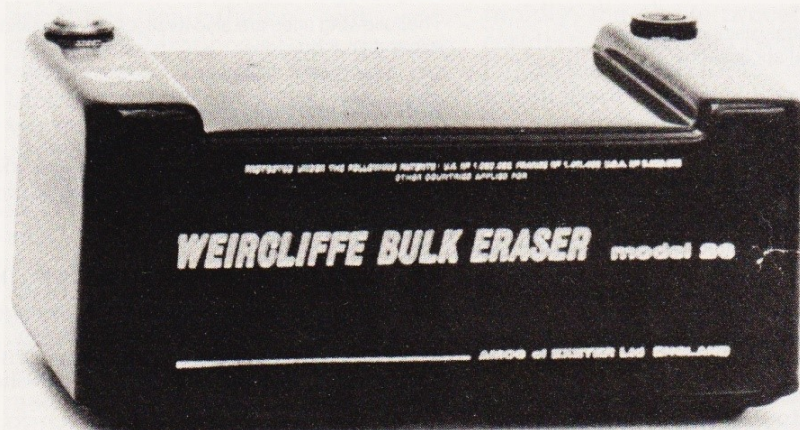


<b>Order Form:</b>		CT81
Orders to Melbourne House Publishers 131 Trafalgar Road, Greenwich London SE10		
(Correspondence to Glebe Cottage, Station Road, Cheddington, Leighton Buzzard, BEDS LU7 7NA)		
NAME:.....		
ADDRESS:.....		
.....		
.....		
Postcode:.....		
The Complete Sinclair ZX 81 BASIC Course	@ £17.50	
Basic Course Programs on Cassette	@ £ 2.50	
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		£ 0.80
Remittance enclosed		£



# 'SUM ERROR'

BULK ERASING WILL VIRTUALLY ELIMINATE 'SUM ERROR' CAUSED BY STATIC AND PREVIOUS PROGRAM BREAK THROUGH IN LESS THAN 5 SECONDS USING THE WEIRCLIFFE \* MODEL 26



PRODUCED BY THE WORLD'S LEADING MANUFACTURER OF TAPE ERASING SYSTEMS AND INCORPORATING 20 YEARS OF EXPERIENCE IN THE DIGITAL FIELD

**PRICED AT ONLY £41.40**  
INCLUSIVE OF VAT & CARRIAGE  
ORDER DIRECT FROM THE  
MANUFACTURER BY MAKING  
CHEQUE PAYABLE TO:-

**AMOS OF EXETER LTD**

WEIRCLIFFE  
EXWICK EXETER EX42AG  
TEL 0392-72132 TLX 42786  
**NEW TAPES BENEFIT AS WELL**

## HILDERBAY LTD.

**PROFESSIONAL PROGRAMS FOR THE SINCLAIR ZX81 + 16K  
SOFTWARE DESIGNED FOR PEOPLE BY COMPUTER PROFESSIONALS**

### THE HILDERBAY PAYROLL £25\*

- 1 to 30 employees. Weekly, monthly, etc. No tables needed. Very easy to use.
- Payslips and summaries printed.
- All pay levels and numeric tax codes catered for. All National Insurance contributions (including contracted-out).
- Provision for pre- and post-tax changes for any reason (overtime, bonus, etc.).
- Last-minute changes no problem.
- Will also work backwards! (compute gross and deductions from net pay).
- Possible to go back to manual calculations at any time — you don't depend on your computer!
- Program maintained and updated by Hilderbay Ltd. Training not necessary, but can be arranged.
- Easily used by the non-specialist. Routine payroll quickly handled. Senior managers can process senior staff salaries confidentially.
- Check your own pay!
- Will handle a payroll of five hundred employees (!) with 48K RAM pack!
- The Inland Revenue does not 'approve' computer programs (we did ask). The Hilderbay payroll satisfactorily deals with the 21 test cases of Inland Revenue systems unit note series 6 number 4 annex B.

### THE HILDERBAY STOCK CONTROL PACKAGE £25

- Program I: up to 400 items in 16K; up to 2000 in 48K. Item code &/or description, supplier code, type code, stock level, re-order level, unit price. Prints lists by supplier, by type, of understocked items, or all items.
- Program II: up to 2500 items in 16K, 8000 items in 48K. Numerical code and stock level only.
- Both programs are very fast! Locate, insert, delete an item a list of 2700 in well under two seconds!

### THE GIBBONS PERSONAL BANKING SYSTEM £15\*

- Do you sometimes wonder where all the money goes? Now you can find out!
- Keep your finances under control. Standing orders automatically allowed for.
- Do you wish your bank statements told you what each item was? Now you can print better statements than your bank can!

### HILDERBAY CRITICAL PATH ANALYSIS (CPA) £15

ZX81 implementation of a powerful tool of modern management. Designed for practical use, but also suitable for learning about CPA.

### HILDERBAY FINANCIAL PACK I £8

VAT: Given a mixture of bills with and without VAT at several

rates, prints table of: price, VAT, total, VAT rate. Displays and prints running totals.

**Mortgage:** How much longer will your mortgage take to repay if you pay £25 less per month? (The answer may surprise you.) How much must you pay per month to repay in 15 years? How long to repay at £200 per month? How much of your latest went towards interest, and how much towards principal (the answer will shock you)? Results given either for UK Building Society or (different) bank loan.

**Loan:** Calculates one of the following in terms of the other three: principal, number of payments, instalment interest.

### BUDGET £15

The user sets up this program with any headings chosen. The program then keeps track of expenses under the various headings, and print details. It is possible (but not obligatory) to do this on a month-by-month basis for up to 1 year at a time. A budget can be entered, and expenses compared with it. Expenditure can be graphed month-by-month. The program is suitable for business use (keeping track of several accounts) and for home expenses.

### HILDERBAY GAMES PACK I £8

**Gold:** A rather difficult adventure. We guarantee that you can get out with the treasure — but we're not telling you how!  
**Pick a Word:** An unusual game of skill. Play against the computer, picking words from the list until one of you gets a winning set of letters.

- All programs require 16K RAM pack. All prices include VAT, postage and packing. C.O.D. (cash on delivery — pay the postman) orders are accepted for a supplement of £2 per order. Urgent orders no problem.
- All programs are supported by Hilderbay Ltd. — we won't abandon you to your fate. Cassettes are produced with great care and are guaranteed.
- Programs are designed for use by people who are not familiar with computers.
- All programs are supplied with full documentation. Manuals for programs marked (\*) can be bought separately (£2, refundable on program purchase).
- Programs can be demonstrated (by appointment only). Further details available on request.
- 48K Memotechs demonstrated and sold.
- Software also supplied for mainframe computers, Hewlett-Packard 9845 and 85, various microcomputers.

Hilderbay Ltd. is not associated with any other company. Hilderbay software is now sold only by us and our authorised dealers.

Please telephone before visiting us.

**HILDERBAY LTD. (Founded 1979)**

**8/10 Parkway, Regents Park, London NW1 7AA**

**Telephone 01-485 1059 Telex 22870**



# SIX TOUGH QUESTIONS YOU SHOULD ASK BEFORE BUYING A MICRO.

1. Is it easy to use?
2. Are the programs versatile?
3. Is it absolutely reliable?
4. Does it have a national network of distributors and dealers offering full service and support?
5. Is it competitively priced?
6. Can you see proof of performance?

With the new Adler Alphatronic the answer is 'yes' to all these questions. Because Alphatronic is the micro that was specially designed for the small businessman. To cut paperwork, cope with accounts, payroll, stock control, VAT — and generally make business, and cash, flow more smoothly. When it comes to versatility, price, reliability and performance, Alphatronic is outstanding value.

The Alphatronic P1 costs £1600\* and includes a 2000 character screen, keyboard, integral double density floppy disk unit and CP/M<sup>†</sup> disk and manual. Alphatronic P2 complete includes 2000 character screen, keyboard, two integral double density floppy disk units together with a dot-matrix printer, CP/M<sup>†</sup> disk and manual and costs £2345.\*

\* Prices exclusive of VAT. † Trade mark of Digital Research Corp.

## FREE

With model P1: a two disk basic teach-in course worth £85.  
With model P2: a two disk data retrieval program worth £120.

Send back the coupon and we'll tell you how Alphatronic could be the answer — your answer.



**ADLER's NEW £1600 MICRO. BRILLIANTLY SIMPLE ALPHATRONIC.**

Alphatronic Division, **TRIUMPH ADLER (UK) LTD.**  
(formerly Adler Business Systems Ltd.)

27 Goswell Road, London EC1M 7AJ. Tel: 01-250 1717.

Please send me further details on the Adler Alphatronic.

Name.....  
Company.....  
Address.....  
Telephone.....

CT/1/82



Printer not included on P1 model at £1600.

IBS 81 October 20-29. Hall 4 Stand 321.



## The quantum jump from programming in BASIC to programming in assembly language is well covered in print. We take a look at some of the material available.

he most frequent question asked about assembly language programming is 'what book do I need to get started?'. After mastering BASIC or some other high level language (see recent Book Pages) the attraction of using assembler is strong. The novice programmer is forever being 'put in his place' by the more advanced programmer saying, 'that's best done in assembler', or 'why not move on to something a little more difficult — try assembler'. Sometimes the point is brought home more forcibly by a 'professional' program doing something amazing, usually a very fast graphics display, and a quick look in the software catalogue reveals that machine code is the key to success. So the next step is to learn machine code/assembly language, but how? A check through the book lists yields a wide range of titles like 'Z80 Guide', '6502 Cookbook', 'Introduction to the 8080' etc.

### First, Find Your Micro

To know which book you need, you must first identify the microprocessor buried deep within your microcomputer. This can usually be discovered by a quick look through the manufacturer's specifications. For example, the PET, VIC, ATOM, Proton, UK101, Superboard, Apple and AIM are 6502s and the ZX80/81, Video Genie, Tandy, SuperBrain are Z80s, DAI and TUSCAN are 8080s, and SWTPC, MSI, SSB are 6800s or 6809s. Armed with this information we can narrow down the choice to the books referring to your particular microprocessor. However, this is not the complete solution, for, although you may acquire a book about the 6502, it usually makes no reference to your computer system. This matters because although all 6502s are the same, and use the same instruction set, the way in which you can gain access to machine code depends on which microcomputer depends on two factors

- 1) The microprocessor you're using
- 2) The 'operating environment' provided by your microcomputer.

Most assembly language books deal only with the first requirement.

They'll tell you about an ideal microprocessor with no reference to how you get the assembly language programming examples to run on your particular machine. How do you find out about the second requirement? If the documentation that came with your machine was particularly complete then it might contain a section called 'machine code programming' which will give you the details you need, although they usually manage to leave something out! Alternatively, the manual that comes with your assembler will tell all. What, you haven't got an assembler?! Then that's your problem, an assembler is simply a program that takes the mnemonic codes which humans find easy (?) to understand such as JSR (jump to subroutine) and convert it to a number that computers find easy to understand. An assembler is necessary for any serious assembly language programming and makes learning assembler easy. So, my recommendation is to make an act of faith and buy an assembler for your machine even if you, at present, fear assembly language programming.

### Not One But Several

Having suggested that you consider buying one of the standard works of reference, I'll now turn the spotlight on some of the books available. Our first book is in fact a series! Back in the early days of microprocessors, a little known expert wrote a number of books with similar titles, **Z80 programming for logic design**, **8080 programming for logic design** etc. The expert was Adam Osborne who went on to become quite well known! The 'programming for logic design' books were really for engineers wanting to come to grips with the 'new' technology. They did have a lot of software information, however, and were invaluable at the time. For programmers, most of the hardware information was simply a nuisance and so Osborne published a new series called **Z80 assembly language programming**, etc. These are written by Lance Leventhal but contain large chunks from the earlier series. To date, there are six volumes covering the **8080A/8085**, the **6502**, the **6800**, the **6809**, the **Z80**, and the **Z8000**. Each book follows an almost

identical course — only the names and instructions are changed. So although each book in the series is very thick, buying more than one of them quickly leads you into diminishing returns. I find the overall layout of the series a bit off-putting. Each instruction is described with the aid of diagrams that look like spiders crawling across the page (and sometimes spinning a web on the way!) The text is printed in two typefaces, a bold type face spells out the important points and a lighter type expands on the idea. Initial chapters deal with the general concepts of assembly language, chapter 3 of each volume gives the full instruction set, and later chapters include practical examples — each chapter including worked examples and problems (with the results supplied) for the reader to apply the principles already explained to slightly modified conditions.

In my opinion, these texts are not really for the hobbyist. Their dense style is altogether too work-a-day. The only glimpse of levity is provided by the colourful front covers of the first four in the series — but I'm puzzled by their illustrations. That on the 8080A/8085 one seems to suggest a warrior from a Star Wars set!

Rodnay Zaks is a name well known in the world of microcomputers and he too has produced a series of volumes, each devoted to programming a single microprocessor. This is admittedly a much smaller series — just covering the 6502 and the Z80 with a similar volume about the Z8000 written by Richard Mateosian — and it is published by Sybex. Zaks uses a much cleaner, neater layout and devotes whole pages to each instruction of the instruction set. I find his diagrams in the instruction set better than Leventhal's, but I still don't think they add much. Again, his volumes reproduce word-for-word large chunks of text — the whole of chapter one, for example, dealing with 'basic concepts' such as flowcharting and binary arithmetic. Chapter 2 of each is devoted to hardware organisation, chapter 3 to fundamental programming techniques and chapter 4 to the instruction set. The topics in later chapters



are advanced techniques, input/output techniques and devices, applications examples, data structures and program development.

I prefer Sybex's presentation to that of the Leventhal equivalents, and at current list prices they also work out slightly cheaper. Sybex books are distributed in the UK by Computer Bookshop so if you have trouble in getting hold of any of their titles get your local bookshop, or computer supplier, to obtain stocks from Computer Bookshop, 30 Lincoln Road, Birmingham.

**The Z80 Microcomputer Handbook** is not one of a series, which is unfortunate because it is an attractive book. Hardware details are covered in chapters one to three and Z80 based systems are reviewed in chapters 17 and 18. The main part of the book is about software, however. The instruction set of the Z80 isn't treated in alphabetical order but in logical groups. This makes the book more useful as a tutor rather than a handbook. Chapter 16 lists and explains some common Z80 subroutines — none are very long but it is nice to see how someone else would write them. This is a book that a hobbyist would find useful. It isn't too mind-boggling at first glance and it proceeds at a reasonable pace. It is far slimmer than the previous two books on the Z80, but it still covers almost as much ground.

The books we've discussed so far have been about microprocessors rather than microcomputers. For the beginner there is nothing better than a book based on the machine he will be using. The trouble is that, to date, there just isn't a book for every machine on the market.

If you've got a TRS-80 or a Video Genie and want to learn to program the Z80 inside then I can wholeheartedly recommend **TRS-80 Assembly Language** by Hubert S Howe Jr. It is well written and succeeds in being easy to understand without 'talking down' to you. The book had its origins in a series of articles in TRS-80 Monthly News Magazine and is typeset using a TRS-80 and a Diablo daisy wheel printer. It is divided into two sections — 'basic concepts' and 'practical programming'. The basic concepts section starts at machine code and the Z80, and ends up discussing the memory map of the TRS-80, including details of the BASIC ROM. The practical programming section assumes that you have the Tandy editor/assembler program right

from the start so there is no PEEKing or POKEing to get programs running. However, this doesn't mean that Howe forgets that the TRS-80 is a BASIC machine. A chapter is devoted to USER subroutines and two chapters tell you nearly everything you could want to know about TRSDOS and disc files. If you read this book you will not only become familiar with the Z80 but also with the inner depths of the TRS-80. What more can I say except; please Mr Howe can we have a volume two?

**Apple Machine Language** by Don & Kurt Inman is on basically similar lines to the TRS-80 book. It is at a simpler level and has strange little cartoons to try to make things clear. Another difference is that the use of an assembler is not emphasised. This has the drawback that unnecessary complications are introduced. For example, having to calculate the relative address for branch instructions. However, I can appreciate the authors' desire to avoid the use of an assembler, since most Apple owners would find it difficult to choose among the various assemblers on the market.

Machine language programs are entered by four different methods: via BASIC PEEK, POKE and CALL instructions; via a small BASIC program ominously called BOS; via the Apple system monitor; and finally, via the Apple mini assembler. This last method is not, however, relevant to owners of Apple II Plus systems since the mini assembler is not included in the APPLESOFT ROM. One good thing about this book is that it gets you writing machine code programs very quickly. This is achieved by the use of the subroutines in APPLESOFT BASIC, so the first programs you write will look like a list of subroutine calls. A program that plots dots on the screen and plays the musical tones corresponding to them (eg an ascending scale), seems a novel and amusing approach to machine code. If you own an Apple and want to learn about assembly language then this book will help, but be prepared to work hard.

Tony Baker's **Mastering Machine Code on Your ZX81** is written for 'people who have a reasonable understanding of BASIC, but whose knowledge of machine code is zero'. It is a comprehensive and clear account. It needs to be read from cover to cover, with your ZX80/1 at your fingertips, but I found it kept my interest and was not difficult. The style

is casual, sometimes in the extreme, but I liked the feeling that the author had actually *used* a ZX80/1 and had made mistakes along with the rest of us. The programs used as examples are many and interesting in themselves, they are mainly games (again draughts is included), or other examples that fall into the category of 'light stuff', eg programs that play music or do graphics. However, the final two chapters cover more serious topics, ROM disassembly and floating point arithmetic (using the ROM subroutines). I would have no hesitation in recommending this book to Sinclair devotees — it will indeed help you to get the most out of your machine.

The books covered this month were:

**Assembly Language Programming Series**, by Lance A Leventhal, published by Osborne (McGraw Hill).

8080A/8085	1978 500 pages £11.60
6800	1978 500 pages £11.60
6502	1979 650 pages £12.10
Z80	1979 640 pages £12.10
Z8000	1980 900 pages £13.60
	(with Adam Osborne and Chuck Collins)
6809	1981 680 pages £12.10

**Programming the 6502**, by Rodnay Zaks, published by Sybex, (1980), 392 pages, £10.25.

**Programming the Z80**, by Rodnay Zaks, published by Sybex, (1981), 620 pages, £11.50.

**Programming the Z8000**, by Richard Mateosian, published by Sybex, (1980), 312 pages, £12.10.

**The Z80 Microcomputer Handbook**, by William Barden, published by Sams (1978), 304 pages, £5.70.

**TRS-80 Assembly Language**, by Hubert S Howe, published by Prentice Hall, (1981), 186 pages, £7.45.

**Apple Machine Language**, by Don and Kurt Inman, published by Reston (Prentice Hall), (1981), 296 pages, £6.45.

**Mastering Machine Code On Your ZX81**, by Tony Baker, published by Database Consultancy, (1981), 180 pages, £5.95.

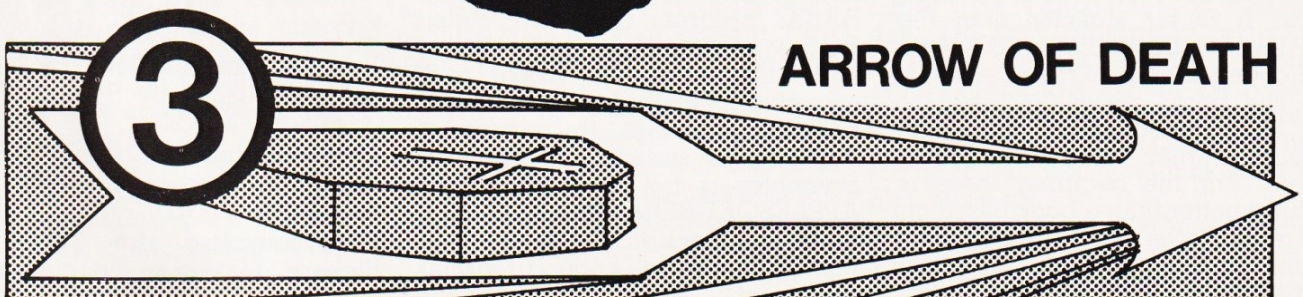
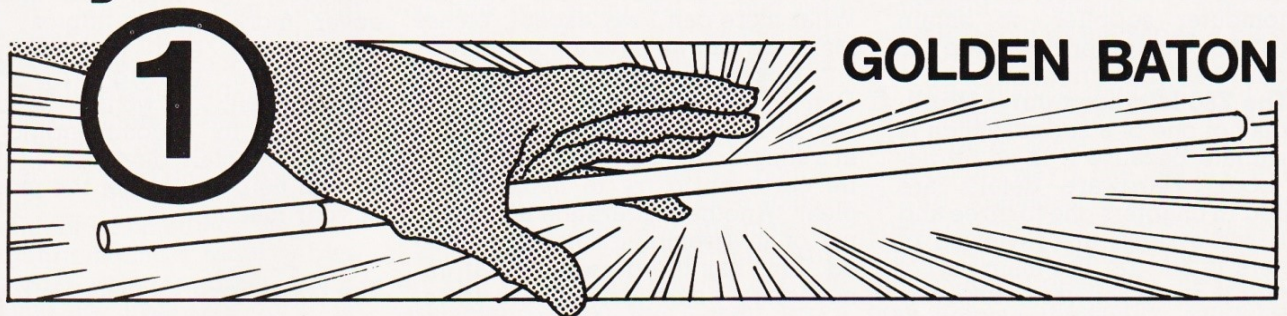
(\*Modesty has prevented Mike James from promoting his own volume on the 6809, **The 6809 Companion**, which will be published in the new year by Babani at the amazing price of £1.95 for 96 pages. Ed.\*)



# INNOVATIVE TRS 80-GENIE SOFTWARE

*from the professionals*

## Mysterious Adventure ★★ ★

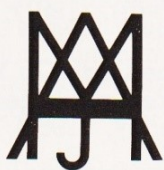


Three months ago we introduced the Mysterious Adventure series, a brand new series of machine language Adventures written by Brian Howarth. The first one, The Golden Baton, was greeted with enthusiasm by experienced and beginner Adventurers alike. Now the second and third in the series, The Time Machine and Arrow of Death, are available. The Arrow of Death, although entirely self-contained, is the first of a two part Adventure. The second part will be available early in the new year.

Mysterious Adventures are available for Models I and III TRS-80 and Models I and II Video Genie, both on tape (16K minimum) or disk (32K 1 disk minimum). A TRS-80 Model II version will be available shortly.

Any 1 Adventure:	On tape ..... £10.06	Any 2 Adventures:	On tape ..... £18.40
	On disk ..... £12.65		On disk ..... £23.00

All prices are inclusive of V.A.T. Please add 50p for P. & P.



# MOLIMERX LTD

## A J HARDING (MOLIMERX)

1 BUCKHURST ROAD, TOWN HALL SQUARE, BEXHILL-ON-SEA, EAST SUSSEX.

TEL: [0424] 220391/223636

TELEX 86736 SOTEX G

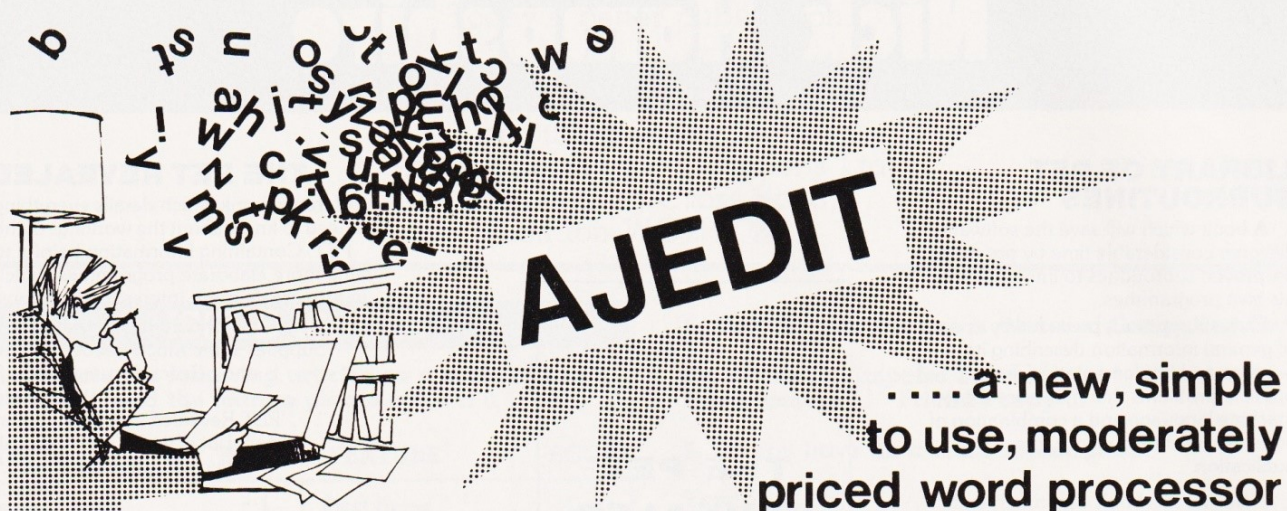
TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus 50p postage.





# INNOVATIVE TRS 80-GENIE SOFTWARE

## *from the professionals*



The introduction of a brand new word processor is a major event and AJEDIT is without doubt a major program. There are, however, quite a few Word Processors around and most of them are extremely good ones - why, therefore, another? The question is even more pertinent when it is known that we specifically commissioned the writing of it from an author of the status of Denville Longhurst of Enhanced Basic fame. The answer is that user feedback shows that a large number of customers do not need or want word processor programs which require a quantity of training before use. Scripsit, for instance, is an excellent program, but is complex to use; it even comes with a training course on tape. If one operator is dedicated to using the word processor then it makes sense to have her trained, and the more complex the program (so long as the complexity is accompanied by more and bigger functions) the better.

AJEDIT has been written for the user who needs a word processor intermittently, say three or four times a week. Its prime design criteria was ease of use - and just as importantly - ease of recollection of its commands. Take, for instance, the text editing commands - they are as close to the Basic Edit commands as possible, so that the user will remember them: To insert type I, to delete D, to take out three letters type 3D and so on.

Furthermore, AJEDIT has benefited from being written after a number of other word processors. The deficiencies in its predecessors are corrected in AJEDIT. For instance, any control characters can be outputted so that full advantage can be taken of the features of the particular printer being used. Disk directory access is available from within AJEDIT as is the killing of files on the disk. The FREE command and a number of other DOS commands can be carried out from within the program with a return to AJEDIT - with its text intact.

AJEDIT contains close to one hundred commands covering most word processor requirements. Dedicated printer commands for the Epson MX series and the Centronics 737 are included - again for ease of use of these two popular printers.

One of the big features of AJEDIT is the ability to 'mail-merge'. The facility is available whereby two special files are created, one containing names and addresses and a salutation, the other a standard letter or form. AJEDIT will call the address and salutation from one file and the letter from the other and thereby compile personalised letters. The salutation may be repeated in the body of the letter.

AJEDIT needs 48K and one disk minimum and is suitable for the TRS-80 Models I and III and the Video Genie Models I and II.

AJEDIT ..... £49.95  
Inclusive of V.A.T. and P. & P.



## MOLIMERX LTD

### A J HARDING (MOLIMERX)

1 BUCKHURST ROAD, TOWN HALL SQUARE, BEXHILL-ON-SEA, EAST SUSSEX.

TEL: [0424] 220391/223636

TELEX 86736 SOTEX G

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus 50p postage.





# THREE PET TITLES

## from

## Nick Hampshire

### LIBRARY OF PET SUBROUTINES

A book which will save the software designer considerable time by providing 55 proven subroutines to integrate with his own programmes.

Each subroutine is preceded by a page of general information describing its purpose and implementation and possible problems that may arise. Basic, machine language and a combination of both, are used throughout this publication.

"... We like this book very much and thoroughly recommend it."

*Printout*

"... well prepared, fun to use, and will help in better program development."

*Compute*

### THE PET™ REVEALED

NICK HAMPSHIRE

### THE PET REVEALED

A reference book which details everything you need to know about the workings of the PET. Containing information helpful to writing more elaborate programmes, which in turn create more interesting functions.

"... Should be congratulated. Supplies some much needed, useful and correct documentation."

*Compute*

"... 'PET Revealed' will save you an awful lot of time. I rate this book as good value for money."

*Printout*

### PET GRAPHICS

This book has two objectives. One, to provide the reader with an introduction to the programming techniques used to generate graphic displays.

Two, providing the programmer with a complete package of machine code routines giving a wide range of normally unavailable graphic functions. The book contains many comprehensively analysed routines and photographs to illustrate the effects created.

"... an invaluable guide to graphics on the PET."

*Micro Forecast*

All 3 publications are widely used by Commodore Business Machines.

#### Please send me:

..... copy/ies of Library of PET Subroutines  
@ 10.00 each

..... copy/ies of The PET Revealed  
@ £10.00 each

..... copy/ies of PET Graphics @ £12.00 each

I enclose a cheque for £ ..... payable to Computabits Ltd., P.O. Box 13, Yeovil, Somerset.

Name .....

Address .....

.....

.....

..... Postcode .....



# SURVEY '82

Once again it's time to ask you what you really think about Computing Today. This is your opportunity to tell us your opinion of the magazine and your chance to influence what we publish.

All you have to do is remove these pages from the magazine, fill them in and send them off to the address below.

All your comments and observations are noted and they will go towards making Computing Today a better publication.

Thank you for your time and trouble.

Computing Today Survey,  
Argus Specialist Publications Ltd.,  
145 Charing Cross Road,  
London WC2H 0EE.

## ISSUE ISSUES

1. Please rate the following articles on a scale of 1 to 9. If you didn't read the feature please score it 0.

FEATURE	SCORE	FEATURE	SCORE
Consumer News		First Bytes	
Business News		# File	
The White Barrows		Superbrain Revisited	
Going FORTH		Special Report	
Programming Languages		Number Crunching	
PC1211 Programming		Book Page	
Leapfrog		Printout	
The Information Age			

2. We cover a wide range of topics in the magazine. If you think we should pay more or less attention to any of the following, or if you think we've got the balance right, please indicate below.

	More Wanted Less Wanted Alright Now		More Wanted Less Wanted Alright Now
Educational features	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Software reviews	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Programming features	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Book reviews	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Hardware features	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	News	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Games software	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Applications software	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Equipment reviews	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		

## READING HABITS

3. Do you consider yourself a regular reader of Computing Today?

Yes ☐ No ☐

If Yes how long have you been reading the magazine?  
.....

4. If you have been reading the last twelve issues of the magazine, do you think that we've

Improved ☐ Got Worse ☐ Stayed the same ☐

5. How long do you keep copies of the magazine?

1 month ☐ 3 months ☐ 12 months ☐ Longer ☐

6. How did you become a reader of Computing Today?

By chance ☐ Impulse buy ☐  
Advertisement ☐ Friend's copy ☐

7. Do you have an annual subscription?

Yes ☐ No ☐

If No do you have any particular reason for not subscribing?

If you are not a subscriber to Computing Today during which week of the month do you purchase your copy?

2nd ☐ 3rd ☐ 4th ☐ Later ☐

8. How many other people read your copy? .....

## COMPUTERS AND YOU

9. Do you use a computer in your job?

Yes ☐ No ☐

10. Do you have your own computer at home?

Yes ☐ No ☐

If you have your own computer please indicate what type it is.

11. If you own a computer, or are planning to purchase one, how much do you intend to spend on it over the next year? .....

12. How much did you spend on your computer system over the last year? .....

13. Are you planning to purchase any of the following peripherals? Please indicate which, and your approx budget for each.

Memory ☐  
Printer ☐  
Discs ☐  
Graphics Unit ☐  
Modem ☐  
Prestel/ Teletext ☐



14. Do you belong to a computer club?

Yes ☐ No ☐

15. Which of the following areas of activity do you use your personal computer for:

Home use/Games ☐ Business ☐  
Scientific ☐ Education ☐

Please indicate the main use only.

## ADVERTISING AWARENESS

16. Do you read the advertisements in Computing Today?

Yes ☐ No ☐

17. Have you ever ordered any goods from an advertiser in Computing Today?

Yes ☐ No ☐

Do you have any comment on the service you received?

## EDUCATIONAL EXAMINATION

18. To which of the following standards were you in full-time education?

CSE ☐ O Level ☐ A Level ☐ ONC ☐  
HNC ☐ TEC ☐ Degree ☐

19. If you are still in full-time education which of the above levels are you currently at? .....

20. Does any part of your course involve computing?

Yes ☐ No ☐

## YOUR JOB

21. Occupation: .....

22. Are you employed in the computer industry?

Yes ☐ No ☐

If Yes please indicate which area your job covers

Software ☐ Hardware ☐ Support ☐ Other ☐

23. If you answered No to the question above does your job involve the use of computers?

Yes ☐ No ☐

If so, in what capacity:-

## PERSONAL PROFILE

The questions in this section are of a personal nature and all replies are treated in the strictest confidence. If you would rather not answer them please feel free to move on to the next section.

24. What sex are you?

Male ☐ Female ☐

25. Please indicate your age bracket

Under 18 ☐ 18-30 ☐ 31-45 ☐ 46-65 ☐ Over 65 ☐

26. Please indicate your income bracket

Under £3,999 ☐ £4,000-6,999 ☐  
£7,000-9,999 ☐ £10,000-12,999 ☐ Over £13,000 ☐

27. Do you hold any of the following credit cards?

Access ☐ Barclaycard ☐  
Diners Club ☐ American Express ☐

## THE COMPETITION

28. Listed below are our competitors. On a scale of 1 to 100, with our magazine rated at 50, please indicate what you think of them.

SCORE

Personal Computer World  
Practical Computing  
Micro Decisions  
Educational Computing  
Your Computer  
Printout  
Electronics & Computing  
Computer & Video Games

29. Do you read any of the weekly publications?

Yes ☐ No ☐

Please indicate which

Computer Weekly ☐ Computing ☐ Datalink ☐  
Other ☐

30. Do you read any of the American publications?

Yes ☐ No ☐

If you do please specify which. ....

31. Do you read a daily newspaper?

Yes ☐ No ☐

If Yes, which one? .....

32. Do you read a Sunday newspaper?

Yes ☐ No ☐

If Yes, which one? .....

33. And, finally, do you have any general comments on the magazine?

Name .....

Address .....

.....

.....



# The unique Computer Supermarket brings you computer hardware at cash-and-carry prices

## SHARP, COMMODORE, TEXAS, RICOH, ATARI and TANGERINE EQUIPMENT

Fully tested before despatch, or collection complete with instruction manuals, tapes, fitted 13 amp plugs.

### SHARP EQUIPMENT

Model	User Ram	exc VAT	inc VAT
MZ80K	48K Ram	346.96	399.00
MZ80FD	Floppy Disc	589.00	677.35
MZ80P	Printer	385.00	442.75
MZ801/0	Input/Output Unit	87.00	100.05
MZ80B	64K Ram	1095.00	1259.25

FREE LEDGER & STOCK CONTROL PROGRAM WITH EVERY COMPLETE SHARP SYSTEM, i.e. 48K Sharp, Twin Floppy Disc, Printer & I/O Unit.

### COMMODORE EQUIPMENT

Model	User Ram	exc VAT	inc VAT
4016	40 Col. PET		
	16K Mem	445.00	511.75
4032	40 Col. PET		
	32K Mem	560.00	644.00
8032	80 Col. PET		
	32K Mem	755.00	868.25
4040	347K Disk	560.00	644.00
8050	1M Byte Disk	755.00	868.25
4022	Printer	350.00	402.50
8024	Printer	975.00	1121.25
8026	Printer	835.00	960.25
8027	Printer	740.00	851.00
VIC 20	Personal		
	Computer	164.35	189.00
VIC/C2N	Cassette Deck	34.35	39.50
VIC 1515	Printer	175.00	201.25
VIC 1011A	RS232 Interface		
	Cartridge	28.00	32.20
VIC 1801	16K ROM Emulator	190.00	218.50
VIC 1210	3K RAM Cartridge	24.50	28.18
VIC 1110	8K RAM Cartridge	34.50	39.68
VIC 1111	16K RAM Cartridge	56.00	64.40
VIC 1212	Programmers Aid	26.25	30.19
VIC 1211M	Super Expander Hi		
	Res. Cartridge	26.25	30.19
VIC 1213	Machine Code		
	Monitor Cartridge	26.25	30.19
VIC Expansion Unit		78.00	89.17
Lid for above expansion unit		6.95	7.99

### RICOH

RP1600	Daisywheel Printer		
	PET Interface	1200.00	1380.00

### TEXAS EQUIPMENT

TI-99/4		242.62	279.00
---------	--	--------	--------

Full range of peripherals available

### ATARI EQUIPMENT

Atari 400 16K		300.00	345.00
Atari 800 16K		560.87	645.00

Full range of peripherals available

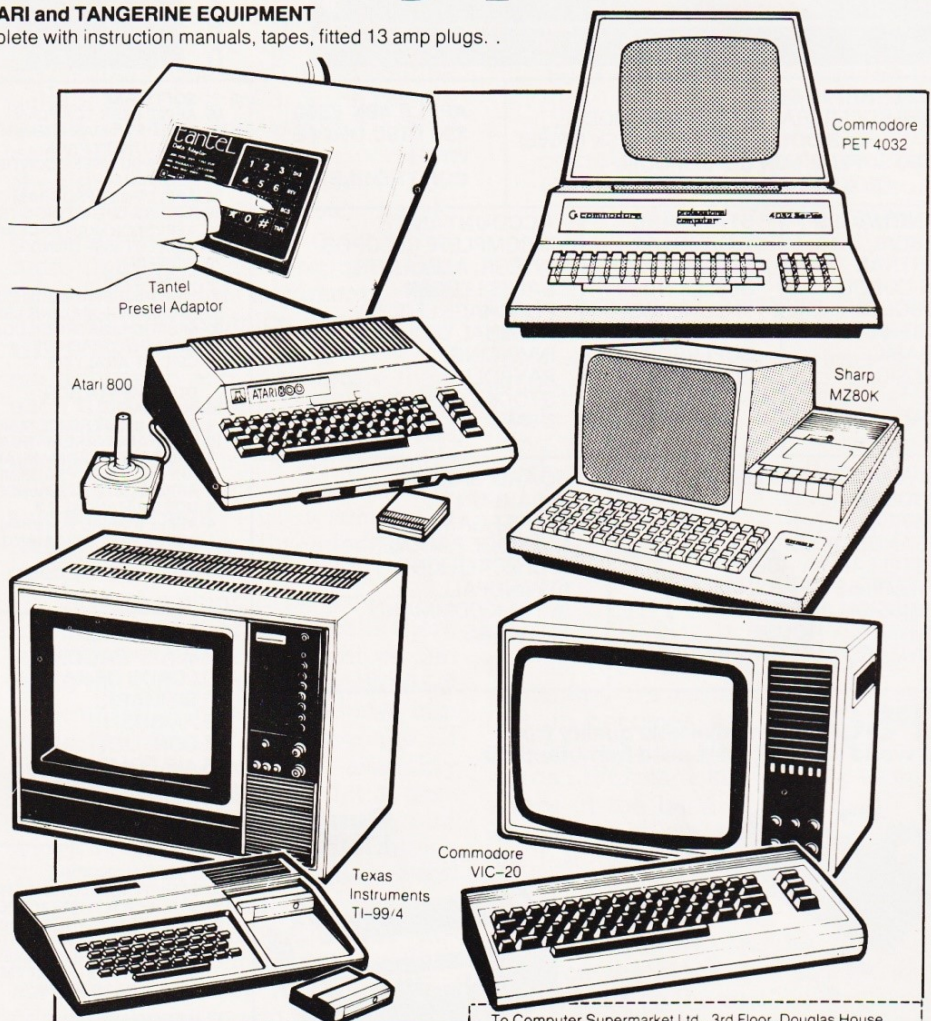
### TANGERINE EQUIPMENT

Micro Tantal Prestel Adaptor		135.00	155.25
------------------------------	--	--------	--------

Full colour output. Connects to any TV. Full British Telecom approval. Requires British Telecom 96A jack-plug. Gives access to massive home computer base information from Mortgages to Theatres, Stocks to Holidays.

Telephone us for further information on ease of installation.

Prices are valid only for the cover date month of this magazine



Insured shipment arranged anywhere in UK for an additional £14.37 (inc. VAT). VIC, Atari and Texas shipped by insured post for £3.50 inc. VAT.

Commodore Approved Distributor  
Registered Sharp, Atari and Texas Dealer

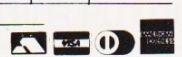
All goods sold with full manufacturer's warranty and subject to conditions of sale (available on request).  
ALL MACHINES ARE FULL UK STANDARD.

To Computer Supermarket Ltd., 3rd Floor, Douglas House, Queens Square, Corby, Northamptonshire.

Please send me

Model No.	Item	Price	Shipment	Total	Info only (✓)

I enclose my cheque for £  
Or debit my Access/Barclaycard/  
Diners Card / American Express No.



(Cardholders may telephone orders to 05366 61587/8 and 62571)

Signature \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

(BLOCK CAPITALS PLEASE)

Your remittance should be made payable to Computer Supermarket Reader's Account, and shall remain your money until the goods have been despatched to you at the address specified.  
All goods offered are subject to Computer Supermarket conditions of sale, copies available on request. Reg. in England No. 2646589.  
Prestel subscribers may order through the Prestel service, Directory No. 400400.

CT

# COMPUTER SUPERMARKET

COMPUTER SUPERMARKET LTD (An associate company of HB Computers Ltd)

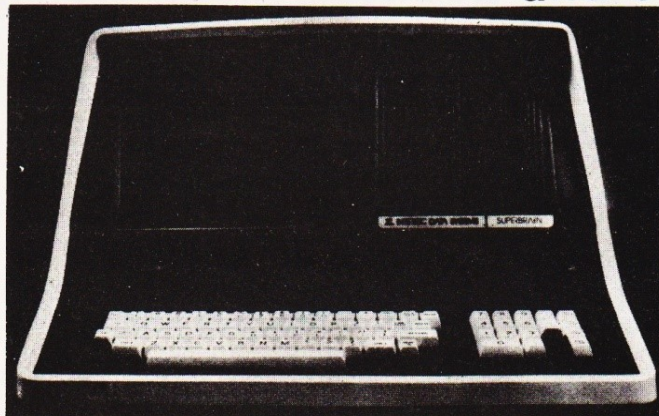
3rd Floor, Douglas House, Queens Square, Corby, Northamptonshire.

Telephone 05366 61587/8 and 62571 Telex COMPSU 341543/4 Prestel No. 400400



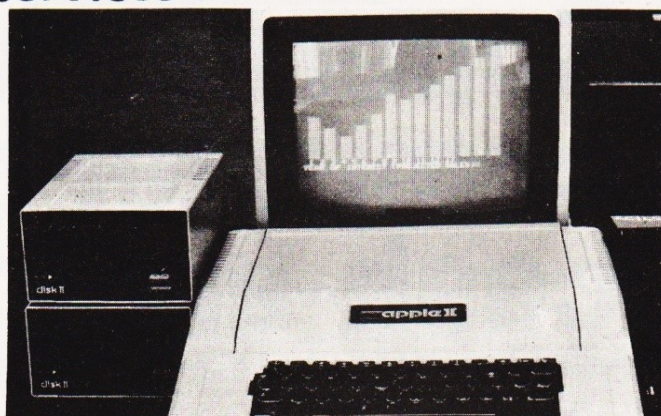
# SALES - LEASE

and other services



64K

S  
U  
P  
E  
R  
B  
R  
A  
I  
N  
  
A  
P  
P  
L  
E  
  
C  
P  
M  
  
Z  
8  
0



## SUPERBRAIN 64K

**£1680** SUPERBRAIN STANDARD MODEL  
(350KB DOUBLE DENSITY DISK DRIVE)  
**£2070** SUPERBRAIN QUAD MODEL  
(700KB QUAD DENSITY DISK DRIVE)

**APPLE 48K £590**  
**320 DISC DRIVE**  
**WITH**  
**CONTROLLER**

## LANGUAGES

PASCAL  
FORTRAN  
CIS-COBOL  
COBOL 80  
FORTRAN 80  
MBASIC  
CBASIC  
APL  
MPM  
PLI

## STANDARD

WORDSTAR  
MAGIC WAND  
SPELLBINDER  
MAILMERGE  
DATASTAR  
SUPERSORT 1  
IBM 3780 EMU  
STATIONERIES

## ACCOUNTANCY

INCOMPLETE RECORDS  
INTEGR. ACCOUNTS  
SALES LEDGER  
PURCHASE LEDGER  
NOMINAL LEDGER  
INVOICING  
PAYROLL  
STOCK CONTROL  
DBMS

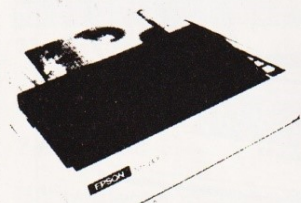
## ADVENTURE GAMES

14 ODDESSY  
16 ZORK  
16 SANDS OF MARS  
8 STELLAR INVADERS  
17 TEMPLES OF ARSHAI  
10 MISSION ASTEROID  
12 MYSTERY HOUSE  
15 WIZARD AND THE PRINCESS

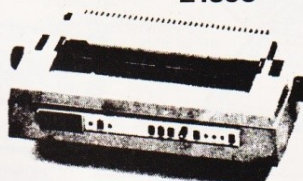
## BOARD GAMES

18 SARGON II  
12 FAST GAMMON  
12 BRIDGE PARTNER  
12 CHECKER KING  
10 WINDFALL  
6 TANK COMMAND  
12 FRACAS

**EPSON** Unbelievable quality from  
the world's largest print head manufacturer.



Qume  
£1395



**MX80F/T<sub>1</sub> = £340**

**MX80F/T<sub>2</sub> = £380**

## SOFTWARE

95 APPLE DESK TOP PLAN  
60 CCA DATA MANAGEMENT SYSTEM  
10 DISC UTILITY PACK  
300 APPLE BUSINESS CONTROLLER  
PROGRAM  
25 APPLE POST PROGRAM  
35 3.3 DISK OPERATING SYSTEM  
100 APPLE FORTRAN PACKAGE  
100 VISIPILOT VISI-TREND  
70 VISITERM  
110 DB MASTER  
100 VISICAL DISK & BOOK COMPLETE 3.3  
50 MICROBASE MAILING LSIT  
100 MICROCHASE STOCK CONTROL  
20 3D SUPER GRAPHICS  
8 CIRCUIT ANALYSIS

## DOCUMENTATION

12 FORTRAN  
9 APPLE II REFERENCE MANUAL  
10 6602 HARDWARE MANUAL  
8 6502 SOFTWARE MANUAL  
3 APPLE II BASIC PROGRAM MANUAL  
100 VISICAL II REFERENCE MANUAL  
4 DOS 3.2 MANUAL 3.3  
4 APPLE II BASIC TUTORIAL MANUAL  
4 AUTOSTART ROM MANUAL  
11 PASCAL MANUALS  
14 BENEATH APPLE DOS

## WAR GAMES

17 WARP FACTOR  
10 LORDS OF KARMA  
25 BISMARCK  
25 AMBUSH  
16 CONFLICT  
25 AIR COMBAT  
25 NAPOLEONICS  
17 BASEBALL

## VIDEO MONITORS

100 9" HIGH RESOLUTION B/W MONITOR  
100 9" BLACK & WHITE VIDEO MONITOR  
165 12" BLACK & WHITE VIDEO MONITOR  
CABLE FOR VIDEO MONITOR  
120 12" VIDEO MONITOR GREEN DISPLAY  
MONITOR CABLE FOR VM12G  
250 12" COLOR MONITOR

## HARDWARE

590 APPLE 48K VIDEO OUTPUT ONLY  
260 DISC DRIVE WITHOUT CONTROLLER  
320 DISC DRIVE WITH CONTROLLER  
25 16K ADD ON  
150 Z80 SOFTCARD

## CARDS & ACCESSORIES

120 ALF MUSIC SYNTHESIZER CARD  
10 TIMING MODE INPUT BOARD  
7 ALF MUSIC ALBUM 1  
7 ALF MUSIC ALBUM 2  
7 ALF MUSIC ALBUM 0 (CHRISTMAS)  
180 ANALOG OUTPUT BOARD 4 CHANNEL  
280 ANALOG OUTPUT BOARD 8 CHANNEL  
200 A1-02 DATA ACQUISITION CARD  
200 AD-DA 16 CH 12 BITS  
11 PROTOTYPE/HOBBY CARD  
40 PARALLEL PRINTER INTERFACE CARD  
100 COMMUNICATIONS CARD  
80 HIGH SPEED SERIAL INTERFACE CARD  
90 LANGUAGE CARD  
50 CENTRONICS CARD  
80 RAM CARD 16K  
150 Z80 CARD CRM OP  
75 EUROCOLOUR CARD  
120 SPEECH LAB  
120 GRAPHICS TABLET  
90 CONTROLLER CARD  
APPLETEL SYSTEM  
160 80-COL DISPLAY CARD FOR BASICS  
10 DISC TO CONVERT DV80 TO PASCAL  
180 APPLE JUICE POWER SUPPLY  
5 APPLE BLACK & WHITE MODULATOR  
58 HEURISTICS CONTROLLER 70  
168 HEURISTICS SPEECHLINK 200  
219 IEEE INTERFACE  
160 CLOCK/CALENDAR CARD  
180 SUPERTALKER  
110 ROM-PLUS CARD  
100 ROMWRITER  
30 COPYPLUS ROM  
MUSIC SYSTEM COMPLETE

## PRINTERS

SILENTYPE 80-COL GRAPHICS PRINTER  
25 10 ROLLS THERMAL PAPER FOR  
A2M0034  
9 DUST COVER FOR SILENTYPE  
PRINTER  
CENTRONICS 737 PRINTER  
C/W ADAPTOR  
20 11x9.5" PAPER FOR CENT. 737  
32 14 ZIPPACK RIBBONS FOR CENT. 737  
9 DUST COVER FOR CENT. 737 PRINTER  
8 SERIAL CABLE FOR TIGER PRINTER  
18 GRAPHICS SOFTWARE FOR TIGER/G  
18 2000 SHEETS 11x9.5 PAPER 1 PART  
RE-INKING RIBBON & ROLLER SET  
1395 QUME 5/45 RX  
110 QUME FORM TRACTOR  
400 CENTRONIC 739  
460 PAPER TIGER 445  
560 PAPER TIGER 460  
650 PAPER 560  
750 ANADEX DP9000  
780 ANADEX DP9500  
810 ANADEX DP9001  
845 ANADEX DP9501

MAIL ORDER TO CENTRAL OFFICE

SEND FOR FURTHER DETAILS ON REST OF OUR EXCELLENT RANGE OF SOFTWARE HARDWARE

\*All prices ex. V.A.T. \*Our own low cost maintenance 24 hrs. service \*Please ask for other brands of software and hardware

## MICROCOMPUTER HIRE SERVICE

A TRIAL PERIOD FOR YOUR COMPUTERISATION  
A COMPREHENSIVE SERVICE FOR RENTALS

Superbrain with application packages · Apple System · PET Tandy Sorcerer Horizon Printers

CENTRAL OFFICE: Microcomputer Spacedrome, 3 Westholm, London NW11. 01-458 5845  
Promglow Ltd., 12 Dene Road, New Southgate.



# NUMBER CRUNCHING

**In the second part of his article on how to process arithmetic expressions, Mike James shows you how to use this as part of your own compiler.**

**M**icros are awful at arithmetic! They can just about manage addition and subtraction, but division and multiplication are usually beyond them. It's obvious that if we are going to evaluate arithmetic expressions, something has to be done about this situation. The usual solution is to write machine code subroutines to carry out each of the four simple operations of arithmetic. This set of routines is often referred to as a 'maths package' and there may be one available for your microprocessor already. If there is, then the best thing to do is to buy it! Otherwise you've got a lot of work to do in writing one.

Maths packages generally come in two sorts!

- 1) Floating Point
- 2) Integer

Floating point packages carry out arithmetic on so-called 'real numbers'. A real number is anything like 3.256, ie it can have a fractional part. An integer, however, cannot have a fractional part. For example 3; 10; -1; 0 are all integers but 3.5; .2; -0.02; 4.0 are all real numbers. Notice that the last example of a real number, 4.0, could be considered to be an integer, ie 4. The point is that you can represent an integer as a floating point number, simply by writing .000 after it, but you cannot represent a floating point number as an integer!

For the rest of this article we will assume that all the arithmetic is done by a 16-bit integer package. The reason for this will become clear as we go on. Briefly, the principles are the same for floating point as for integer and a 16-bit package is easy to write for most micros. With a 16-bit integer the maximum number that we can handle is 32767 and the minimum is -32768, so things are still usefully large.

## Compilers And Subroutines

The purpose of a compiler is to take high level language statements and translate them into machine code. There are a number of ways in which this can be done. For exam-

ple, if we are interested in compiling the statement:

$$A = B * 3$$

we could use subroutines from the maths package we discussed above and simply generate a subroutine call to multiply B by 3. Some people would say that this was not a true compilation! A true compiler shouldn't avoid the problem of how to do multiplication but should generate the necessary code rather than jumping to a subroutine. Personally I think this argument is silly when applied to a microprocessor. It takes a lot of instructions to do multiplication and to generate them each time is wasteful. From now on the sort of compiler that we will be considering will try to compile high level language into a sequence of subroutine calls. This is sometimes referred to as a 'threaded code' compiler.

If we are going to be generating a sequence of subroutine calls there is another simplification that we can make to our compiler. Instead of translating to machine code we can make use of assembly language. If our compiler produces assembly language we can leave a lot of boring jobs to the standard assembler which is available for every micro. The sort of jobs I'm thinking of are converting decimal constants to binary and looking after the absolute addresses of everything. This may seem a messy way to write a compiler because you need another program, ie the assembler, before you get the final code. The procedure is to run the compiler which outputs assembly language and then use this as the input to an assembler. This approach has a few advantages though; the assembly language output can be altered and added to, using a text editor, and the incorporation of other programs, such as the very necessary maths package, can be done by simply appending the two text files. The criticism that this method is slow is true, but it should be remembered that most compilers have to read through the text of the program a number of times and by using an assembler we can make do with one, or at most two, passes.

## Evaluating Reverse Polish

Generating machine code or assembly language for an arithmetic expression is a matter of following the rules that we gave last month for evaluating Reverse Polish.

'Scan the expression from left to right until you meet an operator. When this happens the operator is applied to the two variables to the left. The result is left in the expression replacing all the variables and symbols used to produce it.'

Only, instead of carrying out the arithmetic when we find an operator, we produce instructions that will carry out the arithmetic. For example, consider  $AB * C +$ . The first thing we hit is A, then B — neither of which we are interested in at the moment. Then we hit \* which means do a multiplication on the last two variables we passed over, ie A and B. So our compiler must output "JSR MULTIPLY". We suppose that the subroutine MULTIPLY can find the last two variables automatically and output its result in such a way that it becomes the last variable passed over. At this point I hope the words LIFO stack are flashing somewhere in the back of your mind! If we stack each variable as we meet it the last two variables are easy to find. They are simply the top two items! So if all our arithmetic subroutines work on the top two items on the stack and place their results back on the stack, everything looks after itself.

Using a stack and a set of stack oriented arithmetic subroutines the evaluation of  $AB * C +$  generates the following code:

```
STACK A
STACK B
JSR MULTIPLY
(This multiplies A and B and puts result
back on the stack)
STACK C
JSR ADD
(This adds C to the result of A*B)
```

Of course, the result is left on the stack but can be easily printed out using another subroutine 'PRINT' which prints and removes the top item on the stack. The instructions



STACK A etc have to be written in whatever assembly language you're using, ie 6502, Z80 etc.

There are other ways of evaluating an arithmetic expression. Some result in faster code and a lower memory use — using a stack results in some unnecessary pushing and pulling and extra copies of data. However, the stack method has the advantage of being simple to implement, easy to understand and, in a lot of cases, not too bad in terms of speed and memory use. Some computer manufacturers have taken this liking of the stack method to its logical conclusion by building computers with no other memory than a stack (or sometimes two).

### The Code Generator

If we look at the program for generating 6502 code, it looks very complicated, but the first half from 5000 to 5420 is simply a version of the Reverse Polish converter which was described last month. The only real addition to the original program is the insertion of a blank in front of every constant, ie string of digits. This is done by keeping a count of the number of digits since the last non-digit character (lines 5245-5250 and 5066). The really new section is the subroutine in lines 5500 to 5685. This is the code generator subroutine. The program begins by asking for an arithmetic expression to work on, in line 2. It then calls subroutine 5000 which, using the algorithm discussed last month, converts the string in A\$ into Reverse Polish in C\$. For interest (and to check that the program is working!) A\$ and C\$ are printed at line 4. A call on subroutine 5500 generates the 6502 assembly language for the expression. Each instruction is printed as it is generated. A 'real' version of this program would save the instructions on disc or tape for later use by an assembler, but that's something for you to do. If the character is a letter, it is assumed to be a variable. (Notice that we can only handle single letter names.) The names of all the variables are changed to VAR followed by one letter. This is so that other assembly language routines know which names to avoid using. So, lines 5540-5560 generate code to push the variable onto the stack. In the case of the 6502 this has to be done in two attempts because each variable is 16 bits and the 6502 can only move eight bits at a time. For example, if the variable X is

found in an expression

```
LDA  VARX
PHA
LDA  VARX+1
PHA
```

is generated. For this to work, it is necessary for some other part of the code generator program to produce

VARX FDB 0

to reserve space for the variable. To do this you can either keep a list of all the variables used, or have FDB statements for variables A-Z (all 26 of them). As this latter option uses only 52 bytes, it is obviously the one to use for now.

If the character is a digit, then a constant must be stacked. First we must somehow create the constant. As we are using an assembler, this is easy. Suppose the constant 415 was in the expression, all we have to do is generate something like:

C2 FDB 415

The assembler would take care of the conversion to binary later! The only trouble is that we have to keep count of how many constants we are using and give them all different names, ie C1, C2, . . . Cn. This is what goes on in line 5572. The constant itself is created in lines 5574 to 5619. In this case it's not good enough to print out the code at once because data storage areas are normally separate from the program. The solution is to use an array, C\$ and store the FDB instruction for constant N in C\$(N) and print out C\$ at the end of the code generation. This is what subroutine 5700 does. After creating the constant all that's left is to stack it and this is done exactly as for variables, in line 5573, only the name used is C1, C2, . . . etc.

Finally, if the item isn't a letter or a digit it must be an operator. Lines 5625 to 5680 check which operator and generate the correct subroutine jump.

### The Run Time Package

The assembly language produced by the code generator has to be added to the maths package and the data area declaring the variables (ie 26 FDB instructions). In a complete compiler the code that has to be added to that generated by the compiler is often called the run time package. Although our run time

package is small, real packages can be very large — about 12K to 16K — and if you want to go on to produce a compiler in BASIC then be prepared to spend as much time on the run time package.

### Conclusion

If you've followed so far you should be capable of going on to write an entire compiler in BASIC. The machine you write it for is up to you — all you need to do is change the run time package and the way subroutines are called and items stacked. (For example, on the 6809 the stacking can be done by LDX 0ARA; PHSS X and for the Z80 subroutine calls are done by CALL ADD.) Even the language you write it for is up to you but there is a very surprising advantage in writing a BASIC compiler in BASIC. Once you've finished your compiler you can (if you've finished it well enough) run the BASIC program that is the compiler through the compiler! The result is a machine code BASIC compiler that runs fast! Another advantage in sticking to BASIC is that one of the most difficult parts of writing a compiler is finding and dealing with errors in programs that you are trying to compile. For example, our code generator would pass things like A(+C without any sign that anything was wrong. It would even generate code for it! If we stick to BASIC then we can forget about trying to track down errors and suppose that all the programs that are to be compiled are error-free. The way that this can be achieved is to run and debug all of them using the BASIC interpreter that the compiler is run under!

As you make progress with your BASIC compiler the LIFO stack will crop up time and time again. After a while you'll wonder how you ever managed without it. When you come to implement FOR . . . NEXT loops, for example, each FOR instruction can stack the index variable and the value that it must reach to terminate the loop, and each NEXT instruction simply increments the value on the top of the stack and compares it to the limit. This method of implementation takes into account the normal 'nesting' rules for FOR loops automatically.

The evaluation of arithmetic expressions also proves to be of general use. The simple arithmetic operators can be extended to include logical operators, such as AND and OR, operating on Boolean



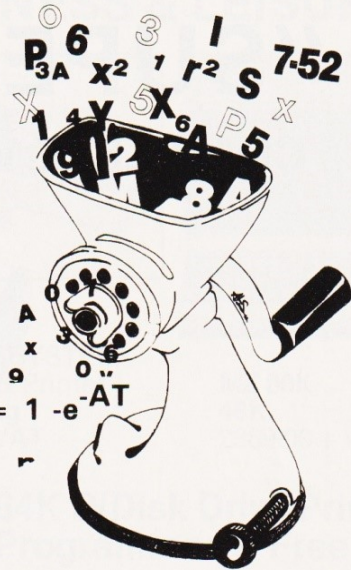
# NUMBER CRUNCHING

variables. (A Boolean variable is often implemented as an integer that has two special values, eg 0 and -1, usually referred to as 'true' and 'false'.) Your only problem in using the Reverse Polish stack method is in deciding the priorities to be assigned to the operators. In IF statements, the relational tests (=, <, >, <> etc.) can also be treated as binary operators and similarly evaluated. Their action is to compare the top two items on the stack and place a Boolean variable on the top, indicating whether the relationship is true or false.

After all this it may come as no surprise to discover that it is possible, although not really practical, to

convert, in its entirety, any BASIC program to Reverse Polish and evaluate it using the techniques described in these two articles!

$$F(T) = \int_0^T p(x)dx = \int_0^T Ae^{-Ax}dx = 1 - e^{-AT}$$



## Program Listing

```

1 DIM Z(25),W(5),C$(10)
2 INPUT A$:I=1
3 GOSUB 5000
4 PRINT A$,C$
5 GOSUB 5500
6 GOSUB 5900
7 END

5000 U$="-+*/()"
5010 Z$="":C$="":X=1:O=1
5020 W(1)=1:W(2)=1:W(3)=2:W(4)=2:
      W(5)=0
5030 FOR J=1 TO 25:Z(J)=0:NEXT J
5040 IF LEN(A$)<I THEN 5470
5050 B$=MID$(A$,I,1)
5060 IF B$="[SPC]" THEN I=I+1:GOTO 5050
5070 K=0
5080 FOR J=1 TO 6
5090 IF B$=MID$(U$,J,1) THEN K=J
5100 NEXT J
5110 IF K=0 THEN 5260
5120 D=0
5130 IF K=6 THEN 5380
5140 S=W(K)
5150 IF S=0 THEN 5230
5160 IF S=1 THEN 5420
5170 O=1
5180 IF X=1 THEN 5230
5190 IF Z(X-1)<S THEN 5230
5200 C$=C$+LEFT$(Z$,1)
5210 X=X-1:Z$=RIGHT$(Z$,LEN(Z$)-1)
5220 GOTO 5180
5230 Z(X)=S
5240 Z$=B$+Z$:X=X+1:I=I+1
5250 GOTO 5040
5260 O=0
5270 IF B$<"A" THEN 5310
5280 IF B$>"Z" THEN 5310
5290 C$=C$+B$
5300 I=I+1
5310 IF B$>"9" THEN 5040
5320 IF B$<"0" THEN 5040
5330 D=D+1
5340 IF D=1 THEN B$="[SPC]" + B$
5350 C$=C$+B$

```

```

5360 I=I+1
5370 GOTO 5040
5380 IF LEN(Z$)=0 THEN I=I+1:GOTO 5040
5390 B$=LEFT$(Z$,1):Z$=RIGHT$(Z$,LEN(Z$)-1):
      X=X-1
5400 IF B$="(" THEN I=I+1:GOTO 5040
5410 C$=C$+B$:GOTO 5380
5420 IF O=0 THEN 5170
5430 S=6
5440 IF B$="-" THEN B$="!"
5450 IF B$="+" THEN B$="?"
5460 GOTO 5170
5470 C$=C$+Z$
5480 RETURN
5490 J=1
5500 IF J>LEN(C$) THEN RETURN
5510 B$=MID$(C$,J,1)
5520 PRINT
5530 IF B$<"A" THEN 5600
5540 IF B$>"Z" THEN 5600
5550 PRINT " LDA VAR";B$
5560 PRINT " PHA"
5570 PRINT " LDA VAR";B$;" +1"
5580 PRINT " PHA"
5590 J=J+1:GOTO 5500
5600 IF B$<"0" THEN 5730
5610 IF B$>"9" THEN 5730
5620 N=N+1
5630 PRINT " LDA C";N:PRINT " PHA ":
      PRINT " LDA C";N;" +1":PRINT " PHA"
5640 C$(N)="C"+STR$(N)+" FDB "
5650 IF B$<"0" THEN 5730
5660 IF B$>"9" THEN 5730
5670 C$(N)=C$(N)+B$
5680 J=J+1:IF J>LEN(C$) THEN RETURN
5690 B$=MID$(C$,J,1)
5700 IF B$>"9" THEN 5520
5710 IF B$<"0" THEN 5520
5720 GOTO 5670
5730 PRINT
5740 IF B$="+" THEN PRINT " JSR ADD"
5750 IF B$="-" THEN PRINT " JSR SUB"
5760 IF B$="*" THEN PRINT " JSR MUL"
5770 IF B$="/" THEN PRINT " JSR DIV"
5780 IF B$="!" THEN PRINT " JSR NEG"
5790 PRINT:J=J+1:GOTO 5500
5900 FOR I=1 TO N
5910 PRINT C$(I)
5920 NEXT I
5930 RETURN

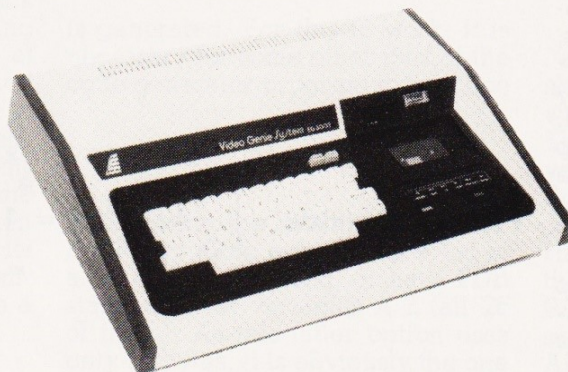
```

This is the Reverse Polish generator from last month with the extra routines necessary to write 6502 code.



# NEW "SUPER VIDEO GENIE"

COMPLETE WITH SOUND AND LOWER CASE



**ONLY £279**

**GENIE II WITH NUMERIC PAD £299**

## DISK DRIVES

Complete cased with power supply  
40 TRACK **single £189**  
**dual £359**  
77 TRACK **single £239**  
**dual £449**

Takes Diabold Wheels Printers  
T.E.C. Daisy-wheel

**ONLY £899**

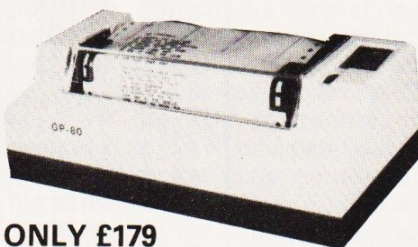
Centronics 737  
Proportional Spacing  
Dot Matrix Printer

**ONLY**

**£339**

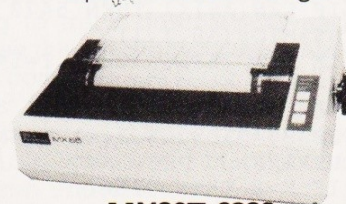


Seikosha GP80A



**ONLY £179**

Epson MX80 Range



**MX80T £329**  
**MX80F/T £379**

Memory Chips  
4116 16K Dynamic

**79p**

2114 4K Static

**89p**

2114L 4K Static

**£1.09**

12 inch green screen  
metal monitors  
made by  
Bergquist & Hobberstad  
Copenhagen  
**ONLY £89**

Ohio Superboard  
**Only £159**  
Fully built & tested

Letters to  
Kram Electronics  
**FREEPOST**  
Leicester (no stamp required)

**Kram Electronics**  
**Victoria House**  
**17 Highcross St**  
**Leicester**  
**Tel: Leicester 27556**

**All prices exclude V.A.T.**





## Diskwise Ltd

25 Fore Street, Callington  
Cornwall, PL17 7AD.  
Tel: 05793 3780

### Devon & Cornwall

Computer enthusiasts look no further

**WE STOCK THE FOLLOWING PRODUCTS:**

APPLE II PLUS 48K . . . . .	£807
ADLER ALPHATRONIC System from . . . . .	£1,825
VIDEO GENIE . . . . .	£325
COMMODORE VIC . . . . .	£165
EPSON MX80 F/T . . . . .	£399
Plus extra for I/F to Pet, TRS80, etc.	
MICRO LINE 80 . . . . .	£350
OLYMPIA SCRIPTA	
DAISYWHEEL quality printers from . . . . .	£838
TANTEL PRESTEL ADAPTER . . . . .	£170

. . . AND LOTS MORE . . .

*Above price plus VAT*

Paper, Disco, Books, Games and the largest range  
of APPLE BUSINESS SOFTWARE in the South West

**Plymouth Shop Now Open at:**

DEPTFORD PLACE,  
NORTH HILL, PLYMOUTH  
TEL: 267000



## MAIN SHARP AGENTS BUSINESS & LEISURE



SHARP 3201

COMPLETE SYSTEM  
64K D/Disk & Printer  
**Free Training**  
£2995.00 + VAT



**MZ 80K**  
**48K**  
£389.00 + VAT

### MZ80B 64K D/Disk Drive Printer and Free Programmes & Free Offer

Any Machine delivered by Securicar to your door.  
We serve Sussex and carry disks, ribbon, paper,  
fire proof diskette cabinets, binders, printer  
tables and stations all ex stock.

COME TO SEE THEM AT OUR  
2000 SQ.FT. SHOWROOM

**CROWN BUSINESS CENTRE LTD**  
56-58 South Street  
Eastbourne 639983/20496

1

# THIS IS PERSONAL

Personal Service  
Personal Software  
Personal Computer  
Personal Maintenance (nationwide)

Micro computers, word processors  
and software from

st choice

micro  
BITS

Microbits, Barford House, Shute End, Wokingham, Berkshire, 0734 792021



## THE ZX81 POCKET BOOK

Also suitable for  
ZX80 with 8K ROM

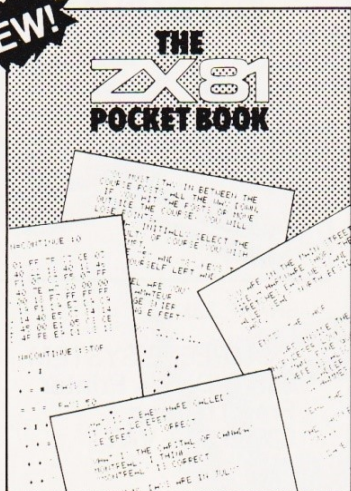
**NEW!**

- ★ ADVENTURE
  - City of Alzan
  - Create your own!
- ★ TUNNELS & TROLLS
- ★ BUCKET CATCHING
- ★ JAWS
- ★ BECOME AN ARTIST
- ★ PRO-AM GOLF
- ★ PUTTER
- ★ ETCH-A-SKETCH
- ★ FRUIT MACHINE
- with hold
- ★ DIGITAL CLOCK
- ★ DICE ROLLING
- plus 20 others

★ require 16K RAM

**PLUS**

Hints & tips on  
programming  
Reference Sections

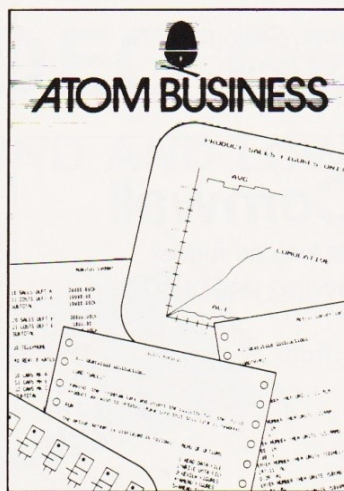


136 Page Book **£5.95**

Cassette  
& Book **£10.00**

The ZX80 Pocket Book still  
available, prices as above.

## ATOM BUSINESS



110 Page Book **£6.95**

Cassette  
& Book **£15.57**

Suitable for the expanded  
Atom with Floating Point ROM

- SALES GRAPH
- SALES RECORDS
- NOMINAL LEDGER
- QUEUEING
- SIMULATION
- EXPENSE CLAIMS

Each section contains:

- Management Summary
- Operating Instructions
- Program notes
- Source listing

ADDLIST

LABEL PRODUCTION

LEASE OR BUY DCF

METRIC CONVERSION

STANDARD  
DEVIATION

BUDGET FACTORING

**PHIPPS ASSOCIATES** 3, DOWNS AVENUE, EPSOM, SURREY, ENGLAND KT18 5HQ.

Telephone: Epsom (03727) 21215 quoting your credit card reference. 24 Hour phone  
service. For Air Mail delivery in Europe add 50p, for air mail elsewhere add £1.50  
per book. Prices shown above include UK postage and VAT on cassettes.



## 15 good reasons for visiting Cambridge

- |                                   |                           |
|-----------------------------------|---------------------------|
| 1. Hewlett-Packard HP-85 & HP-125 | 8. Acorn Atom             |
| 2. Apple II & III                 | 9. Commodore VIC-20       |
| 3. TRS-80 Model I II & III        | 10. Sharp pocket computer |
| 4. Communicator                   | 11. UK101 kit computer    |
| 5. Osborne 1                      | 12. Plotters/digitisers   |
| 6. WordStar/DataStar              | 13. Electronic components |
| 7. Daisy-wheel printers           | 14. Computer books        |

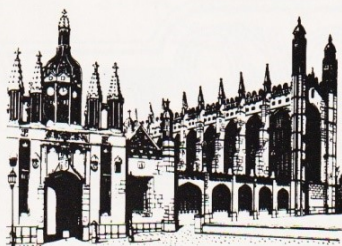
With a uniquely comprehensive selection like this – all  
generally on demonstration and available from stock with  
full support by our team of computer professionals –  
you'll have the ideal chance of finding precisely the right  
system for your application.

Looking for a microcomputer? – then visit us at:

### Cambridge Computer Store

1 Emmanuel Street Cambridge CB1 1NE  
Telephone: (0223) 65334

Mon.-Fri. 9.00 to 12.30, 1.15 to 5.30 Sat. 9.00 to 5.30





## Once again the Editor comes dashing to the assistance of readers with a technical problem.

There's nothing quite like starting off a column like this in a grovelling fashion. It seems that the answer I gave to Mr Deakin's enquiry about the Video Genie is not strictly correct. The Genie normally comes with some 16K of user RAM and this is expandable to 48K by fitting an extra unit on to the system. However, at least one firm, Q Tek to be precise, offer the option of having the Genie with 32K of RAM fitted inside the main unit. I also believe that this expansion capability may be offered as a do-it-yourself option, whether by Q Tek or someone else I'm not yet sure. My apologies Mr Deakin and anyone else who may have been misled. My thanks to Paul Moore of Birmingham for pointing this out.

### The Viewdata Option

An increasingly popular interest among the micro fraternity is connecting Viewdata to one's computer. The letter I received from Mr G Hewson of Ickenham is fairly typical.

*My interest in micros was sparked by a search for a Viewdata and/or Teletext adaptor. My imagination started working overtime when I came across the Tanel Viewdata adaptor, which can be connected to a micro; this obviously opens up all sorts of interesting possibilities. The interface for the Tanel is CUTS — what is this and how common is it?*

*What I am looking for is a highly flexible micro system. This would be rack based, into which I could plug various cards. Is there such a system on the market?*

In a word, yes. The Tanel unit you mention is being offered with a number of interface options; these include ones for their own computer, Apple, NASCOM etc. The CUTS interface is as near to a 'standard' as one is likely to get for computer tapes. It actually stands for Computer Users Tape Standard and defines the two frequencies used; one to indicate the 'ls' and the other the 'Os'.

Apart from the unit you mention there are adaptors available for the Acorn ATOM, the Apple and one from High Tech for the S100 bus.

Waiting in the wings, as it were, is the BBC Computer which will definitely have a Teletext adaptor available and, almost certainly, a Viewdata unit too.

One other thing is fairly certain, the advance of the Telesoftware project and the increase in awareness of the capabilities of Viewdata, mean that the number of options available is going to go up!

### The ASCII Solution

The problems of using odd keys to control one's software seems to arise occasionally and, as you might have guessed, Mr W E F Green of Biggin Hill has a query along these lines.

*I have a UK101 and I wish to control the course of a program by using the Control key together with the 'R' or 'T' key.*

*I'm not quite sure how to do this and any help you can give would be appreciated.*

The key, if you'll excuse the pun, to this is to make use of the ASCII codes generated. Given that the UK101 obeys the rules (I'm afraid I haven't got one in the office to try this on), pressing the control key should alter the ASCII code generated by the other key you've pressed.

For example, the ASCII code generated by the 'R' key should be 82 (decimal), the bit pattern for this is 1010010. If you press Control at the same time it strips off the top bit turning the code to 0010010 or 18 decimal. To detect this you will need a piece of BASIC somewhat similar to this:

```
200 INPUT A$
210 IF ASC(A$) = 18 THEN 300
220 IF ASC(A$) = 20 THEN 400
230 GOTO 200
300 PRINT "I JUST FOUND CONTROL R"
310 GOTO 200
400 PRINT "I JUST FOUND CONTROL T"
410 GOTO 200
```

Now, I make absolutely no claims for the elegance of the above but it should give you some idea of what will be required. A note of warning though; you can only apply this rule to the ASCII codes from 64 (@) to 95 (\_\_) without fear of problems arising.

Furthermore, a little thought will soon reveal that Control and 'M' will produce the same code as pressing Return!

### More Code Confusion

The letter from Mr Green sparked off a dormant memory of the last PCW Show. Whilst attending to the needs of the public, ie selling magazines, one of our readers asked me to explain what the first 32 ASCII codes did. Not being instantly able to recall them all I promised to put him out of his misery and publish the complete list. And, here they are.

Code	Dec	Hex	Function
NUL	0	0	Null
SOH	1	1	Start of header
STX	2	2	Start of text
ETX	3	3	End of text
EOT	4	4	End of transmission
ENQ	5	5	Enquiry
ACK	6	6	Acknowledge
BEL	7	7	Bell (Audible signal)
BS	8	8	Backspace
HT	9	9	Horizontal TAB
LF	10	A	Line feed
VT	11	B	Vertical TAB
FF	12	C	Form feed
CR	13	D	Carriage return
SO	14	E	Shift out
SI	15	F	Shift in
DLE	16	10	Data link escape
DC1	17	11	Device control 1
DC2	18	12	Device control 2
DC3	19	13	Device control 3
DC4	20	14	Device control 4
NAK	21	15	Negative acknowledge
SYN	22	16	Synchronous idle
ETB	23	17	End of transmission block
CAN	24	18	Cancel
EM	25	19	End of medium
SUB	26	1A	Substitute
ESC	27	1B	Escape
FS	28	1C	File separator
GS	29	1D	Group separator
RS	30	1E	Record separator
US	31	1F	Unit separator

Of these the only ones used in general programming are LF, CR, FF and ESC. Sometimes systems will implement the BEL and ESC and others use the DC set to control peripherals. The only devices which will use all the control codes are telecommunications peripherals because this is what they were originally designed for! Please note that the codes can also be generated by using the Control key with the ASCII codes from 40 Hex to 5F Hex as explained above.



**PROGRAM  
POWER**

# NASCOM 1 & 2

## NASPRINT 80

2K extension to NASPEN. New functions incl. Pagination, page no. & title output, title centering & text re-formatting with embedded control codes-change line length, spacing & margins; centre line between margins; - new page; output printer control codes. Contains parallel printer routine for MX80. Use with serial or other parallel catered for. Special routines facilitate operation with ZEAP, NAS-DIS, DEBUG, NAS-SYS & ROM BASIC. In Eproms £14.95

## AY-3-8910 SOUND CHIP

**INVASION EARTH** with INCREDIBLE SOUND EFFECTS(MC/G) £10.95

**SOUND CHIP** — Program up to 3 independent channels with music & sound effects! Data sheet incl. £6.45

**SOUND CHIP INTERFACE BOARD** — Designed to interface between the PIO & the chip. Ready built — plugs straight onto PIO. Nascom 1 connectors available. Sound generation illustrated in MC. & Basic. (chip not incl.) £13.50

**DEMO PROGRAM** (MC) 1st mode — direct entry to chip register making experimentation simple. 2nd mode — turns keyboard into 7 octave 'piano', giving state of registers & notes played. £5.95

**DATA MANUAL** (60 pages) No VAT £2.25

## GRAPHIC GOLF (16K/B/G)

18 hole course, driver, 9 irons & putter, variable wind speed & direction, swing control, super graphics. Beat the par 72. £7.95

## THE KEYS OF KRAAL (24K/B/G)

Superb adventure game PLUS exciting graphics. Fight the monsters & demons in real time. Swords flash, arrows fly & spells home-in. Endless hours of enjoyment. Save on tape. £8.95

## "MICRO-POWER" - Magazine

ISSUE 1 AND 2 AVAILABLE.

3/4 AVAILABLE, NOVEMBER AND DECEMBER. ONLY 95p (P/P Inc.).

ORDER NOW TO SECURE YOUR COPY.

"Hands on", Nas-sys 3 — revealed & Interfacing Printers — These series cont. & much more valuable information. Club news — letters — your points of view, questions & answers.

## THE NEW SPACE ERA

**STARSHIP COMMAND** (16K/B/G) — 3D galaxy (9x9x9). 6 levels from Commodore to Space Marshall. Excellent combination of galactic search and M/C code battles. £9.95

**MOON RAIDER** (MC/G) — 'Scramble' type game with superb SOUND EFFECTS through Keyboard Port. Raid enemy dumps, blast asteroids & defending ram-ships. Limited fuel. 4 skill levels. £8.95

**JAILBREAK IN SPACE** (16K/MC/G) — Fast arcade game. Beat off the alien rescue ships attacking your jail. Hold onto your high security prisoners as long as possible. £8.95

**NEW FASE** 16K/MC/G — Action packed invaders prog. 4 different enemy fleets, individual motion, direct & 'truly' angled missiles. £7.95

(State NASCOM).

## BASIC FILE HANDLER (MC) for cassette-based systems.

PAYROLL, SALES & PURCHASE LEDGERS, PRICE LISTS etc. — NOW you can write them! Save complex data files on cassette — any combination of strings, string variables, string arrays, constants, expressions, variables or arrays. Definable block size. At 2400 BAUD using 1K blocks, 1000 numbers can be stored/accessed in less than 1 min. Comprehensive manual & circuit for optional automatic cassette drive control supplied. £17.50

\*\*\* **NASCOM 1** — Cottis Blandford cassette interface for N2 format, reliability & fast load £14.90

— **8K RAM required unless otherwise stated.**

— **Please state if Nascom TAPE Basic required.**

**ALL PROGRAMS SUPPLIED ON CASSETTE IN CUTS/KANSAS CITY FORMAT.**

**BARCLAYCARD**

**VISA**

Please add 55p/order P & P + VAT @ 15%. Large (15½p) Sae for FULL CATALOGUE.

**PROGRAM POWER**  
5, Wensley Road,  
Leeds LS7 2LX.



## ASTROBIRDS (5K\* + 6K graphics)

Incredible GALAXIAN style program with fantastic sound effects! Screaming missiles, swooping bird-men. Undoubtedly the best game on the market. £8.95

## LUNAR LANDER (5K\* + 6K graphics)

Superb high res. version. Long range scan, short range scan. Limited fuel supplies. Land the module with minimum impact. £8.95

## INVADER FORCE (5K\* + 6K graphics)

4 Invader types + mother ship. Great sound effects. High score. 6 skill levels & increasing difficulty. £8.95

## 3D ASTEROIDS (3K\* + 2K graphics)

Steer through the rolling, hurtling asteroids coming out of the black void. Exciting new graphical representation. £6.95

**CHESSE (12K) AT LAST!!** M/C code + mode 3 graphics. Look ahead up to 8 moves. Offensive, Normal & defensive play. 10 sub-levels. Castling. "En Passant" by player. Rejects illegal moves. Take back facility. Action replay with take-over. Set up problem games. **ONLY £9.95**

# ACORN ATOM

**MODE 4 VDU** (3K+6K gr) Mix text with mode 4 graphics. 224 chars. incl. upper & lower case. Modify characters. £8.95

**MICRO-BUDGET** Personal Finance (12K) Review & analyse income & expenses. Ideal for budgets & cash flow. £8.95

## SUPER RACE-TRACK

(12K) Draw your own race-track & race against the clock, steering & accelerator controls. £4.95

**DAMBUSTERS** (3K+2K gr) Realistic bombing raids, bouncing bombs, ack-ack etc. £4.95

## ALIEN MAZE (5K+2K gr)

Escape the 3D labyrinth before the Alien tracks you down. £5.95

## SPACE STORM (4K\*)

Survive amid the raging comets & space debris. £4.95

## MARTIANS (12K+VIA)

Use your force field to stop them landing. Beware the imposters. Needs quick reactions. £7.95

## MAZE-BALL (12K)

Very fast Ball-in-a-maze game with sound effects. Requires fast reactions. Timings & ratings given. £4.95

## DEMON DUNGEON (5K\*)

Adventure game. Find the treasure in the depths of the dungeons. Beware the lurking demons whilst making your escape. £6.95

**EXTRA MEMORY** — Low power chips as recommended by Acorn 2 x 2114L — £3.25

WRITTEN ANY PROGRAMS? — WE PAY 20% ROYALTIES!

\*\*\*SPECIAL OFFER — Deduct £1 per cassette

when ordering 2 or more.\*\*\*

(Re-invaders program with 10K)

Please add 55p/order P & P + VAT @ 15%

Send Sae for FULL CATALOGUE.

## PROGRAM POWER

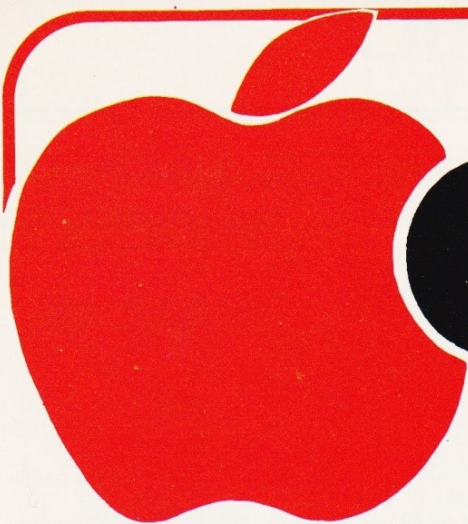


5, Wensley Road,  
Leeds LS7 2LX.  
Tel. (0532) 683186.

**BARCLAYCARD**

**VISA**





# apple



**2 year parts  
and labour  
guarantee on all  
Apple products  
supplied by  
LASKYS**



**The Product:**  
**Apple II**  
**Europlus 48K**

**The Price:**

<b>NETT</b>	<b>VAT</b>	<b>TOTAL</b>
<b>675.00</b>	<b>101.25</b>	<b>776.25</b>

**10 Shops & Mail Order**

**BIRMINGHAM**

19/21 Corporation Street, Birmingham, B2 4LP Tel: 021-632 6303  
Manager: Peter Stallard 300 yards from Bulling Centre

**BRISTOL**

16/20 Penn Street, Bristol, BS1 3AN Tel: 0272 20421  
Between Holiday Inn and C & A

**CHESTER**

The Forum, Northgate Street, Chester, CH1 2BZ Tel: 0244 317667 Manager: Jeremy Ashcroft  
Next to the Town Hall

**EDINBURGH**

4 St James Centre, Edinburgh, EH1 3SR Tel: 031-556 6217 Manager: Colin Draper  
East end of Princes Street, St James Centre

**PRESTON**

1/4 Guildhall Arcade, Preston, PR1 1HR Tel: 0772 59264 Manager: Jim Comisky  
Directly under Guild Hall

**MANCHESTER**

12/14 St Mary's Gate, Market Street, Manchester, M1 1PX Tel: 061-832 6087  
Manager: Lesly Jacobs Corner of Deansgate

**GLASGOW**

22/24 West Nile Street, Glasgow, G7 2PF Tel: 041-226 3349 Manager: David Livingstone  
Between Buchanan Street and Central Station

**SHEFFIELD**

58 Leopold Street, Sheffield, S1 2GZ Tel: 0742 750971 Manager: Justin Rowles  
Top of the Moor, opposite Town Hall

**LIVERPOOL**

33 Dale Street, Liverpool, L2 2HF Tel: 051-236 2828 Manager: Mark Butler  
Between the Town Hall and Magistrates Courts

**LONDON**

42 Tottenham Court Road, London W1 9RD Tel: 01-636 0845 Manager: Vass Demosthenis

**Mail Order**

Microcomputers at Laskys, FREEPOST (No stamp required), Liverpool L2 2AB

**Mail Order**

If you are unable to get to a Laskys shop then you can buy your requirements from our Mail Order  
Department at: **Microcomputers at Laskys, FREEPOST (No stamp required), Liverpool L2 2AB**

**Conditions of Business**

1. Allow one week for personal cheques to clear
2. Add £1 p&p to orders under £10
3. Carriage free on orders over £10 within Mainland UK Overseas add 15%

**Telephone Orders**

Just give your credit card number and requirements on our 24 hour 7 day  
Ansaphone Service 051 236 0707 Mail Order Manageress - Lyn Major

Apple peripherals are also competitively  
priced at Laskys, and carry the same 2 year  
parts and labour guarantee.

Laskys is the largest specialist Hi-Fi chain in Europe. In July 1980 they acquired  
Microdigital - an independent specialist microcomputer store based in Liverpool  
Since then specialist microcomputer departments have been set up within  
selected Laskys stores under the Microdigital name, these have now been renamed  
Microcomputers at Laskys

Please send me: **Mail Order Form**

Qty.		Total
	Apple II Europlus 48K - Total Price 776.25	

MAIL TO: Microcomputers at Laskys, Freeport (No stamp required), Liverpool L2 2AB  
Delivery free within mainland U.K.

Name \_\_\_\_\_

Address \_\_\_\_\_

Post Code \_\_\_\_\_

Tel (day) \_\_\_\_\_

Access: 5224

Barclaycard: 4929

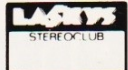
American Express/Diners Club/Stereo Club No \_\_\_\_\_

Expiry date: \_\_\_\_\_

24 Hr Telephone Credit Card Orders 051-236 0707

CT/1/81

Official orders welcome with normal 30 days credit extended to bona fide commercial  
and government organisations.



**MICROCOMPUTERS**  
**AT**  
**LASKYS**

Laskys, the retail division of the Ladbroke Group of Companies



# UK101 — OHIO

## TOOLKIT 2 for UK101/OHIO

The most powerful TOOLKIT on the market, TOOLKIT 2 gives you all the following facilities in only ONE EPROM.

REPL exceptionally powerful Global Search and Replace of BASIC listings

DUPL copy a line into a new line

LIST/ controlled listing of program

FIND anything in a BASIC listing

RENUM renumber from any start in any increment — full error messages, totally reliable and very fast

AUTO generate new line numbers automatically, any start, any increment

DELETE high-speed block line delete

VIEW examine cassette contents without loading to memory

TRACE superb trace feature — screen transparent. Can be turned on and off within a program

MC enter the monitor quickly!

TOOLKIT 2 also lists the relevant line of BASIC where any error occurs and cures the warm starts 'OM ERROR' bug. Requires no user RAM.

Available in EPROM only (8000hex), for CEGMON, MON01 & 2, and SYMNON monitors (DISK soon). Price £19.95. State machine and monitor when ordering.

## BASIC 4 cassette file handling system

This new EPROM for the UK101/OHIO provides a comprehensive file-handling system, capable of working at up to 4800 baud.

- ★ Named programs to cassette
- ★ Verify tape contents facility
- ★ Reliable high speed save/load
- ★ Selectable auto-run of loaded BASIC program
- ★ Crash recovery command (OLD)
- ★ Original SAVE/LOAD commands unaltered
- ★ Reduces LOAD/SAVE times
- ★ Seven new SAVE/LOAD commands
- ★ Non-destructive memory test
- ★ Initialises BASIC 5 automatically if resident

BASIC 4 is a plug-in replacement for your existing BASIC 4 ROM. PRICE £11.95

## INVADERS

Quite simply the best machine code game ever written for the UK101/OHIO. PREMIER have succeeded where others have failed. Our INVADERS has all the features you expect, plus superb graphics and two-player option. A firm favourite with all our customers. NOW AVAILABLE for CIE/CIU in addition to UK101. PRICE £7.95

Also now available for 32 x 48 CEGMON based UK101 BASIC 1 or 5 machines is KAMIKAZE INVADERS — a new slant on this popular game. £5.95.

## TES II HARDWARE RANGE

PRODUCT	KIT	BUILT
8K RAM BOARD	£29.95	£39.95
8K EPROM BOARD	£29.95	£39.95
8 Slot MOTHERBOARD + PSU	£29.95	£39.95
JI BUFFER BOARD	£19.95	£29.95
MINI EPROM/ROM BOARD	£14.95	£20.95
SCREEN ENHANCEMENT KIT	£55.95	£66.95

## SPECIAL OFFERS

TOOLKIT 2 + MINI EPROM BOARD	£29.95
BASIC 5 + MINI EPROM BOARD	£29.95
CODEKIT + MINI EPROM BOARD	£29.95
SOUND/VIA — Base, Sound and 2 x VIA kits	£54.95

## BASIC 5 for UK101 and OHIO

The most devastating enhancement yet, adding 17 new BASIC words to your interpreter which can be used in program lines and give machine-code response speed to graphics and formatting.

HLIN, VLIN, SCR, BLK, SET and TEST allow generation and manipulation of graphics at speeds which are unobtainable in BASIC. PRINTUSING, PRINTAT, INAT allow total control of screen input/output.

GET (key), RD (Read DATA), GS and GT (GOSUB and GOTO a variable), GO and GO\$ (GOTO a machine code routine), allow total program flexibility.

WI and CWI allow CEGMON users to manipulate their screen under variable control, using one command, in Hex or Decimal.

BASIC 5 is available for CEGMON and MON02 only. State precisely your computer and monitor when ordering. Comes complete with comprehensive manual. Available on DISK or in EPROM (9000 hex) £19.95.

## SCOPYM a single disk copier

SCOPYM provides a fast, foolproof method of creating a new, useable disk from a Master. It will copy the first fourteen tracks of a disk in around 1.25 minutes. All copying is automatic; SCOPYM provides a safe, simple and extremely fast and efficient way of creating a new disk. It is supplied complete with comprehensive notes. For 5.25" OS65D users only. £9.95.

## SOUND/V.I.A. BOARD

The TES II VIA/SOUND kit gives you up to 56 Input/Output lines and programmable sound generation. In order to allow you total flexibility in designing your system, we are offering the kit in low-cost packs.

The Base Kit consists of PCB, connector, address decoding and buffering, plus IC sockets.

The Sound Pack consists of AY-3-8910 sound chip, amplifier and components.

The VIA Pack consists of VIA and support. BASE KIT £24.95  
SOUND £11.95 VIA £9.95 Available Dec.

## COMPACT

This useful machine code program provides UK101/OHIO users with a utility that they have been waiting for — a BASIC line compactor.

COMPACT looks at the resident BASIC program and adds lines together wherever possible, thus aiding running speed and saving memory space. It is an extremely reliable way of compacting your program. COMPACT lives at the top end of your memory and will run with any monitor — please state memory size when ordering. Price £7.95.

## NEW PREMIER SOFTWARE

Cartoon Caperbility — Golf — Martian Rescue — Sheep Pen — Adventure Plus (16K) — LINK65 — Fincal — Computer Conversions — UFO — Microbound — Modern Basilisk — Supermind — Patience — Word Square — and many more...



# Premier Publications

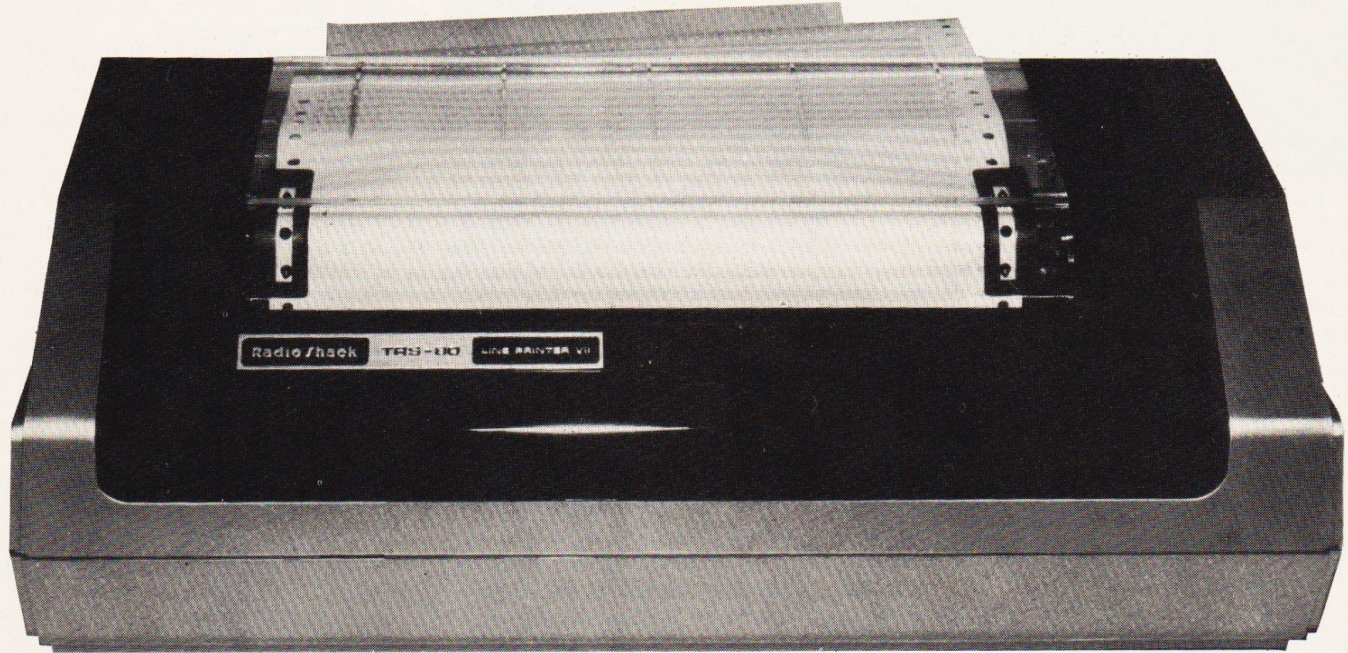
12 Kingscote Road Addiscombe Croydon Surrey Telephone 01-656 6156





# SPECIAL REPORT

**We take a look at two new dedicated peripherals; the uni-hammer printer from Tandy and Sinclair's ZX Printer.**



**T**he new printer from Tandy, called the 'Personal Line Printer', has already awakened quite a bit of interest in the market. At £199 (or £173 + VAT, as most advertisers would say), excluding connecting cables, it is currently the cheapest plain paper printer available in this country. Only its bloodbrother, the Seikosha, comes near it in price. At the time of writing, the latter is about 15% more expensive in its standard version. However, with the pound falling at present, there may well be price rises in the offing on a lot of imported microcomputer equipment.

## The Hardware

The new Tandy printer is an 80 column, unihammer, plain paper printer, with double width character and graphics capabilities. It uses tractor feed for standard (9.5") width paper, and is claimed to handle up to three-part carbonless stationery. There is no provision for friction feed paper rolls or for single sheets. It is also not suitable for adhesive labels, so you couldn't use it to handle a mailing list, for instance. It does, however, have both Centronics parallel and RS-232 serial inputs as standard.

It will be no surprise to learn that the new Tandy printer appears to come from the same stables as the Seikosha. The method of operation (a single hammer) is the same, and the mechanism looks identical.

However, there are one or two differences between them, the Tandy is not simply a repackaged Seikosha. Some of these differences are relatively minor. For example, the Tandy takes paper up to the more usual (for microcomputers) width of 9.5", whilst the Seikosha stops at A4, or 8.5" wide. The basic character sets are identical, except that the Seikosha prints 12 characters per inch compared to the Tandy's 10, in order to fit the 80 columns on to its slightly narrower paper. Also, both have double width character and graphics facilities but the Seikosha has an additional 32 'European' characters as well as the normal ASCII set of 96. The extra 32 include such things as a pound sign, letters with accents, a sprinkling of Greek letters and a few symbols. The Tandy doesn't even have a pound sign! The chief difference, which will make the Tandy appeal to a wider range of microcomputer owners, is the serial input. This is designed for use with the Tandy 'Colour Computer', which is to be launched in Britain in November 1981. A serial input facility is an optional extra for the Seikosha, and costs an extra £56 (inc. VAT) at current prices. The Tandy machine is somewhat larger and heavier than the Seikosha but both are fairly slow and noisy in operation.

## Making The Connection

If you have a serial printer output the connection to the printer is

via a four-pin DIN socket rather than the standard 25-pin D style connector, and you will probably need a special cable. However, only three wires are required, and this form of connection will only cost you a few pounds (and five minutes with a soldering iron), compared with £30 for a parallel cable to the Tandy expansion interface. The serial input is to RS-232 standard, operating at 600 baud and seven- or eight-bit word length, eight bits being required for graphics. There is no parity check. The parallel socket does have a self-test pin, but no test switch is provided and there is no 'out of paper' detector.

If you don't have an expansion interface for your Tandy, you can still use the printer by means of a special cable — a similar cable being available for the 'Video Genie'. However, you could put the £40 this would cost towards an RS-232 interface such as the PCR-81 (from '3-Line Computing' in Hull, at about £50), which can be plugged straight into the keyboard and used to drive the printer. You would then have the capability to connect (via an acoustic coupler, or a modem and the telephone) to other computers and networks such as 'Forum 80'. I was unable, however, to make the serial input operate properly in the time available because (I think) of deficiencies in the software I was using.

The 'Line Printer VII' comes well packed, and with reasonable



documentation. It is attractive in appearance, and seems fairly robust and well made. Virtually, the whole of the top of the machine forms a cover which should provide good protection from dust, no other protection being required.

Setting up the printer is straightforward. The edge connector on the cable supplied with the review machine was fitted upside down, but I was warned that this might be the case. Plugging it in the wrong way round would not be likely to cause any damage. The printer ribbon is packed separately and was easily installed without even getting my hands dirty! Having fitted a mains plug and connected the printer to the computer, all that was required was some paper, which is fairly easy to load, and the printer was ready for use.

### Printing It Out

The appearance of the output is reasonable but not of the standard of more expensive dot matrix printers, it lacks descenders (surely we could have at least a token effort at including these in this day and age!) and there is a tendency for output to be slightly blurred. This is because of the way that the dots are formed — which is unusual, so I'll describe it in some detail:-

The hammer, which strikes the paper through the ribbon, is a narrow bar seven dots high and not quite vertical. Behind the paper is a rotating roller, called the platten, which has a series of longitudinal ridges running the entire width of the page. Where the hammer and a ridge meet, a point is formed and a dot appears on the paper. After printing the topmost dot of the column, the hammer retracts and strikes the paper again a fraction of a second later, by which time the ridge on the platten has moved to the next dot position in the column. In this way a series of up to seven dots are printed at each of the five column positions for the character. The hammer is at a slight angle to the vertical and throughout this process it is continuously moving along the line, so that as the lowest dot is printed at the current column position, the top of the hammer is in the right position for the topmost of the next column of dots (see Fig. 1). The forming of dots by means of two narrow bars set at right angles, one on each side of the paper, is responsible for the fact that the dots are less well defined than those produced by the individual needles of more ex-

pensive dot matrix machines. No indication of anticipated head life is given anywhere in the literature.

The main disadvantage of this printer, apart from the typeface, is its speed: at 30 characters per second, it takes two or three minutes to fill a page, despite the fact that the print head doesn't travel all the way to the right hand side of a page after a line feed, as happens with some printers. As a result, it took me 11 minutes to produce five pages of disassembly of a machine code program! The noise level is also quite high, so you couldn't use it in the same room as someone wishing to listen to the radio or watch television. The fact that the ribbon is held close to the paper occasionally caused it to leave marks, especially where there was a slight ripple. This may be due in part to the new ribbon being full of ink and the effect may wear off as the ribbon gets older.

The printer has only two controls; namely a manual paper advance and an input selector switch. The latter has three positions: parallel; seven-bit serial; and eight-bit serial. It will accept a number of software format controls such as Carriage Return with or without Line Feed and Tab (by character or dot position), it will not, however, accept Form Feed. Double width character and graphics modes are also controlled by software. In the graphics mode the number of lines per inch increases from six to nine, to eliminate gaps between the lines in order to give continuous coverage of the paper. The graphics mode is somewhat cumbersome to use as each dot is controlled individually by regarding the column dot positions as binary numbers, the most significant bit indicating graphics mode, and the other seven representing the seven dots. Consequently, if you wish to produce a

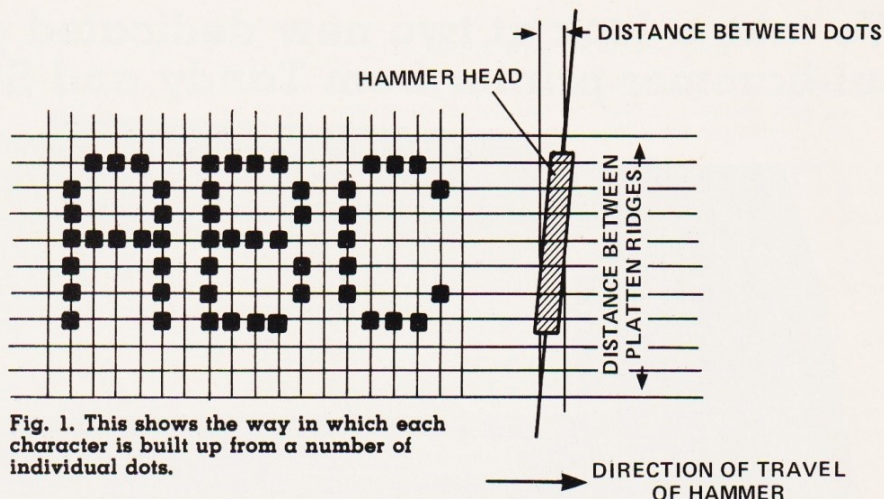


Fig. 1. This shows the way in which each character is built up from a number of individual dots.

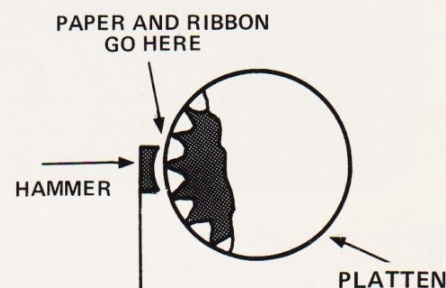


Fig. 2. The hammer strikes through the paper and ribbon and the point is formed by the hammer head hitting one of the ridges on the platten.

graph or a picture, you have to sit down and work out which dots you need to print, and convert the result to decimal (or Hex if you're using machine code), to send to the printer. This could be somewhat laborious, as each line contains 480 x 7 (ie 3360) dots! However, I don't doubt that someone will soon produce the software to facilitate the simple exploitation of the graphics capabilities. Indeed, one advantage of the massive user base of the TRS-80 is that, no matter what you want to do, someone has probably already done it and will sell you the necessary software. This is the case particularly in the US where there are several magazines, some averaging over 300 pages a month, devoted entirely to the TRS-80.

### Conclusion

Apart from the drawbacks of speed and noise, the Tandy Personal Line Printer represents good value for money. If you are looking for cheap hard copy, and can live with the output, then this printer should feature high on your shortlist. Tandy seem, in this instance, to have got the price right and to have produced the right product at the right time.



**T**he ZX Printer has been around now for a few weeks and has been seen at exhibitions and demonstrations on numerous occasions. It is still a pleasant surprise to handle and to use, as it is very compact and has that weighty feeling normally associated with functional and robust equipment. It comes complete with the uprated power supply (1.2 Amp) necessary for use with the ZX81 (or a ZX80 with the replacement ROM) and one roll of printing paper. The ZX Printer uses its own special metallised paper as supplied by Sinclair Research and this costs £11.95 for five rolls. Each roll is 65 ft long, and should enable you to print about 6500 lines of print or about 260 screenfuls of information! Other metallised paper may well work — if you can find a roll which will fit; but not surprisingly Sinclair suggest that their paper will give superior results. The ZX Printer and 1.2 Amp power supply arrive well packaged in expanded polystyrene to enable the Post Office to play rugby with it and yet still arrive on your doorstep in perfect condition.

## Putting It To Use

The ZX Printer is extremely simple and quick to put into operation. It takes longer to put a mains plug on the power supply lead than it takes to plug in the printer and learn the use of the one control available — the paper feed. The plug on the printer lead has an integral socket to accept the add-on 16K RAM pack. The 17-page instruction book gives a clear description of how to load a fresh roll of paper, use of the feed



The connection between the printer and the ZX81 allows the RAM Pack to be attached at the same time, as seen in the picture at the foot of this page.

button, tear the paper neatly off the roll (!), clean the printer and, of course, the general principle of operation. There is also a selection of programs aimed at giving you the pleasure of seeing your new acquisition work, while at the same time showing the use of those BASIC statements associated with the ZX Printer. Strange as it may seem, these BASIC statements are neither explained nor described in the text; instead we are directed to read chapter 20 of the ZX81 instruction book.

It would amuse me to report that the ZX81 instruction book then referred you to the ZX Printer instructions, it does tell you that the printer will have instructions with it, but nonetheless continues with a short chapter to quite clearly explain the function of the three relevant BASIC statements. These are LLIST, LPRINT and COPY. The first two are just like LIST and PRINT except that they direct the display to the printer instead of to the television screen or monitor. The third statement, COPY, enables you to print out a copy of whatever is displayed on the screen at the time.

## General Theory Of Operation

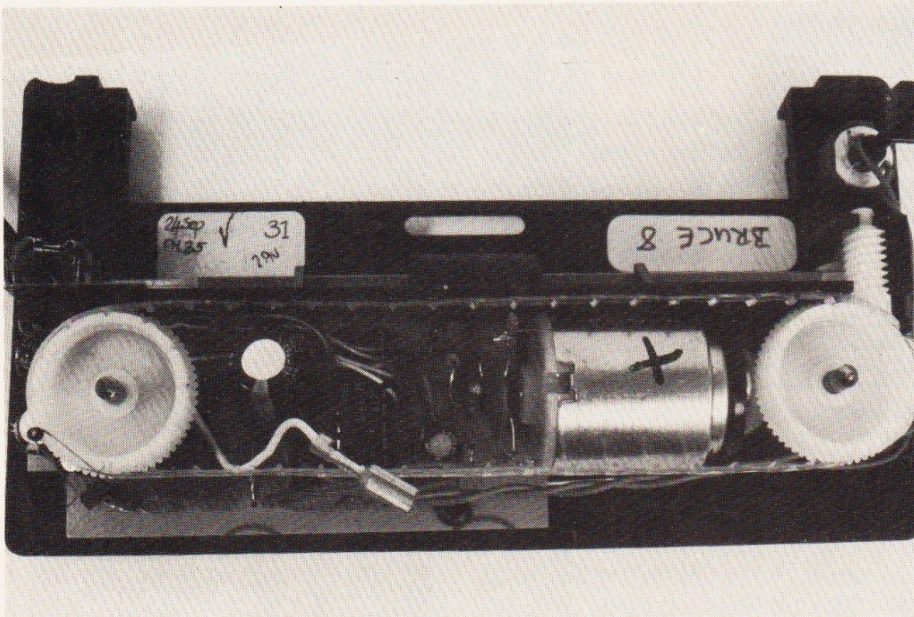
Normally when reviewing equipment or books it is not the 'done thing' to quote more than a sentence or two from any supplied text but in this instance the ZX Printer instruction book gives us a very simple and concise description of the basic workings of the printer.

'the printer functions in rather the same way as a TV picture, ie by scanning from left to right. A conductive stylus is pulled across the paper at high speed, and where a black dot is wanted a pulse of current is passed through the stylus. This evaporates the aluminium coating on the paper, and allows the black backing to show through. To avoid the need to return the stylus quickly to the left-hand edge of the paper, there are in fact two styli, mounted on a moving belt, which follow each other in quick succession. The belt and the paper feed roller are both driven continuously whilst printing; so that when the next stylus comes round, the paper has been moved up ready for the next line.'





# SPECIAL REPORT



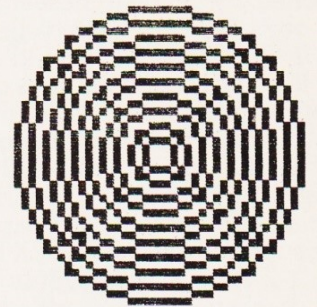
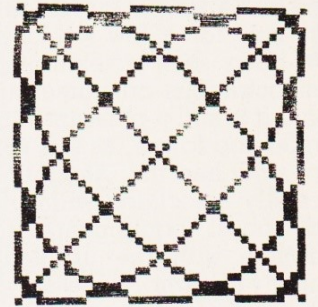
The internal workings of the printer. The belt carrying the two styli runs between the two white pulleys. Some examples of the printout are shown on the left.

Having only three major print statements to consider, the ZX Printer is very easy to use. Formatting the display to the printer can be carried out using the TAB and AT (@) statements, albeit when using the AT statement line commands are ignored and only column commands in the range  $\pm 21$  actioned. Although unlikely to cause much confusion, it must be remembered that the output from LPRINT is not printed immediately but stored in a buffer one line long. The computer will only print:

- 1) when the buffer is full
- 2) after an LPRINT statement that does not end in a comma or semicolon
- 3) when a comma or TAB item requires a new line
- 4) at the end of a program if there is anything left unprinted.

## In Conclusion

The printout presented by the ZX Printer was clear and readable with no disturbing fuzziness which occasionally has been seen with other systems. Graphic symbols can 'join up' from line to line giving a clear continuous picture. Keeping the printer clean is probably very important and although the review model has been tested to some extent, long term reliability can only be commented upon at a later date. As with the ZX81 and the ZX80 before it, the ZX Printer offers something that, for the initial outlay, is quite remarkable and can only add to the effectiveness of your ZX system.



ZX80  
ZX81

WHAT  
NEXT

ZX81 ZX81 ZX81 ZX81

```

1000 CLS
1010 PRINT "AND FINALLY, THE PRI
1020 CAN BE USED TO PRINT TEXT"
1030 FOR N=1 TO 100
1040 NEXT N
1050 LPRINT "ZX81 ZX81 ZX81 ZX81"
1060
1070 LPRINT
1080 LPRINT
1090 FOR N=0 TO 50
1100 NEXT N
1110 PRINT ", AND LIST PROGRAMS"
1120 FOR N=0 TO 40
1130 NEXT N
1140 LIST 5530
1150 LPRINT
1160 LPRINT
1170 LPRINT
1180 LPRINT
1190 LPRINT "FOR ANOTHER CYCLE"
1200 GOTO 1142
    
```



# THE SHARP MZ-80K HAS GOT IT ALL



**STOP PRESS... NOW AVAILABLE**  
**BASIC COMPILER**  
**PASCAL (CASSETTE BASED)**  
**DOUBLE PRECISION DISC BASIC**

Since its introduction the Sharp MZ-80K has proved to be one of the most successful and versatile microcomputer systems around. Sharp now have a comprehensive range of products ready to make the powerful MZ-80K with its Printer and Disc Drives even more adaptable.

Products include: - Universal Interface Card, Machine Language and Z-80 Assembler packages, CP/M\* plus a comprehensive range of software.

\*Trade mark of Digital Research Ltd.

You'll find all the help and advice you need about the MZ-80K at your Specialist Sharp Dealer in the list below.

If there is no dealer in your area, or if you require any further information write to:- Computer Division, Sharp Electronics (UK) Ltd., Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE.

**SHARP**  
*First, and foremost*

## GET IT ALL HERE ...

**AVON**  
BCG Computer Systems Ltd.,  
Bristol. Tel: 0272 425338  
Decimal Business M/Cs Ltd.,  
Bristol. Tel: 0272 294591  
**BERKSHIRE**  
Computer 100,  
Bray. Tel: 0628 35619  
Newbear Computing Store Ltd.,  
Newbury. Tel: 0635 30505  
**BIRMINGHAM**  
Camden Electronics,  
Small Heath. Tel: 021 773 8240  
Electronic Business Systems Ltd.,  
Birmingham. Tel: 021 384 2513  
Jax Rest Ltd.,  
Birmingham. Tel: 021 328 4555  
Newbear Computing Store Ltd.,  
Birmingham B26.  
Tel: 021 707 7170  
**BUCKINGHAMSHIRE**  
Curry's Microsystems,  
High Wycombe. Tel: 0494 40262  
Interface Components Ltd.,  
Amersham. Tel: 02403 22307  
**CAMBRIDGE**  
The Avery Computing Co Ltd.,  
Bar Hill. Tel: 0954 80991  
**CHESHIRE**  
Bellard Electronics Ltd.,  
Chester. Tel: 0244 380123  
Charlesworth of Crewe Ltd.,  
Crewe. Tel: 0270 56342  
Chandos Products,  
New Mills. Tel: New Mills 44344  
CR Technical Services,  
Chester. Tel: 0244 317549  
Fletcher Worthington Ltd.,  
Hale. Tel: 061 928 8928  
Newbear Computing Store Ltd.,  
Stockport. Tel: 061 491 2290

Ors Group Ltd.,  
Warrington. Tel: 0925 67411  
Sumlock Software,  
Warrington. Tel: 0925 574593  
**CLEVELAND**  
Hunting Computer Services Ltd.,  
Stockton-on-Tees. Tel: 0642 769709  
Intex Datalog Ltd.,  
Stockton-on-Tees. Tel: 0642 781193  
**DEVON**  
Plymouth Computers,  
Plymouth. Tel: 0752 23042  
**DURHAM**  
Neccos (DP) Ltd.,  
Darlington. Tel: 0325 69540  
**ESSEX**  
Prorole Ltd.,  
Westcliff-on-Sea. Tel: 0702 335298  
Wilding Office Equipment,  
Ilford. Tel: 01 514 1525  
**GLOUCESTERSHIRE**  
Gloucestershire Shop  
Equipment Ltd.,  
Gloucester. Tel: 0452 36012  
The Computer Shack,  
Cheltenham. Tel: 0242 584343  
**HAMPSHIRE**  
Advanced Business Concepts,  
New Milton. Tel: 0425 618181  
Xitan Systems Ltd.,  
Southampton. Tel: 0703 38740  
**HEREFORD**  
BMP,  
Little Dewchurch. Tel: 021 643 3832

**HUMBERSIDE**  
Commercial Systems Ltd.,  
Hull. Tel: 0482 20500  
Silicon Chip Centre,  
Grimsby. Tel: 0472 45353  
**KENT**  
Technolink Europa Ltd.,  
Tunbridge Wells. Tel: 0892 32116  
Video Services (Bromley) Ltd.,  
Bromley. Tel: 01 460 8833  
**LANCASHIRE**  
Nelson Computer Services,  
Rawtenstall. Tel: 0706 229125  
Sumita Electronics Ltd.,  
Preston. Tel: 0772 51686  
The Micro Chip Shop,  
Blackpool. Tel: 0253 403122  
**LEICESTERSHIRE**  
Gilbert Computers,  
Lubenham. Tel: 0858 65894  
G.W. Cowling Ltd.,  
Leicester. Tel: 0533 553232  
Leicester Computing Centre,  
Leicester. Tel: 0533 556268  
Mays Hi-Fi,  
Leicester. Tel: 0533 22212  
**LINCOLNSHIRE**  
Howes Elect & Autom. Servs.,  
Lincoln. Tel: 0522 32379  
Z.R. Business Consultants,  
Lincoln. Tel: 0522 31621  
**LONDON**  
Bridgewater Accounting,  
Whitehouse. Tel: 01 446 0320  
Butel-Comco Ltd.,  
Hendon. Tel: 01 202 0262  
Central Calculators Ltd.,  
London EC2. Tel: 01 729 5588  
Deans,  
London W8. Tel: 01 937 7896

Digital Design and Development,  
London W1. Tel: 01 387 7388  
Euro-Calc Ltd.,  
London EC2. Tel: 01 729 4555  
Lion Computing Shops Ltd.,  
London W1. Tel: 01 637 1601  
Scope Ltd.,  
London EC2. Tel: 01 729 3035  
Sumlock Bondain Ltd.,  
London EC1. Tel: 01 253 2447  
**MANCHESTER**  
The Byte Shop,  
Manchester M1. Tel: 061 236 4737  
Sumlock Electronic Services Ltd.,  
Manchester M3. Tel: 061 834 4233  
**MERSEYSIDE**  
Microdigital Ltd.,  
Liverpool. Tel: 051 227 2535  
**NORFOLK**  
Sumlock Bondain (East Anglia)  
Norwich. Tel: 0603 26259  
**NORTHAMPTONSHIRE**  
Computer Supermarket,  
Corby. Tel: 05366 62571  
**NORTHERN IRELAND**  
Bromac (UK),  
Co. Antrim. Tel: 023831 3394  
O & M Systems,  
Belfast. Tel: 0232 49440  
**NOTTINGHAMSHIRE**  
Mansfield Business M/C Ltd.,  
Mansfield. Tel: 0623 26610  
**OXFORDSHIRE**  
Oxford Computer Centre,  
Oxford. Tel: 0865 45172  
**REPUBLIC OF IRELAND**  
O'Connor Computers Ltd.,  
Galway. Tel: 0009 61173  
Sharptext,  
Dublin 2. Tel: 0001 764511  
Tomorrow's World Ltd.,  
Dublin 2. Tel: 0001 776861

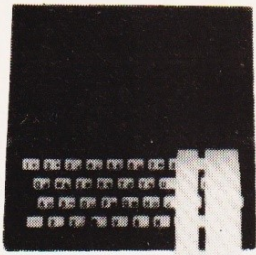
**SALOP**  
Computer Corner,  
Shrewsbury. Tel: 0743 59788  
**SCOTLAND**  
A & G Knight,  
Aberdeen. Tel: 0224 630526  
Business and Electronics M/Cs,  
Edinburgh. Tel: 031 226 5454  
Esco Computing Ltd.,  
Glasgow. Tel: 041 204 1811  
Micro Centre,  
Edinburgh. Tel: 031 556 7354  
Micro Change,  
Glasgow. Tel: 041 554 1462  
Microfith,  
Dunfermline. Tel: 0383 34954  
Moray Instruments Ltd.,  
Elgin. Tel: 0343 3747  
Pointer Business Equipment Ltd.,  
Glasgow. Tel: 041 332 3621  
**SOMERSET**  
Norset Office Supplies Ltd.,  
Cheddar. Tel: 0934 742184  
**STAFFORDSHIRE**  
W.B. Computer Services,  
Cannock. Tel: 0543 75555  
**SUFFOLK**  
C.J.R. Microtek Co. Ltd.,  
Ipswich. Tel: 0473 50152  
**SURREY**  
3D Computers,  
Surrey. Tel: 01 337 4317  
Microlines Ltd.,  
Kingston. Tel: 01 546 9944  
Petalect,  
Woking. Tel: 04862 69032  
R.M.B. Ltd.,  
Croydon. Tel: 01 684 1134  
Saradan Electronic Services,  
Wallington. Tel: 01 669 9483

**SUSSEX**  
Crown Business Centre,  
Eastbourne. Tel: 0323 639983  
**Gamer**  
Brighton. Tel: 0273 698424  
**M & H Office Equipment**  
Brighton. Tel: 0273 697231  
**WALES**  
Limrose Electronics Ltd.,  
Wrexham. Tel: 097 883 5555  
Morriston Computer Centre,  
Swansea. Tel: 0792 795817  
Sigma Systems Ltd.,  
Cardiff. Tel: 0222 21515  
**WARWICKSHIRE**  
Business & Leisure  
Microcomputers,  
Kenilworth. Tel: 0926 512127  
**WILTSHIRE**  
Everyman Computers,  
Westbury. Tel: 0373 823764  
**YORKSHIRE**  
Bits & P.C.'s  
Wetherby. Tel: 0937 63744  
Datron Micro-Centre Ltd.,  
Sheffield. Tel: 0742 585490  
Huddersfield Computer Centre,  
Huddersfield. Tel: 0484 20774  
Omega,  
Leeds. Tel: 0532 704499  
Ram Computer Services Ltd.,  
Bradford. Tel: 0274 391166  
Superior Systems Ltd.,  
Sheffield. Tel: 0742 755005

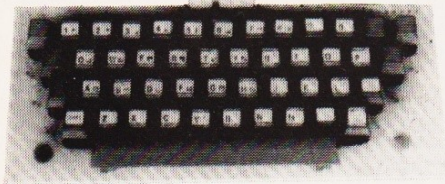
Also at selected Lasky's and Wildings Office Equipment Branches.



# ADD A PROFESSIONAL KEYBOARD TO YOUR ZX 81



- No de-soldering necessary — just plug in.
- Full travel keyboard as used by international computer and terminal manufacturers.



**£28.95**  
including VAT  
post & packing

"All-you-need"  
easy to assemble  
kit comprises:

One piece 47 key keyboard module fitted but not soldered to double-sided printed circuit board; connectors; simple plug-in flexible cables; screws, mounting feet and legends. Two-part keycaps with buttons pre-assembled on keyboard and clear protective clip-on caps for fitting after legends have been positioned. Comprehensive assembly instructions supplied with each kit. Allow 28 days for delivery.

Please send ..... keyboard kit(s) @ £28.95 each, cheque or postal order made payable to: YC Nov.



**COMPUTER KEYBOARDS (dept. )**  
Glendale Park, Fernbank Road, Ascot, Berkshire.

Please ensure your name and address are clearly stated

## SHARP

## MZ80K

Personal Computer

### LOWEST PRICES IN SOUTH

48K RAM **£345** P&P £10

Details of Peripherals & Accessories on request.  
Also available is the PC1211 Pocket Computer.

PC1211 COMPUTER **£78** P&P £3

CE122 PRINTER **£60** P&P £3

### TO PLACE IMMEDIATE ORDER

01-643 4290



Add V.A.T.  
@ 15%

## Croydon Micro Ltd

202 Stanley Park Road, Carshalton, Surrey SM5 3JP

## TRS80



## SORCERER

### SOFTWARE POTIONS

24 Exciting Programs  
for only £2.10 each

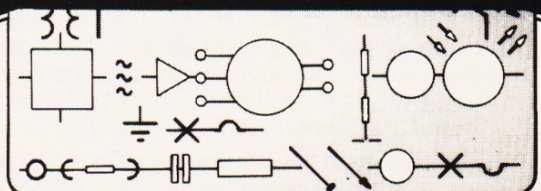
Subscribe now to SOFTWARE POTIONS and you can look forward to receiving a cassette with 4 superb fast action machine code programs every other month for the next year.

Available for TRS80 Models I & III, Level II, 16K RAM min. and SORCERER 8K RAM min. All orders must indicate computer and amount of RAM. Goods are sent by airmail. Payment may be by cheque (Sterling) or Banker's draft (Canadian dollars).

Subscription (6 issues) £49.95 or \$109.95  
Sample issue £10.95 or \$23.95

### SOFTWARE MAGIC

Box 2184, Bramalea Postal Stn., Bramalea,  
ONTARIO, Canada L6T 3S4. Tel: (416) 451 9452.



## DRAWING TEMPLATES...

## MADE FAST TO YOUR OWN DESIGN

*We will meet any individual requirement for drawing templates to the most exacting specification. This invaluable asset to the designer/engineer is prepared with computer controlled precision to provide you with a template that is a cut above the rest.*

*Our technical design team are on hand to advise on all individual requirements. For further information call . . .*

**TONY MILLER on 01-684 6171. NOW!**

## UNO

684 MITCHAM ROAD, CROYDON CR9 3AB. ENGLAND.  
TELEX: 947938





## CROYDON COMPUTER CENTRE

FOR ALL YOUR COMPUTING REQUIREMENTS

We supply everything for the microcomputer user at the most competitive prices.

### Special prices this month on

- ★ **NEW GENIE I** featuring extended basic upper and lower case, sound and machine language monitor for only **£279+VAT**
- ★ **OKI MICROLINES** the top selling printer famous for quietness and reliability OKI80 only **£285+VAT**
- ★ **EPSON** seven different rigged EPSON printers to choose from, ideal companions for your Apple MX80FT only **£395+VAT**

We pride ourselves on speedy delivery of all systems from a single ribbon to a complete superbrain system.

Try us — you will not be disappointed.

Ring or write for FREE CATALOGUE giving details of all our special offers.

**01-689 1280**

**29a BRIGSTOCK ROAD  
THORNTON HEATH CR4 6AF**

PET REPAIRS BASE II SPARES TABS DEALERS BESPOKE PROGRAMS TRS80/GENIE SOFTWARE BOOKS AND MUCH MORE

**UNSURE OF WHAT TO BUY?  
WHY NOT HIRE & TRY?**

## ★ NEW BROOM FOR EPROMS ★ TEX ERASER SWEEPS CLEAN!

*EPROMPT is Prompt Enough!*



Eproms need careful treatment to survive their expected lifetime. Rushing it could burn their brains out. So cop-out of this helter-skelter world; take it easy the TEX way and give your chips a well-earned break. Cool, gentle and affordable; EPROMPT does it properly.

- ★ **16-chip basic economy EPROMPT EB: £32 nett; £39 c.w.o. ★**
- ★ **32-chip interlocked de-luxe EPROMPT GT: £40 nett; £49 c.w.o. ★**



**TEXTIME**  
*is*  
**Tea-Break Time!**

Our EPROMPT needs just half-an-hour to finish its job; this is the proper erase time for all Eproms. While it's busy you may as well take a break yourself, but don't take too long without a timer on the job; over-erasing can shorten data storage time. So our TEXTIME will remember to turn out the light and your chips will forget nothing new.

- ★ **30-minute solid-state TEXTIME M30: £15 nett; £19 c.w.o. ★**
- ★ ★ **Special Offer EB + M30: £45 nett; £55 c.w.o. ★ ★**
- ★ ★ **Special Offer GT + M30: £53 nett; £66 c.w.o. ★ ★**

TEX: Reliable quality at affordable prices. We manufacture in the U.K. and sell direct. All items ex-stock from St. Albans or Watford Electronics. C.W.O. Prices include Carriage & VAT. Write post-free: **BOX 14;**

**TEX MICROSYSTEMS LTD. FREEPOST**  
ST. ALBANS, HERTS. AL1 1BR ST. ALBANS 64077/TRING 4797 ANYTIME

**NOW \* 4 \* Character Sets**  
**512 plain**  
**512 reverse**  
**1024 characters**

**ALL -24- ON  
THE SCREEN  
TOGETHER**

**ALPHA PLUS**  
PET/CBM SET 1 ££  
PET/CBM SET 2 ££  
NEW SCHOOL MATHS SET  
ELECTRONICS & GAMES SET  
OR CUSTOM CHARACTER SETS

**INCA**

INCOMPLETE  
RECORDS  
ACCOUNTS

Written by Chartered Accountants to make the production of final accounts as simple as possible (even farm accounts)

ONLY £425

FULLY TESTED  
AND GUARANTEED

AVON COMPUTER RENTALS

FREEPOST THORNBURY CT  
BRISTOL BS12 1BR  
TEL (0454) 415460



# the software house

1 HORSESHOE YARD  
off BROOK ST  
LONDON W1  
Tel 01-493 3420  
01-493 0566

## VAULTS OF CYMARRON

Ejected from the Pleasure Planet with no Credit you must chance a desperate Mission to an Ancient Precinct in the Northern Extremes of the Planet Cymarron. They contain Treasures beyond your Wildest Dreams. They also contain Monsters from beyond your Nightmares. A GRAPHIC ADVENTURE with Real-Time Animation and sound, 100 Rooms, 15 treasures, 15 objects, many Hazards & Monsters.

TRS-80 & GENIE. Two parts with Manual. 16K CASSETTE or 32K DISK

£20.00

## WIZARDRY

The BEST Dungeons & Dragons Adventure available for the Apple. Written in PASCAL for Speed but RUNS ON ANY APPLE with Dos 3.3. Single or Multi Character Play. Equip and train your party with Magic, Weaponry and Provisions — Then enter into the realms of Wizardry! ALL factors and States of play displayed at all times along with a 3D View of the Dungeon. APPLE 48K DISK

£28.00

## STAR VENTURE

A TOTALLY GRAPHIC Extravaganza of Shelter Exploration and Conflict-Battle your way through Space in this exiting Adventure of Swashbuckling and Discovery. ALL displayed in Real-Time with Incredible Machine-Code Graphics and Sound. No more enigmatic sector scans — Sensors give VISUAL Sighting of Enemy Vessels and Starbases. Arcade style Phasor Battles and Starbase docking. THE ULTIMATE 'TREK'

APPLE 48K DISK

£20.00

## ROBOT ATTACK

You are stranded on a deserted Space Station and pursued by hostile Robots, the walls are electrified. Its the latest SUPER ACTION game from BIG FIVE, a program so good it Speaks for itself! Machine-Code with Sound and VOICE Effects.

TRS-80 & GENIE 16K CASSETTE

£9.00

**BOTH BARRELS:** It's you against the Bad Guys in a Hi-Res Western Shoot-Out!

APPLE 48K DISK

£11.00

**STAR CRUISER:** A tough Galaxian-style game by Nasir for 48K APPLE DISK

£15.00

## APPLE UTILITIES ON DISK

COPY-WRITE: a Bit Copy to backup 70-80% of your most precious disks.	£50.00
LOCKSMITH-4: Improved, with parameter features, slower but much more thorough copies synchronised tracks etc	£69.00
BACK IT UP: Useful Disk backup	£49.95
EXPEDITER II Compiler by On-Line Systems	
Excellent Speed-ups over Basic	£55.00
CCA DATABASE Useful Database manager with built in sort	£45.00
MAGIC WINDOW Word Processor	£55.00

## TRS-80 UTILITIES Disk and Tape

TRAKCESS: The Last word in, allowing TOTAL access to ANY Disk	£18.00
ISAR: Super Disk File creator	£18.00
TASMON: The Best MONITOR for TRS-80, with labelling Disassembler	£18.00
NEWBASIC: A Modular extension to Basic with Graphic commands, Sound, Labelled Subroutines, Call, Do-Until, Quick-keys. Many other facilities	£18.00
LINE DRAW: Machine code line drawing facility, easy to use with Demo	£9.00

## A SELECTION FROM OUR ENORMOUS RANGE OF BOOKS:

PET BASIC	£7.77	TRS 80 BASIC	£5.37
PET GAMES & RECREATIONS	£7.77	MORE TRS BASIC	£5.97
APPLE MACHINE LANGUAGE PROGRAMMING	£9.80	TI 99/4 BASIC	£5.97
THE BASIC WORKBOOK	£4.80	CPM PRIMER	£7.75
PET/CBM PERSONAL COMPUTER GUIDE	£7.90	HOW TO BUY & USE MINI & MICROS	£5.97

In addition to the above we still have our usual range of programs (at the last count over 200 for Apple alone and over 150 for Trs-80 and a growing number of Atari & TI. We also have Books & Mags for Most Micros.

PLEASE ADD 15% VAT TO ALL ORDERS EXCEPT BOOKS

ALSO 80p POSTAGE APPLE OWNERS ORDER OVER £50 and get a FREE COPY of 'BOTH BARRELS' while stocks last.



# THE INFORMATION AGE

Rex Malik

**Following fast on the heels of our articles on Teletext and Viewdata, Rex Malik takes a stroll through the portals of The Year Of Information Technology to show us what's likely to happen in the coming decade.**

**T**hree cheers — or should it be two and a half — for the coming of the information society. Welcome to the all singing, all dancing, real time, fully interactive, brightly coloured, all electronic, home centred information era.

That is how a circus barker would have put it if he had been listening to some of the more interesting gurus and prophets who abound in the fields of technology, computing and telecommunications these days. But it is all hokum, or is it for real? Is there really something new going on out there or is it just another fad like hula hoops, skateboards or Space Invaders?

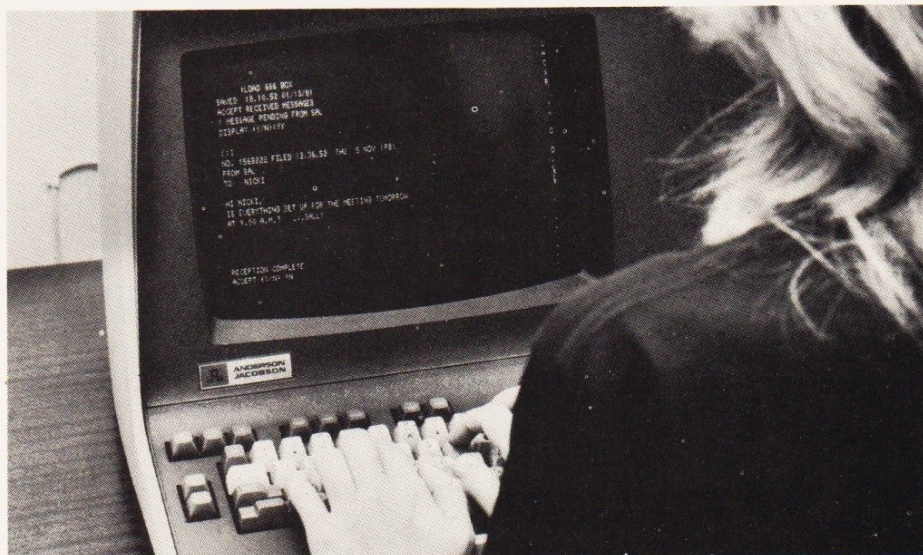
It is for real. All the investment money being poured into it says so. That money comes from Governments and big corporations — it is banking money.

## The Effect On You

But what has all this got to do with the readers of Computing Today? Well by definition you will be a computer buff, indeed a lot of you will be full time 'hackers'. Although you may not agree as you try to patch your BASIC program and 'Syntax Error' comes up for the 23rd time, you are part of the vanguard. The role you play in the coming era is going to be very similar to that played by the wireless buffs in the Twenties and with the same sort of effects as they had on the growth of amateur radio.

My brief, the Editor said, is to discuss (without getting too technical about it) some of the products and systems of the coming era — say over the next 10 years — and to discuss some of the likely changes that could occur and their possible impact on our everyday lives.

I must mention here that changes affecting our everyday lives are the most difficult to predict. The trouble is that there are two different processes at work in this area. One is a set of substitution processes, the other is a set of new processes — by this I mean new human experiences — which could never have been previously experienced no matter how unlimited the resources. Just to cloud the issue further it is often difficult to tell where one process ends and the other begins. Let us first



**IP Sharp's Mailbox service in operation.**

look at a couple of examples of substitution.

## Substitution In Operation

Using Prestel's Viewdata technology at home one can access, say, a British Rail timetable. You have just substituted electronic print for traditional print, assuming of course that you had the printed volume. You have also substituted one electronic means for another. The likelihood was that you didn't have the printed timetable and would have had to rely on a 'phone call instead. That 'phone call would have been limited — I cannot see either you or the enquiry service running through all the possible alternatives!

Prestel, however, gives you the widest set of options and, what's more, is up to date — indeed you would soon stop using it if it wasn't. The simple example of substitution has become rather complicated.

Let us try another example, still using Prestel. Prestel users can now send messages to one another in such a way that when you switch on your receiver the system will alert you to the fact that a message is waiting for you. The system is currently limited for most users; only those with a full alphanumeric keyboard can enter free form messages, the rest of us have to be content with a set of standard formats.

Nevertheless, we can safely say that sometime in the next two years

sets will become available equipped to use the electronic mail facility in its true sense and those sets will have to have an alphanumeric keyboard, thus giving the mass market an electronic mail facility. Whether the mass market takes to it is a function of its cost and the availability of suitable Prestel sets. The majority of television receivers are still supplied by rental companies, over 50% in fact, and these are expected to have a reasonably long life — after all, the rental companies want to recover their costs — so we can hardly expect the change-over to be swift and dramatic.

What is the substitution that takes place here? Well, it is obvious that substitution for the telegram occurs, as well as a substitution for some telephone messages, since we are not dependant on the subscriber we are calling being available — the computer will hold the message for us. The system also substitutes for the Telex service, but at the moment only for the inland service.

The obvious substitution is that of the postal service; why else call it electronic mail? But the system does not substitute for *all* mail, it can only substitute for the letter post. Long items, parcels, papers etc will still have to come through the conventional postal system unless users proceed to buy storage devices and printers — a disc drive in every home?



Come on, the notion is absurd. But, why should it be? Technological change is going to continue and the extra storage needed may well come built into the set itself, as might the printer.

Neither idea is fanciful, there are Viewdata sets already being developed which have built-in printers and if you want one now you can always buy a stand-alone printer from someone like Advanced Consumer Electronics who will willingly supply you with one for about £130.

As for storage, I have seen one company's plans to incorporate a tape deck so that users can pull down information, thus saving themselves the telephone charges if they want to view it more than once.

### The Internal Option

But, why should one assume that tapes and/or other moving magnetic media are the way out? They may represent the economic solution *now* but they could well be superseded for small amounts of storage. There is, after all, some IC based storage already in the Prestel terminal, there could soon be a lot more.

For example, the Japanese implementation of Viewdata is called CAPTAINS. This is slightly different to the Prestel system in that the character generator required to drive the terminal is actually the system's central computer. This is because the Japanese alphabet (if you can call it that), has thousands of characters — many of which are complex ideograms (word pictures). To hold all these in the terminal would require substantial amounts of memory which, when the system was designed, was quite expensive.

But the present method of operation creates some problems, the most important of these being the time delays involved in accessing data. How are they solving it? Well, bit by bit (*Do puns come worse than this? Ed*) storage is being moved into the terminal. Indeed, Hitachi had an experimental terminal on show at the recent Viewdata '81 conference held in London which used local storage. Fujitsu are also developing a system called DAVINS in which the set has all the memory required as well as a lot more local intelligence.

The point is that cheap semiconductor storage is now with us and beginning to move in: I'm not talking in terms of 4K segments, more like 256K and up. So, while the notion of separate moving media devices and printers may seem absurd (apart from anything else

where would you put them in the living room), the notion of a technological offering which fulfills the same function is not.

It will have become apparent that, in considering these two types of use for Prestel/Viewdata, information retrieval and electronic mail, one can agree that substitution does happen but something more is going on.

### An Alternative Approach

This takes me to the second set of processes. I can best illustrate the direction in which I am heading by considering another version of electronic mail which also uses the telecommunications network but does so *internationally* and has been in operation for over 10 years.

Currently connecting more than 300 terminals in 60 offices spread over 20 countries, I P Sharp's MAILBOX service is this network. Their UK Managing Director, Fred Perkins, recently spoke at the Online Business Telecoms Conference and, among other things, said this:

"Electronic mail is a totally new medium of communication, the like of which the world has not seen before. To judge it as an alternative to the telephone or Telex or carrier pigeon is to miss the point".

He then went on to point out that it is true that aspects of electronic mail do offer viable substitutes for conventional methods of communication — the substitution discussed above — but its real strength lies in its ability to provide its users with all the information they need about anything within their sphere of responsibility or operations.

It might be useful to describe the system in slightly more detail. The operation is run by I P Sharp (perhaps better known for their APL software) from a computer centre in Toronto and is accessed through leased lines and a number of packet switched networks — some of them international.

The service offers two types of address — the individual and the group — with the latter being either permanent or transient. This means that the geographical location of any individual, or group member, becomes irrelevant provided he or she has access to a terminal. Furthermore the system uses English language commands, so a knowledge of programming is not required and it can even be linked into the organiser's computer.

It is obvious that MAILBOX is not just an electronic version of the existing mail/message systems. It fulfills these functions but it is also highly interactive. The group broadcast facility referred to earlier is, therefore, more than just a message service; it allows meetings to be called and opinions to be gathered.

So, in this mode, is it an electronic version of a committee meeting? In one sense obviously 'Yes', but in another equally 'No'. 'No' because it is largely time independent. Fred Perkins put it this way "...pseudo meetings are event oriented rather than time oriented". And, because of this, everybody gets a chance to have a say and everybody else has a chance to see it.

What has just been described is something which has substitution effects, but they are not simple. As the above has shown, there is mail, telephone and telex substitution going on here as well as the substitution for face-to-face meetings, whether singular or group, formal or informal. What we are discussing, therefore, is the birth of a new medium. It is true that it has substitution characteristics, all the systems we have touched on have those, even MAILBOX has its roots in trying to do old things in new ways.

### The New Growth

But, they all add something new. Can we isolate what that new thing is? Well, some professionals have had it for years, as in the MAILBOX example, others may have found it in their business systems.

We can call it the capability to interact with a complex information environment in real time, the production of mass market systems which are relatively cheap and user friendly. What these are going to do to society nobody knows, though one can foresee some of the likely effects in a number of areas. Indeed, trying to grapple with the technology and its effects is where I have been spending increasingly more of my research and writing time.

Let me explain why it is so difficult to work out what could happen by looking at a piece of technological history. This gives only a guide to the possible magnitude of effect not of the effect itself.

The piece of history is concerned with the growth of the railway industry. At one level you can look at this as the substitution of trains for horse-drawn carriages, waggons, barges, horses themselves and even feet. At another level you could look



# THE INFORMATION AGE

at it as the bringing together of three well known areas of technology; the track, the wheel and the steam engine.

These viewpoints only take you so far. Where they do not take you (and society had to wait until trains existed in large numbers for it to become obvious) is in the direction of being able to forecast social change. You can forecast a *substitution* but this is only part of the picture.

Thus you could predict, as some people did, that the train would sound the death knell for the canals, at least for commercial, large — scale transportation purposes. But, how could you predict the pace at which the integration of the train changed the growth of the cities, which it did? And, how could you forecast its impact on the growth of the suburbs, indeed how it made these possible? Prediction, in these terms, means to put a time span on the event which is shorter and more realistic than saying 'within the next century'.

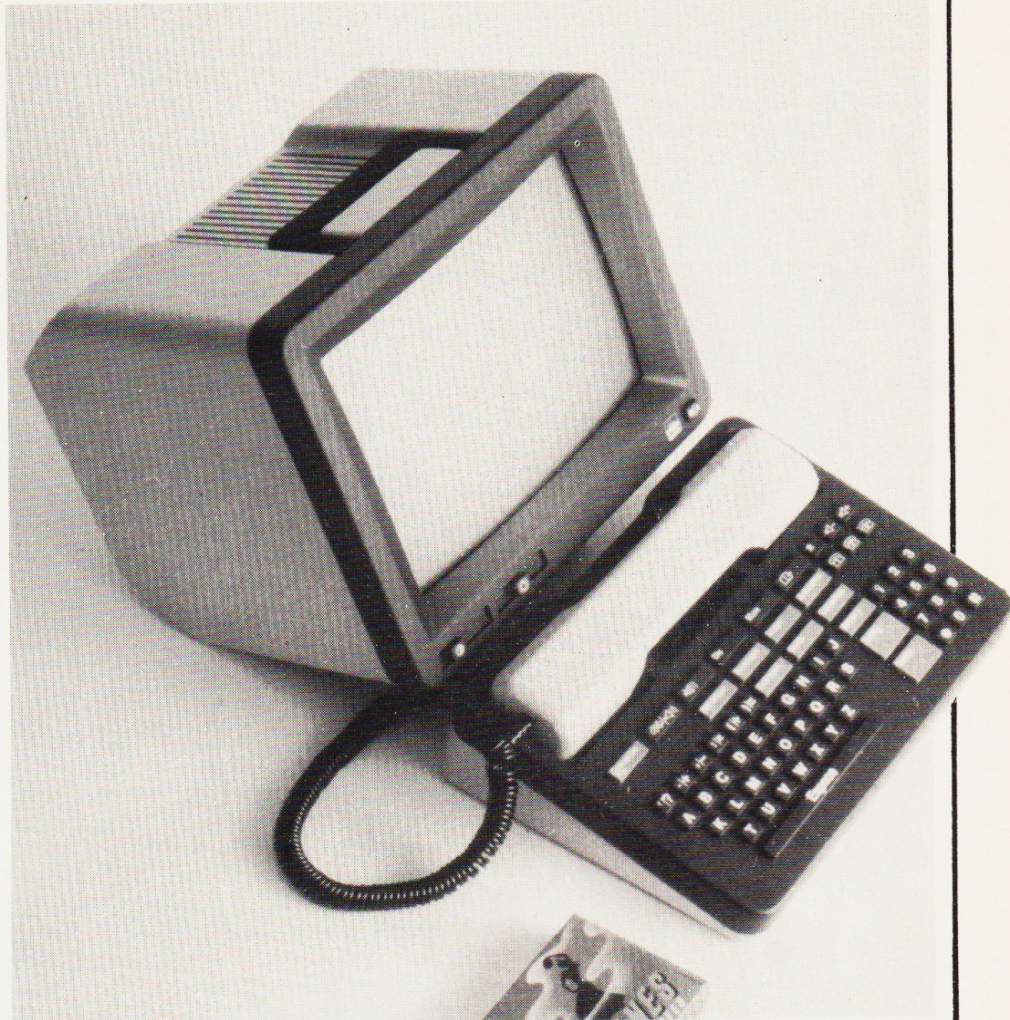
How, indeed, could you have predicted that the two contrary trends above, drawing people into a city for their work and making them leave it to live elsewhere, could have brought about a whole new industry based on gardening?

How, also, could you have foreseen the impact the railways had on creating a national distribution system when this was unknown, or the consequent (some time later) creation of an advertising industry and a national newspaper industry?

Trains changed life as it was known and did so in a drastic way. But, the processes involved took a long time to occur. There were first, second, third and however many other orders of effects you care to think of, some of which are still being felt today.

If you want to get closer to the present day, how could you forecast the effect and impact of television in a society which does not have it? Well, you start by thinking of substitution, which is what the film industry did. It refused to have anything to do with the new medium, guessing (rightly) that it would be a substitute for the cinema. The fact remains that, even allowing for the increase in population between the fifties and the present day, there has been a massive increase in the output of film material worldwide. This would not have happened if we had been stuck with the distribution methods that relied on the cinema as the main outlet.

You may well say at this stage that



One of the four prototype Annuaire Electronique terminals.

I am making things difficult. I am, because the subject is! Indeed, some of the best minds on the planet are busy trying to understand what is going on out there and what it all means. And, I may say, with surprisingly little success — though perhaps if you think about the two examples above, that lack of success will not seem so surprising.

## Taking the Medium Apart

Let us try to go back to the new medium and get some understanding of its component parts. What we can say about it for a start is that it has a generality. Indeed, it cuts right across the famous hot and cool definitions of Marshall McLuhan. It is obvious that it is not a broadcast medium, yet there are times when it encompasses it. For instance you can take a broadcast output and work with it. That output will be used to trigger off some other activity. Let me give you two possible examples.

Imagine that there is a current affairs programme being shown on television which is being watched by a number of people. Argument starts, as argument often does. You

could, in theory at least, reach for Prestel to obtain the latest background facts. In most cases you can't actually do this now because Prestel is currently short of encyclopaedic information and the sets are not organised to superimpose one set of information on another. This facility does exist on the Teletext system however, so it may not be long before the same is possible on Prestel.

This facility is actually exploited in my second example which is a closed, Viewdata-type system called TOPIC. The system is run by the London Stock Exchange and is an information facility for the stock market of the type known as a Closed User Group (CUG for short). On these systems the information is only available to a closed group of people — in this case stockbrokers and their clients.

TOPIC has an interesting facility. When you are accessing information on that system, whether in a CUG or on the general data base, there are a couple of lines free at the bottom of the frame. These are reserved for news flashes or information of



# THE INFORMATION AGE

general interest to the wider group, all TOPIC users. So whatever you may be dealing with or looking at, you can be kept in touch with events set in the wider context of the stock market and the events that have an impact upon it generally.

What else is the new medium? It is obvious that it is not confined to the Viewdata technology, though the principles of both are similar. These principles are that, by the use of digital telecommunications and mass market (ie easy to use) terminals, one should be able to access information and work with it.

It is obvious that it is combinatory; it calls on telecommunications, graphics, print and computing technologies and, no doubt before the decade is out, it will combine video too.

## Future Hardware And Services

Let us harden the ideas up. What could a home user access before the eighties are out? I am not going to say that the home user will have all the facilities I am about to list or all the services, all I am doing is to bring together the various systems currently under development.

For a start they will have equipment which is available now. It may well be that many people will be content with one TV set which has some local intelligence and is capable of being used for Prestel, Teletext and the usual TV broadcasts. This set could also be used for electronic mail and, because it has an alphanumeric keyboard, it could also cope with some of the transaction processing functions I'll describe in a minute.

I write, 'It may well be...'. Somehow I doubt that people will be happy to do all this on one terminal, I suspect that they will need at least two with the capabilities spread between them. The reason I doubt that it will all be done on the one terminal is that experiments have already shown that the medium is very powerful, it destroys all other activity while it is in use. This means that you may not be able to keep it in the living room — if you have a micro, think of how and where you use it.

The power of the medium has been investigated. I was at Bell Northern Research in Ottawa earlier this year and they were telling me about some market research they had done with the Canadian version of Prestel.

A small bit of this is worth retelling. They described the system to

eight little old ladies, people who had no understanding of any technology. Six of them had immediately responded that if the medium made demands, required privacy in other words, then they would have to give up the spare bedroom to it.

I mentioned earlier that the purpose of the medium was to allow the user to obtain information and process it. In the home context this processing could take the form of an Electronic Fund Transfer. This could be a process such as ordering wine from the wine club, books from the book club, airline tickets, holidays or even EFT proper — the access of one's own bank account and its debiting in favour of someone else. In other words, electronic banking.

You may have heard of that before. As a possibility it has existed for a number of years and often shows up in future scenarios. Did you know, however, that it already exists in West Germany. Admittedly it has not been going on for very long but already one bank has some 2000 electronic customers, people it rarely sees. And, interestingly enough, there is a usage pattern developing already. The bank's customers tend to use the system in their own time; it runs 24 hours a day, and usually when the banks are not normally open. Peak traffic is when the evening's television programmes have finished but if there is a poor viewing evening the traffic tends to start sooner.

If you take the route of having two terminals, it is likely that one will be a modified TV and the other will be micro based. Indeed, the printer I mentioned earlier may be replaced by a facsimile transceiver which doubles as a printer. If you think that this is fanciful then you're wrong. In France there is one under development, I have played with the development model, which is scheduled to arrive next year and will cost less than £200. The French telecommunications authority may well rent them just as it rents the telephones.

With a device such as this you can transmit written or pictorial material and, because it was designed to work with their Viewdata system, it doubles as a printer for that as well.

Also under development in France is the *Annuaire Electronique*, the on-line telephone directory. It is their aim to have the whole of the French telephone directory available electronically and accessible via a local call.

You may wonder who's going to pay for this device. The answer is

nobody, they are going to give them away! They calculate that by installing some 30 million terminals over the next 10 years the cost will come down to about £50 each at which price they simply become part of the service. They will also save on all the printed volumes and most of the staff required to man the existing service.

This same terminal could be used to do other things such as those mentioned above and the French are currently researching how the terminals can be designed to be used by anyone. Even with all this research it is unlikely that a totally foolproof system can be produced at a reasonable cost so one is still likely to find a 'panic button' which will summon a human operator to your aid.

## In Conclusion

What I have tried to do has been to guide you through some of the possibilities for the next decade and to give some indications of the new electronic environment. I have concentrated on systems which exist, which are in some way commercial and have already come out of the development laboratory.

What I have tried to show too is that this raises all sorts of possibilities, and that history shows that when you get a set of developments of this order there is consequent social change. I have very carefully avoided what that change could or might be.

I have not investigated it because it is difficult to forecast and it is difficult because the new medium is not so much one, or even a set of, products but forms an environment. The changes that one could predict are major but they could also be complex.

My own views on what these changes could be and might be would take up the space of a book. Indeed, they will, I am currently writing it!

In that book I go further, much further. I will, however, leave you with one thought that is central to this book. It is that the technology I have just described is approaching the stage which, in the motor car industry was known as that of the Model T Ford.

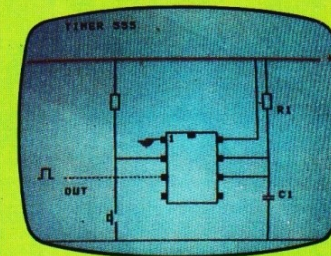
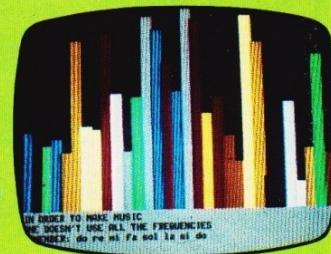
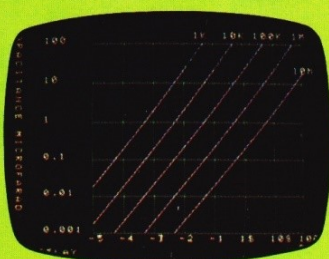
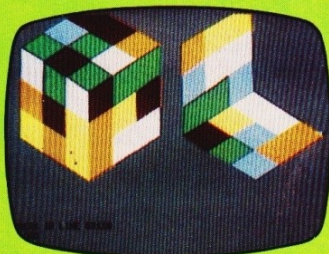
We are at the beginning of a mass market, interactive, electronic era. Coming up is the slicker motoring of the present day with its variety of devices aimed at different markets: the second hand and the 2CV compared to the Porsche and the Rolls.



**Cash price**  
ONLY £595 + VAT  
BEAT THAT FOR VALUE

# The DAI Personal Computer is Here

**\*High Performance\***  
**\*High Value\***



## Standard Features

- \* 24k Resident High-Speed Basic
- \* 16 Colour High-Resolution Graphics (255 × 335)
- \* Scrolling Screen Editor
- \* Sound Commands for Music Generation
- \* Very High Speed Hardware Maths Option
- \* Resident Monitor for Machine Language Programming
- \* 3 Programmable Parallel Ports
- \* Standard TV Interface via Aerial Socket
- \* RS232 Serial Port and Dual Cassette Interfaces

Manufactured by:

# DAI

THE  
MICROCOMPUTER  
ENGINEERING  
COMPANY  
Brussels, Belgium.

Available from:

## Data Applications(UK)Ltd.

Personal Computer Division  
16b Dyer Street  
Cirencester  
Gloucestershire  
GL7 2PF  
Tel: Cirencester  
(0285) 61902

For further information please complete and post to:  
Data Applications (UK) Ltd, 16b Dyer Street, Cirencester, Glos GL7 2PF

NAME.

ADDRESS.

MY INTEREST IS:

CT2



<b>TTLs</b> <b>74 SERIES</b> 7400 11p 7401 11p 7402 12p 7403 14p 7404 14p 7405 18p 7406 27p 7407 27p 7408 16p 7409 15p 7410 15p 7411 20p 7412 20p 7413 25p 7414 35p 7416 25p 7417 25p 7420 17p 7421 30p 7422 22p 7423 28p 7426 30p 7427 25p 7428 30p 7430 15p 7432 25p 7433 27p 7437 28p 7438 13p 7440 17p 7441 70p 7442A 50p 7445 60p 7446A 93p 7447A 45p 7450 17p 7451 17p 7453 17p 7454 17p 7460 17p 7470 36p 7472 30p 7473 30p 7474 23p 7476 30p 7480 50p 7483A 45p 7485 90p 7486 25p 7489 210p 7490A 30p 7491 60p 7492A 30p 7493A 30p 7494 50p 7495A 50p 7496 45p 7497 120p 74100 85p 74107 130p 74109 140p 74116 90p 74118 75p 74119 70p 74120 70p 74121 30p 74122 45p 74123 48p 74125 40p 74128 40p 74132 45p 74136 32p 74141 65p 74142 200p 74145 70p 74147 100p 74148 75p 74150 80p 74151A 45p 74153 45p 74154 70p 74155 50p 74156 50p 74159 100p 74160 66p 74161 60p 74162 60p 74163 60p 74164 65p 74165 60p 74166 70p 74170 160p 74173 75p 74174 70p 74175 70p 74176 50p 74177 70p 74178 100p 74180 160p 74182A 90p 74184A 90p 74185 120p 74186 500p 74188 325p 74190 70p 74191 70p 74192 70p 74193 70p 74194 70p			74195 60p 74196 60p 74197 60p 74198 100p 74211 75p 74259 150p 74278 150p 74279 80p 74283 75p 74284 200p 74285 200p 74290 200p 74293 100p 74298 100p 74365 50p 74366 55p 74367 55p 74390 55p 74393 100p 74430 120p			74LS242 80p 74LS243 80p 74LS244 90p 74LS251 40p 74LS253 90p 74LS257 45p 74LS258 45p 74LS259 90p 74LS260 24p 74LS266 25p 74LS273 90p 74LS279 45p 74LS280 250p 74LS283 45p 74LS298 160p 74LS299 450p 74LS323 250p 74LS324 180p 74LS348 150p 74LS365 36p 74LS367 36p 74LS368 50p 74LS373 80p 74LS374 80p 74LS375 50p 74LS377 90p 74LS378 70p 74LS390 55p 74LS393 60p 74LS399 200p 74LS408 16p 74LS409 15p 74LS445 110p 74LS450 135p 74LS451 135p 74LS452 135p 74LS453 135p 74LS454 135p 74LS455 135p 74LS456 135p 74LS457 135p 74LS458 135p 74LS459 135p 74LS460 135p 74LS461 135p 74LS462 135p 74LS463 135p 74LS464 135p 74LS465 135p 74LS466 135p 74LS467 135p 74LS468 135p 74LS469 135p 74LS470 135p 74LS471 135p 74LS472 135p 74LS473 135p 74LS474 135p 74LS475 135p 74LS476 135p 74LS477 135p 74LS478 135p 74LS479 135p 74LS480 135p 74LS481 135p 74LS482 135p 74LS483 135p 74LS484 135p 74LS485 135p 74LS486 135p 74LS487 135p 74LS488 135p 74LS489 135p 74LS490 135p 74LS491 135p 74LS492 135p 74LS493 135p 74LS494 135p 74LS495 135p 74LS496 135p 74LS497 135p 74LS498 135p 74LS499 135p 74LS500 135p 74LS501 135p 74LS502 135p 74LS503 135p 74LS504 135p 74LS505 135p 74LS506 135p 74LS507 135p 74LS508 135p 74LS509 135p 74LS510 135p 74LS511 135p 74LS512 135p 74LS513 135p 74LS514 135p 74LS515 135p 74LS516 135p 74LS517 135p 74LS518 135p 74LS519 135p 74LS520 135p 74LS521 135p 74LS522 135p 74LS523 135p 74LS524 135p 74LS525 135p 74LS526 135p 74LS527 135p 74LS528 135p 74LS529 135p 74LS530 135p 74LS531 135p 74LS532 135p 74LS533 135p 74LS534 135p 74LS535 135p 74LS536 135p 74LS537 135p 74LS538 135p 74LS539 135p 74LS540 135p 74LS541 135p 74LS542 135p 74LS543 135p 74LS544 135p 74LS545 135p 74LS546 135p 74LS547 135p 74LS548 135p 74LS549 135p 74LS550 135p 74LS551 135p 74LS552 135p 74LS553 135p 74LS554 135p 74LS555 135p 74LS556 135p 74LS557 135p 74LS558 135p 74LS559 135p 74LS560 135p 74LS561 135p 74LS562 135p 74LS563 135p 74LS564 135p 74LS565 135p 74LS566 135p 74LS567 135p 74LS568 135p 74LS569 135p 74LS570 135p 74LS571 135p 74LS572 135p 74LS573 135p 74LS574 135p 74LS575 135p 74LS576 135p 74LS577 135p 74LS578 135p 74LS579 135p 74LS580 135p 74LS581 135p 74LS582 135p 74LS583 135p 74LS584 135p 74LS585 135p 74LS586 135p 74LS587 135p 74LS588 135p 74LS589 135p 74LS590 135p 74LS591 135p 74LS592 135p 74LS593 135p 74LS594 135p 74LS595 135p 74LS596 135p 74LS597 135p 74LS598 135p 74LS599 135p 74LS600 135p 74LS601 135p 74LS602 135p 74LS603 135p 74LS604 135p 74LS605 135p 74LS606 135p 74LS607 135p 74LS608 135p 74LS609 135p 74LS610 135p 74LS611 135p 74LS612 135p 74LS613 135p 74LS614 135p 74LS615 135p 74LS616 135p 74LS617 135p 74LS618 135p 74LS619 135p 74LS620 135p 74LS621 135p 74LS622 135p 74LS623 135p 74LS624 135p 74LS625 135p 74LS626 135p 74LS627 135p 74LS628 135p 74LS629 135p 74LS630 135p 74LS631 135p 74LS632 135p 74LS633 135p 74LS634 135p 74LS635 135p 74LS636 135p 74LS637 135p 74LS638 135p 74LS639 135p 74LS640 135p 74LS641 135p 74LS642 135p 74LS643 135p 74LS644 135p 74LS645 135p 74LS646 135p 74LS647 135p 74LS648 135p 74LS649 135p 74LS650 135p 74LS651 135p 74LS652 135p 74LS653 135p 74LS654 135p 74LS655 135p 74LS656 135p 74LS657 135p 74LS658 135p 74LS659 135p 74LS660 135p 74LS661 135p 74LS662 135p 74LS663 135p 74LS664 135p 74LS665 135p 74LS666 135p 74LS667 135p 74LS668 135p 74LS669 135p 74LS670 135p 74LS671 135p 74LS672 135p 74LS673 135p 74LS674 135p 74LS675 135p 74LS676 135p 74LS677 135p 74LS678 135p 74LS679 135p 74LS680 135p 74LS681 135p 74LS682 135p 74LS683 135p 74LS684 135p 74LS685 135p 74LS686 135p 74LS687 135p 74LS688 135p 74LS689 135p 74LS690 135p 74LS691 135p 74LS692 135p 74LS693 135p 74LS694 135p 74LS695 135p 74LS696 135p 74LS697 135p 74LS698 135p 74LS699 135p 74LS700 135p 74LS701 135p 74LS702 135p 74LS703 135p 74LS704 135p 74LS705 135p 74LS706 135p 74LS707 135p 74LS708 135p 74LS709 135p 74LS710 135p 74LS711 135p 74LS712 135p 74LS713 135p 74LS714 135p 74LS715 135p 74LS716 135p 74LS717 135p 74LS718 135p 74LS719 135p 74LS720 135p 74LS721 135p 74LS722 135p 74LS723 135p 74LS724 135p 74LS725 135p 74LS726 135p 74LS727 135p 74LS728 135p 74LS729 135p 74LS730 135p 74LS731 135p 74LS732 135p 74LS733 135p 74LS734 135p 74LS735 135p 74LS736 135p 74LS737 135p 74LS738 135p 74LS739 135p 74LS740 135p 74LS741 135p 74LS742 135p 74LS743 135p 74LS744 135p 74LS745 135p 74LS746 135p 74LS747 135p 74LS748 135p 74LS749 135p 74LS750 135p 74LS751 135p 74LS752 135p 74LS753 135p 74LS754 135p 74LS755 135p 74LS756 135p 74LS757 135p 74LS758 135p 74LS759 135p 74LS760 135p 74LS761 135p 74LS762 135p 74LS763 135p 74LS764 135p 74LS765 135p 74LS766 135p 74LS767 135p 74LS768 135p 74LS769 135p 74LS770 135p 74LS771 135p 74LS772 135p 74LS773 135p 74LS774 135p 74LS775 135p 74LS776 135p 74LS777 135p 74LS778 135p 74LS779 135p 74LS780 135p 74LS781 135p 74LS782 135p 74LS783 135p 74LS784 135p 74LS785 135p 74LS786 135p 74LS787 135p 74LS788 135p 74LS789 135p 74LS790 135p 74LS791 135p 74LS792 135p 74LS793 135p 74LS794 135p 74LS795 135p 74LS796 135p 74LS797 135p 74LS798 135p 74LS799 135p 74LS800 135p			<b>COMPUTER COMPONENTS</b> <b>CPUs</b> 1802E 750p 2650A £12 6502 450p 6502A 650p 6800 370p 6802 500p 6809 £10 6809E £15 8035 750p 8039 850p 8080A 350p 8085A 550p INS8060 £11 TMS9980 £20 Z80 370p Z80A 450p 8088 £19 <b>SUPPORT DEVICES</b> 3242 800p 3245 450p 6522 500p 6532 775p 6551 700p 6821 160p 6845 £10 6847 £10 6850 180p 6852 370p 6875 600p 8154 950p 8155 800p 8205 320p 8212 180p 8216 180p 8224 250p 8226 250p 8228 250p 8243 450p 8250 850p 8251 400p 8253 300p 8255 400p 8257 800p 8259 800p 8279 950p TMS9918 £60 Z80PIO 350p Z80AP10 400p Z80CTC 350p Z80ADART 800p Z80ADMA £12 Z80S10-1 £20 <b>PROG. SOUND GENERATOR</b> AY3-8910 700p AY3-8912 650p <b>CRYSTALS</b> 32.768KHz 250p 100KHz 300p 200KHz 370p 1.0MHz 320p 1.008MHz 350p 1.8432MHz 250p 2.00MHz 250p 2.45760MHz 250p 3.276MHz 250p 4.194MHz 250p 4.43MHz 125p 6.0MHz 250p 6.144MHz 250p 7.0MHz 250p 7.168MHz 250p 8.00MHz 250p 10.00MHz 250p 10.7MHz 250p 15.0MHz 350p 16.00MHz 250p 18.00MHz 250p 18.423MHz 250p 19.48MHz 390p 26.690MHz 300p 27.145MHz 250p 38.666MHz 250p 48.0MHz 300p 55.5MHz 400p 116.0MHz 350p <b>KEYBOARD ENCODER</b> AY52376 700p 74C922 500p 74C923 500p <b>UHF MODULATORS</b> 6MHz 375p 8MHz 450p <b>DIL SWITCHES</b> 4Way 90p 6Way 105p 8Way 120p 10Way 150p <b>ZERO INSERTION FORCE S</b> 24 Pin 600p 40 Pin £11 <b>ROMs/PROMs</b> 74S188 325p 74S287 308p 74S288 226p 74S387 325p 74S471 650p 74S473 850p 74S474 650p 74S570 650p 74S571 650p 74S573 £12.50p <b>EPROMs</b> 1702A 500p 2708 300p 2716(5V) 300p 2716(5V) 300p 2532 600p 2732 600p 2564 £25 <b>UARTs</b> AY-3-1015P 350p AY-5-1013P 350p IM60402 450p <b>CHARACTER GENERATORS</b> RO-3-2513UC 750p RO-3-2513LC 700p SN74S262AN £10 <b>INTERFACE ICs</b> AD558CJ 775p AD561J £14 AM25S10 350p AM26LS31 100p AM26LS32 190p DAC80 £20 DM8131 375p DP8304 450p DS8832 250p DS8833 225p LF13201 200p MC1488 60p MC1489 60p MC3418 950p MC3446 850p MC3480 850p MC4024 325p MC4044 325p MM58174 £12 ULN2003A 100p ULN2004A 100p 75017 160p 75110 160p 75112 160p 75114 160p 75115 160p 75150P 140p 75154 140p 75182 230p 75324 375p 75361 150p 75363 150p 75365 150p 75451/2 72p 75453/4 72p 75491/2 70p 8126 120p 8128 140p 8195 140p 8197 140p 81LS95 90p 81LS96 120p 81LS97 90p 81LS98 120p 9602 220p 9637AP 160p ZN425E-8 350p ZN426E-8 350p ZN427E-8 650p ZN428E-8 500p <b>DISC CONTROL ICs</b> FD1771 £20 FD1791 £30 WD1691 £15 WD2143 £5.50			<b>CONNECTOR SYSTEMS</b> <b>EDGE CONNECTORS</b> 0.1" .156" — 150p 2x18 Way 310p 2x22 Way 310p 2x23 Way 335p 2x25 Way 350p 1x43 Way 260p 2x43 Way 450p 1x77 Way 700p <b>EUROCONNECTORS</b> <b>PLUG SOCKET</b> DIN41617 31Way 160p DIN41612 160p 2x32Way 300p <b>DIL HEADER PLUGS</b> 14 pin 50p 24 pin 100p 16 pin 60p 40 pin 275p <b>I.D. CONNECTORS</b> <b>HEADER RECYCLE EDGE PLUG</b> 10 Way 220p 24 Way 280p 26 Way 350p 34 Way 450p 40 Way 525p 50 Way 575p <b>HEADERS WITH COVERS</b> 14 Way 130p 24 Way 280p 16 Way 150p 40 Way 350p <b>IDC RIBBON CABLES</b> 10 Way 65p 26 Way 160p 14 Way 90p 34 Way 240p 16 Way p 40 Way 280p 20 Way 140p 50 Way 330p <b>UK101/OHIO II TWO BOARD HARDWARE INTERFACE</b> DECODING BOARD plugs into UK 101/OHIO II socket to provide 16 bit user port plus a wide variety of decoded lines for interfaces (inc. full decoding for AY3-8910/12 PSG) and a 40-pin socket for further expansion. Kit £27.50 <b>ANALOGUE BOARD</b> plugs into decoding board to provide D/A converter, 8-channel multiplexed A/D converter AY3-8910 PSG plus 6522 timer IC allowing complex timing and counting functions, plus 16-bit port. Kit £39.95. Reprint of 'P.E.' articles £1 + SAE.			<b>WIRE WRAP SOCKETS BY TEXAS</b> 8 pin 25p 18 pin 50p 24 pin 70p 14 pin 35p 20 pin 60p 28 pin 80p 16 pin 40p 22 pin 65p 40 pin 100p <b>LOW PROFILE DIL SOCKETS BY TEXAS</b> 8 pin 9p 18 pin 16p 24 pin 24p 14 pin 10p 20 pin 18p 28 pin 26p 16 pin 11p 22 pin 22p 40 pin 30p			<b>ADD SOUND TO YOUR ZX80/81 PLUS RELAY CONTROL AND LIGHT DETECTION</b> ★ ZX80/81 USER PORT ★ (as described in "P.C.W." Oct. '81) Port module plugs directly into ZX80or 81 to provide 8 input and 8 output lines. These allow input of data from switches, photocells, joy-sticks etc., and control of up to 8 relays. Also 7-segment displays or LED lamps may be used and solid state buzzers may be directly connected to the port. Variable tone audio output may be produced. The port is accessed by simple PEEK and POKE commands. The port kit includes plugs, sockets, double-sided PCB and all components. Prices: Kit £11.50 Ready Built & Tested £15.00. Application Notes £1.00 + S.A.E. (Reprint from PCW Oct/Nov '81).			<b>ACORN ATOM</b> A personal computer supplied with full size QWERTY Keyboard and a UHF modulator for connection to a domestic TV. Basic unit is 2K RAM + 8K ROM expandable to 12K + 12K. Basic Kit £1620 Built & Tested £150 Fully expanded £198 P&P £2.50 Power Supply 5v 1.8A £10.20 + £1.20 P&P 4K Floating Point ROM 6 £20. 1K RAM (2x2114 Low Power) £2.20 64K Dynamic RAM Card (fits into ATOM Case) 200mA at 5V Kit £87.50 Ready Built & Tested £95.00 <b>ATOM CONNECTORS</b> 2x32Way Plug £3.00 Skt 4.00 26Way Plug £3.50 Skt 2.65 10Way Plug £2.20 Skt 1.50 <b>SPECIAL OFFERS</b> 1-24 25-99 100+ 2114L 450nS 100p 95p 90p 2114L 200nS 110p 105p 100p 2716 (+5v) 240p 230p 210p 4116 200nS 90p 85p 75p 6116-3 150nS 900p 850p 800p <b>VOLTAGE REGULATORS</b> 1A +ve 5v 7805 50p 12v 7812 50p 15v 7815 50p -ve 7905 55p 7912 55p 7915 55p <b>OTHERS:</b> Fixed Variable 3A5v 450p 1A TO3 325p 5A5v 500p 1A TO220 200p 5A12v 600p -5A TO3 650p <b>ALSO AVAILABLE:</b> Linear ICs, CMOS, Opto Devices, Transistors, Protoboards, Logic Probes, Test Instruments, PCBs, Soldering Irons, Wire Wrapping Acces. Books on Semiconductor Devices, Microprocessors Applications etc.		
--	--	--	--	--	--	---	--	--	--	--	--	---	--	--	--	--	--	---	--	--	---	--	--

# TECHNOMATIC LTD

MAIL ORDERS TO: 17 BURNLEY ROAD, LONDON NW10 1ED  
SHOPS AT: 17 BURNLEY ROAD, LONDON NW10  
(Tel: 01-452 1500, 01-450 6597. Telex: 922806)  
305, EDGWARE ROAD, LONDON W2 Tel: 01-723 0233

PLEASE ADD 40p P&P & 15% VAT (Export no VAT)  
Government, Colleges, etc. ORDERS WELCOME  
BARCLAY & ACCESS CARDS ACCEPTED



# PLAY FOR TODAY

## COMMODORE VIC



- Colour ● Sound
- Programmable Function Keys
- 5K Memory Expandable to 32K
- Standard PETBASIC ● Full sized Typewriter Keyboard ● Graphics Character Set ● Plug-in Program Cartridges
- Low Priced Peripherals
- Self Teaching Materials

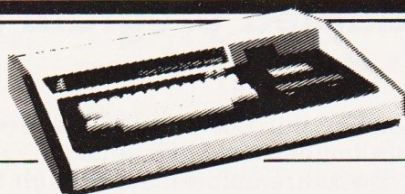
**£189.95**

VIC Compatible Cassette **£44.95**

## ACORN ATOM



- 8K Rom + 2K Ram Assembled **£172.50**
- Atom Power Supply
- 12K Rom + 12K Ram Assembled **£287.50**
- £9.20**

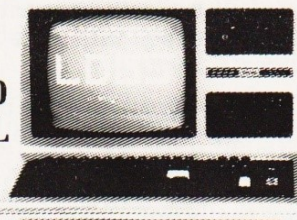


## VIDEO GENIE II

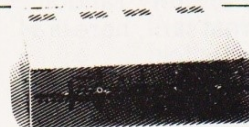
- 16K User Ram ● Extended Microsoft Basic
- Connection to UHF T.V. or Monitor
- Integral Cassette Recorder

**£344.00**

## TRS80 MODEL III



- 48 K User Ram ● Extended Microsoft Basic
- Parallel or RS232 Interfaces
- With 40 Track Single Density Disk Drives **£1596.00**
- With 80 Track Double Sided Disk Drives **£1741.00**
- With 80 Track Double Density Drives 1.4MB **£1999.00**



## TEAC DISK DRIVES

- Interfaces with Video Genie, North Star Horizon, Superbrain Nascom etc.
- 40 Track Single Disk Drive **£259.00**
- 40 Track Double Disk Drive **£448.00**
- 80 Track Single Disk Drive **£344.00**
- 80 Track Double Disk Drive **£599.00**



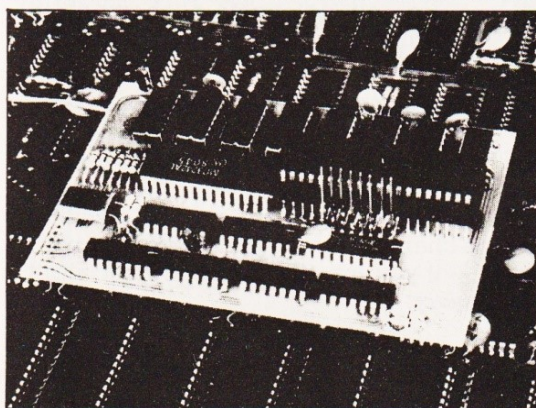
## SHARP MZ80K

- 48K User RAM
- Extended Basic
- Integral Cassette

**£399.00**

## THE COMPUTER SHACK

Computer Shack Ltd, 14, Pittville Street, Cheltenham, Glos. Telephone: (0242) 584343  
Ring or call in for details of our Nationwide 6 months Free Credit Scheme.  
Access or Barclay Card Accepted, Mailorder Enquiries Welcomed. **Prices include VAT**



## A 128K BYTES MICRO FOR LESS THAN £300? \* HOW? RAM EXPANSION FOR Z80 A AND 6502 BASED MICROCOMPUTERS.

Before you buy any 2114 Static Ram for your Atom, UK 101, PET, AIM 65, MICROTAN, ZX 81 etc., consider the facts:

- Dynamic Ram are from 4 to 16 times denser and consume up to 16 times less power than Static Ram
- Dynamic Ram are cheaper — witness our prices.

We have designed the Dynamic Ram Controller Module (DRC module) to expand the memory of the Acorn Atom, PET, UK 101, Sinclair ZX 81 and other machines using the very latest memory devices. These include Hitachi HM 6116 CMOS RAM for battery back up operation and Motorola MCM 6665L2 devices for 128K bytes of memory — these run at very low consumption (they can be used on the ZX 81, for example, with no need for extra power) and take up very little space. They provide reliability, simplicity and large storage at a very low cost.

We supply free programming examples to start you off when writing basic programs longer than 64K bytes and we offer prizes up to £200 every month for the best programs written for one of the most popular micros fitted with DRD 64 and DRC 128 modules.

### Prices:

CMOS 2K bytes chip for the Sinclair ZX 81 **£ 5.80**  
17K bytes CMOS RAM module for ATOM\*\* **£57.00**

### DRAM: in kit form:

DRC 16K for 6502 (PET, ATOM, UK101, AIM 65, MICROTAN, 680X based) **£39.00**  
DRC 16K for Z 80A (ZX81, TRS 80, VIDEOGENIE) **£33.00**  
DRC 32K for 6502 (see above) **£52.00**  
DRC 32K for Z 80A (see above) **£43.00**  
DRC 64K for 6502 (see above) **£87.00**  
DRC 64K for Z 80A (see above) **£70.00**  
DRC 128K for 6502 (see above) **£130.00**  
DRC 128K for Z 80A (see above) **£120.00**

For ready built versions, please add £8 for assembly charges.

Please add 15% VAT to all prices.

Please ring us for further details (full documentation with ordering and delivery information) on Southend (0702) 613081. Alternatively, write to.

**Audio Computers 87 Bournemouth Park Road Southend on Sea Essex (0702) 613081**



# If you thought that fantasy games were illogical then this easily expanded or adapted program should make you change your mind.

If you're fed up with the type of adventure that's entirely random and involves no real skill, here is a game which is truly logical.

Like all good adventure games your task is to recover the magic chalice which has been stolen by an evil sorcerer who is hiding in the labyrinth of the White Barrows. This labyrinth is arranged in a stable pattern (see Fig. 1.) and each of the chambers has an identifying number. The sorcerer is powerless to escape from the labyrinth while carrying the chalice but if you trap him he will drop it and promptly disappear. To aid you in your task you are equipped with a magic staff and a limited supply of magic.

## The Nasties

Lurking in the labyrinth are dragons, serpents, dwarfs, goblins and magic spots. These remain in their own chamber in the labyrinth, they cannot move around like the sorcerer. The program will issue warnings as to the content of the chamber you are about to enter, but these are not in any particular sequence. You may receive a warning about a serpent while you are in, for example, chamber 2 but you will not know — unless you can remember — in which of the four possible move positions it is. You can use the **View** command to check the

chamber but this will use some of your limited stocks of magic.

If you are unfortunate enough to run into a dragon, serpent or dwarf you are faced with one of three choices:

You can **Stun** it, but you must leave the chamber immediately or it will recover and attack you.

You can **Transport** it, but if you are really unlucky it may reappear in the same chamber.

You can **Destroy** it, in which case the creature is removed from the game.

All the above options use some of your magic, the actual amount depends on the creature type and which of the options you choose; these are listed in ascending order of magic required. If you do not use sufficient magic the creature may be stunned (in which case you get a second chance) or it may just get angry and attack you.

The goblins are actually on your side — but for a price. They will tell you where the sorcerer is hiding provided you supply them with gold coins. You can make these with your magical ability but don't be too hasty, as the system gives the same warning for a goblin approaching as for the friendly gnome who doesn't need bribing.

There is one further obstacle

hidden in the labyrinth — a magic spot. This, if trodden on, will instantly transport you to another location within the barrow. Murphy's law determines that no matter what peril you were in before you were transported, the situation you find yourself in will be ten times worse!

## The Sorcerer's Habits

The evil sorcerer does have a degree of intelligence. If you walk into the chamber in which he is hiding, he will run off. The distance he will run can be up to three chambers and, if he can find it, he will always tread on the magic spot to further confuse the issue. To retrieve the chalice you must trap him. This is not easy (the game wouldn't be much fun if it was) but there are three aids for your task:

The sorcerer will not move to a chamber that you have just left.  
He will not enter a chamber that contains a goblin.  
He will not enter a chamber in which you have created the magic wall.

This magic wall can be created at any point in the labyrinth but only one wall can be created at any one time. If you build a second wall, the first will fall down! You cannot build a wall in a chamber which is already occupied — if you try, it will fall down straight away.

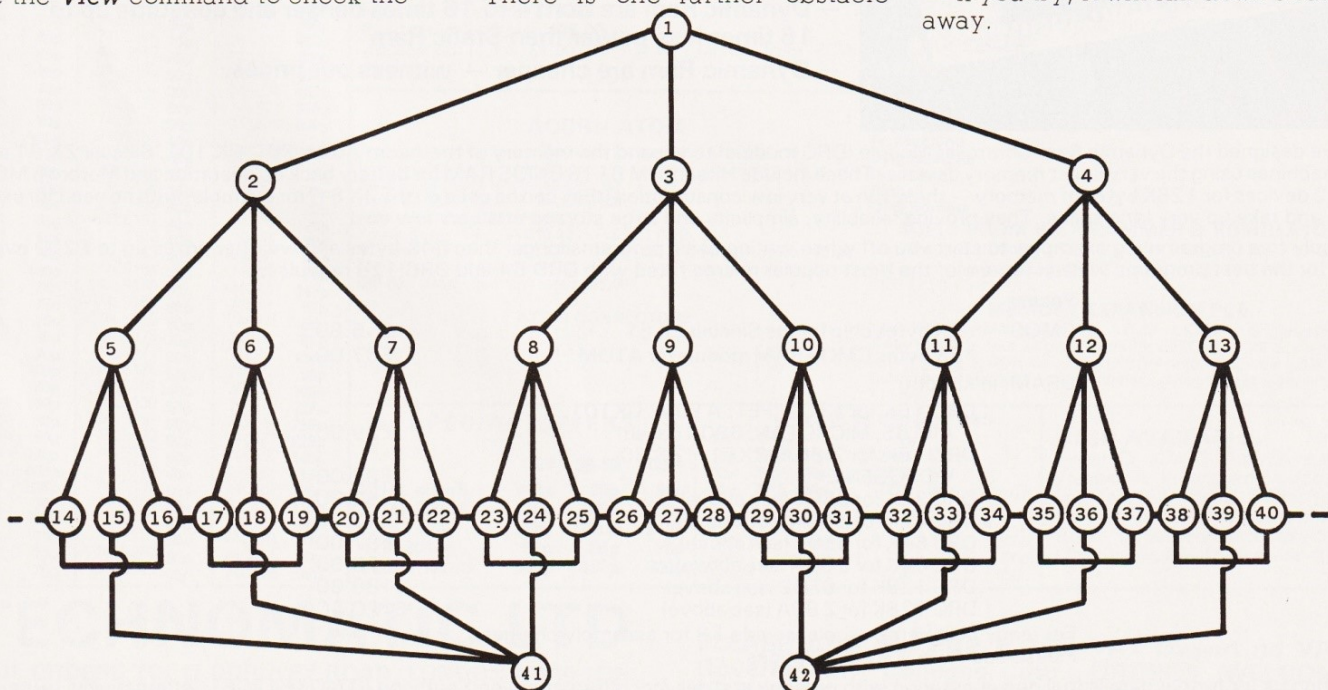


Fig. 1 The map of the chambers and their interconnections found inside the White Barrows. The map is stored in the string array \$A.



# THE WHITE BARROWS

The final option available when all else has failed (you've run out of magic or been killed) is the possibility of re-incarnation.

## The Program

The original code was written for an Acorn ATOM with the full 5K installed in the lower text area. It should prove possible to adapt the program to run on other systems and some notes for this are given below.

For those intending to load the program into an ATOM, it will be necessary to use the abbreviated form of the BASIC commands and to remove some of the spaces which have been included for legibility. Note also that the normally unused 512 bytes in the upper text area have been reserved for string storage.

## Conversion Notes

The string handling commands on the ATOM are, to say the least, unique. However, in this program they have been used in such a way as to make their conversion as simple as possible.

The first major conversion starts by finding all the lines where strings are used. The ATOM labels its string variables with the \$ first, \$A for example. All these must be transposed to come the correct way round.

While on the subject of strings the following batch of lines needs altering:

```
9000 A$=".....
9010 A$=A$+".....
9020 A$=A$+".....
9030 A$=A$+".....

3090 T=ASC(MID$(A$,C*4-4+I,
1))-48
```

```
6020 BB(I)=ASC(MID$(A$,
Y*4-4+I,1))-48

200 IF LEFT$(Q$,1)="V"
THEN GOSUB 5000:GOTO 240
```

The PRINT statement on the ATOM is configured so that those ending with a ' act as a normal PRINT. If there is no ' at the end of the line then you need to add a ; and if there is more than one ' you will need an extra PRINT for each extra '.

The random number generator gives both positive and negative numbers, hence the ABS function. Replace line 4120 with:

```
4120 R=INT(RND(1)*20)+20
```

Other lines that need alteration are:

```
20 DIM AA(N),BB(3)
2000 ON AA(Z) GOTO 2010,
2020,2030,2040,2050,
2060,2070,2080,2090
6090 R=INT(RND(1)*4)+1:IF
MID$(Q$,R,1)="[SPC]"
THEN 6090
6100 Q$=LEFT$(Q$,R-1)+"[SPC]" +
RIGHT$(Q$,4-R):T=AA
(BB(R))
6200 F=0:Q$="1234"
```

And, finally ATOM multi-statement delimiters are represented by ; and these should be changed to the more usual :. The program should now run under most BASICs. Oh, the \$12 is a Clear Screen and the \$8 is a Back Space.

## Variables

For those interested in the structure of the program the following variable list may be of some help.

\$A The string holding the sequence of chambers

B Flag/random for attack  
C The chalice/sorcerer's chamber number  
F General flag  
I & J General loop count  
K Stun flag  
L Chamber where magic wall is  
M Amount of magic left in staff  
N Number of chambers  
P General numeric reply  
\$Q General string reply  
S Strength of an object  
T Temporary store  
U Amount of magic used  
W Won flag  
X Contents of chamber  
Y Your chamber number  
Z Chamber number for object  
Array AA What is in the labyrinth  
Array BB All possible connections from a chamber

The structure is stored in \$A and is constructed of blocks of four characters containing the connections from the chamber whose number corresponds to the block. Block 0 is a dummy. The chamber number is stored as an ASCII number +48. For example, chamber 4 connects to 1; <= which, when translated, becomes chambers 1, 11, 12 and 13.



## THE WHITE BARROWS

YOUR MISSION IS TO TRAP THE EVIL SORCERER AND RETURN THE MAGIC CHALICE.

YOU HAVE BEEN GIVEN A MAGIC STAFF WITH 500 UNITS OF MAGIC. USE IT TO OVERCOME THE HAZARDS HIDDEN IN THE WHITE BARROWS. HIT RETURN TO BEGIN.?

WARNING -

I CAN FEEL MAGIC VERY CLOSE !

TUNNELS LEAD TO 15, 18, 21, 24, YOU ARE CURRENTLY IN CHAMBER 41  
CREATE WALL, MOVE OR VIEW ?M

WHICH CHAMBER TO MOVE TO ?15

WARNING -

I CAN HEAR A DRAGON !

TUNNELS LEAD TO 5, 41, YOU ARE CURRENTLY IN CHAMBER 15  
CREATE WALL, MOVE OR VIEW ?V  
WHICH CHAMBER DO YOU WISH TO VIEW ?5

THERE IS A YELLOW DRAGON IN CHAMBER 5.  
YOU HAVE USED 19 UNITS.  
YOU HAVE 481 UNITS REMAINING.

WARNING -

I CAN HEAR A DRAGON !

TUNNELS LEAD TO 5, 41, YOU ARE CURRENTLY IN CHAMBER 15  
CREATE WALL, MOVE OR VIEW ?M

WHICH CHAMBER TO MOVE TO ?5

YELLOW DRAGON IS ABOUT TO ATTACK !  
YOU HAVE THREE CHOICES:

- 1 - STUN IT.
- 2 - TRANSPORT IT.
- 3 - DESTROY IT.

YOUR CHOICE ?3  
AMOUNT OF MAGIC ?50  
YELLOW DRAGON IS DAZED!

YOU HAVE USED 50 UNITS.  
YOU HAVE 431 UNITS REMAINING.

THE YELLOW DRAGON SUDDENLY ATTACKED !

OH DEAR, YOU APPEAR TO BE DEAD  
WOULD YOU LIKE TO BE REINCARNATED ?N

A typical sample of the game's output.



# Program Listing

```

1  REM**PLEASE READ TEXT FIRST!!!!
10  N=42;@=3
20  DIM AA(N),BB(3);A=$8200;Q=$8300;
   REM**FOR $ READ A HEX ADDRESS
30  PRINT$12"THE WHITE BARROWS"
40  GOSUB 10000
50  GOSUB 9000
60  GOSUB 8000
70  FOR X=1 TO 9
80  GOSUB 7000
90  NEXT X
100 FOR I=1 TO 3
110 X=10;GOSUB 7000
120 X=11;GOSUB 7000
130 NEXT I
140 X=0;GOSUB 7000;Y=R
150 GOSUB 7000;C=R
160 M=500;L=0
170 W=0;K=0;GOSUB 6000
180 INPUT "CREATE WALL, MOVE OR VIEW "$Q
190 PRINT$12
200 IF ?Q=CH"V" GOSUB 5000;GOTO 240
210 IF ?Q=CH"C" GOSUB 4000;GOTO 240
220 IF ?Q=CH"M" GOSUB 3000;GOTO 240
230 GOTO 180
240 IF AA(Y)=0 OR K=1 OR AA(Y)=10 OR
   AA(Y)=11 GOTO 280
250 PRINT "THE ";Z=Y;GOSUB 2000
260 PRINT "SUDDENLY ATTACKED !"
270 GOTO 390
280 IF M>0 GOTO 320
290 PRINT "YOUR STAFF IS NOW USELESS AND"
300 PRINT "THE EVIL FORCE ATTACKS !"
310 GOTO 390
320 IF W=0 GOTO 170
330 PRINT "CONGRATULATIONS YOU HAVE"
340 PRINT "DEFEATED THE EVIL SORCERER !"
350 PRINT "WOULD YOU LIKE TO TRAP ANOTHER"
360 INPUT "SORCERER "$Q
370 IF ?Q=CH"Y" GOTO 30
380 GOTO 999
390 PRINT "OH DEAR, YOU APPEAR TO BE DEAD"
400 PRINT "WOULD YOU LIKE TO BE"
410 INPUT "REINCARNATED "$Q
420 IF ?Q=CH"N" GOTO 999
430 INPUT "THE SAME SORCERER "$Q
440 IF ?Q=CH"Y" GOTO 160
450 GOTO 30
999 END
1000 M=M-R
1010 PRINT "YOU HAVE USED "R" UNITS."
1020 PRINT "YOU HAVE "M" UNITS REMAINING."
1030 RETURN
2000 GOTO (2000+AA(Z)*10)
2010 PRINT "RED DRAGON";S=30;RETURN
2020 PRINT "GREEN DRAGON";S=25;RETURN
2030 PRINT "YELLOW DRAGON";S=20;RETURN
2040 PRINT "PLATINUM SERPENT";S=28;RETURN
2050 PRINT "GOLD SERPENT";S=23;RETURN
2060 PRINT "SILVER SERPENT";S=18;RETURN
2070 PRINT "DWARF WITH A SABRE";S=24;RETURN
2080 PRINT "DWARF WITH A SWORD";S=19;RETURN
2090 PRINT "DWARF WITH A KNIFE";S=14;RETURN
2100 PRINT "FRIENDLY GNOME";RETURN
2110 PRINT "MAGIC SPOT";RETURN
3000 INPUT "WHICH CHAMBER TO MOVE TO "P
3010 F=0;PRINT
3020 FOR I=0 TO 3
3030 IF BB(I)=P THEN F=1
3040 NEXT I
3050 IF P=0 OR F=0 GOSUB 6000;GOTO 3000

3060 IF C<>P GOTO 3180
3070 W=1;F=0
3080 FOR I=0 TO 3
3090 T=A?(C*4-4+I)-48
3100 IF T=0 OR T=Y OR AA(T)=10 OR T=L
   GOTO 3130
3110 IF W=1 OR RND<0 THEN C=T
3120 W=0;IF AA(T)=11 THEN F=1
3130 NEXT I
3140 IF W=1 THEN RETURN
3150 IF F=0 THEN PRINT "THE SORCERER HAS RUN
   OFF !";GOTO 3180
3160 PRINT "THE SORCERER TROD ON THE MAGIC"
3170 PRINT "SPOT !";X=0;GOSUB 7000;C=R;
   GOTO 3060
3180 Y=P;IF AA(P)=0 THEN RETURN
3190 IF AA(P)<>11 THEN 3230
3200 PRINT "POWWW! YOU HAVE JUST TRODDEN
   ON"
3210 PRINT "THE MAGIC SPOT!"
3220 X=0;GOSUB 7000;Y=R;RETURN
3230 IF AA(P)<>10 GOTO 3300
3240 R=ABS(RND%20)+20
3250 PRINT "THE GOBLIN WILL TELL YOU WHERE"
3260 PRINT "THE SORCERER IS FOR "R" GOLD"
3270 INPUT "COINS. AGREED "$Q
3280 IF ?Q<>CH"Y" THEN RETURN
3290 PRINT "THE SORCERER IS IN CHAMBER "C
   ".";M=M-R;GOTO 3450
3300 K=0;Z=Y;GOSUB 2000;PRINT "IS ABOUT TO
   ATTACK !"
3310 PRINT "YOU HAVE THREE CHOICES:"
3320 PRINT "1 - STUN IT."
3330 PRINT "2 - TRANSPORT IT."
3340 PRINT "3 - DESTROY IT."
3350 INPUT "YOUR CHOICE "P
3360 IF P<1 OR P>3 GOTO 3350
3370 INPUT "AMOUNT OF MAGIC "R
3380 IF R<0 OR R>M GOTO 3370
3390 PRINT$12;GOSUB 2000;PRINT "IS ";
   B=0
3400 IF P=1 AND R>S+RND%(S/3) THEN PRINT
   "STUNNED !";K=1
3410 IF P<>2 OR R<S*2+RND%S GOTO 3430
3420 PRINT "TRANSPORTED";X=AA(Y);AA(Y)=0;
   GOSUB 7000
3430 IF P=3 AND R>S*4+RND%S THEN PRINT
   "DESTROYED !";AA(Y)=0
3440 IF K=0 AND AA(Y)<>0 THEN PRINT
   "DAZED !";B=ABS(RND%8)
3450 GOSUB 1000;IF B>2 AND M>0 GOTO 3310
3460 RETURN
4000 PRINT "WHICH CHAMBER DO YOU WISH TO"
4010 INPUT "CREATE THE MAGIC WALL IN "L
4020 PRINT
4030 IF L<1 OR L>N GOSUB 6000;GOTO 4000
4040 IF AA(L)<>0 GOTO 4080
4050 PRINT "THE MAGIC WALL NOW EXISTS IN"
4060 PRINT "CHAMBER "L
4070 GOTO 4110
4080 PRINT "ZAAPPPP ! CHAMBER "L" ALREADY";
   L=0
4090 PRINT "CONTAINS MAGIC, THE WALL HAS"
4100 PRINT "FAILED !"
4110 PRINT
4120 R=ABS(RND%20)+20
4130 GOSUB 1000
4140 RETURN
5000 PRINT "WHICH CHAMBER DO YOU WISH TO"
5010 INPUT "VIEW "P
5020 F=0
5030 FOR I=0 TO 3
5040 IF P=BB(I) THEN F=1
5050 NEXT I

```



# THE WHITE BARROWS

```

5060 IF P=0 OR F=0 GOTO 5040
5070 PRINT'
5080 IF P=C THEN PRINT "YOU HAVE FOUND THE
SORCERER !""
5090 IF AA(P)=0 THEN PRINT "THE CHAMBER IS
EMPTY !";GOTO 5130
5100 PRINT "THERE IS A "
5110 Z=P;GOSUB 2000
5120 PRINT "IN CHAMBER "P"."
5130 R=ABS(RND%20)+10
5140 GOSUB 1000
5150 RETURN
6000 F=0;SQ="1234"
6010 FOR I=0 TO 3
6020 BB(I)=A?(Y*4-4+I)-48
6030 F=F+AA(BB(I))-(100*(BB(I)=C))
6040 NEXT I
6050 IF F=0 GOTO 6170
6060 PRINT "WARNING -""
6070 IF F<0 THEN PRINT "THE CHALICE
IS NEAR !""
6080 FOR I=0 TO 3
6090 R=ABS(RND%4);IF Q?R=32 GOTO 6090
6100 Q?R=32;T=AA(BB(R))
6110 IF T>0 AND T<4 THEN PRINT "I CAN HEAR
A DRAGON !""
6120 IF T>3 AND T<7 THEN PRINT "I CAN HEAR
A SERPENT HISSING !""
6130 IF T>6 AND T<11 THEN PRINT "I CAN HEAR
MONEY RATTLING !""
6140 IF T=11 THEN PRINT "I CAN FEEL MAGIC
VERY CLOSE !""
6150 NEXT I
6160 PRINT'

```

```

6170 PRINT "TUNNELS LEAD TO"
6180 FOR I=0 TO 3
6190 IF BB(I)>0 THEN PRINT BB(I)",",
6200 NEXT I
6210 PRINT$8"[SPC]"
6220 PRINT "YOU ARE CURRENTLY IN CHAMBER "Y
6230 RETURN
7000 R=ABS(RND%42)+1;IF AA(R)>0 GOTO 7000
7010 AA(R)=X
7020 RETURN
8000 FOR I=0 TO 42
8010 AA(I)=0
8020 NEXT I
8030 RETURN
9000 $A="23401567189:1;<=2>?@2ABC2DEF3GHI3JKL
3MNO4PQR4STU"
9010 $A+LENA="4VWX5@X05Y005>A06@C06Y006AD07C
F07Y007DG08FI08Y00"
9020 $A+LENA="8GJ09IK09JL09KM0:LO0:Z00:MP0;O
R0;Z00;PS0<RU0<Z00"
9030 $A+LENA="<SV0=UX0=Z00=>V0?BEHNQ?TW"
9040 RETURN
10000 PRINT' YOUR MISSION IS TO TRAP THE""
10010 PRINT "EVIL SORCERER AND RETURN THE""
10020 PRINT "MAGIC CHALICE.""
10030 PRINT "YOU HAVE BEEN GIVEN A MAGIC""
10040 PRINT "STAFF WITH 500 UNITS OF MAGIC.""
10050 PRINT "USE IT TO OVERCOME THE""
10060 PRINT "HAZARDS HIDDEN IN THE WHITE""
10070 INPUT "BARROWS. HIT RETURN TO
BEGIN."SQ;PRINT$12
10080 RETURN

```

The ATOM BASIC program, conversion notes should be studied before starting translation to other systems.



## TESTED & ASSEMBLED PCB'S & KITS

6 MONTH GUARANTEE — REPAIR SERVICE

**FULCRUM COMPUTER PRODUCTS** I-8080 S-100 ENCLOSURE SHEET METAL KIT  
Just like THE ORIGINAL IMSAI: Mainframe with blue cover, cardguides and hardware spaced for PS-28D Power Supply, up to 22 slot motherboard.  
Kit of all metal parts and hardware with documentation. £120.00  
Thinker Toys Wunder Buss 20 for above w/o conn. £85.00  
S-100 Connectors—each £3.60  
8015 Blank jump-start panel w/3 switches. £41.00  
8035 Jump start panel for 2 SA-400. £95.00  
**PS-28D POWER SUPPLY PARTS KIT**  
Mounts in the I-8080 enclosure, supplies + 8V @ 28A, +/— 16V @ 3A, kit includes board, transformer, documentation, and all components. Improved from original.  
Kit £180.00  
**PIO 4-4**  
4 parallel inputs and outputs (8212). £160.00  
**SIO 2-2**  
2 serial I/O ports, good to 9600 baud. £160.00  
**VIO-F**  
Improved memory mapped video I/O board, includes keyboard port, 256 character EPROM's, firmware, monitor.  
**Assembled & Tested.** £269.00  
**DIO/CD**  
2 board disk controller for 8" or 5 1/4". £299.00  
**CPM 2.2**  
For DIO including documentation. £125.00  
**CPA**  
Improved Imsai style front panel works with Z80, etc. £249.00  
**MPU-A**  
8080 processor board—requires CPA. £129.00  
**MPU-B**  
8085 3MHz processor SBC w/serial plus parallel port, monitor. £249.00  
**RAM III 64K MEMORY**  
64K byte dynamic RAM board—Utilizes the Intel 3242 refresh controller and a single delay line for totally internal refresh. Uses time proven 4116 RAMS. memory mapped I/O boards are allowed to coexist by the use of phantom. Board select via A16 thru A20 extended address lines.  
**Assembled & Tested.** £349.00  
**IKB-1**  
Intelligent keyboard uses 8035. £189.00  
**MDX**  
Dual SA400 drive enclosure. £78.00  
**DE 8**  
Dual 800R/801R horizontal style enclosure w/power supply and fan. £270.00  
**VIO-X**  
New port mapped video I/O board w/8085 processor, 8275 CRT controller keyboard port, firmware.  
**Assembled & Tested.** £249.00  
**IEEE 488 + 3P**  
New IEEE-488 I/O interface with 3 parallel ports.  
**Assembled & Tested.** £599.00

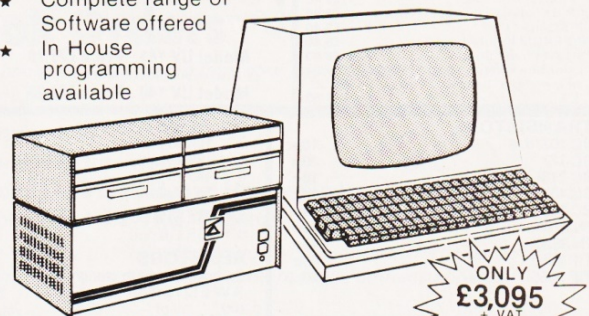


## FULCRUM SYSTEMS THE COMPLETE ANSWER



The 8025 Business System gives you:

- ★ 2.4 Mb Storage
- ★ 64k RAM
- ★ 2 x 8" Disk Drives
- ★ Choice of Terminal or Monitor
- ★ CPM 2.2
- ★ Complete range of Software offered
- ★ In House programming available



A FULL RANGE OF FULCRUM  
SYSTEMS AVAILABLE TO MEET  
YOUR NEEDS!

ALL PRICES PLUS VAT

ONLY  
£3,095  
VAT  
OFFER ENDS  
31st Jan '82

# RING NOW



0621 828763

FOR FREE PRODUCT  
BROCHURE AND DETAILS  
OF OUR SUPPORT SERVICES  
& DEALERS

Telex: 995411  
Export enquiries welcome



# Greenbank

Greenbank Electronics  
(Dept T120) 92 New Chester Road, New Ferry  
Wirral, Merseyside, L62 5AG  
(Tel. 051 645 3391)



**TERMS, VAT, CWO.** Cheques etc payable to Greenbank Electronics and crossed. Add VAT to all prices at 15% except where stated otherwise. Post etc: UK 40p (+5p VAT = 45p) per order. Export: NO VAT but add 40p (Eire), £1 (Europe) and £3.50 elsewhere. Access: Barclaycard, Visa, telephoned orders accepted. (Polys universities, gov depts, etc can telephone their orders for immediate despatch on account.)



## QUARTZ

32 768KHz (watch)	£2.50
60 KHz	£9.95
100 KHz	£2.90
204 KHz	£2.70
262 144 KHz	£3.92
307.2 KHz	£3.92
312.5 KHz	£3.92
455.0 KHz	£3.83
1.000 MHz	£2.95
1.008 MHz	£1.90
1.280 MHz	£3.92
1.5 MHz	£3.23
1.8 MHz	£3.23
2.000 MHz	£2.95
2.048 MHz	£2.80
2.091/52 MHz	£3.23
2.4575 MHz	£2.99
2.500 MHz	£3.92
2.56250 MHz	£3.62
3.000 MHz	£3.62
3.2768 MHz	£2.70
3.579545 MHz	£1.75
3.93216 MHz	£3.92
4.000 MHz	£1.90
4.032 MHz	£1.99
4.096 MHz	£1.99
4.194304 MHz	£1.99
4.433619 MHz	£1.25
4.608 MHz	£3.23
4.800 MHz	£1.99
4.9152 MHz	£3.23
5.000 MHz	£3.92
5.0688 MHz	£2.70
5.120 MHz	£3.23
5.185 MHz	£3.23
5.24288 MHz	£4.25
6.000 MHz	£2.70
6.144 MHz	£3.23
6.400 MHz	£2.70
6.55360 MHz	£1.99
7.000 MHz	£1.99
7.168 MHz	£2.50
7.680 MHz	£1.99
7.86432 MHz	£3.23
8.000 MHz	£1.99
8.08333 MHz	£3.62
8.388608 MHz	£2.99
8.867237 MHz	£3.23
9.375 MHz	£1.99
10.000 MHz	£1.99
10.245 MHz	£3.23
10.700 MHz	£3.23
10.92 MHz	£3.92
11.000 MHz	£3.92
12.000 MHz	£3.50
14.0 MHz	£3.92
14.3198 MHz	£3.62
16.000 MHz	£2.90
18.000 MHz	£2.50
18.432 MHz	£2.90
19.680 MHz	£2.90
20.000 MHz	£2.80
20.1134 MHz	£3.23
24.0 MHz	£3.92
26.690 MHz	£3.92
27.0 MHz	£3.92
27.145 MHz	£3.00
27.648 MHz	£3.23
38.666 MHz	£3.50
48.000 MHz	£2.70
100.000 MHz	£2.90
115.000 MHz	£3.00

## EUROCARD Z80 COMPUTER BOARDS, CUSTOM 80 SYSTEM

The Custom 80 System has been designed as a fully expandable modular computer system. The circuits are supplied as a full kit of parts, all you need are tools and solder.

The colour VDU card gives a teletext format, 24 lines of 40 characters, upper case, lower case, pixel graphics, contiguous, non contiguous, single height, double height, memory mapped etc. The kit is supplied with all the components for colour and is used with your own colour or monochrome T.V. set.

The keyboard Port card is used to interface the ASCII keyboard to the computer. It is interrupt driven giving fast response to keystrokes. On this card is included 1K of user RAM (this is in addition to the 1K of VDU text RAM) and space for a 2K EPROM such as the CSYS operating system. The ROM and RAM can be switched by software, which is desirable if full use of it to be made of the dynamic RAM expansion cards.

The CPU board uses the high speed version of the Z80 microprocessor and operates at full 4MHz. Full use can be made of the Z80's powerful interrupt structures, including mode 2 (vectored) interrupts. The CPU can insert wait states when requested and utilises pulsed reset for use with dynamic RAM's.

For a full 64K system two RAM expansion cards are required. (These may be purchased singly if required. For example if 32K is sufficient for your initial needs).

The microcomputer cards plug into the Custom 80 Micro Bus circuit board which is mounted in the high quality Custom 80 rack, which is in turn fitted with a case conversion kit or a good looking instrument case.

For high speed machine code work the CSYS operating system has been designed to allow maximum use to be made by the user's own programs, of the various subroutines and utilities contained in the firmware.

Programs can be stored using named files on cassette. The dual cassette interface interface facilities for an RS232C or 20 mA current loop to drive a printer. The band rate is software selectable between 300 and 2400 baud. The card also has a Z80A counter timer circuit.

For users who would prefer to write programs in BASIC there is a 4K integer BASIC supplied on cassette tape. It includes commands for setting colour, black and white, graphics etc. PLOT (a plot), draw (a line), erase (a line) etc. A 12K Custom 80 BASIC is in development and this will be produced in both interpreting and compiling versions.

Also in development is an interface to floppy disks (and disk operating systems).

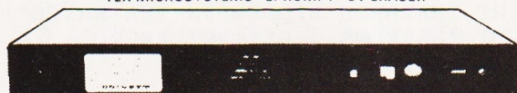
If you are working on a tight budget, the various kits of parts can be purchased one at a time, prices range from £34.09 (for the Micro Bus kit with 5 connectors) or £43.22 (for the CPU kit) up to £74.55 (for the colour VDU kit).

Send for more details (a large SAE is not essential but helps us) and a comprehensive Custom 80 price list.

### NEW RELEASE

We are now able to sell the bare PCB's without the components but including full documentation, Custom 80 CPU £18.83, Custom 80 KBP £19.39, Custom 80 Micro Bus £13.87, Custom 80 32K RAM £21.25, Custom 80 VDU £23.70. Ask us for details of Bare Boards for Custom 80 System.

## TEX MICROSYSTEMS "EPROMPT" UV ERASER



A low-cost alternative to the above erasers (UV 140 141) claimed by the manufacturer to erase up to 32 chips in 15-30 mins. This is the cheapest eraser we have seen. The unit has no timer, power switch or safety interlock switch. The user places up to 32 chips into loose conducting foam in the erasure tray (16 along the base, 8 on each side). The chips are held in place by the UV tube which sits in the tray. (Unlike the UV 140 141, no precautions have been taken to prevent the seepage of UV light, but the manufacturer states that incident light from this device is quite safe at distances above 12 inches (Dimensions - 325 x 64 x 38mm) EPROMPT ERASER Price £33

## MODULAR COMPUTER SYSTEM CARDS

A range of International 1114 x 203mm size cards which may be purchased individually as desired or to build up a complete system. Further details available on request. All boards are epoxy glass with gold plated edge plug.

VDUA 8 B (512K)	£27.20
SC MP PSC MP CPU	£9.40
MFA 7 B (128K) SC MP CPU	£9.40
M2B 3 280 CPU	£9.40
MXA 1 2K of 2102	£9.40
MXA 3 8K of 2114	£9.40
MXD 2 16K of 4141	£9.40
PRM 2 4K of 5704	£9.40
PRM 8 8K of 2708	£9.40
RRM 14 8K of 2516 6K of 2114	£14.95
SIO 2 RS 232 (two)	£9.40
TPA 2 Tape Interface	£9.90
IP 2 In/Out Port	£9.90
DLR 6 Keyboard Input	£9.90
OP 3 Output Port	£9.40
PP 2 PROM Programmer	£9.40
PSJ 4 Player SIO	£9.90
11 Slot board (can be used with most of the above boards 13 - 41) ISBUS 11	£11.50

## UV 141, UV ERASER

Two easy-to-use units designed for both the professional and amateur UV-prom user.

### Features

- Can erase up to 14 proms.
- Special shortwave ultra-violet tube.
- Erase time variable between 5 and 50 minutes in 5 minute steps (preventing over exposure which may shorten prom life).
- Sliding tray carries proms on conducting foam.
- Safety interlock switch prevents the timing circuit from operating and switching on the tube with the tray open.
- Mains On and Tube On indicators.
- Smart textured case.
- Complete instructions supplied.

Supplied complete with mains plug and flex.

Model UV 141 - Price £77.70

Also available without timer as Model UV 140 - Price £61.20

## TRANSISTORS

BC 107/8/9	10p
BC 177	20p
BC 213L	10p
BC 461	34p
BC 548	14p
2N 3703/4/5/6	10p
2N 3820	45p
TIP 2955	60p
TIP 3055	60p

## DIODES

IN 4148	4p
IN 4001/2	5p
IN 4003/4/5	5p
IN 5401	15p
IA BRIDGE 150V	22p

## T.V. MONITOR P.C.B. for OEM users

This is an assembled P.C.B. size 130 x 190mm, which you add to your own 12" 14" black and white C.R.T. (90 degree, 20mm dia. neck). To obtain a T.V. monitor at modest cost. (Regrettably we cannot supply the C.R.T. at present).

Presets controls, contrast brightness, etc. are included, and the only inputs needed are 15 Volts 100 mA AC at 1.5 Amps and 1 Volt pk to pk composite video input.

Supplied with circuit diagram. £33.50

## KEYBOARD CAGES

405 x 210mm Panel size 330 x 188mm	£10.14
510 x 340mm Panel size 430 x 115mm	£26.22

## SIL RESISTORS

7 x 10K (8 pin)	42p
8 x 10K (9 pin)	46p
8 x 4K7 (9 pin)	46p
8 x 1K (9 pin)	46p

## DIL RESISTORS

¼ W 33R (16 pin)	62p
------------------	-----

## RESISTORS

Carbon film, high stability

1/10W E12 range 2p each

100 of one value £1.00

## CERAMIC CAPACITORS

10pF, 15pF, 22pF, 33pF, 47pF, 68pF, 100pF, 150pF, 220pF, 470pF, 1n5F, 2n2F, 3n3F, 4n7F, 6n8F, 10nF all at	4p each
15nF, 22nF, 47nF at	5p each
100nF at	7p

## EUROCARD 19" CARD FRAME

Kit of 2 and plates + angles. 2 front and 2 rear tie bars. 4 guide location strips

Accessories

Card guides (pack of 10)

Connector mounting strips (pair)

Case conversion kit (or fit into separate 3U 19" D-type case)

DIN 41612 Eurocard Connectors

64 way Plug rows a+c (64/96)	£2.22
64 way Socket rows a+c (64/96)	£3.39
64 way Plug rows a+b (64/64)	£2.71
64 way Socket rows a+b (64/64)	£4.24

## CMOS

These cut prices for Amateur Users and Export. Note industrial users quantity prices available. Mostly Motorola, RCA

4000 14p	4042 60p	4093 43p	4409 £7.90	4530 70p
4001 14p	4043 70p	4094 £1.68	4410 £7.20	4531 £1.30
4002 14p	4044 65p	4095 90p	4411 £6.95	4532 £1.10
4006 65p	4045 £1.70	4096 90p	4412V £8.00	4534 £5.00
4007 18p	4046 75p	4097 £3.20	4415V £4.80	4536 £2.95
4008 62p	4047 75p	4098 88p	4422 £5.66	4537 £2.10
4009 35p	4048 55p	4099 95p	4433 £7.70	4538 £1.15
4010 40p	4049 50p	4100 £1.92	4435V £5.40	4539 £1.15
4011 15p	4050 30p	4101 £1.30	4450 £3.50	4541 £1.19
4012 18p	4051 78p	4102 £1.80	4461 £3.93	4543 £1.35
4013 31p	4052 78p	4103 £1.75	4462 £4.41	4549 £3.95
4014 75p	4053 78p	4104 95p	4490PP £3.50	4552 £14.85
4015 66p	4054 £1.25	4105 £1.15	4490VP £3.14	4553 £2.99
4016 32p	4055 £1.25	4106 75p	4500 £6.75	4554 £1.38
4017 48p	4056 £1.20	4107 60p	4501 29p	4555 50p
4018 68p	4059 £4.80	4108 £4.50	4502 £1.20	4556 55p
4019 42p	4060 20p	4109 £1.00	4503 70p	4557 £3.20
4020 91p	4061 £9.95	4110 £3.00	4505 £5.71	4558 £1.20
4021 70p	4063 99p	4114 £1.77	4506 50p	4559 £3.95
4022 66p	4066 36p	4116 £1.54	4507 40p	4560 £1.80
4023 20p	4067 £3.99	4117 £1.54	4508 £2.65	4561 81p
4024 45p	4068 22p	4162 £1.54	4510 68p	4562 £4.95
4025 19p	4069 20p	4163 £1.54	4511 68p	4566 £1.59
4026 £1.30	4070 26p	4164 £1.54	4512 75p	4566 £2.38
4027 43p	4071 26p	4165 £5.03	4513 75p	4567 £1.75
4028 88p	4072 20p	4182 £1.90	4514 £1.95	4572 36p
4029 77p	4073 20p	4192 £2.41	4515 £1.98	4580 £4.60
4030 50p	4075 20p	4193 £2.41	4516 75p	4581 £2.50
4031 £1.70	4076 60p	4194 £1.05	4517 £4.15	4582 99p
4032 £1.25	4077 26p	4208 £7.54	4518 42p	4583 90p
4033 £1.65	4078 26p	4207 £2.31	4519 29p	4584 48p
4034 £1.95	4081 26p	4190 85p	4520 £2.44	4587 75p
4035 91p	4082 26p	4161 99p	4521 £2.00	4598 £2.90
4037 £1.15	4085 21p	4162 99p	4522 £1.11	4599 £5.95
4038 £1.10	4085 65p	4163 99p	4526 95p	4700 £1.75
4039 £2.79	4086 65p	4174 99p	4527 £1.15	ICM7038A £4.25
4040 59p	4086 70p	4175 £1.05	4528 80p	
4041 78p	4089 £1.40	4194 £1.05	4529 £1.30	

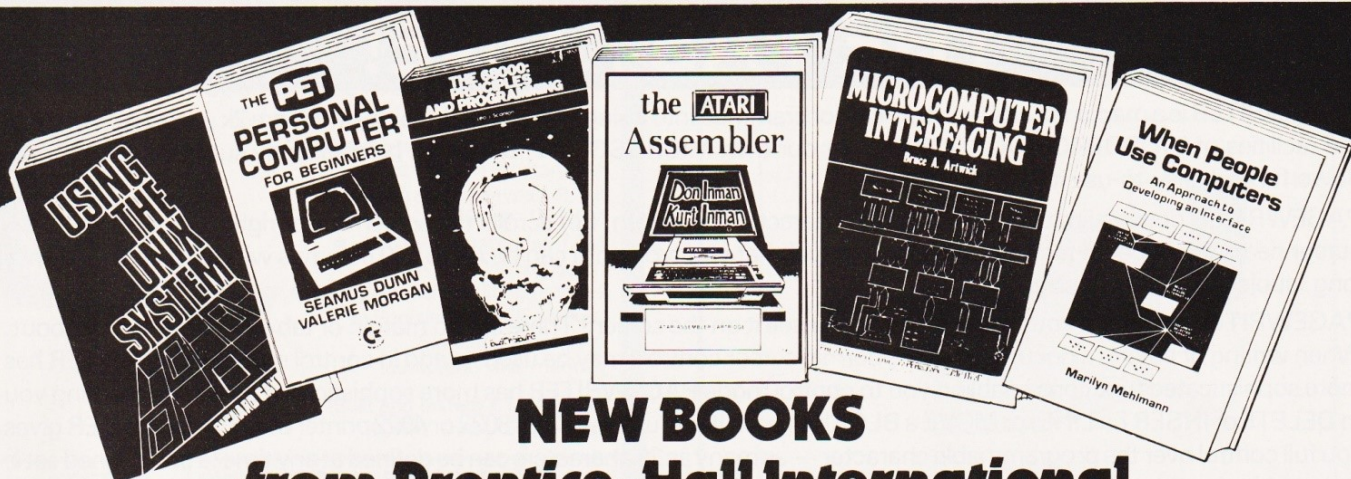
## 74C

74C00 28p	74C76 57p	74C163 £1.15	74C904 57p	74C926 £5.99
74C02 28p	74C83 £1.34	74C164 £1.60	74C905 £7.53	74C927 £5.99
74C04 28p	74C85 £1.34	74C165 £1.08	74C906 57p	74C928 £5.99
74C08 28p	74C89 £4.62	74C174 93p	74C908 £1.00	74C929 £17.90
74C10 28p	74C90 89p	74C175 93p	74C909 £1.69	74C930 £17.90
74C12 28p	74C93 90p	74C192 £1.15	74C909 £1.69	
74C14 28p	74C99 £1.06	74C193 £1.15	74C910 £7.45	80C95 85p
74C16 30p	74C107 £1.27	74C195 £1.00	74C912 £7.39	80C96 92p
74C20 28p	74C150 £3.81	74C200 £7.45	74C914 £1.45	80C97 85p
74C22 28p	74C151 £2.51	74C201 £1.41	74C915 £1.15	80C98 92p
74C28 28p	74C154 £3.81	74C373 £1.79	74C918 £1.15	80C99 £6.20
74C32 28p	74C157 £2.29	74C374 £1.79	74C921 £17.07	80C99 £6.20
74C38 £1.43	74C160 £1.40	74C901 57p	74C922 £3.78	88C30 £2.90
74C42 95p	74C161 £1.15	74C902 79p	74C923 £5.49	
74C48 £1.43	74C162 £1.15	74C903 57p	74C925 £5.99	

## 74LS

74LS00	12p	74LS63	£1.50	74LS151	39p	74LS243	85p	74LS367	37p
74LS01	13p	74LS73	25p	74LS153	39p	74LS244	80p	74LS368	66p
74LS02	14p	74LS74	25p	74LS154	£1.70	74LS245	£1.18	74LS373	75p
74LS03	14p	74LS76	20p	74LS155	39p	74LS247	40p	74LS374	75p
74LS04	15p	74LS02	14p	74LS156	39p	74LS248	65p	74LS375	48p
74LS05	15p	74LS03	14p	74LS157	35p	74LS249	68p	74LS377	90p
74LS06	15p	74LS04	15p	74LS158	36p	74LS251	40p	74LS378	65p
74LS07	15p	74LS05	15p	74LS160	41p	74LS153	40p	74LS379	65p
74LS08	15p	74LS06	15p	74LS161	41p	74LS154	40p	74LS380	62p
74LS09	15p	74LS07	15p	74LS162	41p	74LS155	40p	74LS381	62p
74LS10	15p	74LS08	15p	74LS163	41p	74LS156	40p	74LS382	62p
74LS11	15p	74LS09	15p	74LS164	48p	74LS157	40p	74LS383	62p
74LS12	15p	74LS10	15p	74LS165	39p	74LS158	40p	74LS384	62p
74LS13	30p	74LS11	15p	74LS166	85p	74LS159	40p	74LS385	62p
74LS14	48p	74LS12	15p	74LS167	85p	74LS160	40p	74LS386	62p
74LS15	15p	74LS13	30p	74LS168	85p	74LS161	40p	74LS387	62p
74LS16	15p	74LS14	48p	74LS169	85p	74LS162	40p	74LS388	62p
74LS17	15p	74LS15	15p	74LS170	£1.70	74LS163	40p	74LS389	62p
74LS18	15p	74LS16	15p	74LS171	72p	74LS164	40p	74LS390	62p
74LS19	15p	74LS17	15p	74LS172	72p	74LS165	40p	74LS391	62p
74LS20	15p	74LS18	15p	74LS173	72p	74LS166	40p	74LS392	62p
74LS21	15p	74LS19	15p	74LS174	72p	74LS167	40p	74LS393	62p
74LS22	15p	74LS20	15p	74LS175	58p	74LS168	40p	74LS394	62p
74LS23	15p	74LS21	15p	74LS176	58p	74LS169	40p	74LS395	62p
74LS24	15p	74LS22	15p	74LS177	58p	74LS170	40p	74LS396	62p
74LS25	15p	74LS23	15p	74LS178	58p	74LS171	40p	74LS397	62p
74LS26	15p	74LS24	15p	74LS179	58p	74LS172	40p	74LS398	62p
74LS27	15p	74LS25	15p	74LS180	58p	74LS173	40p	74LS399	62p
74LS28	15p	74LS26	15p	74LS181	58p	74LS174	40p	74LS400	62p
74LS29	15p	74LS27	15p	74LS182	58p	74LS175	40p	74LS401	62p
74LS30	15p	74LS28	15p	74LS183	£2.75	74LS176	40p	74LS402	62p
74LS31	15p	74LS29	15p	74LS184	£2.75	74LS177	40p	74LS403	62p
74LS32	15p	74LS30	15p	74LS185	£2.75	74LS178	40p	74LS404	62p
74LS33	16p	74LS31	15p	74LS186	£2.75	74LS179	40p	74LS405	62p
74LS34	16p	74LS32	15p	74LS187	£2.75	74LS180	40p	74LS406	62p
74LS35	16p	74LS33	16p	74LS188	£2.75	74LS181	40p	74LS407	62p
74LS36	16p	74LS34	16p	74LS189	£2.75	74LS182	40p	74LS408	62p
74LS37	16p	74LS35	16p	74LS190	£2.75	74LS183	40p	74LS409	62p
74LS38	16p	74LS36	16p	74LS191	£2.75	74LS184	40p	74LS410	62p
74LS39	16p	74LS37	16p	74LS192	£2.75	74LS185	40p	74LS411	62p
74LS40	16p	74LS38	16p	74LS193	£2.75	74LS186	40p	74LS412	62p
74LS41	16p	74LS39	16p	74LS194	£2.75	74LS187	40p	74LS413	62p
74LS42	35p	74LS40	16p	74LS195	£2.75	74LS188	40p	74LS414	62p
74LS43	35p	74LS41	16p	74LS196	£2.75	74LS189	40p	74LS415	62p
74LS44	35p	74LS42	35p	74LS197	£2.75	74LS190	40p	74LS416	62p
74LS45	35p	74LS43	35p	74LS198	£2.75	74LS191	40p	74LS417	62p
74LS46	35p	74LS44	35p	74LS199	£2.75	74LS192	40p	74LS418	62p
74LS47	35p	74LS45	35p	74LS200	£2.75	74LS193	40p	74LS419	62p
74LS48	80p	74LS46	35p	74LS201	£2.75	74LS194	40p	74LS420	62p
74LS49	80p	74LS47	35p	74LS202	£2.75	74LS195	40p	74LS421	62p
74LS50	80p	74LS48	80p	74LS203	£2.75	74LS196	40p	74LS422	62p
74LS51	15p	74LS49	80p	74LS204	£2.75	74LS197	40p	74LS423	62p
74LS52	15p	74LS50	80p	74LS205	£2.75	74LS198	40p	74LS424	62p
74LS53	15p	74LS51	15p	74LS206	£2.75	74LS199	40p	74LS425	62p
74LS54	15p	74LS52	15p	74LS207	£2.75	74LS200	40p	74LS426	62p
74LS55	15p	74LS53	15p	74LS208	£2.75	74LS201	40p	74LS427	62p
74LS56	15p	74LS54	15p	74LS209	£2.75	74LS202	40p	74LS428	62p
74LS57	15p	74LS55	15p	74LS210	£2.75	74LS203	40p	74LS429	62p
74LS58	15p	74LS56	15p	74LS211	£2.75	74LS204	40p	74LS430	62p
74LS59	15p	74LS57	15p	74LS212	£2.75	74LS205	40p	74LS431	62p
74LS60	15p	74LS58	15p	74LS213	£2.75	74LS206	40p	74LS432	62p
74LS61	15p	74LS59	15p	74LS214	£2.75	74LS207	40p	74LS433	62p
74LS62	15p	74LS60	15p	74LS215	£2.75	74LS208	40p	74LS434	62p
74LS63	15p	74LS61	15p	74LS216	£2.75	74LS209	40p	74LS435	62p
74LS64	15p	74LS62	15p	74LS217	£2.75	74LS210	40p	74LS436	62p
74LS65	15p	74LS63	15p	74LS218	£2.75	74LS211	40p	74LS437	62p
74LS66	15p	74LS64	15p	74LS219	£2.75	74LS212	40p	74LS438	62p
74LS67	15p	74LS65	15p	74LS220	£2.75	74LS213	40p	74LS439	62p
74LS68	15p	74LS66	15p	74LS221	£2.75	74LS214	40p	74LS440	62p
74LS69	15p	74LS67	15p	74LS222	£2.75	74LS215	40p	74LS441	62p
74LS70	15p	74LS68	15p	74LS223	£2.75	74LS216	40p	74LS442	62p
74LS71	15p	74LS69	15p	74LS224	£2.75	74LS217	40p	74LS443	62p
74LS72	15p	74LS70	15p	74LS225	£2.75	74LS218	40p	74LS444	62p
74LS73	15p	74LS71	15p	74LS226	£2.75	74LS219	40p	74LS445	62p
74LS74	15p	74LS72	15p	74LS227	£2.75	74LS220	40p	74LS446	62p
74LS75	15p	74LS73	15p	74LS228	£2.75	74LS221	40p	74LS447	62p
74LS76	15p	74LS74	15p	74LS229	£2.75	74LS222	40p	74LS448	62p
74LS77	15p	74LS75	15p	74LS230	£2.75	74LS223	40p	74LS449	62p
74LS78	15p	74LS76	15p	74LS231	£2.75	74LS224	40p	74LS450	62p
74LS79	15p	74LS77	15p	74LS232	£2.75	74LS225	40p	74LS451	62p
74LS80	15p	74LS78	15p	74LS233	£2.75	74LS226	40p	74LS452	62p
74LS81	15p	74LS79	15p	74LS234	£2.75	74LS227	40p	74LS453	62p
74LS82	15p	74LS80	15p	74LS235	£2.75	74LS228	40p	74LS454	62p
74LS83	15p	74LS81	15p	74LS236	£2.75	74LS229	40p	74LS455	62p
74LS84	15p	74LS82	15p	74LS237	£2.75	74LS230	40p	74LS456	62p
74LS85	15p	74LS83	15p	74LS238	£2.75	74LS231	40p	74LS457	62p
74LS86	15p	74LS84	15p	74LS239	£2.75	74LS232	40p	74LS458	62p
74LS87	15p	74LS85	15p	74LS240	£2.75	74LS233	40p	74LS459	62p
74LS88	15p	74LS86	15p	74LS241	£2.75	74LS234	40p	74LS460	62p
74LS89	15p	74LS87	15p	74LS242	£2.75	74LS235	40p	74LS461	62p
74LS90	15p	74LS88	15p	74LS243	£2.75	74LS236	40p	74LS462	62p
74LS91	15p	74LS89	15p	74LS244	£2.75	74LS237	40p	74LS463	62p
74LS92	15p	74LS90	15p	74LS245	£2.75	74LS238	40p	74LS464	62p
74LS93	15p	74LS91	15p	74LS246	£2.75	74LS239	40p	74LS465	62p
74LS94	15p	74LS92	15p	74LS247	£2.75	74LS240	40p	74LS466	62p
74LS95	15p	74LS93	15p	74LS248	£2.75	74LS241	40p	74LS467	62p
74LS96	15p	74LS94	15p	74LS249	£2.75	74LS242	40p	74LS468	62p
74LS97	15p	74LS95	15p	74LS250	£2.75	74LS243	40p	74LS469	62p
74LS98	15p	74LS96	15p	74LS251	£2.75	74LS244	40p	74LS470	62p
74LS99	15p	74LS97	15p	74LS252	£2.75	74LS245	40p	74LS471	62p
74LS00	12p	74LS98	15p	74LS253	£2.75	74LS246	40p	74LS472	62p
74LS01	13p	74LS99	15p	74LS254	£2.75	74LS247	40p	74LS473	62p
74LS02	14p			74LS255	£2.75	74LS248	40p	74LS474	62p
74LS03	14p			74LS256	£2.75	74LS249	40p	74LS475	62p
74LS04	15p			74LS257	£2.75	74LS250	40p	74LS476	62p
74LS05	15p			74LS258	£2.75	74LS251	40p	74LS477	62p
74LS06	15p			74LS259	£2.75	74LS252	40p	74LS478	62p
74LS07	15p			74LS260	£2.75	74LS253	40p	74LS479	62p
74LS08	15p			74LS261	£2.75	74LS254	40p	74LS480	62p
74LS09	15p			74LS262	£2.75	74LS255	40p	74LS481	62p
74LS10	15p			74LS263	£2.75	74LS256	40p	74LS482	62p
74LS11	15p			74LS264	£2.75	74LS257	40p	74LS483	62p
74LS12	15p			74LS265	£2.75	74LS258	40p	74LS484	62p
74LS13	30p			74LS266	£2.75	74LS259	40p	74LS485	62p
74LS14	48p			74LS267	£2.75	74LS260	40p	74LS486	62p
74LS15	15p			74LS268	£2.75	74LS261	40p	74LS487	62p
74LS16	15p			74LS269	£2.75	74LS262	40p	74LS488	62p
74LS17	15p			74LS270	£2.75	74LS263	40p	74LS489	62p
74LS18	15p			74LS271	£2.75	74LS264	40p	74LS490	62p
74LS19	15p			74LS272	£2.75	74LS265	40p	74LS491	62p
74LS20	15p			74LS273	£2.75	74LS266	40p	74LS492	62p
74LS21	15p			74LS274	£2.75	74LS267	40p	74LS493	62p
74LS22	15p			74LS275	£2.75	74LS268	40p	74LS494	62p
74LS23	15p			74LS276	£2.75	74LS269	40p	74LS495	62p
74LS24	15p			74LS277	£2.75	74LS270	40p	74LS496	62p
74LS25	15p			74LS278	£2.75	74LS271	40p	74LS497	62p
74LS26	15p			74LS279	£2.75	74LS272	40p	74LS498	62p
74LS27	15p			74LS280	£2.75	74LS273	40p	74LS499	62p
74LS28	15p	</							





## NEW BOOKS from Prentice-Hall International

### new Sams books

#### Applesoft Language

Brian and George Blackwood

Written specifically for Apple II microcomputers using microsoft language, this practical book covers each aspect of programming step-by-step from a basic level to advanced techniques.

☐ £7.65 paperback 254 pages 672-21811-9

#### Intimate Instructions in Integer BASIC

Brian and George Blackwood

Although designed for the Apple II user, this book is suitable, with modifications, for any microcomputer using the BASIC language. Sorting, flowcharting, graphics, loops, functions and variables are covered.

☐ £5.55 paperback 158 pages 672-21812-7

#### Microcomputer Dictionary: 2nd Edition

Charles J. Sippl

All definitions have been carefully reviewed in the new edition of this popular reference book. Over 100 line-drawings and photographs illustrate the entries.

☐ £11.15 paperback 606 pages 672-21696-5

#### The 68000: Principles and Programming

Leo J. Scanlon

A comprehensive introduction to one of the most powerful new 16-bit microprocessors, the Motorola 68000.

☐ £10.45 paperback 238 pages 672-21853-4

#### TRS-80—More than BASIC

J. P. Froelich

☐ £6.95 paperback c. 224 pages 672-21813-5

### new Prentice-Hall books

#### The Atari® Assembler

Don and Kurt Inman

This practical book gives detailed instructions for using the Atari Assembler Cartridge for novices with some knowledge of BASIC programming.

☐ £7.45 paperback 270 pages 8359-0236-6

#### The PET Personal Computer for Beginners

Seamus Dunn and Valerie Morgan

A step-by-step introduction to the Commodore PET for beginners with no experience of computers.

☐ £7.50 hardback 256 pages 13-661835-9

☐ £4.95 paperback 13-661827-8

#### Using the UNIX System

Richard Gauthier

This full description of the UNIX operating system discusses hierarchical file system, asynchronous processing, over 100 subsystems and utilities, and languages such as FORTRAN 77, FORTRAN VI, Pascal, BASIC and C.

☐ £14.20 hardback 298 pages 8539-8164-9

#### Microcomputer Interfacing

Bruce Artwick

*"this book is a good, broad introduction to the interfacing problem."*

Electronics and Power

☐ £18.70 hardback 320 pages 13-580902-9

#### When People Use Computers:

#### An Approach to Developing an Interface

Marilyn Mehlmann

A comprehensive guide to developing computer systems that can be used by non-data processing personnel.

☐ £11.25 hardback 160 pages 13-956219-2

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

### Book Orders

*These books can be ordered from your bookseller or in case of difficulty from:*

Department 30,  
Prentice-Hall International,  
66 Wood Lane End, Hemel Hempstead,  
Hertfordshire HP2 4RG, England.

*Please mark the number of books you wish to order in the boxes beside each title and return the advertisement to the address above.*

Name \_\_\_\_\_

Address \_\_\_\_\_

I enclose a cheque/P.O. for £ \_\_\_\_\_

Please add 75p per book for postage and packing. Payment should be made out to **INTERNATIONAL BOOK DISTRIBUTORS**. Please allow 28 days for delivery.

CT1

Prentice/Hall  International



# THE FAST ONE!

PAGEWRITER is a machine code word processor crammed into a single 2k chip! Obviously in a mere 2k we could'nt fit all of the facilities of WORDPRO, WORDCRAFT, or our own MICROSCRIPT, but you'll be pleasantly surprised to find how powerful and easy-to-use it is!

PAGEWRITER doesn't limit you to a 40 or 80 character line length, but scrolls the screen left or right, up or down as the cursor nears the edge. In fact, the electronic 'page' that you type onto can be up to 240 columns wide and up to 191 lines long (subject to memory size).

PAGEWRITER prints out your text exactly as you see it on the screen! There are no margin or tab settings to worry about. When writing or editing a document all the normal cursor controls may be used — and in control mode PAGEWRITER has more sophisticated functions enabling you to control mode PAGEWRITER has more sophisticated functions enabling you to DELETE or INSERT a LINE, or MOVE a BLOCK of text. If you use the CBM 3022 or 4022 printer then PAGEWRITER gives you full control over the programmable character — as many as 26 characters can be defined at any time (a pre-defined set is included in the chip).

When you've finished writing you can SAVE text to cassette or disk. The whole thing is really so amazingly simple that you'll wonder why nobody thought of it before! And remember, because PAGEWRITER is written entirely in 6502 machine code it's FAST!

PAGEWRITER is available to fit in any spare ROM socket of an 8, 16 or 32k PET with New Roms or Basic 4 (please state socket & model when ordering). And the best thing of all is the price, just £45 plus VAT!

**P.S.** PAGEWRITER is also available in a 4k chip with ARROW, the chip that can LOAD, SAVE, VERIFY and APPEND at 6 to 7 times normal speed. ARROW on its own is £30 plus VAT, the two together cost £75 plus VAT.

## PET AIDS

SUPERSORT (£40) heads the list of new utilities in our latest catalogue. Whereas MULTISORT (£25) will sort a string array and move a number of other string arrays around in parallel, SUPERSORT handles numeric arrays too, and will sort on one field within another all the way down the line.

DISK SEARCH 2 (£40) is an improved version of another powerful utility. If you need to search a RELATIVE FILE all you have to do is put the strings you are looking for into an array — then call up DISK SEARCH 2. You can request records that contain ANY ONE of the strings sought — or just those that contain ALL of them. Why buy a database program when with DISK SEARCH 2 you can design your own?

MAKRO DISASSEMBLER (£25) is a true disassembler — it will take a machine code program apart and turn it into ASSEMBLER SOURCE CODE complete with labels! If you own MAKRO ASSEMBLER (£50) you can then make changes and re-assemble the code — just as if it was one of your own programs! And we've developed a special version of MAKRO with a find-and-replace facility that you'll find particularly useful (put in your own labels etc). MAKRO-XR is available as an upgrade to the standard MAKRO at a cost of just £10.

## DISKS ETC!

VERBATIM double-density 40-track	£18.00
VERBATIM double-density 77-track	£25.00
ACCUTRACK double-density 40-track	£16.00
Ribbons for CBM 3022/Epson TX80	3 for £1.80
Cartridge for CBM 4022/Epson MX80	£10.00
Refill for above	3 for £9.00
Disk library cases (hold 10 disks)	£2.75
Disk storage pages (hold 2 disks)	£0.50
Dustcover for small screen PET/CBM	£4.50
Dustcover for large screen PET/CBM	£5.75
Dustcover for 3022/4022/3040/4040/8050	£3.50
PET to IEEE 2-metre cable	£32.00
IEEE to IEEE 2-metre cable	£32.00
Perspex green screen for PET	£7.50
As above, for large screen models	£12.50
Cassette cleaner & demagnetiser kit	£7.50
Basic 4.0 Commodore Users Manual	£5.00
Power on/error indicator 3040/4040	£17.50
PET REVEALED or LIBRARY OF SUBROUTINES	£10.00
PET GRAPHICS (book) £12.00 (disk)	£10.00
PETMASTER SUPERCHIP (state model)	£45.00
ARROW fast loading chip (state model)	£30.00

## PET GAMES

SUPER GLOOPER, METEORTITES 8k	each £8.00
ASTEROIDS, SPACE RESCUE 8k	each £8.00
HITCH-HIKERS GUIDE TO THE GALAXY 32k	£16.00
CRACKS OF DOOM (Lord of the Rings) 32k	£16.00
HALLS OF DEATH 16k	£14.00

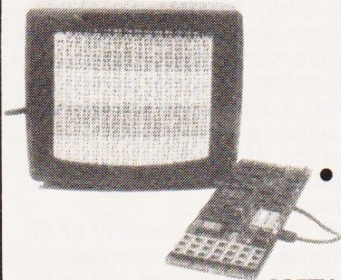
# SUPERSOFT

First Floor, 10-14 Canning Road, Wealdstone,  
Harrow, Middlesex, HA3 7SJ, England  
Telephone: 01-861 1166



## SOFTY SYSTEMS

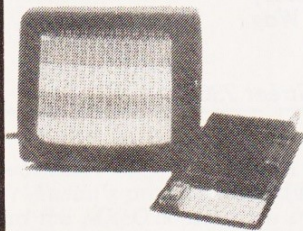
### SOFTY 1 – LOW COST 2704/2708 PROGRAMMER



- Direct output to T.V. • High speed cassette interface • On card EPROM Programmer
- Multifunction keypad • 1k Monitor in 2708 • 1K RAM
- 128 byte scratchpad TAM • 1K EPROM Emulation
- Comprehensive editing facilities
- Supplied with ZIF socket, Simulator cable, and comprehensive manual.

SOFTY 1 (Built and tested) £120 + VAT  
SOFTY 1 PSU £20 + VAT

### SOFTY 2 – LOW COST 2716 PROGRAMMER



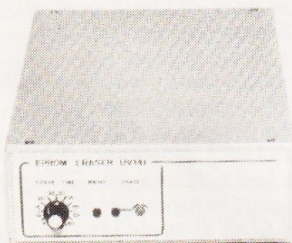
- Direct output to T.V. • High speed cassette interface • On card EPROM Programmer
- Multifunction touch keypad
- 2K Monitor in 2716 • 2K RAM
- 128 byte scratchpad RAM
- 2K EPROM Emulation • Can program 2732/2532 in two halves
- Editing facilities including — Data entry, Block shift, Block store, Match byte, Displacement calculation • Supplied with ZIF socket, Simulator cable, comprehensive manual, Antistatic foam lined EPROM tray and PSU

SOFTY 2 (Built and tested) £169 + VAT

### EPROM ERASERS

#### MODEL UV141

- Fast erase times (typically 20 minutes for 2716 EPROM)
  - 14 EPROM capacity
  - Built-in 5-50 minute electronic timer
  - Safety interlocked to prevent eye and skin damage
  - Convenient slide-tray loading of devices
  - MAINS and ERASE indicators
  - Rugged construction
- Priced at only £78 + VAT



#### MODEL UV140

Similar to Model UV141 but without timer  
Low price at only £61.50 + VAT

### EPROMS

	1-25	25-99	100 +
2708	2:80	2:60	2:40
2716	2:80	2:60	2:40
2732	6:50	5:75	4:95

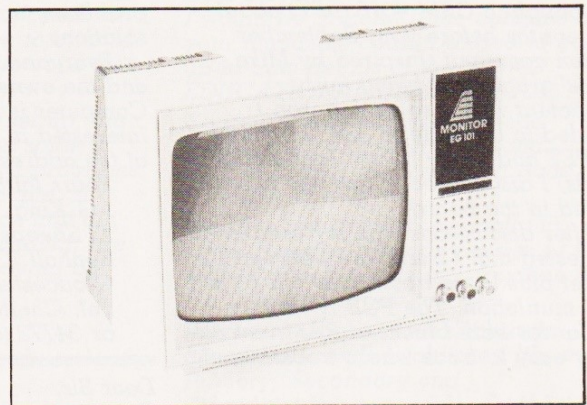
VAT SHOULD BE ADDED TO ALL PRICES

ALL ITEMS IN STOCK: PLEASE WRITE OR PHONE FOR FURTHER DETAILS

**GP Industrial Electronics Ltd**

Unit E, Huxley Close, Newnham Industrial Estate, Plymouth PL7 4JN. Tel: (0752) 332961/332962.

Black. White or Green, Precision engineered video monitors.



Black. White or Green, Precision engineered video monitors, with a 12" screen accepting standard 1.4V P-P inputs at 75 ohms.

Solid state and reliable.

Black/white

the EG100 at £69 plus VAT

Green

the EG101 at £79 plus VAT

# LOWE

## electronics

Chesterfield Road, Matlock,  
Derbyshire DE4 5LE  
Telephone: 0629 4995.

Telex: 377482 Lowlec G.

Trade enquiries welcome.



Dear Sir,

I bought a CBM 4016 (PET) about two months before your September edition came out. Inspired by Mike James' article and being fairly competent with a soldering iron I decided to upgrade to 32K. I opened my PET and to my horror (and naughty words) I discovered four 6 mm holes drilled in the board.

After discussions with my retailer he suggested that I hard wire between IC socket pins those tracks affected by the PCB mutilation. The PCB is very similar for both blocks of RAM and it is fairly easy to trace where tracks should go.

I did this and for a grand total cost of £11 I now have a 32K PET — Take that, Commodore!

If this is a typical Commodore sales technique beware all ye potential VIC owners.

Yours sincerely,  
J R Appleby  
Durham.

Dear Sir,

Recent changes in the use of our clubroom have meant that the Cornish Radio Amateur Club's Computer Section now meets on a different evening to that previously published. The time is now 7.30 pm at the SWEB Social Clubroom, Poole, Redruth on the third Monday of each month. New members are welcome and should contact me at 24 Mitchell Road, Camborne, Cornwall TR14 7JH.

Yours faithfully,  
Bob Reasons.

Dear Sir,

Your readers in the Aylesbury area might be interested to learn of the formation of the Aylesbury ZX Computer Club. The club plans to hold regular meetings at Aylesbury College on the first Tuesday of each month at 7.30 pm. While the club is based on the Sinclair micros, anyone interested in microcomputing is welcome to attend.

For further details contact me on Aylesbury 630867, or just come along to the next meeting.

Yours faithfully,  
David Nowotnik  
12 Long Plough  
Aston Clinton  
Aylesbury, Bucks.

Dear Sir,

We are pleased to announce the formation of a local Apple Microcomputer User Group. The Group will serve the Cotswold Area and will meet at a venue yet to be decided.

The purpose of the meetings will be to exchange ideas and expertise and to enable us all to get more from our computers. There will be an

opportunity to mull over any mutual problems, and, hopefully, find the solutions.

Everyone is welcome to come along and the ownership of an Apple Computer is not essential. Those interested in joining should contact me at the address below.

Yours faithfully,  
J G King  
11 Sheepscombe Close  
Benhall, Cheltenham  
Gloucestershire GL51 6BE  
Tel: Cheltenham 37808  
or 34772 (evenings)

Dear Sir,

Sometimes when programming the ZX80/1, it can be useful to be able to skip some program lines in order to check other lines.

A simple way to do this is to call down the line to be skipped, by using EDIT, index the cursor to the right until it is between the line number and the keyword, and enter REM. Newline will return the line to its place in the listing, but it will now be a REM statement and ignored when the program is RUN.

To re-enter the line to RUN in program, all that is necessary is to EDIT the line by rubbing out the REM.

Hardware enthusiasts of the ZX80 may be interested to note that IC12 pin 12 is connected to pin 2 of IC13, a point not marked in the published Sinclair circuit diagram — this is relevant to my article 2K EXTRA in the May issue, where IC13 pin 1 should be used instead of IC12.

Yours faithfully,  
N J Petry  
Weston-super-Mare.

Dear Sir,

I am writing to inform you of details of the Nottingham Micro-Computer Club, which is now about two years old. A mention of our club's activities would be welcomed or, when next you publish a list of similar clubs, we would ask to be included.

The club caters for those of all ages and levels of experience who are interested in or work with microcomputers, and we arrange regular lectures by visiting speakers. Meetings are held at 7.30 pm on the first Tuesday in most months, at the Friends Meeting House, Clarendon Street, Nottingham.

The subscription is £5 per 12-month period from the date of joining, with reductions for students and OAPs. Non-members, for whom a 50p entrance fee is charged, are welcome. Present membership is in excess of 100 and rising.

Yours faithfully,  
G Jago  
Press and Publicity Officer  
1 Lucknow Avenue  
Mapperley Park  
Nottingham NG3 5AZ  
Tel. (0602) 621453.

Dear Sir,

Would you kindly mention the West Herts 80 Users Group in your columns. Formed in January of this year we currently number 30. Membership is not restricted to Hertfordshire residents and many of our group are also members of the 'Harpenden Microcomputer Group' or the 'TRS-80 National Users Group'.

Meetings are held fortnightly at St Stephens Parish Centre located at Station Road, Bricket Wood just north of Watford.

New members of all ability levels will be warmly welcomed, including those who are only considering the purchase of a TRS-80/Video Genie.

For further details contact:-

Terry Bradbury  
20 Spruce Way  
St Albans  
Herts.  
Tel: Park Street 73633

or

Reg Smith  
24 Sempill Road  
Hemel Hempstead  
Herts.  
Tel: Hemel Hempstead 60085.  
Yours faithfully  
T R Bradbury.

Dear Sir,

As a regular reader of your magazine I was most interested in the article by R N Braybrooke on the differences between the TRS-80 and the Video-Genie (which I have). I had discovered the printer 'hang-up' problem and also discovered that port 253 held part of the answer. The article suggests that the problem is easily solved.

I have an unexpanded machine with an Epsom MX80 connected and on switch-on (if the printer is off) PRINT INP(253) returns 127. However, if the printer is switched ON and put ON-LINE then the port returns 63. If the printer is OFF-LINE then 143 is returned. Now the problem appears. If the printer is switched off, then INP(253) still returns 63. So one is unable to distinguish between the printer ON-LINE and POWER OFF. However, at least the system does not 'hang-up'.

I hope this is of interest and I would be interested in hearing if there is a solution to the complete problem.

Yours faithfully,  
Alan Beattie  
Kilmarnock.

Dear Sir,

I would like to echo Mr Andrew's comments (November issue) about the excellent PET lister program by Paul Williams.

I use an OKI Microline printer and experienced the same problem as Mr Austin with the absence of Carriage Return/line feed. I assumed that the wrong BASIC subroutine was being



called since normal LISTs work as expected. The 'PET Machine Language Guide' from Abacus gives C9E2 as the address in New ROMs for a CR/LF routine. Substituting this address for FDDO does the trick and is obviously the easier answer to the problem. The changes are:-

```
7560 20 E2 C9
7597 20 E2 C9
```

Incidentally, the Microline will print arrows instead of the square brackets required around programmed cursor movements etc. The best substitutes are the { } characters. The changes required are:-

```
75E4 A9 7B
75FB A9 7D
```

Yours sincerely,  
J T Hoskins  
London SE19.

been suggested that OE Hex is recognised as CR, but I don't wish to know that, having no desire to alter all my firmware and software to cope with someone else's error!

Properly programmed and set up, the MX80 is a fine machine, but some of the unsatisfactory alternative programs could easily give it a bad name. A wise purchaser should check that all normal functions, as documented, are working correctly before paying out his money.

Yours faithfully,  
Don Thomasson.

Dear Sir,  
With respect to Frederick Brown's letter in the October issue regarding computer 'Bulletin Boards', I would be obliged if you would inform your readers of the following correction.

CBB-London  
System Operator-Peter Goldman  
Electronic mail, library for downloading programs.  
System Hours-Sunday 4.00pm to 10.00pm Other times possible by prior arrangement.

Needless to say the usage of the system is free, no connection time charge (except for the phone call) and no subscription fee.

When Mr Brown wrote to you the times quoted were correct.

Thanking you for your kind attention.

Peter Goldman  
Surbiton.

Dear Sir,  
It is hoped to re-start the COSMAC Users Group originally proposed by Jim Cunningham if there is sufficient interest. The group will cater for users of the COSMAC series of microprocessors, ie the CDP1802, 1804, 1805, and for computers using this processor such as the ELF, Edukit, etc. Anyone interested in joining the club should send a stamped addressed envelope for further details to me at the address below.

Peter Hibbs  
54 Runnymede Avenue  
Bournemouth  
Dorset BH11 9SE.

Dear Sir,  
I would be grateful if the columns of your magazine could be used to give up-to-date details of the TRS-80 EDUCATIONAL USERS GROUP.

**Contact:** Dave Fletcher — Head Teacher, Beaconsfield First and Middle School, Beaconsfield Road, Southall, Middlesex.

**What it has to offer:** Basically to support and encourage the use of the TRS-80/Video Genie in Education in the following areas.

**Software Library and Exchange:** The group has a well established library of Primary, Secondary and Administrative programs. Further Education programs have been promised. The library has over 50 programs available and it is hoped the library will eventually include programs from the following areas — Computer Assisted Learning, Simulations and Strategy games, Animations for classroom use, Classroom and School Management.

**Advice, Assistance and Help:** The group has a wide experience to draw on in Educational establishments but also it has the membership of the very successful National TRS-80 Users to draw on. Regional workshops take place throughout the UK and it is hoped to plan a National Education Workshop in the coming months.

**A Monthly Newsletter:** In the National TRS-80 Newsletter, space has been found for a regular Educational Spot and this will develop as a forum for Educational Users.

Thanking you for your co-operation in this matter.

Yours sincerely,  
David J Fletcher  
Head Teacher.

Dear Sir,  
We would be grateful if you could mention the formation of the Z80 NAS TUG (Thames Valley User Group) in your magazine.

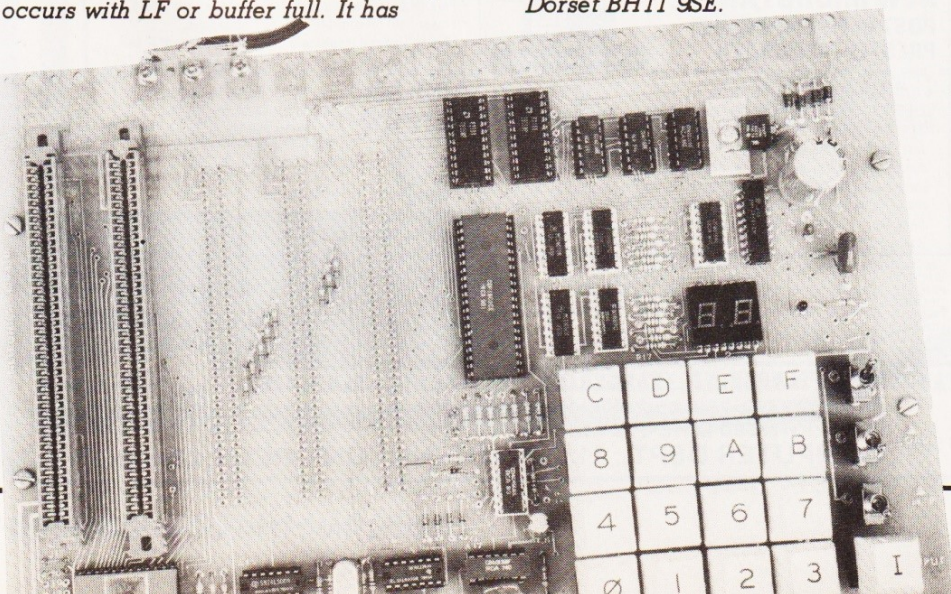
Our aims are to promote the use and development of NASCOM 1 and 2 systems, together with compatible products, and to provide further development of hardware and software. The group also supports the INMC although membership of that organisation is not essential.

We will publish a newsletter and are planning regular meetings in the Slough/Staines/Windsor areas.

It is hoped to produce a software library, the contents of which will be available at prices which will cover the reproduction.

For further information please write to me at the address below giving your areas of interest and details of your system.

Yours faithfully,  
Mike Rothery  
37 Eton Wick Road  
Windsor  
Berks



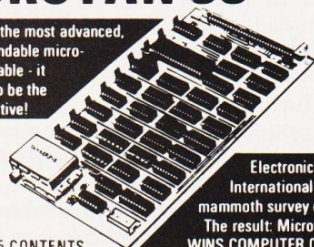


RETAIL SALES & DEMONSTRATIONS 404 EDGWARE RD. LONDON, W2 1ED TEL: 01-402 6822

**TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE**

### MICROTAN 65

Microtan 65 is the most advanced, powerful, expandable micro-computer available - it also happens to be the most cost effective!



Electronic Today International held a mammoth survey of kits. The result: Microtan 65 WINS COMPUTER CLASS!

#### MICROTAN 65 CONTENTS

High quality, plated thru hole printed circuit board, solder resist and silk screened component identification. 6502 microprocessor. 1K monitor. TANBUG. Now with 'V' Bug. 1K RAM for user programme, stack and display memory. VDU alphanumeric display of 16 rows by 32 characters. MICROTAN 65 system file binder. 136 page, bound, users hardware software manual with constructional details and sample programmes. Logic and discrete components to fully expand MICROTAN 65.

The MICROTAN 65 kit has won widespread acclaim for its superb presentation. We pay attention to detail!

**KIT FORM £69.00 + £10.35 V.A.T. total £79.35**

**MICROTAN 65 assembled and tested.** Specification as above, but assembled and fully bench tested by ourselves. **£79.00 + £11.85 V.A.T. total £90.85**

**TANBUG V2.3 KIT (SEPARATELY) £21.85 INCL.**

### MICROTAN 65 OPTIONS

#### LOWER CASE PACK

Two integrated circuits which connect into locations on MICROTAN allowing 128 displayable characters. **£9.48 + £1.42, total £10.90**

#### GRAPHICS PACK

Five integrated circuits which connect into locations on MICROTAN allowing the display of chunky graphics (64 x 64 pixels). What are chunky graphics? Well, imagine a piece of graph paper with 64 squares vertically and 64 squares horizontally, a total of 4096. Each square can be made black on white. **£6.52 + V.A.T. 98p, total £7.50**

#### 20 WAY KEYPAD

Inexpensive means of getting up and running. Uses Schoeller key switches, and connects to MICROTAN through a 16 pin D.I.L. plug on ribbon cable. Black anodised escutcheon, with TANGERINE legends, finishes off what must be the best value for money keypad available. Available assembled and tested. **£10.00 + V.A.T. £1.50, total £11.50**

\*Space Invaders game (for use with keypad only). **£15.22 + V.A.T. £2.28 total £17.50**

### POWER SUPPLIES

MPS 1 Input 120 or 240V AC. Output 5 Volts at 3 Amps Regulated. MPS 1 will power both MICROTAN and TANEX fully expanded. Built on the same size printed circuit board as MICROTAN etc. Available as a fully built and tested unit. **£23.00 + V.A.T. £3.45, total £26.45**

X MPS2 +5V 6A, +12V, 5 and 12V switch mode system PSU. **£69.13 + V.A.T.**

### MINI-SYSTEM RACK

We have produced a mini-system rack which accepts MICROTAN 65, TANEX and our mini-mother board. It has an integral power supply, just plug it into the mains and away you go! Finished in TANGERINE BLACK it gives your system the professional finish. Front panel access for I/O cables. AVAILABLE AS AN ASSEMBLED UNIT. **£56.35 Incl.**

### FULL SYSTEM RACK

For the man that has everything! 19 inch wide system rack which accepts MICROTAN 65, TANEX, TANRAM, SEVEN FURTHER EXPANSION BOARDS, TANDOS and THE SYSTEM POWER SUPPLY. Available in many formats, e.g. Individual front panels, full width hinged front panel, back panel with or without connectors. **£49.00 + V.A.T. £7.35, total £56.35**

### NEW PRODUCTS All including VAT

SYSTEM MOTHERBOARD (4 CONNECTORS)	44.85	EXTRA EDGE CONNECTORS	3.50
SYSTEM MOTHERBOARD (12 CONNECTORS)	672.85	SYSTEM RACK FRONT PANEL (16 LINES)	15.64
		PARALLEL 1/0 BOARD MAX (128 LINES)	66.70
		32K RAM CARD (EXCL. ROM)	

### MICRON COMPUTER

FULLY BUILT, TESTED, and housed



**£395**

### SYSTEM RACK MICRON £550.00 incl.

6502 based microcomputer. VDU alpha numeric display. Powerful monitor TANBUG. 8K RAM. 32 parallel I/O lines. 2 TTL serial I/O lines. Four 16 Bit counter timers. Cassette interface. Data bus buffering. Memory mapping control. 71 key ASCII Keyboard, including numeric keypad. Includes power supply. Also includes the first 10K MICRO-SOFT BASIC - available in the U.K. All the usual BASIC commands.

### TANRAM FULL MANUALS MICROTAN TANEX BASIC X BUG all £5.00 ea.

AVAILABLE NOW TANRAM 40K Bytes on one board! Single board of bulk memory offering 7K Static RAM (2114), and 32K Dynamic RAM (4116). Onboard refresh is totally transparent to CPU operation and is unaffected by normal DMA's. TANRAM fully expands the available address space of the 6502 microprocessor. MICROTAN, TANEX and TANRAM together provide 16K RAM, 48K RAM, and 1K I/O, that's a lot of memory and a lot of I/O! Built and tested TANRAM ASSEMBLED.

### 40K RAM CARD with 16K DYNAMIC RAM £76 + V.A.T.

CONTENTS: High quality plated thru hole printed circuit board, solder resist and silk screened component identification. Full complement of IC sockets for maximum expansion. 64 way D.I.N. edge connector 1K RAM (2114). Data bus buffering. TANRAM users manual.

EXTRA RAM: 1K STATIC (2114) £2.95 each 16K DYNAMIC (4116) £1.50 each

### MEMORIES EXPAND YOUR SYSTEM WITH OUR TANGERINE APPROVED CHIPS

2102 1K x 1 Static RAM	80p	IM 6402 UART	£4.50
2708	£3.50	2114 1K x 4 Static RAM	£2.95
2716	£6.50		
MK 4116 16K x 1 Dynamic RAM		4118 1K x 8 Static RAM	£7.50
£1.50			

ALL INCLUDING VAT

### MONITORS (PROFESSIONAL)

RECONDITIONED AND NEW - FROM £35.00 to £129.95

### CENTRONICS Ideal for Tangerine PRINTERS

SHEIKOSHA £199 + V.A.T.

Model 730 £350 + V.A.T.

Model 737 £395 + V.A.T.



### NEW MICROTANTEL POST OFFICE APPROVED PRESTEL - VIEWDATA

• FULL COLOURGRAPHICS • CAN STORE PRESTEL • CAN BE USED AS AN EDITING TERMINAL • CAN BE INTERFACED WITH PET, APPLE etc.

Just connect to the aerial socket of any colour or black and white domestic T.V. receiver and to your Post Office installed jack socket and you are into the exciting world of PRESTEL. Via simple push button use you are able to view 170,000 pages of up to the minute information on many services, order goods from companies - all this without leaving your armchair!



**£170**

### TANEX £43.00

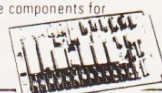
Minimum Config Kit

+ V.A.T. £6.45, total £49.45

#### CONTENTS

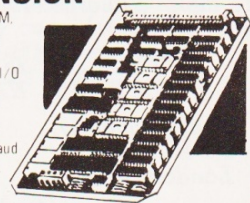
High quality plated thru hole printed circuit board, solder resist and silk screened component identification. IC sockets for maximum expansion. 64 Way D.I.N. edge connector. 1K RAM, cassette interface, 16 parallel I/O lines, a TTL serial I/O port, two 16 bit counter timers, data bus buffering, memory mapping, logic and discrete components for maximum expansion. TANEX users manual.

TANEX (Minimum configuration) Assembled **£53.00 + V.A.T. £7.95, total £60.95**



### TANEX EXPANSION

Expanded, TANEX offers 7K RAM, locations for 4K EPROM (2716), locations for 10K extended MICROSOFT BASIC, 32 parallel I/O lines, two TTL serial I/O ports, a third serial I/O port with RS232/20mA loop, full modem control and 16 programmable baud rates, four 16 bit counter timers, cassette interface, data bus buffering, and memory mapping.



EXPANDED TANEX KIT (Excludes ROM, XBUG and BASIC) **£89.70 + V.A.T. £13.46, total £103.16**

EXPANDED TANEX ASSEMBLED **£99.70 + V.A.T. £14.96, total £114.66**

OPTIONS TO FULLY EXPANDED TANEX

10K Extended MICROSOFT BASIC in EPROM (with manual) **£49.00 + V.A.T. £7.35, total £56.35**

Extra RAM 1K (2 x 2114) **£5.20 + V.A.T. 78p, total £5.98**

SERIAL I/O KIT **£17.25**

6522 VIA **£8.00 + V.A.T. £1.20, total £9.20**

XBUG **£17.35 + V.A.T. £2.60, total £19.95**

± 12V Kit **£9.20 Incl.**

AS YOU CAN SEE THE PRICES OF OUR EXPANSION COMPONENTS ARE VERY, VERY COMPETITIVE!

### TANGERINE DISC SYSTEM

Z8 CONTROLLER CARD **£150.00 + V.A.T.**

DOUBLE SIDED DOUBLE DENSITY DRIVE **£215.00 + V.A.T.**

CP/M DISK OPERATING SYSTEM **£80 + V.A.T.**

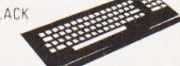


### 71 KEY ASCII KEYBOARD £69.95 Incl.

NO EXTRAS NEEDED

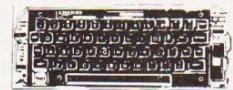
Uses gold crosspoint keys. Includes numeric keypad and ribbon cable. Available as fully assembled and tested.

SUPER METAL CABINET IN TANGERINE BLACK **£20.00 + V.A.T. £3.00, total £23.00**



### PROFESSIONAL ASCII KEYBOARDS Ideal for Tangerine £29.95 + V.A.T.

- 52 key 7 bit ASCII coded
- Positive strobe +5V-12V
- Full ASCII characters
- Parallel output with strobe
- Power light on control
- Chip by General Instrument (G.I.) TTL output
- Superbly made
- Size 13 x 5.5 x 1.5 ins
- Black keys with white ledgers
- Escape shift return & reset keys
- Control repeat & bell
- Complete with DATA



### ADD-ON KEYPAD



A compact 12 button keypad suitable for use with above keyboard to extend its functions plus four extra keys. Supplied brand new with data. A 4x4 non-encoded single mode keyboard.

LIST PRICE £22.00  
OUR PRICE **£7.95** + V.A.T.

PLUS MANY NEW EXCITING PRODUCTS IN DEVELOPMENT AUTOMATICALLY AVAILABLE FROM US WHEN RELEASED BY TANGERINE LTD.

All products are available

FULLY GUARANTEED • BUY WITH CONFIDENCE

BRITISH DESIGN & MANUFACTURE AND ON DEMONSTRATION IN OUR COMPUTER DEPT.

SEND FOR  
FREE BROCHURE

**TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE**

Stockist Enquiries on headed notepaper to:

COMPUTER KIT LTD. (Principal Distributors in U.K.)

11/12 Paddington Green, London, W2. Tele: 01-723 5095

Telex 262284 Ref 1400 TRANSONICS

All orders pre-paid and official advertised here

to be forwarded DIRECTLY to

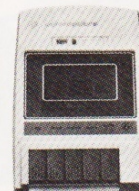
COMPUTER DEPT., 11/12 PADDINGTON GREEN, LONDON W2



Adda Computers Ltd., a major supplier of computer systems to industry and business, have opened the Vic Centre in West London. Here you can see, discuss and buy everything to do with the new VIC 20 personal computer—in person or by mail. Hardware, software, technical advice and information is available from an experienced staff. Even if you already own a VIC 20, get on our mailing list to know about new developments. Remember—everything has the backing of Adda's reputation, and there's a full 12-month warranty on all hardware. The Vic Centre is easy to reach—Just off the A40, close to North Acton tube station.

**AT ONLY £189.95 inc. VAT. Special cassette deck  
£44.95 inc. VAT.**

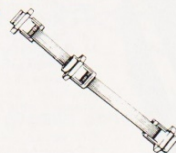
★ **PRINTER**—80 COLUMNS, 30 CHARACTERS PER SECOND. First time users can operate it immediately with plug-in program cartridges, and using your own colour T.V. to get up to 24 colours on screen, four different sound tones and even write your own programs in BASIC. The VIC-20 lets you build a system as needs and budget dictate, so that your VIC-20 can be more than just a personal computer.



**VIC-Games Port Adaptor Cable** £19.85

A two into one adaptor for use with both joysticks and light pens. A must for those who require full control of games with graphics.

**FEATURE** low-cost High quality. Robust



**Fruit Machine, Lander, Road Rally, Alien, Avengers, Poker**  
**TERMS AND CONDITIONS:** All goods sold subject to Adda's 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 inclusive of VAT.**

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

Date: \_\_\_\_\_

103



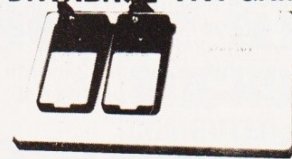
# ELECTRONIC GAMES

## COLOUR CARTRIDGE T.V. GAME



SEMI-PROGRAMMABLE T.V. GAME  
+ 4 Cartridges + Mains  
Adaptor  
Normal Price £73  
NOW REDUCED TO: **£39.50** inc VAT

## DATABASE T.V. GAME



FULLY PROGRAMMABLE  
CARTRIDGE T.V. GAME  
14 Cartridges available  
Normal Price £87.86  
NOW REDUCED TO: **£59** inc VAT

## ATARI T.V. GAME



The most popular T.V. Game on  
the market with a range of over  
40 cartridges including SPACE  
INVADERS with over 112  
games on one cartridge **£95.45** inc VAT

## SPACE INVADERS



Hand-held Invaders Games available **£19.95**  
+ Invaders Cartridges available to fit  
ATARI RADOFIN ACETRONIC PHILIPS G7000  
+ Cartridges also available for  
MATEL TELENG ROWTRON/  
DATABASE INTERTON

## CHESS COMPUTERS



MANY UNITS  
ARE COVERED BY  
THE EXCLUSIVE  
SILICA SHOP 2 YEAR GUARANTEE

We carry a range of over 15  
different Chess computers:  
Electronic Chess **£29.95**  
Chess Traveller **£39.95**  
Chess Challenger 7 **£79.00**  
Sensory 8 **£119.00**  
Sensory Voice **£259.00**  
SPECIAL OFFERS:  
VOICE CHESS CHALLENGER  
Normal Price £245 NOW **£135.00**  
SARGON 2.5 BORIS 2.5  
Normal Price £273.70 NOW **£199.95**  
All prices include V.A.T.

## TELETEXT



## ADD-ON ADAPTOR £199

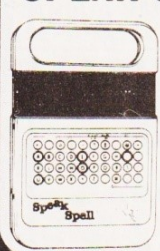
THE RADOFIN TELETEXT ADD-ON  
ADAPTOR

Plug the adaptor into the aerial socket of your  
colour TV and receive the CEEFAX and  
ORACLE television information services

THIS NEW MODEL INCORPORATES:

- Double height character facility
- True PAL Colour
- Meets latest BBC & IBA broadcast specifications
- Push button channel change
- Unnecessary to remove the unit to watch normal TV programmes
- Gold plated circuit board for reliability
- New SUPERIMPOSE News Flash facility

## SPEAK & SPELL

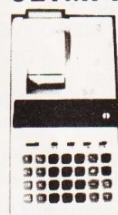


Normal Price £49.95  
NOW REDUCED TO:

**£39.50** inc VAT

Teach your child to  
spell properly with  
this unique learning  
and Fully automatic  
features and scoring  
Additional word  
modules available to  
extend the range of  
words

## ADDING MACHINE OLYMPIA HHP 1010



Normal Price £57.21  
NOW REDUCED TO:

**£34** inc VAT

Uses ordinary paper!  
No need to buy expensive  
thermal paper!  
Fast add listing PRINTER  
CALCULATOR 2 lines per  
second, 10 digit capacity  
Uses normal adding  
machine rolls. Battery or  
mains operated.  
Size 9" x 4 1/2" x 2 1/2"  
(Mains adaptor extra)

## 24 TUNE ELECTRONIC DOOR BELL

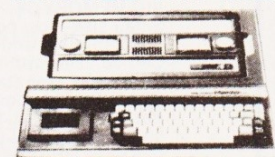


Normal Price £19.70  
NOW REDUCED TO:

**£12.70** inc VAT

Plays 24 different tunes with  
separate speed control and volume  
control. Select the most  
appropriate tune for your  
visitor, with appropriate  
tunes for different times of  
the year!

## MATEL T.V. GAME



The most advanced TV game in the world. 20  
cartridges available. Add  
on KEYBOARD coming  
soon to convert the **£199.95** inc VAT  
MATEL to a home computer with 16K RAM fully  
expandable and programmable in Microsoft Basic.  
Other accessories will be available later in the year.

## HAND HELD GAMES EARTH INVADERS

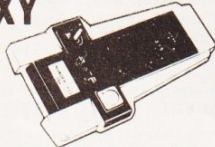


These invaders are a breed of creature hitherto  
unknown to man. They cannot be killed by  
traditional methods — they must be buried.  
The battle is conducted in a maze where squads of  
aliens chase home troops. The only way of  
eliminating them is by  
digging holes and  
burying them.

**£23.95** inc VAT

## HAND HELD GAMES GALAXY 1000

**Galaxy 1000**



The 2nd generation Galaxy Invader. The invaders  
have re-grouped and have a seemingly endless  
supply of spacecraft whilst the player's arsenal is  
limited to just 250 missiles to be launched from 3  
missile stations. You have to prevent the invaders  
landing or from  
destroying your home  
defences.

**£19.95** inc VAT

## THE OLYMPIA — POST OFFICE APPROVED TELEPHONE ANSWERING MACHINE WITH REMOTE CALL-IN BLEEPER

This telephone answering machine is manufactured by Olympia Business Machines, one of the  
largest Office Equipment manufacturers in the U.K. It is fully POST OFFICE APPROVED and will  
answer and record messages for 24 hours a day. With your remote call-in bleeper you can receive  
these messages by telephone wherever you are in the world. The remote call-in bleeper activates the  
Answer/Record Unit, which will at your command repeat messages, keep or erase them, and is  
activated from anywhere in the world, or on your return to your home or office. The machine can also  
be used for message referral, if you have an urgent appointment, but are expecting an important call,  
simply record the phone number and location where you can be reached. With optional extra  
bleepers (£13 each) this facility can be  
extended to colleagues and members of  
the family. Using a C90 standard cassette  
you can record as many as 45 messages.  
The announcement can be up to 16  
seconds long and the incoming message  
up to 30 seconds long.  
The machine is easy to install and comes  
with full instructions. It is easily wired to  
your junction box with the spade connect-  
ors provided or alternatively a jack plug  
can be provided to plug into a jack socket.  
Most important of course, is the fact that  
it is fully POST OFFICE APPROVED.  
The price of £135 (inc. VAT) includes the  
machine, an extra-light remote call-in  
bleeper, the microphone message tape,  
A.C. mains adaptor. The unit is  
9 1/2" x 6 1/2" x 2 1/2" and is fully guaranteed for  
12 months. The telephone can be placed  
directly on the unit — no additional desk  
space is required.



**£135** inc VAT

## PRESTEL VIEWDATA

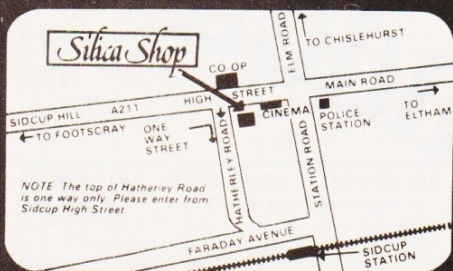


The ACE TELCOM VDX1000 Prestel View-  
data adaptor simply plugs into the aerial  
socket of your television and enables you to  
receive the Prestel Viewdata service in  
colour or black & white.

- Features —
- Simplified controls for quick, easy operation
  - Special graphics feature for high resolution State-of-the-art microprocessor controller
  - Standard remote telephone keypad with Prestel keys 1-8
  - Auto dialler incorporated for easy Prestel acquisition
  - True PAL colour encoder using reliable IC chroma filter and delay line incorporated for minimum picture interference maximum fidelity
  - Includes convenient TV — Prestel switchbox
  - Easily connected to standard home or office telephone lines
  - Fully Post Office approved

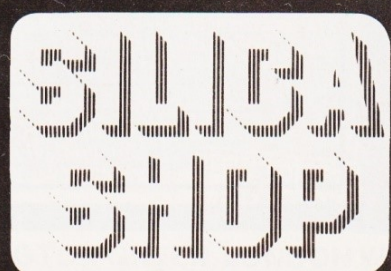
**SPECIAL PRICE £228.85** inc VAT

**FOR FREE BROCHURES — TEL: 01-301 1111**



For free illustrated brochure and reviews on our range of electronic games, please telephone 01-301 1111. Free delivery service available. To order by telephone please quote your name, address and ACCESSBARCLAYCARD number, and leave the rest to us. Post and packing Free of Charge. Express 48hr delivery service available.  
• CREDIT CARD WELCOME. Demonstrations daily at our Sidcup shop, open from 9am-6pm Monday, Saturday, Early Closing Thursday 1pm, Late Opening Friday 6pm.  
• 2 YEAR GUARANTEE. All goods are covered by a full year's guarantee and many are further covered by our exclusive Silica Shop 2 Year Guarantee.  
• MONEY BACK UNDERTAKING. If you are unsatisfied with your purchase and return it within 7 days we will give you a full refund.  
• AFTER SALES SERVICE. We are never known to under-sell.  
• COMPETITIVE PRICES. Available on all machines, out of guarantee.  
• HELPFUL ADVICE. Available on the suitability of each machine.  
• CREDIT FACILITIES. Full credit facilities available over 12, 24 or 36 months at competitive rates of interest.  
• PART EXCHANGE SCHEME. Available on second hand machines.  
• CREDIT CARDS WELCOME. Access Barclaycard, Diners Club, American Express.

**SILICA SHOP LIMITED**  
4 The Mews, Hatherley Road, Sidcup, Kent DA14 4DX  
Telephone: 01-301 1111 or 01-309 1111 CT/1/82





**SCOOP ONLY**  
**£29.95**  
**+VAT**

**BRITISH MADE**  
• 52 KEY 7 BIT  
ASCII CODED  
• POSITIVE STROBE  
+5V - 12V  
• ASCII  
CHARACTERS  
• PARALLEL OUTPUT  
WITH STROBE  
• POWER LIGHT ON  
CONTROL

The 'CHERRY'  
Computer  
Keyboard

• CHIP BY GENERAL  
INSTRUMENT (G.I.)  
• SUPERBLY MADE  
SIZE 13 x 5.5 x  
1.5 ins  
• BLACK KEYS WITH  
WHITE LEDGENS



• ESCAPE SHIFT  
RETURN & RESET  
KEYS  
• CONTROL REPEAT  
& BELL KEYS  
Complete with DATA

Ideal for use with **TANGERINE, TRITON, TUSCAN, APPLE** and most computers. Ex-Stock from HENRY'S  
This is definitely the BEST BUY. FULLY GUARANTEED. Supplied BRAND NEW in manufacturers original packing. Just post remittance total: £35.95 (incl. V.A.T. & Post)

## The 'Apple' Power Supply

A PROFESSIONAL BUILT & TESTED, CASED & VENTILATED POWER UNIT WITH BUILT IN OVERLOAD & CUT OUT PROTECTION CIRCUITS

**SPECIFICATIONS**  
Input voltage: 210-250v  
Supply voltages: +5.0,  
-11.8, -12.0, -5.2  
Power consumption: 60  
watts max. (full load)  
Full load power output:  
-5v: 2.5 amp, -5v: 250ma,  
-12v: 1.5 amp, -12v: 250ma  
Size: 10" x 3 1/2" x 2 1/2"  
Weight: (Approx) 3 lbs

Complete with full data  
& information -  
Supplied brand new

The Apple Power Supply is a high voltage switching power supply. While most other power supplies use a large transformer with many windings to convert the input voltage into many lesser voltages and then rectify and regulate these lesser voltages, the Apple Power Supply first converts the AC line voltage into a DC voltage, and then uses this DC voltage to drive a high frequency oscillator. The output of this oscillator is fed into a small transformer with many windings. The voltages on the secondary windings are then regulated.  
**PREVENTS DAMAGE & RETURNS UNIT TO NORMAL WORKING CONDITIONS**

**TANGERINE APPROVED CHIPS**

2102 450 n/s £1.00  
2114 300 n/s £1.75  
4115 200 n/s £1.50  
2732 450 n/s £7.50

**DISCOUNTS** 10% for 4  
ANY ONE 15% for 8  
TYPE 20% for 16

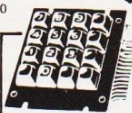
**D.I.L. MINATURE SWITCHES**  
Gold-plated contacts. Sealed base. Ideal for programming. 6-position at less than half manufacturer's price.

ONLY 75p  ON/OFF

Will fit into 14-pin dil socket. Ten at 65p ea.; per 100 55p ea.



**LIST PRICE £60**  
**OUR PRICE £32.50**  
+VAT  
Just post remittance £39.50 (includes VAT post & packing) for delivery by return



'CHERRY' ADD-ON KEYPAD

A compact 12 button keypad suitable for use with Cherry keyboard to extend its functions plus four extra keys  
Supplied brand new with data A 3 x 4 non-encoded single mode keyboard  
**£7.50** Inc. VAT

**HENRY'S**

**COMPERKIT DIVISION**  
404 Edgware Road, London, W2 England  
Telephone: 01-402 6822  
Telex: 262284 Mono Transonics 1400



## If you own a ZX80/ 81 then you need the ABACUS CONTROLLER

Developed to eliminate tedious swapping of plugs when **LOADING** or **SAVING** programs on cassette.

One switch operation allows selection of **TALK, SAVE, CUE** and **LOAD** modes. Using a built-in microphone/speaker to allow fast and reliable program naming and cueing.

Send cheque or P.O. for £12 including p&tp to:



**ABACUS ELECTRONICS**  
186 St. Helens Avenue  
Swansea, W. Glam.  
Tel: (0792) 50282

# COMPUTING TODAY BINDERS



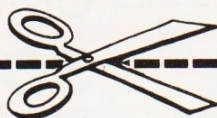
To order just send your cheque or Postal Order (made payable to ASP Ltd) to:

**BINDERS,**  
Computing Today,  
Argus Specialist Publications Ltd,  
145 Charing Cross Road,  
London WC2H 0EE.

If you wish to pay by Access or Barclaycard just fill in your card number and sign the form, **do not send your card.**

Join the great conservation movement and protect your copies of Computing Today with one of our smart red and black biners. Unlike our competitors you can still squeeze a full year's worth of the magazine into each one and it'll only cost you £3.95.

They look good on any bookshelf and, by keeping all your issues in one place, create a valuable reference library of programs and information.



## Order Form

Please send me .... binders @ £3.95 each.

I enclose a cheque/PO for £..... (Payable to ASP Ltd)  
I wish to pay by credit card

Name .....

Address .....

Access ☐ Barclaycard ☐

Signature .....

Please allow 21 days for delivery.

**COMPUTING TODAY BINDERS**

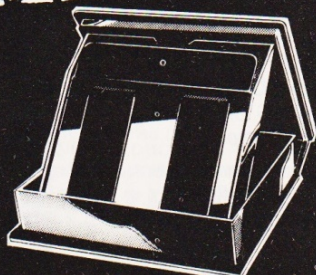


# Mini Floppy Disks

## PRICE WAR

- ★ Anti-static envelopes
- ★ Quality, double density media
- ★ Soft sectored
- ★ Labels with write protect
- ★ Reinforced centres
- ★ Library cases free with tens

Guaranteed quality — Any faulty disks should be returned to us within 12 months of purchase with proof of purchase for replacement by return of post.



	Nett	Vat	Total
Mini Floppy SS/DD	2.50	.38	2.88
Mini Floppy SS/DD x 10	20.00	3.00	23.00
Mini Floppy SS/DD x 50	87.50	13.13	100.63
Mini Floppy SS/DD x 100	150.00	22.50	172.50
Mini Floppy DS/DD	4.00	.60	4.60
Mini Floppy DS/DD x 10	33.00	4.95	37.95
Mini Floppy DS/DD x 50	150.00	22.50	172.50
Mini Floppy DS/DD x 100	275.00	41.25	316.25

## MICROCOMPUTERS

Mail Orders to:  
MICROCOMPUTERS AT LASKYS  
MAIL ORDER DEPT.  
FREEPOST (No Stamp required)  
LIVERPOOL L2 2AB

24 Hr Telephone Credit  
Card Orders 051-236 0707



# \*BIG EARS\*

SPEECH  
INPUT  
FOR  
YOUR  
COMPUTER!



**BIG EARS** opens the door to direct man-machine communication. The system comprises analogue frequency separation filters, preamps and signal conversion, together with a quality microphone and extensive software.

Words, in any language, are stored as "voice-prints" by simply repeating them a few times in "learn" mode. Using keyword selection techniques, large vocabularies can be constructed.

Use **BIG EARS** as a front end for any application: data enquiry, robot control, starwars — the possibilities are unlimited...

**BUILT, TESTED & GUARANTEED ONLY £49!**

PRICE INCLUDES POSTAGE & PACKING PLEASE ADD VAT AT 15%

PLEASE STATE COMPUTER: UK101, SUPERBOARD, NASCOM2, ZX80/81, PET, TRS80, ETC.

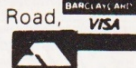
**COLOUR MODULATOR**  
RGB in, PAL/UHF out

**KIT £12**  
**BUILT £18**

Please add VAT at 15% to all prices  
Barclay/Access orders accepted on telephone

**WILLIAM  
STUART  
SYSTEMS Ltd**

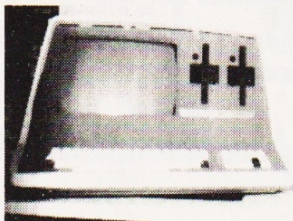
Dower House, Billericay Road,  
Herongate, Brentwood,  
Essex CM13 3SD.  
Telephone: Brentwood (0277) 810244



★★★★★ NOW SHOWING IN CHELTENHAM ★★★★★★  
**PETRI SYSTEMS ARE PROUD TO PRESENT**  
the famous double act

Intertec  
**SUPERBRAIN**

320K-5MB Integral disc  
Professional keyboard  
64K processor memory  
Dual Z80 processors



Olympia  
**SCRIPTA**

Top quality daisywheel print  
Low cost cartridge ribbons  
Full typewriter functions  
Wide range of typestyles



supported by  
**WORDSTAR**  
THE ULTIMATE IN  
WORD PROCESSING  
also showing  
**SUPERBRAIN +**  
**MX100 + T/MAKER**

The best low-cost financial report writing and modelling system available  
**SPECIAL GUEST STAR** — The mystical Analyst — who will turn your wildest software dreams into reality  
Ring (0242) 42466 NOW to avoid disappointment  
or call in to our showroom at 25 St. Georges Rd, Cheltenham  
**BOOK YOUR TICKET FOR THE FUTURE**  
Petri Systems — 25 St. Georges Rd, Cheltenham — (0242) 42466







## NEW ATOM SOFTWARE

### SOFTSCREEN (12K RAM)

only £11.40 incl.

New VDU driver routines for the ACORN ATOM. For the first time ATOM owners can have facilities of the B.B.C. MICRO on their computer, e.g. definable character sets and scrolling text window and 40 characters per line. Other features include —

- TEXT IN MODE 1-4
- 40 x 24 TEXT (same format as PET)
- UPPER AND LOWER CASE AND INVERSE TEXT AND GRAPHICS
- DEFINABLE TEXT WINDOW AREA
- EXPANDED AND NORMAL TEXT DENSITIES etc. etc.

### INVADERS (12K RAM)

only £7.50 incl.

Without doubt the best 'Invaders'. More features than any other including six skill levels and high scores, 'walking' invaders, sound effects, definable invader shapes, free from video noise. A very fast game. Ask for more details.

### ALARM CLOCK AND SOUND EFFECTS

only £4.95 incl. for the two

Clock keeps accurate time even while other programs are running. Sound effects without stopping other programs. Both programs need 6522 VIA (also available for £7.00). Ask for details.

**WANTED:** Good quality software for the B.B.C./Proton and Acorn Atom. We pay 20% royalties. Further details on request.

MAIL ORDER ONLY



**COMPUTER  
CONCEPTS**

Dept CT2  
16 Wayside  
Chipperfield  
Herts. WD4 9JJ  
Tel. (09277) 62955

## A & F SOFTWARE

MORE NEW REAL TIME GAMES

### FOR ATOM USERS

G0100	<b>POLECAT:</b> Avoid being eaten by the Polecat searching the maze for your. 5K Text 6K Graphics. . . . .	£4.95
G0101	<b>EARLY WARNING:</b> Destroy the attacking ICBM's using a realistic radar display & intercept missiles. 48 levels: Sound: Score & Screen Counters 4K Text 6K Graphics. . .	£4.95
G0102	<b>MINEFIELD:</b> Watch out for chain-reactions as you clear the mines with your tank. Each mission becomes harder! Sound: Score & High Score: 5K Text 1/2 K Graphics. . . . .	£4.95
G0103	<b>TANGLED:</b> Challenge your friend or the atom to this game of skill the more you score the harder you find the game: 4 Skill Levels: Sound: Individual & Highest Scores Displayed 5K Text 1/2 K Graphics. . . . .	£3.95
E0200	<b>TIME TUTOR:</b> Teach your children the time the modern way, the program randomly selects a time and displays it on a standard clock face, responding to the students input telling the correct time if the student is wrong makes learning fun: Sound: Score: 5K Text 1/2 K Graphics. . .	£3.95

### ★ SPECIAL OFFER ★ (SUPPLIED ON ONE TAPE)

Select any 2 programs from "Polecat": "Early Warning" or "Minefield" for only £8.50 or all 3 for only £10.00

All four games programs for only £12.00

DEALER ENQUIRIES WELCOME

**ORDER FORM:** Send cheque/P.O. Payable to "Anderson" to A&F Software, 10 Wilshire Ave, Longsight, Manchester, M125TL (061 248 7195)

RETURN NAME & ADDRESS

CODE No	PROGRAM TITLE	QTY	£.p
Special Offers Please Order on Separate Sheet			
(S.A.E. FOR FULL LIST OF AVAILABLE PROGRAMS)			TOTAL

## ZX81 CHESS

- ★ GRAPHIC DISPLAY
- ★ SEPARATE DISPLAY OF YOUR MOVE AND THE COMPUTERS
- ★ SUPERFAST MACHINE CODE
- ★ SIX LEVELS OF PLAY
- ★ ALLOWS ALL LEGAL MOVES INCLUDING CASTLING AND EN PASSANT
- ★ IF AN ILLEGAL MOVE IS ENTERED WILL REPLY "ILLEGAL MOVE"
- ★ BOARD CAN BE SET UP TO ANY CONFIGURATION
- ★ ABILITY TO CHANGE SIDES IN MID GAME
- ★ SUPERB POWER IN A 10K PROGRAMME

### + CHESS CLOCK

- ★ SINGLE KEY ENTRY
- ★ INCREMENTS TIME FOR EACH PLAYERS MOVE
- ★ RESETABLE FUNCTION

ONLY £9.50 + 40p P&P

## ZX NEW YORK

Can you bomb and blow up your targets before your plane loses altitude and crashes?

**Superb Graphics, Superfast Machine Code, Score Continuously Incremented, Simulated bombs and rockets.**

Runs in 2K of Memory

### + ZX REFLEX

Are you as fast as thought?  
Find out with this game!

ONLY £4.50 + 40p P&P

## MICRO GEN

24 Agar Cres., Bracknell, Berks

## 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.



**Catronics** — the South East England Specialists in Everything for the New Computer Age.

## video genie system

as Reviewed in May '81 issue



- 12K MICROSOFT BASIC
- 16K RAM
- UHF MODULATOR
- INTERNAL CASSETTE
- 2nd CASSETTE INTERFACE

SPECIAL DISCOUNT PRICE **£299** + VAT

★ EXPANSION BOX AVAILABLE  
★ DISK DRIVE IF REQUIRED

★ 100's OF PROGRAMS  
★ TRS-80 LEVEL II SOFTWARE COMPATIBLE

If you cannot call write for **FREE** illustrated leaflet

### COMPUTER-RTTY PACKAGE for TRS-80 and VIDEO GENIE

Catronics wonderful new CT600 RTTY package enables a TRS-80 (16K, level II) or Video Genie computer to send and receive Radio Teletype Messages. The package includes a pcb module and program cassette. The pcb carries the terminal unit which includes a PLL discriminator for reception and can handle wide shift as well as narrow. Also on the pcb is an audio oscillator which plugs into the microphone socket of your SSB or FM transmitter to produce FSK or AFSK transmission. The Transmit/receive relay on the pcb is keyboard controlled, as are all other functions. The software allows operation on 4 speeds - 45,50,75 and 110 bauds. Text transmission is simplified with automatic letters/figures shift and there is provision for 10 memories, which can be stored on cassette. Transmit text (including memories) is displayed and entered into buffer, even whilst receiving.

Send now for complete details!  
C.T. 600 complete package: £106.00 + VAT + £1.50 p&p (= £123.40)

**SPECIAL PACKAGE DEAL** (saving over £35 on list price): Video Genie Computer + CT600 for only £460.00 incl. VAT

CREDIT TERMS available. Pay by Access, Barclaycard or Catronics Creditcharge Card.

Personal Shoppers Welcome.  
3 Big Car Parks within 100 yds.

**CATRONICS LTD (Dept. 291), COMMUNICATIONS HOUSE, 20, WALLINGTON SQUARE, WALLINGTON, SURREY SM6 8RG.**

Tel. 01-669 6700 (9am to 5.30pm, Sat 12.45pm) / Closed lunch 12.45-1.45.

## HINTS & TIPS for the ZX81 by Andrew Hewson

£4.25

- ★ 80 pages explaining clearly how to squeeze a computing quart out of a Sinclair pint pot.
- ★ Saving Space — vital reading for all ZX81 owners.
- ★ Understanding the Display File — using the display file as memory, clearing a part of the display, using tokens 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 twelve useful, interesting and entertaining programs such as LINE RENUMBER, BOUNCER, SHOOT, STATISTICS etc.

### Cassettes for 16K ZX81

**SPACE INTRUDERS** — fight the marauding alien as you battle to save the Earth. All the dynamic parts of this program are written in machine code for super fast run . . . . . £6.50

**PROGRAMMERS TOOLKIT** — line renumber including GOSUBs and GOTOs, full facility Hexadecimal Loader/Printer, Find, Edit and Replace BASIC program strings . . . . . £8.50

### Cassettes for 1K ZX81

**MINI SPACE INTRUDERS** — Yes! Our machine language programmers have done it again! Now you can play this super game of your 1K machine! All the fun of the arcade game in your own home! . . . . . £5.95

**STATISTICS** — Mean, standard deviation, regression, trend analysis, chi squared test, graph plot . . . . . £3.75

**Z80 OP CODES** — this handy ready reckoner lists all 600 plus Z80 machine codes in decimal and hexadecimal with their nemonics. Each code is succinctly explained and cross referenced. Complete with protective transparent wallet . . . . . £1.45

BLANK C12 CASSETTES 10 for £5.50, 25 for £13.25

Send SAE for full catalogue

Cheque with order or quote Access number to:  
**HEWSON CONSULTANTS, 7 GRAHAME CLOSE, BLEWBURY, OXFORDSHIRE OX11 9QE TEL: (0235) 850075**

**ATARI APPROVED DEALER**

# ATARI 400 & 800

PERSONAL COMPUTER SYSTEMS

## IN MANCHESTER

★ SOFTWARE ★ PERIPHERALS  
★ COMPUTER CHESS GAMES  
(FULL RANGE IN STOCK)

BARCLAYCARD VISA

ACCESS Buy it with Access

**SPECIAL MAIL ORDER SERVICE WRITE OR PHONE FOR FULL DETAILS**

**GEMINI ELECTRONICS**  
Dept. CT; 50 Newton St., Off Piccadilly,  
Manchester M1 2EA. Tel: 061-236 3083.

WE ARE AT THE CORNER NEWTON ST./ HILTON ST.

**SPECIAL ANNOUNCEMENT**

## Acorn Atom

### PROGRAMMER'S TOOL-BOX

A packed 4K EPROM (fits Utility Socket) containing:-  
1200 BAUD CASSETTE OPERATING SYSTEM  
Visible Load Routine

**PLUS**

- \* TRACE(X) — controlled execution, line no. display
- \* STEP — single step execution
- FIND — any string of chars. in program
- VAR — list variables
- LVAR — print variables
- AUTO X,Y — automatic line numbering (any start, any step)
- RENUMBER X,Y — any start, any step
- DELETE X to Y — any range to line nos.

(\*VIA chip required)

**PLUS Additional BASIC statements**

- READ, DATA & RESTORE
- KEY X — scans keyboard-input to variable
- INKEY \$X — scans keyboard-input to string variable
- IF . . . THEN . . . ELSE
- WHILE . . . ENDWHILE
- CURSOR X,Y — position cursor as required
- ON ERROR
- BEEP X,Y — sound a note-any duration, any pitch
- ZERO — zeroes all basic variables
- POP — close out sub-routine

Suitable for any memory size. Greatly enhances the Atom's existing facilities.

Real Value at £24.50 + VAT & 25p P&P

**5, Wensley Road, Leeds LS7 2LX  
Tel. (0532) 683186**

Send S.A.E. for details & full catalogue.  
(State Atom)

**PROGRAM POWER**

Barclaycard VISA



# INVADERS!

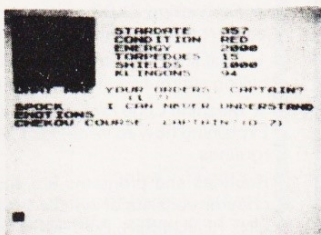
Fast-moving, machine code version of the famous arcade game, for the 16K ZX81. Shields are provided to help protect you from the bombs of the marching aliens. Ten levels of play, from easy to suicidal! On screen scoring.

PRICE ONLY £4.00

# STARTREK

The classic computer game in which you trek across the galaxy in search of Klingons to zap with your phasers and photon torpedoes. You have long and short range scanners to help you find them, Starbases to refuel your ship at and, of course, various witty comments from the crew.

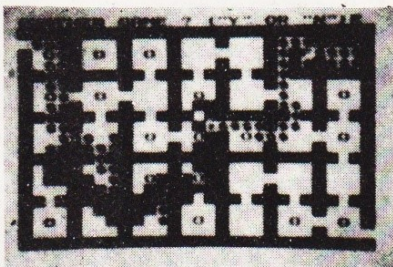
PRICE £5.00



# ADVENTURE

An adventure program entitled: THE DAMSEL AND THE BEAST

A Game of concentration and suspense in which you, the intrepid hero, must wander in the darkness and dangers of the Beast's palace, find the Damsel hiding or imprisoned there, kill the Beast, and then last but not least, lead the Damsel to the palace exit before she starves to death. There is an 'easy' (!) version for L-plate heroes, a medium game for the experienced adventurer, and a difficult game for the suicidal. An extremely complex, frustrating and entertaining game. PRICE ONLY £6.50



# 1K BREAKOUT

Two versions of the popular arcade game, both written in machine code, and both fitting into the 1K ZX81. Flicker-free, fast moving graphics.

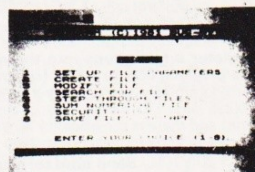
BOTH GAMES FOR ONLY £4.50

# Sinclair ZX81 software

## ZXAS MULTIFILE

Full machine code assembler for the ZX81 & 8K ROM ZX80 (16K) complete with documentation. ONLY £3.95

An amazingly versatile multi-purpose filing system for the 16K ZX81. The program is menu-driven, and number, size and headings of files are user-definable. Both string and numerical files are catered for. Files may be created, modified, replaced, and searched, and are protected by an ingenious foolproof security system. Output to the ZX printer is also provided. The program comes on cassette, together with three quality data cassettes for file storage, and comprehensive documentation, describing a host of applications for both business and personal use. If your ZX81 is bored with playing games, then this program will give it plenty to think about! PRICE £17.50 INCLUSIVE DOCUMENTATION ONLY — £1.00 (refundable).



## ZXDB

Machine code disassembler & debugging program — can be used with ZXAS. Many useful utilities. For 16K ZX81 & 8K ROM ZX80. ONLY £5.95

### NEW: VIEWTEXT

A ten page information display system for the 16K ZX81. Can display both text and graphics in any sequence with variable speed. Many applications including shop window displays, education, animation etc. PRICE: £7.00

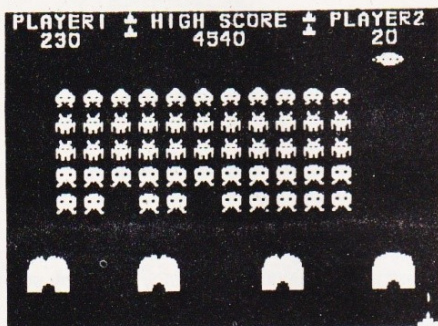
### PROGRAM PACK 4 for 16K ZX81

Two highly entertaining and addictive games for the expanded ZX81, written in machine code with very fast moving graphics. ASTEROID BELT and SURROUND (2 versions) BOTH PROGRAMS FOR ONLY £4.50

### PROGRAM PACK 6 for the 16K ZX81 & 8K ROM ZX80

Two programs for the expanded ZX81 to keep you entertained for hours! 3-D OXO is written in machine code, and is hard to beat. The other is a compulsive adventure game called MARS RESCUE. BOTH PROGRAMS FOR ONLY £4.50

## Acorn Atom INVADERS



"The best excuse to expand your Atom. It is a superb version of the standard game, tough and fast" Your computer Nov '81 12K, graphics mode 4 ONLY £8.00

## Acorn Atom CHESS



### THE PROGRAM YOU'VE BEEN WAITING FOR!

Fantastic machine code chess game for the 12K Atom. Features include: split screen (high res. + alphanumerics); many levels of play; castling & en passant; computer plays black or white; can set up pieces for chess problems etc. Supplied on cassette with instructions. PRICE ONLY £9.00

### DON'T FORGET

OUR PRICES INCLUDE VAT & POSTAGE

## 747

### FLIGHT SIMULATION PROGRAM FOR THE 12K ATOM

Written for Bug-byte by a 747 pilot. Accurate simulation of a 747's cockpit display (airspeed, altitude, rate of climb, attitude, flaps, etc.), and graphic display of horizontal situation & attitude; allows you to guide your craft to the landing strip. On making your final approach the display changes to a high-resolution 3D representation of the runway coming up to meet you. A real test of skill. Finding the runway is quite a challenge-landing safely is even more difficult. If you succeed, you are awarded a skill rating and the chance to take off and try again. REQUIRES FLOATING POINT ROM

PRICE ONLY £8.00

## Acorn Atom FRUIT MACHINE



"A brilliant, incredibly fast model with lovely sound & graphics."

Your Computer Nov '81 8K, graphics mode 2. ONLY £4.00

### MORE ATOM CASSETTES FROM OUR RANGE

PINBALL 6K, gr.2	£6.00
BACKGAMMON 7K	£7.00
BREAKOUT 4K, gr.1	£4.00
STAR TREK 12K, FP	£5.00
LUNAR LANDER 12K, gr.4	£5.50
LABYRINTH 12K, gr.2A, FP	7.00
GOLF 7K, FP	£5.00
NEW 1-Key BASIC 2K	£5.00
STOCKMARKET 5K, FP	£5.00
DODGEMS + SNAKE 6K	£5.00
DISASSEMBLER 2K	£4.00
TYPIST 7K	£4.00
UFO BOMBER 7K	£4.00

### ALL OUR PRICES ARE INCLUSIVE!

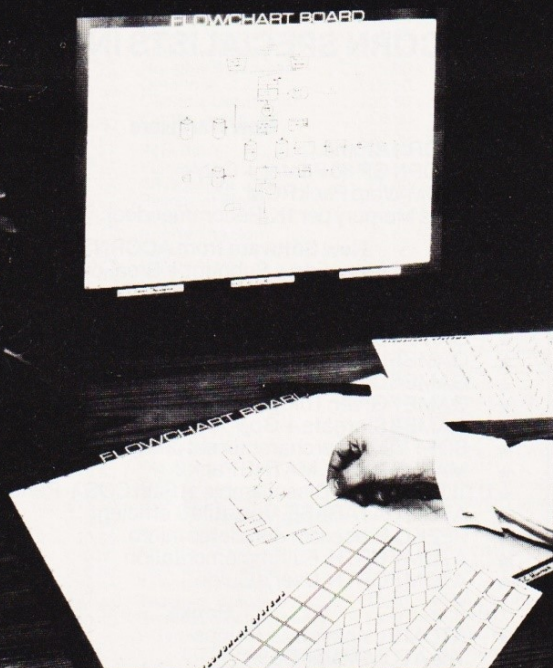
Please cross cheques / POs & make them payable to "Bug-byte". Payment may be made by Access or Barclaycard, and there is a 24hr answering service on 051 227 2642

BUG-BYTE  
Microcomputer Software  
98-100 THE ALBANY  
OLD HALL STREET  
LIVERPOOL L3 9EP

## BUG-BYTE



## SOME IDEAS ARE JUST TOO GOOD FOR WORDS



**FLOWCHART SYSTEMS**

A DIVISION OF DOYLEGUARD LTD.

And yet, we could write pages about how this simple idea transformed our own approach to programming.

Initially, we produced the Flowchart board and self-cling symbols to provide a neat, uniform layout which could be photocopied. But, we soon realised that the real advantage lay in having a flowchart that could keep pace with the programmers ideas and adapt immediately to the inspiration of the moment.

The 'instant flowchart' concept will help you to achieve crisp, error-free programmes.

And we speak from experience.

Please supply:

\_\_\_\_\_ Flowchart board/s at £15.53 each \_\_\_\_\_  
 \_\_\_\_\_ sheet/s of Primary symbols (FS 186-1) \_\_\_\_\_  
 \_\_\_\_\_ at £3.22 each \_\_\_\_\_  
 \_\_\_\_\_ sheet/s of Secondary symbols (FS 186-2) \_\_\_\_\_  
 \_\_\_\_\_ at £3.22 \_\_\_\_\_  
 \_\_\_\_\_ pack/s 6 wipe-off pens at £2.28 per pack \_\_\_\_\_  
 \_\_\_\_\_ Postage & packing £1.75

I enclose a cheque/postal order for £

All prices include vat.

A complete starting kit costs £26.00 including vat/postage.

Name: Mr./Mrs./Miss. \_\_\_\_\_

Company: \_\_\_\_\_

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

Post Code \_\_\_\_\_

**DATARITE HOUSE GRAFTON ROAD  
 NEW MALDEN SURREY KT3 3AA  
 01-942 2830**

## NEWSCRIPT

for

# TRS-80

In the October issue of this magazine we announced the arrival of a superb new word processing package for the TRS-80 Models I & III. We tried to list some of its more outstanding features but were unable to give any idea of the way in which it entirely overshadows its rivals. If you want to know more about the most professional TRS-80 word processor on the market, you will have to write or phone for details. If you want to know all about NEWSCRIPT 6.1 you will have to buy it. Don't be put off by the low price, this is **THE** one.

**NEWSCRIPT 6.1** is priced at £85.00 delivered. **NEWSCRIPT's** little brother, **SUBSCRIPT** only requires 32k but does not support full screen editing and is priced at £69.95 delivered.

### 5-1/4" Floppy Disks

Where are you getting your disks? Our single sided double density disks are selling for £18.00 per 10 (plus VAT) and that **INCLUDES** a genuine plastic library case. (Please add 60p p&p)

### Tried and Trusted

Did you know that we buy and sell used TRS-80 equipment? Give us a ring, we might have it (or want it).

**2 Senacre Square, Maidstone, Kent ME15 8QF**

**LOGICAL CHOICE** TELEPHONE  
 MAIDSTONE  
 (0622) 677574.  
LOGICAL CHOICE COMPUTER PRODUCTS AND LOGICAL CHOICE SOFTWARE

## io systems ltd.

### A/D BOARD FOR NASCOM

- ★ 8 Bit resolution
  - ★ 8 Input channels
  - ★ 30 microsecond conversion
  - ★ Prototyping area
  - ★ Sample and hold
  - ★ Overvoltage protection
  - ★ Full flag/interrupt control
  - ★ Built and tested
- Price £135 + 15% VAT (post free)

### EPROM PROGRAMMER

- ★ Programs 3 rail: 2708/2716
  - single rail: 2508/2758, 2516/2716, 2532/2732
  - ★ Zero insertion force socket
  - ★ Built and tested
- Price £63 + 15% VAT (post free)

### GRAPHICS BOARD FOR NASCOM

- ★ 384 (H) x 256 (V) very high resolution graphics display
  - ★ Fully bit-mapped
  - ★ Full software control
  - ★ Graphics software supplied
  - ★ Mixed text and graphics
  - ★ NASCOM 2 or 4mhz
  - ★ NASCOM 1
  - ★ Built and tested
- Price £55 + 15% VAT (post free)

### GRAPHICS BOARD SOFTWARE

- ★ Lunar lander: £6 + VAT (post free)
- ★ Graphdraw: £8 + VAT (post free)

### DUNCAN

- ★ Fast real time interpreter/control language for NASCOM 1 or 2 (please specify machine)
- Price £12 + 15% VAT (post free)

### MONITORS

- ★ BMC 12" green phosphor
  - ★ 18 mhz bandwidth
- Price £175 + 15% VAT (carriage extra)

### MEMORIES

- ★ 4116 - 150ns 95 pence each + VAT (min order 8)
- ★ 64K - 200ns £10 each + VAT

**6 LALEHAM AVE, MILL HILL, LONDON NW7 3HL**

**TEL: 01-959 0106**





**XMAS OFFER**

**FLOPPY DISCS 5¼"**  
 BASF SS/SD £1.50  
 BASF SS/DD £2.00  
 BASF DS/DD £2.35

**COMPUTER LISTING PAPER (2,000 box)**  
 11" x 9½" Plain White £8.00 per box  
 11" x 9½" Music Ruled Green £9.50 per box  
 12" x 9½" Plain White £9.30 per box

**MAILING LABELS**  
 (Self Adhesive — 2 across)  
 3½" x 1½" £3.20 per 1,000  
 4" x 1½" £3.50 per 1,000

**PRICES DO NOT INCLUDE VAT OR POSTAGE (DELIVERY) WRITE OR PHONE FOR FULL DETAILS**

**CONSUP** LAMBETH INDUSTRIAL ESTATE,  
 62 TRITTON RD, LONDON SE21  
 Telephone: 01-670 4411

Address .....

Phone .....

CT/1

**ACORN COMPUTER B.B.C. ROM SETS SINGLE FLOPPY DISK UNITS (100K)**

**WRITE FOR DETAILS to: the ACORN SPECIALISTS IN YORKSHIRE**

**New Hardware**

★ ACORN Atoms	From £140.00
★ ACORN GP-80 Printer + Cable	£232.00
★ ATOM Word Pack ROM	£30.00
★ Extra Memory per 1K (Recommended)	£3.20

**New Software from ACORN SOFT**

★ GAME 1 Asteroids + Subhunt + Breakout	£11.50
★ GAME 2 Dogfight + Mastermind + Zomble	£11.50
★ GAME 3 Rat Trap + Lunar Lander + Black Box	£11.50
★ GAME 4 Star Trek + Four Row + Space Attack	£11.50
★ GAME 5 Invaders + Wumpus + Reversi	£11.50
★ GAME 6 Dodgems + Simon + Amoeba	£11.50
★ GAME 7 Green Things + Ballistics + Snake	£11.50
★ GAME 8 Stargate + Go + Moko + Robots	£11.50
★ SOFT VDU New character set design	£11.50
★ MATHS Pack 1. MATHS Pack 2	£11.50
★ UTILITY PACK 1. Disassemble + Fast COS + Renumbr	£11.50
★ ATOM DATABASE. Versatile & efficient	£11.50
★ PEEKO-Processor Simulates micro	£11.50
★ ATOM FORTH. Full implementation	£11.50
★ ATOM FORTH. User's Guide	£6.00

**Books**

★ ATOM Business by J. Phipps	£6.95
★ The ATOM Magic Book	£5.50
★ Getting Acquainted With Your ACORN ATOM	£7.95

**ALL PRICES INCLUDE UK P&P + VAT WHERE APPLICABLE**

**ELTEC SERVICES LIMITED**  
 231 MANNINGHAM LANE  
 BRADFORD BD8 7HH  
 TELEPHONE: 0274 491372

BARCLAYCARD  
 VISA

Access

## CASSETTE ONE PROGRAMS FOR ZX81

"I had your invaders/React cassette... I was delighted with this first cassette"

—P. Rubython, London NW10

"Thanks for your Cassette One you sent me — some excellent games at a very cheap price!"

—P. Rushton, Leeds

"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

### CASSETTE ONE SIDE ONE 1K MACHINE CODE PROGRAMS

React, Invaders, Phantom aliens, Maze of death, Planet lander, Bug splat, Bouncing letters

### CASSETTE ONE SIDE ONE 1K BASIC PROGRAMS

I Ching, Mastermind, Basic hangman, Robots

**CASSETTE ONE SIDE TWO** has large screen versions of Invaders and Maze of Death, ready for when you get 16K. (Previous customers who did not get the large screen versions can get free upgrade instructions by sending me an sae.)

**CASSETTE ONE** costs £3.80 from Michael Orwin, 26 Brownlow Rd., Willesden, London NW10 9QL

## ACORN ATOM

### Special Offer Christmas Prices

Atom kit with 12K ram	£162
Atom assembled with 12K ram	£187
Games cassette Atom G1	£6
Atom Power Supply	£10

All prices fully  
inclusive of VAT and P&P

Please allow 28 days for delivery

**ELECTRONEQUIP**  
 128 West Street  
 Portchester  
 Hants PO16 9XE  
 Telephone: 0705 373455





# TRS-80 OWNERS!



## LEVEL II CASSETTE GAMES

Adventures:-	
Special Sampler*	£6.50
Adventureland*	£13.50
Pirates Adventure*	£13.50
Mission Impossible*	£13.50
Voodoo Castle*	£13.50
The Count*	£13.50
Strange Odyssey*	£13.50
Mystery Fun House*	£13.50
Pyramid of Doom*	£13.50
Ghost Town*	£13.50
Kid Venture	£13.50
Savage Island*	£13.50
Crowley Manor*	£13.50
Air Raid*	£7.50
Air Traffic Control*	£8.50
Amazon Mazes	£5.50
Android NIM	£7.50
Attack Force*	£10.50
Backgammon	£6.50
Barricade*	£7.50
Battle Bastogne	£10.50
Battle St. Vith	£10.50
Battleship	£7.50
Bee Wary	£7.50
Bingo	£5.00
Bowling (Ten Pin)	£6.50
Bridge Partner	£13.50
Chess Partner*	£9.50
Cosmic Fighter*	£10.50
Cribbage	£6.50
Dates of Ryn	£17.50
D-Day	£10.50
Death Dreadnaught*	£10.50
Duel & Droids	£10.50
The Empire Strikes	£10.50
End Zone II	£6.50
Fastgammon*	£14.00
Galactic Empire	£10.50
Galactic Revolution	£10.50
Galactic Trader	£10.50
Galaxy Invasion*	£10.50
Game of Life*	£6.50
Gammon Challenger*	£10.50
Gangster	£5.50
Hangman	£5.50
Hellfire Warrior	£20.50
I Ching	£6.50
Interlude*	£12.00
Invasion Orion	£17.50
Invaders from Space*	£10.50
Kamikaze	£6.50

Kreigspiel II	£10.50
Labyrinth*	£10.50
Life Two	£10.50
Lost Dutchman's Gold	£9.50
Lunar Lander*	£10.50
Mean Checkers*	£11.00
Meteor Mission*	£10.50
Morloc's Tower	£17.50
Noughts & Crosses	£5.00
Othello III	£6.50
Olympic Decathlon*	£20.50
Pentominoes	£6.50
Pinball*	£10.50
Pork Barrel	£6.50
Planetoids*	£10.50
PR Dogfight	£6.50
Rescue at Rigel	£17.50
Reversi	£20.50
Round The Horn	£6.50
Safari	£6.50
Sargon II*	£20.50
Snake Eggs	£7.50
Space Battles	£7.50
Starfleet Orion	£14.00
Star Trek III.5	£10.50
Super Nova*	£10.50
Taipan	£6.50
Temple of Asphai	£17.50
Time Trek*	£10.50
Trolls Gold	£4.50
Turret & Track	£7.50
Up Periscope	£10.50
Warfare I	£6.00
Warpath	£10.50
X-Wing Fighter II	£7.50

### EDUCATIONAL

Spelling Builder	£13.00
All other PDI Pgms	£10.50
Teachers Assistant I	£9.50
Teachers Assistant II	£9.50
Teachers Assistant III	£9.50
Semi Conductor Theory	£9.50
9 Games for Preschoolers	£7.50

### BUSINESS & UTILITIES

Accounts Receivable II	£13.50
Amateur Astronomer	£9.50
APL-80*	£10.50
Basic 1P*	£11.50
Basic Toolkit*	£12.50
Biorhythms	£5.50
Calendar Functions	£7.50
Cash Register	£6.50
Copys*	£10.50
Data Base II	£17.00
Debug*	£13.50

Direct Function Graph	£10.50
Editor Assembler Plus*	£20.50
Electric Pencil*	£50.00
Electronics Assistant	£7.50
EMU 02* (requires TBUG)	£17.00
ESP Tester	£5.00
File Handling	£7.50
Finance Pack	£7.50
Finplan	£35.00
Flight Simulator*	£17.00
Forth* (incl. Primer)	£42.00
GSF*	£19.50
General Accounting	£8.50
Ham Radio	£7.50
Histogram/Scattergram	£8.50
Home Finance	£6.50
Infinite Basic*	£34.00
Infinite Business*	£20.50
Instant Calculator	£8.50
Inventory Control	£11.00
Inventory 'S'	£17.00
IRV*	£17.00
Keyboard 80*	£7.50
KVP*	£10.50
Level III Basic*	£34.00
Linear Programming	£7.50
Magic Paper Calculator	£9.50
Mathdrill	£5.50
Maths Library I	£10.50
Maths Library II	£10.50
Memdump*	£8.50
Mortgage Calculator	£5.00
Pascal*	£26.00
Periodical X-REF	£10.50
Personal Finance	£7.50
Pilot 2.2*	£10.50
Pre-Flight	£10.50
Remodel & Proload*	£25.00
Renumber*	£7.50
RPN Calculator	£7.50
RSM 2 Monitor*	£16.00
SCRIPSIT*	£42.95
Screen Hold*	£6.00
Statistics	£6.50
S.T.A.D.*	£17.00
ST-80*	£34.00
Super Pims Data Base	£10.50
Super Simon	£7.50
Super T-Legs*	£7.50
T-Step*	£7.50
System Copy*	£9.50
T-Short*	£6.50
T-Short**	£14.00
Tarot Cards	£6.50
Timser*	£10.50

Tiny Comp	£14.00
TRS80 Opera*	£7.50
Typing Tutor	£13.50
Ultra Mon*	£17.00
X-Ref*	£9.50
Y-Y Bar	£10.50
76 Basic Programs	£23.00
Manual for Above	£8.00
Library 100	£40.00

### DISK

Accounts Receivable II	£40.00
Advanced Personal Finance	£17.00
Amateur Radio System	£17.00
APL 80	£30.00
Auto Disk Directory	£10.50
Basic Compiler	£120.00
Cash Register + Inventory	£40.00
CCA Data Management	£52.50
Comproc	£13.50
Data Base II	£30.00
DCV-1	£9.50
Dosort	£25.00
Dynamic Data Base	£22.50
Electric Pencil	£75.00
File Manager 80	£30.00
Floppy Disk Diagnostic	£13.50
Forth (incl. Primer)	£45.00
Forth Datahandler	£40.00
Forth Utilities Disk	£27.50
Inventory Control	£50.00
Inventory 'S'	£40.00
KVP Extender	£17.00
Mailist IV	£45.00
MyChess	£25.00
Newdos 80 V2.0	£97.50
Newdos +	£47.50
Office Accounting	£20.00
Pascal	£35.00
Penpatch	£11.00
Pencil PAL	£17.00
Roots	£17.00
RSM 2D Monitor	£20.00
Sargon II	£25.00
SCRIPSIT*	£65.00
Simplify It	£15.00
Space Intruders	£20.00
ST80D*	£45.00
ST80D III*	£95.00
SUPERSCRIPIT*	£20.50
Visicalc*	£65.00
Taranto & Associates Conversion of Osbourne & Associates Business Programmes	£90.00
Accounts Payable	£90.00

Accounts Receivable	£90.00
Invoicing for above	£70.00
General Ledger	
Includes Cash Journal	£90.00
Manuals for above (3)	£32.00
Complete Co-ordinated System with Manuals	£300.00

## MODEL II

CPM 2.2 X	£165.00
CBasic (CPM)	£80.00
Disk Sort Merge	£95.00
Development System	£80.00
G.S.F.	£35.00
Pascal	from £125.00
Reference II	£35.00
RM Cobol	from £350.00
RSM II Monitor	£35.00
Supersort III (CPM)	£90.00
Utility Package	£95.00
Hard Disk Operating Sys	£300.00

### WORD PROCESSORS

Electric Pencil II (CP/M)	£200.00
Electric Pencil II TRSDOS	£225.00
Magic Wand (CP/M)	£230.00
Wordstar (CP/M)	£275.00

### BUSINESS SYSTEMS

Accounting	from £150.00
Mailist	from £100.00
Medical	from £100.00
Property Analysis	£175.00

### CP/M USERS GROUP

23 Volumes	Each £12.00
------------	-------------

**ALL PRICES INCLUDE VAT AT 15%, PACKAGING & RETURN POSTAGE TO U.K. ADDRESSES. PRICES TO OVERSEAS ADDRESSES INCLUDE RETURN AIRMAIL. SEND £1.00 FOR NEW DESCRIPTIVE CATALOGUE.**

\*Denotes Machine Language  
TRS-80 Trademark of Tandy Corp.  
CP/M Trademark of Digital Res.  
C-Basic Trademark of Compiler Systems.

**ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE**

## MICROCOMPUTER APPLICATIONS

42A CHURCH STREET,  
CAVERSHAM, READING  
RG4 8AU, ENGLAND.  
TEL: (0734) 470425

## Happy Memories

Part type	1 off	25-99	100 up
4116 200ns	.95	.85	.65
4116 250ns	.90	.80	.60
2114 200ns Low Power	1.25	1.15	.95
2114 450ns Low Power	1.20	1.10	.90
4118 250ns	3.45	3.15	2.65
6116 150ns CMOS	6.95	6.45	5.65
2708 450ns	1.95	1.85	1.65
2716 450ns 5 volt	2.25	2.15	1.95
2716 450ns three rail	6.40	6.00	4.95
2732 450ns Intel type	4.25	3.95	3.35
2532 450ns Texas type	4.95	4.70	4.20

Z80A-CPU £4.75	Z80A-PIO £4.25	Z80A-CTC £4.25
----------------	----------------	----------------

Low profile IC sockets:

Pins	8	14	16	18	20	22	24	28	40
Pence	9	10	11	14	15	18	19	25	33

Soft-sectored floppy discs per 10 in plastic library case:

5 inch SSD £17.00	5 inch SSD £19.25	5 inch DSDD £21.00
8 inch SSD £19.25	8 inch SSD £23.65	8 inch DSDD £25.50

74LS series TTL, large stocks at low prices with DIY discounts starting at a mix of just 25 pieces. Write or 'phone for list.

Please add 30p post & packing to orders under £15 and VAT to total  
Access & Barclaycard welcome, 24hr service on (054 422) 618  
Government & Educational orders welcome, £15 minimum.

Trade accounts operated, 'phone or write for details.  
Prices are still tending to drop, 'phone for a quote before you buy.

**Happy Memories (CT), Gladestry, Kington,  
Herefordshire HR5 3NY. Tel: (054 422) 618 or 628.**

Quality  
support for:

ATOM  
ZX80  
ZX81

### ZX80 ACTION!

Flicker-free action games for your ZX80, need only 1K RAM and the original 4K ROM.  
Cassette CB04: BREAKOUT --- ACK-ACK £4.00  
Cassette CB08: SHELL GAME - INVADERS £4.00

The ZX80 Magic Book \*WITH 8K ROM/ZX81 SUPPLEMENT\*  
Games programs, computer music, converting programs written in other BASICs, improving the picture, RAM

The ATOM Magic Book  
A wealth of games and other programs; storing speech in your ATOM, converting programs written in other BASICs, tape recording hints, plus many other useful hardware and software tips. £5.50

### ATOM CASSETTES: £5 each

CA04: BREAKOUT - CUPBALL-3D MAZE-SIMON 2  
CA08: PINBALL-LETTERS-SPACEWAR-DRIVE  
Both tapes need 1K VDU + 8K text RAM

and I/O circuits, and much more. £4.75

Getting Acquainted with your ZX81 £4.95

Mastering Machine Code on your ZX80/81 £5.95

23x23 MAY ZX80/81 EDGE CONNECTOR SOCKET £3.50

23x23 MAY ZX80/81 GOLD PLATED PLUG EXTENSION £3.50

16/32K ATOM RAM Boards from £59.50

Single Eurocard, can fit inside ATOM's case. Built & tested. Bare PCB only £23.50, S.A.C. for details.

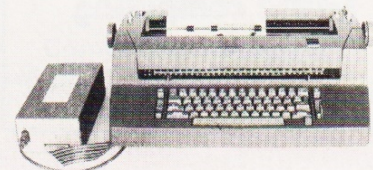
ALL PRICES INCLUDE U.K. P&P + VAT WHERE APPLICABLE

**TIMEDATA Ltd.**

**57 Swallowdale, Basildon, Essex**

## IBM TYPEWRITER + ESCON = COMPUTER PRINTER

- \* Low Cost
- \* Word Processing Quality
- \* In Use World-Wide
- \* Does not affect IBM Servicing
- \* Any Model IBM Selectric can be converted
- \* For use with most micros and minis
- \* From £415 (plus VAT). For more information contact:



**Data Rite Terminals**

144-146 High Road, Chadwell Heath, Essex RM6 6NT  
Telephone: 01-590 1155.



# COMPUTAMART

AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE...

**COMPUTING TODAY  
PRESENTS YOUR OWN  
'WHERE TO BUY IT' GUIDE.**

## AVON

**MicroStyle**

29 Belvedere, Lansdown Road,  
Bath.

Tel: 334659.

Open: 6 days 9am-5pm. late night Thur 9pm.

## BEDFORDSHIRE

**BROADWAY ELECTRONICS**

1 The Broadway, Bedford.

Tel: 0234 213639.

Open: 6 days 9am-5.30pm. (lunch 11.30-2.30  
½ day Thur). We supply ACORN ATOM  
computers.

## CLEVELAND

**BRIERS COMPUTER SERVICES**  
Polytechnic Bookshop (at the Poly)  
1 King Edward Square,  
Middlesbrough.

Tel: 0642 242017.

"Everything for the Genie computer".

## ESSEX

**J. M. PICKARD**

Micro Computer Services  
22 Holland Rd, Clacton-on-Sea  
Essex CO15 6EQ

Tel: 0255 29018

**genie**

video genie centre.

Demonstration by appointment.



**EMPRISE**

EMPRISE - TANDY  
58 East Street, Colchester, Essex.  
Tel: 0206 865926

Open: Mon-Sat 9.00am-5.30pm.  
Branches at Chelmsford.



## HUMBERSIDE

**3-LINE computing**

36 Clough Road, Hull.  
Tel: 0482 445496.

Video Genie; TRS80 + ZX81 software  
Open: 6 day. 9 to 5.30.

## LANCASHIRE

**HARDEN MICROSYSTEMS**

28-30 Back Lord Street,  
Blackpool.

Tel: 0253 27590.

Open: 6 days 9am-5pm. TRS80/Video Genie  
peripherals at discount prices.

**LOOKING FOR  
MICROCOMPUTER HARDWARE  
OR SOFTWARE? LOOK NO  
FURTHER THAN  
COMPUTAMART!**

**cytek (UK) LIMITED**

Sandringham House, 9 Warwick Rd,  
Old Trafford, Manchester M16 0QQ

Tel: 061 872 4682

Open: Mon-Fri 9.00am-5.30pm.  
Sat 10.30am-1.00pm.

**NSC COMPUTER  
SHOPS**

29 Hanging Ditch, Manchester.

Tel: 061 832 2269

Open: Mon-Fri 9.30am-5.30pm.  
Sat 10-5. Retail and Wholesale.

## LINCOLNSHIRE

**SHARP CENTRE**  
16 Melville Street,  
Lincoln.



Tel: Lincoln 32379.

Open: 9am-5.30pm closed Wed.

## LONDON

**Personal  
Computers  
Limited**

194-200 Bishopsgate,  
EC2.

Tel: (01) 626 8121.

Open: Mon-Fri 9am-6pm.  
Retail and Wholesale.

## MERSEYSIDE

**BUG-BYTE**

98-100 The Albany, Old Hall St.,  
Liverpool 3. Tel: (051) 227 2642.

Mail order (callers by appointment) ZX81,  
ATOM and VIC software. Retail and  
Wholesale.

## W. MIDLANDS

**MACRONICS (ZX80/81 Software)**

26, Spiers Close, Knowle,  
Solihull B93 9ES

Mail order only.

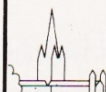
## NORFOLK

**ANGLIA COMPUTER CENTRE**

88 St Benedicts Street,  
Norwich.

Tel: (0603) 29652/26002.

Open: 6 days 9am-5.30pm.



**CALL VANDA HARGEN ON  
01-437 1002 FOR YOUR  
BUSINESS TO BE  
INCLUDED.**

## SCOTLAND

**COMPUTER AND CHIPS**

Feddinch Mains House,  
St. Andrews, Fife.

Tel: St Andrews (0334) 72569.

Open: 9am-7pm.

## SUSSEX

**CROWN**



56-58 South Street,  
Eastbourne.

Tel: Eastbourne (0323) 639983/20496

Open: 6 days 9am-5.15pm.

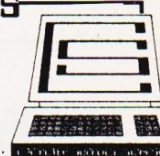
## WALES

**COMPUTER SUPPLIES  
(SWANSEA)**

80/82 Gower Road,  
Sketty, Swansea.

Tel: Swansea 290047.

Open: Mon-Sat 9am-5.30pm.



## WARWICKSHIRE

**BUSINESS & LEISURE  
MICROCOMPUTERS**

16 The Square, Kenilworth.

Tel: Kenilworth 512127.

Open: Mon-Fri 9am-5pm. ½ day Thur

(lunch 1-2). Retail and Wholesale.



## YORKSHIRE

**BRADFORD'S COMPUTER  
SHOP**

at Thomas Wright (Bradford)  
Ltd., Thorite House, Laisterdyke.

Tel: Bradford 668890.

Open: Mon-Fri 8.45-5.30. (Sat 12am)

**HOLDENE ENGINEERING LTD**

10 Blenheim Terrace,  
Woodhouse Lane, Leeds.

Tel: 45673/461386.

Open: Mon-Fri 9am-5pm.

Microcomputer repairs and engineering  
services.

**PLEASE MENTION  
COMPUTING TODAY WHEN  
CONTACTING  
'COMPUTAMART'  
BUSINESSES.**



# MICROCOMPUTER COMPONENTS

LOWEST PRICES - FASTEST DELIVERY

## SPECIAL OFFERS MEMORIES

2114L	200 ns	0.99
2708	450 ns	1.48
2716	450 ns	2.10
2532	450 ns	3.99
2732	450 ns	3.20
4116	150 ns	0.75
4116	200 ns	0.67
6116	200 ns	6.50
5516	200 ns	11.95
4118	200 ns	3.85

\* OFFER VALID FROM DEC 1st - JAN 1st.  
SUBJECT TO AVAILABILITY

OFFICIAL ORDERS WELCOME CREDIT CARD ORDERS WELCOME QUANTITY DISCOUNTS AVAILABLE  
All prices exclude post and packing on orders under £10 (50p) and VAT (15%).  
ALL ORDERS DESPATCHED ON DAY OF RECEIPT WITH FULL REFUND FOR OUT OF STOCK ITEMS IF REQUESTED.  
24-hour Telephone Credit Card Orders

**MIDWICH COMPUTER CO. LTD.**  
(Dept DT/2)

HEWITT HOUSE, NORTHGATE STREET,  
BURY ST. EDMUNDS, SUFFOLK IP33 1HQ  
TELEPHONE: (0284) 701321 TELEX: 817670

## YOUR QUICK-LEARN WAY TO BASIC, COBOL & IBM 360

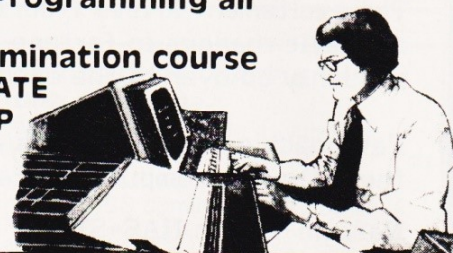
IN YOUR OWN HOME,  
IN YOUR OWN TIME,  
AT YOUR OWN PACE.

Learn computer programming quickly and easily through the renowned ICS "Open College" system.

Use the famous ICS study texts, backed up by your own expert tutor, and learn computer programming, the proven way, with ICS home study.

**Introductory Course, BASIC, COBOL & IBM 360 Programming all covered.**

**... PLUS examination course for ASSOCIATE MEMBERSHIP OF THE BRITISH COMPUTER SOCIETY.**



**ALL DETAILS FREE—SIMPLY RETURN THE COUPON BELOW**

Please send me your prospectus on Computer Programming.

**ICS**

To: Dept  
ICS Intertext House  
London SW8 4UJ or  
Tel: 01-622 9911  
(all hours)

Name.....  
Address.....

345Q

# BACKNUMBERS

## July 1980

Battle of Britain simulation, Multiple choice exam program, Address list program, Kingdoms game.

## September 1980

Pascal overview, PC 1211 reviewed, BASIC dialects, Othello and Ski Run programs.

## November 1980

A special graphics issue containing: Graphic Details, Interactive Graphics, Results Plotter, Space Invasion game.

## June 1981

ZX81 reviewed, What's a Floppy Tape?, BBC BASIC specification, Bubble memories explained.

## July 1981

Holocaust wargame, Data entry validation routines, Multiple column records program, Media survey.

## August 1981

Rubik's Cube simulation, DAI colour computer reviewed, Micro Assembler in BASIC, Micro sound effects unit.

## September 1981

Football pools prediction Pt. 1, Connecting a printer to your micro, VIC reviewed, Upgrading PETs to 32K, Gladiator simulation program.

## October 1981

How to choose your first system, Pools prediction program, Compressing text, Upgrading BASIC, ATOM programming.

## November 1981

Adler's Alphatronic examined, Teletext explained, Speech synthesis board reviewed, New beginners guide to BASIC.

Last month's issue is still available as well but has not yet reached the end of its 'shelflife' and is not included for this reason.

If you are thinking of trying to plug some of the holes in your collection of Computing Today then some fast action is required. Stocks of past issues are running extremely low, we only have the issues shown remaining in stock. If you are missing one of these then **now** is the time to order it because the chances are that it won't be in the list next month. All backnumbers cost £1.00 each. For those of you who want copies of articles that are located in issues not available we do offer a photocopying service. Each copy costs £1.00 and information as to its title and publication date should be given. Ordering backnumbers and photocopies could hardly be easier, just fill in the coupon, cut it out and send it to

**Computing Today,**  
145 Charing Cross Road,  
London WC2H 0EE

Please remember to mark your envelope with the service you require, **BACKNUMBERS** or **PHOTOCOPIES**, otherwise our mailroom suffers brain damage.

## BACKNUMBER AND PHOTOCOPY ORDER FORM

Please send me the following items:

NAME.....

ADDRESS.....

Back issues ..... at £1.00 each

Photocopies of ..... in the

..... issue at £1.00 each

I enclose £..... Cheques and Postal Orders should be made payable to ASP Ltd



**Moi****Mine of Information Ltd**  
Microcomputer Consultancy & Booksellers**Moi**

# OTHELLO™ £10

Othello is a game of skill comparable to chess.  
The rules are few and the range of games enormous.  
The excitement arises from the characteristically  
dramatic changes in fortune as lines of pieces  
suddenly go over to the enemy side.

Fast machine code versions are now available for  
the following computers (state which in your order)

Nascom-2 with NAS-SYS

ZX81 (or ZX80+8K ROM) with 16K RAM

CP/M Z80 edition

Beware of imitations! MoI wrote the first British Othello program and owns the trademark.



## Book early for your Future



- £ 3.90 Illustrating Basic
- 4.60 Stimulating Simulations
- 5.00 Scelbi's Secret Guide to Computers
- 5.00 Getting Acquainted with your ZX81
- 5.00 CP/M Summary Guide
- 5.00 UNIX: Bell System Tech Journal
- 5.40 A Bit of Basic
- 5.90 Basic Computer Games
- 5.90 More Basic Computer Games
- 6.00 ZX81 Pocket Book
- 6.00 Mastering Machine Code on your ZX81
- 6.60 Home Computers Can Make You Rich
- 7.80 Using CP/M: A Self-Teaching Guide
- 7.80 S-100 & Other Micro Buses - 2e
- 8.00 ZX81 Companion
- 8.20 8080/Z80 Assembly Language Techniques
- 10.50 Osborne CP/M User Guide
- 11.00 Basic and the Personal Computer
- 12.00 CP/M Handbook with MP/M
- 12.00 Z80 Software Gourmet Guide & Cookbook
- 12.50 Programming the Z80 - 3e
- 12.50 Z80 Assembly Language Programming
- 14.50 C Programming Language
- 15.00 Basic Handbook - 2e

Prices include P+P in UK Add 20% for delivery to Europe, Africa or the Middle East  
Orders to: Mol (948) 1 Francis Avenue · St Albans · Herts AL3 6BL · England ·  
Phone 0727 52801 · Telex 925859



# CLASSIFIEDS

## RATES

1-3 insertions £6.50 per scc  
4-11 insertions £6.00 per scc  
12 insertions £5.50 per scc  
24p per word (Min 15 words)  
Box No. on application

All advertisements in this section must be pre-paid

Closing Date: - 2nd Fri. month preceding publication

Advertisements are accepted subject to the terms and conditions printed on the advertisement rate card (available on request).

SEND TO: — CT CLASSIFIED, 145, CHARING CROSS ROAD, LONDON WC2H 0EE. TEL: 01-437 1002 Ext. 50.

## WANTED

Computer, Discs, Tapes, Printer, etc working or not anything considered. Phone Leeds (0532) 792163 after 6.00pm or daytime J Spence 631478.

## ZX81 GAMES

HIGH QUALITY,  
LOW COST SOFTWARE  
(ABSOLUTELY NO RUBBISH)

**GAMESTAPE 1, for 1K, only £2.95**  
10 Games incl. Asteroids, UFO, etc.

**GAMESTAPE 2, for 16K, only £3.95**  
Starfighter, Pyramid, Artist.

**GAMESTAPE 3, for 16K, only £4.95**  
Catacombs... A Graphics Adventure.

**GAMESTAPE 4, for 16K, only £4.95**  
3D Monster Maze... Unbelievable Graphics.

Cheque/P.O.s to  
**J.K. GREY SOFTWARE,**  
16 PARK ST., BATH, AVON BA1 2TE.

## SHARP MZ80K SPECIALS

"The Word Processor" cassette. M/C code (6K user). Right, justifies, move, del, append, kill, type, verify, print, list and more. **£28. Super Copy.** Back up those expensive programs. Will copy any cassette and verify, M/C code (6K user) **£12.** Programmers assistant. Eleven new functions for 5025 BASIC no extra memory. Try this. Re-number, auto number, USR (X), cursor control, block delete, break, set rest, trace, string inequalities, single step. At **£14.50** it's a must. **Cassette Database.** OK. So it's boring. But it's got up to 255 cards each 10 lines. Create records, search, browse and print with special report (mailing list) available. Storage on cassette. Take it out of our storage for **£34. CALC II.** This one's a "look alike". Builds complex models for financial or other requirements. Display in a chosen format or as a histogram. Dazzle your bank manager. Save on cassette for future updates. Your financial future for **£39.** We post free. No extras. All prices inclusive. If you have a game or utility we offer good royalties.

Work Force, 140 Wilsden Avenue, Luton, Beds.

**RUBIK CUBE SOLUTION, ZX81/PET 8K,** £3 on C-60 cassette, 5 original PET games £5. Send for details. D. Beard, 1 Gladstone Way, Cambridge.

**NASCOM SOFTWARE:** Standard Z80 assemblers with NAS resets 5.7K cassette £12, 8.5K D DOS £18; Word processors 3K cassette & 4K D DOS £18; 2K position independent debug £9; 2K relocatable disassembler £11; D DOS card index/catalogue simulator £15; Hybrid BASIC (not sold separately) D DOS or cassette £4. Details SAE. Mr. P. Watson, 101 Village Road, Bromham, Bedford MK43 8HU.

**ACORN ATOM** Twenty years software experience backs TRACE (Cassette £4.75) and DISASSEMBLER (Cassette £3.75). From David Jupe, 6 Hindhead Road, Earley, Reading, Berkshire.

## CP/M SOLUTIONS:

**xForth** (Our superb implementation of the FORTH-79 standard.) From £40. S.A.E. for details.

**Amethyst** Write and find out why this is the best word processing system available!

A.I.M. Research, CT,  
20 Montague Road, Cambridge CB4 1BX.

**SHARP MZ-80K.** Enhanced BASIC with auto-number, Re-number, Link, Delete, Single key entry etc cassette only £9.50. Address book programme £3.99. Monitor ROM listings £3.99. Listings service available. HTE (Electronics), 50 Milnefield Ave., Elgin, Morayshire.

**PRINTED CIRCUIT BOARDS.** Top quality glass fibre boards manufactured from your design. Enquiries welcomed from companies, designers and amateurs. Send SAE to HTE (Electronics), 50 Milnefield Ave., Elgin, Morayshire.

**TANGERINE NEW EQUIPMENT** — micron £360, Microtan 65 assembled £83, ASCII keyboard £63, cases £44, Tantal £175 many more. Prices include VAT and P&P. Send SAE for full list or contact Key Software, 85, Nottingham Road, Nuthall, Nottingham 0602 272465 — Access welcome.

**ZX81 (16K) SOFTWARE.** Make learning fun. Many of our programs have a jackpot game incorporated. Six programs on each cassette: — JUNIOR ENGLISH 1: — "MEANINGS 1", "MEANINGS 2", "PARTS OF SPEECH", "PROVERBS", "SIMILES" and "ANAGRAMS". JUNIOR ENGLISH 2: — "IDIOMS", "OPPOSITES 1", "OPPOSITES 2", "GROUP TERMS", "ODD WORD OUT" and "SPELLINGS". JUNIOR MATHS 1: — "LONG MULTIPLICATION", "LONG DIVISION", "HCF", "LCM", "FRACTIONS 1" and "FRACTIONS 2". JUNIOR MATHS 2: — "AREAS", "PERIMETERS", "SIMPLE EQUATIONS", "PERCENTAGES", "SETS" and "VENN DIAGRAMS". £4.50 per cassette. Rose Cassettes, 148 Widney Lane, Solihull, West Midlands B91 3LH.

**PARAPHYSICS JOURNAL** (Russian translations); Psychotronic Generators, Kirlianography, gravity lasers, telekinesis. Details: SAE 4 x 9". Paralab, Downton, Wilts.

## NEW BOOK

### 'STRETCHING YOUR ZX81 OR ZX80'

More information on how to improve your programming and get the most from your machine. Only £6.95 from:

DEPT CTC,  
Computer Publications,  
Unit 3,  
33 Woodthorpe Rd,  
Ashford, Middx.

## RUBIKS CUBE — APPLE II + . Disc or cassette.

Anybody can now do it with this programme. Mark I — £9.90 (also Mark II with 3D HI-RES GRAPHICS coming soon!). Send cheque or P.O.

**A.H. BAUGHAN**  
97 Christchurch Rd.,  
Norwich.

## TRS80 — VIDEO GENIE SOFTWARE

**BREAKOUT:** Fast action machine language program; first break through a double and then a triple wall, but beware of increasing speed at each new level; with skill control the angle of bounce or even swerve the ball as it approaches the wall, only £3.85 or send an s.a.e. for our full lists of software at unusually low prices.

**J. T. WILSON**  
9 Cotswold Terrace,  
Chipping Norton, Oxon.

**ZX81,** 8 superb games listings (graphics), £1.00. SAE to ComSoft, 36 Linwood Crescent, Ravenshead, Notts.

**C.12 MICRO COMPUTER CASSETTES.** Plain labels. Screwed. Complete with Lugs and Case. £5.50 for 10; £12.50 for 25; £23.50 for 50; £44.25 for 100. NO RUBBISH. VAT Inclusive. POSTAGE £1 for 10; £1.60 for 25; £2 for 50; £2.50 for 100. WORK FORCE, 140 WILSDEN AVENUE, LUTON, BEDS. P.S. If you want 1,000 or more, write!

**MZ80K "KILLER WORM".** M/C Code Program. Very Fast. This infuriating character SPLITS where you hit him. This program will have you in BITS. Moving Bonus Points. ARCADE STYLE High Score and WINNERS INITIALS. £7.50 inclusive VAT & Postage. WORK FORCE, 140 WILSDEN AVENUE, LUTON, BEDS. P.S. Good Royalties for Sharp Programs.

## ZX81 — Z80 TUITION:

How to use a 1k ZX81 for Machine Code Programming. Course also includes details for adding Extra Memory, Hex keypad, LCD display, PROM programmer. Send S.A.E. for Details:

**Andover Software Kits, CT,**  
15 Winchester Road, Andover,  
Hants SP10 2EG.



## ZX80/81 HARDWARE

DESCRIPTION OF KIT  
(Price includes VAT, but add 80p postage)

	Price £—p
1.0 amp, 5.0 volt power supply. Requires	
9.0 volt transformer	8.03
16 bit latched LED board	9.80
Edge connector for LED board	3.00
40 key full size keyboard for ZX80, ZX81	19.95
Edge connector to fit above	1.95
4 rubber feet for keyboard	0.24
Spare key and keypad	0.48
Case for keyboard	Enquire
24 line In/Out port	13.50
In/Out edge connector	3.00
23 way edge connector for ZX80, ZX81	2.95
Motherboard	10.44
Voltage regulator kit for motherboard	2.40
Connector for motherboard	2.95
Digital to analogue converter board	16.95
One digital to analogue and buffer IC	6.89
23 way male connector, single	1.30
23 way male connector, double	1.60
Pair of connectors for ZX81 keyboard	1.50
24 line In/Out port (ZX81 only)	16.95

All the above are available built — see catalogue

### BOOKS (post free)

GETTING ACQUAINTED WITH YOUR ZX81.  
Tim Hartnell. 4.95  
MASTERING MACHINE CODE ON YOUR ZX81.  
Tony Baker. £5.95  
THE SINCLEAR ZX81. PROGRAMMING FOR REAL  
APPLICATIONS. Randle Hurley. 170 pages. £6.95.  
Tape £9.95 (post 40p).

Send 10" x 7" SAE for free illustrated catalogue

**REDDITCH ELECTRONICS, 21 Ferney Hill Ave.,  
Redditch, Worcs. B97 4RU.**

## MICRO COMPUTER SERVICES

### The new Genie II Business System

48K of memory, 2 double density disk drives  
(500K), 12" green screen monitor, MX80 FT  
friction and tractor printer, Tridata sales  
ledger, Tridata purchase ledger.

**All for the amazing low cost of £1,675.00**  
**Also special discount for educational**  
**users (up to 15%)**

Apple 48K Europlus, 2 drives and 12" B/W  
monitor £1,350.00  
Apple Silent Type printer £189.00  
Epson MX80T £299.00 ... MX80FT £325.00  
Others ring for quote.  
The new Genie I 16K £299.00  
12 inch green screen monitor £69.00  
Video Genie 16K £289.00 ... 32K £345.00  
12 inch B/W monitor £69.00

Paper 11 x 9.5 inch 60g continuous plain with  
perforated sprockets £12.00 per box of 2000  
sheets.

Labels 1.44 x 4 inch 2 across on web £7.50  
per 1000.

Floppy disks:- Verbatim £16.50 per box of 10.  
Memorex £16.20 per box of 10.

Post and packing at cost ... all items plus  
VAT.

**22, Holland Rd., Clacton-On-Sea, Essex.  
Tel (0255) 29018.**

**MICROTAN GAMES** Death Park BASIC 8K  
£3.50. Space Battle BASIC (sound effects)  
8K £3.50. Breakout BASIC/MC/graphics 7K  
£3.50. Gunfighter BASIC/graphics 7K £3.00.  
All four £9.00. Any two £5.50. All on tape.  
S. Broadbent, 34 Manor Road, Scarborough,  
Yorks.

**ZX81 — 16K** interplanetary war-battle  
strategically against Romulans. C60 cassette,  
instructions, £2.50 (or SAE, more details).  
Several re-recordings. Unbeatable value. 14  
Beech Crescent, Irchester, Northants.

**ZX COLOUR!!** Enhanced version of board  
demonstrated at ZX microfair. **Program-**  
**mable character generator**, memory,  
motherboard, UK101/S2 P.C.G. P.O.A.  
Repeating key £2.50. **Keyboard** £17.50.  
Edge connector £1.95. **Input/Output port**  
£7.95. 2114 200ns 99p. Resistors 3/4p. SAE  
for details. Haven Hardware. 4 Asby Road,  
Asby, Workington, Cumbria.

**ZX81 16K**, no-flicker Games on Cassette.  
Catacombs, maze in excellent 3D graphics,  
£3.75. Great Flood, chompers attacking your  
dam, save the town, £2.50. Formula One, ex-  
citing racing game, test of skill, £3.50. Fruit  
Machine, £3.50. Also 1K version, £1.20.  
Many more. S.A.E. please. St. Christopher  
Electronics, 174 Marsh House Lane, Darwen,  
Lancs.

**ZX81 ARCADE GAMES** 4K in machine  
code. New Space Invaders, 49 aliens, flying  
saucer, deflector shield. Galaxy Invaders, in-  
dependently moving aliens, random direc-  
tions. Suicide Mission, moving backgrounds,  
obstacles, missiles, alien installations, bombs  
and laser. Asteroids. £3.95 each on tape or  
send sae for details. J. Steadman, 6 Carron  
Close, Leighton Buzzard, Beds. LU7 7XB.

**EPROM PROGRAMMING:** your 2708/  
2716, £2 per K from NAS SYS, 300 Bd  
cassette else £2.50 from listing. Erasing 50p,  
Copying £1.50 per K. Our 2708 £3/2716 £4.  
Mr. P. Watson, 101 Village Road, Bromham,  
Bedford MK43 8HU.

**TANGERINE MICRON COMPUTER** £260.  
MK1 Keyboard (unused) £35. Sound chips  
(with circuit) £6. Tele Blidworth (062 34)  
6587.

**TRITON COMPLETE** main board memory,  
extended basic L5:1; UHF monitor, computer  
cassette unit; Creed 75R teleprinter. All leads  
and manuals; worth over £500 will accept  
£400 o.n.o. Phone Weymouth 787443, 5-6.30  
p.m.

**TUSCAN MICROPROCESSOR.** Full main  
board memory, scientific basic, 71 station  
keyboard video monitor 3 manuals. Unit as  
new never used, worth over £750 will take  
£600. Phone Weymouth 787443, 5-6.30 p.m.

**ZX81 16K:** Alien Destructor. Machine code  
space game. Cassette £2.95. (SAE details  
other software.) M. McAuley, 14 Leam  
Close, Avonway, Colchester.

**MICROTAN 65** for sale with new monitor,  
chunky graphics, lower case, hex keypad,  
P.S.U., mini-rack, manual and software.  
Worth over £180. Offers around £100. Phone  
Redcar 485516.

**GREEN SCREENS**, blue screens or amber  
screens. 11" x 9" TRS80 £4.95. Other sizes  
up to 12" x 12" £5.95. State size and colour  
required. Price includes fixers, postage and  
packing. P.A. Young, 40 Willow Park,  
Wilberfoss, York.

**TANDY TRS-80** Level 2 16K, 32K expansion  
interface, Aculab floppy tape drive with 12  
tapes, Tandy quick printer with 2 spare rolls  
of paper, cassette recorder, editor assembler  
package, renumber cassette, cassette head  
cleaner and demagnetizer. All in mint condi-  
tion with full instructions and documenta-  
tion. Valued at £1000.00, £890.00 for quick  
sale. Phone Clive Tippet on Chipping Sod-  
bury 317626 after 6.30p.m.

**UK101 AND SPRBD SOFTWARE ON  
TAPE.** 8K: Lunar Lander\*, Space Invaders\*,  
X-Wing Fighter (+ Atom)\*, Chess (101 only,  
2 play), 3D Maze, Zombie, Biorhythm (needs  
printer), Startrek. 4K: Digiclock (large  
H/M/S)\*, Hangman (+ Atom). 16x48 and  
25x25 displays only '\*=real-time!! Excellent  
Graphics!! 500p each, or 4 for 1500p. From K  
A SPENCER, 74 Dovers Park, Bathford,  
BATH.

**ATOM DIS-ASSEMBLER/MONITOR.** Full  
symbolic dis-assembler (ATOM format).  
Monitor commands include Dump, Fill,  
Search, Copy, etc. Professionally written to  
run in under 1½K! Cassette £5.95. SAE for  
details. N.P.Capper, Bryn Awelon, High  
Street, Pentre Broughton, Wrexham, Clwyd.

## \*BIG EARS\*

SPEECH  
INPUT  
FOR  
YOUR  
COMPUTER!



**BIG EARS** opens the door to direct  
man-machine communication. The system  
comprises analogue frequency separation filters,  
preamps and signal conversion, together with a quality  
microphone and extensive software.

Words, in any language, are stored as "voice-prints" by  
simply repeating them a few times in "learn" mode.  
Using keyword selection techniques, large vocabularies  
can be constructed.

Use **BIG EARS** as a front end for any application: data  
enquiry, robot control, starwars — the possibilities are  
unlimited...

**BUILT, TESTED & GUARANTEED ONLY £49!**

PRICE INCLUDES POSTAGE & PACKING PLEASE ADD VAT AT 15%  
PLEASE STATE COMPUTER: UK101, SUPERBOARD, NASCOM2,  
ZX80/81, PET, TRS80, M280K, APPLE II, ETC.

**COLOUR MODULATOR**  
RGB in, PAL/UHF out

**KIT £12  
BUILT £18**

Please add VAT at 15% to all prices  
Barclay/Access orders accepted on telephone

**WILLIAM  
STUART  
SYSTEMS Ltd**

Dower House, Billericay Road,  
Herongate, Brentwood,  
Essex CM13 3SD.  
Telephone: Brentwood (0277) 810244

**JAGUAR XJ12.** 2 tone Silver/Blue. Red  
Hide Upholstery. Redg. March 1979 (T).  
35,000 miles. Purchased from new. All  
scheduled services. Main Jaguar agents Ap-  
pleyard of Leeds. Managing Directors Car,  
exchange for Micro Computer hardware to  
update company into 1980's and we need a  
computer more than a prestige motor car.  
Tel. 0904 31021.

**FOOTBALL POOLS COMPUTER PREDIC-  
TION.** A few vacancies only. Small weekly  
outlay secures our computer results predic-  
tion printout service. SAE details SUSSEX  
SOFTWARE, 6B WALLSEND HOUSE,  
PEVENESEY BAY, SUSSEX.

**TRANSAM TRITON COMPUTER** L7.2 full  
on board RAM, plus motherboard with extra  
16K. £250. 0274 668738.

**FAST SPACE INVADERS** in m/c for  
TRS-80 L2. £8.50. K. Meeran, 32 Lismore  
Road, S.Croydon, Surrey CR2 7QA.

**PET PROGRAMS** — send stamped SAE to  
Steve Doyle, 38 Hawthorne Avenue, Long  
Eaton, Notts NG10 3NF.

**TEXAS TI-58** programmable. New unwanted  
gift £55.00. Cheques to Clive Tippet, 193  
Witcombe, Yate, Bristol.

## 5 MORE SUPERB SCENARIOS FROM THE SPECIALISTS IN COMPUTER SIMULATED CONFLICT

### SEA BATTLE

A graphics simulation of Naval warfare in the  
days of the Bismark — as Gunnery Officer of  
one of the most impressive fighting machines  
devised by man, you will experience all the  
thrills and drama of action at sea. .... £9.95

### WORLD WAR III

It's your finger on the button! .... £6.95

### CHARIOT OF DEATH

The ultimate weapon, can you stop the unstop-  
pable? .... £8.75

### STAR FIGHTER

A dogfight in space, real-time 3D action ... £7.45

### BATTLE BEYOND THE STARS

Only its battle fleet stands between earth and  
the end of mankind. .... £7.45

All prices are fully inclusive

Send your cheque/P.O. to:

**"THE WAR GAMES LIBRARY"**

at

2 Highfield House, Courtenay Road,  
Lower Parkstone, Poole, Dorset BH14 0HE

**TRS-80 LII 16K**



## ACORN ATOM UTILITY ROM £29.90

The Willow Software Utility ROM simply plugs into the spare utility ROM socket in your Atom and provides 18 powerful new commands and facilities including: Renumber, Range delete, Find, Auto line numbers, Program compression, Disassembler, True keyboard scanning, Memory dump, Variable dump, Register dump, Keyboard sounder and much more. The Utilities make the Atom easier to use, and provide a 'toolkit' of facilities for program development in both Basic and Assembler.

The ROM Utilities are professionally written and fully tested. All standard Atom facilities are unaffected and no textspace memory is used.

Due to increased demand, we are now able to offer the Utility ROM with full instruction manual at the reduced price of only £29.90 inclusive.

Send cheque/PO now for delivery by return of post, or write for further details.

WILLOW SOFTWARE  
PO BOX 6, CREDITON, DEVON  
EX17 1DL

## ACORN ATOM MACHINE CODE SOFTWARE ON TAPE

SPACE INVADERS (12K m/c gr.4)	£6
REVERSI (7K m/c gr.0)	£6
SUPER MAZE (9K m/c gr.3)	£6
AIR STRIKE (9K m/c gr.3a)	£6
ELIZA (7K m/c gr.0)	£4
CHASE (4K m/c gr.2)	£4
UFO ATTACK (4K m/c gr.1)	£4
ROAD RACE (4K m/c gr.0)	£3
FIZZLE BRICKS (4K m/c gr.1a)	£3
LIFE (4K m/c gr.1a)	£3
5 (2K) games	£3

### ★ SPECIAL OFFER ★

FREE cassette with 4 games supplied with orders of £6 or over.

Send large SAE for free catalogue.  
All prices shown are inclusive, no extras.

Pro Software,  
121 Tyn-y-Twr, Baglan,  
Port Talbot, West Glam SA12 8YE

## UK101 (and enhanced SUPERBOARD) SOFTWARE ON TAPE from the guy who wrote "Le Passe-Temps"

**GALACTIC HITCHHIKER** (8K) An adventure, all in machine code. A beauty! (£7.00 all incl.)  
**SUPERTREK** (8K) Sail boldly through the universe, zapping moving Klingons in real time. Superb graphics. (£7.00) **LUNAR LANDER** A real challenge. You won't get down in less than 3 hours. (£3.00) **STARTREK** (8K) The old favourite, beautifully presented. Not real time, but great graphics nonetheless. (£6.00)

● **HANGMAN** Excellent graphics. P.E. said so! (£3.00)

● **PIRANHA** Fancy your chances in a tankful? (£3.00)

● **BREAKOUT** A smashing version, especially on the enhanced display. (£3.00)

● **LE PASSE-TEMPS** This is what a computer game SHOULD be like. (£3.00)

**BASIC TUTOR** (8 x 4K) Everything you wanted to know but didn't know who to ask. (£12.00)

**STOCKMARKET** (8K) A realistic game for 1-3 would-be millionaires. (£5.50)

Please note that these are all ORIGINAL PROGRAMS, not 101 varieties of PRINT. Available for 16x48 or 32x48 display and compatible all Monitor ROMs. Items marked "●" also available for 24x24 screen.

Write to: A.Knight (Dept CT), 28 Simonside Walk, Ormesby, Cleveland. Tel. (0642) 321266.

**MICROTAN LIGHT PEN:** Input from screen etc. (BASIC or M/C). Uses Tanex via. Simple kit plus software £10.90. Andover Computer Products, 29 Penrhyn Avenue, Middleton, Manchester.

**NASCOM 2 SOFTWARE.** Extension Basic, Disk System, games e.g. Missile Defence, Fantasy. SAE for details to Level 9 Computing, 229 Hughenden Road, High Wycombe, Bucks.

**16K-ZX81 FLEXIBILITY.** Load a 2.5K BASIC program and store it within the RAM using PROGSTORE. Then load a second program. Run them separately or let one call the other. Read the ROM with DIS-ACSEM, a full Zilog mnemonic disassembler — can be used with PROGSTORE to read any M/C program £3.75 each or both on one cassette for £6. ACS Software, 7 Lidgett Crescent, Roundhay, Leeds LS8 1HN.

**ZX81 FLICKER-FREE GAMES.** 6 super games, each 1K, plus free menu, all on cassette, plus free listing, £3. Bobker, 29 Chadderton Drive, Unsworth, Bury, Lancs.

**NASCOM I,** Nas-Sys, power supply, 16K expansion, case, ROM BASIC, cassette interface, 10" V.D.U. Offers 01-859 6672 (evenings).

**ZX81 (1K)** Eight excellent animated games. Listings £1.00 + SAE. Techtel, 21 Berkeley Road, Kenilworth, Warwickshire.

**PUBLISHER** requires more manuscripts to publish on all aspects of microcomputing. Reply: Computer Publications, Unit 3, 33 Woodthorpe Road, Ashford, Middx.

### ZX81/80.

3 programs for the basic 1K system — **SPACE INVADERS** — **BREAKOUT** (both machine code for flicker free FAST interactive graphics) — **MUSIC**; turn your ZX into a toy piano — no hardware modifications. Supplied on cassette with listings — all for only £6.95. Specify 4K or 8K Rom when ordering.

**MACRONICS, Dept S., 26 Spiers Close, Knowle, Solihull, B93 9ES.**

**TEST, SERVICE, REPAIR.** Computers, Peripherals, Memory boards, I/O interface boards. Floppy disk drives repair and alignment. Assembly and Test of Computer Kits. 1K, 2K, 4K, Complete Eeprom Service. A.N. Electro & Computer Services Ltd, 211 Park Barn Drive, Guildford, Surrey. Tel: Guildford 504897.

QUICKSILVA PRESENTS A RANGE OF QUALITY  
HARDWARE / SOFTWARE FOR THE  
**ZX80/ZX81**

**HARDWARE** ----- All hardware is sent with complete instructions and programming examples. Please allow 28 days for delivery.

**QS MOTHER BD.** ----- ZX-80 / 81 ----- £10 : 00  
Extends existing port to allow any Ram Pack + two other boards to be fitted. On board 5V, Regulator, 23 way double sided edge connector for add-ons.

**QS 32K RAM BD.** ----- ZX 80 / 81 ----- £18 : 00  
Reliable (pre-shrunk?) Static Ram Board which combines with the Computer internal 1K to give a total of 4K. Plugs direct into Computer or Mother Board.

**QS SOUND BD.** ----- ZX 80 / 81 ----- £25 : 00  
A programmable sound generator board using the versatile AY-3-8910, 3 Pitches / 3 Volumes / Noise source / two 8 bit Input / Output Ports / Envelope shaper, all controlled from 'BASIC'. Plugs into any external amplifier.

**QS CHARACTERS BD.** ----- ZX 81 ONLY ----- £25 : 00  
"Simple Hardware mod (1 cut; 1 resistor; 1 wire) required to ZX-80."  
Gives two programmable character sets of 64 characters each. Uses graphics key to shift between the two sets. Uses NO Ram space. Create your own characters. Upper and lower case alphabet; scientific characters; fine line graphics characters; games characters (real space invaders). Works with existing programs and with the Printer. Price includes Demo Cassette.

**QS CONNECTOR.** ----- ZX-80 / 81 ----- £3 : 00  
Consists of two 23 way double sided edge connectors back to back. One needed for any or all QS Expansions. (Except Ram Boards)

**SOFTWARE** ----- All software is recorded twice on high quality cassettes and is sent complete with full operating instructions.

**QS DEFENDER.** ----- 32K RAM minimum ----- 4K or 8K ROM ----- £5 : 50  
Fast, Flicker free, Machine code, Moving graphics version of Arcade Game. Most complex moving graphics game yet for ZX-Computers. Up to 84 Fast moving characters on screen at once. First and only Full screen display.

**QS LIFE.** ----- 4K RAM Minimum ----- ZX-81 ONLY ----- £4 : 50  
Fast program with Machine Code cell generation and screen display routine. Simulates the growth of living cells in a 20 \* 32 Matrix. Random or programmed start positions plus M/C routine make this a fast, complex and varied program.

Send S.A.E. for FULL data sheets on all hardware and software. Cheques made payable to "Quicksilva" and orders sent to the following address. -----  
QUICKSILVA : 95, UPPER BROWN HILL RD., MAYBUSH : SOTON : HANTS.

## TELESOUND 82 FOR UK101/MICROTAN/NASCOM/ ZX80/81/TUSCAN/SUPERBOARD II/ETC.

Any system with a UHF modulator will benefit from this add on kit. No modifications to TV set necessary. Connects to computer cassette output, also replaces the loudspeaker on your sound-board to get sound direct through your TV monitor.

Only £10 inc. P&P

Send cheque/P.O. or SAE for further details to:

**COMPUSOUND (UK), 32 LANGLEY  
CLOSE, REDDITCH, WORCS B98 0ET.**

## LB ELECTRONICS 11 HERCIES ROAD, HILLINGDON, MIDDX.

TMS 2516 (single rail) full spec. £3.25. 2708 (450ns) £1.85 full spec. Special offer 2114, 4-E5.40, 8-E10.00 (450ns). Any C 2732 £5.50. SN 74116 60p. SN 74118 70p. SN 74194 50p. SN 74198 75p. SN 74LS 240 £1.50. 74LS 245 £2.40. 74LS 266 75p. 74S260 40p. 710 (DIL) 25p. 711 (DIL) 30p. 2102 (200ns) £1.00. FND 500 0.5 inch LED Display (cc) full spec 50p. 12 for £5.00. Header plugs 16 way with cover 60p. 16 way without cover 35p. 24 way with cover 95p. Ansley (Insulating Piercing Type) 14 way 75p. 16 way 95p. 24 way £1.50.

Cannon D Type. Plugs and sockets stocked.  
C4004 4 BIT Channel Microprocessor plus P4002 RAM £2.50 the pair with full data sheets. Just arrived **MICROTAN 65.** Micro PCB (blank) supplied complete with circuit diagram £4.50. Special offer 7 way DIL SWT Rocker Type 65p. AUGAT 16 PIN IC socket 20p. AUGAT 18 PIN IC socket 25p. AUGAT 24 WAY IC socket 50p. Cannon 25 way D type plug £1.85. 25 way D type socket £1.85 (solder tail). 4116 (200ns) £1.00 each. All prices inclusive of VAT p&p on all components 45p.

Telephone Uxbridge 55399  
Access or Barclaycard accepted.



## ARTIC COMPUTING MOVING AHEAD WITH ZX SOFTWARE

PROGRAMS FOR THE ZX 80/81 INCLUDING:  
**ZX CHESS** — Machine Code Program £10.00  
**ADVENTURES** — From £7.00 To £9.00  
**ZX BUG** — Machine Code Debugging £7.00  
**EDUCATIONAL GAMES** For Children,  
AND MANY OTHERS

FOR A CATALOGUE GIVING DETAILS TO ALL PROGRAMS PLEASE SEND A S.A.E. TO:

DEALER ENQUIRIES ARTIC COMPUTING,  
WELCOME 396, JAMES RECKITT AVENUE,  
TEL (0482) 445496 HULL, HU8 0JA

**ZX81. THE NEW BOOK** by Tim Hartnell  
"Getting Acquainted with Your ZX81" contains 80 great programs, including a complete draughts game, plus many hints and tips. It is just £4.95 from Users Club, 44 Earls Court Road, Dept CT, London W8.

## ACORN ATOM UTILITY ROM

Upgrade your Atom now! Our 4K ROM simply plugs into the spare socket and provides 18 new commands and utilities including: renumber, range delete, find, auto line numbers, program compression, disassembler, true keyboard scanning, memory dump, variable dump, and much more. Supplied with full instruction manual. To order send cheque/PO for £35 inclusive (delivery 1 week) or SAE for further details.

**WILLOW SOFTWARE  
PO BOX 6, CREDITON, DEVON EX17 1DL**

## ZX80 AND ZX81 ATARI VIC 20, SHARP PC1211 AND ALPHATRONIC SOFTWARE

First class quality programs. Not to be confused with apparently similar but inferior software offered elsewhere.

Send S.A.E. for full details. Business/household programs include 'Stock Control', 'VAT' and 'Datamap' — an amazing financial aid. Amongst the games there's our highly rated arcade-style 'Searcher' and 'Bingo'. Also full details on our unique computer and video cassette filing system, plus 'wages' — our brand new ZX81 payroll program for up to 84 employees!

Zipprint, 418, Poole Rd, Parkstone, Poole, Dorset, BH12 1DF.



**ZX81 SOUND (1K).** Connect computer mic, socket to your own amp (hi-fi/cassette etc) then loading this amazing programme converts your ZX81 into a one octave electronic organ. Computer stores up to 100 notes as you play, and replays tunes endlessly at tempo you select. (No hardware modifications.) Cassette and instructions £1.75 to: Second Foundation, 22 Bramber, Belgrave, Tamworth, Staffs B77 2LL.

## VETS FOR PETS

Anita Electronic Services (London) Ltd. are specialists in the repair and service of Commodore Pets. We offer a fast on-site service, or alternatively repairs can be carried out at our workshops should you wish to bring in your Pet.

Pet maintenance contracts are available at very competitive prices. Trade inquiries welcomed.

\* We also specialise in the repair of all makes of office equipment.

For further information tel. or write to:

**John Meade**  
**Anita Electronic Services**  
**15 Clerkenwell Close,**  
**London EC1**  
**01-253 2444**

## NASCOM USERS

**Naspen Printer Enhancement:** Gives control of left margin, text length and pagination. Single or continuous stationary and double spacing of lines supported. Multiple copies of text can be made with auto page numbering. Fully relocatable. £12.50 + £1 P & P on cassette.

**Printers: Epson MX80FT £410 inclusive**

**Computer Grade Tapes: C20. 48 pence each inclusive.**

**Radbay Ltd, 3 Bishopstone Close,**  
**Cheltenham, GL51 0UD. Tel. 0242 69443.**

**CENTURION BURGLAR ALARM EQUIPMENT** send SAE for free list or a cheque/PO for £11.50 for our special offer of a full sized signwritten bell cover. To CENTURION DEPT CT 265 Wakefield Rd, Huddersfield, W. Yorkshire. ACCESS & BARCLAYCARD Telephone orders on 0484-35527.

**ZX81-16K ARCADE GAME PACK** Four excellent arcade games on one cassette: SURROUND, TANK SHOOT, TENPIN BOWLING, SPIDER CHASE. Excellent graphics, no flicker. Compare this quality with any. £3.90 for cassette and instructions to: Second Foundation, M.P. Biddell, 22 Bramber, Belgrave, Tamworth, Staffs B77 2LL.

### NEW! KAMIKAZE NEW!

A fast action arcade style game for 16K Video Genie/TRS 80 with sound effects, music and scoring

— simulating pearl harbour —  
Tape £4.50 (inc. P & P)

W. A. Latham (Micros)  
72 Sidmouth Rd, Welling, Kent, DA16 1DS.

**TUSCAN.** We are stockists from bare board level to complete units. On demonstration now. All components available separately. Newhaven Computers 1, Bridge St., Newhaven. Tel: 3699.

**ACORN ATOM.** The book for all Atom owners is here. **GETTING ACQUAINTED WITH YOUR ACORN ATOM** by Trevor Sharples and Tim Hartnell. More than 80 programs, including a full draughts game. Chapters included: PEEK and POKE, Mastering the Graphics, Introduction to Assembler. 184 pages, only £7.95. Interface, Dept. CT, 44 — 46 Earls Court Road, LONDON, W8 6EJ.

**ATOM PROGRAMMES THAT ARE DIFFERENT** (1) **BEDTIME STORY.** Split screen with text and moving graphics, sound effects, lullaby in two part harmony. (5k + ½k graphics), £3. (2) **CHRISTMAS CAROL.** Words, music (2 parts), picture (1½k + ½k graphics), £2. On high quality data cassettes from J. Hancox, 3 Station Rd., Burton Joyce, Nottingham.

## 65 ZX81 PROGRAMS

Yes 65 ZX81 program listings including a multitude of Games, Utility Programs, Home Finance, Maths, Stock Control, Phone Timer, Chequebook plus Hints'n'Tips.  
All for only £4.95. Barclaycard accepted.

**Sussex Software, Wallsend House,**  
**Pevensey Bay, E.Sussex.**

**VIC VIC VIC GETTING ACQUAINTED WITH YOUR VIC 20** by Tim Hartnell has over 60 programs to get your VIC up and running with worthwhile games and programs from day one. If you've never touched a computer before you bought your VIC, or you're an experienced programmer, you'll find much of value and interest in this new, high value book. £5.95, from: Interface, Dept. CT, 44 Earls Court Road, LONDON, W8 6EJ.

**KEYBOARDS.** Brand new 79 switch encoded K/B with data for £20 incl. We buy/sell second user gear. Newhaven Computers, 1 Bridge St. Newhaven. Tel: 3699.

## ZX MICROFAIR

Central Hall, Westminster, London SW1\*  
Saturday 30 January 1982 (10.30am-8.30pm)

### EVERYTHING FOR THE ZX80/81

Hardware, Software, Books, Mags,  
User Groups, Bring and Buy Sale

### BIGGEST SELECTION ANYWHERE

Admission: Adults — 50p.  
Under 14's — 30p  
(under 10's FREE with Adult)

\* (opposite Westminster Abbey. Nearest tube St James' Park)

Send S.a.e. for more details to:

Organiser: Mike Johnston, ZX Microfair,  
71 Park Lane, Tottenham, London N17 0HG.

## EPROM PROGRAMMER

Programs 2716/2516/2732/2532 Eproms. Uses 7 cheap TTL ICs. Full software control. Program any single location or complete Eprom in under 2 minutes (2k). Pre-drilled fibreglass PCB, circuit, software & flowcharts **£13.75**

**6800/EDITOR/ASSEMBLER/DISASSEMBLER**  
**EDITOR** Now has line renumbering, open/close. Optional automatic line numbering. Cassette files. Save/load routines link files.

**ASSEMBLER** Supports all motorola mnemonics & FCC, FCB, FDB, ORG, REM. Up to 200 labels plus many other features.

**DISASSEMBLER** Will disassemble complete blocks of code, generate labels and add these to the Editor text files. It is possible to disassemble for example, a 1k monitor, change the ORG statement and reassemble at the new address. A separate section allows use of the disassembler without label generation, for general use.

User manual + listing & Tape (6k — Begins at 8000) **£22.50**

**J. MORRISON (MICROS), 2, Glensdale St.**  
**Leeds LS9 9JJ. TEL. 0532 480987.**

**VIC.** Good VIC games programs wanted for new book. If your program is accepted you'll be paid a fee, get an author credit, plus free copies of the book.

**Ken Mahogany, 12 Hadyn Park Road,**  
**London, W12**

**MZ-80K DUSTCOVER £5.** Backgammon, Moonlander, Organ Composer, Police Chase, Maniac Drive £5 each. Biorhythms, Address Book, Bank Account, Autocross, Connect Four, Mastermind £4 each. CAL — Wordmatch, Picture Count, Shapes, Count/Add £5 each. **FREE SPACE INVADERS** with orders £15+. Highlight Software, 3 Nether Court, Halstead, Essex. (0787) 475714.

**TANSAN TRITON COMPUTER L5.2** Full on board RAM, plus motherboard so ready for full expansion. All documentation including newsletters. £255 Ruislip 38844 (6-8pm).

## ATOM OWNERS!

### THIS IS WHAT YOU'VE BEEN WAITING FOR!

A single card EPROM PROGRAMMER for 2k and 4k EPROMS (2716s, 2532s, etc). Plugs directly into the Atom extension socket. Copies programs from any part of memory. No external supplies required. Everything on a D.S.T.H.P. professional quality eurocard. Complete with Zero Insertion Force socket for EPROM. Complete board for only £99.95 inc p + p etc.

S.A.E for more details to:

**CUSTOM MICRO,**  
**RUSSELL HOUSE, RUSSELL PLACE,**  
**EDINBURGH EH5 3HA**

P.S. Merry Xmas to all our customers.

## SPECIAL OFFER

### BLANK C12 CASSETTES

**£4.95 for 10**

**£11.75 for 25**

**ZX81 16K Rampacks £42.95**  
**ZX81 48K Rampacks £148.50**

All prices include VAT & post & packing. Cheque with order or quote Access number to:

**Hewson Consultants,**  
**7 Grahame Close, Blewbury,**  
**Oxon OX11 9QE (0235) 850075**

**ZX81 ZX80** More than 60 programs, games and routines, plus **ZX BASIC** explained in detail in **THE GATEWAY GUIDE TO THE ZX81 AND ZX80** by Mark Charlton.. Beginner or experienced user, this book will take you further.. £5.95 from Interface, Dept., CT, 44 - 46 Earls Court Road, LONDON W8 6EJ.

**COMPUKIT SOFTWARE WITH SOUND.** **CHICANE CHASER** - race through the deadly maze. **ASTEROIDS** — blast them to fragments. **ASTROSLED** — fly through the jagged space canyon. **INVADERS** — full feature version. **SPACE FIGHTER** — space dogfight simulator. All 8K with sound for AY38910/AY38912 based PSGs. **NEW 4K games pack.** Four incredible 4K games for the price of one! Programs/games pack £1.95 each, on cassette from, **ARCADIA SOFTWARE, 4 Chestnut Avenue, Swansea, SA3 5NL.**



ABACUS COMPUTERS	106
ADDA	58
A & E SOFTWARE	108
AMOS OF EXETER	58
AUDIO COMPUTERS	91
AVON COMPUTER RENTALS	83
BUG BYTE	110
BYTE SHOP COMPUTERLAND	11
CALISTO COMPUTERS LTD	54
CAMBRIDGE COMPUTER STORE	72
CASTLE ELECTRONICS	28
CATRONICS	109
CHROMASONICS	34
COMP SHOP	134
COMPUTABITS LTD	62
COMPUTER CONCEPTS	108
COMPUTER KEYBOARDS	82
COMPUTER SHACK	91
COMPUTER SUPERMARKET	66
CONSUP	112
CONTROL TECHNOLOGY	35
CROWN BUSINESS CENTRE	71
CROYDON COMPUTER CENTRE	83
CROYDON MICRO LTD	82
DATA APPLICATION	89
DATA RITE TERMINALS	113
DDP RESEARCH TERMINALS	51
DISKWISE	71
ELECTRON EQUIP	112
ELTEC SERVICES LTD	112
ESSENTIAL SOFTWARE	52
FLIGHT ELECTRONICS	14 & 15
FLOWCHART SYSTEMS	111
FULCRUM	96
GEMINI ELECTRONICS	109
G.P. INDUSTRIAL	99
GREENBANK	96
HAPPY MEMORIES	113
A.J. HARDING	60 & 61
HEATHKIT	20
HELISTAR	51
HENRYS RADIO	102 & 106
HEWSON CONSULTANTS	109
HILDERBRAY LTD	58
INTERNATIONAL BUSINESS	115
I.O. SYSTEMS LTD	111
KNIGHTS	5
KRAM ELECTRONICS	70
LOGICAL CHOICE	111
LOWE ELECTRONICS	2 & 99
MDR INTERFACE	108
MELBOURNE HOUSE	55
MEMOTECH	36
MICHAEL ORWIN	112
MICRO BITS	71
MICROCOMPUTER APPLICATION	113
MICROCOMPUTER SPACEDROME	66
MICRODIGITAL	75 & 106
MICROGEN	108
MICRO SOLUTION	29
MICROSTYLE	123
MICROTANIC	19
MIDWICH COMPUTERS	115
MINE OF INFORMATION	116
NEWBEAR	124
PATRI SYSTEMS	106
PHIPPS ASS	72
PREMIER PUBLICATIONS	76
PRENTICE HALL LTD	97
PROFESSIONAL SOFTWARE	50
PROGRAM POWER	74 & 109
Q TEK	16
SBD SOFTWARE	6
SCIENCE OF CAMBRIDGE	41, 42, 43, 44 & 49
SHARP ELECTRONICS	81
SILICA SHOP	104
SILVERSOFT	35
SOFTWARE HOUSE	84
SOFTWARE MAGIC	82
SUPERIOR SYSTEMS	4
SUPERSOFT	98
SWANLEY ELECTRONICS	35
TECHNOMATIC	90
TEMPUS	10
TEXAS INSTRUMENTS	6
TEX MICROSYSTEMS	83
TIMEDATA	113
TRANSAM COMPONENTS	30
TRIUMPH ADLER	57
UNO	82
VISION BUSINESS SYSTEMS	21
WILLIAM STUART	106

**COMPUTAMART**

National advertising for the price of a pack of discs

**COMPUTAMART**

Read by 60,000 computer people each month

**COMPUTAMART**

The definitive checklist for your buyers

**COMPUTAMART**

Their at-a-glance directory

**COMPUTAMART**

Your monthly shop window

**COMPUTAMART**

Puts you on the map

**BLOCK CAPITALS PLEASE**

NAME .....

ADDRESS .....

COUNTY ..... TEL .....

OPENING HOURS .....

OPENING DAYS .....

PLEASE SEND TO:  
**COMPUTAMART**  
 145 CHARING CROSS ROAD,  
 LONDON WC2H 0EE.

**Please mention CT  
 when replying  
 to advertisers**

**COMPUTING TODAY****CLASSIFIED ADVERTISEMENT**

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15

Advertise nationally in Computing Today. Simply print your advertisement in the coupon here (left). Or telephone for more information.

Name .....

Address .....

Tel. No. (Day) .....

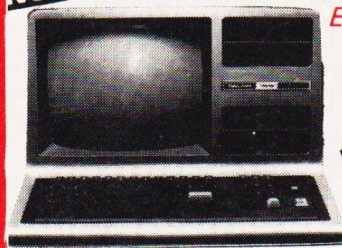
Send, together with your cheque to:  
**Jenny Naraine, CT,**  
 145 Charing Cross Rd., London WC2H 0EE.  
 Tel: 01-437 1002 Ext. 50.

Please place my advert in Computing Today



**NOW IN STOCK**

## THE NEW & EXCITING TRS80 MODEL III



**EXTENDED GUARANTEE BY COMPUKITE**  
48K

£619 + 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

Add £25 for Installation

## YOUR ZX80 IS NOW NO LONGER REDUNDANT

Upgrade your ZX80 to the full animated graphics of the ZX81. (No screen flicker).

FOR ONLY £12.95 + VAT IN KIT FORM

Works only in conjunction with NEW 8K ROM from Sinclair (Not Included).

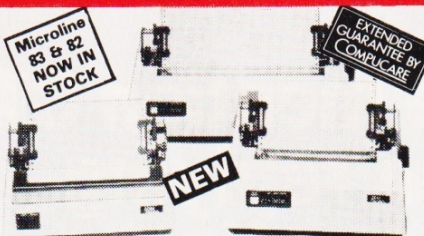
ZX81 part-exchanges accepted - GOOD PRICES OFFERED

## UP GRADE YOUR SINCLAIR TO A 16K RAM PLUS EXPANSION BOARD WITH 3 SLOTS

This Expansion Board is designed for more than just memory - that's why it costs more than others!

16K £69 + VAT

4K £49 + VAT



### MICROLINE 80

£299 + VAT

- 80 cps Uni-directional
- Small size: 342 (W) x 254 (D) x 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

### MICROLINE 82

£449 + VAT

- 80 cps Bi-directional logic seeking
- Small size: 360 (W) x 328 (D) x 130 (H) mm.
- 160 characters, 96 ASCII and 64 graphics, with 10 National character-set Variants.
- 4 Character sizes: 40, 66, 80 or 132 chars/line.
- Built-in parallel and serial interfaces.
- Friction and Pin Feed
- Low noise: 65dB
- Low weight: 8kg

### MICROLINE 83

£779 + VAT

- 120 cps bi-directional logic seeking
- 136 column printing on up to 15in forms
- Small size: 512 (W) x 328 (D) x 130 (H) mm.
- 160 characters, 96 ASCII and 64 graphics with 10 National character-set variants
- 3 Character spacings: 5, 10 and 16.5 Chars/in.
- Built-in parallel and serial interfaces
- Friction and Pin Feed
- Low noise: 65dB
- Low weight: 13 kg

## STOCKTAKE SALE NEVER TO BE REPEATED AT THIS PRICE UNTIL STOCKS LAST

★ 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 Disassembler 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.

Build, Understand and Program your own Computer for only a small outlay.

NEW MONITOR IN ROM — available separately at £7.90 + VAT.

Improved Basic function — revised GARBAGE routine. Allows correct use of STRING ARRAYS £4.90 + VAT

This chip can be sold separately to existing CompuKit and Super board users.

FOR THE COMPUKIT — Assembler Editor £14.90

GAME PACKS — 1). Four Games £5.00 2). Four Games £5.00 3). Three Games 8K only £5.00

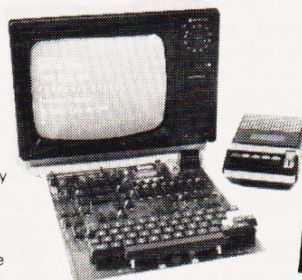
Super Space Invaders (8K) £6.50 Chequers £3.00 Realtime Clock £3.00

Case for CompuKit £29.50

40 pin Expansion Jumper Cable £8.50

All Prices exclusive VAT

## EUROPE'S FASTEST SELLING ONE BOARD COMPUTER COMPUKIT UK101



COMPUKIT WITH ALL THE FEATURES THAT MADE IT THE MOST PROFESSIONAL COMPUTER KIT ON THE MARKET. NOW WITH FREE NEW MONITOR (a saving), which includes Flashing Cursor, Screen Editing, & Save Data on Tape.

KIT ONLY £99.95 + VAT

Fully Assembled — £149 + VAT

4K Upgrade Kit £15.90 + VAT

## CASIO VL TONE

NEW £29.95 + VAT



It's a new kind of musical instrument. A computer controlled synthesiser that helps you create, play and arrange compositions that normally take years of musical training.

## WE ARE NOW STOCKING THE APPLE II AT REDUCED PRICES

AUTOSTART EURO PLUS



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.



## ACORN ATOM

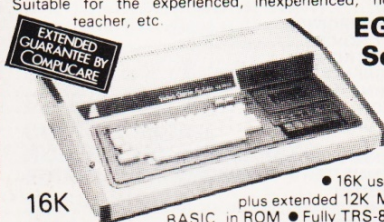
UNIQUE IN CONCEPT — THE HOME COMPUTER THAT GROWS AS YOU DO

Fully Assembled £149 + VAT

Special features include: • Full Sized Keyboard • Assembler and Basic • Top Quality Moulded Case • High Resolution Colour Graphics • 6502 Microprocessor

## THE VIDEO GENIE SYSTEM

Ideal for small businesses, schools, colleges, homes, etc. Suitable for the experienced, inexperienced, hobbyist, teacher, etc.



EG3000 Series

WITH NEW EXTRA KEYS!

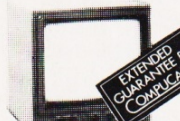
16K

£279 + VAT

- 16K user RAM plus extended 12K Microsoft BASIC in ROM
- Fully TRS-80 Level II software compatible
- Huge range of software already available
- Self contained, PSU, UHF modulator, and cassette
- Simply plugs into video monitor or UHF TV
- Full expansion to disks and printer
- Absolutely complete — just fit into mains plug.

The Video Genie is a complete computer system, requiring only connection to a domestic 625 line TV set to be fully operational; or if required a video monitor can be connected to provide the best quality display. 51 key typewriter style keyboard, which features a 10 key rollover. Supplied with the following accessories: • BASIC demonstration tape; • Video lead; • Second cassette lead; • Users manual; • BASIC manual; • Beginners programming manual. Write useful programs in the BASIC computer language yourself.

## HITACHI PROFESSIONAL MONITORS



9" — £129 £99.95  
12" — £199 £149

- 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.



SHARP PC1211

£79.90 + VAT

COMPUTER POWER THAT ONCE FILLED A ROOM CAN NOW BE CARRIED IN YOUR POCKET!



"Europe's Largest Discount Personal Computer Stores"

Delivery is added at cost. Please make cheques and postal orders payable to **COMP SHOP LTD.**, or phone your order quoting **BARCLAYCARD, ACCESS, DINERS CLUB** or **AMERICAN EXPRESS** number.

### MAIL ORDER AND SHOP:

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 604155

★ COMPSHOP USA, 1348 East Edinger, Santa Ana, California, Zip Code 92705. Telephone: 0101 714 5472526

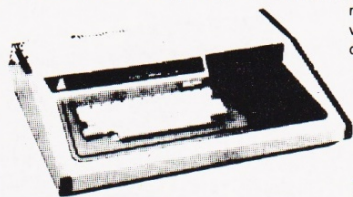


TELEPHONE SALES  
OPEN 24 hrs. 7 days a week  
01-449 6596



## THE Video Genie EG3000 Series

WITH \*16K user RAM plus extended 12K Microsoft BASIC in ROM \*Fully TRS-80 Level II software compatible \*Huge range of software already available \*Self contained, PSU, UHF modulator, and cassette \*Simply plugs into video monitor or UHF TV \*Full expansion to disks, and printer \*Absolutely complete just fit into mains plug.



16K **£299** + VAT

## GP80 The most compact 80 column impact graphic-dot printer available - at a very compact price

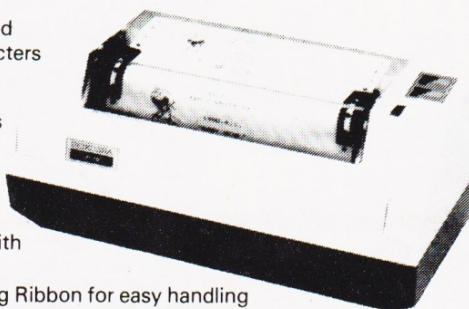
by seikosha

Graphics, Normal and Double-Width Characters can be printed on the same line. Pine Feed Tractor is equipped as standard.

Two Line-Feed Commands (1/6 and 1/9 inch)

Print on Plain Paper with two copies

Continuous Self-Inking Ribbon for easy handling  
Centronics type Parallel Interface standard  
Wide Range of Optional Interface Boards  
Self-Test Programme standard



**£225** + VAT

## Aculab

### Floppy Tape The tape that behaves like a disk

Connects directly to TRS-80 level 2 keyboard. Operating and file handling software in ROM 8 commands add 12 powerful functions to level 2 BASIC. No buttons, switches or volume controls. Full control of all functions from keyboard or program. Maintains directory with up to 32 files on each tape.

### for all TRS 80 & Video Genie owners

TRS80 version: **£165**  
Video Genie: **£170**

## PRINTERS

EPSON TX80B (inc. I/F & cable) **£299**  
EPSON MX80T **£395**  
ANADIX DP8000 **£495**  
ANADIX DP9500 **£895**  
ANADIX DP9501 **£995**

## VIDEO MONITORS

10" BLACK & WHITE **£85**  
10" GREEN SCREEN **£95**

## Tantel Prestel Adaptor

**Prestel information at the touch of a button.** For less than £200 you can now have full Prestel information at your fingertips. Information on just about everything you want to know, need to know, or would like to know. The Tantel desk-top adaptor plugs into a standard colour or black and white television. Then all you need to do is tap the keys and the information you require will appear on the screen in front of you.

**For the office. For the home.** A Tantel adaptor is portable which means you have access to Prestel both in your office and at home. We can supply you with a matching 12" black and white or 10" colour television at a competitive price. These, in conjunction with the adaptor, will provide you with a complete portable Prestel receiver.

**Complete in every way.** The Tantel adaptor comes complete with the latest copy of the Prestel Directory. It has a programmable auto-dialler and comes with the leads necessary for connection to TV, telephone and electricity supply. (You will simply require a Prestel jack socket to be installed by the Post Office at a cost of £13 plus £0.50 rental per quarter.)

**Tantel for access to Prestel in your office or at home!**

**Please add £10 Securicor delivery charge to all computers etc.  
Plus 15% VAT on all prices.**

## Acorn Atom



Also available ready to go **£150** plus VAT and delivery

**Unique in concept — the home computer that grows as you do!**

**Special features include**  
\*FULL SIZED KEYBOARD  
\*ASSEMBLER AND BASIC  
\*TOP QUALITY MOULDED CASE  
\*HIGH RESOLUTION COLOUR GRAPHICS

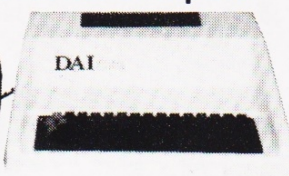
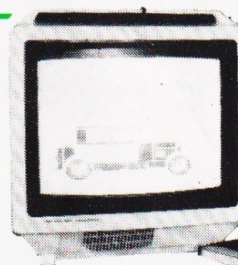
Simple to build, simple to operate. A powerful, full facility computer with all the features you would expect. Just connect the assembled computer to any domestic TV and power source and you are ready to begin.

Full-sized QWERTY keyboard  
6502 Microprocessor Rugged injection-moulded case 2K RAM  
8K HYPER-ROM 23 integrated circuits and sockets Audio

cassette interface UHF TV output Full assembly instructions

**£120** + VAT

## The Second Generation Personal Computer



## Highest performance-lowest price

\*48K (8080A)  
\*16 Colours or shades of Grey  
\*Multiple High Resolution Graphics Modes (64 x 71, 129 x 159, 255 x 335)  
\*Character mode (60 x 24)  
\*Split Screen Modes

\*Full ASCII Upper & Lower Character Set  
\*Unique graphical — Sound Commands for Smooth Music, random frequencies & enveloped sound!

\*RS232 I/F  
at only **£595** + VAT

## DAI Personal Computer

## Paper Tiger 460

The Paper Tiger 460 sets new standards by incorporating many features previously only available on units costing much more.

Features like a specially developed nine wire 'staggered column' head which overlaps the dots of each matrix character with just one pass of the printhead giving a dense, high quality print image without reducing the units 160 c.p.s. print speed.

It also offers a bi-directional logic seeking device to enhance its print optimisation characteristics and wide range of 'print versatility' features such as mono or proportional spacing, automatic justification, programmable horizontal and vertical tabbing, and 'fine' positioning for word processing applications.

## Paper Tiger 560

**£795** + VAT

The Paper Tiger 560 is the first printer which bridges the gap between conventional matrix and 'daisy wheel' types offering quality printing at a relatively low price.

Full 'width' 132 column printing at 160 c.p.s., a unique nine wire 'staggered' print head, bi-directional printing, an inbuilt tractor feed and a host of selectable features set it apart from ordinary matrix printers.

Plus for even greater versatility a full dot plot graphics facility if supplied which includes a 2K buffer.

**£995** + VAT

## Books & bits

Books — Manuals — Diskettes — ribbons — Paper — chips (2114 x 2 1K) £4 pair.

RS232 to Centronics interfaces £40 etc. etc.

A variety of second-hand computer equipment usually available, spares, repairs and service.

# MicroStyle

26 Belvedere, Lansdown Road, Bath.

Telephone: (0225) 334659. After hours: (0761) 33283



name  
interest  
address

# NewBear Limited



**For the Best Deal  
from the largest  
Sharp Dealer  
Phone Newbear  
(0635) 30505**

**Comart Communicator  
& North Star Horizon**

**Newbury Terminals**

**C. Itoh Printer**

**DRE Printer**

**Epsom Printers**

**Daisy Wheel  
Printers**

**apple II Plus**

**mz-80K**

**MZ-80B**

**S-100 Bus  
Cromenco Boards**

**Diskettes  
& Paper**

**Books  
Send for List**

**Hardware  
Component  
Special Offers  
Send for List**

For further information,  
phone, call at our show-  
room or cut off the coupon  
at the top of the page and  
send to:

Newbear Computing  
Store Ltd. (head Office)  
40 Bartholomew St.,  
Newbury, Berks.  
Tel: (0635) 30505

Many unique  
Products,  
Zen/Listings/  
Word proc.



**First Floor Offices, Tivoli Centre, Coventry Road,  
Birmingham. Tel: (021) 707 8255  
220/222 Stockport Road, Cheadle Heath, Stockport,  
Manchester. Tel: (061) 4912290**

**Better Prices!  
Better Delivery!  
Better Service!  
Widest Range of Software**

**for Sharp  
for Sharp  
for Sharp  
for Sharp**