

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

# computing today

SEPTEMBER 1981

ISSN 0142-7210

ONLY 70p

FOR THE BUSINESS  
OF MICROCOMPUTING

## PREDICTING THE OUTCOME:

Let your micro help you make  
the best pools selections



Is connecting  
a printer to your micro  
really as easy as it sounds?

Is Commodore's  
new baby really going  
to take the UK by storm?

Detailed printer  
Buyer's Guide inside

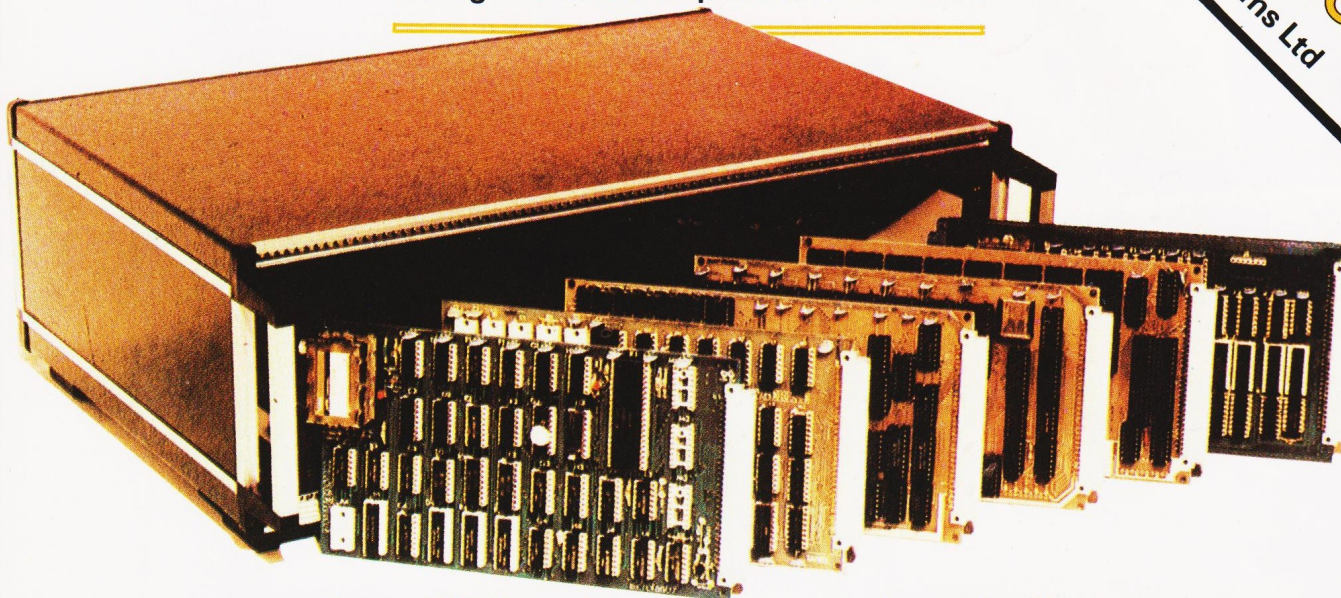
Upgrade your 16K PET  
to the full  
32K



# microtan

designed with expansion in mind

**Tangerine**  
Computer Systems Ltd



**TANGERINE COMPUTERS** get you into computing for less than £80 with

## microtan 65

a one-board 6502-based microcomputer

**But it doesn't stop there - Microtan is a SYSTEM**

Start your expansion with **TANEX** - cassette interface, 16 I/O lines, two 16 bit counter timers, data bus buffering, memory mapping and a further 1K of RAM. Just plug in extra chips for 8K of RAM, 16 more I/O lines, two more counter timers and a serial I/O line with RS232/20 mA loop and full modem control.

**XBUG** - a firmware package with cassette file handling routines and a line-by-line assembler/dis-assembler. 10K extended Microsoft BASIC (as used by Apple, Tandy and NASCOM).

**TANRAM** - up to 40K of extra memory.

The system rack houses up to 12 boards. Extra serial and parallel I/O boards offer up to 128 I/O lines (16 eight bit ports) and eight serial I/O ports.

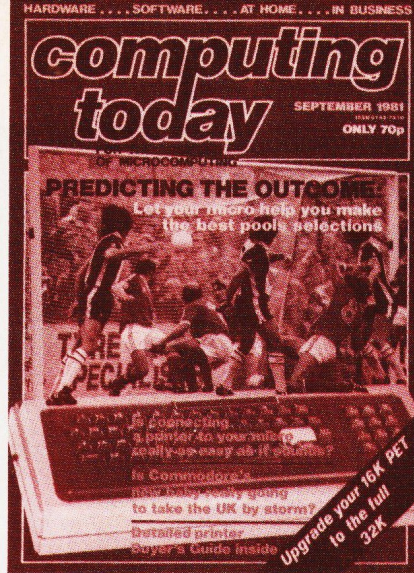
Coming soon... 32K Eprom board, 6502 based Controller, 256 x 256 Graphics board and TANDOS — a CPM disc system utilising a Slave 280 accessible by the System.

**Tangerine**  
Computer Systems Ltd

FOREHILL WORKS,  
FOREHILL, ELY,  
CAMBS.

SEND NOW FOR THE LATEST INFORMATION  
AVAILABLE ON THE MICROTAN SYSTEM.  
PLEASE ENCLOSE A 12p STAMP.





# CONTENTS

## VOL 3 No 7 SEPTEMBER 1981

**EDITORIAL & ADVERTISEMENT OFFICE**  
 145 Charing Cross Road, London WC2H 0EE.  
 Telephone 01-437-1002-7. Telex 8811896.

**Acting Editor** : Henry Budgett  
**Group Art Editor** : Paul Wilson-Patterson BA  
**Advertisement Manager** : Bill Delaney

### CONSUMER NEWS . . . . . 8

Our monthly look at the latest offerings for the personal computer user.

### BUSINESS NEWS . . . . . 12

More media updates and some of the latest business software are among the new products this month.

### THE TEACHER'S TALE . . . . . 17

A short story on the micro revolution in schools starts off our regular spot for teachers to air their views.

### GETTING INTO PRINT . . . . . 22

Connecting a printer to one's computer may appear to be just a matter of plugs and sockets. Sometimes it's not that simple.

### COMPACTOR . . . . . 27

Reduce your memory requirements for programs by removing the spaces with this NASCOM routine.

### GLADIATORS . . . . . 32

A real-time combat simulation in BASIC that's fun on its own or as part of a complete Adventure.

### UPGRADE YOUR PET . . . . . 39

Give yourself more program space by adding an extra 16K to this popular system.

### DISC PURGE . . . . . 44

An intelligent utility for the TRS 80 which will make disc operations neater.

### PET LISTER . . . . . 46

Convert those awkward graphics codes into standard symbols with this machine code routine.

### POOLS PREDICTIONS . . . . . 52

Compiling a data base on recent

performance seems to give an advantage when filling in those coupons.

### COLOUR CUBE . . . . . 59

It was only a demonstration, but as you all seem to want to know how we did it here's the program.

### BOOK PAGE . . . . . 63

There are probably as many books on BASIC for microcomputers as there are computers that run it. We take a look at some of the lesser known titles.

### PRINTOUT . . . . . 66

Among this month's reader's writes are messages from Darkest Africa, comment on The Bomb and details of some new clubs.

### PROGRAMMING LANGUAGES . . . . . 69

Robotics is definitely the current rage so we present WSNF.

### UNVEILING THE VIC . . . . . 73

Hailed as the best thing to come out of the Commodore since office furniture, it certainly looks attractive. Our technical team investigates.

### MORSE TRAINER . . . . . 78

Let your Tandy take the strain out of all those dits and dahs.

### BUYER'S GUIDE . . . . . 82

Printer selection made easy.

### Next Month's Issue . . . . . 18

### Subscriptions . . . . . 23

### Binders . . . . . 37

### Breadboard '81 . . . . . 41

### Book Service . . . . . 77

### Electronics Digest . . . . . 81

### Electronics Today . . . . . 90

### Backnumbers . . . . . 91

**Editorial Assistants** : Tina Boylan  
 Judith Jacobs

**Drawing Office Manager** : Paul Edwards

**Assistant Art Editor** : Alison Lilly

**Sales Executive** : Claire Fullerton

**Advertisement Copy Control** : Sandie Neville,  
 Sonia Hunt

**Managing Editor** : Ron Harris BSc

**Managing Director** : T J Connell

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

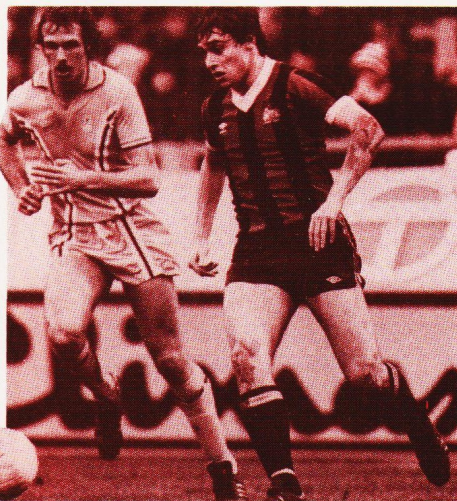
Computing Today is normally published on the second Friday in the month preceding cover date.  
 Distributed by: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. 01-247 8233.  
 Printed by: Alabaster Passmore & Sons Ltd, Maidstone, Kent.

©MODMAGS LTD 1981: All material is subject to worldwide copyright protection. All reasonable care is taken in the preparation of the magazine's contents, but the publishers cannot be held legally responsible for errors. Where mistakes do occur, a correction will normally be published as soon as possible afterwards. All prices and data contained in advertisements are accepted by us in good faith as correct at time of going to press. Neither the advertisers nor the publishers can be held responsible, however, for any variations affecting price or availability which may occur after the publication has closed for press.

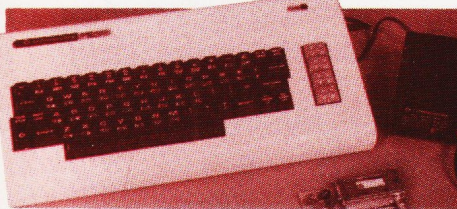
Subscription Rates : UK £11.25 including postage. Airmail and other rates upon application to Computing Today Subscriptions Department, 513 London Rd, Thornton Heath, Surrey CR4 6AR.



Circus Maximus p32



Kicking up a storm p52



VIC's here p73

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

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

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



When it comes to looking at what the incredible VIC-20 has to offer, there's one cost-free add-on it will pay you to consider right from the start - The VIC Centre.

Established by Adda Microshops Ltd, part of the successful Adda Computers group, The VIC Centre aims to offer the kind of service you'll not find anywhere else in the country.

To begin with, our business is dedicated towards providing you with a "one-stop" source for the VIC-20, VIC-20 peripherals and VIC-20 software. On the basis of a very simple philosophy: to provide a friendly, fast and comprehensive service for the world's most user-friendly and helpful personal computer.

We'll be amongst the first to have available supplies of the VIC-20 with its magnificent sound and colour capabilities.

# The VIC centre

## It's the add on to start with for your VIC-20

Contact us now to ensure early delivery of your VIC-20. When you've found how the VIC-20 makes it easy for you to

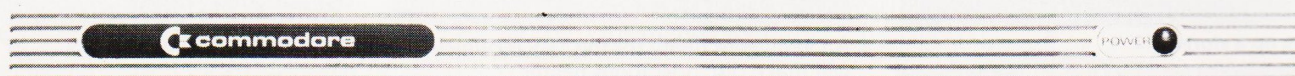
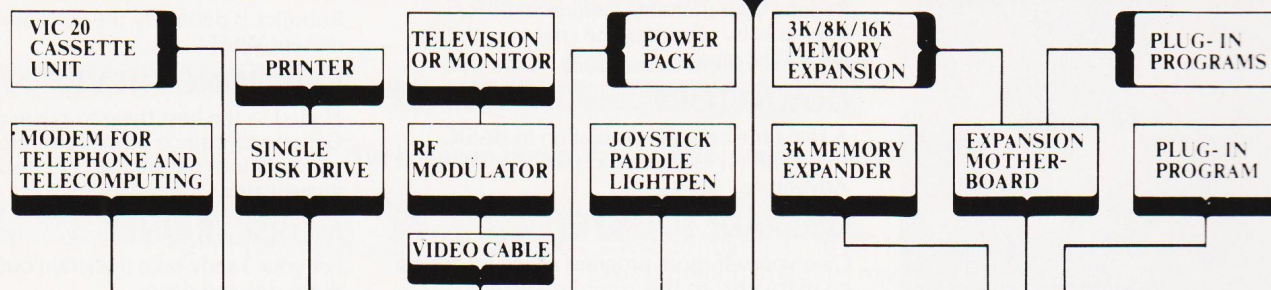
learn all about computing, we'll supply the software to help your knowledge grow.

We'll keep you informed of new peripherals which will give the VIC-20 system unrivalled versatility on applications ranging from home budgeting and video games to business records and statistics.

All our customers benefit from our telephone technical advisory service and in-store repair facilities.

If you want to get to the heart of what the VIC-20 system is all about then go straight to the centre - The VIC Centre - and join our information service now.

Just complete and post the coupon. Or telephone 01-579 1962.



VIC-20

**Our new shop opens August 4th!**  
154 Victoria Road, Acton, London W3,  
next to North Acton  
tube station.

Please put me on your mailing list to receive up-to-date information on the VIC-20 system.

Name \_\_\_\_\_  
Address \_\_\_\_\_

**The VIC Centre**  
Adda Microshops Ltd  
14 Broadway  
West Ealing  
W13 6SR

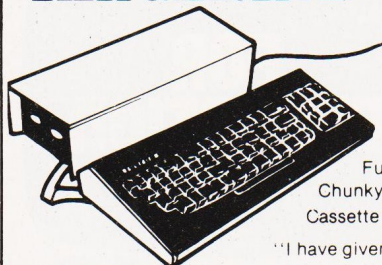


# CASTLE ELECTRONICS

## MICRO COMPUTER CENTRE

Telephone Hastings (0424) 437875

### TANGERINE



### microtan 65

£69

Microtan 65 is the most advanced, most powerful, most expandable microcomputer available — it also happens to be the most cost effective.

6502 Microprocessor 1K Tanbug 1K User RAM Full TV Display £79 (ready-built). 20-way KEYPAD—£10. TANEX—£43  
1K 16 parallel I/O lines. Cassette Interface—1 serial I/O line. 2 x 16 BIT counter timers OPTIONS TK  
RAM total—32 parallel I/O lines. 4 x 16 BIT counter timers—RS232. 20MA current loop.  
10K MICROSOFT BASIC—£49  
System Rack—£49 in black/tangerine in brushed aluminium.  
Full Ascii Keyboard with numeric pad—£60.85. Cabinet available—£20. Lower Case option—£9.48.  
Chunky Graphics Pack—£6.52. Tanram Full Memory Expansion to 40K—£119.00. Mini Motherboard—£10.00.  
Cassette with counter—£21.70.

"I have given TANGERINE five bonus points for getting just about everything right"—E.T.I. Mag., May 1980.

### COMMODORE PET

Everything has been said about PET — Britain's number one selling microcomputer. A full range of accessories and software, (both games and business), is held in stock.

8K Inbuilt Cassette—£399,  
8K Large Keyboard—£425  
16K Large Keyboard—£499  
External Cassette—£55  
Dual Disc Drive—£695  
Tractor Printer—£395

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!



£399



£599



The Apple II+ is more powerful than its predecessors with built-in sound and high resolution graphics, which make it ideal for scientific and games applications.

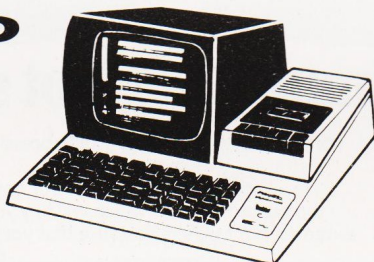
APPLE 16K—£599  
APPLE 32K—£649  
APPLE 48K—£659  
Epson Printer—£349

Cassette with counter—£21.70  
Disc drive without controller—£299  
Disc drive with controller—£349

16K add-on—£69  
CARDS: Prototype/hobby card—£15, parallel printer interface card—£104, communications card—£130, high speed serial interface card—£113, Pascal language system—£299.

### SHARP

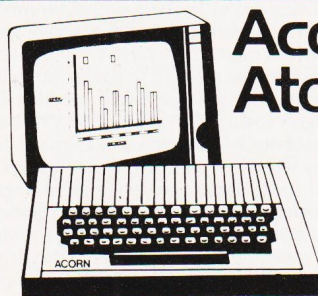
MZ80 20K ... .. £449  
36K ... .. £475  
48K ... .. £495  
Printer ... .. £475  
Dual disc drive ... .. £715



### video genie system

The Video Genie system has many uses in all spheres of life, the easy to use BASIC language means that programmes are easily written for specific applications, and pre-recorded programme tapes are available in great variety. TRS/80 software can be used with this system. The system has great scope in the home, sophisticated games programmes can introduce the computer age to all the family, who can then progress to writing their own programmes in BASIC or even machine code. Software is continuously being developed to aid home budgeting and education.

£299

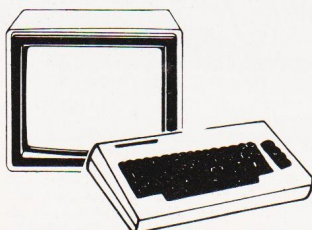


### Acorn Atom

The ATOM is a British-designed personal computer—simple to operate, and in kit form, simple to build. It has all the features found in machines twice the price or more, and yet it has one outstanding advantage. It is designed on an expandable basis.

Atom kit 8K ROM 2K RAM ... ..	£ 120
assembled ... ..	£ 150
kit 12K ROM 12K RAM ... ..	£ 220
assembled 12K ROM 12K RAM ... ..	£ 250
1K RAM set ... ..	£ 9.50
4K Floating Point ROM (included in 12K version) ... ..	£20.00
Printer drive ... ..	£ 9.00
LS244 buffer ... ..	£ 2.50
Colour encoder ... ..	£19.00
Mains PSU ... ..	£ 8.00

### COMMODORE VIC



Commodore International Ltd. (AMEX-CBU) has officially introduced the world's first full-featured colour computer priced at under £200.

The new VIC 20, which retails at £199.00 was unveiled on January 8th at the Consumer Electronics Show in Las Vegas.

The new computer puts Commodore squarely in the low priced personal computer market with a fully expandable microcomputer which connects to any television set and rivals the features of existing microcomputers selling at four or five times the price. The features speak for themselves:

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

ALL PRICES—ADD 15% VAT. DELIVERY: POSTAGE/PACKING WILL BE NOTIFIED BARCLAYCARD AND ACCESS ORDERS TAKEN BY PHONE

CASTLE ELECTRONICS 7 CASTLE ST., HASTINGS, E.SUSSEX  
Telephone Hastings (0424) 437875

Shop hours 09.00 to 1730 Mondays to Saturdays



# CHOOSING A COMPUTER MADE SIMPLE

**FOR  
BUSINESS**

**Made simple...**

**FOR WORD  
PROCESSING**

**Made simple...**

**FOR  
EDUCATION**

**Made simple...**

**ADVICE**

**Made simple...**

**SERVICE  
AND  
BACK-UP**

**Made simple...**

**IMPROVING  
ON PET**

**Not so simple**

**Choosing a computer is...** Choosing a computer is more than just choosing a computer. That is, it's a lot more than just hardware. Mind you, PET stacks up very well when it comes to the computer itself. Because at Commodore we've been involved with microcomputers for over 20 years – in fact, many other manufacturers pay us the compliment of using our microchip for their own computers.

So, when you choose PET you know you have a microcomputer that everyone in the business admires and respects.

**... choosing software...** Our software programs live up to the quality of our computer. The range, from both Commodore and specialist suppliers, covers everything from word processing, stock control and payroll to accounting and information processing. As well as specialist applications for education and the sciences.

For light relief, we've a pretty impressive range of games and other brain-teasing packages.

**... choosing value...** Our computers start at under £200 and go through to £3000 – which will buy you a complete business system. The extent of our range makes sure that you'll easily be able to choose the right computer for your individual needs.

**... choosing a dealer...** As you can see, you do get nationwide dealer back-up with Commodore.

What's more, many of our dealers have specific expertise – which means they can advise on anything from business systems to specialist technical applications. So, if your particular problem is of a highly specialised nature, it may be best to contact our Information Department direct.

They will then recommend the dealers who understand – and who speak your kind of language.

**... choosing your computer...** It all adds up.

By choosing a PET you're getting the kind of systems and service that you'd expect from Britain's biggest selling microcomputer.



Send to: Commodore Information Services, P.O. Box 109, Baker Street, High Wycombe.  
Tel: Slough 79292.

I'd like to know how a Commodore PET will make choosing a computer simple for me.

Name.....

Company.....

Address.....

Tel:..... 24 CT1

**COMMODORE PET**  
**Quite simply, Britain's biggest  
selling microcomputer**



## LONDON AREA

Adda Computers Ltd  
W13, 01-579 5845  
Byteshop Computerland  
NW11, 01-387 0505  
Capital Computer Systems Ltd  
W1, 01-636 3863 & 637 5551  
Centralex - London Ltd  
SE13, 01-318 4213-7  
Chromasonic Electronics  
N19, 01-263 9493/9495  
Healey Management Services Ltd  
E1, 01-247 2858/3149  
Home and Business Computers  
E12, 01-472 5107  
Logic Box Ltd  
SW11, 01-222 1122/5492  
Merchant Systems Limited  
EC4, 01-583 6774  
Metyclean Ltd  
EC4, 01-236 2000  
Micro Computation  
N14, 01-882 5104  
Micro Computer Centre  
SW14, 01-878 7044-7  
Sumlock Bordin Ltd  
EC1, 01-250 0505  
The Computer Shop (City) Ltd  
EC1, 01-628 3531

## HOME COUNTIES

Millhouse Designs Ltd  
ALTON, 04517  
The Computer Shop (Banbury) Ltd  
BANBURY, 3477  
H.S.V. Ltd  
BASINGSTOKE, 62444  
M.M.S. Limited  
BEDFORD, 40601/2  
Bracknell Computers  
BRACKNELL, 52929  
D.D.M. Direct Data Marketing Ltd  
BRENTWOOD, 229379 & 230480  
Amplicon Micro Systems Limited  
BRIGHTON, 562163 & 608331  
T & V Johnson (Microcomputers Etc) Ltd  
CAMBERLEY, 20446  
Vego Computers Ltd  
CATERHAM, 49235  
The Computer Shop (Caversham) Ltd  
CAVERSHAM, 481555  
Dataview Ltd  
COLCHESTER, 865835  
DaVinci Computers Ltd  
EDGWARE, 01-952 0526  
Micro-Facilities Ltd  
HAMPTON HILL, 01-979 4546  
Cream Computer Shop  
HARROW, 01-863 0833  
L & J Computers  
HARROW, 01-204 7525  
South East Computers Ltd  
HASTINGS, 426844  
Bromwall Data Services Ltd  
HATFIELD, 60980/67111  
Alpha Business Systems  
HERTFORD, 57425  
Commonsense Business Systems Ltd  
HIGH WYCOMBE, 40116  
Kingsley Computers Ltd  
HIGH WYCOMBE, 449749  
Computer Sales & Software Centre Ltd  
ILFORD, 01-554 3344  
H.B. Computers Ltd  
KETTERING, 520910  
H.B. Computers (Luton) Ltd  
LUTON, 426887/416892  
South East Computers Ltd  
MAIDSTONE, 681263  
Photo Acoustics Ltd  
NEWPORT PAGNELL, 610625  
WATFORD, 32006 & 40698  
Sumlock Bordin (East Anglia) Ltd  
NORWICH, 26259 & 614302  
The Computer Shop (Oxford) Ltd  
OXFORD, 722872  
T & V Johnson (Microcomputers Etc) Ltd  
OXFORD, 721461  
Arden Data Processing  
PETERBOROUGH, 49577 & 67831  
H.S.V. Ltd  
SOUTHAMPTON, 331422  
Sumlock Tabdown Ltd  
SOUTHAMPTON, 26647  
D.D.M. Direct Data Marketing Ltd  
SOUTHEND-ON-SEA, 65787 & 64589  
Scan Computers Ltd  
STORRINGTON, (09066) 5432  
The Computer Room  
TONBRIDGE, 355962  
Orchard Computer Services  
WALLINGFORD, 35529  
Microchips  
WINCHESTER, 68085  
P.P.M. Ltd  
WOKING, (04867) 80111  
Petalect Limited  
WOKING, (04862) 69032 & 21776

## MIDLANDS

Byteshop Computerland  
BIRMINGHAM, 021-622 7149  
C.P.S. (Data Systems) Limited  
BIRMINGHAM, 021-707 3866  
Camden Electronics Limited  
BIRMINGHAM, 021-773 8240  
Marchant Business Systems Ltd  
BIRMINGHAM, 021-706 8232  
Micro Associates  
BIRMINGHAM, 021-328 4574  
Peach Data Services  
BURTON-ON-TRENT, 44968  
Catlands Information Systems  
CHESTER, 46327  
PEG Associates (Computer Systems) Ltd  
COVENTRY, 20246  
Davidson-Richards Ltd  
DERBY, 366803  
Taylor Wilson Systems Ltd  
DORRIDGE, (056 45) 6192  
Caddis Computer Systems Ltd  
HINCKLEY, 613544

Arden Data Processing  
LEICESTER, 22255  
Roger Clark Business Systems Ltd  
LEICESTER, 20455  
Betos (Systems) Ltd  
NOTTINGHAM, 48108  
Byteshop Computerland  
NOTTINGHAM, 40576  
PEG Associates (Computer Systems) Ltd  
RUGBY, 65756  
Synchro Computing Ltd  
STOKE-ON-TRENT, 825391  
Walters Computer Systems Ltd  
STOURBRIDGE, 70811  
The Computer Shop (Swindon) Ltd  
SWINDON, 694061  
McDowell, Knaggs & Associates Limited  
WORCESTER, 28466

## YORKS AND HUMBERSIDE

Ackroyd Typewriter & Adding Machine Co. Ltd  
BRADFORD, 31835 & 32243  
Allen Computers  
GRIMSBY, 40568  
Microprocessor Services  
HULL, 23146  
Microware Computers Ltd  
HULL, 562107  
Holdene Ltd  
LEEDS, 459459  
Yorkshire Electronics Services Ltd  
MORLEY, 522181  
Computer Centre (Sheffield) Ltd  
SHEFFIELD, 53519/588731  
Holbrook Business Systems Ltd  
SHEFFIELD, 484466  
Estate Computer Systems  
SLEAFORD, 305637  
Mitrefinch Ltd  
YORK, 52995

## NORTH EAST

Currie & Maughan  
GATESHEAD, 774540  
Dyson Instruments  
HETTON, 260452  
Key Computer Services Ltd  
NEWCASTLE-UPON-TYNE, 815157  
Index Datalog Ltd  
STOCKTON-ON-TEES, (0642) 781193

## MANCHESTER AREA

Byteshop Computerland  
MANCHESTER, 061-236 4737  
Computastore Limited  
MANCHESTER, 061-832 4761  
Cytek (UK) Limited  
MANCHESTER, 061-872 4682  
Executive Reprographic Ltd  
MANCHESTER, 061-228 1637  
Professional Computer Services Ltd  
OLDHAM, 061-624 4065  
Catlands Information Systems Ltd  
STOCKPORT, 061-477 6699  
Catlands Information Systems Ltd  
WILMSLOW, 527166

## LIVERPOOL

Stack Computer Services Ltd  
BOOTLE, 051-933 5511  
Aughton Microsystems  
KIRKSTOWN, 051-548 7788  
Rockcliff Micro Computers  
LIVERPOOL, 051-521 5830  
The Computer Shop (Southport) Ltd  
SOUTHPORT, 77783

## NORTH WEST

B & B (Computers) Limited  
BOLTON, 26644  
Tharstern Limited  
BURNLEY, 38481  
Preston Computer Centre  
PRESTON, 57684

## WEST COUNTRY

Radan Computational Ltd  
BATH, 318483  
Calculator Services & Sales (Bristol) Ltd  
BRISTOL, 779452/3  
Sumlock Tabdown Ltd  
BRISTOL, 276685  
T & V Johnson (Microcomputers Etc) Ltd  
BRISTOL, 422061  
A.C. Systems  
EXETER, 71718  
South Coast Business Machines Ltd  
FERNDOWN, 893040  
Milequip Ltd  
GLOUCESTER, 411010  
Devon Computers  
PAIGNTON, 526303  
A.C. Systems  
PLYMOUTH, 260861  
JAD Integrated Services (Plymouth) Ltd  
PLYMOUTH, 662616 & 29038  
J.M. Computer Services Ltd  
TRURO, 71626

## WALES

Sumlock Tabdown Ltd  
CARDIFF, 41361  
Sigma Systems Ltd  
CARDIFF, 34869 & 21515  
Reeves Computers Limited  
CARMARTHEN, 32441/2  
Computer Supplies (Swansea)  
SWANSEA, 290047

## SCOTLAND

MacMicro Ltd  
BEAULY, 046-371.2774  
Holdene Microsystems Ltd  
EDINBURGH, 031-668 2727  
Byteshop Computerland  
GLASGOW, 041-221 7409  
Gate Microsystems Limited  
GLASGOW, 041-221 9372-4  
Robox Ltd  
GLASGOW, 041-221 8413/4  
Ayrshire Office Computers  
KILMARNOCK, 42972

## NORTHERN IRELAND

Northern Ireland Computer Centre Limited  
HOLYWOOD, (02317) 6548

# Computers and People Series

This series is concerned with all aspects of man-computer relationships, including interaction, interfacing, modelling and artificial intelligence. The volumes are interdisciplinary, communicating results derived in one area of study to workers in another. Applied, experimental, theoretical and tutorial studies are included.

## Fuzzy Reasoning and its Applications

edited by E.H. Mamdani and B.R. Gaines

April/May 1981, xviii + 314pp., 0.12.467750.9  
£12.60 (UK only) / \$ 30.50

The papers in the volume are grouped into three sections. The first covers the philosophical foundations of fuzzy and other multiple-valued logics and is therefore concerned with the fundamentals of fuzzy logic. The general application of the theory to the handling of fuzzy data is dealt with in Part II, while the more specific use of fuzzy logic in the design of process controllers is discussed in Part III.

## Computing Skills and the User Interface

edited by M.J. Coombs and J.L. Alty

April/May 1981, x + 496pp., 0.12.186520.7  
£19.00 (UK only) / \$ 46.00

The opening chapters discuss the issues involved in providing computer facilities for two classes of new user: university researchers who want specialised packages which are easy to use yet are both flexible and adaptive, and commercial users who want simple supportive systems which will cause the minimum disruption to their normal work practices. This section is followed by a consideration of the nature of computing skills, techniques of interaction and program comprehension. Finally, the book focusses on conflicting philosophies of interface design and reports practical attempts to produce improved user interfaces.

## Academic Press



A Subsidiary of Harcourt Brace Jovanovich, Publishers  
London New York Toronto Sydney San Francisco  
24-28 Oval Road, London NW1 7DX, England  
111 Fifth Avenue, New York, NY 10003, USA



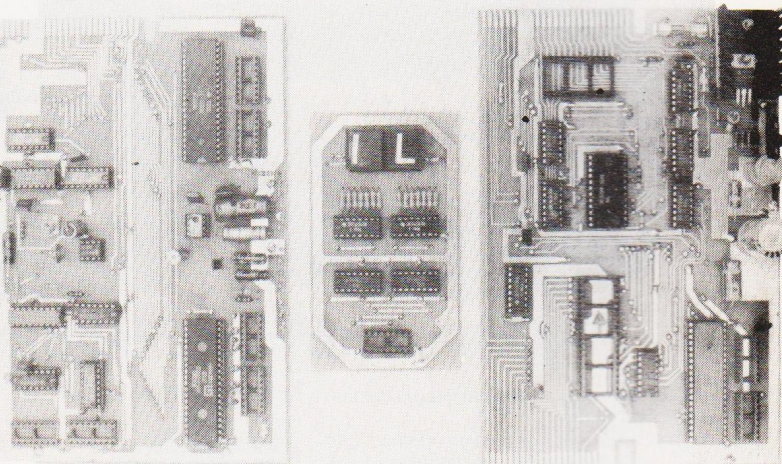


## GIVING IT AWAY

Our illustrious sister magazine, ETI, is featuring a competition this month that may well appeal to the active programmers among you. Their main feature is a robot arm project and the competition is to write software to drive it from any of the common personal computers; PETs, Tandys, RML 380Zs, MICRONs etc etc. Full rules are published in ETI but essentially all programs must be supplied in listed form with full documentation. Cassettes and discs are NOT acceptable as entries although they may be used to support entries on PET and Sharp systems. There is a first prize of £100 so get coding.

## THREE FOR TWO

A new set of interface boards for the Superboard II and UK 101 has been introduced by Technomatic. Connecting directly to the expansion socket they offer additional user ports, a sound generator, a D to A and an A to D. All are accessible from BASIC and machine code programs. A 50-page booklet describes the applications to which they can be put and a set of 27 programs is also available on cassette. The system comprises a decoding module at £27.50, an analogue board at £47.50 and a display board at £9.50. The cassette costs £3.50 and all prices are exclusive of VAT. For further information contact Technomatic at 17 Burnley Road, London NW10 1ED or ring on 01-452 1500.



## WRAPPING IT UP

A prototyping kit to introduce electronic engineers to the technology of solder-wrapping has been launched by Pye Borders Electronics. All the necessary components and tools are included allowing a single Eurocard to be equipped with up to 40 16-pin DIP sockets. The nearest equivalents

to this system currently available are those supplied by Vero Electronics and T J Brine's Roadrunner. Pye Borders are also offering an automatic wiring service for large production runs as an alternative to PCB type production systems. For further information contact them at Pinnacle Hill Industrial Estate, Kelso, Roxburghshire TD5 8DW.

## ON COURSE

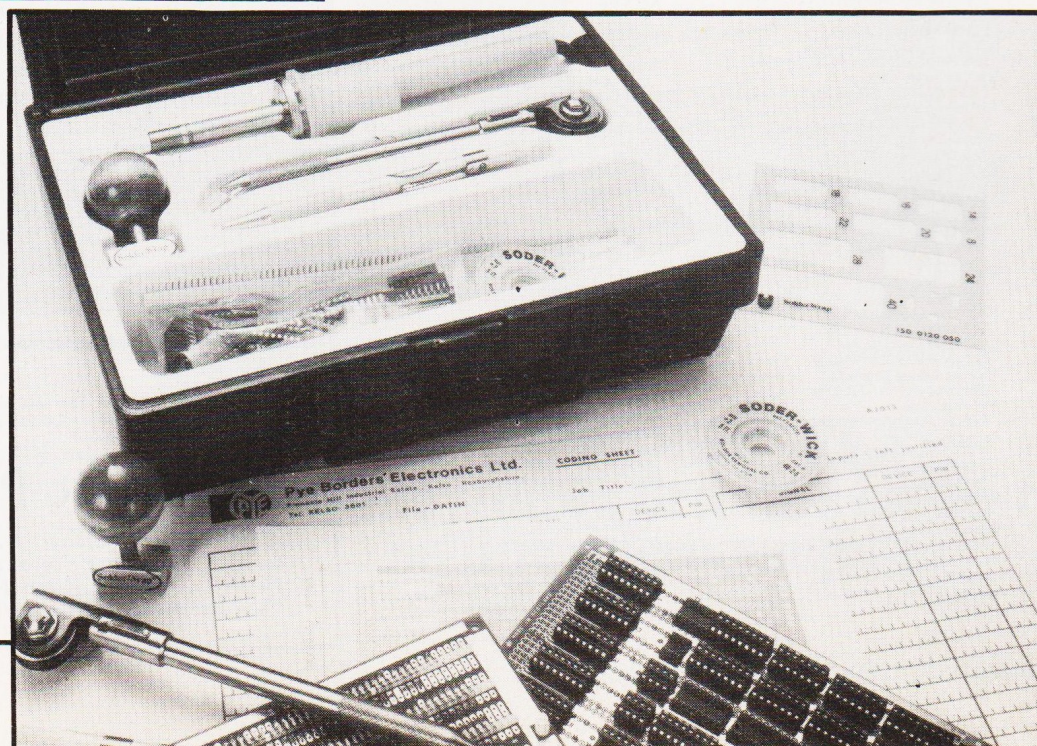
With the continuing shortage of trained programmers and systems analysts in the computer market, not to mention the considerable understaffing in other areas, it is nice to see some more courses appearing. Slough College of Further Education are offering a wide range of courses including a TOPS supported Higher TEC in Computer Technology and an HND in Computer Studies. Interviews will start in September for the January 1982 courses and information can be obtained from Dr E Huzan, Head of Computing Division, Slough College of Further Education, Wellington Street, Slough, Berks SL1 1YG. Computer based training is the subject of a one-day workshop and a two-day course being organised by Mills and Allen Communications. The workshop is on 30th September and the course runs on 1st and 2nd October. Full details from Sue Punch at Mills and Allen Communications, 1-4 Langley Court, Long Acre, London WC2E 9JY or ring on 01-240 1307. The Society of Industrial Artists and Designers are running a third series of one-day courses on Computer Typography. Dates are December 16th, February 9th, March 19th and 26th and June 25th, all but the first are in 1982, of course. The cost is £70 inclusive for non-members and £40 for SAID members. Information from Susan Hirst, Education and Training Department, SAID, 12 Carlton House Terrace, London SW1Y 5AH or telephone on 01-930 1911.

## NCC EVENTS

The new Microsystems Centre has announced its Autumn training programme for secretarial people who may be asked to advise on word processing equipment. There is a one-day course on September 7th or you can go for five one and a half hour evening sessions starting on 17th September. The cost is £50 for both methods. Wednesday September 2nd is the date for a one-day workshop on Microcomputer Appreciation for Managers. Both of the above are to be held in the Centre at 11 New Fetter Lane, London EC4A 1PU. Other courses and seminars scheduled for September include Computer Based Training, Electronic Office Systems, CP/M In Practice and Elementary BASIC Programming. Full details and prices can be obtained from the above address or by ringing on 01-353 0013, or by contacting the NCC direct at Oxford Road, Manchester M1 7ED or telephone on 061-228 6333.

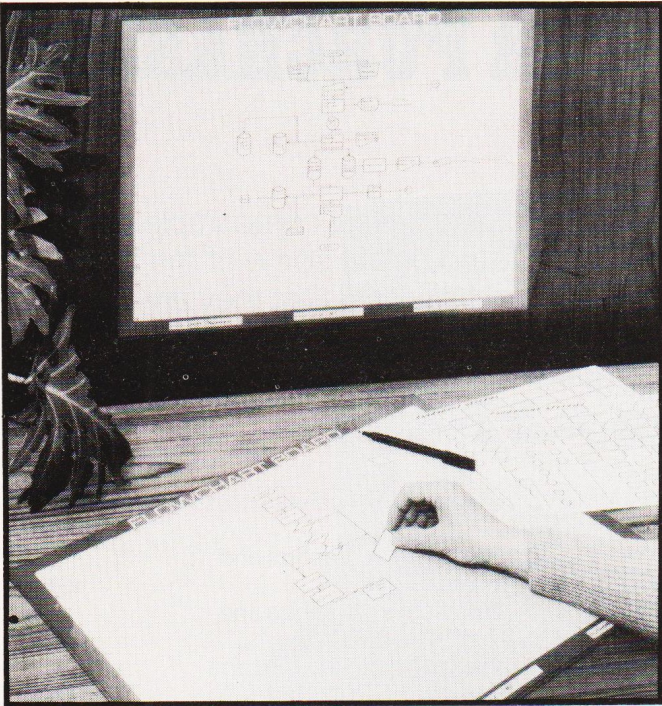
## CPU UPGRADE

The ever popular Z80 CPU has been available in 2 and 4 MHz versions for quite a while now but if this still isn't fast enough you can buy a 6 MHz variant called the Z80B. Fully compatible with the existing types and all peripheral devices it is now available through Hi-Tek Distribution, Trafalgar Way, Bar Hill, Cambridge CB3 8SQ.





# CONSUMER NEWS

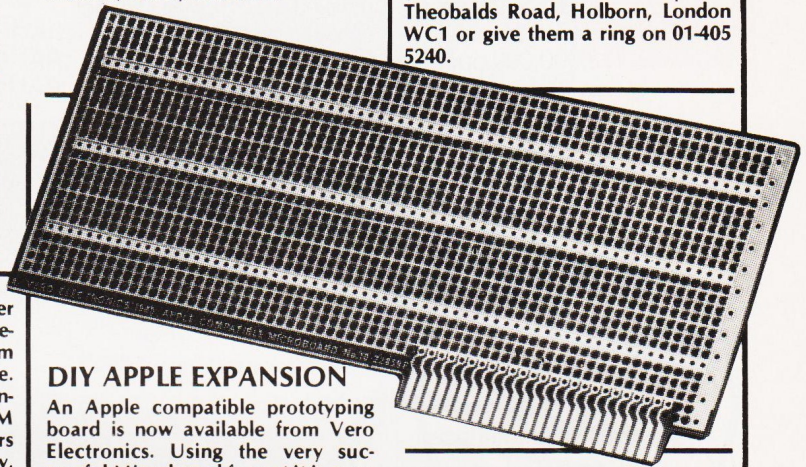


## CHART ART

A new programming aid has been introduced for the serious programmer or small software house. It consists of a large laminated work-board and sheets of cling-plastic symbols. Annotations and flowchart lines are drawn in with special marker pens and the board can be wiped clean after use. To make a permanent record a photocopy can be taken. Originally developed for in-house use by Data Communications it proved so successful that they set up a special company to market it. The board and two sets of symbols costs £23.72 inclusive. For more information contact Flowchart Systems at Datarite House, Grafton Road, New Malden, Surrey KT3 3AA.

## WHISTLE STOP TOUR

The latest catalogue from Transam offers some solace for those who can't afford to get to London to look at their Tuscan computer. It is currently on-board the MAP train making a 21 week tour round the country. At the time of reading the train is just about half-way round with the next scheduled stops as Aberdeen, Dundee, Newcastle and Middlesbrough. If you have a Prestel set you can check the progress with a quick \*204200#. The catalogue lists all the hardware and ancillaries which Transam produce with the notable exception of their original Triton, the 8080 based system produced in conjunction with ETI. For your copy contact them at 59/61 Theobalds Road, Holborn, London WC1 or give them a ring on 01-405 5240.



## DIY APPLE EXPANSION

An Apple compatible prototyping board is now available from Vero Electronics. Using the very successful Microboard format it is complete with a colander ground plane and gold plated connectors and should be readily available from your local stockists. Also using the Microboard format is an \$100 compatible board that has space dedicated for on-board regulators and their associated heatsinks. The third recent offering is a KM6 case frame that can be rack mounted. Fully compatible with the existing free-standing versions, it allows Eurocard systems to be permanently installed. If you have any difficulties in supply or obtaining further information contact Vero direct at the Industrial Estate, Chandler's Ford, Hants S05 3ZR.

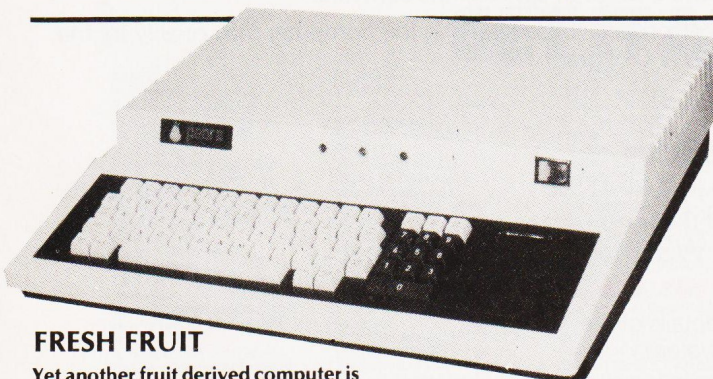
## ON-SCREEN EDUCATION

If you own or rent a VCR and want to learn BASIC then a new-style programming course may be of interest. Just introduced by Guild Sound & Vision it consists of a set of four video cassettes, a manual and a set of exercise sheets which cost £180 per set to schools and £240 to individual customers. These prices are for VHS and Betamax systems: others are available. The next course to be released will be on Pascal. More information is available from Guild Sound & Vision at Woodston House, Oundle Road, Peterborough PE2 9PZ or give them a ring on 0733-63122.

## OF MICE AND MEN!

Supersoft have recently launched what might well be two winners for the PET. First, in the software field: an adventure game that, unlike most previous games of this type, is supplied on cassette not disc. It requires 32K of RAM and as there are no graphics so it will work on 40 or 80 column machines. It is called 'The Hitch Hiker's Guide To The Galaxy' and loosely uses scenarios from the well known book. Like others of the genre it requires you to search for and use various items scattered between here and the end of the universe. You will have to decide just what to do with your 'towel', 'rubber duck' and a 'bowl of petunias' not to mention those wandering 'white mice' and 'Marvin the Robot'. Movement throughout the galaxy is logical and repeatable and you may store

your current status on tape for later re-entry. Price £16 plus VAT. The second item of interest comes from Supersoft's growing firmware stable. ARROW is yet another chip to fit into one of your PET's spare ROM sockets (if you have any left!) It offers facilities such as optional repeat key, hexadecimal calculator, double density plotting, tape positioning and ... wait for it ... hyperspeed (Supersoft's term) cassette LOAD, SAVE, VERIFY and APPEND. Under ARROW control you can LOAD, SAVE etc a program at about six (yes, six) times faster than normal. When you next LOAD a 16K program get out your stop-watch and time it ... then contact Supersoft for the latest price of ARROW. Their location is on the First Floor, 10-14 Canning Road, Wealdstone, Harrow, Middlesex HA3 7SJ.



## FRESH FRUIT

Yet another fruit derived computer is being launched into the European marketplace, the Pear II. If the name sounds a little similar to one you already know and the logo looks rather familiar as well — don't let yourself be fooled. Based on the 6502 processor and complete with full PAL colour graphics the Pear is a cased system with 32K of RAM, expandable to 96K, 24 by 40 screen display, 14 expansion slots and quite a lot more besides. Deliveries will

start at the end of September at a cost of £975 excluding VAT. The supplied language is BASIC with COBOL available provided the Z80 'softcard' is installed. Other options include an EPROM programmer, joystick and the facility to re-program the character set to suit your requirements. For further information contact Pearcom Ltd at 17 Nobel Square, Basildon, Essex SS13 1LP.





# IMPORTANT NOTICE TO ALL MICRO-COMPUTER PURCHASERS

## The BBC Micro-computer System

In September 1981 the new BBC Microcomputer\* goes into production. It will be available by mail-order from the end of October. We believe that this computer will far out-perform any other

- Full QWERTY keyboard with full cursor controls and 10 user programmable keys. Sealed contact switch construction tested to a minimum of 3,000,000 operations.
- Built-in power supply.
- RAM expandable to 32K bytes.
- ROM expandable to 48K bytes.
- Second 8-bit processor option with up to a total of 96K RAM.
- 16-bit processor expansion with up to 8 Megabytes of RAM.
- Cassette and disk interface and filing system.
- Teletext and Prestel (Viewdata) interfaces.
- Networking facility (Econet).
- RS232 Interface.
- Centronics printer interface.
- Analogue to Digital Interface (Paddle or joystick).
- Built-in loudspeaker and sound generator.
- Voice synthesiser.
- Elapsed time clock.

A full range of peripherals including printers, disks, monitors will be available for business use.

Regional advice centres for educationalists and user groups for hobbyists are being established.

Nationwide servicing facilities.

machine at a remotely comparable price. We have listed below some of the many features, and suggest that they are considered by anyone choosing a computer for home, school or business use.

### VDU modes as follows:

Memory mapped, transparent access with eight formats:

1. 640 x 256-2 colour graphics and 80 x 30 text (20K)
2. 320 x 256-4 colour graphics and 40 x 32 text (20K)
3. 160 x 256-16 colour graphics and 20 x 32 text (20K)
4. 80 x 25-2 colour text (16K)
5. 320 x 256-2 colour graphics and 40 x 32 text (10K)
6. 160 x 256-4 colour graphics and 20 x 32 text (10K)
7. 40 x 25-2 colour text (8K)
8. 40 x 25 teletext compatible (1K)

Operates in a microsoft-type basic extended to provide unrestricted variable names; multi-line statements, functions and procedures with local variables; powerful string handling; built-in mnemonic assembler and features for structured programming.

Pascal in ROM available as a second language.

This computer system has been developed as part of the computer literacy project to be launched on BBC 1 in January 1982. The project also includes a 10-part television series, a book, a 30-hour course in programming in BASIC and a range of applications software.

Secondary schools buying this computer may qualify for the 50% DOI grant.

For more details of the BBC Microcomputer System just fill in the coupon below and send it to:  
BBC, Box No 7, London W3 6XJ

Please send me more details of the BBC Microcomputer System.

Name \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

Postcode \_\_\_\_\_

CT/9/81



\*Designed and made under license from BBC Enterprises Ltd by Acorn Computers Ltd of Cambridge.



# THE SHARP MZ-80K HAS GOT IT ALL



**NOW WITH  
PASCAL**  
(CASSETTE BASED)

**NOW ONLY**  
**£460** R.R.P.  
+Vat  
**48K**

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 Shop Equipment Ltd  
Bristol, Tel: 0272 425338  
**DECIMAL BUSINESS M/Cs Ltd**  
Bristol, Tel: 0272 294591  
**BEDFORDSHIRE**  
H.B. Computers (Luton) Ltd  
Luton, Tel: 0582 416887  
**BERKSHIRE**  
Newbear Computing Store Ltd  
Newbury, Tel: 0635 30505  
**BIRMINGHAM**  
Camden Electronics  
Small Heath, Tel: 021-773 8240  
E.B.S. Ltd  
Birmingham, 1, Tel: 021-233 3045  
**ELECTRONIC BUSINESS SYSTEMS LTD**  
Birmingham, Tel: 021-384 2513  
**Jax Rest Ltd**  
Birmingham, Tel: 021-328 4908  
**Newbear Computing Store Ltd**  
Birmingham B26, Tel: 021-707 7170  
**BUCKINGHAMSHIRE**  
Interface Components Ltd  
Amersham, Tel: 02403 22307  
**CHESHIRE**  
Charlesworth of Crewe Ltd  
Crewe, Tel: 0270 56342  
Cash Register Services  
Chester, Tel: 0244 317549  
Cheshire Computer Services Ltd  
Levenshulme, Tel: 061-491 2290  
Ors Group Ltd  
Warrington, Tel: 0925 67411  
**CLEVELAND**  
Hunting Computer Services Ltd  
Stockton-on-Tees, Tel: 0642 769709

**DERBYSHIRE**  
Chandos Products  
New Mills, Tel: New Mills 44344  
Lowe Electronics Ltd  
Matlock, Tel: 0629 2817  
**DEVON**  
Crystal Electronics Ltd  
Torquay, Tel: 0803 22699  
**PLYMOUTH COMPUTERS**  
Plymouth, Tel: 0752 23042  
**EXETER**  
Peter Scott (Exeter) Ltd  
Exeter, Tel: 0392 73309  
**DORSET**  
South Coast Business M/Cs  
Ferndown, Tel: 0202 893040  
**ESSEX**  
Prorole Ltd  
Westcliff-on-Sea, Tel: 0702 335298  
**GLOUCESTERSHIRE**  
Gloucestershire Shop Equipment Ltd  
Gloucester, Tel: 0452 36012  
**HAMPSHIRE**  
Advanced Business Concepts  
New Milton, Tel: 0425 618181  
**Xitan Systems Ltd**  
Southampton, Tel: 0703 39890  
**KENT**  
Video Services (Bromley) Ltd  
Bromley, Tel: 01-460 8833  
**LANCASHIRE**  
B & B Computers Ltd  
Bolton, Tel: 0202 26644  
H.R. Control Systems Ltd  
Chorley, Tel: 02572 75234  
**Sound Service**  
Burnley, Tel: 0282 38481  
Sumita Electronics Ltd  
Preston, Tel: 0772 51686  
The Micro Chip Shop  
Blackpool, Tel: 0253 403122

**LEICESTERSHIRE**  
Gilbert Computers  
Lubenham, Tel: 0858 65894  
C.W. Cowling Ltd  
Leicester, Tel: 0533 556268  
**Leicester Computer Centre**  
Leicester, Tel: 0533 556268  
Mayes Hi Fi  
Leicestershire, Tel: Leics 22213  
**LINCOLNSHIRE**  
Howes Elect. & Autom. Servs.  
Lincoln, Tel: Lincoln 32379  
Z.R. Business Consultants  
Lincoln, Tel: 0522 680087  
**LONDON**  
Bridgewater Accounting  
Whetstone, Tel: 01-446 0320  
**Butel-Comco Ltd**  
Hendon, Tel: 01-202 0262  
Central Calculators Ltd  
London EC2, Tel: 01-729 5588  
Digital Design & Development  
London W1, Tel: 01-387 7388  
Euro-Calc Ltd  
London WC1, Tel: 01-405 3223  
**Euro-Calc Ltd**  
London EC2, Tel: 01-729 4555  
**Lion Computer Shops Ltd**  
London W1, Tel: 01-636 5560  
Personal Computers Ltd  
London EC2, Tel: 01-626 8121  
Hart House  
London EC2, Tel: 01-729 3035  
**Sumlock Bondain Ltd**  
London EC1, Tel: 01-253 2447  
**Scope Ltd**  
London EC2, Tel: 01-729 3035

**MANCHESTER**  
Sumlock Electronic Services Ltd  
Manchester M3, Tel: 061-834 4233  
**Sumlock Software Ltd**  
Manchester M3,  
Tel: 061-228 3502  
**MERSEYSIDE**  
Microdigital Ltd  
Liverpool, Tel: 051-227 2535  
Sota Communication Systems  
Liverpool L14, Tel: 051-480 5770  
**NORFOLK**  
Sumlock Bondain (East Anglia)  
Norwich, Tel: 0603 26259  
**NORTHAMPTONSHIRE**  
Computer Supermarket  
Corby, Tel: 05366 62571  
**H.B. Computers Ltd**  
Kettering, Northamptonshire,  
Tel: 0536 520910  
**NORTHERN IRELAND**  
Bromac (U.K.)  
Co. Antrim, Tel: 023831 3394  
**O & M Systems**  
Belfast, Tel: 0232 49440  
**The Microcomputer Centre (N.1.)**  
Belfast, Tel: Belfast 682277  
**NOTTINGHAMSHIRE**  
Mansfield Business M/C Ltd  
Mansfield, Tel: 0623 26610  
**OXFORDSHIRE**  
Oxford Computer Centre  
Oxford, Tel: 0865 45172  
or 0865 49349  
**REPUBLIC OF IRELAND**  
O'Connor Computers Ltd  
Galway, Tel: 0009 61173  
Tomorrows World Ltd  
Dublin 2, Tel: 0001 776861

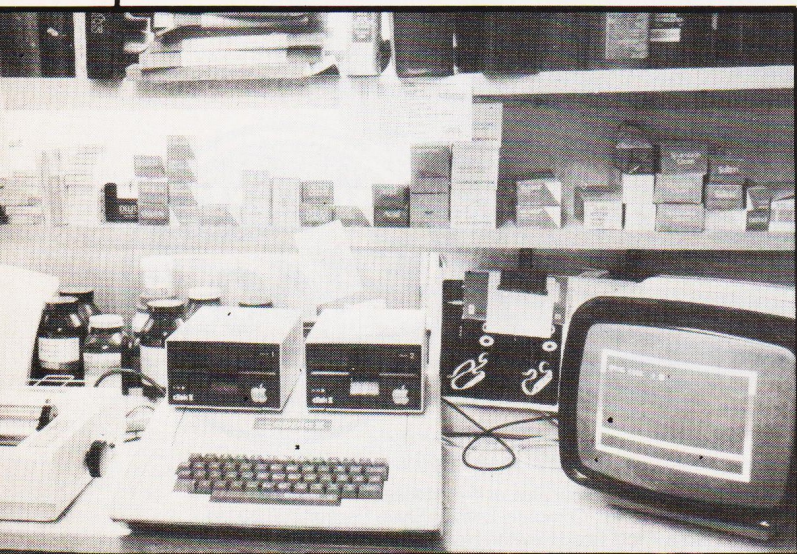
**SALOP**  
Computer Corner  
Shrewsbury, Tel: 0743 59788  
**SCOTLAND**  
A & G Knight  
Aberdeen, Tel: 0224 630526  
**Business and Electronics M/Cs**  
Edinburgh, Tel: 031-226 5454  
**Micro Centre**  
Edinburgh, Tel: 031-556 7354  
**Microforth**  
Dunfermline, Tel: 0383 34954  
**Moray Instruments Ltd**  
Elgin, Tel: 0343 3747  
**Pointer Business Equip Ltd**  
Glasgow, Tel: 041-332 3621  
**Tyseal Computers Ltd**  
Aberdeen, Tel: 0224 573111  
**SOMERSET**  
Norsett Office Supplies Ltd  
Cheddar, Tel: 0934 742184  
**SOUTH HUMBERSIDE**  
Silicon Chip Centre  
Grimsby, Tel: 0472 45353  
**STAFFORDSHIRE**  
W.B. Computer Services  
Cannock, Tel: 0543 75555  
**SUFFOLK**  
C.J.R. Microtek Co. Ltd  
Ipswich, Tel: 0473 50152  
**SURREY**  
R.M.B. Ltd  
Croydon, Tel: 01-684 1134  
Saradan Electronic Services  
Wallington, Tel: 01-669 9483  
T & V Johnson (Microcomputers)  
Camberley, Tel: 0276 20446

**SUSSEX**  
Gamer  
Brighton, Tel: 0273 698424  
**Jax Rest Ltd**  
Brighton, Tel: 0273 687667  
**M & H Office Equipment**  
Brighton, Tel: 0273 697231  
**Oval Automation**  
Worthing, Tel: 0903 501355  
**WALES**  
Limrose Electronics Ltd  
Wrexham, Tel: 097 883 5555  
**Morrison Computer Centre**  
Swansea, Tel: 0792 795817  
**Sigma Systems Ltd**  
Cardiff, Tel: 0222 21515  
**WARWICKSHIRE**  
Business & Leisure Microcomputers  
Kenilworth, Tel: 0926 512127  
**WORCESTERSHIRE**  
Capricorn Computer Systems  
Worcester, Tel: 0905 21541  
**YORKSHIRE**  
Bits & P.C.'s  
Wetherby, Tel: 0937 63744  
**Datron Micro-Centre Ltd**  
Sheffield, Tel: 0742 585490  
**Huddersfield Computer Centre**  
Huddersfield, Tel: 0484 20774  
**Neocos (D.P.) Ltd**  
Darlington, Tel: 0325 69540  
**Superior Systems Ltd**  
Sheffield, Tel: 0742 755005  
**Ram Computer Services Ltd**  
Bradford, Tel: 0274 391166



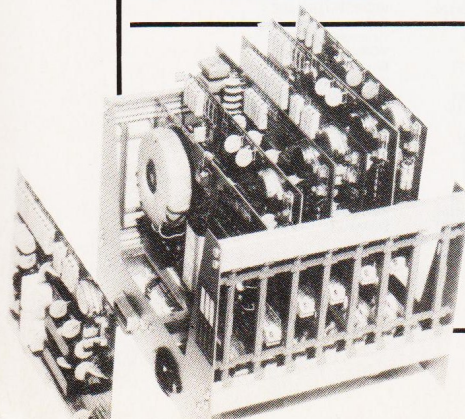
## ADDS ADD ON

The latest version of ADDS/VANTAGE software for the Multivision range of computers has a number of improvements. Still running under CP/M but with a number of additions such as the Target BASIC Interpreter and direct file access the systems software will be implemented in all the current range of commercial applications software. The Multivision range starts at around £5,000 for a basic system, and a four terminal package with 10Mb of disc storage will cost around £12,000. To improve the availability of the system ADDS have appointed Peters Business Systems as their regional distributor for the Sussex area. For general enquiries contact ADDS direct at 137-141 High Street, New Malden, Surrey KT3 4BH or ring them on 01-949 1272.



## PILL POPPERS

Pharmacies seem to be a popular place to install micros. The latest offering for this type of High Street outlet comes from Micro Management of Princes Street, Ipswich, Suffolk. The original software was developed for a local client on an Apple system and cost some £2,500. Facilities include label printout for drug dispensing, inventory of drugs supplied and the facility to check for overstocks — it is estimated that many chemists are some £10,000 overstocked in any given year. If you are interested in this application or any of the others that Micro Management can offer then contact them at the above address.



## EXHIBITIONISM

Hailed as the first computer and business efficiency exhibition to be held in South East Essex, Combex will be running between 10th and 13th September. Although Combex is a Trade Fair invited visitors will be admitted, so drop a line to Ted North at Modern Living, 497 London Road, Westcliff-on-Sea, Essex.

## INDUSTRIALISATION

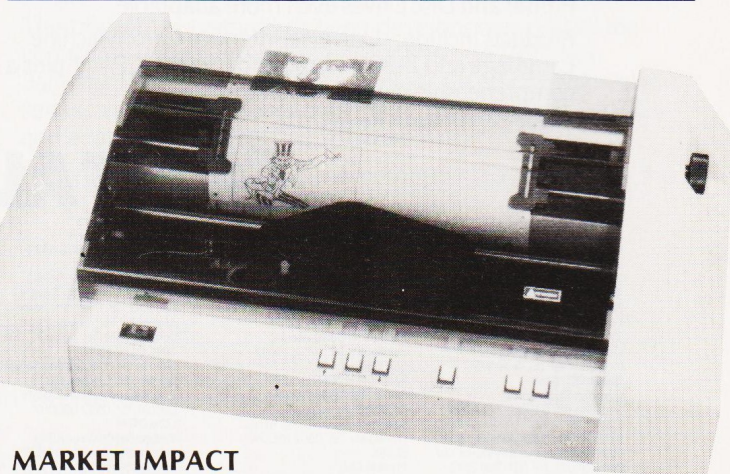
If your production or manufacturing facility needs a micro to look after the boring bits then a new product from Machsize could provide part of the answer. Based on a cardframe with an inbuilt power supply and an IEEE decoder, it can accept up to five plug-in boards such as an A to D, a D to A or a variety of other industrial interfaces. The IEEE bus connects directly to micros like the HP85 or the PET and forms a data highway for information to pass to and from the equipment under control. Price of the basic rack is £350 with the boards extra. For details contact Machsize at York House, Clarendon Avenue, Leamington Spa, Warwickshire CV32 5PP or ring on 0926-312542.

## VISICALC UPGRADE

Another version of the evergreen Visicalc is now available. Compatible with Apple's DOS 3.3, the new package has the version code 1.4 and will cost around £150. Among the new functions supported are Boolean algebra, data interchange, improved reporting and the elimination of that annoying quirk which required you to turn the Apple off before loading another program. Personal Software, the people who produced it, have launched four new programs, Visitrend, Visidex, Visiterm and Visiplot. The names are fairly self-explanatory and prices range between £123 and £210. All the above are available from Personal Computers Ltd, 194-200 Bishopsgate, London EC2M 4NR or you can phone on 01-626 8121.

## LET IT FLOW

As an alternative to tying up your computer's time in formatting text output for the high quality printer you could consider a new British enhancement to the Ricoh 1600 daisywheel printer. The Flowriter, as it is called, is an intelligent printing terminal using two CPUs and an 8K buffer to store down-loaded text. The internal program is capable of responding to both Diablo and Qume commands and interfacing can be through RS232, IEEE-488 or Centronics ports, all of which are supplied. Development of the system was carried out by Small Systems Engineering and Appropriate Technology and further information can be obtained from the latter company at 9 Poland Street, London W1 or give them a ring on 01-437 8954.



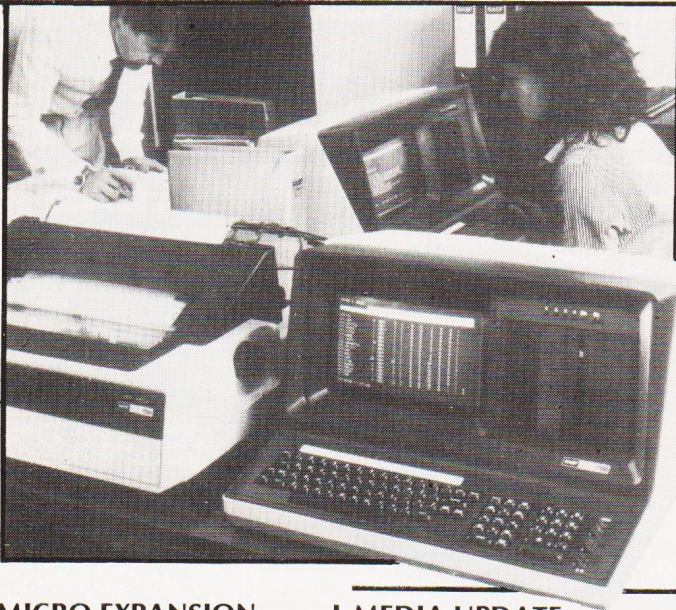
## MARKET IMPACT

Microsense, the soon-to-be 'English Apple', have started to distribute Anadex's range of dot matrix printers. The four models selected for release are the 9000, 9001, 9500 and 9501. Full details of these can be found in our Buyer's Guide at the back of this issue — the prices are £795, £895, £895 and £995 respectively. One rather interesting item of news concerning Apples is that the current 'price war' appears to be making a large dent in the official distributor's share of the market. In-

dications are that some 25% of Apples bought in recent months have been supplied through the cut-price network. If you are in the throes of considering buying an Apple you appear to have two options — pay the full price and get the service, or pay less and take the risk of having to pay extra if the system fails after delivery. For details of the Anadex printers and your local official stockist contact Microsense Computers at Finway Road, Hemel Hempstead, Herts HP2 7PS.



# BUSINESS NEWS



## MICRO EXPANSION

BASF have added another micro-based system to their 7100 series. The new 7130 is specifically for applications where large storage capacity is needed. Fitted with up to 10 Mb of fixed disc storage in addition to twin mini floppies the system can run Extended Business BASIC, COBOL and Assembler as well as a number of supplied utility programs. Further information from Paul Raggett at BASF Computers, 4 Fitzroy Square, London W1P 6ER or ring him on 01-388 4200.

## MEDIA UPDATE

Petalect are now offering a range of diskettes, ribbons and paper for micro-based systems. Verbatim or Nashua branded 5 1/4" discs will set you back £25.50 per 10, paper is £16 per 2,000 sheets and ribbons for the Commodore 4022 printer are £3.45 each. Many other items are available and prices and details can be obtained from Petalect at 33-35 Portugal Road, Woking, Surrey GU21 5JE. You can telephone on Woking 69032 or drop into their showroom at 32 Chertsey Road in Woking.

## APL SEMINAR FOR DP USERS

I P Sharp, the well known APL timesharing consultancy, are running a one-day seminar on September 22nd for DP Consultants who use APL. The idea is to bring them up to date with the latest enhancements in the language and to show these enhancements in operation. If you or your company makes heavy use of APL then contact Molly Donnelly at 132 Buckingham Palace Road, London SW1 or give her a ring on 01-730 0361.

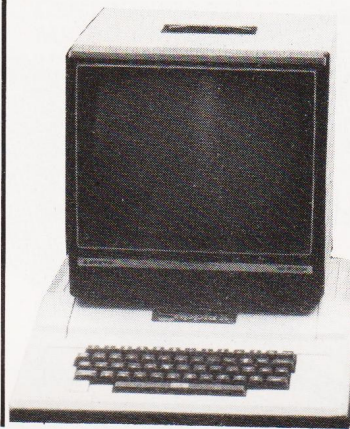
## SWITCH FOR POWER

Dialogue marketing are now stocking a switch-mode power supply especially for Winchester type discs. Designated the Conver AC-160 it can supply 24 V at up to 7 A for the drive and  $\pm 12$  and  $\pm 5$  V for the interface circuitry. All regulations are  $\pm 5\%$  except the +12 V rail which is stabilised to  $\pm 0.5\%$  for use on a CRT. Full technical details from Dialogue Marketing at Unit 11A, Rose Industrial Estate, Bourne End, Bucks or ring on 06285-29222.

## COR STOR?

Keen Computers are now offering the latest Corvus hard disc unit for Apple users. The new 5Mb drives are

compatible with both the Apple II and III and complement the existing 10 and 20Mb versions. Disc backup is possible with the MIRROR video tape system and up to 64 systems can share the same disc using the CONSTELLATION networker. Control is handled by a supplied Z80 based card and up to three other drives of either size may be added. As an added bonus 12 utility programs are supplied with the discs. For pricing and further information contact Keen Computers at Minerva House, Spaniel Row, Nottingham or ring on 0602-412777.



## CAT UPDATE

Inmac have just published their latest catalogue of supplies for mini and microcomputer users. As well as listing all the previous categories they have extended their range by some 50 new items. The theme of the catalogue is 'Protect Your Data' and they show some 20 ways you can guard against data loss. Copies of the catalogue are free and to get yourself on the mailing list drop a line to Dept P10, Inmac UK Ltd, 18 Goddard Road, Astmoor Industrial Estate, Runcorn, Cheshire WA7 1QF. All prices quoted in the catalogue will be maintained until November 1st when the next issue will be published.

## VISUAL OBSERVATIONS

Anderson Jacobson are bringing out a new 15" VDU designated the AJ 520. Ergonomically designed, it features a detachable keyboard, user programmability and 132 column display capacity. Because of the large screen, characters are still 50% larger than usual at 132 column size. The terminal includes a 5K buffer which uses memory management techniques to allow more pages of storage — this can be expanded to 21K. To further enhance the memory capacity a 5 1/4" disc can be attached allowing 204K of off-line storage. The unit is VT-100 and VT-52 compatible and a full technical spec can be obtained from Anderson Jacobson at 752 Deal Avenue, Slough, Berkshire SL1 4SJ.

## SIG NET GOES APL

A low-cost entry point into APL programming is being offered by MicroAPL who are using the Shelton SIG NET computer. Based on a Z80A CPU with 64K of RAM, twin 5 1/4" discs giving 380K of storage and two RS232C serial ports it features MicroAPL running under CP/M 2.2 and a self-teaching package. Adding an APL VDU and printer will still leave you some change from £3,500. To add to the attractiveness of the system they are also selling software packages at £200 and up: buy four and they'll throw in a fifth free. To find out more about this package deal contact MicroAPL at 19 Catherine Place, Victoria, London SW1E 6DX or give them a ring on 01-834 2687.



**inmac**

Computer supplies, accessories and cables — instantly.  
Now more than 50,000 satisfied customers worldwide.

2nd EUROPEAN EDITION  
SUMMER 1981 CATALOGUE

NO! SAME DAY DESPATCH  
Telephone: RUNCORN  
(092 85) 67551  
Fax: (092 85) 67461  
0285 64321

**PROTECT YOUR DATA**

20 proven ways to guard against Data loss, p. 2.

**50 new products inside**

- Just arrived! Double sided, double density mini floppies, pp. 24/25
- New! Cleaning kits for disks and mag tapes, pp. 23 and 27
- At last! A hexadecimal and octal programmer's calculator, p. 3
- Now! A line printer stand for your micro printer, p. 13

**No-nonsense 12 months double guarantee**

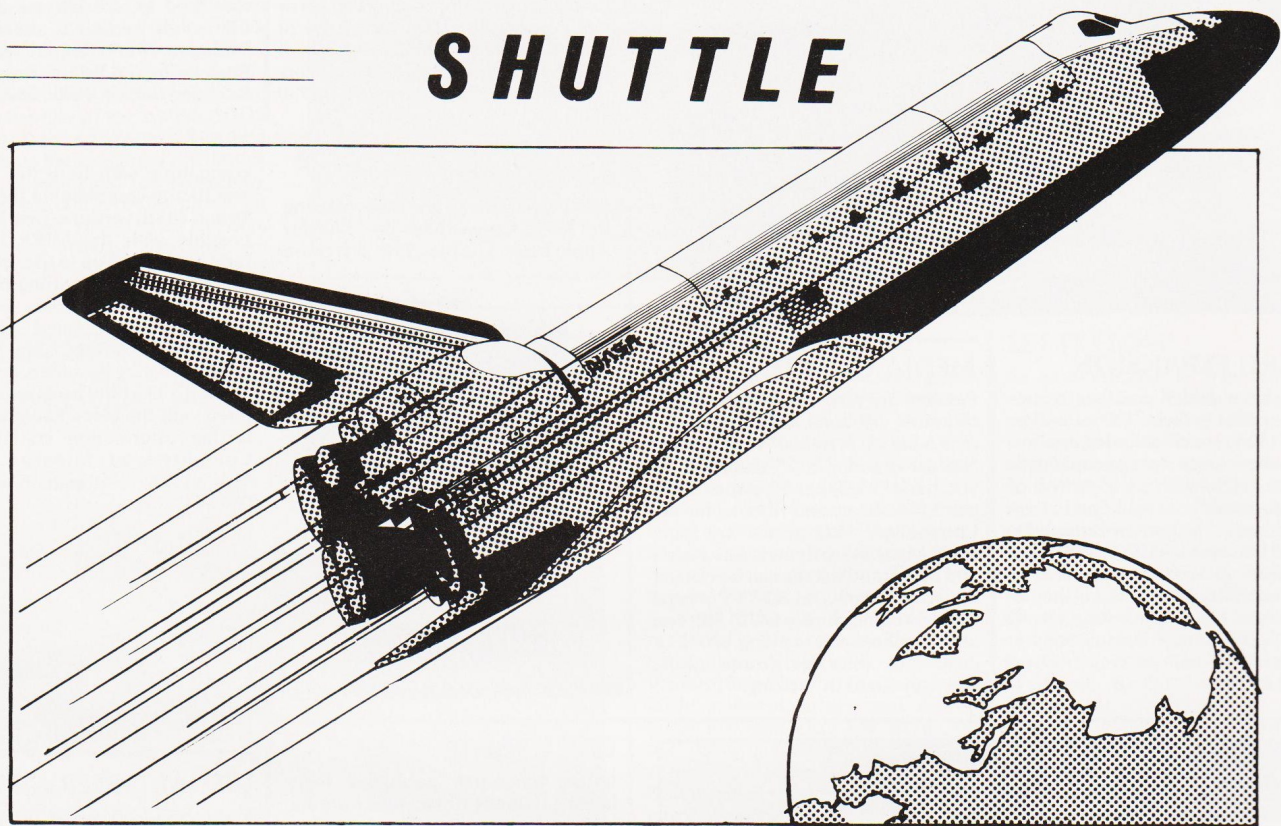
- Quality assured
- Free trial of any product for 30 days



# INNOVATIVE TRS-80 SOFTWARE

## FROM THE PROFESSIONALS

### SHUTTLE



This program is a highly accurate computer simulation of the flight of the Space Shuttle Columbia from the initial countdown through the launch period, the launch itself and into a stable orbit. The craft may be manoeuvred within the orbit and then dropped out to finally fly through the atmosphere to a safe touchdown.

The attraction of this simulation is its authenticity. So far as is possible, it follows the actual parameters of the first Columbia flight with only one or two minor exceptions. The shuttle, of course, starts its flight pointed vertically into the sky and carries a huge fuel tank to provide the fuel for its three main engines in addition to the solid fuel rockets which provide the major thrust to lift it off the ground. Two minutes into the flight the rockets are jettisoned, having burned all their fuel. The count-down for take off starts at T-20 seconds. At T-10 seconds the shuttle motors start firing, but the shuttle remains tethered until T=0. When the shuttle blasts off, the pilot must guide the craft into its orbit by controlling its attitude and track. A number of guidance controls are supplied, together, of course, with control of the shuttle motors' thrust.

The simulation may be started at one of three points in time: either at take off, at a point where the Columbia is in a stable orbit round the earth, or finally, prior to landing. Measurements of speed, fuel and so on may be selected for either Metric or Imperial measurements. All of the physical forces which acted upon the actual flight are taken into account. One departure from fact has been included in that the two solid fuel rockets have had their thrusts increased from 26 to 36 million Newtons so as to give the pilot an increased latitude for error. In other words to make the take off easier.

A fascinating program, the more so because it follows fact so closely. Available for the Model I and Model III TRS 80, Model I and Model II Genie and on tape or disk. The tape version will run in 16K, the disk in 32K.

Tape version.....£14.95      Disk version.....£17.95

Both inclusive of V.A.T. but plus 50p P & P (if ordered alone).

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus 50p postage.



**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

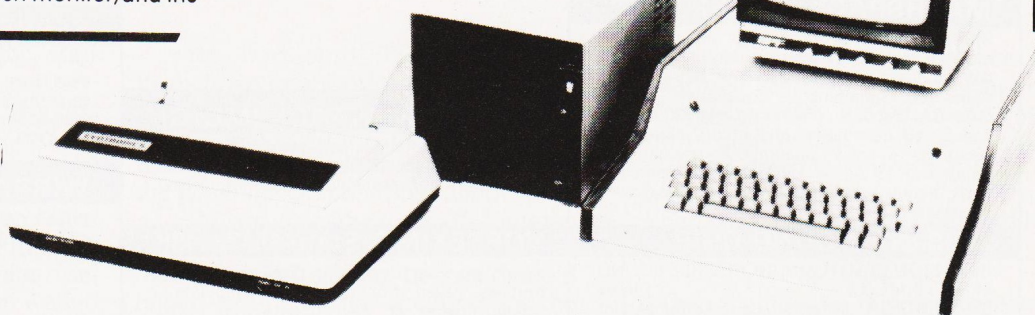




## A NASCOM-2 BASED SYSTEM FOR £1499 + VAT

The proven Nascom-2 microcomputer can now be bought as a complete system from £1499 + VAT. For this price you get the Nascom-2 kit, 16K RAM board kit, Kenilworth case with 2 card frame, Centronics 737 printer, 10 inch monitor, and the

Gemini Dual Drive Floppy Disk System. The CPU and RAM boards are also available built - the additional cost is available on application.



### GEMINI G805 FLOPPY DISK SYSTEM FOR NASCOM-1 & 2

It's here at last. A floppy disk system and CP/M.

**CP/M SYSTEM.** The disk unit comes fully assembled complete with one or two 5 1/4" drives (FD250 double sided, single density) giving 160K per drive, controller card, power supply, interconnects from Nascom-1 or 2 to the FDC card and a second interconnect from the FDC card to two drives. CP/M 1.4 on diskette plus manual, a BIOS EPROM and new N2MD PROM. All in a stylish enclosure.

Nascom-2 Single drive system ..... **£450 + VAT**  
Nascom-2 Double drive system ..... **£640 + VAT**  
Nascom-1 Single drive system ..... **£460 + VAT**  
Nascom-1 Double drive system ..... **£640 + VAT**  
Additional FD250 drives ..... **£205 + VAT**

**D-DOS SYSTEM.** The disk unit is also available without CP/M to enable existing Nas-Sys software to be used. Simple read, write routines are supplied in EPROM. The unit plugs straight into the Nascom P10.

Single drive system ..... **£395 + VAT**  
(please state which Nascom the unit is for)  
Certain parts of the CP/M and D-DOS disk systems are available in kit form.

### KENILWORTH CASE FOR NASCOM-2

The Kenilworth case is a professional case designed specifically for the Nascom-2 and up to four additional 8" x 8" cards. It has hardwood side panels and a plastic coated steel base and cover. A fully cut back panel will accept a fan, UHF and video connectors and up to 8 D-type connectors. The basic case accepts the N2 board, PSU and keyboard. Optional support kits are available for 2 and 5 card expansion.

Kenilworth case ..... **£49.50 + VAT**  
2-card support kit ..... **£7.50 + VAT**  
5-card support kit ..... **£19.50 + VAT**

### NASBUS EPROM BOARD

The Nasbus compatible EPROM board accepts up to 16,2716 or 16,2708 EPROMs. It has a separate socket for the MK36271 8K BASIC ROM for the benefit of Nascom-1 users. And for Nascom-2 users, a wait state for slower EPROMs. The board also supports the Nascom Page Mode Scheme.

EPROM Board (kit) ..... **£55 + VAT**  
EPROM Board (built & tested) ..... **£70 + VAT**

### CASSETTE ENHANCING UNIT

The Castle interface is a built and tested add-on unit which lifts the Nascom-2 into the class of the fully professional computer. It mutes spurious output from cassette recorder switching, adds motor control facilities, automatically switches output between cassette and printer, simplifies 2400 baud cassette operating and provides true RS232C handshake.

Castle Interface Unit ..... **£17.50 + VAT**

### A-D CONVERTER

For really interesting and useful interactions with the 'outside world' the Milham analogue to digital converter is a must. This 8-bit converter is multiplexed between four channels - all software selectable. Sampling rate is 4KHz. Sensitivity is adjustable. Typical applications include temperature measurement, voice analysis, joystick tracking and voltage measurement. It is supplied built and tested with extensive software and easy connection to the Nascom P10.

Milham A-D Converter (built and tested) ..... **£49.50 + VAT**

### PROGRAMMER'S AID

For Nascom ROM BASIC running under Nas-Sys. Supplied in 2 x 2708 EPROMs. Features include: auto line numbering; intelligent renumbering; program appending; line deletion; hexadecimal conversion; recompression of reserved words; auto repeat; and printer handshake routines. When ordering please state whether this is to be used with Nas-Sys 1 or 2. **Price £28 + VAT.**

### DUAL MONITOR BOARD

A piggy-back board that allows N1 users to switch rapidly between two separate operating systems. **Price (kit) £6.50 + VAT.**

NASCOM-2 Microcomputer Kit ..... **£225 + VAT**  
NASCOM-1 Microcomputer Kit ..... **£125 + VAT**  
Built & tested ..... **£140 + VAT**

### CENTRONICS 737 MICRO PRINTER

A high performance, low price, dot-matrix printer that runs at 80cps (proportional) and 50cps (monospaced). This new printer gives text processing quality print. And can print subscripts and superscripts. It has 3-way paper handling and parallel interface as standard. Serial interface is optional. **Price £395 + VAT.** Fanfold paper (2000 series) **£18 + VAT.**

### GEMINI 'SUPERMUM'

12 x 8 piggy-back board for Nascom-1 offering five-slot motherboard, quality 5A power supply and reliable buffering with reset jump facility. **Price £85 + VAT.**

### BITS & PC's PCG

5 x 4 board which plugs straight into Nascom-2. Operates on cell structure of 128 dots, producing 64 different cells. Once defined, each cell may be placed anywhere, any number of times on screen simultaneously. Max screen capacity: 768 cells. Dot resolution: 384 x 256 = 98304. Many other features including intermixing of alpha-numeric characters and pixels. **Price (kit) £60 + VAT.**

### GEMINI 64K RAM BOARD

Newly developed NASBUS board that can accommodate up to 64K of RAM with optional Page Mode facility. **Prices: £90 (16K), £110 (32K), £130 (48K), £150 (64K).** Add VAT to all prices.

### DISC CONTROLLER CARD KIT

Henelec kit for up to three 5 1/4 inch drives. **Price £75.00 + VAT.**

### DISKPEN

The powerful text editor written for the Nascom is now available on a 5 1/4 inch floppy disk with a number of new features. **Price £43.25 + VAT.**

### PORT PROBE

Allows monitoring of input and output of Nascom P10. This board can generate interrupts and simulate handshake control. **Price (kit) £17.50 + VAT.**

### HEX & CONTROL KEYPADS

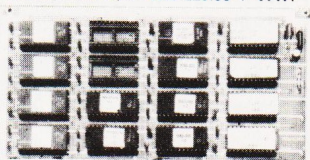
Hexadecimal scratchpad keyboard kit for N1/2. **Price £34 + VAT.**  
As above but including (on the same board) a control keypad kit to add N2 control keys to N1. **Price £40.50 + VAT.**

### BASIC PROGRAMMER'S KIT

Supplied on tape for N1/2 running Nas-Sys and Nascom ROM BASIC. Features include auto line number, full cross-reference listing, delete lines, find, compacting command, plus a comprehensive line re-numbering facility. **Price £13 + VAT.**

### PROM-PROG

2708 (multi-rail) and 2716 (single-rail) EPROM programmer kit controlled by N1/2 P10. Supplied with comprehensive software for use with Nas-Sys. **Price £26.95 + VAT.**



## TANGERINE LONDON STOCKISTS

Microtan 65 kit (now with new TANBUG) ..... **£89.00 + VAT**  
Microtan 65 assembled with new TANBUG ..... **£79.00 + VAT**  
Min. config. Tanex kit, supplied with 1K of RAM ..... **£43.00 + VAT**  
Min. Config. Tanex assembled ..... **£53.00 + VAT**  
Expanded Tanex kit with 7K of RAM ..... **£89.70 + VAT**  
Assembled Tanex with 7K of RAM ..... **£99.70 + VAT**  
Tanram 40K RAM card with 16K of dynamic RAM ..... **£76.00 + VAT**  
High resolution graphics (available Sept.) ..... **£79.00 + VAT**  
Serial I/O card (available Sept.) ..... **from £58.00 + VAT**  
Parallel I/O card (available Sept.) ..... **from £47.50 + VAT**  
ROM card built (Less ROM, available Sept.) ..... **£47.50 + VAT**  
Controller card = Microtan + Tanex - Video ..... **£120.00 + VAT**  
Aim-Kim interface card (available Sept.) ..... **£59.00 + VAT**  
**DISK SYSTEM**  
280 controller card (available Sept.) ..... **£150.00 + VAT**  
Double sided double density drive ..... **£215.00 + VAT**

CP/M disk operating system ..... **£80.00 + VAT**  
Mini key pad for machine code programming ..... **£10.00 + VAT**  
NEW Tangerine 70 key keyboard with numeric pad ..... **£56.34 + VAT**  
Case for Tangerine 70 key keyboard ..... **£20.00 + VAT**  
Mini mother board for Microtan and Tanex ..... **£10.00 + VAT**  
System mother board with 4 sockets, for system rack ..... **£39.00 + VAT**  
System mother board with 12 sockets for system rack ..... **£55.00 + VAT**  
Mini rack with PSU for Microtan and Tanex ..... **£43.00 + VAT**  
System rack for MPS2 and up to 12 cards ..... **£49.00 + VAT**  
Tangerine 10K Microsoft Basic in EPROM ..... **£49.00 + VAT**  
X-BUG tape I/O utilities, assembler and disassembler ..... **£17.34 + VAT**  
Microtan chunky graphics option ..... **£6.52 + VAT**  
Microtan lower case option ..... **£9.47 + VAT**  
Microtan I/O option for Tanex ..... **£15.00 + VAT**  
+/- 12 Volt option for MPS1 ..... **£8.00 + VAT**  
Space Invaders game (for use with keypad only) ..... **£15.22 + VAT**  
MPS1 + 5V 2.5A, with provision for +12V and -12V ..... **£22.95 + VAT**

**SCOOP ONLY**  
**£29.95 + V.A.T.**  
**BRITISH MADE**

\* 52 KEY 7 BIT  
\* ASCII CODED  
\* POSITIVE STROBE  
\* +5V - 12V  
\* FULL ASCII  
\* CHARACTERS  
\* PARALLEL OUTPUT  
\* WITH STROBE  
\* POWER LIGHT ON  
\* CONTROL

## Professional ASCII Keyboards

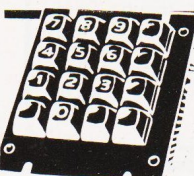
The 'CHERRY' Computer Keyboard



\* CHIP BY GENERAL INSTRUMENT (G.I.)  
\* TTL OUTPUT  
\* SUPERBLY MADE  
\* SIZE 13 x 5 x 1 5 ins  
\* BLACK KEYS WITH WHITE LEDGENS

\* ESCAPE, SHIFT, RETURN & RESET KEYS  
\* CONTROL REPEAT & BELL  
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)



**LIST PRICE £22.00**  
**OUR PRICE £7.95 PLUS VAT**

### '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 in sloped format

Tangerine manuals (all types), refundable when appropriate item purchased CHIPS large range - low prices contact us.

THE TANGERINE MICRON, complete 6502 microcomputer system. 8K of RAM + 10K Basic with all the options assembled with PSU in Mini-rack with fully cased 70 key keyboard. UHF TV output and all tape I/O. Now available ex-stock **£343.47 + VAT** **£395.00 inc.**

**HENRY'S**

**COMPERKIT DIVISION**  
404 Edgware Road, London, W2, England  
Telephone: 01-402 6822  
Telex: 262284 Mono Transonics

Buy it with Access

BARCLAYCARD VISA





# NASCOM 1 & 2

## MATHSPACK (B/32K)

Studying maths at 'O' level or above? These routines will be of interest! Plotting — user defined function, with 'zoom in & out', alter scales etc. Simultaneous Equations — up to order 32. Calculus — function evaluation, 1st, 2nd & 3rd derivatives, integration. Non-linear equations — solves quadratic equations. Factorials (up to 33) — permutations, combinations. Vector Routines — manipulates 3 dimensional vectors. £7.95

## 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

## GALAXIAN ATTACK (MC/G)

Fast M/C space game, featuring diving Galaxian spacecraft. 10 speeds from good to impossible. No barriers for protection. Hi-score display. £8.95

## VORTEX(MC/State 16/32/48K)

Speed up your display of pixel graphics. 29 routines called from BASIC. Manipulate 2 screen images & then update your VDU. Changes appear instantaneous. Extensive examples and instructions supplied. £8.95

## "MICRO-POWER" - Magazine

ISSUE 1 NOW AVAILABLE.  
ISSUE 2 COMING SHORTLY.

WHY NOT ORDER BOTH NOW — only 95p each.

"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 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

## SERPENT (MK/G)

8K of incredible M/C. An interactive game 'par excellence'. Torpedo the moving snake-like sea serpents & the marauding killer whales. 5 levels & special missions with almost infinite skill settings. £5.95

## WIRRAL PILOT V4.0 (MC)

WIDELY USED VERSION of this computer aided learning language. Being adept at matching long strings, it has considerable advantages over BASIC in interactive learning projects. £12.50

## 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.**

**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

## STAR TREK (5K\* + fl.pt.) 8 x 8 galaxy, starbases, torpedoes etc.

£6.95

**SKETCHPAD** (3K\*) Draw in black on white & vice versa. Many options incl. choice of gr. modes & save & recover routines. £6.95

**DAMBUSTERS** (3K\* + 2K gr) Realistic bombing raids, bouncing bombs, ack-ack etc. £4.95

**SPACE STORM** (4K\*) Survive amid the raging comets & space debris. £4.95

# ACORN ATOM

**TERRITORY + AZTEC** (3K\* + 2K graphics) 2 super arcade games. £5.95

**ZOMBIES + DEMOVADERS + LASER FIGHT** (3K\*) 3 excellent games for only £6.95

**MINEFIELD + SNAKE + AWARI** (2K\*) £5.95

**ALIEN MAZE** (5K\* + 2K graphics) Escape the 3D labyrinth before the beast eats you. £5.95

## HISTATS (5K\* + 6K + fl.pt.)

Statistical analysis of up to 255 data items. Calculates mean, variance and standard deviation. Draws histograms to chosen scales. Data manipulation. Cassette input/output. £7.95

## OTHELLO (5K\* + 2K gr.)

Popular board game. 5 levels + problem setting. Take-back a move. Complete 'action-replay' with take-over option. Highly sophisticated version. £5.95

## DEMON DUNGEON (5K\*)

Adventure game. Find the treasure in the depths of the dungeons. Beware the lurking demons whilst making your escape. £6.95

## MUSIC BOX (5K\* + VIA)

Make music with your ATOM. Create tunes or key in old favourites. Seven octaves, full edit facilities. Variable tempo. Excellent entertainment. £8.95

**EXTRA MEMORY** — Low power chips as recommended by Acorn 2 x 2114L — £3.75

WRITTEN ANY PROGRAMS? — WE PAY 20% ROYALTIES!

\*\*\*SPECIAL OFFER — Deduct £1 per cassette when ordering 2 or more.\*\*\*

Please add 55p/order P & P + VAT @ 15%

Send Sae for FULL CATALOGUE.

## PROGRAM POWER

5, Wensley Road,  
Leeds LS7 2LX.  
Tel. (0532) 683186.



# THE TEACHER'S TALE

**We open our new spot for educationalists with a short story that could easily be fact rather than fiction**

Pearson staggered into the staff room and dumped 38 ragged exercise books, and 35 crumbling text books onto the table. The table rocked, despite the copy of "The Programmed Learning Revolution" wedged under one leg, and flipped the ash tray into Miss Witheridge's lap. Disgruntled mutterings issued forth with the No 6 smoke from behind bridge hands, as Pearson waded through the haze to the electric kettle. Coffee at last!

Miss Witheridge watched Pearson discover that the kettle was empty, watched him fill it and discover it wasn't working. "Fuse again", she announced. She watched him cross the room and rattle a drawer before adding, "Fuse drawer's locked. Caretaker's off sick".

Pearson slumped into a chair to begin marking. If he survived 3H1 after break he was on the home run to lunchtime, but not if it was anything like this morning! He ruminated on the high rate of nervous breakdowns amongst teachers...

Pearson had not had one of his better mornings. 3H3 had been in room 12 when he'd arrived after first period. Someone had sent them in as they were blocking the corridor while the rest of the school was trying to swirl its way to period two.

First period he had taken 2L2 in "The Hut". The overhead projector slides which he'd spent the previous evening preparing had been useless. "The Hut" had no power points. (Pearson's usual Wednesday period one room had been commandeered for 5L2s' Anti-smoking film). Room 12 was on the far side of the school, and of course the bell that gave the coup de grace to period one was also the starting pistol for period two. No interlude.

And so it was that Pearson finally arrived at room 12, turned down the volume, banished the make-up, and subdued the soccer crowd, before discovering that someone had wiped out the prerecorded tape he had set up in his own time before Assembly. Pearson's baleful gaze settled on Ellis. "Weren't me sir!" It was, though, but Ellis was a bona fide problem child. No dad. Visited the educational psychologist. There'd been a memo round: disturbed child — no punishments. Ellis was unsinkable.

Pearson tried to write on the whiteboard, but the marker had dried up. No-one knew why one day all the blackboards had gone and the hated whiteboards had appeared. No-one had asked the teachers what they wanted.

He had sent Tracie to Miss Witheridge to borrow a marker and she had come back saying Miss Witheridge's marker had dried up, and did he know where the spare bulb for the projector in the language lab could be found?

He had to occupy the 35 fourteen year olds for the remainder of the 35 minute period as best he could. He'd hoped to update the accounts for the school shop while they had been listening to the tape.

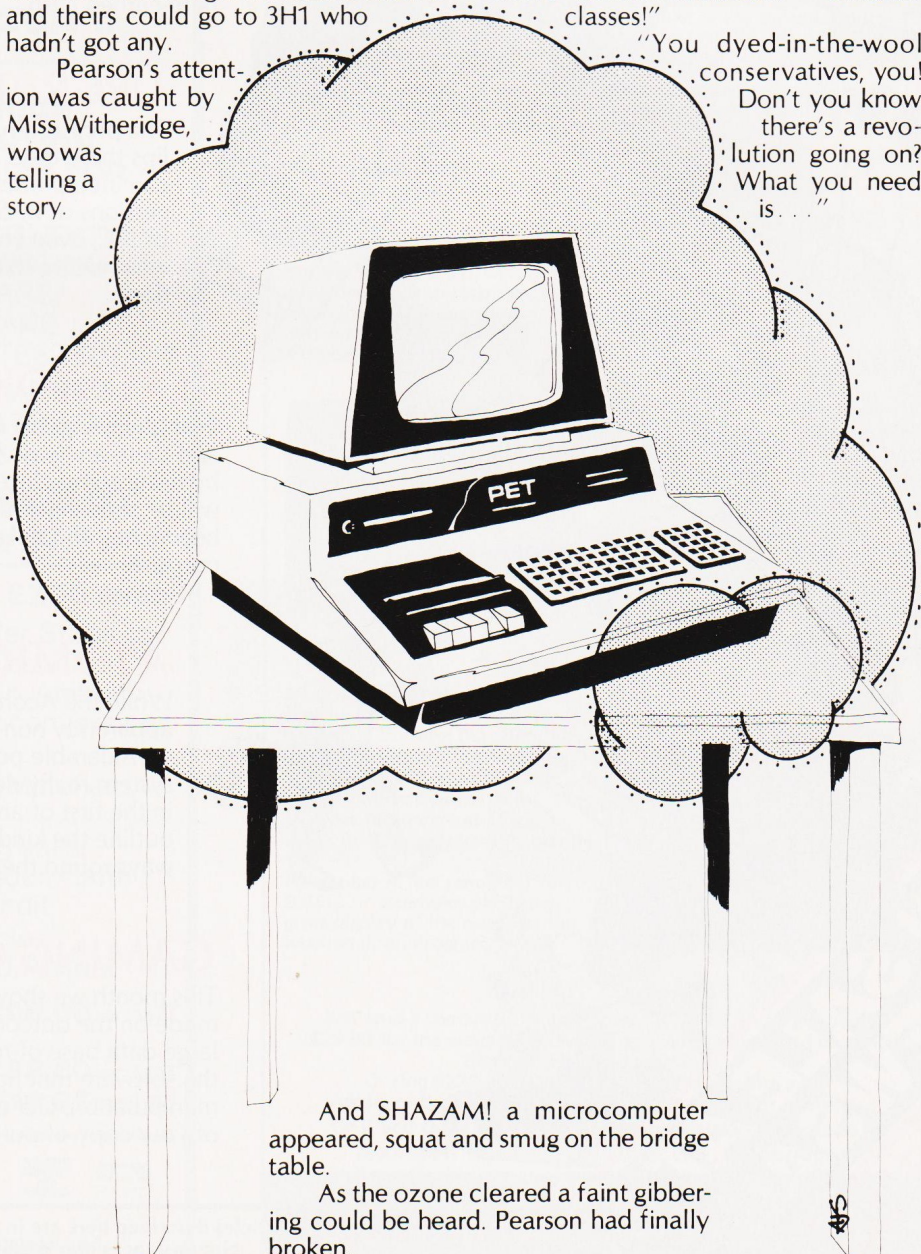
Pearson paused in his marking, and looked at the fustian textbooks on the end of the bridge table. At least if the shop continued to flog sticky buns at the present rate there'd be enough money by the end of term to get new books for 3H3 and theirs could go to 3H1 who hadn't got any.

Pearson's attention was caught by Miss Witheridge, who was telling a story.

"... And over my earphones I could hear one say to the other, it's gone wrong again Kev, we can talk to each other and Witless can't hear us. I shouted down the mike that I damn well could. But they couldn't hear me. I had to charge into the class and rip their earphones off..."

Just then there was a minor detonation and a shower of stardust. An intellectual fellow of well-meaning demeanor stepped forward and announced: "I am your Fairy Techno-Wizard. Ask of me what you wish!" A stunned staff room found its voice again. "More preparation time!" "Decent wages!" "Ancillary helpers!" "More accommodation!" "Smaller classes!"

"You dyed-in-the-wool conservatives, you! Don't you know there's a revolution going on? What you need is..."





# computing today

OCTOBER 1981

ISSN 0142-7210

70p

COMPUTING TODAY • NEXT MONTH



## PLAYING THE SYSTEMS GAME

Choosing a system nowadays is a complex and intricate process where a single mistake can lead to financial disaster. It matters little whether the system you are considering costs £100 or £1,000: the same principles apply. To assist you in your first steps to micro ownership we have compiled a major feature on the pitfalls to avoid and the questions you should ask before parting with that hard-earned cash.

## UPGRADE YOUR BASIC

The phrase 'structured programming' is on everybody's lips these days, but few people seem to realise that they can incorporate the necessary routines into their own versions of BASIC. One particular implementation, Crystal BASIC, even encourages the user to enhance it and, using information that is readily available, we show you how it's done.

## TEXT STORAGE PROBLEMS

Text always seems to take up a large amount of memory, and there are ways to substantially reduce this overhead by using some clever routines. In next month's issue we will be showing you how to reduce your memory headaches and developing a set of routines for just this purpose.

## ATOMIC TECHNIQUES

While the Acorn ATOM has been criticised for its apparently non-standard version of BASIC it does have considerable potential. Getting the most out of your system really depends on using the right techniques and, in the first of an occasional series on small systems, we outline the kind of problems you may encounter and the ways round them.

## GAMING GAINS

This month we showed you how predictions could be made on the outcome of football matches by using a large data base of recent results. Next month we present the software that handles all the data base generation and manipulation. Get onto a winning streak by making sure of your copy of our October issue!

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

ON SALE AT YOUR  
NEWSAGENT  
FRIDAY  
SEPTEMBER  
11th

MONTH • COMPUTING TODAY • NEXT MONTH

COMPUTING TODAY • NEXT MONTH



# BITS & P.C.S.

COMPUTER PRODUCTS LTD

The North's Leading Computer Specialist —  
Service & Advice  
our Speciality

Full range of EPSON PRINTERS at  
Competitive prices.

Free Interfacing details & Software

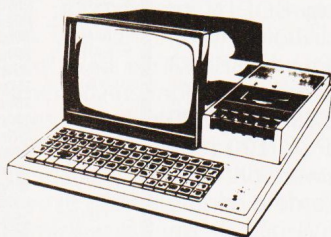
**\*\*NEW FOR NASCOM 1\*\***  
**THE Mk11 BITS & P.C.S. GRAPHICS**  
**SYSTEM GIVES NASCOM 2**  
**GRAPHICS ON A NASCOM 1.**



Quantum Micros

**HIGH  
RESOLUTION  
GRAPHICS FOR  
MZ80K**

FULLY COMPATIBLE  
WITH EXISTING  
SOFTWARE/  
HARDWARE  
BUILT & TESTED UNIT.



COMPLETE WITH DEMO SOFTWARE &  
EDITOR. RESOLUTION DOWN TO 1 DOT  
LARGE SAE FOR FULL DETAILS



**MZ80K ONLY £529.00**  
**INCLUDING V.A.T.**



**Software for MZ80K £7.00 each**

- GAMES (1)** Star Trek, Spacefighter, Stock car,  
Labyrinth, Reverse, Test.
- GAMES (2)** Electric organ, Othello, Ambush,  
Fox & hounds, Metric conversions,  
Hangman, Shuffle.
- GAMES (3)** Ten pin, War, Swamp, Minefield,  
Biorythm, Scramble.
- GAMES (4)** Paper stone, Jumping balls,  
Bounce, Race, Calendar, Alarm  
clock, One armed bandit.
- GAMES (5)** Poker, Stamp, Obstacle,  
Battleships, Surround, Animal.

**PC1211 POCKET COMPUTER £96.00 inc VAT**

**PC1211 POCKET COMPUTER**

**PRINTER**

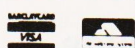
**£88.00 inc VAT**

**PC1211 CASS INTERFACE**

**£16.95 inc VAT**

BITS & P.C.s Computer Products Ltd.  
4 Westgate, Wetherby, West Yorkshire.  
LS22 4LL Tel: 0937 63744.

SAE for details: prices include VAT and postage and  
package.



## Attention Atom Owners become **WORD PERFECT** WITH THE NEW ATOM WORD PACK

The ATOM WORD PACK is a combined text editor and word processor ROM for the Acorn ATOM. It needs 1K test memory and 6K of graphics memory.

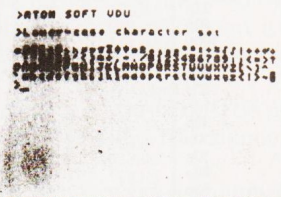
The ATOM Word Pack is ideal for the preparation of leaflets, letters, booklets, and documents. Text can be edited, saved on cassette or disk, and printed out in any desired format. BASIC programs and data created by programs can also be edited. The Word Pack is a 4K ROM which simply plugs into the ATOM's utility ROM socket and adds EDIT and TEXT to the command set. Complete with a 16 page booklet giving full instructions and examples. Just £29.90 including post, packing and insurance.

The ATOM word pack is ideal for the preparation of leaflets, letters, booklets and documents. Text can be edited, saved on cassette or disk and then printed out in any desired format. BASIC programs and data created by programs can also be edited. The Word Pack is a 4K ROM which simply plugs into the ATOM's utility ROM socket and adds EDIT and TEXT to the command set. Complete with a 16 page booklet giving full instructions and examples. Just £29.90 including post, packing and insurance.

### Also Available:

#### SOFT VDU

The soft VDU replaces the normal ATOM VDU, but provides 128 characters including upper and lower-case letters, and mathematical symbols. Program 1.5K, graphics 6K.



#### MATHS PACK 1

**Plot** A versatile graph-plotting package for research, accounting, schools and mathematics, or simply for amusement. Program 5K, graphics 6K.

**Simultaneous** Solves a set of simultaneous equations, with integer or real coefficients. Program 2K, graphics ½K.

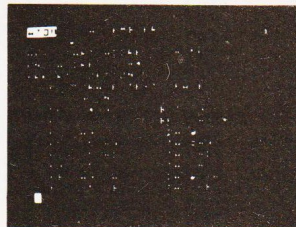
**Regression** Calculates the best-fitting straight line to a specified set of data points, gives the equation and the correlation coefficient. Program 2K, graphics ½K.

#### UTILITY PACK 1

**Disassembler** Lists machine code in standard ATOM assembler form, or stores the assembler text into memory. Graphics 2K.

**Fast Cos** Modifies the ATOM's standard cassette-interface routines to operate at 1200 baud, or 4 times faster. Program 1K.

**Renumber** A fast renumber for BASIC or assembler programs, gives display of the numbers for labelled lines. Program 1K.



### ORDER TODAY!

Just send a cheque or money order for only £11.50 per pack (£29.90 for the word pack) including VAT and post and packing. State which packs you want.

Or ring 0223 316039 or 01-930 1614 quoting your Access or Barclaycard number. Allow 14 days for delivery.

Or if you think you can wait for more details just write to  
Acornsoft Limited, 4a Market Hill, Cambridge

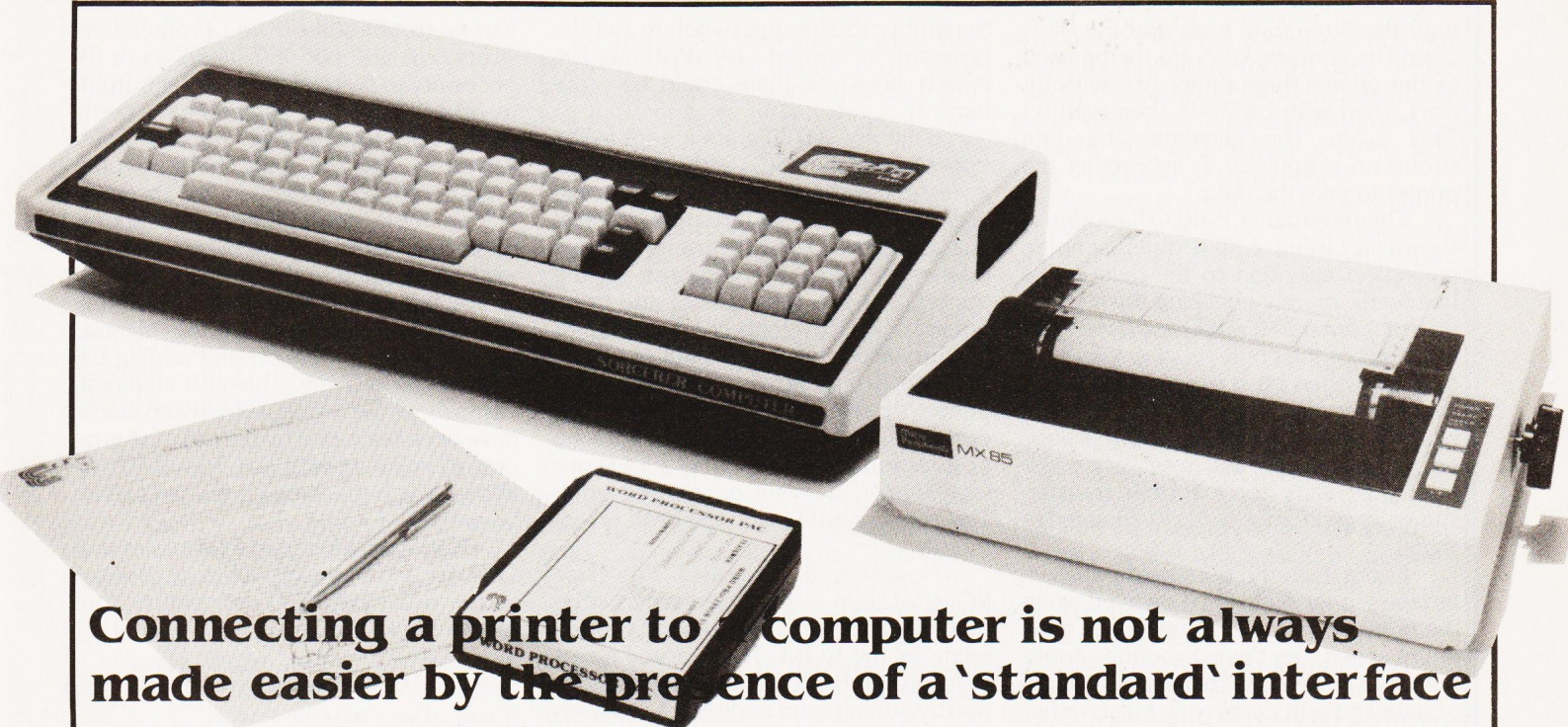
**ACORN**SOFT







# GETTING INTO PRINT



## Connecting a printer to a computer is not always made easier by the presence of a 'standard' interface

**Y**ou have a computer. You buy a printer and plug it in. Switch on, and you can print what you like. True or false? Well, we shall say the statement is rather oversimplified. The following notes, although they deal specifically with the combination of a Sorcerer computer and an Epson MX80 printer, should serve to draw attention to the sort of problems that are likely to arise.

First, there is the little matter of choosing a printer from the wide range of available makes and types. Compromise is necessary here. Silence of operation must be balanced against durability of printout to the lower half of the full is more noisy the results are less likely to fade or discolour with the passing of time. Cost must be balanced against print quality. If you can afford a daisy-wheel machine you will get more professional-looking results, but some matrix printers can produce an adequate type-face for most purposes. There is also the question of interface compatibility between printer and computer to be taken into account. In some cases, there may be a significant increase in cost involved in matching up interfaces which are almost, but not quite, compatible.

### Industry Standards

The printer interface most commonly quoted is the 'Centronics', but it has variations. The Sorcerer provides a 'Centronics' interface which handles only seven data bits, the eighth being used as a strobe. Using this interface would limit printout to the lower half of the full ASCII code range. Fortunately, there is an alternative interface, covering eight data bits. Both interfaces use the same

connector, but the driving routines are different.

Listing 1 shows the routine for the 'Centronics' interface. The Video routine is first called to put the character defined by the A register contents on to the screen. Now, the Video routine responds to CHR\$(13), carriage return, by setting the cursor column counter to 0, but it does not move to the next line. CHR\$(10), line feed, is therefore generated after carriage return, and this moves the cursor down a line and, if necessary, calls the scrolling routine.

A printer usually has no need for the

line feed, the line advance being automatic, and the 'Centronics' routine therefore suppresses the line feed by the jump to BB2. If the suppression is not wanted, it can be avoided by entering the routine at E99B. Entry must be by a jump from a subroutine, and AF must be pushed just before the jump to balance the pop at E9AF.

The rest of the routine is mainly concerned with port 255 (FF), which handles parallel data transactions. Input bit 7 is checked, this being connected to the Busy line from the printer. If the printer is busy, bit 7 is true, and the routine loops

E993 F5		PUSH AF	
E994 CD 1B E0		CALL E01B	VIDEO
E997 FE 0A		CP,10	Line Feed?
E999 28 14		JR Z,+22	BB2
E99B F5		PUSH AF	
E99C DB FF	BB1	IN A,(255)	Check Busy
E99E CB 7F		BIT A,7	
E9A0 20 FA		JR NZ,-4	BB1
E9A2 F1		POP AF	
E9A3 F6 80		OR 128	Insert bit 7
E9A5 D3 FF		OUT (255),A	
E9A7 E6 7F		AND 127	Zero bit 7
E9A9 D3 FF		OUT (255),A	
E9AB F6 80		OR 128	Insert bit 7
E9AD D3 FF		OUT (255),A	
E9AF F1	BB2	POP AF	
E9B0 C9		RETURN	

Listing 1 Centronics Routine

E77F F5		PUSH AF	
E780 DB FE	AW1	IN A, (254)	Check busy state
E782 CB 77		BIT A,6	
E784 28 FA		JR Z,-4	AW1
E786 F1		POP AF	
E787 D3 FF		OUT (255),A	
E789 C9		RETURN	

Listing 2 PARLOT Routine



until the Busy state ends and the bit is zero. The contents of A are then passed to the printer three times, first with bit 7=1, then with bit 7=0, then with bit 7=1 again. This generates the data strobe on output bit 7, instructing the printer to take the data.

The alternative PARLOT routine is shown in Listing 2. It is much simpler, paying no attention to the deletion of line feeds, merely checking the state of bit 6 of input port 254 (FE) and passing all eight bits of the contents of A to output port 255 when bit 6 is zero. The handshake control is effected by a bistable which is set whenever an output is passed to the printer, and reset when the printer is ready for a further transfer, shown by generation of the Acknowledge signal.

In practice, the output of either interface is only likely to be delayed while the printer is actually printing. For maximum speed, the driving routine should therefore be arranged to assemble a line of data and output it in one burst, rather than sending it to the printer in dribs and drabs. For example, in a disassembler program originally written for output to the VDU, the various elements forming an output line were passed to the screen as they were generated. With the printer in use as an output device, it was found better to assemble the line by statements of the form  $A\$ = A\$ + B\$$ , finally putting out the whole line by `PRINT A$`.

There is no need to opt definitely for either of the two possible interfaces. The connection diagram in Fig.1 shows how a DPCO switch can be included in the connection cable, preferably in a small box, to allow selection of either interface. The only disadvantage of this is the need to

remember to alter the switch to suit the program in current use. Without the switch, however, there could be problems.

Since the MX80 graphics are in the upper half of the ASCII table, they are inaccessible with the seven-bit interface in use. So are the alternative control characters, which may be useful to avoid clashes between the response of the printer and the response of the computer. `CHR$(15)` selects condensed print on the MX80, but is a disable code in Sorcerer BASIC, and is also output as a printer disable code by the Word Processor ROMPAC. It may therefore be convenient to use `CHR$(143) = Graphics/W` to select condensed print. This is only possible with the PARLOT interface.

However, if the word Processor ROMPAC is in use, the Centronics interface is mandatory, the relevant routine being in the ROM. There are ways of bringing the PARLOT interface into action by adding extra code in RAM, which must be entered after a cold start, but these need a comprehensive knowledge of the Word Processor routines which would be too complex to explain here.

### Solving The BASIC Problem

A similar problem arises with Exidy Extended Cassette BASIC, but that is loaded from tape into RAM, so a simpler solution is possible. The original and revised routines are;

#### Original

```
1FBE B7      OR A
1FBF F2 C4 1F JP P,1FC4
1FC2 3E 3F   LD A,63
1FC4 F5      PUSH AF
1FC5 C3 97 E9 JP U,E997
```

#### Revised

```
1FBE B7      OR A
1FBF F2 C4 1F JP P,1FC4
1FC2 00 00   NOP
1FC4 F5      PUSH AF
1FC5 C3 80 E7 JP U,E780
```

The original routine inserts '?' when the contents of A relate to a code in the upper half of the ASCII range. The jump has been left in place to allow a modifying instruction to be inserted in place of the two NOPs. For example, `C6 20` adds 32 to the ASCII value, moving the lower half of the Sorcerer Graphics range up to match the MX80 graphics area. The Extended BASIC covers `LLIST`, `LPRINT` and `LPRINT USING`, all providing direct output to the printer, so it would be a pity to suffer a limitation to the available range of print codes.

Quite apart from these special cases, the introduction of the printing function into ordinary BASIC programs

can be troublesome. The L-prefaced instructions are not available, so it is necessary to switch to the printer output by other means. The Sorcerer has a common `SEND` routine used for all output functions, and this calls the particular output function indicated by an entry link set in the Monitor RAM, at locations 63 and 64. The position of these locations varies according to the amount of RAM in use, but can be found by subtracting 110 from the address of the highest available RAM location and adding 63 and 64 respectively. This also covers a case where the Monitor RAM and stack have been relocated by the user, the process defining an artificial 'top of RAM' above which machine codes can safely be entered.

Noting that location 63 contains the low byte and 64 the high byte, according to the usual 8080/Z80 convention, the relevant links are;

	Indirect	Direct
VIDEO	E01B	E9F0
PARLOT	E021	E7FF
CENTRONICS	—	E993

The indirect links are in a switch area at the start of the Monitor program, and are unconditional jumps to the direct links. It should be noted that only the normal routine starts are accessible by these links.

During cold start, the link E9F0 is set. Other links can be set by use of the Monitor `SET O=` command, but these are all indirect links, except in the case of CENTRONICS, which only has a direct link. Now, it is more convenient to be able to set new links without visiting the Monitor, and it has been suggested that this can be done by `POKE`ing into the link locations directly. It can, but extreme care is needed. For example, suppose the link is E9F0, and an attempt is made to set it to E021. Location 63 is set to 21 by the first `POKE`, and the link is now E921. This is a location in the Test routine, and before the second `POKE` can take effect the test routine goes into action. It is therefore only possible to switch between E993 and E9F0, or between E01B and E021, one byte of the link being changed. Life is sometimes so complicated!

A safer and more flexible method of switching the links is to use a small machine code subroutine, to which a selection code is passed. A useful machine code routine is;

```
0000 3A C2 01 LD A,(01C2)
0003 CD 9F D6 CALL D69F *BF for 48K
0006 21 0B 00 LD HL,000B 7F for 32K
0009 19 ADD HL,DE 3F for 16K
000A E9 JU(HL)
```

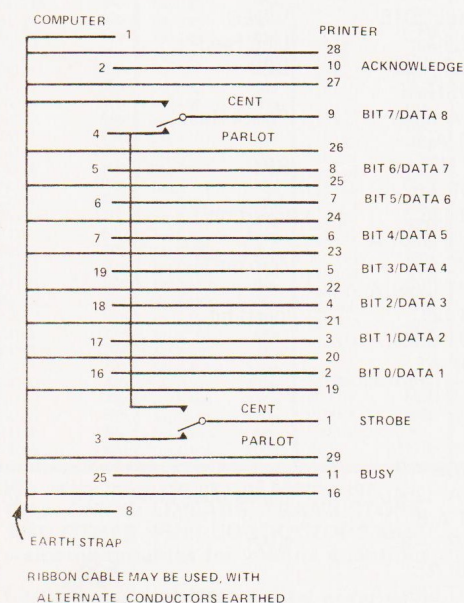


Fig. 1 The connection diagram for the printer/computer interface.



000B 21 1B E0 LD HL,E01B (Video Link)  
 000E 22 D0 \* LD (\* D0),HL  
 0011 C9 RETURN  
 0012 21 21 E0 LD HL,E021 (Parlot Link)  
 0015 18 F7 JR U - 7  
 0017 21 93 E9 LD HL,E993 (Centronics)  
 001A 18 F2 JR U - 12 Link)

And then, in BASIC

POKE 260,0:POKE 261,0

To call Video, Z=USR(0)

To call Parlot, Z=USR(7)

To call Centronics, Z=USR(12)

The D69F routine puts the integer value of the bracketed number in DE: this is added to HL to determine which of the three dependent routines is entered, and therefore which link is set.

### Using The System

Having made up the connection cable and decided on the routines to be used, it will be possible for you to produce hard copy — of a kind. You may have no objection to the LIST and READY prompts topping and tailing your listings, but in other cases you will want to separate the real text from such intru-

sions. This rather depends on what you want to do with your printer. If you use a word processor or Extended BASIC, you will have little to worry about. If you want to work in machine code or Standard BASIC, you may have further problems.

One of the more useful capabilities of the MX80 is the control of the printer by select and deselect, though the description in the User's Manual has more than a touch of Oriental subtlety. To use this facility, the SLCT IN input to the printer must be high, so DIP switch 1/8 must be off. Code DC1 (CHR\$(17)) will then enable the printer, and Code DC3 (CHR\$(19)) will disable it. (These happen to be the Cursor Home and Cursor Right codes for the Sorcerer, so they need to be generated in the CHR\$ form.) The important point is that the printer, when disabled, will still accept and acknowledge data — it has to, in order to detect the enable code — so the handshake is not blocked, as it is when the printer is switched off line.

Once this stage of 'working up' has been reached, progress should become reasonably smooth, but there can still be surprises. Repeated form feeds were traced to a horizontal graphics character

which had the same code — CHR\$(140) — as the upper Form Feed code of the MX80. The rather fiendish hooter which is the MX80 equivalent of a bell was also brought into action by a graphic, this time CHR\$(135), a vertical line.

Users of the Sorcerer Toolkit should be aware that it is not compatible with printed output, as it uses its own output routine and insists on talking to the screen. If there is a way round this, it would be nice to know.

Sadly, there is no way to make the basic MX80 reproduce the delicate Sorcerer graphics, which have 64 defined points per character. The MX80 TRS-type graphics have 6 pixels per character, and that is a wide gulf. There is hope that the problem can be solved by the use of a 'frame grabber', which takes a screenful of information at a gulp, and can re-issue it at a more sober pace, but until we have one it would be rash to comment.

The warnings and complexities of the above could be taken to mean that the Sorcerer and the MX80 form an uneasy combination. Not so. The reverse is true. The flexibility of both devices is rather above average, and that means that a little more care can, and must, be taken to get the best results.

# FINDING IT HARD TO GET?

Have you had a struggle to find this issue?  
 If the answer is 'Yes' then we are not surprised.

Demand for Computing Today has rocketed by 39% over the last six months and, despite all the extra copies we print, shops are still selling out. There is a way, however, to ensure that you always get your monthly copy of the magazine, take out a subscription. For £11.25 a year we will send you a personal copy of the magazine each month, delivered to your doorstep. No more staggering round the newsstands and looking for the last copy in town. You can even spread the cost of subscribing by using your Access or Barclaycard, just fill in the number and sign the form before sending it back. Do not send your card!

To obtain your year's supply of Computing Today send this coupon together with a cheque or postal order for £11.25 to: Computing Today Subscriptions Department, 513 London Road, Thornton Heath, Surrey CR4 6AR

I enclose a cheque/postal order for £.....  
 to cover one year's subscription to Computing Today.

NAME.....

ADDRESS.....

SIGNATURE.....

NO.....

CT7





# FASTER, FASTER, FASTER!

One way you can get your PET programs to run faster is to use machine code — in which case you'll need a good assembler, like our MIKRO ASSEMBLER. In just one 4K chip we've packed a very powerful assembler/editor — and because MIKRO source code is written as Basic lines it's an easy way to start. £50 plus VAT.

Writing in machine code can be tedious — and if you only want to improve the speed of your program by 50% or so it isn't necessary. Instead why not consider our new FASTER BASIC chip which can speed up existing Basic programs by 50-100%, sometimes more. And at just £30 plus VAT it won't break the bank!

Of course, if you don't have a disk unit much of your time is wasted waiting for programs to load and save. We've got an answer for that one, too. ARROW is a chip that enables the standard Commodore cassette deck to load and save at 6 to 7 times its normal speed! ARROW also supports VERIFY and APPEND, whilst for extra measure you get a repeat key, a plot command and a 'hex-decimal calculator'.

**Arron** costs — £30 plus V.A.T.

Each of these chips is available to fit any of the vacant ROM sockets in a 40 or 80 column PET. If you're short of socket space we can combine any two 2K chips that we sell (other than Toolkit) in a 4K EPROM (i.e. FASTER BASIC, ARROW, SUPERCHIP, PICCHIP).

WRITE NOW FOR OUR SUMMER CATALOGUE — IT'S ABSOLUTELY FREE TO PET OWNERS

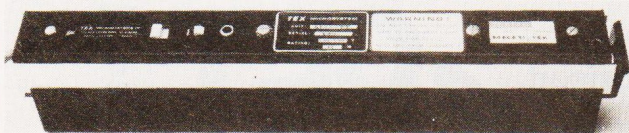
## SUPERSOFT

Details now available on our Hi-Resolution Board at £149 + V.A.T.

First floor, 10-14 Canning Road,  
Wealdstone, Harrow, Middlesex  
Phone: 01-861 1166.

### ★ 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

### Quality support for; **ATOM** **ZX80** **ZX81**

#### **ZX80 ACTION !** **2 games for £4!!**

Flicker-free action games for your ZX80.  
Only 1K RAM needed, and the original (4K) ROM.  
Hours of fun.

Cassette C80A: **BRKOUT** ----- **ACK-ACK** £4.00

Cassette C80B: **SHELL GAME** ---- **INVADERS** £4.00

#### **The ZX80 Magic Book**

\*NOW WITH 8K ROM / ZX81 SUPPLEMENT\*. Games programs, computer music, converting programs written in other BASICs RAM and I/O circuits, and much more. £4.75

#### **Getting Acquainted with your ZX81**

A Tim Hartnell masterpiece. £4.95  
23 + 23 WAY ZX80/81 EDGE CONNECTOR SOCKET £3.50

#### **ATOM CASSETTES; £5 each**

CAAA: **BREAKOUT + CUPBALL + 3D MAZE + SIMON 2**  
CAAB: **PINBALL + LETTERS + SPACEWAR + DRIVE**  
CAAC: **HAMMURABI + OTHELLO + SCRAMBLE + HEXPAWN**

#### **The ATOM Magic Book** \*RECOMMENDED BY ACORN\*

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

#### **32K Byte ATOM RAM Board** £125.00

Single Eurocard; fits inside ATOM's case. Built and tested. Complete with connectors and buffer IC's. Also suitable for other 1MHz 6502 / 6800 computers.

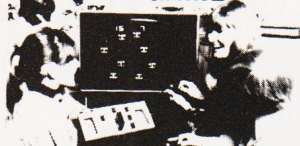
All prices include U.K. P&P & VAT where applicable.

**TIMEDATA Ltd. 57 Swallowdale, Basildon, Essex**



# 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  
MATTTEL TELENG ROWTRON  
DATABASE INTERTON

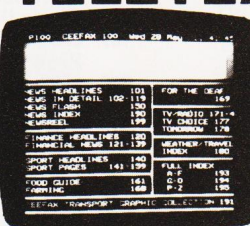
## CHESS COMPUTERS



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

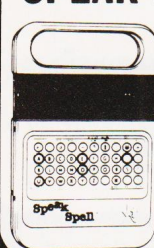
THE RADOFIN TELETEXT ADD-ON ADAPTOR

Plug the adaptor into the aerial socket of your colour T.V. 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 aid. 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 1/4" x 4 1/8" x 2 1/8"  
(Mains adaptor extra)

## 24 TUNE ELECTRONIC DOOR BELL

Normal Price £19.70  
**NOW REDUCED TO: £12.70**  
inc VAT

Plays 24 different tunes with a separate speed control and volume control. Select the most appropriate tune for your visitor, with appropriate tunes for different times of the year!

## MATTTEL T.V. GAME



The most advanced T.V. game in the world. 20 cartridges available. Add on KEYBOARD coming soon to convert the MATTTEL to a home computer with 16K RAM fully expandable and programmable in Microsoft Basic. Other accessories will be available later in the year.  
**£199.95**  
inc VAT

## 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

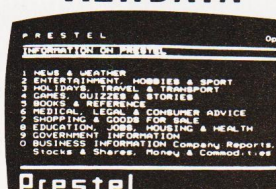
## THE OLYMPIA — POST OFFICE APPROVED TELEPHONE ANSWERING MACHINE WITH REMOTE CALL-IN BLEEPER

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 connectors 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" x 2 1/8" 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

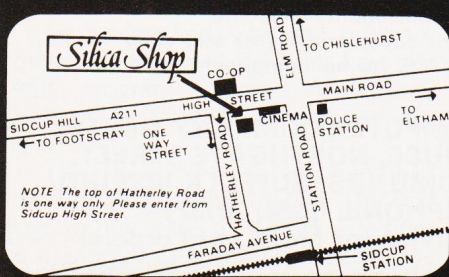


The ACE TELCOM VDX1000 Prestel Viewdata adaptor simply plugs into the aerial socket of your television and enables you to receive the Prestel Viewdata service in colour or black & white.

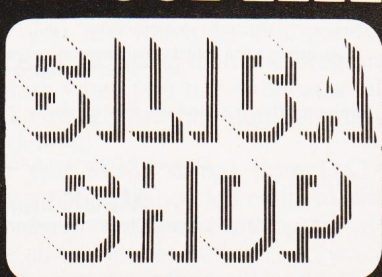
**Features —**  
Simplified controls for quick, easy operation.  
Special graphics feature for high resolution.  
State of the art microprocessor controller.  
Standard remote telephone keypad with Prestel keys '1' to '9'.  
Auto dialler incorporated for easy Prestel acquisition.  
True PAL colour encoder 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.  
• CALLERS WELCOME — Demonstrations daily at our Sidcup shop, open from 9am-6pm.  
• Monday-Saturday, Early Closing Thursday 1pm — Late Opening Friday 8pm.  
• 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 — Available on all machines out of guarantee.  
• COMPETITIVE PRICES — We are never knowingly undersold.  
• 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/9





NASCOM now added to our range of:-

## TANGERINE PRODUCTS INCLUDING TANTEL

# Video Genie £322 including V.A.T.

## TUSCAN IN KIT OR ASSEMBLED FROM £299.00 + V.A.T.

**PRINTERS:** EPSON MX70 and MX80 RANGE from £259.00 + V.A.T.

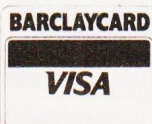
PRINTED PAPER: £1.50 per hundred sheets incl. postage

Branded Cassette tapes — MP12 — £5.20 per 10 incl. postage.

*372	Atari BASIC	5.30
289	BASIC Comp Progs for the Home	6.50
287	S-100 Bus Handbook	9.15
261	TRS-80 Disk & Other Mysteries	12.95
65	BASIC Computer Games	5.50
335	Microsoft BASIC Decoded	16.75
161	More BASIC Games	5.50
354	50 Rip Roaring Games For Sinclair ZX-80/81	4.95
*385	Getting Acquainted with your ZX-81	4.95
*387	Laymans Guide to Microprocessors	7.95
388	Acorn Atom Magic Book	5.50
390	Making the Most of your ZX-80	6.95

392	Pet Graphics	12.00
155	6502 Applications Book	9.10
258	6502 Games	9.10
342	The Pascal Handbook	10.05
334	50 BASIC Exercises	9.10
60	Programming the 6502	9.10
200	Programming the Z-80	10.05
45	Advanced BASIC	6.85
365	Apple II Users Guide	11.50
187	6502 Assembly Lang. Prog.	13.50
256	6502 Gourmet Guide/Cookbook	7.75
215	6502 Software Design	7.95
306	TRS-80 BASIC Self Teaching Gde	5.95
159	Z-80 Assembly Lang. Prog.	13.50
40	Basic BASIC	6.75
344	CP/M Primer	8.45
205	Software Tools	8.20

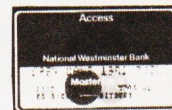
*371	8080/Z80 Assembly Language	6.75
203	Best of Micro Vol. 1	5.50
204	Best of Micro Vol. 2	6.50
317	Best of Micro Vol. 3 (6502's)	8.25
394	Pascal Primer	11.15
395	Pet Interfacing	11.15
504	Writing Interactive Compilers and Interpreters	10.75
178	Fundamental Algorithms	9.95
353	MC6809 Cookbook	5.10
356	6809 Assembly Language	13.50
	Software Portability	5.50
	Apple Machine Language	9.05



Postage 80p on books: Extra on Tangerine Equipment etc.  
ANSAFONE FACILITY — 24hrs for Barclaycard and Access V.A.T. included (where applicable)

## MICRO-PRINT LTD.,

59, Church Street, Stoke-on-Trent, Tel: (0782) 48348



## MaricK Computer Products UK101 Software on Tape

8K Nuclear Holocaust	8K Home Finance
8K Asteroid Runner	5K Space Defender
4K Alien Invaders	4K UK101 Breakout
4K Drawing Machine	4K Snakes and Ladders
4K Fruit Machine	4K The My-mY Game

Still only £3.50 each.

### 8K Quest for the Golden Crown £5.50

A graphics adventure game that lets you search the Labyrinth in the Mountain in the West for the Golden Crown of the late King Triaric. Collect all the treasures you can but the Guardians will do their best to see that you don't leave the Labyrinth alive! The treasures are in different rooms for each game so you can play game after game and not learn all its secrets!

### 8K Balloon Race £4.50

A gorse bush thicket and a balloon are all you need for hours of fun trying to steer the balloon around five different tracks in the gorse. Of course, it's never as easy as it seems, there are a few tricks to make it more difficult. Those of you with the MaricK Sound Generator will find an added dimension.

### 8K Space Pirate £3.50

This is best described as a cross between Star Trek and an adventure game in reverse! With approximately half the screen for real-time graphics for added complication, the simple aim of the game is to escape through a hole in space the co-ordinates of which are given at the start of the game. There are problems however, as you will find out when you try to fly this game!

### 8K C.B. Log Program £3.50

Be ready for legalisation of CB radio this autumn, no more log sheets needed — this program will log your contacts and store them on tape, it can also supply a hard copy for those of you with printers. Data may be amended and specific entries searched for. The program stores the data directly into the memory, so that there will be no hang-ups from using and manipulating string variables.

All games come on individual cassettes with a listing as well, and will work on Mon 1; Mon 2; Cegmon monitors.

**Special Offer** £2.00 off any three programs.

Cheques, P.O.'s or just SAE for details to:-

**MaricK Dept CT.E**  
1 Branksome Close, Paignton, Devon TQ9 1EA.

## MEMORIES AT UNBEATABLE PRICES

	1 +	25 +	100 +
2114 200NS Low Power GTE	1.28	1.19	1.11
2708 450NS	1.99	1.86	1.73
2716 450NS SINGLE +5V	2.49	2.33	2.19
2732 450NS	5.85	5.43	5.05
2532 450NS	5.92	5.50	5.13
4116 150NS	1.06	0.99	0.92
4116 200NS	0.80	0.74	0.69
4118 200NS	4.29	3.99	3.79
6116 200NS	12.00	11.50	11.00

E. & O.E.

All products branded full specification and guarantee.  
All prices exclude post and packing (50p on orders under £10) and VAT.

Official orders from schools, colleges and government establishments welcome.

Credit cards accepted (Access and Visa)

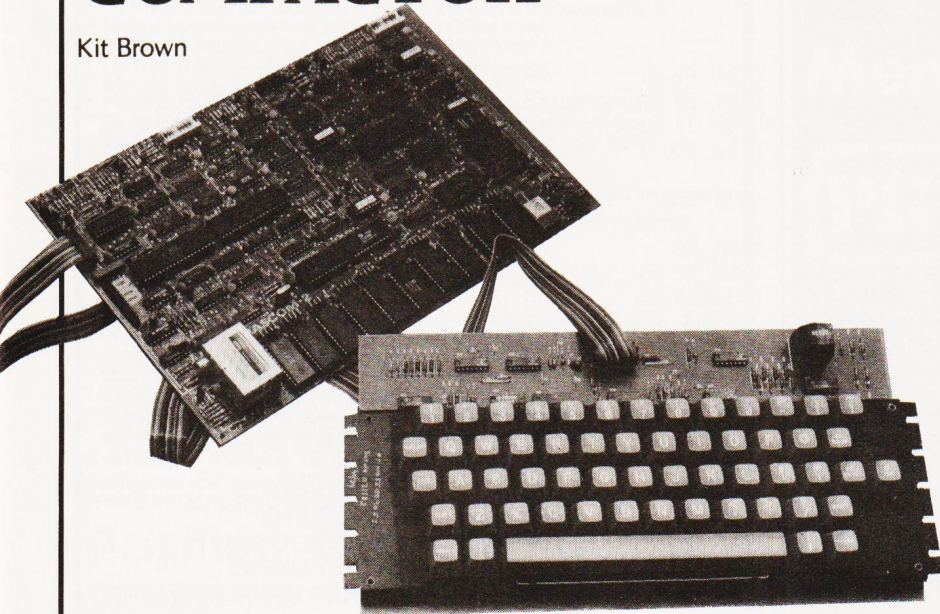
Please send S.A.E. for full component price list.

**MIDWICH COMPUTER COMPANY LIMITED,**  
HEWITT HOUSE, NORTHGATE STREET,  
BURY ST. EDMUNDS, SUFFOLK IP33 1HQ  
TELEPHONE: (0284) 701321  
(24 Hour service for credit card orders)



## COMPACTOR

Kit Brown



## Reduce the space needed for your NASCOM BASIC programs

**T**his is a short program, 130 bytes long, which is written in Z80 code. It is designed to run on a NASCOM 2 with the 8K Microsoft ROM BASIC, and is fully relocatable.

The only machine-dependent instruction is the Reset at the end, so it should be possible to convert it to other Z80 machines, especially those running Microsoft BASIC. Obviously, in this case the start location would have to be changed, and the tokens checked and changed if necessary.

### What It Does

The program starts at the first BASIC address, and goes through the program stripping out all REMs and spaces between program statements while leaving the spaces in PRINT and INPUT strings.

How good is it? I have used it on all my programs, and have achieved savings of 87 bytes for a short program and 1736 bytes on a 17K Star Trek. 87 bytes is neither here nor there, but 1736 bytes is not to be sneezed at!

### BASICally Speaking

To understand how the program works, we must first consider how the BASIC program is stored in memory. (Those of you familiar with this can skip the next bit.)

The top address of the program is stored in 10D6H and 10D7H. The first program line starts at 10FAH. The lines are organised as two bytes holding the address of the start of the next line, two

bytes holding the line number, and then the line itself, terminated by a zero byte. The BASIC uses codes 80H to CFH as reserved words. Thus, the program

```
10 PRINT "PRINT THIS"
20 X = 1: Y = 2
30 END
```

appears in memory as

```
10FA 0C 11 0A 00 9E 22 50 52 49 4E 54 20 54 48 49 53 22 00
110C 18 11 14 00 58 B4 31 3A 59 B4 32 00
1118 1E 11 1E 00 80 00
111E 00 00
```

the last 00 00 being the 'end of program' token.

### How It Does It

HL is pointed to the next byte to be tested. DE points to the next free location in the 'new' program. BC points to the last next-line address. Each byte is loaded and tested in turn. If it is found to be 20H, the code for a space, and it is not in a string, then HL is incremented without loading the byte in the new program, thus disposing of it effectively.

If the byte is 22H, the code for inverted commas, then the program knows that it has arrived at the start of a string, so jumps to a routine that picks up the next byte and puts it straight into the new program. This saves all the spaces in strings. It keeps on doing this until it finds the closing inverted commas, when it jumps back to the main loop.

If the byte is 00H, the code for the end of a line, it jumps to a routine that puts the address of the next line in the

last next line location. (You might have to read that a couple of times before you understand it. I had to, and I wrote it!) BC is then pointed to the new next-line location, and HL and DE are incremented to leave those two bytes free. A test is then performed to see if the end of the program has been reached. If it has not, it jumps back to the main loop. If it has reached the end, then it jumps to another routine that puts the double zero end of program token in, then loads the new address in the 'Top of Program' pointers. This routine ends the program with a return to NAS-SYS. In the BASIC program, address 0F80H has been changed to C9H, to return control to the BASIC.

If the byte is 8EH, the code for a REM, then the program jumps to a routine which deletes everything it finds until it finds the end of the line. It then goes back to the start of that line, and tests to see if this was 3AH, the code for a colon. If it was a colon, then the REM was tagged onto a line containing program statements, so it puts zero at the end and leaves it alone. If it was not a colon, then the REM was a line on its own, and the line number can be deleted as well.

### How To Use It

Personally, I write and develop my programs with spaces and explanatory REMs as usual. This helps a lot when debugging a new program. I then SAVE this as my back-up copy (you do all keep back-up copies, don't you?). I then run the compactor through the program, and SAVE this as my working copy.

This means that I gain all the advantages of speed and compactness where I need them, but that I still have a commented, expanded version should program development ever be required. Alternatively you could load the program into memory, and use it after LOADING each program.

The machine code version is executed from 0F00, or wherever you have sited it. The BASIC version is called by DOKE 4100, 3840:X=USR(0), but only in command mode.

### Things To Watch For

If you use REMs as a target for GOTOs or GOSUBs then the program will crash when you run it, because all the REMs and their line numbers have been deleted!

If you READ strings from DATA statements, and do not delimit them with inverted commas, then the program will delete all the spaces in them and you'll have to go and put them all back!



## Program Listing

```

65325 FOR X=3840 TO 3968 STEP 2:READ Y
65326 DOKE X,Y:NEXT
65327 DATA -1503,-6896,9153,8995,-6877,32465
65328 DATA 8446,3624,8958,3368,254,13864
65329 DATA -28930,3880,4882,6179,4842,8979,-386
65330 DATA 10274,6387,-14858,-6699,-7719,-15919
65331 DATA 32291,254,552,-2024,11225,-386,8250
65332 DATA -20731,7129,-12776,9177,8995,6939
65333 DATA 5144,4882,635,31235,-11006,9153
65334 DATA 8995,-10694,-17136,2344,4883,4734
65335 DATA 4899,6270,15027,4311,8380,-20495
65336 DATA 4882,4882,21485,4310,21485,4312
65337 DATA 21485,4314,201

```

This BASIC program contains all the machine code of the listing below.

### INITIALISATION

0F00	21 FA 10	LD HL, 10FA	START OF FIRST BASIC LINE
0F03	E5	PUSH HL	SAVE THE START
0F04	C1	POP BC	LOCATION IN BC
0F05	23	INC HL	ADD 4 TO HL
0F06	23	INC HL	TO PASS OVER THE
0F07	23	INC HL	NEXT LINE AND
0F08	23	INC HL	LINE NO LOCATIONS
0F09	E5	PUSH HL	LOAD FIRST PROGRAM
0F0A	D1	POP DE	LOCATION INTO DE

### MAIN LOOP

0F0B	7E	LD A, (HL)	GET NEXT BYTE
0F0C	FE 20	CP 20	IS IT A SPACE?
0F0E	28 0E	JR Z 0EH	YES - SO JUMP TO INC HL TO LOSE IT
0F10	FE 22	CP 22	INVERTED COMMAS?
0F12	28 0D	JR Z 0DH	YES - IT'S A STRING - KEEP IT
0F14	FE 00	CP 00	END OF LINE?
0F16	28 36	JR Z 36H	YES - JUMP TO END OF LINE ROUTINE
0F18	FE 8E	CP 8E	BASIC TOKEN FOR REM
0F1A	28 0F	JR Z 0FH	JUMP TO DELETE ROUTINE
0F1C	12	LD (DE), A	LOAD BYTE INTO NEXT PUT LOCATION
0F1D	13	INC DE	POINT TO NEXT PUT LOCATION
0F1E	23	INC HL	POINT TO NEXT TAKE LOCATION
0F1F	18 EA	JR EAH	GO AND DO IT AGAIN

### STRING ROUTINE

0F21	12	LD (DE), A	PART OF STRING - PUT IT BACK
0F22	13	INC DE	NEXT PUT LOCATION
0F23	23	INC HL	NEXT TAKE LOCATION
0F24	7E	LD A, (HL)	TAKE NEXT BYTE
0F25	FE 22	CP 22	END OF STRING YET?
0F27	28 F3	JR Z F3H	YES - JUMP BACK TO MAIN LOOP
0F29	18 F6	JR F6H	NO - JUMP BACK TO START OF ROUTINE

### REM DELETE

0F2B	C5	PUSH BC	SAVE THE
0F2C	D5	PUSH DE	REGISTERS AND
0F2D	E5	PUSH HL	EXCHANGE WITH
0F2E	D9	EXX	ALTERNATE REGISTERS
0F2F	E1	POP HL	RESTORE
0F30	D1	POP DE	THE
0F31	C1	POP BC	REGISTERS
0F32	23	INC HL	NEXT TAKE LOCATION
0F33	7E	LD A, (HL)	TAKE IT

0F34	FE 00	CP 00	END OF LINE?
0F36	28 02	JR Z 02H	YES - GO ON TO NEXT BIT
0F38	18 F8	JR F8H	NO - GO AND DO IT AGAIN
0F3A	D9	EXX	RECALL ORIGINAL REGISTERS
0F3B	2B	DEC HL	POINT TO LAST BYTE BEFORE REM TOKEN
0F3C	7E	LD A, (HL)	GET IT
0F3D	FE 3A	CP 3A	IS IT A ;
0F3F	20 05	JR NZ 05H	NO - GO DELETE LINE No AS WELL
0F41	AF	XOR A	MAKE A=00
0F42	D9	EXX	RESTORE THE REGISTERS
0F43	1B	DEC DE	POINT DE AT ;:TO DELETE IT
0F44	18 CE	JR CEH	JUMP BACK TO MAIN LOOP
0F46	D9	EXX	RESTORE THE REGISTERS
0F47	23	INC HL	POINT HL
0F48	23	INC HL	AT START OF
0F49	23	INC HL	NEXT LINE NO
0F4A	1B	DEC DE	POINT DE TO START
0F4B	1B	DEC DE	OF LAST LINE NO
0F4C	18 14	JR 14H	JUMP TO LINE NO INSERTION

END OF LINE ROUTINE

0F4E	12	LD (DE), A	PLACE LAST BYTE
0F4F	13	INC DE	POINT TO NEXT
0F50	7B	LD A, E	LOW BYTE OF PRESENT LOCATION
0F51	02	LD (BC), A	PUT IT IN NEXT LINE LOCATION
0F52	03	INC BC	POINT TO HIGH BYTE LOCATION
0F53	7A	LD A, D	HIGH BYTE OF PRESENT LOCATION
0F54	02	LD (BC), A	PUT IT IN NEXT LINE LOCATION
0F55	D5	PUSH DE	SAVE PRESENT LOCATION
0F56	C1	POP BC	NEXT LINE POINTER
0F57	23	INC HL	ADVANCE HL TO
0F58	23	INC HL	GET OVER THE PRESENT
0F59	23	INC HL	NEXTLINE LOCATION
0F5A	3A D6 10	LD A, (10D6)	LOAD A WITH LOW BYTE OF TOP OF PROG
0F5D	BD	CP L	ARE WE THERE?
0F5E	28 09	JR Z 09H	YES - GO CHECK HIGH BYTE TO OVERCOME NEXT
0F60	13	INC DE	LINE LOCATION
0F61	13	INC DE	LINE LOCATION
0F62	7E	LD A, (HL)	LOW BYTE OF LINE NO
0F63	12	LD (DE), A	PUT IT IN THE PROPER PLACE
0F64	23	INC HL	MOVE EVERYTHING ALONG
0F65	13	INC DE	TO THE HIGH BYTE
0F66	7E	LD A, (HL)	GET IT
0F67	18 B3	JR B3H	JUMP BACK TO MAIN LOOP

END OF PROGRAM

0F69	3A D7 10	LD A, (10D7)	LOAD A WITH HIGH BYTE OF TOP OF PROG
0F6C	BC	CP H	ARE WE THERE?
0F6D	20 F1	JR NZ F1H	NO - BACK TO MAIN LOOP
0F6F	AF	XOR A	CLEAR A
0F70	12	LD (DE), A	END OF PROGRAM TOKEN
0F71	13	INC DE	NEXT LOCATION
0F72	12	LD (DE), A	END OF PROGRAM TOKEN
0F73	13	INC DE	NEXT LOCATION
0F74	ED 53 D6 10	LD 10D6, DE	POINT THE POINTERS
0F78	ED 53 D8 10	LD 10D8, DE	TO THE TOP
0F7C	ED 53 DA 10	LD 10DA, DE	OF NEW PROGRAM
0F80	DF 5B	MRET	RETURN TO NAS - SYS

This is the full machine code program for the compactor for those wishing to incorporate it into a utilities package.



- \* What other small computer gives you, AS STANDARD, a
- \* 1920 character screen output and REALLY high definition
- \* 512 x 240 dot graphic resolution, via
- \* 128 USER-DEFINABLE 8 x 8 dot characters in ADDITION TO
- \* 128 STANDARD ASCII characters, including punctuation,
- \* LOWER CASE with TRUE DESCENDERS and a
- \* full control set, all under program control or from the
- \* TOP TYPEWRITER QUALITY 79 key keyboard incorporating a
- \* 16 key numeric/control pad, thus providing over
- \* 256 key functions (plus tab, repeat, 2 key reset) in
- \* FIVE shift levels (!) together with standard
- \* SERIAL (RS232) AND
- \* PARALLEL (Centronics) interfaces, plus plug-in MICROSOFT
- \* 8K Floating Point BASIC ROMPAC that wastes none of the
- \* 48k user RAM, now standard, plus 8k system/monitor ROM,
- \* TOTAL 64K MEMORY ...

(Add 15% VAT to prices)

* UHF tuner for TV output .....	£10
* Cassette recorder for 1200 baud rate (4 times norm) .....	£25
* Green phosphor 12 inch video monitor .....	£150
* Plug-in ROMPAC word processor (inc. mail/merge etc) .....	£120
* Plug-in Z80 Assembler/Editor/relocating Loader .....	£70
* 308k master disk drive, standard CP/M, MBASIC assembler .....	£599
* 308k add-on disk drive (up to 3 for total 1.2MB) .....	£450
* 6 slot S100 expansion box for colour card, A/D etc .....	£240
* Complete CP/M business package for 55k RAM (sales, purchase & nominal ledgers; stock control; payroll) .....	£650
<b>SYSTEMS — including 12" green screen &amp; relevant software:-</b>	
<b>BUSINESS (C): 55k RAM, 616k Disk, fast dot printer .....</b>	<b>£2,800</b>
<b>WORD PROCESSING (B): 308k Disk, Daisywheel printer .....</b>	<b>£2,500</b>

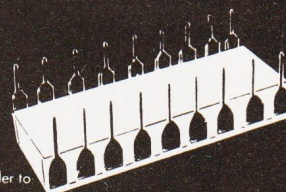
**130 Lewes Road, Brighton BN2 3LG, E. Sussex.  
(0273-688946)**

8k BASIC:£9, Monitor Operations:£7, CP/M (2 vols):£16,  
Hardware Technical:£9, Software (inc. monitor listing):£19,  
MBASIC:£8.

# PRICE WAR

**4116** 200 nanoseconds **87 pence** + VAT each.

**2114 low power**  
300 nanoseconds 130 pence  
+ VAT each



Send cash, cheque, credit card number or official order to

Freepost (No Stamp Required)

Liverpool L2 2AB.

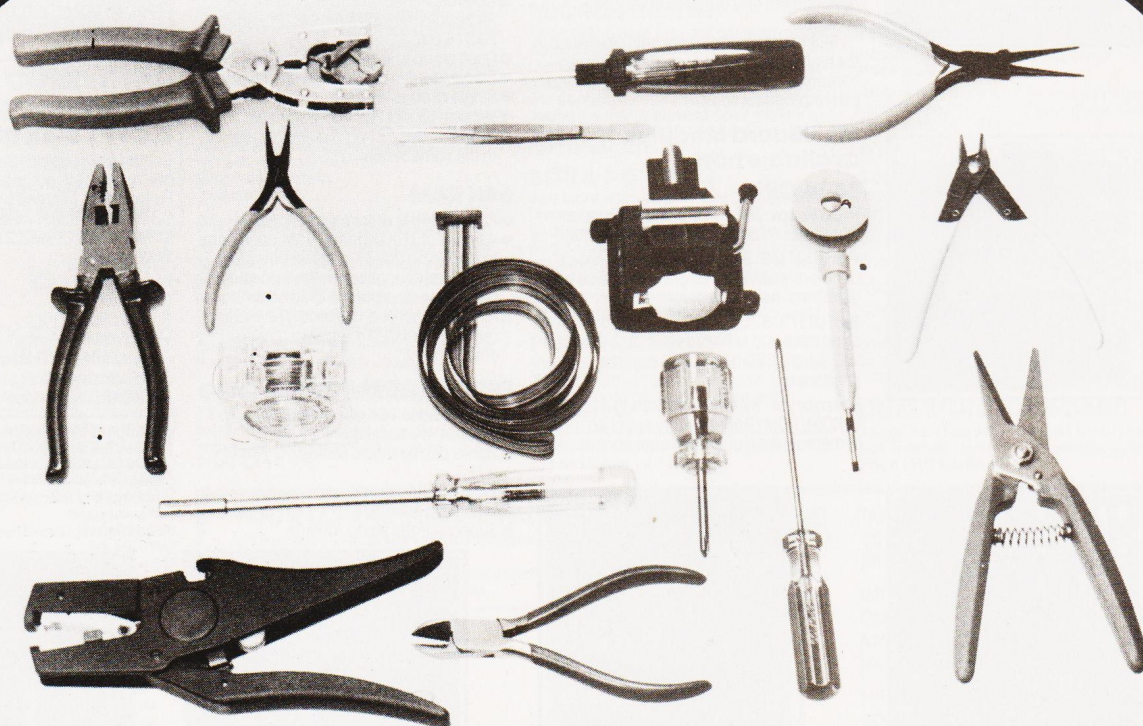
24 Hr. 7 day credit card orders on 051-236 0707

**Same price  
any quantity**

**For  
your  
FREE  
Catalogue**  
Send 30p to cover P&P

**Batvale Marketing Ltd.,**  
Ely 0353-778320  
Ely 0353-778756  
(24 hours)

**ok** Part of a complete range



ELECTROWARE\*

**AVAILABLE FROM ALL LEADING ELECTRONIC DISTRIBUTORS**

Neltronic Ltd.,  
Dublin 510845  
Cobbies Ltd.,  
London. 01-699-2282  
Microdigital Ltd.,  
Liverpool. 051-227-2535  
Electronica CG Ltd.,  
Manchester. 061-788-0656

Lee Distribution Ltd

Watford Electronics Ltd.

Technomatic Ltd

New Bear Computing Store Ltd

A. Marshall (London) Ltd.,  
London. 01-624-0805

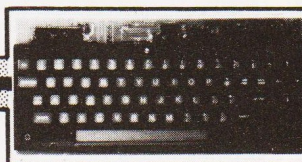
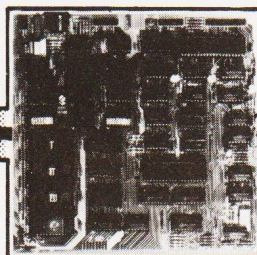
Interface Components Ltd.,  
Amersham 02403-22307

\* A DIVISION OF OK MACHINE & TOOL (UK) LIMITED



# MicroValue

## New British Microsystem. Gemini MultiBoard



● Eight boards available NOW ● 8" x 8" board modules ● Z80A CPU board ● Z80A Video board ● 64K RAM ● Built and tested Developed by one of the most experienced micro board design teams in the UK, Gemini MultiBoard\* is the ultimate modular board system. Unlike most systems of its kind, virtually nothing is made redundant when you expand it. And for those who want expansion this can be immediate, for we are launching eight boards simultaneously. No other system has offered so much so soon.

All MultiBoard modules are Nasbus† and Gemini 80-BUS\* compatible and can be used in a wide spectrum of application, e.g. educational, personal, business, system development and process/production control.

MultiBoard modules are built and tested to the highest standards. And offer enormous computing power and potential at astonishingly low cost.

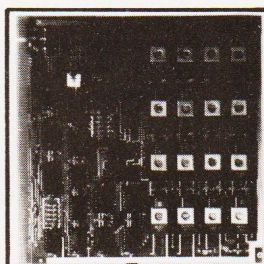
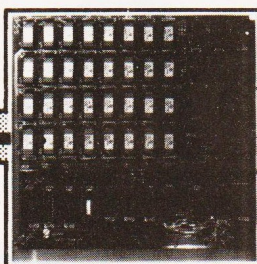
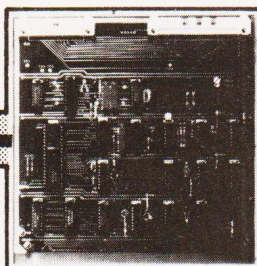
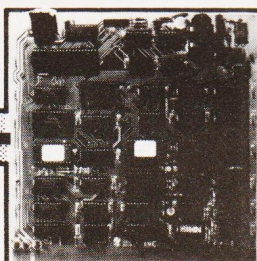
### MultiBoard Modules available now Z80A CPU

**Processor:** Z80A CPU at 4MHz. Optional wait-states. Reset jump to any 4K boundary.

**Parallel I/O:** 8 bit ASCII keyboard socket. Uncommitted Z80A PIO giving two 8 bit bi-directional ports with handshake.

**Serial I/O:** 8250 UART with programmable baud rates and software selectable between RS232 or 1200 baud CUTS cassette interfaces.

**Memory:** 4 'Bytewyde' sockets to accept EPROM/ROM/RAM. Memory switched in/out of memory map under software control.



**Software:** Comprehensive monitor. Optional 12K Microsoft BASIC (ROM). Standard configuration PROM provides decodes for 4 x 2732 (4K x 8) EPROMs.

The CPU Board is fully buffered to the Gemini 80-BUS standard.

### INTELLIGENT VIDEO

- Z80A microprocessor controlled.
- 80 x 25 display controlled by 6845 CRT chip.
- Adjustable dot clock for alternative screen formats.
- Character set: 128 in EPROM + 128 in RAM which can be defined as the video inverse of the main set or as block graphics with 160 x 75 resolution.
- I/O port communication with host computer.
- Light pen socket.
- 8-bit input port allowing several video boards (each with its own keyboard) to be connected to a single CPU board.

### FLOPPY DISK CONTROLLER

- Controls: Perfec FD250 5.25in 48 TPI, Micropolis 1015 5.25in 96 TPI, Perfec FD514 8in.
- Controls up to 4 drives of same type.
- Single/double density software selectable.
- Single or double sided.
- Western Digital FD1797 controller.
- Up to 8 drives (2 boards) can be used in the same system.

### 64K RAM

- Runs at 4MHz with no wait-states.
- 4 banks of 16K dynamic RAM, each bank locatable on any 4K address boundary.
- Page Mode supplied as standard allowing up to 4 memory boards to be addressed.
- All the memory can be used by switching out on-board CPU memory, e.g. in disk environment.

### EPROM/ROM BOARD

- Accepts up to 40K of firmware.
- 4 banks of 4 sockets.
- Banks can be mixed between 2708 or 2716.
- 24-pin ROM socket.
- Wait-state generator.
- Supports Page Mode scheme.

### EPROM PROGRAMMER

- Programs multi-rail 2708 or single rail 2716.
- Connects to PIO on CPU board.
- Software provided on tape.

### 3A PSU

- Supplies 4/5 boards.
- LED on each output.
- -5V at 3A; -12 at 1A; -5V at 1A; -12V at 80mA.

### KEYBOARD

- Full alpha-numeric ● 59-keys ASCII encoded ● Exclusively designed for Gemini
- Auto repeat ● Cursor control keys

### MULTIBOARD PRICES (excl VAT)

(All built and tested except where marked)

CPU (G811).....	£125.00
Video (G812).....	£140.00
64K RAM (G802).....	£140.00
FDC (G809).....	£140.00
EPROM/ROM (G803).....	£ 70.00
EPROM PROG. (G808) Kit.....	£ 29.50
3A PSU (G807).....	£ 40.00
Keyboard (G613).....	£ 57.50

### FLOPPY DISK UNIT

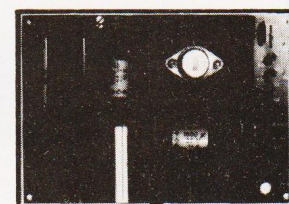
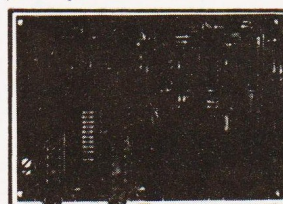
Gemini unit suitable for MultiBoard. Holds one or two 5¼in double sided, double density Perfec drives. Integral power supply. Price £375 plus VAT for one drive, £575 plus VAT for two drives. CP/M2.2 and documentation £90 plus VAT.

KENILWORTH CASE for MultiBoard .....	£49.50 + VAT
5-Card Support Kit.....	£19.50 + VAT
VERO Frame.....	£32.50 + VAT
(also suitable for Nascom)	
PSU Enclosure Kit .....	£24.50 + VAT

KEYBOARD enclosures available soon.

MultiBoard Modules are available from the MicroValue dealers listed on facing page.

\* Trademarks of Gemini Microcomputers Limited  
† Trademarks of Nascom Microcomputers Division of Lucas Logic  
‡ Trademarks of Digital Research Inc.





# MicroValue

## COMPATIBLE Nasbus products from your MicroValue Dealers

### GEMINI G805 FLOPPY DISK SYSTEM FOR NASCOM-1 & 2

It's here at last. A floppy disk system and CP/M CP/M SYSTEM. The disk unit comes fully assembled complete with one or two 5 $\frac{1}{4}$ " drives (FD250 double sided, single density) giving 160K per drive, controller card, power supply, interconnects from Nascom-1 or 2 to the FDC card and a second interconnect from the FDC card to two drives, CP/M 1.4 on diskette plus manual, a BIOS EPROM and a new N2MD PROM. All in a stylish enclosure.

Single drive system ..... £450 + VAT  
Double drive system ..... £640 + VAT  
Additional FD250 drives ..... £205 + VAT

**D-DOS SYSTEM.** The disk unit is also available without CP/M to enable existing Nas-Sys software to be used. Simple read, write routines are supplied in EPROM. The unit plugs straight into the Nascom PIO.

Single drive system £395 + VAT

**DCS-DOS** A greatly enhanced version of D-DOS, running under Nas-Sys. Gives named files in BASIC, ZEP, NAS-PEN and machine code programs ..... £50 + VAT

### DISKPEN

The powerful text editor written for the Nascom is now available on a 5 $\frac{1}{4}$ " floppy disk with a number of new features. Price £43.25 + VAT.

### NASCOM COMPUTERS

NASCOM-2 Microcomputer Kit  
£225 + VAT

NASCOM-1 Microcomputer Kit  
£125 + VAT

Built and tested £140 + VAT

16K RAM KIT ..... £100 + VAT  
3A PSU KIT ..... £32.50 + VAT

### KENILWORTH CASE FOR NASCOM-2

The Kenilworth case is a professional case designed specifically for the Nascom-2 and up to four additional 8" x 8" cards. It has hardwood side panels and a plastic coated steel base and cover. A fully cut back panel will accept a fan, UHF and video connectors and up to 8 D-type connectors. The basic case accepts the N2 board, PSU and keyboard. Optional support kits are available for 2 and 5 card expansion.

Kenilworth case ..... £49.50 + VAT  
2-card support kit ..... £7.50 + VAT  
5-card support kit ..... £19.50 + VAT

### CASSETTE ENHANCING UNIT

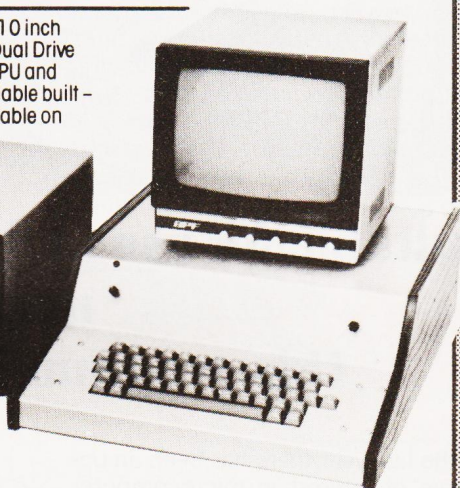
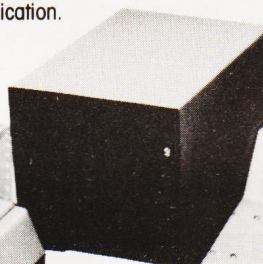
The Castle interface is a built and tested add-on unit which lifts the Nascom-2 into the class of the fully professional computer. It mutes spurious output from cassette recorder switching, adds motor control facilities, automatically switches output between cassette and printer, simplifies 2400 baud cassette operating and provides true RS232 handshake.

Castle Interface Unit ..... £17.50 + VAT

### A NASCOM-2 BASED SYSTEM FOR LESS THAN £1500 + VAT

The proven Nascom-2 microcomputer can now be bought as a complete system from under £1500 + VAT. For this price you get the Nascom-2 kit, 16K RAM board kit, Kenilworth case with 2 card frame,

Centronics 737 printer—10 inch monitor, and the Gemini Dual Drive Floppy Disk System. The CPU and RAM boards are also available built—the additional cost is available on application.



### A-D CONVERTER

For really interesting and useful interactions with the 'outside world' the Milham analogue to digital converter is a must. This 8-bit converter is multiplexed between four channels—all software selectable. Sampling rate is 4KHz. Sensitivity is adjustable. Typical applications include temperature measurement, voice analysis, joystick tracking and voltage measurement. It is supplied built and tested with extensive software and easy connection to the Nascom PIO.

Milham A-D Converter (built and tested) ..... £49.50 + VAT

### PROGRAMMER'S AID

For Nascom ROM BASIC running under Nas-Sys. Supplied in 2 x 2708 EPROMs. Features include: auto line numbering; intelligent renumbering; program appending; line deletion; hexadecimal conversion; recompression of reserved words; auto repeat; and printer handshake routines. When ordering please state whether this is to be used with Nas-Sys 1 or 3. Price £28 + VAT.

### GEMINI 'SUPERMUM'

12 x 8 piggy-back board for Nascom-1 offering five-slot motherboard, quality 5A power supply and reliable buffering with reset jump facility. Kit Price £85 + VAT.

### CENTRONICS 737 MICRO PRINTER

A high performance, low price, dot-matrix printer that runs at 80cps (proportional) and 50cps (monospaced). This new printer gives text processing quality print. And can print subscripts and superscripts. It has 3-way paper handling and parallel interface as standard. Serial interface is optional. Price £375 + VAT. Fanfold paper (2000 sheets) £18 + VAT.

### BITS & PC's PCG

5 x 4 board which plugs straight into Nascom-2. Operates on cell structure of 128 dots, producing 64 different cells. Once defined, each cell may be placed anywhere, any number of times on screen simultaneously. Max screen capacity: 768 cells. Dot resolution: 384 x 256 98304. Many other features including intermixing of alpha-numeric characters and pixels. Price (kit) £60 + VAT.

### PORT PROBE

Allows monitoring of input and output of Nascom PIO. This board can generate interrupts and simulate handshake control. Price (kit) £17.50 + VAT.

All prices are correct at time of going to press and are effective 1st July 1981.

### HEX & CONTROL KEYPADS

Hexadecimal scratchpad keyboard kit for N1/2. Price £34 + VAT.

As above but including (on the same board) a control keypad kit to add N2 control keys to N1. Price £40.50 + VAT.

### BASIC PROGRAMMER'S AID

Supplied on tape for N1/2 running Nas-Sys and Nascom ROM BASIC. Features include auto line number, full cross-reference listing, delete lines, find, compacting command, plus a comprehensive line re-numbering facility. Price £13 + VAT.

### 'SCREENPLUS'

Screenplus enables a programmer to blank or display in reverse video, selected words, letters or areas of the screen under program control. Suitable for use with either Nascom 1 or 2. 'Screenplus' (built and tested) ... £40.00 + VAT.

### DUAL MONITOR BOARD

A piggy-back board that allows N1 users to switch rapidly between two separate operating systems. Price (kit) £6.50 + VAT.

### YOUR LOCAL MICROVALUE DEALER

All the products on these two pages are available while stocks last from the MicroValue dealers listed below. (Mail order enquiries should telephone for delivery dates and post and packing costs.) Access and Barclaycard welcome.

**BITS & PC'S**  
4 Westgate, Wetherby, W. Yorks.  
Tel: (0937) 63774.

**BUSINESS & LEISURE  
MICROCOMPUTERS**  
16 The Square, Kenilworth, Warks.  
Tel: (0926) 512127.

**ELECTROVALUE LTD.**  
680 Burnage Lane, Burnage,  
Manchester M19 1NA.  
Tel: (061) 432 4945.  
28 St Judes, Englefield Green,  
Egham, Surrey TW20 0HB.  
Tel: (0784) 33603. Tlx: 264475.



**TARGET ELECTRONICS**  
16 Cherry Lane, Bristol BS1 3NG.  
Tel: (0272) 421196.

**INTERFACE COMPONENTS LTD.**  
Oakfield Corner, Sycamore Road,  
Amersham, Bucks.  
Tel: (02403) 22307. Tlx: 837788.

**HENRY'S RADIO**  
404 Edgware Road, London W2.  
Tel: (01) 402 6822.  
Tlx: 262284 (quote ref: 1400).





**Suitable for use in its own right or as a routine within a major Adventure game, this program should prove easily adaptable**

**I**n the last year there has been an upsurge of interest in microcomputer games of the 'Adventure' variety. In the field of detailing the environment in which adventures take place these computer games have been quite successful, but where they tend to fall down is in their system for simulating battles, a crucial part of many a dungeon campaign! This article describes a BASIC program that could be modified to simulate hand-to-hand combat in such games, and can also be fun in its own right.

### **Personality Profile**

'Gladiators' is a game suitable for most microcomputer systems. The player has control over one gladiator, and the computer controls the other, in a fight to the death. Each combat is rated for strength, constitution and dexterity. Strength represents the ability of a gladiator to do substantial damage to his opponent (eg kill him) — the greater his strength, the more telling each blow will be. Constitution reflects general fitness and staying power; the amount of punishment a fighter can take before shuffling off this mortal coil to join his tribal ancestors. Dexterity is an expression of co-ordination — the greater a gladiator's dexterity, the more likely it is that he will be able to dodge a blow.

### **Tactics Made Simple**

In essence, 'Gladiators' is a computer-moderated guessing game in which the player aims to beat the machine by making a succession of tactical decisions. The human habit of assuming that anything that can make decisions must be intelligent, adds to the interest of the game, since the semi-random manoeuvres of the computer's gladiator can often seem to be more planned than they really are. On the basis of information about the capabilities of his opponent and himself, and the physical distance between the fighters, he decides upon one of six manoeuvres:

**BASH** — a blow to the enemy's head. The smaller the distance between the combatants, and the greater the attacker's strength, the more damage this will do to an opponent. If a blow is not dodged it will result in blows equal to the attacker's strength at a range of one, half that at range two, a third at range three, and so on. The number of blows is always rounded up to the nearest whole number, and brings about an equal decrease in the enemy's constitution. If constitution falls below one a fighter is dead.

**DUCK** — an attempted dodge of a blow

to the head. When the dodge is attempted a random decimal number between 0 and 20 is worked out. If the result is less than the defender's dexterity rating the duck is successful, and the opponent's Bash has no effect. Of course if you weren't bashed in the first place you'd be wasting your time! One popular mistake is a Duck in response to a Stab in the guts. Not a recommended strategy!

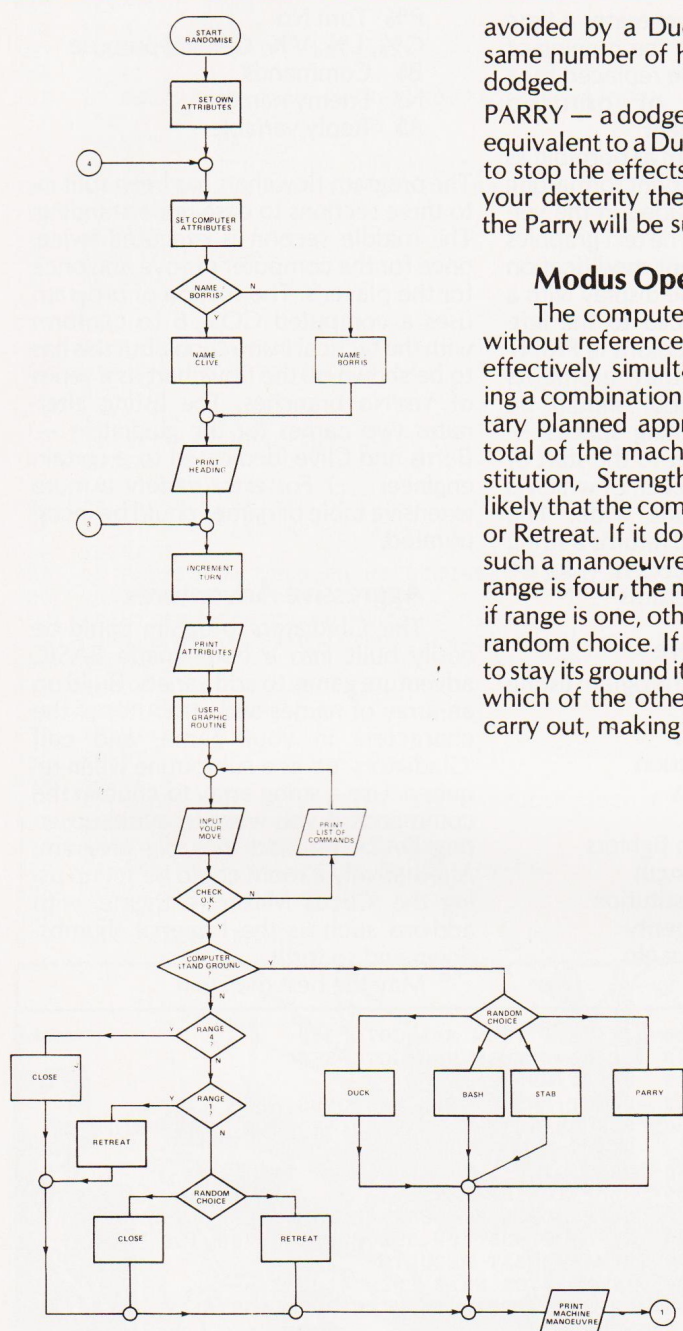
**CLOSE** — a move towards the opponent. This brings about a decrease in the 'range' between the two fighters unless the other gladiator Closes or Retreats (see below). Range can never be less than one, and decreases by one unit at each Close by either combatant.

**RETREAT** — a move away from the enemy (cf Bloodnok, Major, Coward and Bar). Range increases by one for each retreat, hence if the player Retreats and the computer Closes in a turn, range will be unaffected. Maximum value is four, hence it is impossible to get completely out of range of your opponent. This rule may seem unfair, but it reflects the problem of players opting to avoid battle — in the Circus Maximus the Emperor might be expected to take a dim view of such a stratagem.

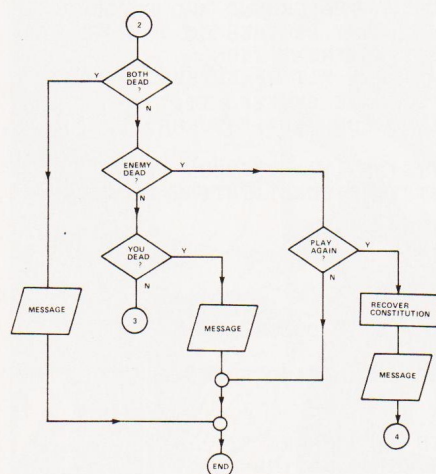
**STAB** — similar to a Bash, but a blow to the body of the opponent. It cannot be



# GLADIATORS



**Fig.1. The main operating flowchart for the game.**



**Fig.3. The endgame routines.**

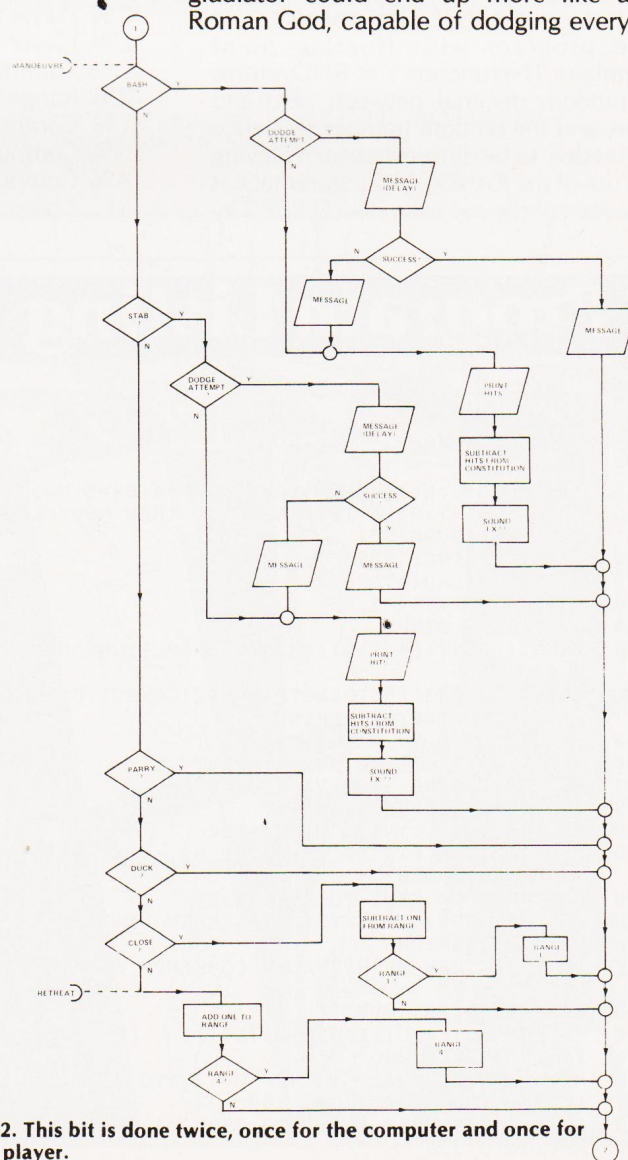
avoided by a Duck, and results in the same number of hits as a Bash if it isn't dodged.

**PARRY** — a dodge of a blow to the body, equivalent to a Duck for a Bash and used to stop the effects of a Stab. The higher your dexterity the more likely it is that the Parry will be successful.

## Modus Operandi

The computer works out its moves without reference to yours (so they are effectively simultaneous decisions), using a combination random and rudimentary planned approach. The higher the total of the machine's 'attributes' (Constitution, Strength, Dexterity) the less likely that the computer will opt to Close or Retreat. If it does decide to carry out such a manoeuvre it will always Close if range is four, the maximum, and Retreat if range is one, otherwise making a 50:50 random choice. If the computer decides to stay its ground it will choose randomly which of the other four manoeuvres to carry out, making a decision influenced

by its dexterity rating. This system is easily modified (lines 260-340 in the listing) to allow the computer to formulate a more 'intelligent' strategy — at the moment it is given an advantage of higher attributes than the player to make up for its moronic style of combat, but with practice and a little luck it is possible to defeat it half a dozen times in a row before you bite the dust. There is ample scope for tinkering in the Machine Move routine, but if it is improved the semi-random starting values of the attributes should be adjusted. Alter the 'recovery value if you find that your character invariably loses his second battle — this value represents the effect of extra training and the healing of wounds. It might be interesting to give the player the choice of different types of training — the fixed number of recovery points could be optionally used to increase dexterity or strength instead of constitution. Upper limits of 10 for strength and 19 for dexterity would probably be a good idea if this system was used, otherwise a lucky gladiator could end up more like a Roman God, capable of dodging every



**Fig.2.** This bit is done twice, once for the computer and once for the player.



attack and killing off the opposition at a blow from long range.

The player tells the machine what move it has selected through his reply to the MANOEUVRE? command. If the first letter of the response is B(ash), S(tab), P(arry), D(uck), R(etreat) or C(lose) the appropriate tactic is carried out. If any other character is used at the start of the response a scolding message appears followed by a list of the valid instructions, followed by the MANOEUVRE? question once again. An entry of ? has the same effect, but without the message.

### Modo Et Forma

The BASIC used in the program is slightly non-standard but should be easy to convert for most microcomputer implementations of the language. All the variables except M are integer types, marked by the % symbol in the listing. If a decimal is assigned to one of these it is rounded down to the nearest whole number. Omit the % symbols if your BASIC does not allow integer variable types, but bear in mind that you will need to put in some INT( ) statements to use the program with floating point numbers. The function Y = RND returns a random decimal between zero and one, and the random number sequence is 'seeded' to be different at each playing by use of the RANDOMIZE statement at the start of the program. The SLEEP 2 in-

struction (for example) generates a time delay of two seconds in the running of the program, and can be replaced by a FOR...NEXT loop or omitted altogether by the impatient.

To make the program as portable as possible few graphics or print formatting routines have been included in the version of the game listed. The text graphics used should work without modification on any 80 character wide display with a TAB command referenced to the left-hand screen edge. Semicolons in PRINT statements indicate that elements separated by the symbol should be printed without intervening spaces — commas space items out to the start of successive 'TAB fields', each of which is eight character-positions wide. The STRING\$(X,Y) command returns a string of X characters of ASCII code Y — for example STRING\$(5,42) returns "\*\*\*\*\*".

### What Goes Where

Variables used in the program listing are as follows:

S% Player Strength  
C% Player Constitution  
D% Player Dexterity  
U% Your move No  
R% Range between fighters  
T% Computer Strength  
N% Computer Constitution  
A% Computer Dexterity  
M Computer move No

P% Turn No  
G%, L%, V% General-purpose  
B\$ Commands  
N\$ Enemy name  
A\$ Reply variable

The program flowchart has been split into three sections to ease understanding. The middle section is executed twice, once for the computer's move and once for the player's. The section of program uses a computed GOSUB to conform with the tactical instructions, but this has to be shown on the flowchart as a series of Yes/No branches. The listing alternates two names for the gladiators — Borris and Clive (dedicated to a certain engineer...). For extra variety a more extensive table of names could be incorporated.

### Aggressive Adventures

The 'Gladiators' program could be easily built into a home-made BASIC adventure game, to add variety. Build up an array of names and attributes of the characters in your game, and call 'Gladiators' up as a subroutine when required. Use a string array to contain the commands if you want to avoid upsetting DATA pointers in a big program. Alternatively a room could be set up using the 'Circus Maximus' theme, with add-ons such as the Imperial thumbs-down and so forth.

May the best man win...

## Program Listing

```

89 REM**INITIALISE
90 RANDOMIZE
100 S%=5:C%=9+RND*3:D%=8+RND*6
105 N$="BORRIS"
110 T%=5+RND*6:N%=9+RND*5:A%=9+RND*4:U%=5:M=5
115 PRINT:PRINT:R%=4:IF LEN(N$)=6 THEN N$="CLIVE"
    ELSE N$="BORRIS"
120 PRINT STRING$(33,35);
130 PRINT " GLADIATORS "
140 PRINT STRING$(33,35)
149 REM**LOOP START
150 PRINT:PRINT:P%=P%+1:PRINT"[2 SPC]TURN NUMBER
    ";P%
160 PRINT TAB(23);"STRENGTH[3 SPC]CONSTITUTION
    [3 SPC]DEXTERITY":PRINT
170 PRINT"YOU : ",S%,C%,D%:PRINT
180 PRINT N$;" : ",T%,N%,A%:PRINT
190 RESTORE:GOSUB 3000:V%=0:U%=0
200 INPUT"MANOEUVRE ";A$
210 IF LEFT$(A$,1)<>"?" THEN 220
215 FOR G%=1 TO 6:READ B$:PRINT B$,:NEXT G%:
    PRINT:GOTO 200
220 RESTORE:FOR G%=1 TO 6:READ B$
230 IF LEFT$(B$,1)=LEFT$(A$,1) THEN U%=G%
240 NEXT G%:RESTORE
250 IF U%=0 THEN PRINT"VALID COMMANDS ARE",:GOTO
    215
259 REM**MACHINE MOVE
260 M=RND*(55+F%/10):F%=T%+N%+A%+15
270 IF M>F% THEN 320
280 M=RND:IF M*30>11+A% THEN M=1:GOTO 350
290 IF M>.5 THEN M=2:GOTO 350
300 IF M*36>A% THEN M=3:GOTO 350
310 M=4:GOTO 350

```

```

320 IF R%=1 THEN M=5:GOTO 350
330 IF R%=4 THEN M=6:GOTO 350
340 M=INT(RND*2)+5
350 PRINT:PRINT N$;" RESPONDS WITH A ";
360 FOR G%=1 TO 6:READ B$:IF G%=M THEN PRINT B$:
    PRINT
370 NEXT G%
379 REM**THE BATTLE
380 ON M GOSUB 800,850,900,950,1000,1050
390 ON U% GOSUB 500,550,600,650,700,750
399 REM**COMBAT RESULTS
400 IF C%>0 OR N%>0 THEN 410
402 PRINT"OH DEAR, YOU'RE BOTH MORTALLY
    WOUNDED."
405 PRINT"BETTER LUCK NEXT TIME.":GOTO 10000
410 IF N%>0 THEN 420
412 PRINT N$;" FALLS TO THE GROUND AND EXPIRES.";
415 PRINT" WELL DONE, WANT ANOTHER GO ?":GOTO 440
420 IF C%>0 THEN 150:REM**NEXT TURN
425 PRINT"SORRY, BUT IN A FIT OF ENTHUSIASM ";
430 PRINT"YOU SEEM TO HAVE SNUFFED IT."
435 PRINT"YOU SURVIVED FOR ";P%;" TURNS.":GOTO
    10000
440 INPUT A$:IF LEFT$(A$,1)<>"Y" THEN 10000
450 G%=RND*7+2:PRINT"YOUR CONSTITUTION RECOVERS
    BY ";G%
460 C%=C%+G%:L%=0
470 GOTO 110
499 REM**YOU BASH
500 IF M<>4 THEN 530
505 PRINT N$;" ATTEMPTS TO DODGE - ";
510 SLEEP 5
520 IF RND*20<A% THEN PRINT"AND SUCCEEDS.":GOTO
    545
525 PRINT"AND FAILS."
530 PRINT:PRINT"HITS ON HIM ARE ";
535 G%=(S%/R%)+.999:PRINT G%,:N%=N%-G%
540 GOSUB 2000
545 RETURN

```



# GLADIATORS

```

549 REM**YOU STAB
550 IF M<>3 THEN 575
555 PRINT N$;" TRIES TO DODGE - ";
560 SLEEP 2
565 IF RND*20<A% THEN PRINT"AND SUCCEEDS.":GOTO
590
570 PRINT"AND FAILS."
575 PRINT:PRINT"HITS ON HIM ARE ";
580 G%=(S%/R%)+.999:PRINT G%,:N%=N%-G%
585 GOSUB 2000
590 RETURN
599 REM**YOU PARRY
600 RETURN
649 REM**YOU DUCK
650 RETURN
699 REM**YOU RETREAT
700 R%=R%+1:IF R%>4 THEN R%=4
710 RETURN
749 REM**YOU CLOSE
750 R%=R%-1:IF R%<1 THEN R%=1
760 RETURN
799 REM**ENEMY BASH
800 IF U%<>4 THEN 830
805 PRINT"YOUR ATTEMPTED DODGE - ";
810 SLEEP 3
820 IF RND*20<D% THEN PRINT"SUCCESS!":GOTO 840
825 PRINT"NO LUCK."
830 PRINT:PRINT"HITS ON YOU ARE ";
835 G%=(T%/R%)+.999:PRINT G%,:C%=C%-G%
840 GOSUB 2000
845 RETURN
849 REM**ENEMY STAB
850 IF U%<>3 THEN 875
855 PRINT"YOUR ATTEMPTED DODGE - ";
860 SLEEP 4
865 IF RND*20<D% THEN PRINT"SUCCESSFUL.":GOTO 890
870 PRINT"WITHOUT SUCCESS."
875 PRINT:PRINT"HITS ON YOU ARE ";
880 G%=(T%/R%)+.999:PRINT G%,:C%=C%-G%
885 GOSUB 2000
890 RETURN
899 REM**ENEMY PARRY

```

```

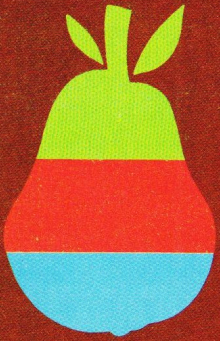
900 RETURN
949 REM**ENEMY DUCK
950 RETURN
999 REM**ENEMY RETREAT
1000 R%=R%+1:IF R%>4 THEN R%=4
1010 RETURN
1049 REM**ENEMY CLOSE
1050 R%=R%-1:IF R%<1 THEN R%=1
1060 RETURN
1999 REM**SOUND FX?
2000 ON G% GOSUB 2020,2030,2040,2050,2060,
2070,2080,2090
2010 PRINT:RETURN
2020 PRINT"COUGH...":RETURN
2030 PRINT"GASP...":RETURN
2040 PRINT"YAEGH...":RETURN
2050 PRINT"EUFFF...":RETURN
2060 PRINT"REUCH...":RETURN
2070 PRINT"TAERCK...":RETURN
2080 PRINT"ARGHHH...":RETURN
2090 PRINT"@#!@<<!":RETURN
2999 REM**VISUAL DISPLAY
3000 PRINT:PRINT"RANGE ";R%;". ";TAB(29-R%);
3010 IF U%=4 THEN PRINT"* ";ELSE PRINT" *";
3020 IF M=4 THEN PRINT TAB(30+R%);" *";ELSE PRINT
TAB(30+R%);" * ";
3030 PRINT TAB(64);"<- SEPARATION."
3040 PRINT TAB(30-R%);"]";:IF U%=3 THEN PRINT")";
3050 IF U%=2 THEN PRINT"\";
3055 IF U%=1 THEN PRINT"~";
3060 IF M=1 THEN PRINT TAB(29+R%);"~";
3065 IF M=2 THEN PRINT TAB(29+R%);"/";
3070 IF M=3 THEN PRINT TAB(29+R%);"(";
3075 IF M>3 THEN PRINT TAB(29+R%);" ";
3080 PRINT TAB(30+R%);"[";:PRINT TAB(30-R%);"]";
TAB(30+R%);"]":PRINT
3090 RETURN
8999 REM**LIST OF COMMANDS
9000 DATA BASH,STAB,PARRY,DUCK,RETREAT,CLOSE
9999 REM**THAT'S ALL FOLKS
10000 END

```





We proudly announce  
the arrival of the computer  
you have been waiting for

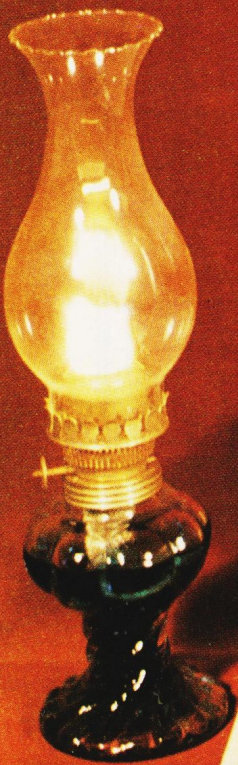


**pear II<sup>®</sup>**

**£ 975** excluding VAT

**Main features:**

- large amount of compatible software already available
- interactive cards, firmware & hardware available everywhere
- 14 I/O expansion slots as standard
- screen size: 25 lines of 40 characters, upper and lower case
- 32k byte of RAM standard, on board expandable to 96k byte
- uses the popular 6502 CPU
- bus compatible with the Z80 Firmware Card with CP/M and Microsoft BASIC
- Programming languages including BASIC, Fortran and Cobol etc., are available separately
- full PAL-colour video supplied as standard
- professional keyboard with function keys and number pad



**pearcom<sup>™</sup>**

Order from: **PEARCOM LTD.**,  
17 Nobel Square, Basildon - ESSEX SS13 1LP.  
Tel.: 0268 - 728484 — Tlx.: 995323 - England.

Or from: **PEARCOM B.V. i.o.**,  
Stationstraat 1a,  
6241 CL BUNDE (L). - Netherlands.



# Acorn Atom

## SOFTWARE

At low prices — All prices **inclusive!**  
Software is supplied on quality C12 cassettes.

### NEW RELEASE :

#### LUNAR LANDER

This is the proper arcade-type Lunar Lander, using the Atom's high resolution graphics. Continuous readouts on screen, 5 levels of play, high score etc. etc. Requires 12K RAM.  
ONLY £5.50

### NEW RELEASE :

#### ATOM GOLF

Very true-to-life game requiring skill and judgement. The only thing missing is the 19th hole! Requires 6K RAM + floating point. £5.00

### \* LOW PRICES MAINTAINED! \*

ATOM INVADERS (12K)	£8.00	2K PROGRAMS (2)	£4.50
PINBALL (6K)	£4.50	2K PROGRAMS (3)	£4.50
ATOM BREAKOUT (4K)	£4.00	PONTOON (4K)	£3.00
FRUIT MACHINE (8K)	£4.00	BATTLESHIPS (4K)	£3.00
UFO BOMBER (7K)	£4.00	BIO-RHYTHMS (4K)	£3.00
*STAR TREK (12K)	£5.00		
DISASSEMBLER (3K)	£4.00	SUBSCRIPTION TO	
2K PROGRAMS (1)	£4.50	"THE ATOM"	£3.95

Figures refer to **total** memory needed  
\* = Floating point required

We pay generous royalties  
on **your** software!

**SEND LARGE SAE FOR OUR FULLY ILLUSTRATED ATOM**

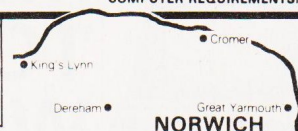
Note new address **CATALOGUE.** Mail Order only  
98-100, The Albany, Old Hall Street, Liverpool L3 9EG.

# BUG-BYTE

## ANGLIA COMPUTER CENTRE

MICROCOMPUTERS FOR  
BUSINESS, EDUCATION & HOME  
NO. 1 FOR ALL YOUR BUSINESS, EDUCATION & LEISURE  
COMPUTER REQUIREMENTS!!!

ACORN  
APPLE II & III  
TRS 80  
SHARP  
NORTH STAR  
HORIZON  
TANGERINE  
U.K. 101  
NASCOM  
VIDEO GENIE



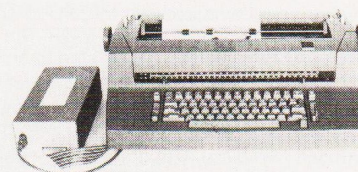
+ **PRINTERS &  
OTHER PERIPHERALS.**

**BOOKS\*\*  
SOFTWARE\*  
MAGAZINES\*\*  
STATIONERY\*\*\***

**WE ARE HERE!!!**  
88 St. Benedict's Street  
NORWICH NR2 4AB  
Tel: (0603) 29652  
24 hr. Answering Service  
OPEN Monday-Saturday

## 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.

# COMPUTING TODAY BINDERS

**SAVE  
IT**

Save it, your back issues of COMPUTING TODAY will fit neatly into the binders on sale. Each binder holds 12 issues and binders will only accommodate issue size up to issue dated April 1981.

Special sale price **£3.50**  
including postage, packing  
and V.A.T.

Overseas orders add 30p.

**Hurry now while stocks are  
available.**

NAT. GIRO. 5157552

Please allow 3/4 weeks  
delivery.

*it's easy with*

## EASIBIND

Easibind Ltd, 4 Uxbridge St, London, W8 7SZ.



## Order Form

I enclose P.O./cheque value ..... for ..... binders.  
Special sale binders for issue sizes up to April 1981.

**BLOCK LETTERS**

Name

Address

Registration No. 307469.



**Special binder sale  
Don't delay  
post today**



# 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.

FROM LEADING MANUFACTURER

£2.50

NEW



## COMPLETE EPROM SERVICE

COPYING

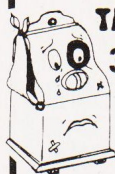
➡ ERASING

➡ CUSTOM PROGRAMMING EG TWO 2708  
INTO ONE 2716 and ADDRESS CHANGES ETC  
(all prices subject to VAT p + p 60p)

THIS COULD BE FUN (TECHNICAL SERVICES) LTD.

307 New Kings Rd., London SW6 4RF.

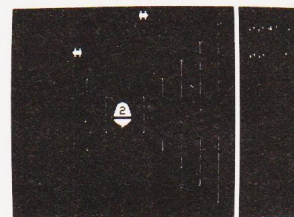
Tel. 01-736 5503/4



## ATOM OWNERS LOOK OUT

### There are DODGEMS about!

Dodgems is just one of the brand new games packs from Acorn, the manufacturers of your Atom. You have to steer your car around the lanes collecting points. But beware! There's a computer controlled car programmed on a collision course. If you survive the game gets faster. Also in Games Pack 6 are Simon and Amoeba.



### GET THE BEST—FORGET THE REST

All Acornsoft games are designed and produced by the manufacturers of the Atom. Trust the manufacturer to get the very best out of his product. Realistic sound effects, great graphics and colour too!

#### GAMES PACK 1

**Asteroids** Shoot them before they crash into you. Lists ten best scores. Program 4K, graphics 6K.

**Sub Hunt** Command a destroyer tracking a submarine, find its position and destroy it. Program 1K, graphics ½K, needs floating-point.

**Breakout** Score points knocking bricks from wall. Ball has two changes of angle and speed. Program 3K, graphics 1-2K. COLOUR

#### GAMES PACK 3

**Rat Trap** Move your rats without colliding with the trails left. Entangle your opponent before he entangles you! High-speed rat action-replay. Program 4K, graphics 6K.

**Lunar Lander** Land a spacecraft on a lunar crater; altitude velocity, fuel and drift. Program 1K, graphics ½K.

**Black Box** Deduce the position of four invisible objects in the Black Box by firing rays at them. Program 4K, graphics ½K.

#### GAMES PACK 4

**Star Trek** Classic computer game; rid the universe of Klingons. Short and long-range scans, galactic map, phasers, photon torpedoes, shields etc. Program 5K, graphics 2K.

**Four Row** Take turns in placing marbles on the board; the first to get a line of four wins. Program 5K, graphics 6K. COLOUR

**Space Attack** Repel the invasions of earth and avoid being hit by the gunner ships. Becomes progressively harder with each invasion. Program 3K, graphics 6K.

#### GAMES PACK 7

**Green Things** An alien life-form has invaded your space-craft; discover a way of destroying it with the weapons available on the ship. Program 5K, graphics 2K. COLOUR

**Ballistics** Take turns in firing shells at the other player, taking into account the wind and shape of the hill. Program 3K, graphics 6K, needs floating-point.

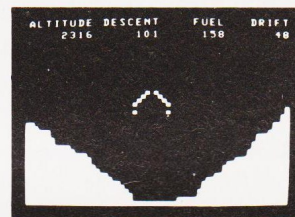
**Snake** Grow yourself a snake by guiding it towards digits which it eats. Program 2K, graphics ½K.

#### GAMES PACK 2

**Dogfight** Two-player game; each player controls a plane and tries to shoot down his opponent without crashing. Program 4K, graphics 6K.

**Mastermind** Guess the computer's code before the computer guesses yours; program 3K, graphics ½K.

**Zombie Land** on Zombie island; try to lure all the zombies into the swamp. In desperation jump into hyper-space! Program 3K, graphics ½K. COLOUR

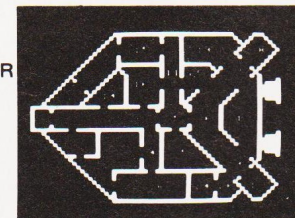


#### GAMES PACK 5

**Invaders** The most popular video game, with invaders, flying saucers, shelters, and full sound effects. Program 5K, graphics 6K.

**Wumpus** Wander in caves inhabited by the Wumpus. Find and shoot him before he eats you. Pits and bats make things harder. Program 2K, graphics ½K.

**Reversi** Reversi, or Othello played with counters that are black one side and white on the other; Program 3K, graphics ½K. COLOUR



### ORDER TODAY!

Just send a cheque or money order. Only £11.50 per pack including VAT and post and packing. State which packs you want.

Or ring 0223 316039 or 01-930 1614 quoting your Access or Barclaycard number. Allow 14 days for delivery.

Or if you think you can wait for more details just write to  
Acornsoft Limited, 4a Market Hill, Cambridge.

**ACORNSOFT TAKE GAMES SERIOUSLY**



# UPGRADE YOUR PET

Mike James

## Expanding the memory capacity of your 16K PET can be a relatively simple operation if you follow our guide

**W**hen the first PETs were introduced in 1978 their standard 4K seemed to be both adequate and a bargain! Now it seems strange that anyone could have managed to write a program in so small a space and why would anyone build a machine with such little storage?! In microelectronics things move fast and most microcomputer owners soon find that the machine they bought as 'just what they needed' is now too small. For both the 4K and 8K PETs the only solution is to buy a memory expansion unit, either an internal board or an external box. For the more recent 16K PETs expansion to 32K can generally be achieved simply by changing a number of memory chips on the main logic board. This modification is simple and should be within the capabilities of anyone willing to take the covers off.

It appears that in some models Commodore deliberately prevented the modification I suggest by drilling holes in the part of printed circuit board where the extra chips would otherwise be mounted. People who find quarter inch holes in their PET's PCB should *not* try to upgrade as described in this article.

Having said that, it should be pointed out that any modifications carried out will render any remaining guarantee on your PET invalid and if you do get stuck you may have to pay to be rescued. So, before you begin, read this article carefully, open and examine your PET and make sure that you feel up to the work **BEFORE** you place your order for the necessary chips and things.

### Two PETs!

When Commodore introduced the 16K PET they did, in fact, introduce two different versions: a true 16K machine and a 32K machine with half of the memory left out (which I shall refer to as a 16/32K machine). Conversion of the 16/32K type is considerably easier than for the 16K type. Before conversion we have to discover which it is we have. In all of the PETs that I've encountered the 16K versions were called '2000 series' and the 16/32K types were called '3000 series' so by looking at the front legend you should have a good idea of which type you've got. However, I cannot claim that this observation always holds true so the only sure way of discovering your type is to look at the main logic board. This is not too difficult. First the

case of the PET has to be opened. The best way to do this is to tip the PET over so that it is resting on its back and remove the four Philips screws, near the front holding the black base to the cover. Then tip the entire PET back to its usual position and hinge the cover up (display screen and all!) to reveal the main logic board. To make things easier a metal arm will be found on the left hand side inside the cover which can be used to prop the cover up in much the same way as the bonnet of a car (Commodore think of everything!).

After marvelling at how pretty the inside of your PET is (it runs all your programs and it looks pretty!) it's necessary to identify a few components. Looking at the front right hand side of the main logic

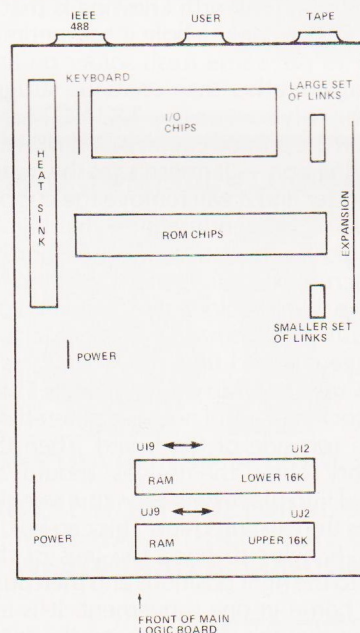


Fig. 1. The layout of the circuit board showing the locations of the main components.

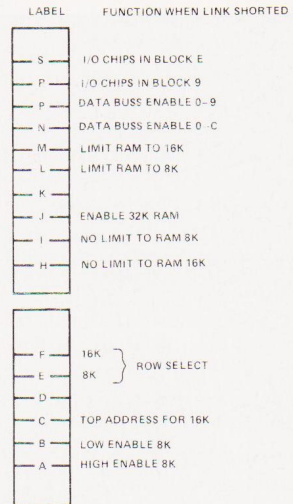


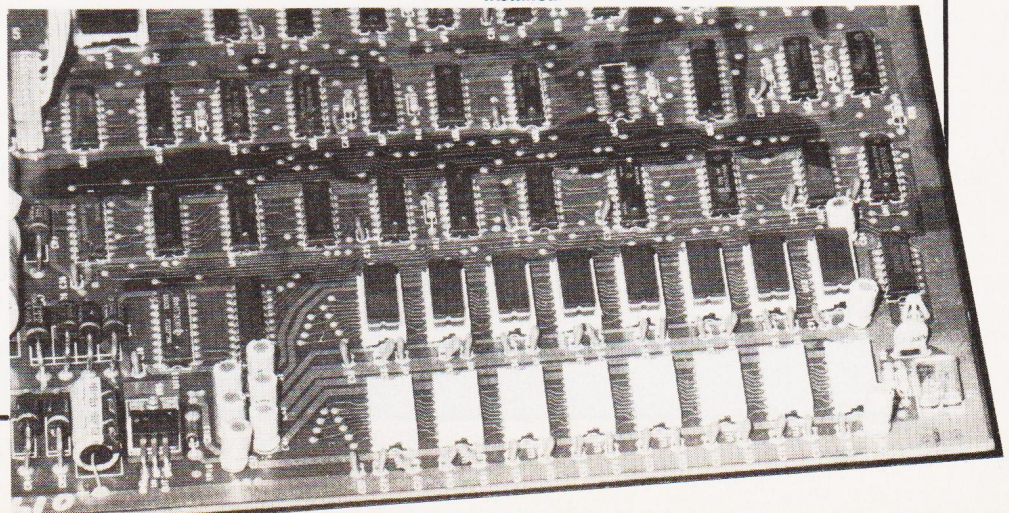
Fig. 2. What the links do.

board (Fig.1 should help) you will see either two rows, each of eight chips, one labelled (on the board) U12 to U19 and the other labelled UJ2 to UJ9 or one row of chips labelled (on the board) U12 to U19 and one row of eight ghostly solder-filled chip locations where chips might have been expected. If you have two rows of chips then you have a 16K PET: a further check is that each of the chips should bear the number 4415 somewhere. If you can only find one row of chips you have a 16/32K PET and a further check for this is that each of the chips should bear the number 4416 somewhere. While you have the cover open it's worth identifying the other two relevant items on the main logic board, the 'programming links'. If you look towards the back of the board on the right hand side near the edge you should be able to locate two black plastic strips with metal bands at right angles (some of the metal bands will have been cut through). When you have found them, all that is necessary for the time being is to notice that they are labelled as shown in Fig.2.

### Desoldering

Most 'how to do it' articles use their words to tell the novice how to solder a

Halfway through upgrading with the new sockets installed.





chip into place without heating it to the point of no return — ie how to notice that it's about to flow off the side of the board in a black plastic puddle. In this case it's *desoldering* that is our problem. Desoldering differs from soldering in that, in general, the component that we are removing is of little importance, so the condition that it leaves the board in doesn't matter. This would make desoldering easy if it wasn't for the fact that we are concerned about the state of the printed circuit board *after* the component is removed. Too much heat will remove the copper tracks from a board more easily than the component.

I've tried most of the methods of desoldering on the market and talked to people who've tried methods not in the text books (including one who favoured a blow lamp!) and one thing I've discovered is that there is no 100% sure method of removing components from a board without damage or frustration. But of the methods I've used I can recommend only one. The technique I favour is based on a *large* wattage soldering iron and a plunger type solder sucker. A large wattage iron is necessary to heat the solder on both sides of the board and the spring loader solder sucker is usually (as long as it has a newish tip) strong enough to remove most of the solder. The procedure is to heat the solder on the reverse side of the board, *without pressing hard* on the copper foil, and when the solder is well melted to place the tip of the solder sucker right over the hole and press the release button. If you've been successful all of the solder should be removed in one go. When all of the legs of a chip have been desoldered it can usually be removed with a small amount of pressure from a screwdriver (be careful not to damage the front copper tracks with the blade) or an IC remover. Notice that only a small amount of pressure should be used, because although it is possible to remove a partially desoldered chip from a board with brute force with no apparent harm it usually results in the through plating being ripped from the board. For those who don't know about through plating it means that the holes through the printed circuit board are plated with copper and serve to connect any copper tracks on the top of the board to any tracks on the bottom. If the removal of a chip has resulted in the destruction of any through plating it can usually be seen by the bits of reddish copper sticking to the legs of the removed chip.

Just as with soldering, desoldering needs practice and a certain amount of skill — but if you are patient it's not too difficult, especially if you buy the correct tools.

## Converting The 16/32K PET

At last we come to the details of conversion and we start with the easier of the two, the 16/32K PET, which is also the cheapest. The components required are:

8 4116 Dynamic RAM (DRAM) chips (cost about £2.50 each)

8 16 pin DIL sockets (cost about 10 pence each).

The first job is to remove the main logic board. After *disconnecting your PET from the mains* unplug the connectors and remove the two screws from the logic board, being careful of the earth lead on the screw near the back. Then unclip the printed circuit board clips by pressing them in and lifting the board slightly.

The second job is to remove the solder from the vacant chip positions on the printed circuit board. This is relatively easy as long as you are patient — get the solder good and hot so that it is fluid on both sides of the hole and then place the nozzle of the desoldering tool right over the hole and press the button! If you're lucky the hole will be clear, if not try again. A tip worth knowing is that if you partially clear a hole it's sometimes easier to put some fresh solder on and start again rather than continue struggling. The only caution is — **DO NOT** press hard on the printed circuit board with the soldering iron — it doesn't get the board any hotter and it will remove the copper foil — so be gentle! After clearing all eight positions find an old toothbrush and scrub both sides of the board to remove loose solder and inspect very *carefully* for damaged tracks. If any damage is found then repair using very fine wire (wire wrap gauge is ideal). The 8 chip sockets should now be soldered onto the top side of the board. Then the memory chips themselves should be pushed into place with the same orientation as the existing chips. This can be difficult. It helps to bend the legs of the chips to the right positions and then push them home in one movement. It is important that the new chips are the *same way round* as the old ones.

At this stage check that the con-

figuration of the wire 'programming links' is as shown in Fig.3. If not alter them accordingly. Replace the main logic board by reversing the procedure for removal. It is important not to forget to replace the earth cable under the screw at the back of the board. Close the PET and reconnect the mains. When you switch on you should be greeted by

31743 BYTES FREE

If not, read the section on fault finding and even if you have the correct answer run the memory diagnostic given in that section to make sure everything's OK.

## Converting The 16K PET

This is a little more difficult and expensive. The components you require are:

16 4416 DRAM chips

16 16 pin DIL sockets.

First the main logic board has to be removed as described for the 16/32K machine. The next job is the most difficult: each of the 16 memory chips marked U12 to U19 and UJ2 to UJ9 on the board have to be removed. This can be done by using the desoldering method earlier described, or by cutting the pins of the chips with a good quality pair of side cutters and then removing the end pins with a hot soldering iron and clearing the holes as for the 16/32K conversion. If this 'cut and rip' method is used then obviously the chips that are removed are useless but it is the safest way. Again it is important to work with care to avoid damaging the printed circuit board.

After this operation is complete the chip sockets should be soldered in and the chips added. Again, they should be the *same way round* as the old chips. Before closing the case and testing we have to alter the two sets of 'programming links' mentioned earlier. These should be as shown in Fig.3 and the links must be cut and joined with solder accordingly.

Finally switch on and test.

## Testing And Repairing

If you are not greeted with PET's 32K sign-on then you have problems and even if you are you may still have problems! To check your memory run the diagnostic program given below and note the results. If you can't even get the program in then your first 2K of memory has got troubles. Any faults found by the diagnostic program can be pinned down to the printed circuit board or a chip by the simple method of moving the lower row of eight chips to the top row and vice versa. If the fault moves then a chip is the cause. Which one can be found by swapping chips within a row. If the fault stays put then the printed circuit board or socket is the problem. Remake all the

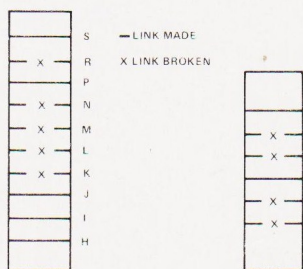


Fig. 3. How the links should look after upgrading.

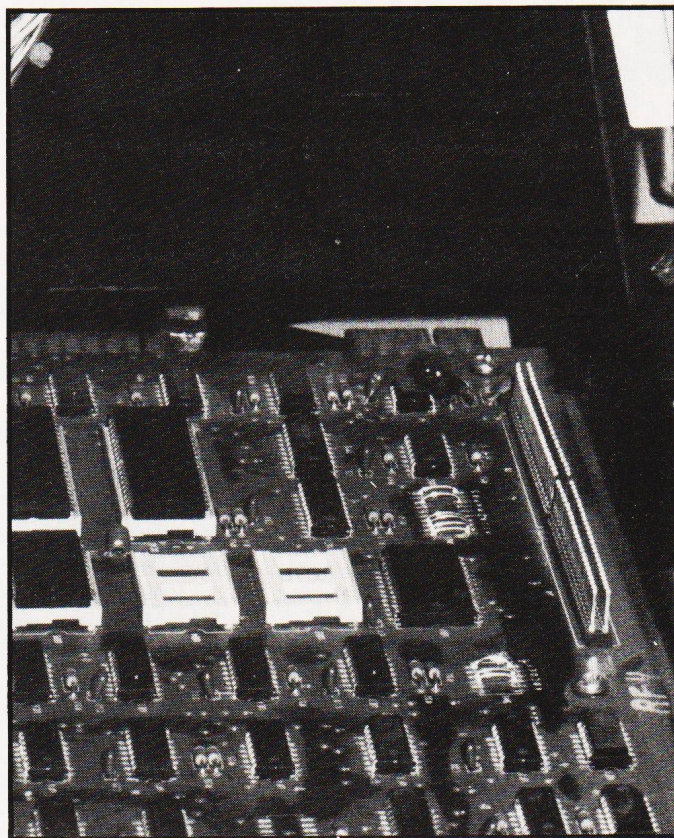


joints and check for solder bridges etc. If all fails then you need a logic probe to find out which lines are shorted or not connected and if you haven't got one — you need help.

If after reading this article you are in the least bit doubtful about conversion — then don't. However, it is relatively easy, and apart from trouble with the printed circuit board very little can go wrong. If you have a 16/32K PET then it is especially trouble free because unsoldering filled IC pads is almost impossible to do incorrectly and the worst that can happen is that a fault will lie in one of the new memory chips.

Happy desoldering!

The links show up clearly here at the rear of the board.

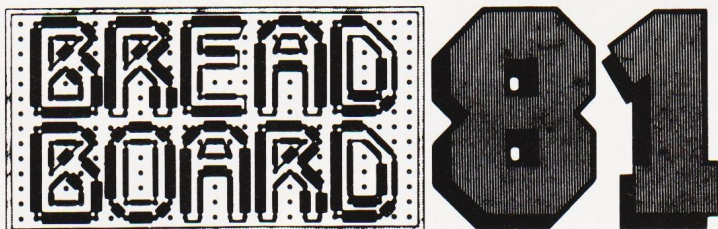


```

10 INPUT "START ADDRESS"; A:REM** (typical value of A —
    2000)
20 INPUT "END ADDRESS"; B:REM** (typical value of B —
    31000)
30 FOR I=A TO B
40 POKE I, 170
50 NEXT I
60 FOR I=A TO B
70 IF PEEK(I) < > 170 THEN PRINT "ERROR AT";I
80 POKE I,85
90 NEXT I
100 FOR I=A TO B
110 IF PEEK(I) < > 85 THEN PRINT "ERROR AT";I
120 NEXT I
    
```

The memory test program.

## COMPUTERS • AUDIO • RADIO • MUSIC • LOGIC • TEST GEAR • CB • GAMES • KITS



Wednesday	11th November	10 a.m.-6 p.m.
Thursday	12th November	10 a.m.-8 p.m.
Friday	13th November	10 a.m.-6 p.m.
Saturday	14th November	10 a.m.-6 p.m.
Sunday	15th November	10 a.m.-4 p.m.

## COMPONENTS • DEMONSTRATIONS • SPECIAL OFFERS • MAGAZINES • BOOKS

ROYAL HORTICULTURAL SOCIETY'S  
NEW HALL, GREYCOAT STREET,  
WESTMINSTER, LONDON S.W.1.

### 17,000 PEOPLE CAN'T BE WRONG

For 5 days last year they packed the RHS halls for Breadboard '80. All the leading companies were there.....

.....and they're back again this year for BREADBOARD '81.....with larger stands and wider gangways.

Whether you're buying or just browsing, BREADBOARD '81 has something to offer you. The top electronics magazines will be there.

If you're interested in kits, components or computing, BREADBOARD '81 covers it all..... books, bargains and demonstrations. It's all happening at BREADBOARD '81.

Cost of entry will be £2.00 for adults, and £1.00 for children under 14 yrs and O.A.P.s.

To avoid queueing. Advance tickets will be available from:  
Advance Tickets BB '81,  
Modmags Ltd, 145 Charing Cross Road,  
London WC2H 0EE.

**\*\*Special Advance Booking Price\*\***  
Adults £1.75, Children under 14 yrs and O.A.P.s 80p

Please send..... tickets @ £1.75 ..... tickets @ 80p

To .....

.....

.....

I enclose PO/cheque for £ .....

Advance tickets MUST be ordered BEFORE 20th October 1981.



# New! Sinclair ZX81 Personal Computer.

**Kit: £49.<sup>95</sup> complete**

## Reach advanced computer comprehension in a few absorbing hours

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. At £99.95, the ZX80 offered a specification unchallenged at the price.

Over 50,000 were sold, and the ZX80 won virtually universal praise from computer professionals.

Now the Sinclair lead is increased: for just £69.95, the new Sinclair ZX81 offers even more advanced computer facilities at an even lower price. And the ZX81 kit means an even bigger saving. At £49.95 it costs almost 40% less than the ZX80 kit!

## Lower price: higher capability

With the ZX81, it's just as 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, or to select a program off a cassette through the keyboard.

## 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!

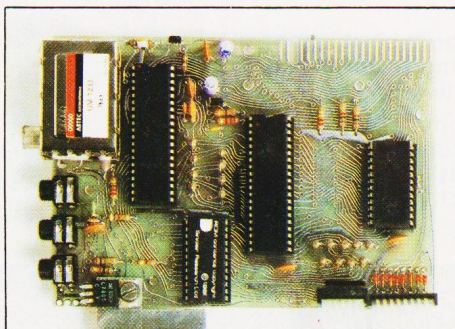
The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

**Built:  
£69.<sup>95</sup>  
complete**

## Kit or built – it's up to you!

The picture shows dramatically 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).

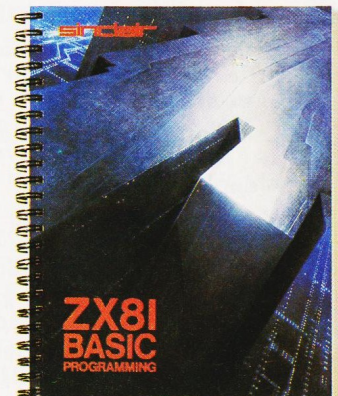
Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



Proven micro-processor, new 8K BASIC ROM, RAM – and unique new master chip.

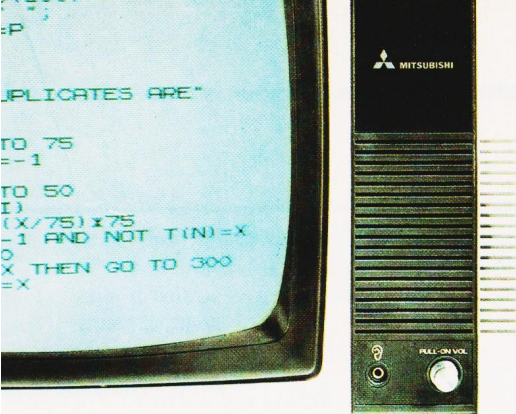


## New BASIC manual



Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.





### New, improved specification

- Z80 A 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 (not available yet – but coming soon!)
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

# sinclair ZX81

**Sinclair Research Ltd,**  
6 Kings Parade, Cambridge, Cambs.,  
CB2 1SN. Tel: 0276 66104.  
Reg. no: 214 4630 00.

## 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.

## Coming soon- the ZX Printer.

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics across 32 columns, and highly sophisticated graphics. Special features include COPY, which prints out exactly what is on the whole TV screen without the need for further instructions. The ZX Printer will be available in Summer 1981, at around £50 – watch this space!



## 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.



### How to order your ZX81

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

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

				Order
Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack(s).	18	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.

COT09



# DISC PURGE

Tony Lacy

## An intelligent disc management utility for TRS 80s

**T**his program is intended to run on a system with one or more disc drives. With the CLEAR argument and array sizes shown it occupies 5K bytes in memory and 3 granules on disc. It is written in DISC BASIC 1.1 and needs to run under NEWDOS. A 'system' disc should be in drive :0 at all times.

### Purpose Of The Program

I recently purchased a second disc drive unit and decided to re-arrange my disc files to take maximum advantage of the upgrade. The plan involved using drive :0 to hold utility programs and, of course, the DOS.

Drive :1 would contain any other programs or data and the discs would be data discs containing a minimum of system information (BOOT/SYS and DIR/SYS).

On the face of it this would involve formatting discs and transferring the required files over from a system disc, using FORMAT and COPY, a laborious task. Well, there is another way. If all the system files (except BOOT/SYS, DIR/SYS and any other programs or data) could be removed we would end up with a data disc. This is one of the functions of the program.

There was also a need to remove duplicated files, backup copies, etc, and I had been playing around with TRS 80 FORTRAN — this seems to spawn hundreds of superfluous files! The other main function of the program is to remove the tedium of KILLXXXX, KILLYYYY, and so on. Instead of this the user is presented with the question 'KILL Y OR N' for each file, and the program does the rest. A search and kill of specified types of file can also be done, a typical example of this option would be to remove all of the 'BAS' files on a disc.

### Using The Program

The program is self-prompting — just answer the questions as they appear. Since mistakes on disc files tend to be big ones, the input data is presented to the user for checking before any files are killed. Also, since drive :0 must always contain a system disc the option 'REMOVE SYSTEM FILES' is not presented if drive :0 is selected. I would recommend that the program is tested thoroughly on a backup disc before it is let loose on your program library!

The 'KILL FILES BY CATEGORY' option requires some care in use, the user is prompted to 'ENTER KEY'. A string of characters is entered and the program will search for files containing the keyword as a substring: I will give a few examples.

<SPACE> <ENTER> Most filespecs contain trailing spaces, usually as a 'blank' password, so this program would probably select ALL of the visible files for killing. You would be shown a list of these files, and be able to change your mind, BEFORE the files were killed.

If you typed <BAS> <ENTER> the following files would be selected, if present:

BASEBALL/CMD  
TUBAS/REL  
POOL/BAS  
BBBASSS/CMD

To kill files with the 'BAS' extension the correct form would be </BAS> <ENTER>, note the space.

### How The Program Works

The main problem was to get directory information into the program from disc since DIR/SYS is not readable like a normal file. I have seen some clever ways of doing this, for example a special DCB can be defined in machine code and DIR/SYS can be read into a buffer which also happens to be a string array. The array could then be processed by a BASIC program. Well, I didn't do it like that!

The method used here is to get a directory display onto the screen using CMD 'XXXXX', this method of accessing DOS is not available in TRSDOS, by the way. The screen information is then PEEKed into a string array.

Refer to the main program listing for the following description.

LINE 50 Defines string space and array sizes, the values given work fine on my system, you might have to change them. Note the use of '\$' character in the program, all variables not defined as strings are integers.

LINES 70-130 Various functions are defined here for use later, see the associated :REM statements in the listing.

LINES 160-190 The command for killing system files is built up, a 'universal' password is added and the file currently being killed is displayed.

LINES 200-340 These are keyboard input routines, the routine at 230 is similar in function to the standard INPUT statement, except that pressing <ENTER> does not print a line feed to the screen, this is useful when we need to use the bottom line but wish to avoid a screen scroll.

LINES 360-440 The main program starts here and asks the user which drive is to be used, so that it can present the correct options in the next section.

LINES 460-560 Get the option and set various flags, depending on the choice. Refer to the list of variables used for information on these flags.

LINES 580-740 The directory for the target file is displayed and as file information is extracted, it is flagged in line 690 or 720, depending on the option previously selected, and if it is to be killed. We wish to avoid screen scrolling at this stage and so the subroutine at 230 is used to enter strings. If there are so many files that the directory display scrolls off the screen then the program will only kill the files which appear below print position 192, you can either run it twice or kill the extra files manually.

LINES 760-740 The files to be killed are displayed for a final check. If the list is correct then mass murder begins!

LINES 830-980 The files are killed, if a 'P' followed the filename then the program halts and requests the password. If the incorrect password is given then the error is trapped and you are given the choice to try again or go on to the next file.

LINES 1000-1090 This is the error trapping routine, its function is to take action on either ERROR70 (FILE ACCESS DENIED) or ERROR54 (FILE NOT FOUND). Any other error will be processed in the normal way, that is with program halt and the usual error message. The list of disc related error codes in the TRSDOS manual is *not* correct, by the way.

LINES 1100-1270 This section does a system purge, it converts a system disc into a data disc without affecting user files or data. This section can only be used if drive :0 was NOT selected, suitable stern warnings are given on the screen before the killing starts. If a particular system file is not present a message is displayed and the program continues.



And that's it! The program was concocted for a specific purpose and I hope that it will be as useful to others as it has been to me.

## Variables Used

A	Dummy variable	G	Set to 1 if system purge was selected	Q\$	Used in 'CMD 'XXX' ' statement
BLANKS	Function name, returns 0 if no password	I-I7	Loop counters, array pointers	SYS	Name of SYSTEM file to be killed
C	Set to 1 if option 2 is selected	KEY	Key string for option 3	TRAIL	Function name, removes trailing blanks
ENT	Set to 1 if keyboard character was < ENTER >	L	Dummy variable	U	Single character returned from keyboard
FLAG	Used to mark files to be killed	LEAD	Function name, removes a leading character	UD	As U but between MIN and MAX, or < ENTER >
		M	Dummy variable	VID	Filespec, obtained from video display
		MAX	Maximum acceptable keyboard input	ZAP	Filespec, including password and drive number.
		MIN	Minimum acceptable keyboard input		
		ND	Target drive number		
		PASS	Password for protected files		

## Program Listing

```

10 REM**DISC PURGE
20 REM**INITIALISE, ARRAYS MAY NEED TO BE LARGER FOR
30 REM**SOME SYSTEMS
40 REM**SUGGEST REMOVE REMS FOR WORKING VERSION
50 CLEAR 1000:CLS:DEF INT A-J:DEF STR K-Z:DIM VID(42),
  FLAG(42)
60 REM**REMOVES TRAILING BLANKS FROM A STRING
70 DEF FNTRAIL(M) = MID$(M,1,INSTR(M," ") - 1)
80 REM**REMOVES A LEADING CHR FROM A STRING
90 DEF FNLEAD(L) = RIGHT$(L,LEN(L) - 1)
100 REM**RETURNS ZERO IF PASSWORD IS BLANKS ONLY
110 DEF FNBLANKS(M) = INSTR(INSTR(M," "),M,"P")
120 ON ERROR GOTO 1000
130 GOTO 360
140 REM**SYSTEM FILE KILL
160 ZAP = SYS + ".NV36" + ":" + ND
170 PRINT@192,SYS;CHR$(30);
180 KILL ZAP
190 RETURN
200 REM**GET ONE CHARACTER FROM KEYBOARD
210 U = INKEY$:IF U = "" THEN 210 ELSE RETURN
220 REM**BUILD A STRING CALLED 'KEY'
230 GOSUB 210:IF U < " [SPC]" THEN RETURN
240 PRINT U;:KEY = KEY + U:GOTO 230
250 REM**GET A 'Y' OR 'N' FROM KEYBOARD
260 PRINT " --- Y OR N ";:GOSUB 210:IF U = "Y" OR U = "N"
  THEN RETURN
270 PRINT "PLEASE ANSWER 'Y' OR 'N' ";:FOR I6 = 1 TO 500:
  NEXT
280 PRINT STRING$(36,8);:GOTO 260
290 REM**GET A CHR BETWEEN MIN AND MAX OR SET FLAG
  ENT IF 'ENTER'
300 ENT = 0:GOSUB 210:IF U > = MIN AND U < = MAX THEN
  UD = U:RETURN
310 IF U = CHR$(13) THEN ENT = 1:RETURN
320 PRINT "BETWEEN ";MIN;" AND ";MAX;" PLEASE";:GOSUB
  330:GOTO 300
330 FOR I = 1 TO 500:NEXT:PRINT CHR$(29);:PRINT CHR$(30);:
  RETURN
340 RETURN
350 REM**START OF MAIN PROGRAM
360 PRINT TAB(20)"PURGE UTILITY 1.2"
370 PRINT TAB(20)"-----":PRINT:PRINT
380 PRINT "THIS UTILITY NEEDS TO HAVE A 'NEWDOS'
  SYSTEM DISC IN"
390 PRINT "DRIVE :0 AT ALL TIMES":PRINT
400 PRINT "WHICH DRIVE IS TO BE USED? (ENTER WILL
  DEFAULT TO :0)"
410 MIN = "0":MAX = "3":GOSUB 300
420 IF ENT = 1 THEN UD = "0"
430 PRINT "DRIVE ";UD;:GOSUB 260
440 IF U = "N" THEN RUN
450 KEY = ""
460 PRINT@192,CHR$(31);"DRIVE ";UD;" --- SELECT YOUR
  OPTION";

```

```

470 PRINT " (OR ENTER TO START AGAIN)"
480 PRINT:PRINT:PRINT "0";TAB(10)"EXIT PROGRAM"
490 PRINT "1";TAB(10)"KILL SPECIFIED FILES"
500 PRINT "2";TAB(10)"KILL FILES BY CATEGORY"
510 IF UD < > "0" THEN PRINT "3" TAB(10);"REMOVE SYSTEM
  FILES"
520 MIN = "0":IF UD < > "0" THEN MAX = "3" ELSE MAX = "2"
530 ND = UD:GOSUB 300:IF ENT = 1 THEN RUN
540 IF UD = "0" THEN END
550 IF UD = "3" THEN 1110
560 IF UD = "2" THEN C = 1 ELSE C = 0
570 REM**GET FILESPESCS FROM SCREEN INTO ARRAY 'VID'
580 Q$ = "DIR : " + ND
590 CMD "Q$"
600 IF C = 1 THEN PRINT@960,"ENTER KEY STRING ";:GOSUB
  230
610 FOR I = 15488 TO 16320 STEP 64:FOR I1 = 0 TO 40 STEP 20
620 FOR I2 = I + I1 TO I + I1 + 19:VID(I3) = VID(I3) + CHR$(
  PEEK(I2))
630 NEXT I2
640 IF C = 0 THEN PRINT@960,CHR$(30);
650 REM**IF 'FLAG' = 1 THEN FILE IS TO BE KILLED
660 FLAG(I3) = 0
670 IF LEFT$(VID(I3),1) = " [SPC]" THEN 760
680 IF C = 0 THEN 710
690 IF INSTR(VID(I3),KEY) < > 0 THEN FLAG(I3) = 1
700 GOTO 730
710 PRINT VID(I3);" --- KILL";:GOSUB 260
720 IF U = "Y" THEN FLAG(I3) = 1
730 I3 = I3 + 1
740 NEXT I1,I
750 REM**DATA VERIFICATION
760 CLS:PRINT "THESE FILES ARE TO BE KILLED ON DRIVE
  ";ND;:PRINT
770 PRINT:FOR I4 = 0 TO I3
780 IF FLAG(I4) + 1 THEN PRINT VID(I4),
790 NEXT I4
800 PRINT:PRINT:PRINT "CORRECT? ";:GOSUB 260
810 REM**ESCAPE CLAUSE
820 IF U = "N" THEN RUN
830 CLS:PRINT "KILLING FILES, DRIVE ";ND;:PRINT
840 FOR I4 = 0 TO I3 - 1
850 IF FLAG(I4) = 0 THEN 970
860 PRINT@192,VID(I4);CHR$(30);
870 ZAP = FNTRAIL(VID(I4))
880 IF FNBLANKS(VID(I4)) = 0 THEN 950
890 PRINT@192,VID(I4);" ";ND;"IS PASSWORD PROTECTED
  !!!":PRINT
900 PASS = ""
910 INPUT "PASSWORD PLEASE";PASS
920 PRINT@213,CHR$(31);
930 REM**BUILD UP FILESPEC AND THEN KILL
940 ZAP = ZAP + ":" + PASS
950 ZAP = ZAP + ":" + ND
960 KILL ZAP
970 NEXT I4
980 RUN
990 REM**TRAP ERRORS AND TAKE APPROPRIATE ACTION
1000 IF ERR = 138 THEN 1050

```



```

1010 IF G=0 THEN ON ERROR GOTO 0
1020 IF ERR < > 106 THEN 1040
1030 PRINT@192,SYS;" NOT FOUND, CONTINUING";CHR$(30);
FOR I5=1 TO 400:NEXT:RESUME NEXT
1040 ON ERROR GOTO 0
1050 PRINT:PRINT"ACCESS DENIED, TRY AGAIN (Y) OR SKIP
THIS FILE (N)?"
1060 PRINT:PRINT"TYPE ";:GOSUB 260
1070 PRINT@192,CHR$(31);
1080 IF U="Y" THEN RESUME 870
1090 RESUME 970
1100 REM**SYSTEM PURGE
1110 CLS:PRINT"DRIVE ";ND;TAB(20)"!! WARNING !!"
1120 PRINT:PRINT"SYSTEM PURGE WILL KILL ALL '/SYS' FILES
EXCEPT"
1130 PRINT"FOR BOOT/SYS AND DIR/SYS. IT WILL ALSO KILL
FORMAT/CMD"

```

```

1140 PRINT"COPY/CMD AND BASIC/CMD"
1150 PRINT:PRINT"GO AHEAD? ";:GOSUB 250
1160 REM**ESCAPE CLAUSE FOR THE NERVOUS
1170 IF U="N" THEN RUN
1180 G=1:CLS:PRINT"KILLING SYSTEM FILES, DRIVE ";ND;:
PRINT
1190 FOR I7=0 TO 13
1200 SYS="SYS"+FNLEAD(STR$(I7))+"/"+SYS"
1210 GOSUB 160
1220 NEXT I7
1230 SYS="COPY/CMD":GOSUB 160
1240 SYS="FORMAT/CMD":GOSUB 160
1250 SYS="BASIC/CMD":GOSUB 160
1260 CLS:PRINT:PRINT"SYSTEM PURGE COMPLETE, PRESS
ENTER TO CONTINUE"
1270 INPUT A:RUN

```

# PET LISTER

Paul Williams

## Convert PET's awkward graphics to CT standard codes

When PET BASIC programs are listed on a printer, the cursor controls and shifted characters are printed as cryptic symbols that are often difficult to decipher. This machine code program lists BASIC programs on paper, spacing out the statements (if necessary) and showing cursor control and shifted characters as more easily identifiable characters, these generally correspond to the CT standards.

A Clear Screen (normally "☐") is printed as "[CLS]"

A Cursor Down (normally "␣") is printed as "[CD]"

Shifted characters are printed as their unshifted versions but in square brackets ([ ]).

### Using It

To list a BASIC program in this way, load the lister, type NEW and then load the BASIC program. If SYS 30000 is now typed, the program will be listed in this special way on the printer, as fast as a normal listing. After one SYS 30000, the area of memory used for the lister program will be protected from being overwritten by strings, as the top of memory pointers are set by the machine code program.

The lister can be entered using an assembler, or using TIM. If you are using an assembler on an 8K machine, change BEGIN = \$ 7530 to BEGIN = \$ 1EDC and execute the program with a SYS 7900 instead. Because a number of zero-page and ROM addresses are used by the program, it will not work without con-

siderable alteration on the Old ROM machines.

### How It Works

As BASIC statements in a program are stored as single bytes (eg 128 for END and 153 for PRINT) to save memory and speed up the interpreter, reference has to be made to the ROM table of statements to print the correct characters for each command. If the lister finds a BASIC token byte while listing on the printer, it does not directly print it but finds the correct word in the ROM string starting at \$ C092.

At \$ 758D in the lister, if the LDA #0 is changed to LDA #32 (A9 00 Hex to A9 20 Hex), a space will automatically be printed after each keyword (eg PRINT, GOTO, — etc). This amendment can make program listings even clearer, but often it is better to leave \$ 758D as LDA #0.

The actual method used by the lister is explained in the assembler listing, and the program takes just over 256 bytes.

The changes made to cursor control characters in the output of the lister are shown below:

	MEANING	NEW CHARACTERS
Q	DOWN CURSOR	[CD]
J	CURSOR RIGHT	[CR]
□	CURSOR UP	[CU]
■	CURSOR LEFT	[CL]
S	HOME CURSOR	[HOME]
☐	CLEAR SCREEN	[CLS]
R	REVERSE FIELD	[RVS]
▬	OFF REVERSE FIELD	[OFF]

All shifted graphic symbols are printed as unshifted characters in square brackets.

```

1500 PRINTCHR$(147):CLR:DIMA$(50,10)
1510 PRINTTAB(12)"CREATE RECORD":PRINT:
1520 GOSUB 2470:REM * LINE
1530 PRINT"WHAT IS FILE NAME ";:GOSUB2340:REM ** KEYBOARD INPUT **
1540 N#=18#:PRINT
1550 GOSUB 2470:REM * LINE
1560 PRINT"HOW MANY COLUMNS IN EACH RECORD ";:GOSUB2340
1570 N=VAL(18#):PRINT
1580 IFN<10ORN>10THENPRINT"MAXIMUM IS 10":GOTO1560
1590 PRINTCHR$(147):C=1
1600 PRINT"THIS FILE IS NAMED "N#":GOSUB2470
1610 PRINT"REMEMBER THAT COLUMN 1 IS THE KEY FIELD":PRINT
1620 PRINT"WHICH WILL BE USED TO IDENTIFY RECORD":GOSUB2470
1630 PRINT"STATE TITLE OF COL"C" ";:
1640 GOSUB2340:REM * KEYBOARD INPUT
1650 A$(0,C)=18#:PRINT

```



## Program Listing

QUOTES	= \$00	In quotes flag
NEXTLN	= \$01	Pointer to next BASIC line
PTR	= \$0F	Text pointer
TXST	= \$28	Start of BASIC program pointer
HIMEM	= \$34	Top of RAM
LENFN	= \$D1	Length of file name
LOGFL	= \$D2	Logical file number
SECAD	= \$D3	Secondary address
DEVICE	= \$D4	Device number — Printer = 4
BEGIN	= \$7530	Start of lister: SYS 30000
PRTLN	= \$DCD9	Prints a decimal number < 65536
OPEN	= \$F524	Open file
SETOUT	= \$F7BC	Set output device
RESTOR	= \$F272	Restore all I/O
CLOSE	= \$F2AC	Close file
STOP	= \$F301	Test STOP key
SPACE	= \$FDCD	Print a space
CRLF	= \$FDD0	Print (CR) (LF)
PRINT	= \$FFD2	Print ASCII character
BASIC	= \$C092	Table of BASIC keywords

7530	A5 30	LDA < BEGIN	Set top of memory pointer to
7532	85 34	STA HIMEM	Protect lister from being corrupted
7534	A5 75	LDA > BEGIN	
7536	85 35	STA HIMEM + 1	
7538	A9 00	LDA #0	
753A	85 D1	STA LENFN	No file name for Printer
753C	85 D3	STA SECAD	No secondary address needed
753E	A9 04	LDA #4	
7540	85 D2	STA LOGFL	
7542	85 D4	STA DEVICE	
7544	20 24 F5	JSR OPEN	Open file to Printer : OPEN 4,4
7547	A6 D2	LDX LOGFL	
7549	20 BC F7	JSR SETOUT	Set output device to Printer
754C	A5 28	LDA TXST	
754E	A6 29	LDX TXST + 1	Start of BASIC program pointers
7550	85 0F	NEWLIN STA PTR	Set lister pointer to
7552	86 10	STX PTR + 1	Start of next line
7554	20 70 75	JSR LAST	Save pointer to next line
7557	85 01	STA NEXTLN	
7559	20 6A 75	JSR NEXT	
755C	85 02	STA NEXTLN + 1	
755E	D0 15	BNE MOR100	Must be more lines to follow
7560	20 D0 FD	FINISH JSR CRLF	Terminate listing
7563	20 72 F2	JSR RESTOR	Restore output device to screen
7566	20 AC F2	JSR CLOSE	Close file, then
7569	60	RTS	Return to BASIC
756A	E6 0F	NEXT INC PTR	Subroutine to get
756C	D0 02	BNE LAST	Next character from
756E	E6 10	INC PTR + 1	BASIC text
7570	A0 00	LDY #0	
7572	B1 0F	LDA (PTR),Y	PTR is pointer to actual text
7574	60	RTS	
7575	20 01 F3	MOR100 JSR STOP	STOP key pressed?
7578	F0 E6	BEQ FINISH	Yes — terminate listing
757A	A9 00	LDA #0	Beginning of line so no quotes
757C	85 00	STA QUOTES	
757E	20 6A 75	JSR NEXT	Get line number
7581	AA	TAX	Store high byte
7582	20 6A 75	JSR NEXT	Get low byte
7585	EA	NOP	
7586	EA	NOP	
7587	20 D9 DC	JSR PRTLN	Print line number in decimal
758A	20 CD FD	JSR SPACE	Leave a space
758D	A9 00	EXTRA LDA #0	Change to LDA #32 if spacing
758F	20 D2 FF	PRT JSR PRINT	Between keywords is required
7592	20 6A 75	JSR NEXT	Get next character
7595	D0 0A	BNE MOR200	Not end of line
7597	20 D0 FD	JSR CRLF	Go on to next printer line
759A	A5 01	LDA NEXTLN	Use stored pointer to
759C	A6 02	LDX NEXTLN + 1	Get next line
759E	4C 50 75	JMP NEWLIN	Go back
75A1	C9 22	MOR200 CMP #'"	Quotes?
75A3	D0 08	BNE NOTQUIT	No — go on
75A5	A5 00	LDA QUOTES	Reverse quotes flag
75A7	49 01	EOR #1	
75A9	85 00	STA QUOTES	
75AB	A9 22	LDA #'"	Restore accumulator value

/5AD	A6 00	NOTQUIT	LDX QUOTES	
75AF	D0 27		BNE INQUOT	Text is in quotes
75B1	AA		TAX	
75B2	10 DB		BPL PRT	Not a keyword token
75B4	C9 FF		CMP # \$FF	Check for PI symbol
75B6	F0 D7		BEQ PRT	Yes — do normal print
75B8	29 7F		AND # \$7F	Drop bit 7
75BA	A0 FF		LDY # \$FF	
75BC	AA		TAX	
75BD	F0 09		BEQ FOUND	Must be 'END' token
75BF	C8	CYCLE	INX	
75C0	B9 92 C0		LDA BASIC,Y	Cycle through all characters
75C3	10 FA		BPL CYCLE	Of a keyword
75C5	CA		DEX	
75C6	D0 F7		BNE CYCLE	Go back if wrong word
75C8	C8	FOUND	INX	Found correct keyword
75C9	B9 92 C0		LDA BASIC,Y	Print keyword in full
75CC	08		PHP	
75CD	29 7F		AND # \$7F	Print unshifted characters
75CF	20 D2 FF		JSR PRINT	
75D2	28		PLP	
75D3	10 F3		BPL FOUND	Do rest of characters in word
75D5	4C 8D 75		JMP EXTRA	Go back for next CHR from text
75D8	C9 22	INQUOT	CMP #'"	Quotes to end text?
75DA	F0 B3		BEQ PRT	Yes — go back
75DC	C9 80		CMP # \$80	
75DE	B0 04		BCS CHECK	A shifted character
75E0	C9 20		CMP # \$20	
75E2	B0 AB		BCS PRT	Not a control/shifted CHR
75E4	A9 5B	CHECK	LDA #' ['	Print a square bracket: ' ['
75E6	20 D2 FF		JSR PRINT	
75E9	20 70 75		JSR LAST	Get last CHR
75EC	A0 07		LDY #7	
75EE	D9 13 76	SEARCH	CMP KEYCHR,Y	Try and match it
75F1	F0 0D		BEQ YES	Yes — found it
75F3	88		DEY	
75F4	10 F8		BPL SEARCH	Try next one
75F6	29 7F		AND # \$7F	Must be just a shifted graphic
75F8	20 D2 FF		JSR PRINT	Print it
75FB	A9 5D	SQCLOS	LDA #' ]'	Close brackets
75FD	4C 8F 75		JMP PRT	
7600	BE 1B 76	YES	LDX OFFSET,Y	Offset for replacement text
7603	E8	MOR400	INX	
7604	BD 23 76		LDA NEWCHR,X	Table of replacement CHR's
7607	08		PHP	
7608	29 7F		AND # \$7F	Print replacement text
760A	20 D2 FF		JSR PRINT	
760D	28		PLP	
760E	10 F3		BPL MOR400	More CHR's
7610	4C FB 75		JMP SQCLOS	Close brackets, etc.
7613	11	KEYCHR	.BYT \$11,\$1D,\$91,\$9D	Table of control
7614	1D			
7615	91			
7616	9D			
7617	93		.BYT \$93,\$13,\$12,\$92	Characters to change
7618	13			
7619	12			
761A	92			
761B	FF	OFFSET	.BYT \$FF,\$01,\$03,\$05	Offsets to 'NEWCHR'
761C	01			
761D	03			
761E	05			
761F	07		.BYT \$07,\$0A,\$0E,\$11	Table
7620	0A			
7621	0E			
7622	11			
7623	43	NEWCHR	.BYT 'C',\$C4	'CURSOR DOWN'
7624	C4			
7625	43		.BYT 'C',\$D2	'CURSOR RIGHT'
7626	D2			
7627	43		.BYT 'C',\$D5	'CURSOR UP'
7628	D5			
7629	43		.BYT 'C',\$CC	'CURSOR LEFT'
762A	CC			
762B	43 4C		.BYT 'C',\$D3	'CLEAR SCREEN'
762D	D3			
762E	48 4F 4D		.BYT 'HOM',\$C5	'HOME CURSOR'
7631	C5			
7632	52 56		.BYT 'RV',\$D3	'REVERSE FIELD'
7634	D3			
7635	4F 46		.BYT 'OF',\$C6	'OFF REVERSE'
7637	C6			
7638	00		.BYT \$00,\$00,\$00	End of table
7639	00			
763A	00			
763B			END	



**Catronics** Specialists say...  
Enter the NEW  
Computer Age  
with the well proven  
**video genie system**

as Reviewed in May issue

- 12K MICROSOFT BASIC
- 16K RAM
- UHF MODULATOR
- INTERNAL CASSETTE
- 2nd CASSETTE INTERFACE

**SPECIAL OFFER 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

## PRESTEL IS HERE ! NOW !

The fabulous 'TANTEL' adaptor is now available from Catronics at only £170 + VAT.

This compact unit sits on your desk or chair and will drive virtually any television set, B/W or colour. Send to Catronics for full details.



CREDIT TERMS available. Pay by Access, Barclaycard or Catronics Creditcharge Card.

Personal Shoppers Welcome



**CATRONICS LTD (Dept. 199),  
COMMUNICATIONS HOUSE,  
20, WALLINGTON SQUARE,  
WALLINGTON, SURREY SM6 8RG.**

Tel. 01-669-6700 (9am to 5.30pm. Sat 1pm)/Closed lunch 12.45-1.45.

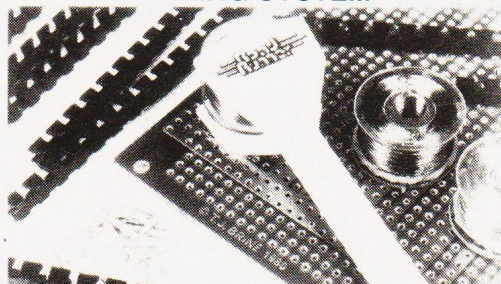
**It's easy  
to complain  
about  
advertisements.**

**The Advertising Standards Authority.** ✓  
If an advertisement is wrong, we're here to put it right.

ASA Ltd, Brook House, Torrington Place, London WC1E 7HN

SPEED — VERSATILITY — ECONOMY

## Road Runner WIRING SYSTEM



Designed originally for logic wiring applications, it is now accepted and used extensively throughout industry, education and research. ROADRUNNER is used by hobbyists, students, technicians, designers and engineers, and is ideal:-

• FOR COMPLEX INTERCONNECTING OF MICROS & MEMORIES • FOR SIMPLE LOGIC WIRING • FOR WIRING DISCRETE CIRCUITS • FOR REPAIRING AND MODIFYING PCB's • FOR USE AS A TRAINING AID.

EUROINTROKIT £15.99 — PROJECT INTROKIT £6.60 — PCB REPAIR KIT £5.57 — DISCRETE WIRING/TRAINING KIT £8.81 — PENCIL LOADED WITH QSE BOBBIN £2.90 — WIRE DISTRIBUTION STRIPS — GLUE FIX 20/pkt 6" LONG — GENERAL PURPOSE £2.92 — HIGH DENSITY £3.20 — ADHESIVE £0.38/TUBE — PRESS FIX 20/pkt 2" LONG £2.46 — SINGLE EUROCARD, HIGH DENSITY 3 PLANE (36 x 16 PIN DILS) £4.99 — DOUBLE EUROCARD (CAPACITY OF 84 x 16 PIN DILS) £7.50 — PROJECT CARD HIGH DENSITY S-SIDED (20 x 14 PIN DILS) £1.30 — BOBBINS — BLUE 4/pkt. £2 — GREEN 4/pkt. £2 — PINK 4/pkt. £2 — COPPER 4/pkt. £2 — 1 OF EACH COLOUR £2.08 — TINNED COPPER WIRE 2/pkt. £0.92 — ROADRUNNER SOLDERING IRON FOR QSE APPLIC. £5.72 — GEN. PURPOSE IRON £5.20 — IRON STAND £4.82 — REPLACEMENT BITS £0.60 — MICROSCISSORS £2.85 — TWEEZERS £1.80 — KNIFE £0.43 — SOLDER PINS 100/pkt £0.59 — PIN INSERTER £1.80 — WELLER BITS 430° or 480°C £1.49

ACCESS-BARCLAYCARD-ADD 40p P & P + 15% VAT TO ALL ORDERS  
DEALER ENQ'S WELCOME-TRADE & CLUB DISCOUNTS

ORDERS TO:- T.J. BRINE ASSOC., FREEPOST (NO STAMPS)  
HASLEMERE, SURREY, GU27 3BL (TEL: 0423 53850)

## STRETCHING YOUR ZX81 OR ZX80 TO ITS LIMITS

Tim Hartnell & Trevor Sharples

**NEW  
BOOK  
£6-95**



FOLLOWING THE  
FANTASTIC SUCCESS  
OF 'MAKING THE  
MOST OF YOUR ZX80'

For those owners who want to realize the FULL potential of their machines and their own programming ability, this book is essential.

DEPT. C17, Computer Publications, Unit 3,  
33 Woodthorpe Rd., Ashford, Middlesex TW15 2RP



# 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,  
Cambs., 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

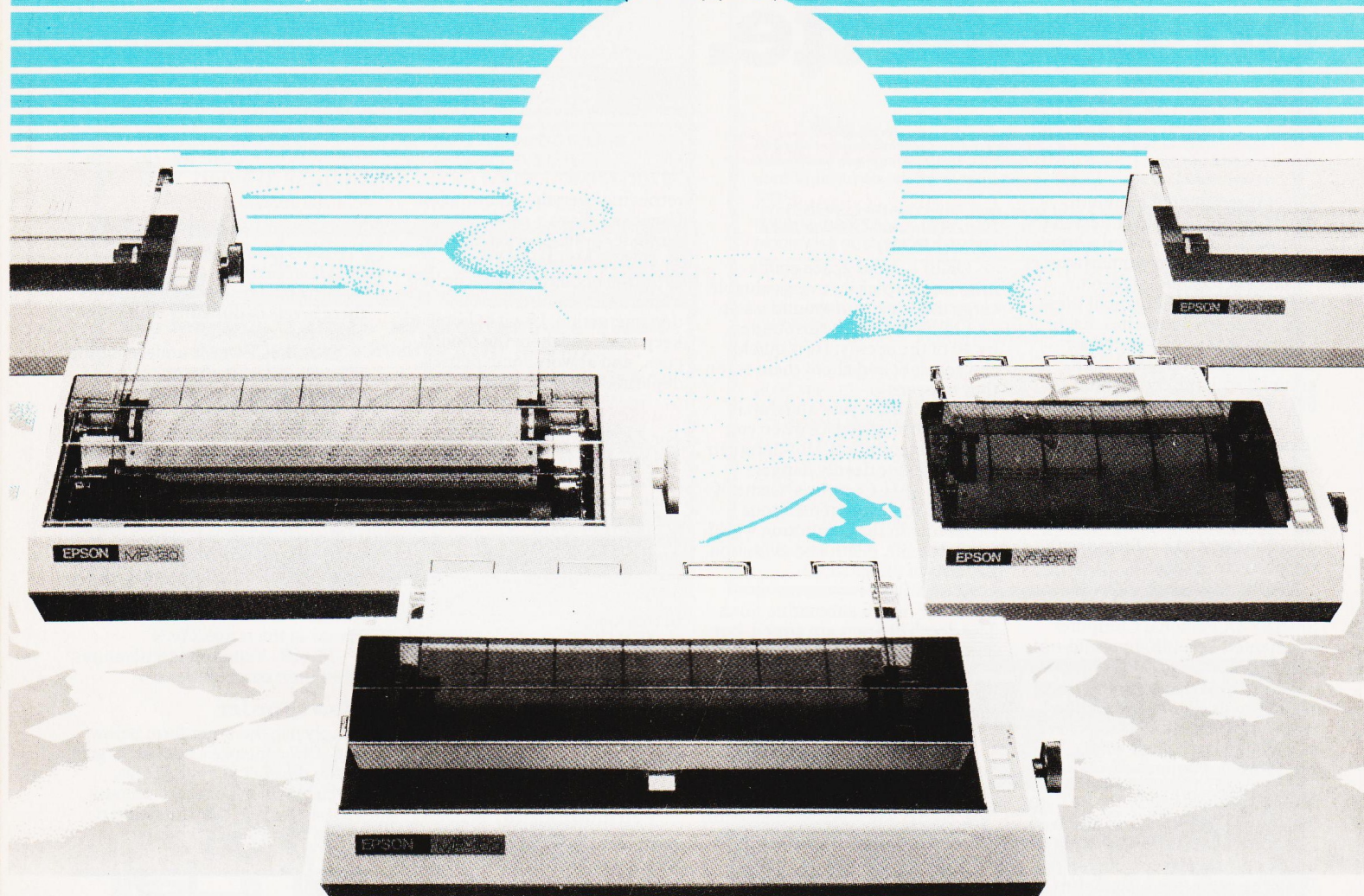
Address:

SOFO8



# ICHBAN

(No. 1 in Japanese)



Highest possible quality + the lowest possible cost = EPSON & MICRO PERIPHERALS  
for the best of both worlds.

	Matrix			Paper Handling		Speed		Max. Paper Width		High Resolution Graphics	Price
	7 x 5	9 x 7	9 x 9	Friction	Tractor	80 CPS	135 CPS	10"	15½"		
MX70-2	●				●	●		●		●	£ call
MX80 T			●		●	●		●			£359
MX80 FT/1			●	●	●	●		●			£399
MX80 FT/2			●	●	●	●		●		●	£ call
MX82			●		●	●		●		●	£389
MX100			●	●	●	●			●	●	£575
MX130		●		●	●		●		●	●	£ call

These prices do not include VAT & delivery

*The above machines have many more features including interfaces for Apple, PET (with PET Graphics), TRS80, Sharp, NEC, Hitachi, Nascom, Acorn, BBC Micro etc, some have correspondence quality printing and multiple character sets including international languages. Ring Ian today for full details and specifications and printout samples. All machines usually ex-stock with next day delivery plus 12 month no-quibble guarantee.*

# Micro Peripherals

61 NEW MARKET SQUARE, BASINGSTOKE, HANTS. Telephone: 0256 56468  
Europe's leading Epson distributor

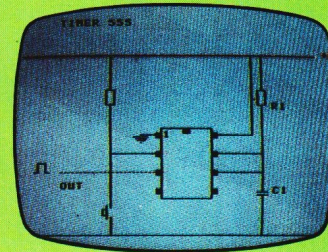
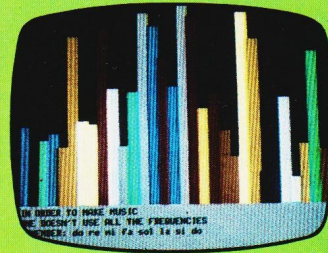
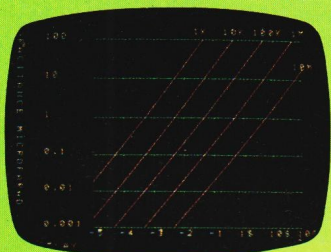
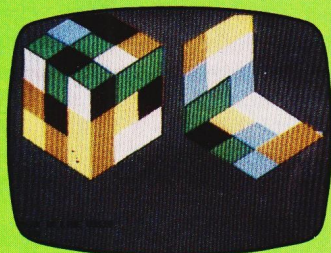


# The DAI Personal Computer is Here

**\*High Performance\***

**\*High Value\***

**Cash Price**  
ONLY £595 + VAT  
BEAT THAT FOR 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





## Basing your predictions of football results on recent form certainly seems to be a winning method.

**O**nce you've actually bought a personal computer, the problem sometimes arises of what to do with it — how do you justify it to your nearest and dearest? Saving menus is all very well, but it's usually quicker and simpler to look them up in books.

This is the first of two articles that will describe a way of using a computer to win the football pools. Actually, it does not *guarantee* wins every week, but it will improve your chances of winning. It's the sort of microcomputer application that has the knack of silencing the opposition!

The program runs in a 16K TRS-80 or Video Genie, and manipulates a data base, formed from the results of many matches, in an attempt to predict the most likely draws each week. It is based on an article which appeared in 'New Scientist' (see reference) and if you want to know more about its background, I urge you to dig a copy of that article out of your local library. In this article I will describe the program's basic philosophy

and the things that it has to do. Next month I'll give a BASIC listing for the program and explain how to use it.

### Prediction Method

There are as many ways of predicting pools results as there are punters. Some give forecasts that are consistently better than picking the matches with a pin, while others are no better than random number generators.

The key point to understand from the start is that there is no 'best' way of winning the pools, but the advantages of a computer in this sort of business is that it can handle vast masses of data. That allows us to do two things which would be impractical any other way. We can use forecasting methods that analyse the masses of data, and we can try out lots of different prediction methods to find one that seems to have promise.

The starting point is to choose a forecasting method. For instance, you might feel that matches in which the home team's name starts with 'N' to 'Z',

and which are refereed by a man born south of Watford, will always be draws. Providing that your data base is properly structured, you can set your computer to analysing lots of matches to see if this hypothesis works. You may even find that it does!

I think, though, that the assumption made by my program is a little more reasonable. It is that a match's result is strongly affected by both of the teams' recent form. By recent form I mean the results of the last couple of matches.

Having originally made this assumption, and at that stage it was only an assumption, I had to collect the results of lots of matches to see if there was anything in it. My data base now has two seasons' worth of results in it (around 3800 matches) and it is not too difficult to see whether or not my original hypothesis was correct.

If we look at some examples we'll see that it does appear to work. The examples are actually for teams playing in the normal home — away — home —



# POOLS PREDICTION

away sequence, although my data base is not limited to such teams.

First of all, suppose that the home team won its last home match and drew its last away, while the away team lost its last away match and drew last week at home. A draw sounds unlikely in this sort of case — a home win might be a better bet — and the data base confirms that the chance of a draw is only around 16%.

On the other hand, if the home team drew last time it played at home and lost away, and the away team won its last two matches, the probability of a draw leaps to 35%. Again, this sounds reasonable.

To put these figures into perspective, over the last two seasons just under 28% of all matches have been draws. Thus, if you pick eight matches at random you can expect slightly more than two of them to be draws.

There are also some surprises. For instance, I have a record of six matches in which both teams had drawn their last two matches. Make what you will of the fact that none of the six results were draws.

A detailed study of the data base shows that the 'recent form' hypothesis really does have merits. Certain combinations of form are much more likely to produce draws than others. On its own, this is not a very earth-shattering conclusion, but it is one that is made for computer analysis. Using a computer lets us pick out the most likely combinations with far more confidence than by using experience on its own. Being able to analyse a lot of data very quickly makes all the difference in this game.

The pools program, then, works on the basis of looking at the performance of each team in its last two matches. The form of the two teams in a match is then used to discover how many matches with similar form have produced draws in the past. This approach dictates the shape of the data base that the program needs.

Each of a team's last two matches could have been at home or away, and it could have won, drawn or lost either of those matches. A single result can therefore have one of six values: HW, HD, HL, AW, AD or AL. Since we are looking at a team's form over two matches, we need to be able to code it with any one of 36 values.

In fact, the program codes form on a points basis, with HW, HD, HL, AW, AD and AL being awarded 0, 1, 2, 3, 4 and 5 points respectively. The form over the last two matches is saved by multiplying the points for the first match by 6 and adding those for the second. Thus a HW, AD record is coded as 4, while AL, HL emerges as 32.

This suggests the basic shape of the data base — two teams per match, 36 possible form values (0-35) for each team — a 36x36 matrix. Remember, we are not trying to follow matches between specific teams but we are tracking matches between teams of known recent form.

What must be stored in the data base? Ideally, we would keep a record of the number of no-score draws, score draws, home wins and away wins for each combination of form. Add up the four items and you get the total number of matches. With this sort of detail, we could predict anything.

Unfortunately, the program has to fit into a 16K computer! Since the TRS-80 and Video Genie, like most micros, store an integer in two bytes, a full data base would take up 36x36x4x2, that's 10368 bytes. This would leave no room for the program, let alone all the other items of data we will need, such as the record of each team's name and its recent form.

The way around this problem was to concentrate only on draws, without even being able to tell 'score' from 'no-score'. The program limits itself to saving the number of draws, and the total number of matches, for each of the 36x36 form combinations. Even with this compromise, there is still only room for one 36x36 integer array, which has to hold the two sets of data. The 'draws' and 'all matches' totals are each squeezed into a single byte of the two bytes that the computer allocates to each cell of the array.

## Predicting The Draws

It now sounds easy to get the probability (P) of any matches resulting in a

draw. Simply read the number of draws (D) and the total number of matches (N) for that combination of form and:

$$P = D/N$$

Inevitably, it's not quite as easy as that. In particular, the prediction is very poor when N is small. For instance, suppose that there is only one match on record for a given form-pair, and that was a draw. That gives us:

$$P = 1/1 = 1$$

In other words, the match is certain to be a draw.

That does not sound right. The way out is to form a 'weighted average' of the predicted value and the probability of a draw if we did not know anything about the match. You'll remember that the overall chance of a draw is around 28%, but let's call it 25% (or 1/4) to make the sums easier. 'Weighting' means that the more matches there are in the sample, the more notice the program should take of them and the less attention it should pay to the 25% figure.

There are lots of ways of producing a weighted average, but I chose to use an inverse exponential curve; Fig 1 shows its effect. The predictions from the data base and from '25%' are mixed together so that, with only one match in the data base, they have roughly equal weight, and with lots of matches the program virtually ignores the 25%.

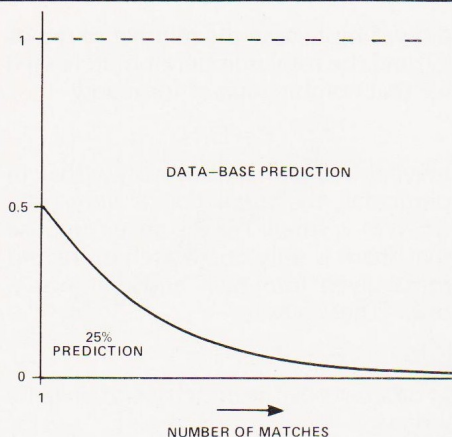
The sums to do this are easy for a computer. It has to generate the weighting factor (P3) as:

$$P3 = \text{EXP}(-N/KW)/2$$

That is the basic equation of the curve in







**Fig. 1 The curve produced by the weighted average equation.**

Fig. 1. 'KW' is a fiddle-factor which makes the curve fall off at the proper rate — after a lot of experiments, I found that a value of 15 is about right.

Once P3 has been calculated, the overall probability of a draw becomes:

$$P = (1 - P3) * (N/D) + P3/4$$

As N increases, P3 becomes very small, and P gets closer and closer to the original '(N/D)'.

To see the effect of these equations, think about two sets of data; the first has one draw out of one match, the second

has 20 draws out of 20 matches. Obviously, in each case:

$$N/D = 1$$

But if we weight the predictions, then the first example gives a 65% chance of a draw, while the second suggests a 90% chance. That sounds much more reasonable.

Even now, we are not finished. Although the prediction is based on the teams' recent form, we can't ignore long-term form altogether. The best way of getting this is to look at the teams' positions in the League. The program must allow for the fact that, say, a top of the table team playing at home against one from the bottom of the table is likely to win at home. The chance of a draw is correspondingly reduced.

The program gets around this by recording the approximate league position of a team as one of three categories — top quarter, middle and bottom quarter. The splits are not critical, but those proportions give good results.

The three categories are assigned position values of 1, 2 and 3 respectively. By subtracting the away team's position code from that of the home team, we can get their relative league positions. A value of '2' means a top of the league

club playing away to a straggler, while '—2' has that strong club at home to the weak one. Clearly, there are 5 possible categories: —2, —1, 0, 1, 2.

Each category has a weighting factor (Q) associated with it, and Q is used to adjust the value of P we calculated a few lines ago. The values of Q which I recommend are shown in Table 1. After a lot of trials, these have given the best chances of predicting draws, but if you want to experiment they are very easy to change.

Let's go back to the 20-match sample we had earlier, which gave a 90% chance of a draw. Suppose the home team is from the middle of the table, while the away team is near the top. This gives a relative league position of '1', and a final draw probability of:

$$90 \times 1.3 = 117\%$$

Before all you statisticians write in to me, I know perfectly well that probabilities cannot be greater than unity. We are not, in fact, calculating probability any more, but providing numbers which the program can use to rank matches in order of the likelihood of their producing a draw. The actual numbers are not that important. If it's any consolation, it is very unusual for the program actually to generate a 'probability' that is greater than 1.





That, then, is the basic idea behind the program — to identify the recent form of the two teams in a match and then, on the basis of a record of previous matches with that form, to predict the chance of a draw this time around. However, what does the program actually have to do in order to support this task?

## Program Tasks

The program's fundamental job, of course, is the ranking of the matches in order of draw probability. To use in conjunction with the main data base, the program must have a record of each team's league position and its current form, stored as the integer values 1-3 and 0-35 respectively.

I found it best to leave out the Scottish Second Division! The early versions of the program included it, but it soon became clear that it was not worthwhile for two reasons:

- a) The Division's matches are not often on the pools coupon.
- b) The results follow laws known only to themselves — the program's methods do not work.

The team data is therefore stored as a 6x24 matrix which allows one row per division and 24 columns to accommodate the 24 teams of the Third and Fourth Divisions.

Before it can predict the draws, the program must know what matches are to be played and it uses a menu approach to generate a match list. The list is held as a 6x12x2 matrix six rows for the six divisions, and 12 columns for the maximum of 12 matches per division. One layer of the matrix holds the identity of the two teams in a match, while the second layer holds the computed probability of the match being a draw.

Once the matches have been played, their results must be used to modify the team records and to expand the main data base. The program therefore contains routines to input the result of each match. This result updates all the main data, but does *not* affect the League positions.

A separate routine is provided to adjust the League positions without affecting any other data. In practice, you will find that, once the season is properly under way (say two months), you will only need to change the league tables every three or four weeks.

It is not worth trying to use the program in the first weeks of a season, because the teams take that amount of time to settle down. Once they have, their most recent form must be supplied to the program before it can be used. There is a procedure to do just this, but you are only likely to need it once a year.

## MOST LIKELY DRAWS:

1.	AIRDRIE	VS	MORTON	0.6169	5
2.	DUMBARTON	VS	DUNFERMLINE	0.6117	7
2.	LINCOLN	VS	GILLINGHAM	0.4543	1
4.	SHREWSBURY	VS	QPR	0.4500	5
5.	WALSALL	VS	BRISTOL ROV.	0.4392	29
6.	NEWCASTLE	VS	BOLTON	0.3906	2
7.	SWINDON	VS	WIMBLEDON	0.3839	3
8.	YORK	VS	BOURNEMOUTH	0.3889	3
9.	CARDIFF	VS	DERBY	0.3462	5
10.	ROCHDALE	VS	TRANMERE	0.3462	5
11.	DARLINGTON	VS	ALDERSHOT	0.3359	5
12.	SOUTHAMPTON	VS	MAN. CITY	0.3248	30
13.	HAMILTON	VS	E. STIRLING	0.3180	15
14.	BURNLEY	VS	PLYMOUTH	0.2771	3

Fig. 2 Some typical results produced by the program which will appear in next month's issue.

You will have realised by now that the program is useless without its record of drawn matches, and so we must be able to create this data base in the first place. In practice, I found that the program needs at least a season's worth of results (about 1900 matches) before it is any use.

One way to set that data up is to create a match list for each week and then to put in the results in the normal way. This would use the routines that the program has to have anyway. I soon found, however, that this approach made a tedious job even more tedious. The program therefore includes an option to enter a match's result as soon as the match has been defined. This facility speeds up the essential job of creating the data base, but it still takes a long time.

Finally, the data base has to be saved from week to week. The program has to transfer all the significant data (the main array, the teams' form and the match list) to cassette, and to read it in again. It also provides the option of verifying that data has been read from, or written to, the tape correctly. With the poor reliability of cassettes, and the vital importance of keeping the data uncorrupted, you would have to be very brave to skip the verification stage.

## Conclusion

In this article I have introduced a program which I have written and used successfully to help win the football pools.

The program grew from a 'New Scientist' article, and works on the basis of looking at the recent form of the teams in each match and seeing what happened before when any teams with a similar record played. It performs the sort of detailed, methodical analysis that would be impossible without a computer.

Because the program is written to fit

into 16K it can only handle draws, and cannot tell the difference between the 'score' and 'no-score' varieties. Nevertheless, it manages to do around 20-25% better than picking the matches with a pin.

I do not guarantee that it will make money for you nor, indeed, that it will always do better than choosing matches at random — you must expect setbacks from time to time. However, if you use it every week, and keep the data base current, you will significantly improve your chances of winning small dividends. A methodical technique like this has no chance of scooping the jackpot, which relies on the unexpected happening.

I've outlined all the facilities which the program offers, and indicated vaguely how it actually provides them. Next month I will give you a listing for the program and explain in detail how to use it.

Until then, you may be interested in Fig. 2, which shows a typical example of the program's output. It lists, in descending order, the 14 most likely draws and gives the 'probability' of each one. The right-hand column shows how many previous matches each prediction is based on — the more matches there are, the more confidence you can have in the prediction.

## Reference

- (1) George, Frank. 'A Challenge to Win the Pools'. New Scientist, 20 March 1980, p 910.

Relative League Position	Weight
-2	0.4
-1	0.7
0	1.0
1	1.3
2	1.1

Table 1. Effect of Relative League Position.



**THE  
WAITING  
IS OVER.  
THE RUSH  
HAS  
BEGUN.**





For the past few months you've all been hearing and reading a lot of good things about Commodore's new VIC 20.

Like the fact that it has a real typewriter keyboard with full graphics.

And music in three voices and three octaves, as well as language and sound effects. And eight border and sixteen screen colours.

Not to mention that it's the best home computer in the world!

Well, after all that, what could you do but hang on?

But all that's over now. The VIC is at your dealer's.

So rush down and see the VIC. And you'll see why it was well worth the wait.

**commodore**  
**COMPUTER**

For more information on the VIC 20, telephone or write to Commodore Information Centre, Baker Street, High Wycombe, Bucks. Tel: High Wycombe 445211.





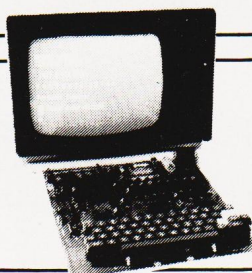
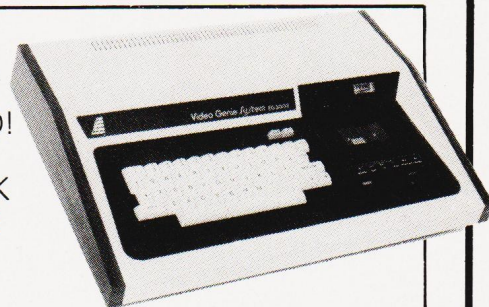
## FREE SOUND WITH VIDEO GENIE



CASE FOR OHIO  
SUPERBOARD OR UK101  
ONLY £24  
IN PLASTIC OR IN STEEL! £37  
NUMBER PAD FOR ABOVE  
ONLY £12

**OHIO  
SUPERBOARD**  
COMPLETE WITH  
SOUND, POWER  
SUPPLY,  
MODULATOR  
FULLY BUILT &  
TESTED FOR  
BRITISH T.V.  
STANDARDS  
ONLY **£159**

WE CAN OFFER THE  
INCREDIBLE VIDEO GENIE FOR  
ONLY £279 INCLUDING SOUND!  
32K EXPANSION INTERFACE  
FOR ONLY £279 AND 40 TRACK  
DISKS FOR ONLY £195 SINGLE  
AND £380 DUAL!



EUROPE'S FASTEST SELLING ONE BOARD COMPUTER  
**COMPUKIT UK101**

ONLY £149 KIT OR £199 BUILT &  
TESTED  
NOW WITH FREE SOUND!

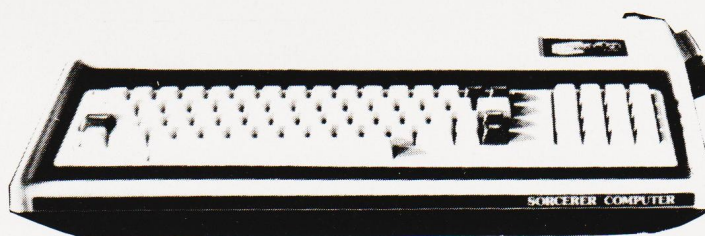
SEIKOSHA PRINTER  
NOW £179  
EPSON PRINTERS  
FROM £329 (MX80T)

APPLE — CENTRONICS  
INTERFACE  
ONLY **£79!**

**ALL PRICES INCLUDE POSTAGE & PACKING BUT EXCLUDE V.A.T.  
KRAM ELECTRONICS, VICTORIA HOUSE, 17 HIGHCROSS STREET,  
LEICESTER. TEL. LEICESTER 27556**

# **EXIDY**

# **SORCERER**



### FEATURES INCLUDE:-

- Z80 cpu with 48K of on board RAM
- Connects directly to 315K 5" disk system using CP/M
- Serial/RS232 port for cassette or printer
- Port for Parallel/Centronics printer connection
- S100 bus expansion capability
- Plug in ROM PACs for Word Processing, Z80 assembler and BASIC
- Wide range of Business and System software, Games etc available

For detailed information contact:-

**LIVEPORT DATA PRODUCTS, THE IVORY WORKS, ST IVES,  
CORNWALL. TR26 2HF**

Tel: PENZANCE (0736 798157)



# COLOUR CUBE

**Last month's cover illustrates the graphics capabilities of the DAI, this program shows how easy it was to produce.**

**W**e're giving away our secrets by publishing this program — it is the one used to generate last month's front cover pictures on the DAI. Written for us by their resident programming genius, Dave Collier, it gives an insight into the power of the BASIC and colour graphics commands that the system has built-in.

No apologies are made for the lack

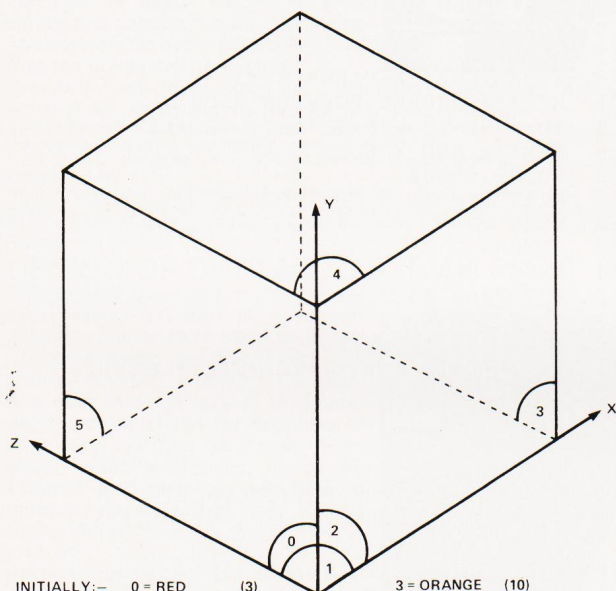
of documentation as this is not supposed to be more than a demonstration, but there are REMs for all the important bits and the diagram shows the way in which the faces are numbered.

It is quite simple to make the program operate manually by INPUTting the J and K co-ordinates at line 1020 instead of having them randomly determined. The program is designed to allow

only legal moves so the only checking that needs to be done is to ensure that the numbers are in the range 0 to 2.

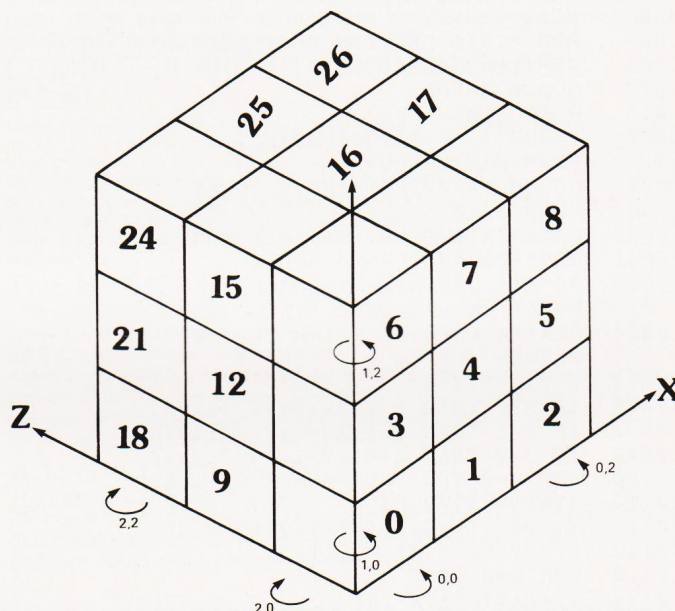
The program has been prepared on a high quality printer. We've now got a new daisy wheel which prints zeros with the line through them — another source of confusion removed!

All we need now is to get rid of the human element...



INITIALLY:- 0 = RED (3) 3 = ORANGE (10)  
1 = BLUE (1) 4 = GREEN (5)  
2 = YELLOW (14) 5 = WHITE (15)

(1)



(2)

## Program Listing

```

5      CLEAR 15000
10     NCUBE=3*3*3
20     DIM POSN(2,2,2)
21     REM**HOLDS CUBE # AT EACH POINT
30     DIM FACE(NCUBE-1,6-1)
31     REM**COLOURS OF FACES OF EACH CUBE
100    XV=0:YV=1:ZV=1:K=0
110    GOSUB 200:REM**COLOUR FACES 0,3
120    XV=1:YV=0:ZV=1:K=1
130    GOSUB 200:REM**FACES 1,4
140    XV=1:YV=1:ZV=0:K=2
150    GOSUB 200:REM**FACES 2,5
160    GOTO 400
200    FOR X=0 TO 2*XV
210    FOR Y=0 TO 2*YV
220    FOR Z=0 TO 2*ZV
230    FACE(X+Y*3+Z*9,K)=K+1
240    X1=X+2*(1-XV)
250    Y1=Y+2*(1-YV)
260    Z1=Z+2*(1-ZV)
270    FACE(X1+Y1*3+Z1*9,K+3)=K+1+3
280    NEXT Z

```

```

290    NEXT Y
300    NEXT X
310    RETURN
400    REM**SET INITIAL CUBE NUMBERS
410    FOR X=0 TO 2
420    FOR Y=0 TO 2
430    FOR Z=0 TO 2
440    POSN(X,Y,Z)=X+Y*3+Z*9
441    REM**EACH POSITION HOLDS ITS OWN CUBE
450    NEXT Z
460    NEXT Y
470    NEXT X
500    REM**SET UP ACTUAL COLOURS CORRESPONDING
501    REM**TO COLOUR NUMBERS 1 TO 6
510    DIM COL(6)
520    DATA 3,1,14,10,5,15
530    REM**RED BLUE YELLOW ORANGE GREEN WHITE
540    FOR K=1 TO 6
550    READ COL(K)
560    NEXT K
600    REM**THIS TABLE GIVES X+Y OFFSETS
601    REM**FOR THE FOUR CORNER CUBES
610    DIM V(3,2,1)
620    DATA 0,0,0
630    DATA 0,2,0
640    DATA 0,2,2

```



```

650 DATA 0,0,2
660 FOR Q=0 TO 3:FOR V=0 TO 2
670 READ V(Q,V,0)
680 NEXT V:NEXT Q
700 REM**THIS TABLE GIVES OFFSETS FOR
701 REM**THE FOUR EDGE CUBES
710 DATA 0,1,0
720 DATA 0,2,1
730 DATA 0,1,2
740 DATA 0,0,1
750 FOR Q=0 TO 3:FOR V=0 TO 2
760 READ V(Q,V,1)
770 NEXT V:NEXT Q
800 REM**THIS TABLE GIVES SIDE SEQUENCES
801 REM**FOR ROTATION IN THE
    THREE DIRECTIONS
810 DIM VF(3,2)
820 DATA 2,2,1
830 DATA 4,0,3
840 DATA 5,5,4
850 DATA 1,3,0
860 FOR Q=0 TO 3:FOR V=0 TO 2
870 READ VF(Q,V)
880 NEXT V:NEXT Q
1000 REM**THIS SECTION CONTROLS WHAT THE
1001 REM**PROGRAM DOES
1010 GOSUB 50000
1015 WAIT TIME 1000
1020 J=RND(3):K=2*INT(RND(2))
1021 REM**RANDOM MOVES
1030 GOSUB 10000:REM**MOVE CUBES
1040 GOTO 1010
10000 REM**ENTRYPOINT TO MOVE CUBES
10001 REM**PARAMETERS J AND K
10002 REM**J DEFINES AXIS OF
    ROTATION - 0 TO 2
10003 REM**K DEFINES WHICH OF THE
    PLANES - 0 TO 2
10010 X=0:Y=0:Z=0
10020 IF J=0 THEN X=K:XV=0:YV=1:ZV=2
10030 IF J=1 THEN Y=K:XV=2:YV=0:ZV=1
10040 IF J=2 THEN Z=K:XV=1:YV=2:ZV=0
10100 FOR R=0 TO 1:REM**CORNERS+EDGES
10110 XT=X+V(0,XV,R)
10111 YT=Y+V(0,YV,R):ZT=Z+V(0,ZV,R)
10112 PTEMP=POSN(XT,YT,ZT)
10120 FOR Q=0 TO 2
10130 XT=X+V(Q+1,XV,R)
10131 YT=Y+V(Q+1,YV,R):ZT=Z+V(Q+1,ZV,R)
10132 TEMP=POSN(XT,YT,ZT)
10140 XT=X+V(Q,XV,R)
10141 YT=Y+V(Q,YV,R):ZT=Z+V(Q,ZV,R)
10142 POSN(XT,YT,ZT)=TEMP
10150 NEXT Q
10160 XT=X+V(3,XV,R)
10161 YT=Y+V(3,YV,R):ZT=Z+V(3,ZV,R)
10162 POSN(XT,YT,ZT)=PTEMP
10170 NEXT R
10200 REM**NOW ROTATE ALL CUBES IN PLANE
10210 XV=SGN(XV):YV=SGN(YV):ZV=SGN(ZV)
10220 IF XV<>0 THEN FOR X=0 TO 2*XV
10230 IF YV<>0 THEN FOR Y=0 TO 2*YV
10240 IF ZV<>0 THEN FOR Z=0 TO 2*ZV
10250 C=POSN(X,Y,Z)
10260 VT=VF(0,J):FTEMP=FACE(C,VT)
10270 FOR Q=0 TO 2
10280 VT=VF(Q+1,J):TEMP=FACE(C,VT)
10290 VT=VF(Q,J):FACE(C,VT)=TEMP
10300 NEXT Q
10310 VT=VF(3,J):FACE(C,VT)=FTEMP
10320 IF ZV<>0 THEN NEXT Z
10330 IF YV<>0 THEN NEXT Y
10340 IF XV<>0 THEN NEXT X
10350 RETURN
50000 REM**DRAW THE CUBE
50005 COLORG 4 0 0 0:REM**SET
    BACKGROUND COLOUR
50010 MODE 5:MODE 5:REM**CLEAR SCREEN

```

```

50100 L=32
50110 LB2=L/2
50111 REM**HALF LONG SIDE OF CUBE XMAX/16
50120 LR2=24
50121 REM**ROUGHLY L/SQR(2) BUT ALSO 0 MOD 80
50130 FOR VIEW=0 TO 1:REM**DRAW 2 VIEWS
50200 XM=(XMAX+1)/2-(3.5-VIEW*7)*LR2
50201 XM=(XM+4)-(XM+4) MOD 8:YM=YMAX/2
50202 REM**FIND CENTRE OF EACH VIEW
50210 GOSUB 51000
50220 GOSUB 52000
50230 GOSUB 53000
50300 NEXT VIEW
50999 RETURN
51000 REM**DRAW TOP/BOTTOM
51010 FOR FX=0 TO 2
51020 FOR FZ=0 TO 2
51030 XC=XM+(FX-FZ)*LR2
51040 YC=YM+(1+FX+FZ)*LB2-VIEW*LB2*6
51050 GOSUB 61000
51060 NEXT FZ
51070 NEXT FX
51080 RETURN
52000 REM**DRAW FACES 2/5
52010 FOR FX=0 TO 2
52015 FOR FY=0 TO 2
52020 XC=XM+LR2*FX-VIEW*LR2*3
52021 REM**X SCREEN POSN OF FACE
52025 YC=YM-L*(2-FY)+FX*LB2+VIEW*LB2*3
52026 REM**X AND Y POSN
52030 GOSUB 62000
52050 NEXT FY
52060 NEXT FX
52070 RETURN
53000 REM** DRAW FACES 0/3
53010 FOR FY=0 TO 2
53020 FOR FZ=0 TO 2
53030 XC=XM-LR2*FZ+VIEW*LR2*3
53040 YC=YM-L*(2-FY)+FZ*LB2+VIEW*LB2*3
53050 GOSUB 63000
53060 NEXT FZ
53070 NEXT FY
53080 RETURN
61000 REM**DRAW A TOP/BOTTOM FACET
61010 C=COL(FACE(POSN(FX,2*(1-VIEW),FZ),
    1+3*(1-VIEW)))
61100 FOR Y=YC-LB2 TO YC+LB2-1
61110 T=LR2-ABS(Y-YC)*LR2/LB2
61120 DRAW XC-T,Y XC+T,Y C
61130 NEXT Y
61999 RETURN
62000 REM**DRAW FACETS 2/5
62010 C=COL(FACE(POSN(FX,FY,2*VIEW),2+VIEW*3))
62011 REM**LOOK UP ITS COLOUR
62100 FOR Y=YC-L TO YC-LB2-1
62110 DRAW XC,Y XC+(LR2-1)*(Y-(YC-L))/LB2,Y C
62120 NEXT Y
62200 FOR Y=YC-LB2 TO YC-1
62210 DRAW XC,Y XC+LR2-1,Y C
62220 NEXT Y
62300 FOR Y=YC TO YC+LB2-1
62310 DRAW XC+(Y-YC)*LR2/LB2,Y XC+LR2-1,Y C
62320 NEXT Y
62499 RETURN
63000 REM**DRAW FACETS 0/3
63010 C=COL(FACE(POSN(2*VIEW,FY,FZ),0+VIEW*3))
63100 FOR Y=YC-L TO YC-LB2-1
63110 DRAW XC-1,Y XC-(LR2-1)*(Y-(YC-L))
    /LB2-1,Y C
63120 NEXT Y
63200 FOR Y=YC-LB2 TO YC-1
63210 DRAW XC-1,Y XC-(LR2-1)-1,Y C
63220 NEXT Y
63300 FOR Y=YC TO YC+LB2-1
63310 DRAW XC-(Y-YC)*LR2/LB2-1,
    Y XC-(LR2-1)-1,Y C
63320 NEXT Y
63999 RETURN

```



# CAMBRIDGE LEARNING

## SELF-INSTRUCTION COURSES

*It's faster and more thorough than classroom learning: you pace yourself and answer questions on each new aspect as you go. This gives rare satisfaction – you know that you are really learning and without mindless drudgery. With a good self-instruction course you become your own best teacher.*

### Understand Digital Electronics

In the years ahead digital electronics will play an increasing part in your life. Calculators and digital watches mushroomed in the 1970's – soon we will have digital car instrumentation, cash cards, TV messages from friends and electronic mail. After completing these books you will have broadened your career prospects and increased your knowledge of the fast-changing world around you.

#### DIGITAL COMPUTER LOGIC AND ELECTRONICS £8.50

This course is designed as an introduction to digital electronics and is written at a pace that suits the raw beginner. No mathematical knowledge is assumed other than the use of simple arithmetic and decimals and no electronic knowledge is expected at all. The course moves painstakingly through all the basic concepts of digital electronics in a simple and concise fashion: questions and answers on every page make sure that the points are understood.

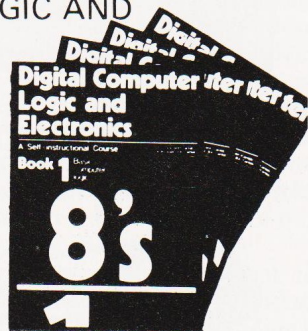
Everyone can learn from it – students, engineers, hobbyists, housewives, scientists. Its four A4 volumes consist of:

**Book 1** Binary, octal and decimal number systems; conversion between number systems; conversion of fractions; octal-decimal conversion tables.

**Book 2** AND, OR gates, inverters; NOR and NAND gates; truth tables; introduction to Boolean algebra.

**Book 3** Positive ECL; De Morgans Laws; designing logic circuits using NOR gates, dual input gates.

**Book 4** Introduction to pulse driven circuits; R-S and J-K flip flops; binary counters; shift registers; half-adders.



#### DESIGN OF DIGITAL SYSTEMS £14.00

This course takes the reader to real proficiency. Written in a similar question and answer style to Digital Computer Logic and Electronics, this course moves at a much faster pace and goes into the subject in greater depth. Ideally suited for scientists or engineers wanting to know more about digital electronics, its six A4 volumes lead step by step through number systems and Boolean algebra to memories, counters and arithmetic circuits and finally to an understanding of calculator and computer design.

**Book 1** Octal, hexadecimal and binary number systems; conversion between number systems; representation of negative numbers; complementary systems; binary multiplication and division.

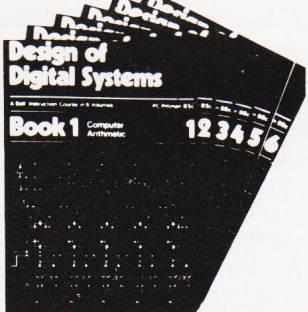
**Book 2** OR and AND functions; logic gates: NOT, exclusive-OR, NAND, NOR and exclusive-NOR functions; multiple input gates; truth tables; De Morgans Laws; canonical forms; logic conventions; Karnaugh mapping; three state and wired logic.

**Book 3** Half adders and full adders; subtractors; serial and parallel adders; processors and arithmetic logic units (ALUs); multiplication and division systems.

**Book 4** Flip flops; shift registers; asynchronous and synchronous counters; ring, Johnson and exclusive-OR feedback counters; random access memories (RAMs) and read only memories (ROMs).

**Book 5** Structure of calculators; keyboard encoding; decoding display data; register systems; control unit; program ROM; address decoding; instruction sets; instruction decoding; control programme structure.

**Book 6** Central processing unit (CPU); memory organization; character representation; program storage; address modes; input/output systems; program interrupts; interrupt priorities; programming; assemblers; computers; executive programs; operating systems and time sharing.



### Flow Charts and Algorithms

are the essential logical procedures used in all computer programming and mastering them is the key to success here as well as being a priceless tool in all administrative areas – presenting safety regulations, government legislation, office procedures etc.

#### THE ALGORITHM WRITER'S GUIDE £4.00

explains how to define questions, put them in the best order and draw the flow chart, with numerous examples.

#### GUARANTEE No risk to you.

If you are not completely satisfied, your money will be refunded upon return of the books in good condition.

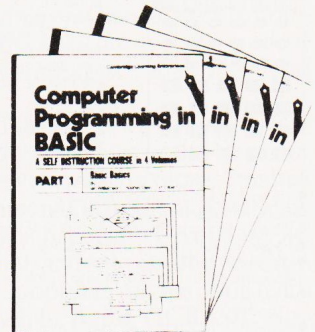
**CAMBRIDGE LEARNING LIMITED, UNIT 56**  
RIVERMILL SITE, FREEPOST, ST. IVES, HUNTINGDON,  
CAMBS., PE17 4BR, ENGLAND.  
TELEPHONE: ST. IVES (0480) 67446

All prices include worldwide postage (airmail is extra – please ask for prepayment invoice).

Please allow 28 days for delivery in U.K.

### Microcomputers are coming - ride the wave! Learn to program.

Millions of jobs are threatened but millions more will be created. Learn BASIC – the language of the small computer and the most easy-to-learn computer language in widespread use. Teach yourself with a course which takes you from complete ignorance step by step to real proficiency with a unique style of graded hints. In 60 straightforward lessons you will learn the five essentials of programming: problem definition, flowcharting, coding the program, debugging, clear documentation. Harder problems are provided with a series of hints so you never sit glassy-eyed with your mind a blank. You soon learn to tackle really tough tasks such as programs for graphs, cost estimates, compound interest and computer games.



#### COMPUTER PROGRAMMING IN BASIC £10.50

**Book 1** Computers and what they do well. READ, DATA, PRINT, powers, brackets, variable names, LET, errors, coding simple programs.

**Book 2** High and low level languages; flowcharting; functions, REM and documentation; INPUT, IF, THEN, GO TO, limitations of computers, problem definition.

**Book 3** Compilers and interpreters; loops, FOR, NEXT, RESTORE, debugging, arrays, bubble sorting, TAB.

**Book 4** Advanced BASIC; subroutines, string variables, files, complex programming, examples, glossary.

#### THE BASIC HANDBOOK £11.50

This best-selling American title usefully supplements our BASIC course with an alphabetical guide to the many variations that occur in BASIC terminology. The dozens of BASIC 'dialects' in use today mean programmers often need to translate instructions so that they can be RUN on their system. The BASIC Handbook is clear, easy to use and should save hours of your time and computer time. A must for all users of BASIC throughout the world.

#### A.N.S. COBOL £5.90

The indispensable guide to the world's No. 1 business language. After 25 hours with this course, one beginner took a consulting job, documenting oil company programs and did invaluable work from the first day. Need we say more?

## ORDER FORM

Please send me the following books:-

..... Digital Computer Logic & Electronics @ £8.50

..... Design of Digital Systems @ £14.00

..... Algorithm Writer's Guide @ £4.00

..... Computer Programming in BASIC @ £10.50

..... BASIC Handbook @ £11.50

..... ANS COBOL @ £5.90

..... Your Booklist (Free)

I enclose a \*cheque/PO payable to Cambridge Learning Ltd.

for £..... (\*delete where applicable)

Please charge my:

\*Access/American Express/Bardclaycard/Diners Club/Visa  
Mastercharge/Trustcard

Exp. Date ..... Credit Card No. ....

Signature .....

Telephone orders from credit card holders accepted on 0480 67446 (Ansafone).

Overseas customers (incl. Eire) should send a bank draft in sterling drawn on a London bank, or quote credit card number.

Name .....

Address .....

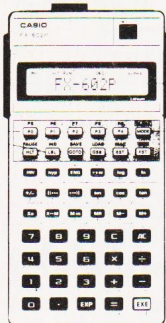
Cambridge Learning Limited, Unit 56, Rivermill Site,  
FREEPOST, St. Ives, Huntingdon, Cambs PE17 4BR, England.  
(Registered in England, No. 1328762)



# THE LAST WORD IN POCKET PROGRAMMABLE CALCULATORS

Ultra-high speed ultra-capacity calculator with "Computer Talk" programming via upper and lower case dot matrix scrolling display

## CASIO FX-602P PROGRAMMABLE



- 88 memories, up to 512 functional steps
- Up to 10 programs, or exclusive commands
- A variety of "Jump" commands
- Up to 9 subroutines, up to 9 levels
- 86 character dot matrix scrolling display with upper and lower case alphabet
- A variable range of input capacity from 32 program steps with 88 independent memories, to 512 steps with 22 memories. The data memory expands as required, 1 data memory = 8 steps
- The most powerful programmable in its class, since 1-step equals 1-function in principle
- Memory and program retention when switched off

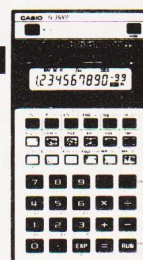
- Up to 10 pairs of unconditional jumps (GOTO)
- Conditional jumps and count jumps
- Up to 9 subroutines, nesting up to 9 levels
- Password function to protect stored programs
- Ultra high speed calculations, 5 to 11 times faster than the opposition. (Decomposition of 379721 into prime numbers in 37 seconds)
- PAM (Perfect Algebraic Method) judges priority with 33 parenthesis nestable up to 11 levels
- 50 built-in functions, all usable in programs
- An almost infinite number of programs can be stored on standard cassette tape using the optional FA-1 adaptor. (Price £19.95)
- Compatible with FX-502P and FX-501P
- Two lithium batteries give approx. 660 hours continuous use, with battery saving Auto Power Off after approx. 6 minutes non-use
- Thin and lightweight — easy to carry around. Dims: 9.6 x 71 x 141.2mm (3 7/8 x 2 3/4 x 5 1/2")
- Program manual, batteries and wallet included.

**ONLY £74.95 (RRP £84.95)**

## CASIO FX3500P PROGRAMMABLE

38 functional steps, two program capability, 10 plus 2 digits, 61 scientific functions including **Integrals and Regression Analysis** 9/32 x 2 1/4 x 5 1/4" With wallet **£22.95** FX180P, Hand held version (2 x AA batteries) without hyperbolics. 3/4 x 3 x 5 1/4". With Pouch. **£19.95**

**BECOME AN INSTANT MUSICIAN. NO EXPERIENCE NECESSARY.** As featured on "Tomorrow's World".  
**CASIO VL-TONE** Electronic musical instrument



VL-1  
(RRP £39.95)  
**ONLY £35.95**

VL-1 records and plays back up to 100 notes as a melody. **One Key Play** or **Auto Play** of piano, Violin, Flute, Guitar and Fantasy, or create your own unique sounds with **A.D.S.R.** 10 built in **Auto Rhythms** and **Tempo** control. LCD digital readout of notes and tempo. Also a calculator. Battery/mains power with memory and program retention. Integral amplifier/speaker. Output jack. With Song Book. Dims: 1 1/2 x 11 1/4 x 3 in.



**THESE SPACE INVADERS WILL ALARM YOU — THE PRICE WON'T!**

**CASIO CA901**  
Calculator watch with alarm, hourly chimes, professional stopwatch, dual time, calendar and amazing **DIGITAL SPACE INVADER GAME**

CA901 (metal) **£29.95**  
CA90 Resin case/Strap **£19.95**

Offers are subject to availability

Price includes VAT, P&P. Send your company order, cheque, P.O. or phone your **ACCESS** or **BARCLAYCARD** number to:

# TEMPUS

Dept. CT, FREEPOST, 164-167 East Road, Cambridge CB1 1DB. Tel: 0223 312866.

## WARD ELECTRONICS

021-554-0708

**apple computer**  
SALES AND SERVICE



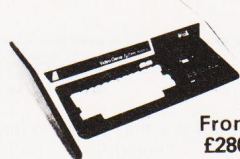
From  
**£695**

The powerful and versatile Apple II for Business, Education and Leisure. Excellent handbooks cover all aspects of the system. Expansion capability allows system to grow to meet your needs. TV compatible with UHF Modulator.

Molimerx Software  
C12 Cassettes **55p**  
Red LEDs Panel Mounting chrome **25p**

Computer Books  
Basic Cookbook **3.95**  
Basic Computer Games **5.50**  
Basic Basic **6.75**  
Business Information Processing **9.15**  
Introduction to T Bug **6.25**  
Common Basic Progs PET **8.95**  
Hands on Basic with a PET **10.95**

VIDEO GENIE



From  
**£280**

This popular low cost ready to go computer is stocked together with its range of accessories. Expansion capability allows easy interfacing of a printer. Expansion box and Discs available.

We also stock all Lowe Electronics range of equipment for the Computing, Electronics and Amateur Radio enthusiast. This includes the range of TRIO Oscilloscopes and Amateur Radio Equipment.

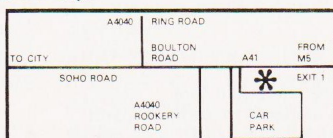
CP/M Handbook **8.95**  
Programming the Z80 **9.75**  
30 Progs Sinclair ZX80 **6.95**  
Video Genie Handbooks **5.00**

Many other books in stock for callers.

PLEASE ADD VAT TO PRICES AT APPLICABLE RATE

## WARD ELECTRONICS

First Floor  
Soho House,  
362-364, Soho Road,  
Handsworth,  
Birmingham B21 9QL.  
Tel. 021-554-0708.



9am-5pm Tues-Sat  
Closed Mondays.

Compose an Apple March.....



**MUSIC MAKER** gives you a range of three full octaves on your APPLE, with 3 note lengths and 3 overall tempos. Each note is displayed on a 'piano keyboard' while played. **MUSIC MAKER** is ready to run, but can be easily modified, so when you write your own programs you can have musical interludes. The machine code section is readily accessible for experimentation with sounds other than the 37 notes provided.

Complete with instructions and demonstration **£9.95**

### OTHER APPLE SOFTWARE

Wilderness Campaign (48K RAM)	£10.95
Dungeon Campaign (32K RAM)	£10.95
Battleship Commander (32K RAM)	£11.95
Asteroids in Space (32K RAM + Disc.DOS3.2)	£14.95
German Whist (48K RAM, Disc.DOS3.2)	£ 9.95
Pyramid of Doom	£ 8.95
Adventure Sampler	£ 5.50
Spy Satellite	£ 4.95
Skirmish (2 player board game)	£ 5.95
Game of Life (400 cells)	£ 4.95

### PROGRAMS FOR THE TRS-80 LEVEL II

Temple of Aphai	£16.95
Morloc's Tower	£ 9.95
Space Colony (Invaders game)	£ 8.95
Breakout	£ 4.95
Spy Satellite	£ 2.95

### Adventures

Strange Odyssey	£ 8.95
Pyramid of Doom	£ 8.95
Adventure Sampler	£ 5.50

### PROGRAMS FOR THE SORCERER

Breakout	£ 5.95
Pyramid of Doom	£ 8.95
Martian Invaders (8K RAM)	£11.95
Starbase Hyperion	£13.50
Screen Editor (8K-RAM)	£ 8.95

### BOOKS ON THE TRS-80 LEVEL II

Supermap	£ 7.95
The Book Vol 1 maths routines	£ 8.95
Vol 2 input/output	£ 8.95
Microsoft Basic Decoded	£19.95

### FROM AVOLON HILL FOR THE PET, TRS-80 LEVEL II AND APPLE II

Lords of Karma (Pet & Apple 32K, TRS-80 48K)	£12.95	B-1 Nuclear Bomber	£10.95
Computer Acquire	£12.95	Nukewar	£10.95
Conflict 2500	£10.95	Planet Miners	£10.95
		Midway Campaign	£10.95
		North Atlantic Convoy Raider	£10.95

Unless otherwise stated all software requires only a cassette, 16K RAM in the Sorcerer, TRS-80 Level II, Apple II (with Applesoft) and 32K in a new ROM PET

All prices include P&P Send cheque/P.O. to:

**SAPPHIRE SOFTWARE LTD.,**  
95 RISBOROUGH ROAD, BEDFORD, MK41 9QR

Overseas customers please add £2.00 per order



## Our staple offering this month is a set of books on the BASIC language

All the books reviewed this month approach, in one way or another, the problem of how to communicate with a computer. English is a non-starter as a computing language because of its ambiguity — only a human being is able to understand what is meant by 'times flies' — so programming languages have, therefore, been developed. These are restricted, well defined and entirely unambiguous subsets of the English language (which is fine if you start off as a fluent English language speaker, but is just another problem if you don't!) allowing the programmer to express his requirements to the computer. The programmer writes his programs in a 'high level language' which is then processed by a compiler, or he can skip this step and write them straight into 'assembly language' — which no longer resembles English but is a mixture of two- or three-letter mnemonics and numbers specifying address locations in the computer's memory.

BASIC became popular about 10 years ago and it remains popular as a first language for hobbyists. Pascal first came on the scene in 1975 but really took off with the advent of UCSD Pascal in 1978. In the last six months COMAL has become the most talked about language. It's a development of BASIC which includes features derived from Pascal (ALGOL actually, Ed), but although it stimulates a lot of interest, there are, as yet, no books available about it and few people around can actually program using it.

There are literally hundreds of books on BASIC. All the popular micros start out running BASIC and, to my knowledge, all of them come with at least a manual defining their dialect of the language. In some cases the information provided is insufficient for the beginner to start from, as is the case when the machine comes with the CP/M Microsoft BASIC Manual, which is merely a list of commands available. In others, the level of instruction is excellent and the beginner need look no further — a case in point is The Applesoft Tutorial, which is a model that we would like to see others copying.

When choosing a book about a programming language you have to decide whether you want a book that is going to restrict itself to teaching you how to program in a given language or one that is also going to teach you some of the principles of programming. The first book we have chosen falls into the former category. **Making BASIC Work for You**, by Claude J DeRossi, is written in an 'in-

formal, non-technical style' and appears to succeed as an easy-to-read, teach-yourself guide not restricted to any particular machine. One disadvantage as far as the complete newcomer with a personal computer is concerned is that this book is oriented to a time share system so that it describes the wrong environment. An advantage is that it is a relatively inexpensive book, but take heed of this before you go out to buy it: the same author and publisher have brought out the same text under another title — **Learning BASIC Fast** — and the revised edition of this book sells for over twice the price!

A book that falls into the other category is **Introduction to Microcomputer Programming** by Peter Sanderson. This is intended as a simple introduction for users of micros whether commercially oriented, teachers or hobbyists. It starts with a general introduction, followed by a chapter on flowcharting, and then one entitled 'Choosing a language' which covers a number of high level languages very briefly and with some factual inaccuracies. The next five chapters are devoted to BASIC and the book rounds off with two chapters on assembly and one on program development and testing, which is far too short to be useful. This book does, however, include some useful examples and exercises in its middle section.

Richard E Mayer's **Ten Statement Spiral BASIC : From Calculator to Computer** also falls into the latter category. This is a book written for absolute beginners in programming who, in the author's own words, want to 'learn how to communicate with computers'. Its purpose is to give an understanding of how computers work rather than to give a complete working knowledge of BASIC. The author attempts to do this by restricting his account to only a part of BASIC, the 10 statements of the title, namely : READ, DATA, LET, PRINT, IF, GOTO, END, FOR, NEXT and INPUT. These are used in programs which handle a variety of simple arithmetical problems to demonstrate how computers can be used to carry out such tasks. The idea of the 'spiral approach' is that only a limited amount of information is presented initially and more peripheral details are added only after this central core has been understood. The book has two weaknesses. First, its approach is deliberately repetitious, this can be frustrating to those who grasp the author's point first time round. Secondly, it employs a model of the computer system with punched cards (!) which

could lead the novice reader to adopt a false impression. We were not very impressed by this book. It seemed boring and pedantic compared to many of the other introductions to BASIC which are available. However, for people who find computing completely bewildering and a little terrifying, or where access to computers is extremely limited, its gradual and repetitive approach may be found useful.

Two books by Dwyer and Critchfield address themselves to the beginner who has a new micro to explore. **You Just Bought A Personal What?** is a general introduction which features Level II BASIC (on Tandy only) and Microsoft BASIC (on most other popular micros but with variations), while **A Bit Of BASIC** provides an eight-hour self-study course that goes on to rather more advanced features which include some graphics. Although from different publishing houses, these two books share a distinctly American format. Both are large softbacks, enlivened with entertaining cartoon illustrations. We thought the latter book represented value for money compared with many others.

For a new British book about BASIC on micros look out for the latest title from Babani, **An Introduction to BASIC Programming Techniques**, by S Daly. This slim volume throws the reader in at the deep end — by page four you are solving quadratic equations, so if you are not well up on maths you may feel a little lost. However, if you can keep up with its fairly rapid pace you'll find that this little book covers the same ground as many that appear as giants beside it. Chapter 7 presents six complete programs including one to work out biorhythms, one to compute standard deviations and another to generate tuneful musical note sequences. In our opinion, this book is worth its price for these programs alone.

The titles included in this month's selection were:

**Making BASIC Work For You**, by Claude J DeRossi, published by Reston (Prentice Hall) (1981), 179 pages, £3.85.

**Introduction to Microcomputer Programming**, by Peter C Sanderson, published by Newnes Technical Books (1980), 138 pages, £4.25.

**Ten Statement Spiral BASIC : From Calculator to Computer**, by Richard E Mayer, published by Glencoe (1980), £5.65.

**You Just Bought A Personal What?** by Dwyer and Critchfield, published by Byte Books (McGraw Hill) (1981), £8.50.

**A Bit Of BASIC**, by Dwyer and Critchfield, published by Addison Wesley (1980), 184 pages, £3.85.

**An Introduction to BASIC Programming Techniques**, by S Daly, published by Bernard Babani (1981), 87 pages, £1.95.



# COMPUTECH for apple

# COMPUTECH for ITT

## COMPUTECH SOFTWARE & HARDWARE IS WIDELY ACCLAIMED - WHY?

Companies like Shell UK Oil, Grindlays Bank, W.H. Smith, government departments and hundreds of firms from multinational corporations to sole traders and small businesses have licensed Computech software. Why?

Thirty years experience of business fifteen years experience of computing and dedication to serving the users' interests economically must be major contributions. By the time this advertisement appears about 1000 business software packages will have been installed and supported by us. Note other features which appeal to our customers - no special equipment, all configurations of Apple systems supported, no extra charge for lifetime support, hot-line service, economical use of hardware resources, program code supplied, modifications allowed, full validation, all accountancy requirements satisfied, all data written to disk and recoverable on demand, very simple operation, emulation of traditional manual methods, comprehensive manuals with sample reports, reliable operation, advisory bulletins and free fixing of bugs, (which is fortunately rare). Reduced licence fee for new versions with extra features. As approved dealers of Apple products and actual manufacturers of compatible hardware we combine the knowledge of hardware and software so essential for the application of microcomputers.

## COMPUTECH SOFTWARE AND HARDWARE INCLUDES:


**Payroll** for 350 employees, 100 departments, all pay periods, printed payslips, approved year end documents, very quick and easy to use, **£375**. **Sales, Purchases** and **General Ledgers** **£295** each, detailed statements. **Job Costing** and **Group Consolidation** are amongst many and various applications of the **General Ledger** package, which supports values to totals of one thousand million accurate to a penny! Our **Utilities Disk** available like other packages in 13 sector or 16 sector format, is widely used for reliable, error checking, copying, including single drive, and the renowned **DPATCH** program beloved of programmers for **£20**. We have developed a **Terminal Utilities** package which enables Apple to Apple and Apple to mainframe communications with local processing and storage as well as Apple to host communications from the amazingly low price of **£130**. Our **Graphics Utilities** program for use with the **Microline** and **Epson** families of printers enable the plain paper production on low cost printers of high resolution screen pictures, graphs etc. - free with **Microlines** or **£30** separately. **Keyboard Driver** enables the use of our **Lower Case** adaptor with BASIC programs and **Applewriter Patches** supplied **FREE** with our character generator package (total cost **£50**) is separately available on disk with documents for **£10**. At the same price **CAI** (convert Apple pictures for ITT) makes binary high resolution picture files display properly on the ITT 2020. We sell the famous **Visicalc** for **£125** and have delivered systems using it to do amazing things like production control, shipping accounts and stocks and shares valuations! The versatile **Applewriter** word-processing package at only **£42**, especially employed with our **Lower Case Character Generator** is widely used by people who cannot type to produce word-perfect copy! Experience with Apple systems has led to the design and manufacture of compatible products with enhanced features at very favourable prices to satisfy users' needs. These include the **Diplomat Serial Interface** which has handshaking capability and switchable options (**£80**), the **Diplomat Parallel Interface** which enables the direct use of text and graphics with the **Microline** and **Epson** printers and is a complete 'plug in and go' item with gold-plated edge-connector at **£80** and has optional direct connection for **Centronics 730/737** printers. Our new **Diplomat Communications Card** at **£95** is a sophisticated peripheral especially suitable for Apple to mainframe communications at high speeds in full duplex mode with switch selectable bit rates and other options. The **Lower Case** adaptor is available for Apples (revision 7 and earlier) as well as ITT 2020, complete with diskette software for **£50**. It offers true descenders on screen and the £ sign. We also have an **Optional Character Generator** for the ever popular **Microline M80** at **£15**. This provides £ sign and improved digits and lower case characters with USASCII special symbols. Our price for the **Microline M80**, with graphics, 40, 80 and 132 characters per line, friction, sprocket and teleprinter feed, is only **£345**, amazing for this small, quiet reliable 'look alike' printer. Tractor option is **£40** and **Serial Adaptor** **£80**. The **Microline M82**, bidirectional printer with both parallel and serial input is only **£525**, it can have an optional 2K buffer, while the **Microline M83** full width adjustable tractor 120 cps printer with similar specification is only **£775**. Then for all computer users there is the unique **Micromux** which from **£800** provides up to 16 ports for simultaneous independent serial asynchronous communications! Telephone for data sheets or to arrange a demonstration or for the address of our nearest dealer. Please hurry - the demand for our products has been such that some have been temporarily out of stock. We offer the effective low cost solutions you need. **Prices exclude V.A.T., carriage and packing.**

## COMPUTECH SYSTEMS

168, Finchley Road, London NW3 6HP. Tel: 01-794 0202

AGENTS THROUGHOUT THE UK AND OVERSEAS






**12 TDM ONLY**  
**£65**

THESE SUPERB PROFESSIONAL DISPLAYS OFFER THE MICRO ENTHUSIAST A NEVER-TO-BE-REPEATED CHANCE TO HAVE A VDU WITH A SPECIFICATION UNRIVALLED BY DISPLAYS AT THREE TIMES THE PRICE MADE BY AN ENGLISH MANUFACTURER TO AN EXACTING SPEC. BUILT TO LAST. THE KEYBOARD ALONE IS WORTH OUR PRICE.

- \* GREEN SCREEN FOR REDUCED EYE STRAIN
- \* 80 CHARACTERS PER LINE, 26 LINES
- \* STANDARD V24 INTERFACE LEVELS
- \* PRINTER DRIVE PORT
- \* ASCII SUBSET - 600 1200 2400 BAUD
- \* ON SCREEN EDITING AND FULL CURSOR CONTROL
- \* MODEM CONTROL CAN BE MULTIPLEXED

**15 WDM ONLY**  
**£80**




**GRAPHICS**

- \* CALCOMP 565 INCREMENTAL X-Y PLOTTERS
- \* 10 THOU STEPS
- \* EASY MICRO-COMP INTERFACING
- \* SINGLE SHEET OR ROLL PAPER
- \* PRECISION INSTRUMENT

ONLY

**£115**



SECONDHAND EQUIPMENT SUPPLIED IN WORKING ORDER BUT UNGUARANTEED

**HARDCOPY**


- \* ASCII CODED
- \* SIMPLE INTERFACE
- \* INDUSTRY STANDARDS
- \* PLAIN PAPER
- \* 110 BAUD
- \* FLOOR STAND
- \* SET OF 3 MANUALS FOR ONLY £7.50

RO 390 PRINTER ONLY **£65**

KSR 33 WITH KEYBOARD **£95**

ASR 33 **£160**

AS ABOVE PLUS PAPER TAPE PUNCH AND READER



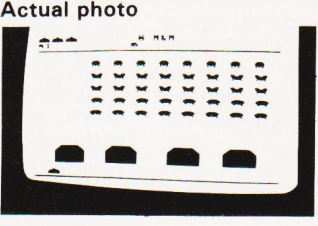
**MAWSON ASSOCIATES**  
124 LENNARD ROAD  
BECKENHAM, KENT BR3 1QP  
**01-778 3600**

WE ALSO BUY SURPLUS COMPUTERS AND COMPUTER PERIPHERALS. PLEASE RING FOR DETAILS

CARRIAGE AND PACKING AT COST  
CALLERS WELCOME BY APPOINTMENT

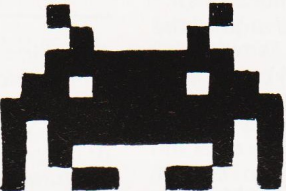
**ANY ZX80 HIRES (256x192) ZX80 INVADERS. JUST PLUG IN. FLICKER FREE, FAST MOVING GRAPHICS. FULL FEATURE ARCADE GAME. NO TEDIOUS CASSETTE LOADING. ONLY £16.95 FROM**

**M&M SOFTWARE**  
CT Box No. 207  
145 Charing Cross Rd  
London WC2.



Actual photo

Detail like this



**SUPERB ZX81 SOFTWARE AND HARDWARE**  
**WE ARE THE ONLY PEOPLE WHO WANT YOU TO READ OUR COMPETITORS ADVERTS**

Because we offer best value and quality, for example **Tape Book 50** a cassette of programs for 1K RAM ZX81 for £6.95. This includes programs for Education, Science, Maths, Business and of course lots of fully animated games. Some of the titles included are: Land Columbia, Invaders, Squash Practice, Breakout, Numerical Integration, Tank Battle, Bank Account, Torpedo, Splatt I & Splatt II, Duck Shoot, Fruit Machine, Linear Regression, Matrix Algebra, Hex Loader, Differentiating, VAT Calculator with Entry Cheque, plus many more.

**All this for £6.95 inclusive. UK & Europe.**  
Also **Tape Book 20** for **£3.95** (23 programs for 1K RAM ZX81)

16K RAM ZX81 you can now get our **Game! 81 Interpreter** for **£14.00**, which allows you to write adventure programs in plain English. We now have memory expansion boards up to 16K at £29.95.

How on earth do they do it? Because the production of program cassettes is completely automated and a microprocessor is used to check the signal as it is being recorded. This ensures 100% quality and low, low prices.

**Control Technology,**  
39 Gloucester Road, Gee Cross, Hyde,  
Greater Manchester SK14 5JG.  
Tel: 061-368-7558.

**ZX81 RAM PACKS**

<b>4K RAM PACK</b>	<b>£19.95</b>
<b>8K RAM PACK</b>	<b>£33.95</b>
<b>4-16K EXPANDABLE RAM PACK</b>	<b>£29.95</b>
<b>FULL SIZE ZX KEYBOARDS</b>	<b>£24.95</b>

4-16K Expandable RAM Pack. A highly flexible memory expansion that can grow as you learn supplied as 3K (4K with on-board RAM), but expandable to 16K by simply plugging more RAM chips into holders fitted on the board.

Keyboard. A full size keyboard for the 80/1. Has proper keys as larger computers. Enables faster programming.

Please add £1.00 P/P for above items.  
Specify on order ZX80/81.

Software at unbeatable prices. 50 programs on one cassette. Invaders, Breakout, Tank Battle, Torpedo etc. Also includes Education, Maths, Business. All for 1K RAM. £6.95.

**dK'tronics**

23 Sussex Road, Gorleston, Gt. Yarmouth, Norfolk.  
Tel: Yarmouth (0493) 602453

# Video Genie

## BRITAINS' BEST BUY IN PERSONAL COMPUTERS?

**Latest version with Vu-meter and extra Keys**

- \* EG 3003 Model
- \* 16k Ram, + 12K Microsoft Basic in Rom
- \* TRS80, Level II Compatible
- \* 100's of Programs Available
- \* Self-Contained Power Supply
- \* Integral Cassette, Plugs into TV or Monitor
- \* Ideal for Business, Education + Leisure
- \* Includes Demo Cassette with 5 Programs, + 3 Manuals, and leads

**Options:**  
Sound Unit, fitted when ordering £15 + VAT.  
Lower Case Characters fitted when ordering £38 + VAT  
With 32K memory £325 + VAT



**£275 + VAT**

**32K Version! £325 + VAT**

**VG System Expansion**

Expansion Box	£189
Floppy Tape ACCULAB	£168
Single Disc Drive	£210
Disc Drive TEAC FD-50A	£145
Double Disc Drive	£389
Light Pen	£16
Seikosha GP/80 Printer	£195
Epson MX-70 Printer	P. O. A.
Epson MX/80 Printer	P. O. A.
Microline 80 printer	£285
Printer Interface (CENTRONICS)	£35
S100 RAM Card 32K	£129
Monitor 9" B/W Screen	£65
Monitor 12" B/W Screen	£70
Monitor 12" Green	£95
Green/Amber Monitor Filter	£9
Joy-stick with software	£18.50
Colour (fitted) Board	£49
Colour monitor uncased 14"	£199
RS232 Interface	£50
EPROM Programmer	P. O. A.
Cassettes C12 10 for	£5
Expansion Box plus 32K	£289

**Books**

TRS-80 Interfacing Book 1 or 2	£7.95
Microsoft Basic decoded	£16.95
TRS-80 Disk Mysteries	£14.95
TRS-80 Machine Language	£8.50
VG Service manual	£5.95
TRS-80 Basic	£5.95

**Software**

Space Invaders with Sound	£13.00
Music Master with Sound	£14.95
Cosmic Raiders Sound/Joysticks	£10.00
Meteor Mission Sound/Joysticks	£10.00
Z Chess III Chess	£14.50
Saragon II Chess	£22.50
Stock Control	£17.00
Tookit	£29.95
Editor Assembler +	£21.70
Monitor machine code	£23.10
System Loader/ Copy	£8.50
Basic Level III	£29.95
Teach yourself machine code-6	
cassettes plus manual	£49
Z80 In Circuit Emulator	£195

**Disc**

Adventure	£19.50
LDOS	£84.00
Z-Chess	£17.45
Verbatim 5 1/4 Disk 10 for	£19.50
Scripfit word processor suitable for MX-80.	£69.50

**Kits**

Colour Kit	£39
Lower Case	£30
Sound Unit	£10
Keyboard Up Grade	£6
16K Memory Upgrade Board	£45

**EPSON MX-80**

**80 COLUMN DOT MATRIX PRINTER one of the worlds most advanced printers. Pinfeed and pinfeed/friction versions available. Phone for prices. Video Genie Printer Interface £35 + VAT.**

**SOFTY** INTELLIGENT EPROM PROGRAMMER

Connects Directly to TV.  
Develop, Copy, Burn, Verify 2716, 2732, 2532.  
Softy is a versatile product and each application will be different by definition. When Softy is connected via a serial (RS 232) or parallel link with any small computer capable of supporting an assembler a simple and Capable Product Development System is performed. For product developments less than 2k of firmware Softy may be the only development tool you need.

Send for leaflet £169 + VAT. Built includes power supply

**TEAC FD-50A 5 1/4" DISC DRIVES**

**Uncased**

**£145 VAT - £150 p/p**



**Eprom Eraser**  
Low cost eraser £39.50

**ACORN ATOM**

To use the ATOM immediately you just connect the plug to the power supply and cable into an aerial socket of TV. ACORN ATOM built 8K, 2K RAM £150 + VAT. Power supply £10.20 + VAT.  
Includes cassette with programmes.  
Book: Get Acquainted With Your Acorn Atom.

**Q-Tek Systems Ltd**

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

Send 50p for Latest Catalogue Please add VAT to all items

Order Under £50 Add 50p p + p Otherwise carriage at cost



Dear Sir,

It has been said that "The bad wheel usually creaks the most" so before I start to "creak" let me commence by complimenting you on the standard of your magazine, however. . .

Shut your eyes, put your feet up on your desk, let your mind wander maybe 6000 miles or more southwards to a modest home in 'darkest' Africa. The latest issue of Computing Today has hit the news stands. Gathered around the PET, better known as Fred in this household, stand three young boys aged from 9 to 12 years. The eldest has the magazine in one hand whilst the other hand is flying across the keyboard, greedily feeding in the latest program. Alas! At run-time the blasted machine throws out error messages that, if translated, would make a sailor blush. Advance the clock a few hours. Father comes home from a day at the salt mines and instead of being able to relax with the evening news, is hauled feet first, kicking and screaming, to this machine, designed and built by some obscure womans' libber to reduce the male chauvinistic pigs amongst us to neurotic cretins. Those at least are the feelings of the writer at a time long past midnight, having at last been able to make a redesigned bomber drop its load on the unsuspecting fish in the dam below.

On a more serious note, would it not be possible to request authors to elaborate their software with remarks to detail various key sectors and the purpose of variables so that in the event of a printer's error, the original algorithm can be recreated and the error easily corrected?

Secondly, can you possibly supply me with the name of the manufacturer of the Video Genie Computer (not the UK distributors) in Hong Kong?

Thanking you,  
Yours faithfully,  
Alan Nathan.  
Cape Town,  
Republic of South Africa

(\*The Video Genie is produced in Hong Kong by Eaca Computer Ltd., who according to the latest issue of the 'Hong Kong Trader' are set to launch a second Genie onto the market later in the year. Their address is Ground Floor, Arise Industrial Building, 20 Hung To Road, Kwun Tong, Kowloon, Hong Kong. Ed.\*)

Dear Sir,

Having read both the ATOM review (April 81) and Mr Meredith's reply in the June issue, I feel that an important point is being missed concerning the BASIC supplied.

BASIC is nearly 20 years old and has been criticised for never having had a standard produced. The version of BASIC in the ATOM seems sufficiently distant from any known BASICs to warrant a name other than BASIC. In view of the BASIC being developed for the BBC will there be much support for

the ATOM in its present form? Or will it turn into another MK14?

On the point of jumping out of FOR-NEXT loops, many interpreters can get into trouble if the return address is left on the stack.

A possible method to exit early from such a loop is

```
100 FOR X=1 TO 100
200 IF A(X)=0 THEN X=100 : GOTO 900
300 :
900 NEXT X
```

Finally, text can be stored exactly as typed in, if preceded by a REM statement. Microsoft BASIC will not tokenise this.

Yours faithfully,  
David Bolton B.Sc.  
Carrickfergus, Co. Antrim

(\*Acorn will be introducing a BBC BASIC ROM for the ATOM. Ed\*)

Dear Sirs,

Four of us have put together a small micro group which is centred around the area of Wantage, Abingdon, Didcot, Wallingford and Newbury. We refer to ourselves as the South Oxford Computer Club and would like to know if you will help to publicise the group. We meet in East Ilsley on the first Tuesday of each month. The group consists of 6800, Z80 and 8080 users. There are four phone numbers where we may be contacted. They are Mike 0235-834402, Malcolm 0235-816949, Paul 0235-815305, and Rocky 0635-34456.

Thanks for your help,  
A L Jardes, III  
Newbury, Berks

Dear Sir,

Thanks must go to A P Stephenson for his excellent program 'Multicolumn Records'. May I point out an error which must have crept in during transcription to your magazine. Line 2465 should not be there! 'GOSUB 2360:GOTO 210' is to be included in line 2460. Also line 2270 should read IF K\$=" [SPC]" THEN R=R-1:GOTO 580.

May I add that those who have PET BASIC 4 will need to change line 185 to read 'POKE 144,88' and line 3490 to read 'POKE 144,85:END'.

Yours faithfully,  
G J Tucker  
Paignton, Devon

Dear Sir,

I am a TRS-80 owner and I would like to find another TRS owner in Brussels. If there is anyone out there. . . I have only just started out in computing and would like to share ideas (and mysteries!) Also I agree with Peter Tootill (CT July '81), there are no cassette or keybounce problems with the more recent Model I's.

Yours faithfully,  
Timothy Noyce,  
Brussels, Belgium

Dear Sir,

With reference to B Wragg's letter in the July issue. The original listing of 'Space Invasion' does result in the game ending with a score of about 26,000. If Mr Wragg has the necessary stamina he may attain scores of 220,000 plus by making the following changes.

Change memory location

```
0AB4 TO 20 F5 0B
0AB7 TO EA
```

Then add the following

```
0BF5 A5 4A LDA
0BF7 C9 20 CMP
0BF9 90 04 BCC
0BFB C6 4A DEC
0BFD C6 4A DEC
0BFF 60 RTS
```

As you can see I've managed to keep within the 2K — just. The higher the value in 0BF8 the easier the game.

Yours sincerely,  
J C Hawthorn  
Watford, Herts

Dear Sir,

I would like to bring to your readers' attention the setting up of the Apple Music Synthesis Group. The lion's share of micro-based digital synthesis is being captured by the Apple II, but, so far, no attempt has been made to co-ordinate activities or direct them to particular musical goals.

The AMSC is interested in hearing from any Apple-owning musicians, but, in particular, will be concerned with the Alf, Mountain Hardware Music System, alpha-Syntauri system, and the Soundchaser. Long term goals include an international conference in London and the release of LPs of Apple music but, initially, feed-back is urgently requested. A newsletter is envisaged but, for the time being, user contact will be via a regular feature in the new Apple magazine, Windfall.

Further information on the AMSC, is available from me at the address below, but please enclose a SAE!

Yours sincerely,  
Dr David Ellis,  
22, Lennox Gardens,  
London SW1

Dear Sir,

I would be most grateful if you publish a user group column in your magazine to include this entry.

A new local CBM/PET/VIC user group covering the North Herts Area has been formed. It holds regular meetings, talks, exchange of news, views etc. The club is affiliated to IPUG. Anyone interested should telephone Hitchin (0462) 54435 or write to the address below.

Thanking you for your assistance.

Yours faithfully,  
N Mortiboy  
2, Spurris Close,  
Hitchin,  
Herts SL4 9QE



Dear Ed,

After keying in A P Stephenson's Multipurpose, Multicolumn Records program in the July 81 issue, I found a potential bug and give below my solution which I hope you will pass on to others.

The BASIC I use is Sharp (MZ80K) and is so close to the PET Microsoft BASIC that my code should work immediately on the PETs it was originally designed for.

## Record Search

A P Stephenson does not allow for more than one entry with the same data in the KEY column. This code corrects that and also allows for incomplete entry of the KEY field (ie MIN will find MINATAUR, MINEFIELD etc — in fact any word containing the sequence "MIN"). Also, once found, the program will ask if the found data is that which is required, if not the search will continue from where left off.

```
515 FOR XX = 0 TO LEN (A$(R,1))
520 IF IBS = MID$(A$(R,1),XX,LEN(IBS))
    THEN 565
525 NEXT XX
565 PRINT A$(R,1);"?";:INPUT A8$:IF A8$
    = "N" THEN 530
```

## Column Search

As for Record Search, the Column Search routine is modified to allow for "incomplete" entries.

```
2200 FOR R = 1 TO Y
2210 FOR XX = 0 TO LEN(A$(R,C))
2212 IF MID$(A$(R,C),XX,LEN(DI$))=DI$
    THEN PRINT TAB(10); A$(R,1);
    TAB(22);"Rec";:R
2215 NEXT XX
2217 S = 1
```

I know that this does mean more code (the person who puts the program into an 8K machine has a sense of humour) and that it slows the search down, but, and this is the important part, it is "user friendly". In fact I was quite astonished to notice the lack of similar code in the original, which I am delighted with.

Oh well, now I suppose APS will be on the lookout for one of my gems — well, if I can get the hang of the MZ80 keyboard (I am a trained typist) and can get some time off from the wife, I'll see what I can do.

D A Thompson  
Chatham, Kent

Dear Editor,

As a beginner (and probably the only ZX80 user in Port Elizabeth) I am very confused as to whether or not moving graphics are feasible on the ZX80. All reviews say "impossible", but the numerous adverts in CT say "yes". This contradiction has put me off buying any programs.

If you could, through "Printout", enlighten me (and presumably others) I should be most grateful.

I have had hours of enjoyment (albeit painful at times) from both the MK14 and ZX80. Looking forward to CT (one

month late) on the 1st Friday in the month.

Keep up the good work.  
Kind regards,  
R R Diamond  
Port Elizabeth, South Africa

(\*This is a common question and the answer, although generally well known, is worth repeating. The ZX80 and ZX81 computers use a serial print file which is filled and then displayed. The ZX81 contains a routine which allows you to put information into specific locations in that file before it is displayed, thus giving the illusion of moving graphics. The ZX80 did not have this facility built in but the software routines are commercially available. It should be noted that this is NOT the same as providing a memory mapped screen and the system is not as flexible. Ed.\*)

Dear Sir,

I feel that the program 'Holocaust' by Mr S Goodwin in the July issue should not have been published. Nuclear war cannot in any way be considered something to make a game of.

Just because the microcomputer makes it possible to play games such as this in a relatively exciting and interactive way, this should not be regarded as a licence to produce games as tasteless and unpleasant as Holocaust.

Nuclear war must never be made to appear acceptable. The survival of us all, including Mr Goodwin, depends on its total unacceptability.

Games of this type in which one can 'fight it out in your living room', only make light of the threat of nuclear war and the disastrous consequences should one occur.

Hoping that in future you will choose your games programs for publication with more thought.

Yours sincerely  
C M Jordan  
Powsy

(\*It would appear from the overwhelming number of letters and telephone calls from CT readers looking for the missing section of Holocaust that the majority do not share your views. In my view I feel that the only way people are ever likely to do anything about the 'threat of nuclear war' is if they actually realise the kind of destruction that is likely to result. Unfortunately the BBC decided to 'ban' the programme 'War Game' which certainly brought home the realities. I trust you have complained equally to the other publications who have run similar programs and to the makers of Space Invader type machines for promoting the wanton killing of cute little green bug-eyed monsters. Ed.\*)

Dear Sir,

Mr Want's letter in your July edition is correct — the PET does run noticeably

slower on Integer arithmetic. Individual variables seem to take the same space as floating point numbers as well, but arrays only need two bytes per integer, as compared with 5 for floating point numbers.

The storage space for integer data is therefore 150% greater than for ordinary numbers, in array systems. This is about the only advantage, although there would be some advantage in the handling of Boolean expressions as well.

Jim McCartney  
Coleraine,  
Co. Londonderry

Dear Sir,

Someone appears to have misled Mr Want on this matter (July issue). I have not seen claims for increased speed by using integer variables on the PET, though they are made for other machines.

I refer Mr Want to the PET Guide by Donahue and Enger, Page 57: "PET BASIC converts any integers to floating point representation. . . an integer array (my emphasis) uses less storage space in memory (two bytes for an integer versus five bytes for a floating point number)"; and page 322: ". . . for integers the unused three bytes are dropped for array elements."

The following simple test took 97 jiffies on my own machine, whether the arrays were X( ), Y( ) or X%( ), Y%( ). However the storage requirement for the floating point version was 5130 bytes against 2129 for the integer version.

```
100 T=TI
110 DIM X(500),Y(500)
120 FOR K = 1 TO 500
130 X(K)=K+1
140 Y(K)=X(K)*3
150 NEXT K
160 PRINT TI-T
```

Yours faithfully,  
B Thorpe  
Cheadle, Cheshire

Dear Sir,

I would like to see a computer club start up in the area of Chippenham and Calne. To aid in its beginning I am prepared to liaise with people who feel they are interested in helping to start it up and run it, and those who just want to come along. I aim to make it into a multi-machine, multi-language (varieties of high and low level languages) multi-processor club to cover everything and with two aims.

1. To spread ideas from machine to machine, language to language, etc.

2. To enable newcomers to learn and choose a computer for themselves.

People in the area (or outside) should, if interested, write to me at Pinhills, Bowood, Calne SN11 0LY, giving details of their machine, interests and what they can do to help and what day they would like it on, enclosing an SAE.

Thank you,  
Matthew Jones





# 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
Barriade*	£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
Startrek 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
<b>EDUCATIONAL</b>	
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
<b>BUSINESS &amp; UTILITIES</b>	
Accounts Receivable II	£13.50
Amateur Astronomer	£9.50
APL-80*	£10.50
Basic 1P*	£11.50
Basic Toolkit*	£12.50
Biorythms	£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
SCRIPSI*	£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
Timer*	£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
Compro	£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
SCRIPSI*	£65.00
Simplify It	£15.00
Space Intruders	£20.00
ST80D*	£45.00
ST80D III*	£95.00
SUPERSCRIPT*	£20.50
Visicalc*	£65.00
Taranto & Associates Conversion of Osborne & Associates Business Programmes	
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**

## YOUR QUICK-LEARN WAY TO BASIC, COBOL & IBM 360

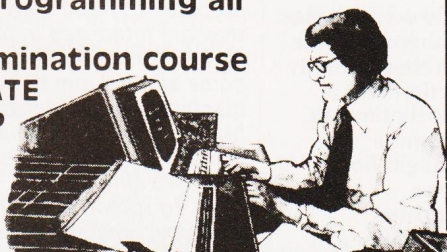
**IN YOUR OWN HOME, IN YOUR OWN TIME, AT YOUR OWN PACE.**

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.....

345L

# Happy Memories

Part type	1 off	50-99	100 up
4116 200ns	1.05	.95	.85
4116 250ns	.95	.85	.75
2114 200ns	1.35	1.20	1.10
2114 450ns	1.30	1.15	1.05
4118 250ns	3.95	3.25	2.95
2708 450ns	2.40	2.25	2.15
2716 450ns 5 volt	2.65	2.40	2.20
2716 450ns three rail	7.40	7.00	6.75
2732 450ns Intel type	5.40	4.95	4.65
2532 450ns Texas type	5.40	4.95	4.65

SOFT-SECTORED MINI-DISCS for PET, TRS-80, etc.  
Supplied in **Free Library Case** ..... **£19.00 per 10**

## Low profile I.C. Sockets by Texas

Pins	8	14	16	18	20	22	24	28	40
Pence	9	10	11	14	15	18	19	25	33

Soft sectored mini discs in plastic library case of ten discs:  
1 case: £19.00    10 cases: £17.00    25 cases: £15.50

Please add 30p post & packing to orders under £15 and VAT @ 15%. Access & Barclaycard accepted, 24hr service on (054 422) 618. Government & Educational orders welcome, £15 minimum. Trade accounts operated, 'phone or write for details. Full list of components & books available on request.

**HAPPY MEMORIES (CT), Gladestry, Kington, Herefordshire HR5 3NY. Tel: (054 422) 618 or 628.**



# PROGRAMMING LANGUAGES

Dr G J Marshall

## If you can't afford the actual hardware of a robot you can still use your micro to simulate their behaviour with WSFN

**W**SFN is a robot control language. It is intended to be a language in which commands to a micro-processor-controlled robot can be expressed, and then issued using a keyboard as the input device. The language was devised by Lichen Wang and was first published in 1977. Wang also invented the name of the language, which stands for something rather silly that can be found by consulting the references given at the end of this article. The language possesses a small number of instructions. All robot commands must be expressed in terms of this small repertoire, which includes instructions such as 'move forward one step' and 'turn to the right'. However, the language permits these instructions to be combined in quite complex ways, so that sophisticated programs can be written despite the smallness of the language. A version of the language is available for controlling a simple robot, such as a 'Turtle', making it interesting to anyone seeking a new application for their micro. Other versions are written to control a cursor which can leave a trace on a screen to show the path it has taken. This provides either a robot simulation or a facility for drawing patterns depending on how you regard it.

### Language Properties

As a robot command language, WSFN provides the robot with a memory and generates the signals necessary for the robot to obey the commands issued to it. The memory consists of an accumulator and a facility for storing macros. The accumulator is an eight-bit register capable of storing any integer from 0 to 255. A macro is a sequence of commands that is given a name. When a macro is defined, the sequence of instructions is stored together with the name. Subsequently, the name can be given as an instruction, and when this occurs the name is replaced by the associated sequence of instructions which are then executed. Thus, a macro is a way of extending the language.

The commands to the accumulator are '+' to increment it and '-' to decrement it. Repetition is achieved by preceding the command with the number giving the repetitions required. Thus, 32+ means increment the accumulator 32 times. Preceding an instruction by 'A' indicates that it should

be repeated as many times as the number in the accumulator. To illustrate this, A+ is an instruction to double the number in the accumulator, while A- is an instruction to set the accumulator to zero.

Since setting the accumulator to zero is a useful facility, it may be worth defining it as a macro. This is done by giving it a simple letter name that does not clash with the name of any other instruction, say Z, and then issuing the command:

Z = A -

This stores the macro definition A - with the name Z, and, subsequently, when the command 'Z' is issued, the accumulator becomes zero.

In WSFN, brackets can be used to group commands, and blanks are significant, being interpreted as 'no operation' instructions or instructions to do nothing.

The remaining instructions can conveniently be explained in terms of a system controlling a cursor that is leaving a white trace on a black screen. There are three initialisation instructions, 'C' to clear the screen, 'N' to face North, or up the screen, and 'H' to send the cursor home to the centre of the screen. These instructions are for convenience when using a screen, and have no particular relevance to controlling an actual robot. The fundamental instructions for robot movement are 'F' to move one step forward and 'R' to turn 45° to the right (ie clockwise as seen from above). These two instructions are sufficient to move the robot to any position within its field of activity.

Additionally, there are conditional commands signified by 'T' and 'S'. The instruction Txy, where x and y represent commands, means if A ≠ 0 then execute x else execute y. Similarly, Sxy means if the sensor indicated an obstacle execute x, otherwise execute y. With this very small instruction repertoire, programs for quite sophisticated tasks can be written.

### Example Programs

It is always possible to describe to a robot the way in which it should follow a particular path by providing the directions in detail. A program that causes a robot to move along a square path and return to its starting position is:

4(2R8F)

A square of the same size (but in a different position) is traversed anti-clockwise rather than clockwise by:

4(6R8F)

A robot faced with an unknown labyrinth, such as that in Fig. 1, can find the way through it by use of the condi-

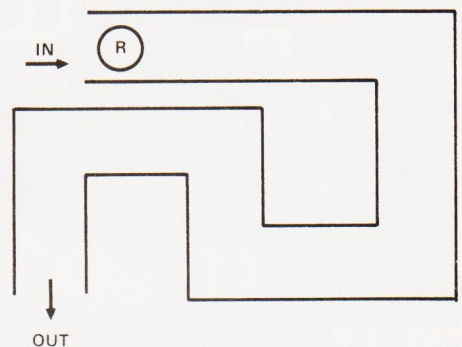


Fig.1. Labyrinth.

tional instruction which tests the sensor. Assuming that the labyrinth has only right-angle turns, an algorithm for proceeding through it is:

Repeatedly  
if you can, go ahead  
else  
(if you can, turn right  
else  
turn left)

In WSFN, this algorithm is expressed as repeated executions of

S(2RS(4RF)F)

Similar programs can be written to enable a robot to find its way through a maze. A maze is more complex than a labyrinth, since it can also contain T-junctions, crossroads and dead ends. However, a program for exploring a maze need be only slightly more complex than that for a labyrinth. For this reason, WSFN may well be of interest to Micromouse enthusiasts.

Recursion is supported in WSFN, as illustrated by the following, in which the macro U is defined in term of itself:

U = T(AF2R - U)b

where b denotes a blank, meaning that the macro U requires that nothing should



# PROGRAMMING LANGUAGES

be done if  $A=0$ . You might like to find the result of executing the program:

Z9+U

The 'Dragon curve' illustrated in Fig.2 was produced by:

L = T(-L6RJ+ )G  
J = T(-L2RJ+ )G  
G = 4F  
Z8+L

## Implementations

Wang published WSNF in Dr Dobbs' Journal, Number 18, 1977, in an article entitled 'An interactive programming

language for control of robots'. The article includes a listing of an implementation of the language written in 8080 assembly code. Routines are given for controlling a 'Turtle' and for screen cursor control. Actually, it is necessary to look at Dr Dobbs' Journal, Number 20, as well, because the article had to be reprinted after being badly mangled.

A version of WSNF for the PET is available from Petsoft. It is written in BASIC and enables control of a cursor on a 39 x 78 grid. It comes with documentation which, although useful, is not entirely adequate. Figure 2 is a photograph of a pattern on a PET screen generated with

this version of WSNF.

## Conclusion

WSNF is a small language for an interesting application. It includes the features that are necessary to construct all the useful program 'shapes'. Consequently, it reveals the small core that is really essential to any computer language. Programs written in WSNF are concise but, as a result, they can be hard to read. These factors must be balanced against each other in any language, although languages do exist with which it is hard to make programs either concise or readable!

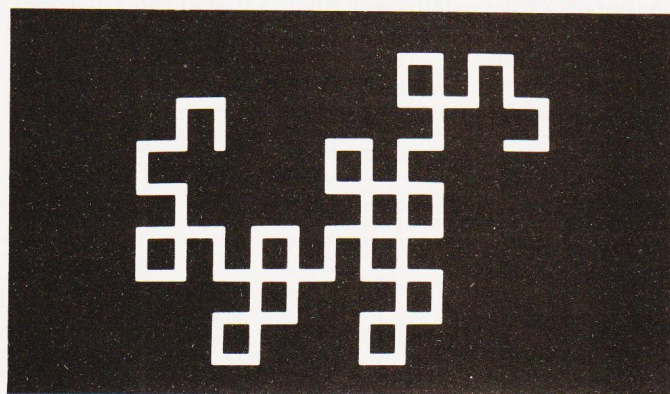
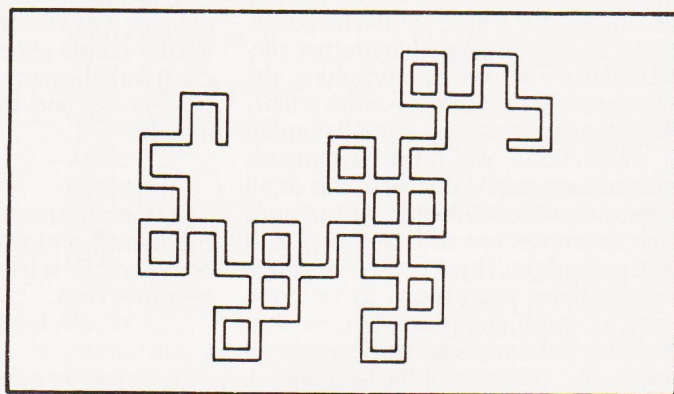


Fig.2. The Dragon curve.



## OUTSTANDING SOFTWARE FOR THE

# Sinclair ZX81

ALL SOFTWARE IS SUPPLIED ON QUALITY C12 CASSETTE WITH PRINTED INSTRUCTIONS

## ZXAS MACHINE CODE ASSEMBLER

for 16K ZX81 & 8K ROM ZX80

Complete assembler. Assembles standard mnemonics written into REM statements. Overwrite protection. Occupies 5K. Supplied with documentation. Amazing value at only £3.95

**MORE MACHINE CODE AIDS COMING SOON**

## MULTIFILE

16K ZX81 only

Amazingly versatile multi-purpose filing system, with comprehensive documentation and 3 data cassettes. Possible application includes: Sales Records; Bank Account; Mailing List; Appointments Book; Order Book; Product Catalogue/Price List; Club Membership; Address/Phone Book; Diary; School Records; Language Translator; Recipe Book; Bookings etc.etc.

No programming skill required. Many examples of use given.

PRICE: £17.50 inclusive, or £1.00 for documentation only (refundable against purchase)

## ALIEN ATTACK

For 1K ZX81 & 8K ROM ZX80

Machine code game for the unexpanded ZX, with fast moving graphics. PRICE ONLY £3.50

Send SAE for our complete catalogue of software for the ZX81 & 8K ROM ZX80. All prices inclusive! Mail order only.

**BUG-BYTE**

**SOFTWARE**

98-100 The Albany, Old Hall Street, Liverpool L3 9EG.

NEWBEAR

NewBear

2708 . . . . .	£1.99	2716 . . . . .	£2.99
4116 . . . . .	£1.99	4027 . . . . .	£0.45
SFF96364 . . .	£8.00	6821 . . . . .	£3.10
6402 . . . . .	£5.00	6800 . . . . .	£4.99
80 0.1" Pitch edge connector . . . . . £2.30			
(NASCOM & 77/68)			

SEND/PHONE FOR EXTENSIVE

## special offer

LISTS

74LS, 6800, 6502, Z80, 6809

CONNECTORS, CRYSTALS, SWITCHES,

DISK DRIVES, MEMORIES

"LOW PRICES"

## Fast Delivery

**40 BARTHOLOMEW STREET, NEWBURY, BERKS.**  
**(0635) 30505. PLEASE ADD V.A.T., P. & P. 30p**  
**BARCLAYCARD, ACCESS & OFFICIAL ORDERS**  
**WELCOME.**

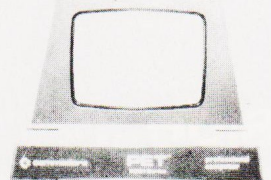


# CHROMASONIC electronics

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



**4008 8K RAM**  
**4016 16K RAM**  
**4032 32K RAM**  
**4040 Dual Drive**

**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 **£14**  
Memory Expansion Kit 8K **£79.95**  
Memory Expansion Kit 16K **£106.95**  
Printer Interface **£29.95**  
Sound generator plus  
PIO kit **£29.95**  
Cases **£24.50**

### NEW

Chromasonics Sound Kit **£24.95**  
Colour Kit **£84.95**

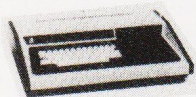
Inc. Demo Tape & Full Documentation Send for details.

DOWN IN PRICE

VIC 20

### 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 **£24.95**  
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**

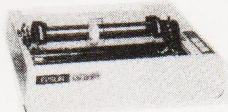
### APPLE

#### APPLE II PLUS

48K Machines **P.O.A.**  
Disk Drive with Controller **£349**  
Disk Drive without Controller **£299**  
Graphic Tablet **P.O.A.**  
Colour Card **P.O.A.**  
**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.

**EPSON MX80 FT/1 £399**

Dual single sheet friction and tractor feed, 9 wire head, true descenders.

Interfaces and Cables for APPLE II, PET, TRS80, RS232, UK101, Sharp Superboard All Available.

**EPSON-MX FT/2 £449**

An FT/1 with high resolution graphics.

**EPSON MX70 £259**

Tractor feed, 7 wire head, high resolution graphics.

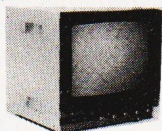
**SEIKOSHA GP80A £199**

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

JUST PHONE FOR FURTHER DETAILS

### MONITORS

Green Monitor **£99.00**  
MONI9" (illust) B&W **£82.00**  
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).

VIC 1515 — Low cost VIC DOT Matrix printer.

VIC 1540 — Single disk unit with 170K Byte capacity.

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**

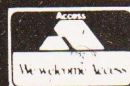
180,000 pages of information on Travel, News, Investment, Holidays, Hotels Etc., Etc.

**£170**

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.





**Comart Approved  
Dealers**

**Belfast**

O & M Systems  
95 Dublin Road  
Tel: 0232 49440

**Birmingham**

Byteshop Computerland Ltd  
94/96 Hurst St, B5 4TD  
Tel: 021 622 7149

**Cambridge**

Cambridge Computer Stores  
1 Emmanuel St, CB1 1NE  
Tel: 0223 68155

**Cornwall**

Benchmark Computer  
Systems Ltd  
Tremena Manor  
Tremena Road  
St Austell, PL25 5GG  
Tel: 0726 610000

**Dublin**

Lendac Data Systems Ltd  
8 Dawson St  
Tel: 0001 372052

**Glasgow**

Byteshop Computerland Ltd  
Magnet House  
61 Waterloo St, G2 7BP  
Tel: 041 221 7409

**Leeds**

Holdene Ltd  
Manchester Unity House  
11/12 Rampart Road  
Woodhouse St  
Tel: 0532 459459

**London**

Byteshop Computerland Ltd  
48 Tottenham Court Road,  
W1B 5TD  
Tel: 01 636 0647

**Digitus**

9 Macklin Street  
Covent Garden WC2  
Tel: 01 405 6761

**Jarrogate**

67 Tulse Mere Road,  
West Norwood,  
London SE17  
Tel: 01-670 3674

**Manchester**

Byteshop Computerland Ltd  
11 Gateway House  
Piccadilly Station Approach  
Tel: 061 236 4737

**NSC Computers**

29 Hanging Ditch  
Tel: 061 832 2269

**Newbury**

Newbear Computing Store  
40 Bartholomew St  
Tel: 0635 30505

**Nottingham**

Byteshop Computerland Ltd  
92A Upper Parliament St,  
NG1 6LF  
Tel: 0602 40576

**Sheffield**

Hallam Computer Systems  
451 Eccleshall Road, S11 9PN  
Tel: 0742 663125

**Southampton**

Xitan Systems  
23 Cumberland Place,  
SO1 2BB  
Tel: 0703 38740

**Sudbury**

Eurotec Consultants  
Holbrook Hall  
Little Walsingham  
Tel: 0206 262319

**Warwick**

Business & Leisure  
Microcomputers  
16 The Square  
Kenilworth  
Tel: 0926 512127

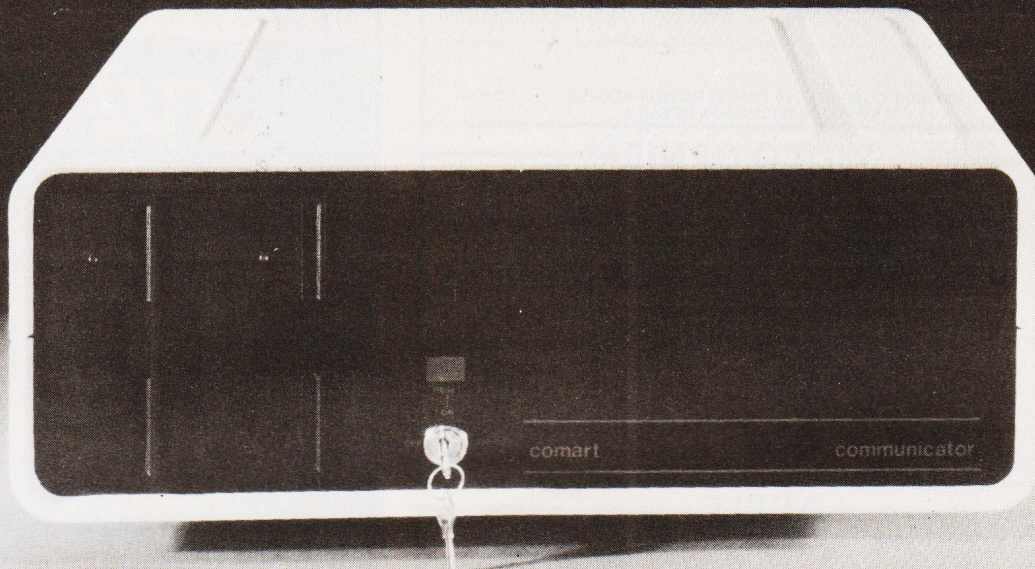
**Watford**

Lux Computer Services  
108 The Parade  
High Street  
Watford WD11 2AW  
Tel: 0923 29513

Comart Microcomputer dealers  
are located strategically  
throughout the country to give  
support, guidance and  
assistance. In the event of  
difficulty contact Comart direct.

# comart communicator

## The clean simplicity outside...



## ...conceals the pedigree inside.

Comart's CP100 Communicator is the new British designed, British made Microcomputer from Comart. It is the result of a carefully conceived development programme. It exploits Comart's first hand experience of the British computer market, and their growing strength as a manufacturer.

CP100 is the first of a new generation of flexible, expandable micros specifically developed to suit British operating conditions and communication requirements.

The clean lines outside, conceal the power within; its S-100 bus means wide ranging peripheral support, and simple after sales care. And, that's not all. Communicator is built to keep your future options open. It's ready for Prestel, asynchronous, and synchronous operation. It has expandable memory capability and yet it's price competitive as a stand-alone system with its CP/MTM operating system, and support software.

Find out more about Communicator today.

# comart

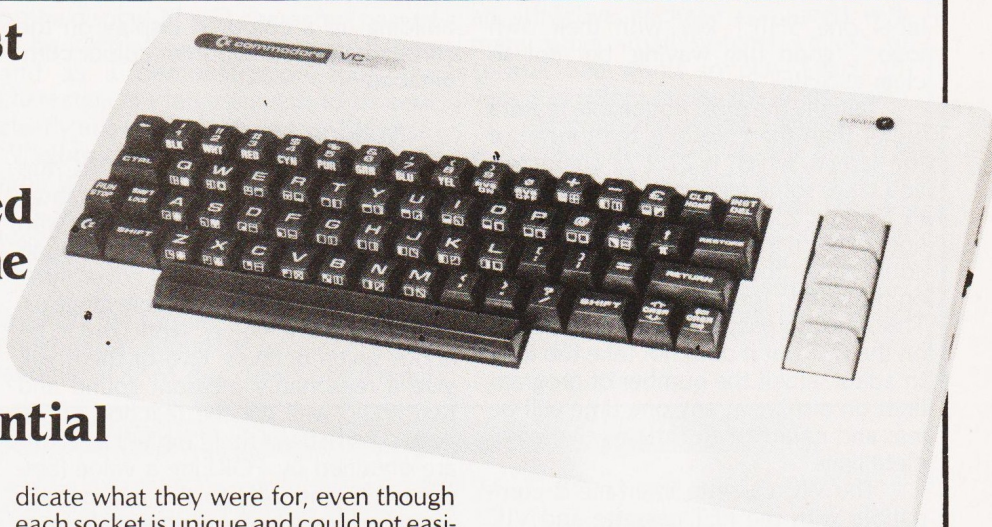
St Neots HUNTINGDON Cambs PE19 2AF  
Tel (0480) 215005 Telex: 32514 Comart G.

The U.K. Leaders in Microcomputer  
Development, Application and Support.



# UNVEILING THE VIC

**The VIC is the latest offering from Commodore and appears to be aimed directly at the home computer market. We take the lid off and assess its potential**



**T**he long awaited VIC-20 is about to hit this country and Commodore confidently predict high sales of this remarkable little machine. Initially to be sold through computer shops and existing dealers, it is understood that within a few months the VIC will be available through outlets in most major high streets throughout the land.

Who will buy it? What will they use it for? Will the VIC-20 be bought as a microcomputer, a sophisticated home entertainment centre or as an educational tool? It could fulfill the functions of all these and many more. VIC's future should be full of interesting developments.

## Physical Appearance

As you open the box, the VIC-20 gives the appearance of a relatively small neat package. It will sit quite comfortably on desk or table top with enough space behind it to stand one of the readily available portable colour televisions. The case is made of white plastic, is robust and well finished with non-slip feet that are really effective (an important point with light machines — there's nothing worse than the unit skating across the table as you start typing!). The full-size keyboard is somewhat similar in layout to the SuperPET but without the numeric keypad; there are four double-sized function keys in its place. Although not perhaps of professional quality, the keyboard has a good feel to it and is easy and positive to use.

Sockets are provided on the right-hand side and rear of the housing, those on the right being a games port (joystick control, light pen, etc) and power supply connection. Also sensibly placed on this side is the ON/OFF switch. At the rear are found: the expansion port (additional RAM or VIC program cartridges); Video and Audio port; Serial port (printer, discs, etc); Cassette port and the USER port (IEEE, modem, etc). The quality of the sockets used is adequate for the task intended but we were disappointed to see no labels or markings of any kind to in-

dicate what they were for, even though each socket is unique and could not easily be used for the wrong purpose.

Internally the VIC shows neat construction, with a well conceived layout that will prove easy to service should the need ever arise. There is adequate ventilation with open vents beneath the unit and shrouded vents on top behind the keyboard. The case is held together with two plastic hooks and three screws.

## What Comes Out Of The Box

In addition to the basic unit there is also a separate power supply, an RF modulator and video cable together with a 164-page manual. The power supply did not get noticeably hot after working for many hours, nor did the complete system exhibit any indication that the voltage or current were not as they should be.

The RF modulator supplied with the review model was not enclosed or boxed in any way, presumably being a pre-production unit. Hopefully those reaching the shops will be the finished article. The manual was eagerly scrutinised, as we had been promised an improvement over previous Commodore offerings. 'Personal Computing on the VIC-20, a friendly computer guide' is certainly several magnitudes better than the original PET manuals but still falls far short of what should be presented with a machine that has the potential of the VIC. It is essentially an 'idiot's guide' to the computer, trying to give a rapid 'hands on' crash course on operating the VIC. It does not really succeed as a teaching manual and one cannot escape the impression that with instructions such as these the VIC is presented as a noise producing, colour changing, 20th century toy. This, of course, is far from the truth as the VIC is capable of being very much more. The manual errs drastically in assuming that British televisions are similar to those in America, working with VHF (ours use UHF!) and also that our antenna (aerial) connections consist of two screw terminals

(most unlikely). In use, the manual will certainly help the absolute novice in quickly getting his VIC to do something interesting but it is going to be very frustrating to those who, although new to computing, are of reasonable intelligence. They may want their computer to do something other than draw birds flapping their wings and making chirping noises.

What, for example, are those four important looking keys on the right of the keyboard? The manual tells us they are 'Programmable Function Keys and can be assigned tasks or functions from within the applications that you create...'. Well, speak to me someone... how do I use them? The manual remains mute! Are there other uses for a FOR... TO... NEXT loop other than as a time delay! Reading our friendly computer guide leads us to believe that it would appear not, although one program hints that there may be more to this statement than meets the eye! The appendices do have a fair amount of useful information: memory maps, POKE charts and error messages, to name but a few. At least Commodore get a merit point for trying — their manuals are improving, if a little slowly.

## The VIC Powered Up

On connecting the VIC to its power supply, the RF modulator, a television set and switching on we are informed that we are about to use V-2 BASIC and have 3584 bytes of memory free. The keyboard, although similar to SuperPET, differs in two significant ways: it has no numeric keypad and it has two different SHIFT keys and a colour control key. It will generate the same wide range of predefined graphic symbols as the PET but now the keys call up two sets of graphic characters depending on which shift key is depressed. There is also the option of one graphic set together with upper and lower case text. For some reason Commodore have decided to



label one SHIFT key with their own logo... good flag waving, but not so clear as SHIFT 2.

Initially the most noticeable feature (other than the colour) is the format of the screen, which is 22 x 23 characters and takes some getting used to after the PET's 40 x 25. You may write program lines of 88 characters (PET allows 80); this could mean four lines of 22 characters on the screen for just one program line! This is not so easy to understand as it is on the PET but it does not take too long to adapt, albeit the number of program lines on display at any one time will be less and could be as little as five complete lines.

The VIC cassette interface is compatible with the PET cassette and VIC BASIC uses the same BASIC commands as PET BASIC 2 plus the additional colour commands required by the VIC. We are told that PET programs are compatible with the VIC. VIC will load a program from cassette written for a PET but could need some attention before it will RUN in a satisfactory manner.

The major areas of difference are:

a) the screen is memory mapped but uses different POKE addresses.

b) a program written for PET and using text will be formatted for a 40 character line.

c) larger quantities of text will be organised to use PET's 25 lines without scrolling.

VIC will RUN the program providing the POKE addresses are altered but the text may be difficult or impossible to read. A frustrating situation, but easy to overcome with a little patience.

The memory mapped screen has two POKE addresses for each character cell, one (between 7680 and 8185) is used to define the position and the character or symbol required and the other (between 38400 and 38905) specifies the colour of that character. VIC has a very versatile control over the colour representation displayed on the screen. It offers any combination of eight border colours (the area outside the 22 x 23 display area) and eight character colours. The first two are defined by one POKE code. The others are defined by use of the CTRL key and the appropriate colour key within a PRINT statement. To get a light orange border, a purple background and black text all that is needed is:

1) POKE 36879,156

2) PRINT "open quotes... press CTRL and BLACK (numeral 1)... your text... close quotes"

There is no need to specify black text in any following PRINT statements, as it will remain black until a change is specified. The alternative to 2) above is to POKE the character required of the colour required direct to the screen, so

building up a coloured display on the chosen background/border colour combination.

### Making Music?

Not only, but also... the VIC has three music 'voices' listed in the manual as alto, tenor and soprano together with one noise generator for 'special' sound effects. Any one 'voice' will cover three octaves, and the total available range using the different 'voices' works out to be about seven octaves. Five of them will give a reasonably pleasant sound and two could well get the reaction of 'Ye gods... what was that!' Individual tones are obtained by POKEing a value (between 135 and 241) to the appropriate 'voice' address. Volume on a scale from 1 to 15 is determined by an additional POKE. A number of sample programs for sound generation are given in the manual from 'turn your VIC into a piano(!)' to such special effects as Red Alert, Birds Chirping and Ocean Waves. The range of possibilities seems only limited by your patience and ingenuity.

VIC uses the upgraded 6502A microprocessor chip which is faster than the PET's 6502. There is no machine language monitor, which means that to use machine code you will have to:

a) create a machine code program on a PET, save it onto tape and load this program into the VIC;

b) wait until Commodore launch a machine code ROM cartridge;

c) wait a little longer for a cassette loaded program, although if the program you write crashes, you will have to switch off and start again; or

d) write machine code programs via BASIC PEEK and POKE statements... which should keep you busy until option b) arrives!

### Goodies To Come

Appendix A of the manual is entitled 'VIC Accessories, a quick introduction'.

To our knowledge the only accessory available initially is the PET cassette recorder. The printer is not far behind and doubtless the others will arrive in due course. Briefly they are:

- dot matrix printer
- super expander cartridge... 3K add on memory, high resolution graphics
- programming aid cartridge
- ... programmer's toolkit, machine language monitor

- master control panel... accepts multiple cartridges/memory expander

- VIC single floppy disc drive

- IEEE 488 interface cartridge

Also hinted at elsewhere are the following:

- 8K and 16K memory cartridges

- RS 232 C interface cartridge

- joysticks, light-pens, paddles

- acoustic modem

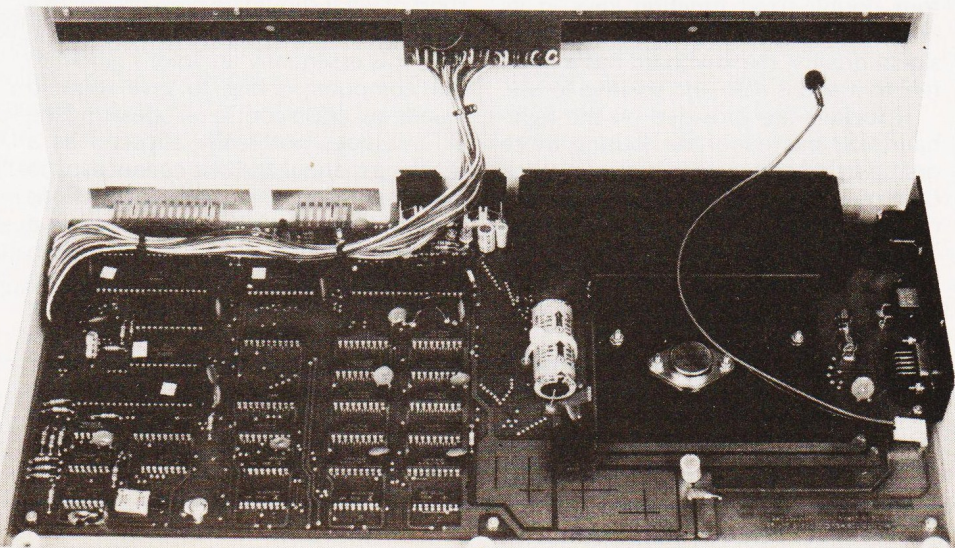
- various plug-in program cartridges.

### Conclusions

Powered up, the VIC performed well, although the television display was somewhat critical to tuning and the block colours of the border and background could have been a little more stable. There was also some occasional colour fringing associated with displayed characters. In fairness, one must remember that the RF modulator of the review model was not in the finished state that production models will have supplied.

The manual leaves a lot to be desired for the person past the initial novice stage and as the VIC is definitely 'user friendly' this stage should be reached quite quickly. There is mention of a 'VIC Programmer's Reference Guide', which may very well fill in the gaps but as it was not supplied we are unable to pass comment. There is no doubt that VIC's versatility with colour displays adds another dimension to any use of the screen, even very simple games become

Internal layout is neat and well thought out.





# UNVEILING THE VIC

more enjoyable, not to mention graphic displays such as histograms, etc.

The basic VIC has a little over 3K of user memory — fine for the novice, but as he progresses this will soon need to be increased. The big question here is how much will additional memory cost? As yet, we have no firm answer.

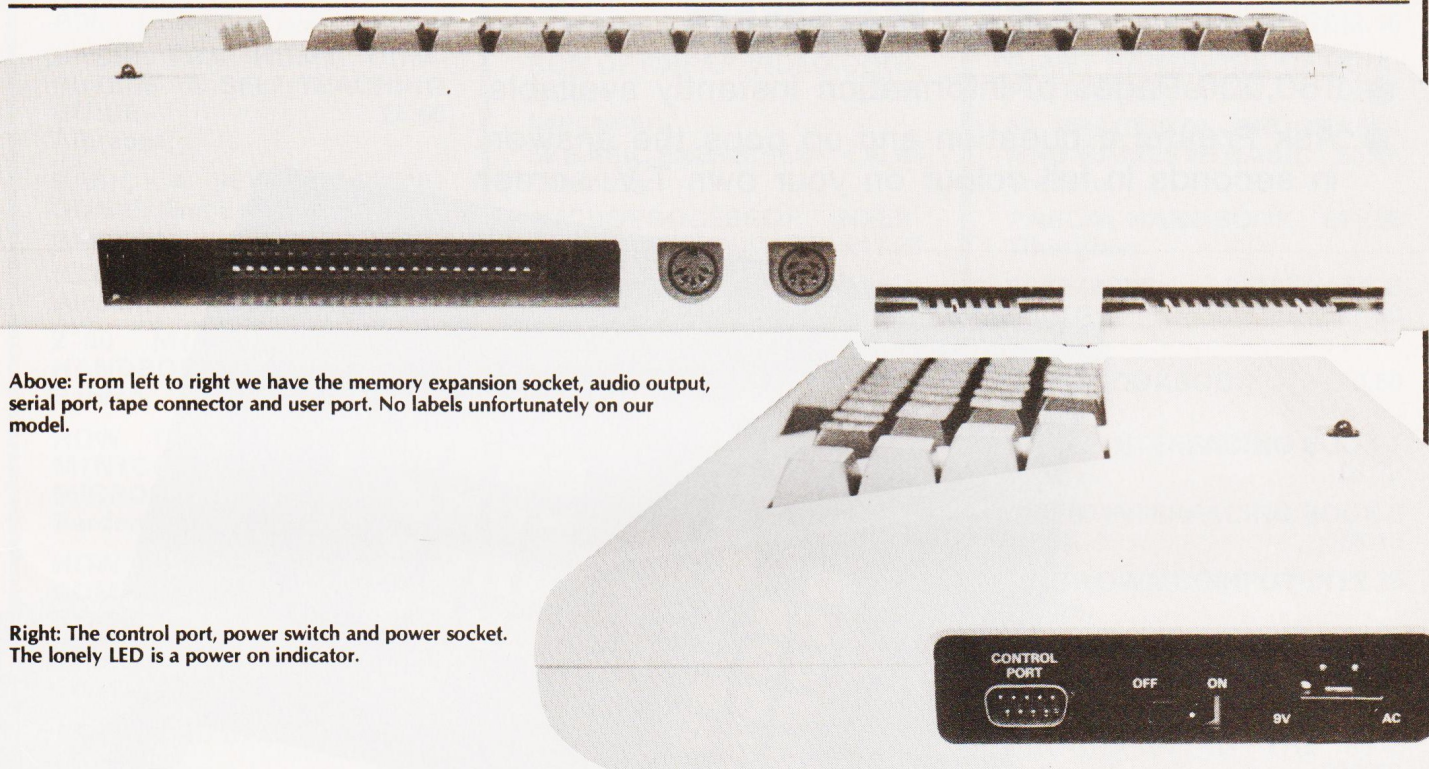
The machine appears to be aimed fairly and squarely at the home environment, although we have doubts that Commodore's suggestions that it will be used as a diary or for home accounts will really have many followers. The format

of the display 22 x 23 characters has yet to be justified — fine for many games and as a demonstration tool, the characters are large enough to be seen clearly at a reasonable viewing distance. Whether it has a future in education only time will tell: with Government grants and subsidies on certain machines together with the advent of the BBC machine, this could be a tough market.

As a computer for the small business the format is against it. By the time one has added the necessary extras (additional RAM, disc drives, etc) it is not

an attractive package compared with many other small systems. Unless, of course, one wants to play Space Invaders in colour during the lunch break!

Although the above criticises certain aspects of the VIC-20, one must not lose sight of the fact that the VIC in some ways offers more facilities than the PET and is a fully fledged microcomputer in its own right. Also, the basic unit, with colour and sound, costs less than £200 — which may well be a strong argument in its favour.



Above: From left to right we have the memory expansion socket, audio output, serial port, tape connector and user port. No labels unfortunately on our model.

Right: The control port, power switch and power socket. The lonely LED is a power on indicator.

## COMMANDS

**CONT** Continues STOPped or ENDED program  
**LIST** Lists specified line(s) of program to screen  
**LOAD** Loads program stored on cassette tape  
**NEW** Erases entire program and variables from memory  
**RUN** Executes current program  
**SAVE** Writes current program to cassette tape or disc  
**VERIFY** Checks program stored on tape or disc against one in memory

## STATEMENTS

**CLOSE** Completes and closes any files used by OPEN statements  
**CLR** Erases all variables in memory leaving program intact  
**QMD** Sends outputs normally sent to screen, to another device  
**DATA** List of items to be used by READ statement  
**DEF FN** Defines complex calculation as a function with a short name  
**DIM** Defines dimensions of an array  
**END** Stops a program that is RUNNING  
**FOR** Used in conjunction with TO and NEXT to execute a defined loop  
**GET** Reads keyboard, result is character of next key pressed  
**GET#** Used with an OPENed device or file to input one character  
**GOSUB** Jumps to defined subroutine  
**GOTO** Jumps to specified program line number  
**IF** Conditional test, used in conjunction with THEN followed by specified statement  
**INPUT** Assigns value of keyboard entry to specified variable  
**INPUT#** As INPUT but takes data from an OPENed device or file  
**LET** Assigns specified value to specified variable  
**NEXT** See FOR  
**ON** Jumps to program line or subroutine as specified by variable  
**OPEN** Gives access to specified device, printer, disc, screen etc.  
**POKE** Places assigned value in specified memory location  
**PRINT** Transmits specified data to screen  
**PRINT#** Transmits specified data to device or file OPENed  
**READ** Accesses next item in DATA statement  
**REM** No effect on program, allows inclusion of text for comments  
**RESTORE** Resets DATA pointer to the first DATA statement  
**RETURN** Returns to main program from subroutine  
**STOP** STOPS a program that is RUNNING  
**SYS** Starts machine language program at specified memory location  
**WAIT** Halts program until specified memory location corresponds to defined value

## NUMERIC FUNCTIONS

**ABS(X)** Returns absolute value of X  
**ATN(X)** Returns the angle, measured in radians, whose tangent is X  
**COS(X)** Returns cosine of angle X (in radians)  
**EXP(X)** Returns exponential of X  
**FNA(X)** Returns the value of the user defined function A (see DEF FN)  
**INT(X)** Returns integer part of X (rounded down)  
**LOG(X)** Returns natural log of X  
**PEEK(X)** Returns contents of memory location X  
**RND(X)** Returns random number between 0 and 1  
**SGN(X)** Returns sign of X  
**SIN(X)** Returns sine of angle X (in radians)  
**SQR(X)** Returns square root of positive number X  
**TAN(X)** Returns tangent of angle X (in radians)  
**USR(X)** Program jumps to machine language program

## STRING FUNCTIONS

**ASC(X\$)** Returns ASCII code of the first character of X\$  
**CHR\$(X)** Returns string character whose ASCII code is X  
**LEFT\$(X\$,X)** Returns the leftmost X characters of X\$  
**LEN(X\$)** Returns the number of characters in X\$  
**MID\$(X\$,S,X)** Returns X characters starting with the Sth from X\$  
**RIGHT\$(X\$,X)** Returns rightmost X characters of X\$  
**STR\$(X)** Returns string representation of number X  
**VAL(X\$)** Returns numeric value of X\$

## OTHER FUNCTION

**FRE(X)** Returns the number of unused bytes available in memory  
**POS(X)** Returns column number where next PRINT statement will begin  
**SPC(X)** Forces PRINT statement to skip X spaces forward  
**TAB(X)** Used in PRINT statement, next item will be printed in column X

NOTE: Most of the above have abbreviated forms, PRINT may be written as ? whilst most others are abbreviated by typing the first one or two letters of the key word followed by the SHIFTed next letter of the word.

The BASIC command set available.

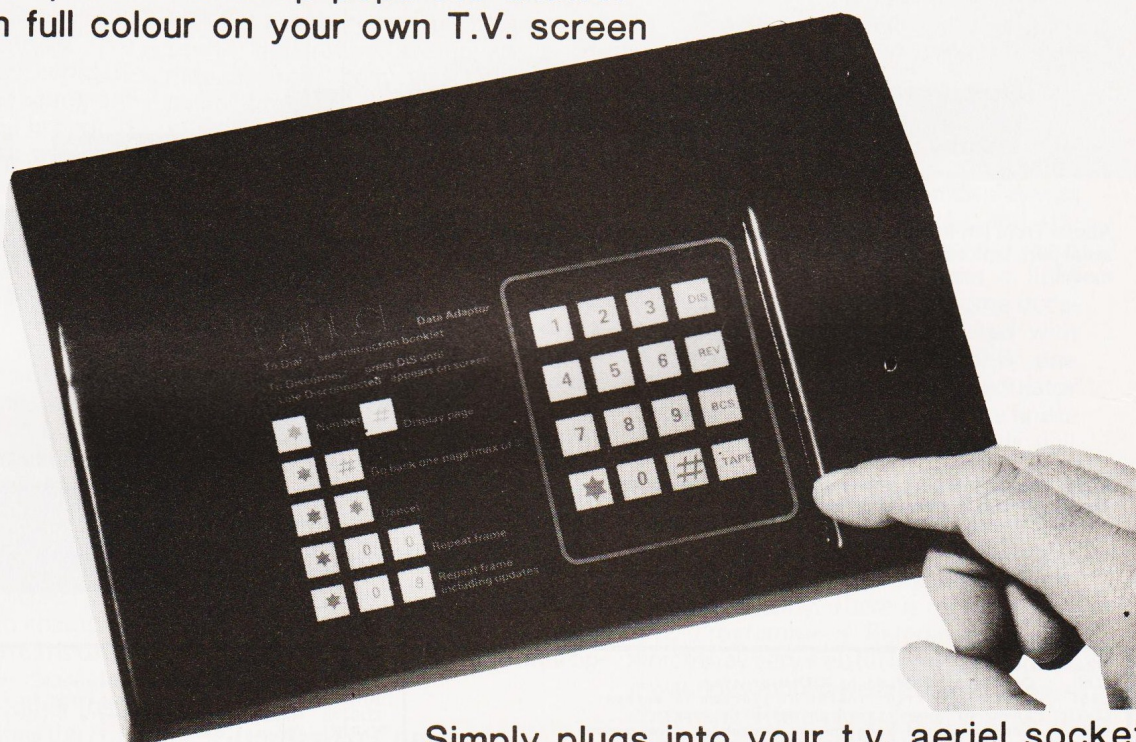


# PRESTEL.

## THE BIGGEST BREAKTHROUGH IN COMMUNICATION SINCE THE TELEPHONE AND TELEVISION.

POST OFFICE  
APPROVED

- 180,000 Pages of information instantly available
- Ask Prestel a question and up pops the answer in seconds in full colour on your own T.V. screen



**EXPENSIVE?**

**NOT ANY LONGER WITH**

# TanTel

**BY TANGERINE**

*Only £170 + VAT*

**Simply plugs into your t.v. ariel socket**

Tantel requires a jack socket on your telephone line (available from the Post Office)

PLEASE SEND ME .....TANTEL ADAPTORS  
I ENCLOSE CHEQUE / P.O. TO THE VALUE OF .....  
OR DEBIT MY ACCESS/BARCLAYCARD No. ....

NAME .....

ADDRESS .....

PAYABLE TO TANGERINE COMPUTER SYSTEMS LIMITED

FOR FURTHER INFORMATION PLEASE SEND A 12p STAMP TO :-  
TANDATA MARKETING  
FOREHILL WORKS  
ELY CAMBS CB7 4AE



# Computing Today BOOK SERVICE

How to order: Make cheques payable to Computing Today Book Service. Payment in sterling only please. Orders should be sent to: Computing Today Book Service, Modmags Sales Office, 145 Charing Cross Road, London WC2H 0EE. All prices include P&P. Prices may be subject to change without notice.

**BEGINNERS GUIDE TO COMPUTERS AND MICROPROCESSORS WITH PROJECTS**  
Adams. £6.05

**MORE BASIC COMPUTER GAMES**  
Ahl. £6.60

**BASIC FOR HOME COMPUTERS. A SELF TEACHING GUIDE**  
Albrecht. £6.60

**BASIC. A SELF TEACHING GUIDE. (2nd Edition)**  
Albrecht. £7.15

**ILLUSTRATING BASIC**  
Alcock. £4.25

**Z-80 MICROCOMPUTER HANDBOOK**  
Barden. £7.75

**HOW TO BUY AND USE MINICOMPUTERS AND MICROCOMPUTERS**  
Barden. £7.90

**HOW TO PROGRAM MICROCOMPUTERS**  
Barden. £7.25

**BASIC BASIC**  
Coan.J. £7.25

**ADVANCED BASIC**  
Coan.J. £7.35

**MICROPROCESSORS FOR HOBBYISTS**  
Coles. £3.75

**MUSICAL APPLICATIONS OF MICROPROCESSORS**  
Chamberlain. £18.30

**PROGRAMMING AND INTERFACING THE 6502, WITH EXPERIEMENTS**  
De Jong. £11.90

**CRASH COURSE — MICROPROCESSORS**  
Frienzel. £13.10

**HOW TO DESIGN, BUILD AND PROGRAM YOUR OWN WORKING COMPUTER SYSTEM**  
Haviland. £7.10

**MICROCOMPUTERS, MICROPROCESSORS, HARDWARE, SOFTWARE**

**AND APPLICATIONS** £17.40  
Hilburn.

**MICROPROCESSOR SYSTEMS DESIGN** £18.80  
Klingman.

**CHEAP VIDEO COOKBOOK**  
Lancaster. £6.50

**SON OF CHEAP VIDEO COOKBOOK** £6.65  
Lancaster.

**50 BASIC EXERCISES** £10.05  
Lamoitier.

**MICROPROCESSOR INTERFACING TECHNIQUES** £11.20  
Lesea.

**INTRODUCTION TO MICROPROCESSORS** £11.25  
Leventhal.

**BASIC WITH STYLE** £4.50  
Nagin.P.

**LEARNING BASIC WITH THE SINCLAIR ZX80** £4.55  
Norman.

**HANDS ON BASIC WITH A PET** £11.95  
Peckham.

**THE 8080A BUGBOOK** £8.35  
Rony P.H.

**6800 SOFTWARE GOURMET GUIDE AND COOKBOOK** £9.20  
Scelbi.

**8080 SOFTWARE GOURMET GUIDE AND COOKBOOK** £9.20  
Scelbi.

**6502 SOFTWARE DESIGN**  
Scanlan. £7.50

**1001 THINGS TO DO WITH YOUR PERSONAL COMPUTER** £6.00  
Sawusch.

**6801/68701/6803 MICROCOMPUTER PROGRAMMING AND INTERFACING** £10.40  
Stangaard.

**CP/M PRIMER** £8.90

**MOSTLY BASIC. Applications for your TRS 80** £8.20

**MOSTLY BASIC. Applications for your APPLE** £8.20

**MOSTLY BASIC. Applications for your PET** £8.20

**CIRCUIT DESIGN PROGRAMS FOR THE TRS 80** £9.60

**INTRO TO PASCAL** £10.50

**USING CP/M SELF TEACHING GUIDE** £6.85

**Z-8000 PROGRAMMING** £12.15

**GIANT HANDBOOK OF COMPUTER PROJECTS** £6.10

**57 PRACTICAL PROGRAMS AND GAMES IN BASIC** £6.65  
Tracton.

**PASCAL HANDBOOK** £11.55  
Tiberghier.

**8080/8085 SOFTWARE DESIGN** £7.60  
Titus.

**8085A COOKBOOK** £10.50  
Titus.

**TRS 80 INTERFACING BOOK 1**  
Titus. £6.75

**TRS 80 INTERFACING BOOK 2**  
Titus. £8.15

**YOUR OWN COMPUTER** £2.25  
Waite.

**MICROPROCESSORS. FROM CHIPS TO SYSTEMS** £8.50  
Zaks.

**PROGRAMMING THE 6502**  
Zaks. £10.50

**6502 APPLICATIONS BOOK**  
Zaks. £10.50

**PROGRAMMING THE Z80**  
Zaks. £11.55

**CP/M HANDBOOK** £10.90  
Zaks.

**INTRODUCTION TO MICROCOMPUTER PROGRAMMES** £4.90

**6502 GAMES** £10.50

**INTRO TO MICROCOMPUTERS. Vol 0** £8.00

**INTRO TO MICROCOMPUTERS. Vol 1** £12.05

**PET AND THE IEEE 488 BUS** £14.35

**8086 BOOK** £15.50

**WHAT IS A MICROPROCESSOR** £10.00



# MORSE TRAINER

## Key in the program to practise your keying

**M**any people today are still interested in using Morse code, and despite many programs and machines, the human ear is still supreme in decoding a weak, interference-laden signal. The audio filtering between our ears remains the best available by several orders of magnitude. However, as the back of the head is not fitted with an output socket to take advantage of these filters, the decoding also has to be done in the brain. Unfortunately this requires learning and usually involves listening to records, tapes or friends sending Morse code which you can subsequently verify that you have taken down correctly. The trouble with this is that you soon become familiar with the contents of the records and tapes, and unfamiliar with your friends. The answer lies with your friendly computer, which will sit for hours contentedly churning out Morse code for you to learn.

The program is written for a 16K Level II TRS-80 microcomputer or for the disc BASIC. It introduces you to Morse code gradually in a series of lessons. In the first one, the letters are either all dots or all dashes and so easy to learn. As you progress, other letters are added, but you are still tested on those you should already know.

The Class A Radio Amateur Exam requires the sending and receiving of Morse at 12 words per minute, so that is the top speed for which this program is designed. Higher speeds can be achieved by altering the appropriate delay values.

Following the recommended practice (see *The Morse Code for Radio Amateurs*, Mills, M, RSGB Publications), the dots and dashes are sent at 12 wpm rate even at the slower speeds, the spaces being increased to provide a lower overall speed. In this way the code is learned more easily. The program provides a sound output via the cassette output port.

### Deft Digits

Each lesson can be one of two types. First, there is keyboard recognition: in this mode the computer gives you a Morse character which you have to match on the keyboard. If you get it right the computer tells you so and one point is added to your score and to your 'tries' total; if you get it wrong you will again be told, just one point being added to your tries total. You will keep getting the same character until you get it right. Once you can obtain a good score on that, go to the second mode in which five letter random groups are given. Write these down without looking at the screen and check them when the group is completed. Incidentally, the characters appear on the screen just after the sound, so a beginner could guess in advance of the characters and subconsciously learn Morse.

The secret of learning Morse code is regular practice every day for 15 to 30 minutes. You should start with the slowest speed and work right through the lessons again. Do not learn lesson 1 at 12 wpm before proceeding to lesson 2.

Each section of the program is

broken down according to its function, and these are shown in Table 1. Most of it is quite straightforward, but the code conversion/production process may need a little explanation:

L is an array which contains the binary equivalent of the Morse code character in an array position corresponding to its ASCII value. For example, L(65) contains 6 (the Morse value of A). This is calculated by taking the Morse code for A which is .- This is then written in the reverse order, using a 0 for a dot and a 1 for a dash, thus 10. A 1 is placed on the left-hand side of this number to indicate that the character is complete. The resulting number (110) is then converted from binary and becomes 6. To output the Morse the least significant bit is tested; for a 0 a dot is produced, for a 1 a dash. The number is then shifted one place to the right and the process is repeated until the number is 1, indicating that the entire character has been sent. The duration of the tone is set in line 210, and the inter-element space in variable DE.

The listing shown is for disc BASIC. To convert to Level II, replace line 270 with:

```
270 POKE 16527, A: POKE 16526, B
```

In lines 1510 and 1560 change USR1 to USR.

When typing in the listing, if you see a line which suddenly continues on the next line, press the down arrow (↓), so that the screen format looks correct.

The sound can be heard by connecting an external audio amplifier or by using the cassette recorder in the 'record' mode (with no tape in). The sound can be heard through an earphone plugged in the 'ear' socket.

This program has been successful in helping to improve Morse code receiving speeds, and aids in the initial recognition of Morse characters.

LINES			
100-310	Set up code conversion and speed constants array.	1090-1250	Keyboard recognition routines.
	POKE machine language program for audio tone into string.	1270-1420	Random group routines.
320-390	Select speeds and set delay variables.	1430-1480	Subroutine to output a Morse character contained in M.
400-550	Main menu and branch to appropriate lesson.	1500-1570	Subroutine to output a dot or dash with or without a graphics output.
560-620	Morse keyboard routine.	1580-1590	Subroutine setting the delay for the gap between words.
630-800	Introduces new letters for the lesson, displays them and creates LS\$ using letters from previous lessons.	1610-1660	ASCII to Morse code conversion data. 00 indicates no code programmed (may be altered to suit).
810-1020	Subroutine to display new letters introduced in this lesson.	1670	Delay values: inter-letter, inter-word pairs.
1030-1080	Menu to decide which type of lesson is required.	1680-1710	Machine language for audio output.

Table 1: Program routines

VARIABLES	USE
L(96)	Array with Morse code for conversion.
SP(4)	Array with inter-letter space delay.
SW(4)	Array with inter-word space delay.
BL\$	String array with machine language program for producing audio tones.
LS\$	String variable with the current lesson's characters.
M	Morse characters used by 'Morse out' routine
GR	Variable = 0 if dots and dashes are to be displayed graphically, otherwise = 1.

Table 2: The use of some variables



## Program Listing

```

120 CLEAR 100
130 DEFINT A-Z
140 DIM L(96)
150 FOR A=32 TO 95
160 READ L(A)
170 NEXT
180 FOR A=1 TO 4
190 READ SP(A),SW(A)
200 NEXT
210 TS=96:TL=TS*3:REM**TIME OF TONE
220 BL$=STRINGS(35,"A")
230 A=PEEK(VARPTR(BL$)+2)
240 B=PEEK(VARPTR(BL$)+1)
250 AD!=A*256+B
260 IF AD!>32768 THEN C=AD!-65536 ELSE C=AD!
270 DEFUSR1=C:CMD"T"
280 FOR A1=C TO C+29
290 READ T
300 POKE(A1),T
310 NEXT
320 CLS:PRINT CHR$(23);" ** MORSE TRAINER **"
330 PRINT:PRINT"SELECT SPEED -----
1 = 6 WORDS/MIN
2 = 8 WORDS/MIN
3 = 10 WORDS/MIN
4 = 12 WORDS/MIN
340 K$=INKEY$:IF K$="" THEN 340
350 PRINT K$;" SPEED"
360 T=ASC(K$)
370 IF T>52 OR T<49 THEN PRINT"PLEASE ENTER 1 TO
4":GOTO 340
380 DE=SP(VAL(K$))
390 WD=SW(VAL(K$))
400 CLS:PRINT CHR$(23)"MORSE TRAINER MENU"
410 GR=0:NW=0:R=0
420 PRINT"1 - LESSON ONE (EISHTMO)"
430 PRINT"2 - LESSON TWO (AUV)"
440 PRINT"3 - LESSON THREE (NDB)"
450 PRINT"4 - LESSON FOUR (AWJ)"
460 PRINT"5 - LESSON FIVE (CKPG)"
470 PRINT"6 - LESSON SIX (RLQZ)"
480 PRINT"7 - LESSON SEVEN (FXY)"
490 PRINT"8 - LESSON EIGHT (0123456789)"
500 PRINT"9 - KEYBOARD SENDING"
510 PRINT"ANY OTHER KEY TO RESET SPEED"
520 K$=INKEY$:IF K$="" THEN 520
530 IF ASC(K$)>57 OR ASC(K$)<49 THEN 320
540 SW=0:LSS=""
550 ON VAL(K$) GOTO 780,760,740,720,700,680,
660,630,560
560 CLS:PRINT CHR$(23);"MORSE KEYBOARD - ENTER
FOR MENU"
570 K$=INKEY$:IF K$="" THEN 570
580 IF K$=CHR$(13) THEN 400
590 M=L(ASC(K$))
600 IF M=0 THEN GOSUB 1580 ELSE GOSUB 1430
610 PRINT TAB(15);K$
620 GOTO 570
630 L$="0123456789"
640 GOSUB 810
650 GOTO 1030
660 LSS="FXY"
670 GOSUB 810
680 LSS=LSS+"RLQZ"
690 IF NW=0 THEN GOSUB 810
700 LSS=LSS+"CKPG"
710 IF NW=0 THEN GOSUB 810
720 LSS=LSS+"AWJ"
730 IF NW=0 THEN GOSUB 810
740 LSS=LSS+"NDB"
750 IF NW=0 THEN GOSUB 810
760 LSS=LSS+"AUV"
770 IF NW=0 THEN GOSUB 810
780 LSS=LSS+"EISHTMO"
790 IF NW=0 THEN GOSUB 810
800 IF R=1 THEN 400 ELSE 1030
810 CLS:PRINT CHR$(23);"LESSON ";VAL(K$);" --
IN WHICH WE LEARN"
820 PRINT
830 IF K$="8" THEN PRINT"NUMBERS ";
ELSE PRINT"LETTERS ";
840 FOR A=1 TO LEN(LSS)
850 PRINT MID$(LSS,A,1);" [SPC]";
860 NEXT
870 PRINT
880 FOR A=1 TO 500:NEXT A
890 GR=0
900 FOR A=1 TO LEN(LSS)
910 K$=MID$(LSS,A,1)

```

```

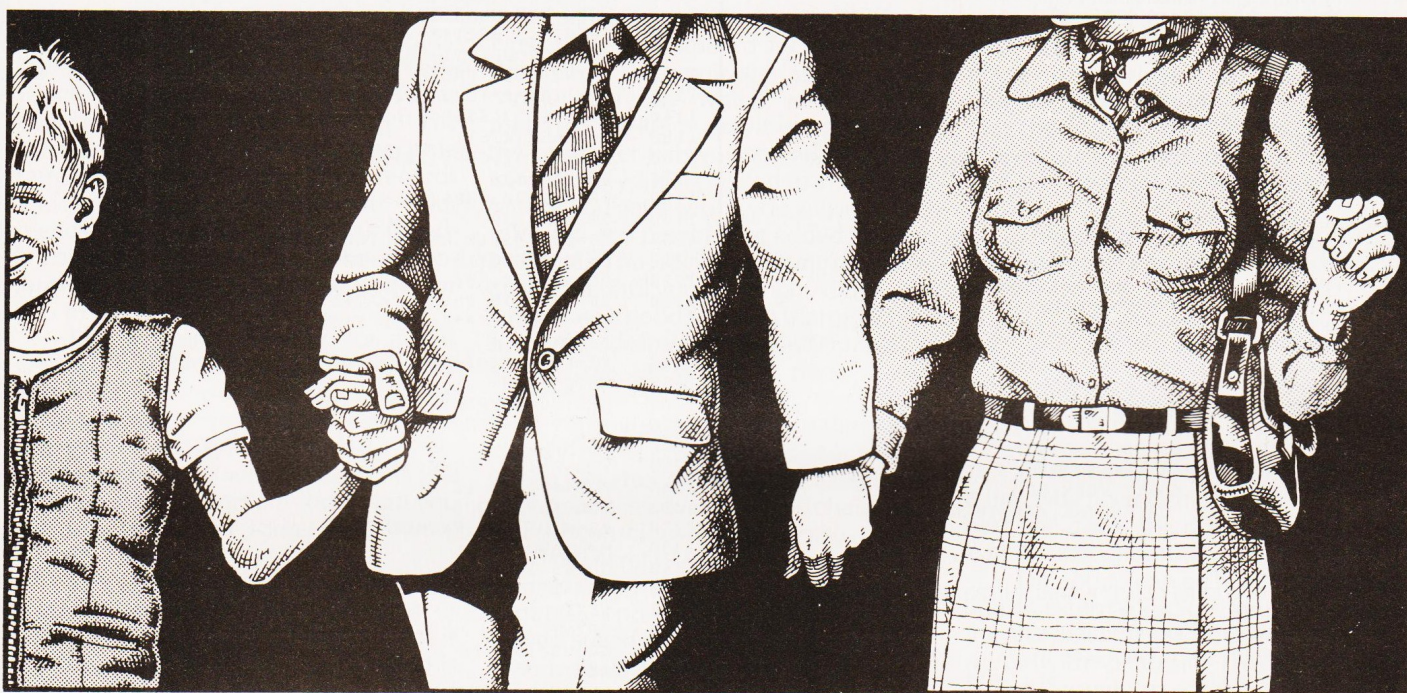
920 M=L(ASC(K$))
930 GOSUB 1430
940 PRINT TAB(11);K$
950 GOSUB 1580
960 NEXT
970 PRINT"PRESS 'R' TO REPEAT "
980 PRINT"ENTER FOR MENU"
990 PRINT"ANY KEY TO CONTINUE"
1000 K$=INKEY$:IF K$="" THEN 1000 ELSE
IF K$="R" THEN 900
1010 IF K$=CHR$(13) THEN R=1
1020 NW=1:RETURN
1030 CLS:PRINT CHR$(23);"PLEASE SELECT
AN OPTION"
1040 PRINT"1 - KEYBOARD RECOGNITION
I GIVE A SOUND AND YOU
MATCH IT ON THE KEYBOARD
2 - RANDOM GROUPS
I GIVE YOU 12 GROUPS AND YOU
TAKE THEM DOWN WITHOUT LOOKING"
1050 PRINT"PRESS ENTER TO SELECT AGAIN"
1060 K$=INKEY$:IF K$="" THEN 1060
1070 IF K$="2" THEN 1260
1080 IF K$<>"1" THEN 400
1090 CLS:PRINT CHR$(23);"ECHO EACH CHARACTER
WHEN YOU HEAR IT"
1100 PRINT"[3 SPC]*** SCORE ***"
1110 PRINT"CORRECT[7 SPC]OUT OF"
1120 PRINT@960,"PRESS ENTER FOR MENU";
1130 GR=1:REM**TURN OFF GRAPHICS
1140 K1$=MID$(LSS,RND(LEN(LSS)),1)
1150 M=L(ASC(K1$))
1160 PRINT@192,CHR$(30);FT,AT
1170 GOSUB 1580
1180 PRINT@320,CHR$(30);
1190 GOSUB 1430
1200 K$=INKEY$:IF K$="" THEN 1200
1210 IF K$=CHR$(13) THEN 1030
1220 PRINT@320,K$;
1230 IF K$<>K1$ THEN AT=AT+1:PRINT" *** NO
TRY AGAIN ***":GOTO 1150 ELSE PRINT
" -OK-"
1240 FT=FT+1:AT=1+AT
1250 GOTO 1140
1260 CLS:GR=1:PRINT CHR$(23);
1270 PRINT"RANDOM GROUPS"
1280 PRINT
1290 FOR A=1 TO 1000:NEXT A
1300 FOR A=1 TO 12
1310 FOR AW=1 TO 5
1320 K$=MID$(LSS,RND(LEN(LSS)),1)
1330 M=L(ASC(K$))
1340 GOSUB 1430
1350 PRINT"[SPC]";K$;
1360 NEXT
1370 PRINT
1380 GOSUB 1580
1390 NEXT
1400 PRINT:PRINT"HIT ENTER FOR MENU
ANY KEY TO REPEAT"
1410 K$=INKEY$:IF K$="" THEN 1410
1420 IF K$=CHR$(13) THEN 1030 ELSE 1260
1430 T=(M AND 1)+1
1440 ON T GOSUB 1500,1550
1450 M=M/2
1460 IF M<>1 THEN 1430
1470 FOR A1=1 TO DE
1480 NEXT A1
1490 RETURN
1500 IF GR=0 THEN PRINT". ";
1510 X=USR1(TS)
1520 FOR A1=1 TO 23
1530 NEXT A1
1540 RETURN
1550 IF GR=0 THEN PRINT"- ";
1560 X=USR1(TL)
1570 GOTO 1520
1580 FOR A1=1 TO WD
1590 NEXT A1
1600 RETURN
1610 DATA 0,0,94,0,0,0,0,94,45,109,0,0,115,97,106,41
1620 DATA 63,62,60,56,48,32,33,35,39,47
1630 DATA 71,0,0,0,0,76,0
1640 DATA 6,17,21,9,2,20,11,16,4,30,13,18,7,5,15,22
1650 DATA 27,10,8,3,12,24,14,25,29,19
1660 DATA 0,0,0,0,0
1670 DATA 219,565,131,360,79,238,46,161
1680 REM**MACHINE CODE FOR TONE BLIP
1690 DATA 205,127,10,14,9,219,255,203,
119,40,2,203,209,6
1700 DATA 100,0,16,253,121,238,3
1710 DATA 211,255,79,43,124,181,32,240,201

```



# MIXING BUSINESS WITH PLEASURE

The 4th  
Personal  
Computer  
World  
Show



This year, *The Personal Computer World Show* will be twice the size of last year's event. Almost every big name (and a lot of smaller ones) in the micro-electronics industry will be represented somewhere in our new style exhibition. (In the September issue of *PCW* you will find a complete list of companies and organisations participating). And many of the products will be on display for the first time in this country.

We've divided the Show into two broad areas of interest. A massive array of business and professional applications upstairs and a mouthwatering range of hobbyist orientated products downstairs. Downstairs, too, you'll be able to watch a battle of

electronic wits in the 2nd European Microcomputer Chess Championship or talk to any one of the many representatives from computer societies and the ComputerTown UK! network.

Whatever you're looking for in the microcomputing field, or even if you're not certain what you *should* be looking for, you'll find it at The 4th Personal Computer World Show. You don't have to leave your spouse or the kids behind, either. We have designed the Show deliberately to cater for the widest possible spectrum of visitors. And children under eight years old will be admitted free.

Now, who says you can't mix business with pleasure?



The 4th  
Personal  
Computer  
Show

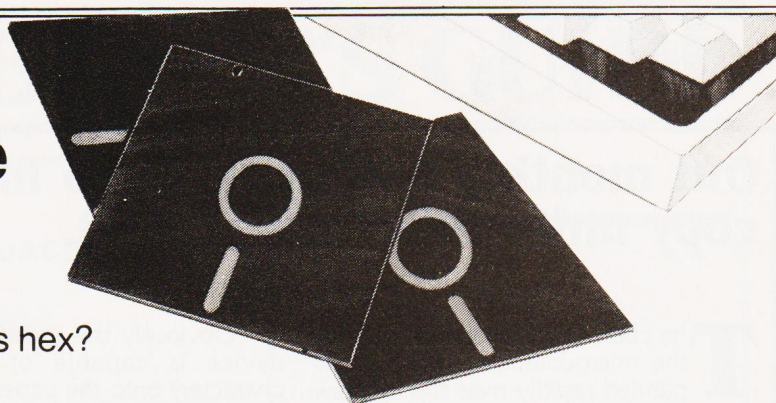
Cunard Hotel, Hammersmith  
10th, 11th, 12th September 1981

Can you afford not to be there?



# How does a floppy disc store information?

- What is a microprocessor?
- What are binary numbers? ■ What is hex?
- What is an ASCII keyboard?



## Questions & Answers on Personal Computing

by Peter Lafferty

**"An excellent starting point for the newcomer"**

David Tebbutt  
(editor Personal Computer World)

This book will help anyone who wishes to learn about personal computers and the uses to which they can be put. It describes the development of the personal computer, explains its operation and outlines the principles of programming. It deals in large part with systems that are available, particularly in the middle price range, and what can be expected from them, while a chapter on applications surveys the many uses of these remarkable machines.

Illustrated Paperback 165 x 111mm 96 pages £1.95 0 408 00555 6

Already published...

**Introduction to Microcomputer Programming** by Peter C Sanderson  
Illustrated Paperback 216 x 138mm 144 pages £4.25 0 408 00415 0

**Learning BASIC with your Sinclair ZX80** by Robin Norman  
Illustrated Paperback 216 x 135mm 160 pages £3.95 0 408 01101 7

**Microprocessors for Hobbyists** by Ray Coles  
Illustrated Paperback 234 x 156mm 92 pages £3.25 0 408 00414 2

Forthcoming... (to be published late 1981)

**Microprocessors: Your Questions Answered** by Alec Wood  
Illustrated Paperback 216 x 138mm 160 pages £4.95 approx.  
0 408 00580 7

**Practical Microprocessor Systems** by Ian R Sinclair  
Illustrated Paperback 216 x 138mm 144 pages £4.95 approx.  
0 408 00496 7

ORDER NOW from your local bookseller

In case of difficulty send cash with order to  
Patricia Davies, Marketing Manager at the address below

**Newnes Technical Books**  
Borough Green, Sevenoaks, Kent TN15 8PH

a division of  
Butterworths

(CT9.81)

VOL 2  
NO 2  
OUT  
AUGUST 21st

## ELECTRONICS DIGEST

Vol.1 No.1

Circuit ideas from Electronics Today International for experimenters.

Vol.1 No.2

30 top projects to build from Electronics Today International

Vol.1 No.3

100 pages of essential information for the electronics and computing enthusiast

Vol.1 No.4

30 of the most popular projects from the publishers of Hobby Electronics

Vol.2 No.1

Safeguard your home with this security electronics special featuring projects to build and explanatory articles. Free inside — Photo Digest, a 32 page magazine for the technically minded photographer.



Catch up on Electronics Digest back issues.

Send your cheque or PO (made payable to Modmags Ltd) for £1.75 per issue, including post and packing.

Backnumbers,  
Electronics Digest,  
145 Charing Cross Road,  
London WC2H 0EE.



## Our monthly listing turns to hard copy units this time around.

**T**he choice of low-cost printers for the microcomputer user has expanded rapidly over the last few years with the introduction of new technology. Prices have also come tumbling down as the market has expanded, so that selecting a device is an even harder task — hence the inclusion of a regular Buyer's Guide in the magazine.

The following pages list all the suitable printers that we know about which are available on the UK market, and the purpose of this introduction is to help the potential purchaser get the best out of the information presented.

As far as we can we have listed the major UK source of supply of each device or family of devices, whether a distributor or the actual manufacturer, and it is to this address that you should write if you have any enquiries or problems locating a local source of supply.

### Heading It Up

There are several ways of getting a character onto a piece of paper but these can be classified into two major categories, impact and non-impact. The former category includes 'dot-matrix', 'daisywheel' and 'golfball' types whereas the latter include 'electrostatic' and 'thermal' types. The relevant entry in the product list is **Face**. A matrix printer, whether impact or not, creates its characters by using a set of needles. The number used to create each character is given under the **Head size** entry. Basically, a 5 by 7 head will not be able to produce as good a character as a 9 by 7 head: the former type cannot produce descenders on letters such as 'p', 'q' and 'g'. Thermal and electrostatic printers require special paper rather than using a conventional typewriter ribbon to create the image on normal paper. Daisy and golfball type printers produce a much higher quality type in a manner similar to that used by a conventional typewriter. They are normally used for correspondence and tend to be much more expensive.

### Connecting It Up

The **Interface** is the method of connection to your micro; serial, parallel, etc. Several printers are offered with custom interfaces for certain popular micros — check the **Options** entry further down the list for these. If a serial interface is available the speed at which the micro can send information is given in the **Baud rates** entry.

Obviously the speed at which the device is capable of putting the characters onto the paper is important, and this is shown in the **Print speed** entry (cps stands for characters per second). A note specifying 'bi-directional' against this entry means that the printing head is capable of printing backwards — you don't have to wait until the head has returned to the left-hand margin.

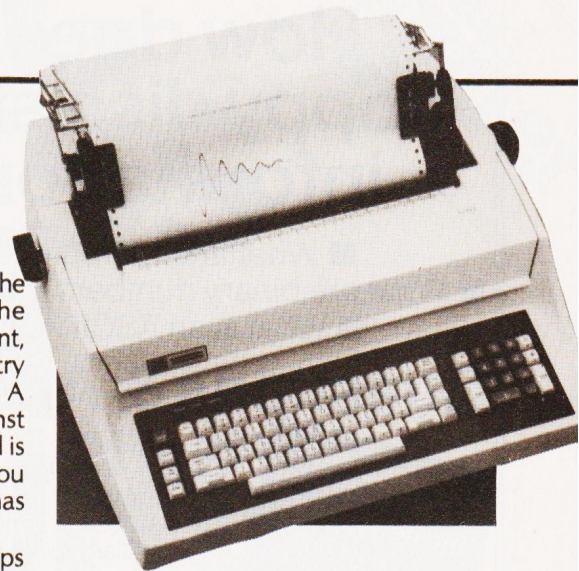
Because of this a bi-directional 120cps printer will actually be able to print faster than a 120cps mono-directional device.

The way the printer handles the paper is shown in the **Paper feed** entry. Friction feed is similar to a normal typewriter, OK for single sheets but not so good for continuous stationery. Sprocket feed is basically the same as friction feed except that there are pegs mounted on the end of the platen which engage in the holes in continuous stationery and keep it straight. Tractor feed is the best of all if you are using continuous stationery. It can usually be adjusted for various widths of paper.

### Columns Of Type

The **Columns** entry tells you how many 'normal'-sized characters can be printed on each line, a hang-over from the days of machines like the faithful Teletype. An entry under **Type sizes** tells you if the printer can produce different sizes of character; expanded and compressed are generally available on matrix printers.

Some printers offer **Graphics** characters as part of the normal font built into the machine, and others can be



user-programmed with special characters or can produce 'High-res' dot graphics.

In general, the quoted **Price** is the end user cost of the printer but, as prices change all the time, it is well worth shopping around for a bargain.

### The Choice Of Options

The entries under **Options** and **Notes** detail any special extras available and any special qualities that the printer might have. If you are looking for a printer to go with a simple personal computer then you are probably not interested in a high quality correspondence type, conversely if you expect to put a large amount of paper through your machine then you must be prepared to pay for a device capable of coping with that kind of volume.

If you are considering a printer for your business then you might have thought of using multi-part stationery. If you have, it is essential to check that the device can cope with this type of load; a normal type will simply not stand up to the strain.





# BUYER'S GUIDE

## ADCOMP

ADCOMP X80 SP  
**Dist:-** Roxburgh Printers,  
 22 Winchelsea Road,  
 Rye, East Sussex  
 07973-3777

**Face:-** Dot  
**Interface:-** RS232/IEEE/Centronics/  
 /20mA  
**Feed:-** Sprocket/Tractor  
**Head Size:-** 8x8  
**Baud Rates:-** 50-9600  
**Print Speed:-** 100cps (bi-directional)  
**Col:-** 80/96  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** £795 - £840

**Notes:-** Intelligent bi-directional feed printer plotter with a variety of fonts.

## ANADEX

DP-1000  
**Dist:-** Anadex Ltd  
 Dorna House, Guildford Road,  
 West End, Woking, Surrey  
 09905-6333

+ regional outlets

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** 110-2400  
**Print Speed:-** 50cps  
**Col:-** 40  
**Type Sizes:-** 2  
**Graphics Option:-** No  
**Price:-** £400

**Options:-** Choice of the 3 indicated interfaces  
**Notes:-** 40 column version of DP-8000 with slightly reduced facilities.

DP-8000

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Sprocket  
**Head Size:-** 9x7  
**Baud Rates:-** 110-9600  
**Print Speed:-** 112cps bi-directional  
**Col:-** 80  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £500

**Options:-** Large character buffer, other interfaces  
**Notes:-** General purpose dot matrix machine.

DP-9500

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Tractor  
**Head Size:-** 9x9 or 9x7  
**Baud Rates:-** 110-9600  
**Print Speed:-** 200cps bi-directional  
**Col:-** 132/220  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £895

**Options:-** Extended character buffer.  
**Notes:-** 132 column system with expansion to 176 column with coms control. High density graphics.

DP-9501

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Tractor  
**Head Size:-** 9x11  
**Baud Rates:-** 110-9600  
**Print Speed:-** 200cps bi-directional  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £995

**Notes:-** Extended carriage version of 9500 with higher density plotting.

## ANDERSON JACOBSON

AJ 860  
**Manuf:-** Anderson Jacobson  
 752 Deal Avenue, Slough,  
 Berkshire SL1 4SJ  
 Slough 25172

Also Manchester office

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Tractor  
**Head Size:-** 9x5  
**Baud Rates:-** 110-1200  
**Print Speed:-** 120cps bi-directional  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £—

**Notes:-** True descender matrix printer that gives both graphics and full APL character set.

AJ 832

**Face:-** Daisy  
**Interface:-** RS232  
**Feed:-** Friction  
**Head Size:-** N/A  
**Baud Rates:-** 110-300  
**Print Speed:-** 30cps  
**Col:-** 132/156  
**Type Sizes:-** Various  
**Graphics Option:-** Yes  
**Price:-** £2,560

**Options:-** Tractor option, 45cps printing option.  
**Notes:-** Daisy wheel printer capable of both graphics plotting and APL printing. IBM 2741 compatible option.

AJ 880

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Friction  
**Head Size:-** 7x9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 30cps  
**Col:-** 132/216  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £899

**Options:-** Tractor feed.  
**Notes:-** Low cost APL terminal.

## BASE 2

Z-800  
**Dist:-** Zero One Electronics  
 36 Oaklands Avenue,  
 Thornton Heath, Surrey CR4 7PH  
 01-689 7924

Also Intelligent Artefacts

**Face:-** Dot  
**Interface:-** RS232/20mA/  
 Centronics/IEEE  
**Feed:-** Tractor/Friction  
**Head Size:-** 5x7  
**Baud Rates:-** 75-9600  
**Print Speed:-** 100cps  
**Col:-** 64/132  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £375

**Options:-** User definable font.  
**Notes:-** Supplier also runs a service and repair centre and supplies ribbons and paper.

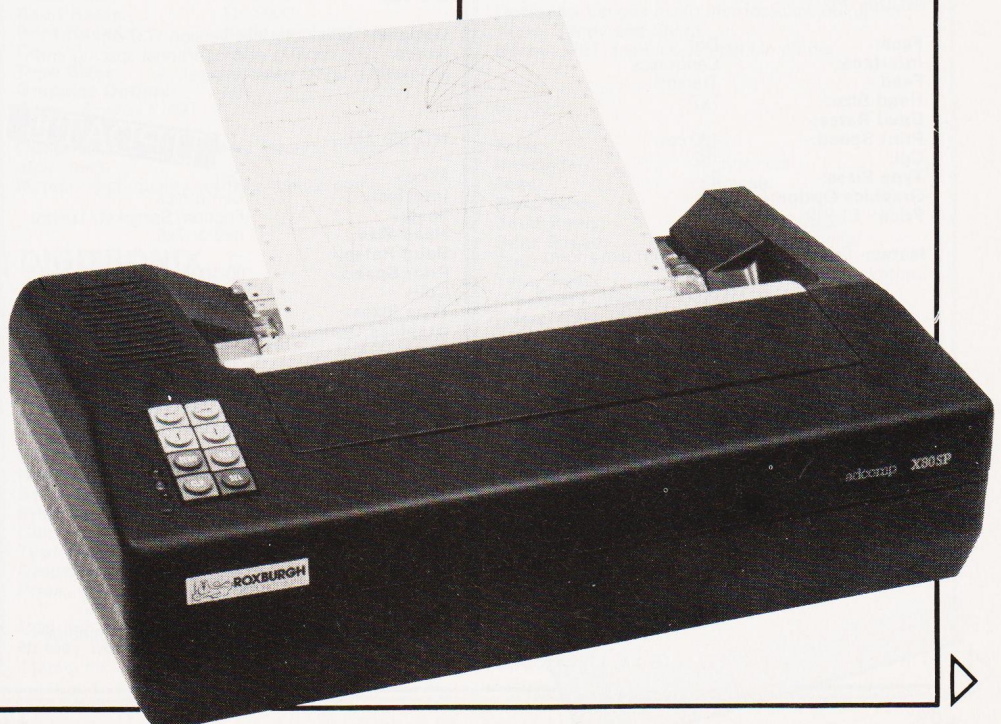
## CENTRONICS

MICROPRINTER P1  
**Manuf:-** Centronics Data Computer (UK) Ltd.,  
 Victoria Way, Burgess Hill, Sussex RH15 9NU  
 04446-56011

All prices are one-off OEM. Wide UK distribution network including Sintrom, Bytech, Datic, Hamilton Rentals, Rair, Comma, Dacoll and MIBF.

**Face:-** Dot Electrostatic  
**Interface:-** Centronics  
**Feed:-** Friction  
**Head Size:-** 5x8  
**Baud Rates:-** —  
**Print Speed** 150 lpm  
**Col:-** 132  
**Type Sizes:-** 3  
**Graphics Option:-** —  
**Price:-** £190

**Options:-** Teletex/Prestel interface @ £375  
**Notes:-** Software selectable line and type sizes.





# MODEL 150

**UPDATE**

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** 7x9  
**Baud Rates:-** —  
**Print Speed:-** 150cps (bi-directional)  
**Col:-** 80  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** —

**Options:-** International character set, RS232 interface.

# MODEL 152

**UPDATE**

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** 7x9  
**Baud Rates:-** —  
**Print Speed:-** 150cps (bi-directional)  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** —

**Options:-** International character set, RS232 interface.

# MODEL 700

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor  
**Head Size:-** 5x7  
**Baud Rates:-** —  
**Print Speed:-** 60cps  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £890

**Notes:-** Conventional low speed matrix printer.

# MODEL 701

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor  
**Head Size:-** 5x7  
**Baud Rates:-** —  
**Print Speed:-** 60cps bi-directional  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £980

# MODEL 702

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor  
**Head Size:-** 7x7  
**Baud Rates:-** —  
**Print Speed:-** 120 cps  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £1,210

**Notes:-** Faster version of 701 with extra form controls.



# MODEL 703

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor  
**Head Size:-** 7x7  
**Baud Rates:-** —  
**Print Speed:-** 150cps  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £1,360

**Options:-** Graphics plotting option.

# MODEL 704

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Tractor  
**Head Size:-** choice  
**Baud Rates:-** 110-9600  
**Print Speed:-** 150cps bi-directional  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £1,360

**Options:-** Stand, Buffer, "hush" kit.  
**Notes:-** Large carriage high quality matrix printer.

# 730 MINIPRINTER

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** 7x7  
**Baud Rates:-** —  
**Print Speed:-** 100cps  
**Col:-** 80  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £375  
End user

**Options:-** Serial interface (730-4).

# 737 MINIPRINTER

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** Nx9 or 7x8  
**Baud Rates:-** —  
**Print Speed:-** 50 or 80cps  
**Col:-** 80  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £425  
End user

**Options:-** Serial interface version (737-4)  
**Notes:-** Unit capable of proportional spacing and justification under micro control.

# MODEL 739

**UPDATE**

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Friction/Sprocket/Tractor  
**Head Size:-** nx9 or 7x8  
**Baud Rates:-** —  
**Print Speed:-** 80-100cps (bi-directional)  
**Col:-** 80-132  
**Type Sizes:-** 3  
**Graphics Option:-** Yes  
**Price:-** —

**Options:-** Serial interface, Text buffer.  
**Notes:-** Quieter model than 737 with pin-addressable graphics. Faster than 737 and also includes TOF.

# MODEL 753

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor  
**Head Size:-** Nx9  
**Baud Rates:-** —  
**Print Speed:-** 100-150cps bi-directional  
**Col:-** 132

**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £1,360

**Options:-** Stand, Various electronic options.  
**Notes:-** Correspondence printer with proportional spacing.

# MODEL 779

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** —  
**Print Speed:-** 60cps  
**Col:-** 80/132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £370

**Options:-** Tractor feed.  
**Notes:-** The original micro printer as supplied by Tandy.

# MODEL 780

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Friction  
**Head Size:-** 9x7  
**Baud Rates:-** —  
**Print Speed:-** 60cps  
**Col:-** 80/132  
**Type Sizes:-** 2  
**Graphics Option:-** No  
**Price:-** £830

**Notes:-** Upmarket version of 779 with better quality head.

# MODEL 781

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Friction  
**Head Size:-** 9x7  
**Baud Rates:-** —  
**Print Speed:-** 60cps  
**Col:-** 80/132  
**Type Sizes:-** 2  
**Graphics Option:-** No  
**Price:-** £930

**Notes:-** Bi-directional version of 780.

# DRE

**UPDATE**

8810  
**Dist:-** Geveke Electronics,  
RMC House, Vale Farm Road,  
Woking, Surrey GU21 1DW  
04862-71337

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Tractor  
**Head Size:-** 9x7  
**Baud Rates:-** 110-9600  
**Print Speed:-** 120cps (bi-directional)  
**Col:-** —  
**Type Sizes:-** 3  
**Graphics Option:-** Yes  
**Price:-** —

**Options:-** Paper stacker.

# 8830/40

**UPDATE**

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Tractor  
**Head Size:-** 9x7 or 9x9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 180/240cps (bi-directional)  
**Col:-** —  
**Type Sizes:-** 4  
**Graphics Option:-** Yes  
**Price:-** —

**Options:-** Detached keyboard, VFU, stand.



# BUYER'S GUIDE



8910/20

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Friction  
**Head Size:-** nx9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 160 or 240cps (bi-directional)  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** —

**Options:-** Detached keyboard, VFU, stand.

**Notes:-** Correspondence quality drafting printer capable of proportional justification.

## DATAROYAL

DATAROYAL IPS 5000

**Dist:-** Facit Data Products Ltd.  
 Maidstone Road, Rochester, Kent.  
 0634-401721

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Tractor  
**Head Size:-** 9x9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 125cps  
**Col:-** 80/136  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £774 - 910

**Options:-** Large 136 column platten, 2K buffer, 20mA interface.

**Notes:-** Slightly less enhanced versions of FACIT 4525/6.

## DATAPRODUCTS

T80

**Dist:-** Pericom Data Systems Limited,  
 1/3 Burners Lane, Kiln Farm,  
 Milton Keynes, Bucks.  
 0908-564747

**Face:-** Dot/Thermal  
**Interface:-** RS232/20mA/Parallel/Centronics  
**Feed:-** Friction  
**Head Size:-** 7x5  
**Baud Rates:-** 110-9600  
**Print Speed:-** 80cps  
**Col:-** —  
**Type Sizes:-** 1  
**Graphics Option:-** Yes  
**Price:-** From £950

**Options:-** Interfaces for Burroughs, Apple II, TRS80, Intellec MDS, Page Buffer.

M200

**Face:-** Dot  
**Interface:-** Parallel/Centronics/RS232/20mA  
**Feed:-** Tractor  
**Head Size:-** 7x7  
**Baud Rates:-** 75-19200  
**Print Speed:-** 340cps  
**Col:-** —  
**Type Sizes:-** Various  
**Graphics Option:-** No  
**Price:-** £1495

**Options:-** VFU, Acoustic Cabinet, Compressed Print.

**Notes:-** Forms Length Select Switch, Pedestal, Diagnostic Display and Expanded Print Facility fitted as standard.

## DIABLO

630

**Dist:-** Geveke Electronics,  
 RMC House, Vale Farm Road,  
 Woking, Surrey GU21 1DW.  
 04862-71337  
 Many suppliers including Pericom

**Face:-** Daisy  
**Interface:-** RS232/20mA  
**Feed:-** Friction  
**Head Size:-** N/A  
**Baud Rates:-** 110-9600  
**Print Speed:-** 40cps (bi-directional)  
**Col:-** 132  
**Type Sizes:-** Various  
**Graphics Option:-** Yes  
**Price:-** Approx £1400

**Options:-** Tractor and sheet feeders, bi-directional paper feed.

**Notes:-** High quality correspondence printer.

## DIGITRONIX

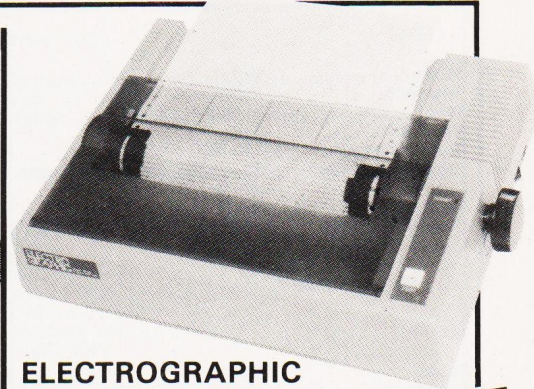
DIGITRONIX MINI PRINTER

**Manuf:-** Digitronix Ltd,  
 10 Burners Lane, Kiln Farm Industrial Estate,  
 Milton Keynes.  
 0908-566888

**Face:-** Electrostatic  
**Interface:-** RS232/20mA  
**Feed:-** Friction  
**Head Size:-** —  
**Baud Rates:-** 110-4800  
**Print Speed:-** 64cps  
**Col:-** 32  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £195

**Options:-** Different font or graphics set

**Notes:-** Electrosensitive paper printer for data logging etc.



## ELECTROGRAPHIC

EG700

**Dist:-** Electrographic Peripherals,  
 Printinghouse Lane,  
 Hayes, Middx UB3 1AP.  
 01-573 1826

**Face:-** Dot  
**Interface:-** Parallel  
**Feed:-** Sprocket  
**Head Size:-** 5x7  
**Baud Rates:-** —  
**Print Speed:-** 80cps  
**Col:-** 80  
**Type Sizes:-** 2  
**Graphics Option:-** High-res  
**Price:-** £275

**Options:-** RS232 interface with 1K buffer.

**Notes:-** Printing head can be controlled to produce dot resolution graphics.

## EPSON

EPSON TX 80

**Dist:-** Westrex,  
 Bilton Fairway Estate, Long Drive,  
 Greenford, Middx.  
 01-578 0957

Micro peripherals and others

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** 5x7 or 6x7  
**Baud Rates:-** —  
**Print Speed:-** 125cps  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £395

**Options:-** Various micro interfaces including Pet, Apple, Tandy and Sharp

**Notes:-** PET graphics compatible printer.

MX 80-T

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Sprocket  
**Head Size:-** 9x9  
**Baud Rates:-** 110-9600 (RS232)  
**Print Speed:-** 80cps bi-directional  
**Col:-** 80  
**Type Sizes:-** 3  
**Graphics Option:-** Yes  
**Price:-** £360

**Options:-** As TX 80 plus RS232 and IEEE interfaces.

MX 80-FT

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Friction/Tractor  
**Head Size:-** 9x9  
**Baud Rates:-** 110-9600 (RS232)  
**Print Speed:-** 80cps bi-directional  
**Col:-** 80  
**Type Sizes:-** 3  
**Graphics Option:-** Yes  
**Price:-** £399

**Options:-** As MX 80-T.



#### MX 80-2

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Friction/Tractor  
**Head Size:-** 9x9  
**Baud Rates:-** 110-9600 (RS232)  
**Print Speed:-** 80cps bi-directional  
**Col:-** 80  
**Type Sizes:-** 3  
**Graphics Option:-** High res  
**Price:-** £420

**Options:-** As MX 80-T.

#### MX 70

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor  
**Head Size:-** 5x7  
**Baud Rates:-** —  
**Print Speed:-** 80cps  
**Col:-** 80  
**Type Sizes:-** 3  
**Graphics Option:-** High res  
**Price:-** £260

**Options:-** Apple, Tandy and Sharp interfaces only.

#### MX 100

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor  
**Head Size:-** 9x9  
**Baud Rates:-** —  
**Print Speed:-** 80cps bi-directional  
**Col:-** 132  
**Type Sizes:-** 3  
**Graphics Option:-** High res  
**Price:-** £TBA

**Notes:-** New model: check with distributor.

### FACIT

**FACIT 4520/1**  
**Dist:-** Facit Data Products  
Maidstone Road, Rochester, Kent.  
0634-401721

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Friction  
**Head Size:-** 9x7  
**Baud Rates:-** —  
**Print Speed:-** 80cps  
**Col:-** 80/132  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £583

**Options:-** Tractor feed (4521).

**Notes:-** Intelligent, bi-directional matrix printer.

#### FACIT 4525/6

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Tractor  
**Head Size:-** 9x9  
**Baud Rates:-** —  
**Print Speed:-** 150cps  
**Col:-** 80/132  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £890-1046

**Options:-** 132 column version (4526)

**Notes:-** Bi-directional printer, can be equipped with most European fonts.

#### FACIT 4530

**Face:-** Dot  
**Interface:-** RS232/Centronics/20mA  
**Feed:-** Tractor  
**Head Size:-** 5x7 or 9x7  
**Baud Rates:-** —  
**Print Speed:-** 200cps  
**Col:-** 132/198  
**Type Sizes:-** Various  
**Graphics Option:-** —  
**Price:-** £1,628

**Notes:-** Microcontrolled printer, capable of bar code printing.

#### FACIT 4540

**Face:-** Dot  
**Interface:-** RS232/Parallel/  
Centronics/IEEE/20mA  
**Feed:-** Tractor  
**Head Size:-** 7x9 or 9x9  
**Baud Rates:-** —  
**Print Speed:-** 250cps  
**Col:-** 155  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £2,764-3,040

**Options:-** Keyboard unit (4610), Graphics (4542).

### GENERAL ELECTRIC (USA)

**TERMINET 200**  
**Dist:-** International General Electric of New York,  
111 Park Road, London NW8 7JL  
01-402 4100

Distributors include Zygat & Middletron.

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Tractor  
**Head Size:-** 7x9  
**Baud Rates:-** 110-1200  
**Print Speed:-** 200cps  
**Col:-** 136/224  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** —

**Notes:-** Available as ASR, KSR or forms access printer with wide range of print formats.

#### TERMINET 2000

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Friction  
**Head Size:-** 7x9  
**Baud Rates:-** —  
**Print Speed:-** —  
**Col:-** —  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** —

**Options:-** Tractor feed, character buffer, modem.

**Notes:-** KSR terminal unit offering three-part form handling and various print formats.

### HEATH ELECTRONICS

**H14**  
**Dist:-** Heath Electronics  
Bristol Road, Gloucester GL2 6EE  
0452-29451

+ London shop — 01-636 7349

**Face:-** Dot  
**Interface:-** RS232/20mA  
**Feed:-** Tractor  
**Head Size:-** 5x7  
**Baud Rates:-** 110-4800  
**Print Speed:-** 135cps  
**Col:-** 80/132  
**Type Sizes:-** 3  
**Graphics Option:-** —  
**Price:-** £413 (kit) — £592 (built)

**Notes:-** High quality reliable printer with no frills.

### HEWLETT PACKARD

**HP 2631B**  
**Dist:-** Hewlett Packard Ltd.  
308-314 Kings Road,  
Reading, Berkshire RG1 4ES  
0734-61022

**Face:-** Dot  
**Interface:-** RS232/Centronics  
Centronics/IEEE  
**Feed:-** Tractor  
**Head Size:-** 7x9  
**Baud Rates:-** 110-2400  
**Print Speed:-** 180cps  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £2,110

**Options:-** Graphics copy option.

**Notes:-** Software selectable print densities and form sizes.

#### HP 2635B

**Face:-** Dot  
**Interface:-** RS232/20mA  
Centronics/IEEE  
**Feed:-** Tractor  
**Head Size:-** 7x9  
**Baud Rates:-** 110-2400  
**Print Speed:-** 180cps  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £2,315

**Notes:-** KSR version of 2631 with same facilities.

### HONEYWELL

**HONEYWELL S10**  
**Dist:-** MBS Terminals  
Aldwych House, Madeira Road,  
West Byfleet, Surrey KT14 6BA  
09323-53151

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Friction/Sprocket/Tractor  
**Head Size:-** 7x7  
**Baud Rates:-** —  
**Print Speed:-** 80cps (bi-directional)  
**Col:-** 80  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £510

#### HONEYWELL S30

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Friction/Sprocket/Tractor  
**Head Size:-** 7x7  
**Baud Rates:-** —  
**Print Speed:-** 80cps (bi-directional)  
**Col:-** 132  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £690

### INTEGREX

**CX 80**  
**Manuf:-** Integrex Ltd.,  
Portwood Industrial Estate, Church Gresley,  
Burton on Trent, Staffordshire DE11 9PT  
0283-215432

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor  
**Head Size:-** 5x7  
**Baud Rates:-** 300-9600 (RS232)  
**Print Speed:-** 125-150 cps  
**Col:-** 80  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** £895

**Options:-** RS232, IEEE, Tandy and Apple interfaces.

**Notes:-** Matrix printer that can print in up to 7 colours. Can be user programmed for High res graphics.



454C

**Face:-** Dot  
**Interface:-** Parallel  
**Feed:-** Tractor  
**Head Size:-** 9x9  
**Baud Rates:-** 300-9600 (RS232)  
**Print Speed:-** 250cps bi-directional  
**Col:-** 155  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £3,950

**Options:-** Centronics, RS232 and IEEE interfaces.  
**Notes:-** High quality seven colour matrix printer — professional version of CX80.

## LEAR SIEGLER

**BALLISTIC 300**  
**Dist:-** Penny & Giles Recorders Ltd.  
 Mudeford, Christchurch,  
 Dorset BH23 4AT  
 04252-71511

**Face:-** Dot  
**Interface:-** RS232/20mA  
**Feed:-** Tractor  
**Head Size:-** 9x7  
**Baud Rates:-** 75-9600  
**Print Speed:-** 180cps  
**Col:-** 136  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** —

**Options:-** Foreign character sets, 9x9 or 9x12 heads.

**Notes:-** Micro controlled 'smart' printer with powerful forms control.

## LOGABAX

**LOGABAX 100**  
**Dist:-** Brospa Data  
 87 Castle Street, Reading,  
 Berkshire RG1 7ST  
 0734-589393

**Face:-** Dot  
**Interface:-** RS232/Parallel/Centronics/IEEE/20mA  
**Feed:-** Tractor  
**Head Size:-** Various  
**Baud Rates:-** 110-9600  
**Print Speed:-** 100cps  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** No  
**Price:-** £1,152

**Options:-** Stand and paper handling trays.

**LOGABAX 200**

**Face:-** Dot  
**Interface:-** RS232/Parallel/Centronics/IEEE/20mA  
**Feed:-** Tractor  
**Head Size:-** 7x9 or 9x9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 180cps  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £1,590

**Options:-** Stand and paper handling trays.  
**Notes:-** Bi-directional matrix printer with expanded and compressed type facility.

**LOGABAX LXI200**

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Friction/Sprocket/Tractor  
**Head Size:-** 9x9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 180cps (bi-directional)  
**Col:-** —  
**Type Sizes:-** Selectable (various)  
**Graphics Option:-** Yes  
**Price:-** £2,031

**Options:-** Stand and paper holder  
**Notes:-** Full software controlled matrix printer offering WP quality and facilities.

## MASTERPRINT

**MASTERPRINT 165**  
**Dist:-** MBS Terminals,  
 Aldwych House, Madeira Road,  
 West Byfleet, Surrey KT14 6BA.  
 09323-53151

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Tractor  
**Head Size:-** 10x9  
**Baud Rates:-** —  
**Print Speed:-** 90/165cps (bi-directional)  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £1,450

**Options:-** Apple and S100 interfaces, special character sets, high resolution graphics  
**Notes:-** High quality drafting printer with 18 by 9 matrix print capability.

## MICROTEK

**MICROTEK MT 80P**  
**Dist:-** HAL Computers,  
 133 Woodham Lane, New Haw,  
 Weybridge, Surrey KT15 3NJ  
 Weybridge 48346

**Face:-** Dot  
**Interface:-** RS232/IEEE/Centronics  
**Feed:-** Tractor  
**Head Size:-** 9x7  
**Baud Rates:-** to 9600  
**Print Speed:-** 125cps  
**Col:-** 80/120  
**Type Sizes:-** 2  
**Graphics Option:-** No  
**Price:-** £495 - £550

**Options:-** Various interfaces, character buffer.  
**Notes:-** 80 or 120 column matrix printer.

## NASCOM

**IMP**  
**Dist:-** Currently available from many local outlets.

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Friction  
**Head Size:-** 7x7  
**Baud Rates:-** 110-9600  
**Print Speed:-** 60 lpm  
**Col:-** 80  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** £325

**Options:-** Tractor feed, programmable character set.  
**Notes:-** First of a new generation of matrix printers, like the BASE 2 and EPSON.

## NEWBURY LABS

**8300 RM**  
**Dist:-** Newbear Computing Store,  
 40 Bartholomew Street,  
 Newbury, Berkshire  
 0635-30505

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Tractor  
**Head Size:-** 7x9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 125cps  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** No

**Price:-** £525

**Options:-** Choice of character per line and buffer sizes.  
**Notes:-** General purpose dot matrix printer.

## OKI

**MICROLINE 80**  
**Dist:-** Rohan Computing  
 52 Coventry Street,  
 Southam, Warcs CV OEP  
 092681-4045

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Friction  
**Head Size:-** 9x7  
**Baud Rates:-** —  
**Print Speed:-** 80cps  
**Col:-** 80  
**Type Sizes:-** 3  
**Graphics Option:-** Yes  
**Price:-** £399

**Options:-** Tractor feed, RS232 1200 Baud interface  
**Notes:-** One of the new generation of micro printers for small business and personal use.

**MICROLINE 82**

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Friction/Sprocket  
**Head Size:-** 9x7  
**Baud Rates:-** 1200  
**Print Speed:-** 80cps (bi-directional)  
**Col:-** 80/132  
**Type Sizes:-** 3  
**Graphics Option:-** Yes  
**Price:-** £550

**Notes:-** Bi-directional version of the MICROLINE 80 with form controls.

**MICROLINE 83**

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Friction/Sprocket  
**Head Size:-** 9x7  
**Baud Rates:-** 1200  
**Print Speed:-** 120cps (bi-directional)  
**Col:-** 132/136  
**Type Sizes:-** 3  
**Graphics Option:-** Yes  
**Price:-** £799

**Notes:-** Full width version of MICROLINE range.

## OLIVETTI

**DY 311**  
**Dist:-** Dealership currently under negotiation.

**Face:-** Daisy  
**Interface:-** RS232/IEEE  
**Feed:-** Tractor/Friction  
**Head Size:-** N/A  
**Baud Rates:-** 110-9600  
**Print Speed:-** 32cps  
**Col:-** —  
**Type Sizes:-** Various  
**Graphics Option:-** —  
**Price:-** £1,300

**Options:-** Sheet feeder, 20mA interface  
**Notes:-** High quality daisy system with full proportional spacing and tabbing.

**TH 240**

**Face:-** Dot/Thermal  
**Interface:-** RS232  
**Feed:-** Tractor/Friction  
**Head Size:-** 7 pin  
**Baud Rates:-** 110-9600  
**Print Speed:-** 320cps  
**Col:-** —  
**Type Sizes:-** —



**Graphics Option:-** Yes  
**Price:-** £860

**Options:-** High speed plot, paper handling accessories.

**Notes:-** Thermal printer capable of producing eight ISO alphabets.

## PAPER TIGER

PAPER TIGER

**Dist:-** Microsense  
Finway Road, Hemel Hempstead, Herts HP2 7PS  
0442-48151

+ regional outlets inc. Teleprinter Equipment

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** 7x7  
**Baud Rates:-** 110-1200  
**Print Speed:-** 95cps  
**Col:-** 132  
**Type Sizes:-** 4  
**Graphics Option:-** Yes  
**Price:-** £598

**Notes:-** Very versatile printer with various built-in options for line length, etc.

PAPER TIGER 460

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Tractor  
**Head Size:-** Staggered nx9  
**Baud Rates:-** 300-9600  
**Print Speed:-** 110-160cps bi-directional  
**Col:-** 80  
**Type Sizes:-** 3  
**Graphics Option:-** High res  
**Price:-** £ —

PAPER TIGER 560

**Dist:-** Teleprinter Equipment,  
Akeman Street, Tring, Herts HP23 6AJ  
044282-4011

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Sprocket  
**Head Size:-** Staggered nx9  
**Baud Rates:-** 300-9600  
**Print Speed:-** 110-160 (bi-directional)  
**Col:-** 132  
**Type Sizes:-** 8  
**Graphics Option:-** Yes  
**Price:-** —

**Notes:-** Full width version of popular matrix printer.

## PERTEC

STYLIST 360

**Manuf:-** Pertec International  
10 Portman Road, Reading,  
Berkshire RG3 1DU  
0734-582115

**Face:-** Daisy  
**Interface:-** Centronics  
**Feed:-** Friction  
**Head Size:-** —  
**Baud Rates:-** —  
**Print Speed:-** 17cps  
**Col:-** 132/198  
**Type Sizes:-** Various  
**Graphics Option:-** No  
**Price:-** £666

PERTEC P80

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Friction/Sprocket  
**Head Size:-** 7x9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 80cps (bi-directional)  
**Col:-** 80/120  
**Type Sizes:-** 2

**Graphics Option:-** No  
**Price:-** £478

**Options:-** RS232 or 20mA interfaces.

PERTEC P250

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Tractor  
**Head Size:-** 7x9  
**Baud Rates:-** 110-19,200  
**Print Speed:-** 250cps (bi-directional)  
**Col:-** 132/158/198  
**Type Sizes:-** 3  
**Graphics Option:-** Yes  
**Price:-** £1,311

**Options:-** Centronics and 20mA interfaces.

## QUME

SPRINT 5

**Dist:-** Facit Data Products Ltd.  
Maidstone Road, Rochester, Kent.  
0634-401721

Local distribution by: Access Data, Fortronics,  
Cytec, Wilkes, Rohan, Brosa etc.

**Face:-** Daisy  
**Interface:-** RS232/20mA/Parallel  
**Feed:-** Tractor/Friction  
**Head Size:-** N/A  
**Baud Rates:-** 110-1200  
**Print Speed:-** 45-55cps  
**Col:-** 132/158  
**Type Sizes:-** Various  
**Graphics Option:-** Yes  
**Price:-** From £1,625

**Options:-** RO or KSR terminals, single sheet feed  
**Notes:-** High quality correspondence printer.

## RICOH

RICOH RP1600

**Dist:-** Nexos (UK) Ltd.,  
Metropolitan House, 1 Hagley Road,  
Edgbaston, Birmingham B16 8TG  
021-454 2235

**Face:-** Daisy  
**Interface:-** Centronics  
**Feed:-** Friction  
**Head Size:-** N/A  
**Baud Rates:-** —  
**Print Speed:-** 60cps  
**Col:-** N/A  
**Type Sizes:-** various  
**Graphics Option:-** —  
**Price:-** £1,290

**Options:-** Various interfaces.

**Notes:-** Fast commercial daisy wheel for WP and other office applications.

## ROBETRON

ROBETRON 1152

**Dist:-** Penny & Giles,  
Mudeford, Christchurch,  
Dorset BH23 4AJ.  
04252-71511

**Face:-** Daisy  
**Interface:-** Centronics  
**Feed:-** Friction  
**Head Size:-** N/A  
**Baud Rates:-** —  
**Print Speed:-** 45cps  
**Col:-** —  
**Type Sizes:-** various  
**Graphics Option:-** No  
**Price:-** £863

**Options:-** Tractor feed.

**Notes:-** East German RO daisywheel type printer.

## SANDERS MEDIA

**UPDATE**

Vario Printer 12/7

**Dist:-** Real Time Developments,  
Caroline House, Invincible Road,  
Farnborough, Hants GU14 7QU.  
0252-46213

**Face:-** Dot  
**Interface:-** RS232/Centronics  
**Feed:-** Friction  
**Head Size:-** nxn  
**Baud Rates:-** —  
**Print Speed:-** 30-50 or 120-200cps (bi-directional)  
**Col:-** —  
**Type Sizes:-** up to 11 fonts  
**Graphics Option:-** —  
**Price:-** —

**Options:-** Roll feed or tractor feed.

**Notes:-** Extremely high quality matrix printer capable of producing a wide range of typesyles using an 'Infinite Matrix'.

## SEIKO

**UPDATE**

SEIKOSHA GP-80

**Dist:-** DRG Business Machines,  
Unit 8, Lynx Crescent,  
Winterstoke Road,  
Weston Super Mare BS24 9DW.  
0934-416392

Many suppliers including Micro Peripherals etc.

**Face:-** Dot  
**Interface:-** Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** 'unihammer'  
**Baud Rates:-** —  
**Print Speed:-** 30cps  
**Col:-** 80  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** £225

**Options:-** Various interfaces.

**Notes:-** Amazingly low cost single needle printer capable of reasonable print and graphics quality.

## SIGMA

MODEL 801

**Dist:-** Sigma UK  
Unit 2, 106-120 Garrat Lane,  
Wandsworth, London SW18  
01-870 4524

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** 7x7  
**Baud Rates:-** 110-1200  
**Print Speed:-** 132cps  
**Col:-** —  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £695

## TELETYPE

TELETYPE 43

**Dist:-** Peripheral Hardware Ltd.,  
Armfield Close, West Molesey, Surrey.  
01-941 4806

**Face:-** Dot  
**Interface:-** RS232/20mA  
**Feed:-** Tractor/Friction  
**Head Size:-** 7x9  
**Baud Rates:-** —  
**Print Speed:-** 10 or 30cps  
**Col:-** 132  
**Type Sizes:-** —  
**Graphics Option:-** No  
**Price:-** —

**Options:-** IEEE interface, Buffer store, Stand, ASR.

**Notes:-** High quality matrix terminal available as KSR, ASR or RO. Portable and TTY compatible.



## TEXAS INSTRUMENTS

TI 810

**Dist:-** Texas Instruments,  
Manton Lane, Bedford.  
0234-67466

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Tractor  
**Head Size:-** 9x7  
**Baud Rates:-** 110-9600  
**Print Speed:-** 150cps  
**Col:-** 132  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £1,450

**Options:-** Character sets, various interfaces, form handling.

TI 820

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Tractor  
**Head Size:-** 9x7  
**Baud Rates:-** 110-9600  
**Print Speed:-** 150cps  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £1,450 - £1,650

**Notes:-** KSR bi-directional with RO option at reduced cost.

TI 825

**Face:-** Dot  
**Interface:-** RS232  
**Feed:-** Tractor  
**Head Size:-** 9x7  
**Baud Rates:-** 110-600  
**Print Speed:-** 75cps  
**Col:-** —  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £1,095 - £1,250

**Notes:-** Slower RO or KSR matrix printer.

TI 743

**Face:-** Dot Thermal  
**Interface:-** RS232/20mA  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** 110-300  
**Print Speed:-** 30cps  
**Col:-** —  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £995 - £1,105

**Notes:-** Thermal printer KSR terminal.

TI 745

**Face:-** Dot Thermal  
**Interface:-** RS232  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** 110-300  
**Print Speed:-** 30cps  
**Col:-** —  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £1,250

**Notes:-** Integral modem in portable terminal.

TI 763

**Face:-** Dot Thermal  
**Interface:-** RS232/20mA  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** 110-9600  
**Print Speed:-** 30cps  
**Col:-** —  
**Type Sizes:-** —  
**Graphics Option:-** —  
**Price:-** £2,195

**Options:-** Expanded character store.

**Notes:-** Bubble memory based terminal with 20K internal storage.

## TRENDCOM

TCM 100.

**Dist:-** Personal Computers Ltd.  
194-200 Bishopsgate,  
London EC2M 4NR

**Face:-** Dot Thermal  
**Interface:-** Parallel  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** —  
**Print Speed:-** 40cps  
**Col:-** 40  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** £240

**Options:-** Interfaces for various machines.

**Notes:-** 40 column thermal printer capable of graphics plotting.

TCM 200

**Face:-** Dot Thermal  
**Interface:-** Parallel  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** —  
**Print Speed:-** 40cps  
**Col:-** 80  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** £340

**Options:-** Interfaces for various machines.

**Notes:-** 80 column version of TCM 100.

SILENTYPE

**Dist:-** Microsense  
Finway Road, Hemel Hempstead, Herts HP2 7PS  
0442-48151

+ regional outlets

**Face:-** Dot Thermal  
**Interface:-** Apple  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** —  
**Print Speed:-** 40cps  
**Col:-** 80  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** £349

**Notes:-** Custom interfaced TRENDCOM printer for Apple capable of high density graphics.

## WALTERS MICROSYSTEMS

DOLPHIN BD-80P

**Manuf:-** Walters Microsystems  
1 Blenheim Road,  
High Wycombe, Bucks  
0494-445172

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics/  
IEEE  
**Feed:-** Tractor/Friction  
**Head Size:-** 7x9  
**Baud Rates:-** 50-19,200  
**Print Speed:-** 125cps  
**Col:-** 80/132  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £525

**Options:-** Stand, Buffer, Coms interface.

**Notes:-** A standard matrix printer with excellent reliability reputation.

DOLPHIN BD-136

**Face:-** Dot  
**Interface:-** RS232/Parallel/Centronics/  
IEEE/20mA

**Feed:-** Friction/Sprocket/Tractor  
**Head Size:-** 9x9  
**Baud Rates:-** —  
**Print Speed:-** 240cps (bi-directional)  
**Col:-** 136  
**Type Sizes:-** —  
**Graphics Option:-** Yes  
**Price:-** £1,200

**Notes:-** Flexible, intelligent matrix printer capable of a wide formatting range.

## WEYFRINGE

MODEL 480

**Dist:-** Weyfringe  
Longbeck Road, Marske,  
Redcar, Cleveland TS11 6HQ  
0642-470121

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Friction  
**Head Size:-** 5x7  
**Baud Rates:-** 110-9600  
**Print Speed:-** 110cps  
**Col:-** 40  
**Type Sizes:-** 2  
**Graphics Option:-** —  
**Price:-** £475

**Options:-** Choice of indicated interfaces.

**Notes:-** Tally roll printer for logging applications.

CENTURY

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics  
**Feed:-** Tractor/Friction  
**Head Size:-** 7x9  
**Baud Rates:-** 110-9600  
**Print Speed:-** 110cps  
**Col:-** 96/132  
**Type Sizes:-** 4  
**Graphics Option:-** —  
**Price:-** £945

**Options:-** Optional PET interface, alternate character set.

**Notes:-** General purpose machine with form handling facilities. Now available with keyboard.

## WHYMARK

WHYMARK 201

**Dist:-** Whymark Instruments  
6 Holmesdale Road,  
Reigate, Surrey RH2 0BQ  
07372-21753

**Face:-** Dot  
**Interface:-** RS232/20mA/Centronics/  
IEEE/Parallel  
**Feed:-** Friction  
**Head Size:-** 7x7  
**Baud Rates:-** 110-4800  
**Print Speed:-** 1 lps  
**Col:-** 40  
**Type Sizes:-** 4  
**Graphics Option:-** —  
**Price:-** £410 - £490

**Options:-** Label printer, rack mounted, interfaces to order.

**Notes:-** Tally roll printer with 40 character line.

WHYMARK 801

**Face:-** Dot  
**Interface:-** RS232/Centronics/IEEE  
**Feed:-** Tractor  
**Head Size:-** nx7  
**Baud Rates:-** 75-9600  
**Print Speed:-** 140cps  
**Col:-** 120  
**Type Sizes:-** 2  
**Graphics Option:-** Yes  
**Price:-** £750

**Options:-** User definable character set, stand.

**Notes:-** Intelligent printer with proportional control and absolute alignment.



**NEXT  
MONTH**

# electronics today

INTERNATIONAL

## DIY SPEAKERS

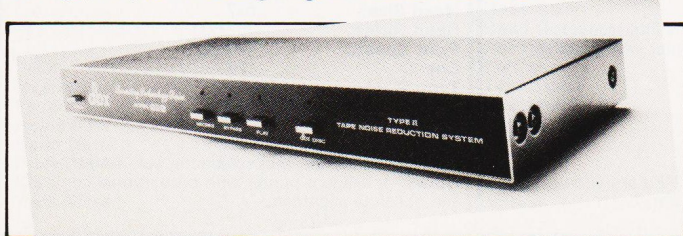
ETI has a long-standing tradition of bringing you the very best in hi-fi projects, but we haven't done a speaker design for... well, ever such a long time. Next month we put things right with this superb design, ideal for those of you looking around for something to bolt onto the back of the System A amplifier you've just finished building. In fact these speakers will do justice to any system; featuring three drive units and a recommended power rating of over 100 W, they out-perform commercial speakers costing twice as much. As well as a kit of parts with all the electronic bits needed, a pre-cut baffle will be available for those people not too happy with a fretsaw.

## MAINS REMOTE CONTROL

We promised it to you some months ago and here it is — remote control of domestic appliances using mains-borne signals. A single transmitter can control up to 16 appliances, each one containing a small receiver module which is preset by switches to one of the 16 channels. All you have to do is plug the transmitter into a convenient power socket, press the required channel button followed by 'on' or 'off', and the selected receiver drives a relay according to your instruction. The transmitter can be unplugged and moved around without changing the state of the receivers, and you can select any one of 16 'house codes' so that your system doesn't interfere with that of a neighbour. Turn on the kettle and the toaster without leaving your bed, open and shut the garage door from inside the house — or how about finding a helpful neighbour on the same mains phase and giving him your transmitter when you go on holiday? He can deter burglars by turning your lights on and off without leaving the comfort of his armchair. The possibilities are endless.

## dbx RULES OK?

Mention noise reduction to anyone and the name Dolby immediately springs to mind — but an amazing demonstration last month of the new dbx system could herald a dramatic change in the hi-fi scene. A noise level improvement over Dolby C of 30 dB across the whole audio band is claimed for the Recording Technology Series system, while the reproducible dynamic range approaches that of a live performance. How has this minor miracle been accomplished? A comprehensive technical lecture accompanied the demonstration and next month we'll be telling you just what's going on inside the boxes.



## ENLARGER TIMER

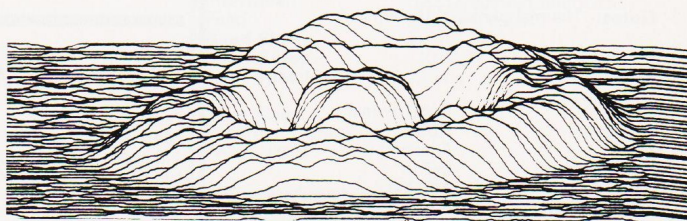
Photographers who want to build their own enlarger timer for home printing are generally faced with a choice between the lack of precision offered by a 'rotary pot' design, or the limited number of timing periods available from a rotary switch. Our new design overcomes these difficulties by using a programmable timer IC and a bank of toggle switches which allow timing periods to be set in one-second intervals from 1 s to 255 s. A relay controls the mains supply to the enlarger bulb and the usual Start, Abort and Focus switches are provided.

## SOUND BENDER

Want to sound like a Vagon — or even a Ravenous Bugblatter Beast of Traal? Our ring modulator lets you muck about with your vocal chords (or musical chords, if you wish). The simple, single-chip design contains its own built-in oscillator for modulating the input signal (both sine and triangle waveforms are available) and a mix control varies the depth of the effect. A fun little gadget for being silly with.

## TAKING SCALPS

Nothing to do with redskins; SCALP stands for Scanned Laser Probe and is the latest method being used by Wharfedale to develop better speakers. In just 15 minutes SCALP can provide an exact three-dimensional picture of the surface vibrations of a speaker cone when a single frequency is fed into it. We'll be taking a look at the technology and techniques involved, and seeing how the system is making speaker design faster, cheaper and easier.



**LOOK OUT FOR  
THE OCTOBER ISSUE  
ON SALE SEPTEMBER 4th**

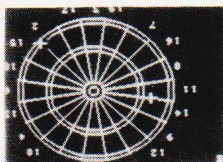


## CUT PRICE

### SPECIAL INTRODUCTORY OFFER

2114 450ns. MEMORY £1.30 inc.  
Suitable for Atom, UK101, etc.

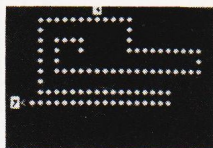
## ATOM GAMES



**DARTS**  
12K F.P.



**INVADERS**  
8K F.P.



**SNAKES**  
8K

**DARTS** Plays 501, 301, etc.  
plus Noughts + Crosses only £5.00 inc.

**INVADERS** Great sound effects. Two shades plus Ski Slope only £5.00 inc.

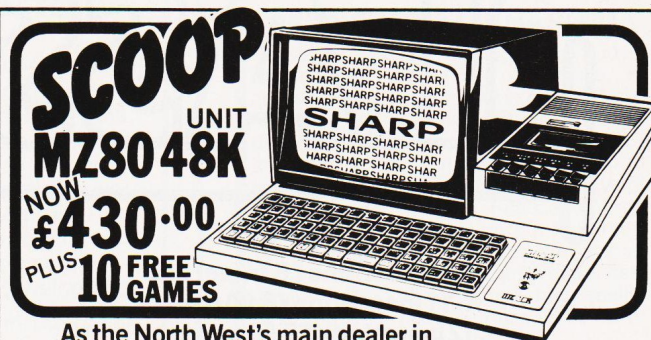
**SNAKES** Exciting compelling game plus Lunar Lander only £5.00 inc.  
OR all three tapes for only £10.00 inc.

F.P. means Floating Point ROM used.

K. means Total Memory used.

Add 50p on all orders for P&P.

**MAKE CHEQUES PAYABLE TO 'ELECTROCOMP SUPPLIES'**  
**ELECTROCOMP SUPPLIES. P.O. BOX 124, LONDON SE25 6YB.**



As the North West's main dealer in Sharp office products, we are able to offer the renowned MZ80K microcomputer at the following unbeatable prices:

20K Unit.....£390.00

36K Unit.....£410.00

48K Unit.....£430.00

Peripherals for the above available at competitive prices.

ALSO:-

Sharp PC1211 Pocket Micro £75.00

CE122 Printer Cass/Interface £62.00

CE121 Cassette Interface . . £13.00

**\* STOP PRESS—MZ80B'S NOW IN STOCK \***

We fully support all our own Sharp Micro Systems.

Bespoke software undertaken for the above, also for the new PC3201 System. CWO please add VAT & carriage.



**FLETCHER WORTHINGTON**  
(BUS. EQ.) LTD.,  
PROGRESS HOUSE,  
CECIL ROAD, HALE.  
TEL: 061-928 8928.



Access welcome  
PERSONAL  
CALLERS  
WELCOME

# BACKNUMBERS

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 should 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.

### Backnumbers issue list

#### July 1980

Battle of Britain simulation, Multiple choice exam program, Address list program, Kingdoms game.

#### August 1980

Multipurpose records program, Conlan language, Floppy discs examined, Systematic programming theory.

#### September 1980

Pascal overview, PC 1211 reviewed, BASIC dialects, Othello and Ski Run programs.

#### March 1981

SuperPET review, 6502 programming course, Boolean algebra on micros, Golf simulation.

#### June 1981

Sinclair's ZX81 reviewed, Versatile A to D converter project, The BBC's software specification, CT's programming standards.

#### July 1981

Holocaust wargame, Data entry validation routines, Multiple column records program, Media survey.

A very limited number of copies of May and October 1980 are available in addition to the above. 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.

### 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 £.....



# CLASSIFIED

## 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.

## ACORN ATOM

### MACHINE CODE SOFTWARE ON TAPE

SPACE INVADERS (12K m/c) ..... £6  
Super level 4 graphics version of the popular arcade game.  
OTHELLO (7K m/c) ..... £6  
Can you beat this version of the popular board game? 6 levels of play.  
AIR STRIKE (8K m/c) ..... £6  
Level 3 graphic simulation of a bomb run, but watch out for enemy flak.  
ELIZA (7K m/c) ..... £4  
Very fast conversational with excess of 100 replies.  
ROAD RACE (4K m/c) ..... £3  
Fast moving racing game, with great level 1a graphics.  
FIZZLE BRICKS (4K m/c) ..... £3  
Moving wall breakout with a difference. Level 1a graphics.  
LIFE (4K m/c) ..... £3  
Create fascinating patterns on a 64 by 64 grid and watch generations tick away in a fraction of a second.  
5 (2K) games ..... £3

All prices shown are inclusive, no extras.  
SAE for catalogue free with each order.

Pro Software, 121 Tyn-y-Twr, Baglan, Port Talbot, West Glam SA12 8YE.

## TAPES—ACORN ATOM

1 Galaxy Run, Entomb, Invasion (1-2K ea)	£3.50
2 Oil Patch, Missile, Randball (1-2K ea)	£3.50
3 Hangman (4K)	£3.50
4 King (6K)	£4.50
5 Blackjack (6K)	£4.50
6 Editor (6K)	£5.00

Sell your programs — 25% royalties paid

SAE for details and full list



**Castle Computers**

5 Green Lane, Malvern Wells, Worcestershire WR14 4WT

**SHARP BASIC** computer games: games include:- Othello, Fruit Machine, Machine Gun Alley, Star Wars, Zener, Mastermind and many more. All under £7.00. Write for FREE complete list to: 'Clyst-Haven', Ringwood Rd, Three Cross, Wimborne, Dorset BH21 6QY.

**UK101 PROGRAMS**, Noughts and Crosses, Bar-graph, Hex. to decimal convertor on one cassette. Send £2.00 to B.Bowler, 43 Spinney Road, Ilkeston, Derbyshire.

**TRS-80/VIDEO GENIE ADVENTURES**. The glowing globe of power — £8.00. Real-time adventures include The Mad Wizards Lair, The Caves of Doom and The Tower of the Insect-God — £12.00. All programs in MC for 16K machines, make cheques payable to G.Smith, send to 24 The Chantry's, West Street, Farnham, Surrey.

**ZX81, 128** user definable graphics kit plus software £12.00. D.Elwin, 20 Baldwin Rd, King's Lynn, Norfolk PE30 4AN.

## MAINS PROTECTION FOR YOUR MICRO!

Combined inlet plug/filter with lead etc. New low prices: 10 amp £15.50. Basic 6 amp filter only £11.50 \* 100 watt soldering gun £4.95 \* **Special Seiko Quartz Offer** to Computing Today readers — Gents day/date analogue 30% off! £27.95 \* Gents and ladies digitals £4.95 each \* P&P 50p per item \* Send to:

**Specialist Marketing,**  
11 Stonecliffe Drive, Middlestown,  
Wakefield, Yorks.

## CALCULATOR SCENE

We provide all help with programmable calculators and help with purchasing and processing all other types.

For further information  
Ring 01-641 4999.  
Evenings and Weekends.

**SHARP MZ80K (48K)** plus printer + interface. As new condition. Also PC1211 + interface. Offers? Seaford 891755.

## ZX80 and ZX81

HINTS & TIPS for the ZX81 — 60 pages on Saving Space, Understanding the Display File, Converting ZX80 programs, Chaining programs, Use of Machine Code plus listings of twelve programs £4.25

### Cassettes for 16K ZX81

Space Intruders — fight the marauding alien as you battle to save the Earth £6.50  
PROGRAMMERS TOOLKIT — line renamer including GOSUBs and GOTOs, Hexadecimal Loader/Printer, Find, Edit and Replace BASIC program strings £8.50

### Cassettes for 2K + ZX80

SPACE INTRUDERS £6.50

### Cassettes for 1K ZX81

PROGRAMMERS TOOLKIT — simplified version of above £6.50  
PLANET LANDER + 3 others £3.75

BLANK C12 cassettes 5 for £2.75, 25 for £13.25

Send SAE for full catalogue

Cheque with order or quote Access number to

**Hewson Consultants, 7 Grahame Close,**  
**Blewbury Oxon OX11 9QE (0235) 850075**

## ZX80 — 1K/16K MOVING GRAPHICS.

Give your 1k/16k ZX80 a pause function similar to the ZX81. Load this cassette then write your own moving display games in normal ZX80 basic. Load, save and run your programmes as normal, no complications. This amazing programme uses 100 bytes only. Plus free programme, "Random Buzz-word Generator", which generates endless screens of complicated phrases. Full instructions. £2.50 only to: M.P. Biddell, 22 Bramber, Belgrave, Tamworth, Staffs B77 2LL.

## LORDS OF KARMA

An excitingly new and different fantasy adventure that will hold you spellbound. From penniless beginnings in the city and country of Golconda you must explore, adventure and win your way to heaven. By your deeds are you judged. The computer is your eyes and ears.

Orders are not pre-set. The machine language program allows you to 'talk' to the computer in simple English and discover which instructions it will understand.

On tape only. For TRS 80 LII 48K, Apple II 32K, Pet 32K £13.95 incl. P&P.

And for TRS80 LII 16K, Apple II 16K, Pet 16K and larger:

**PLANET MINERS** (1-4 players) Rival corporations race to lay claim to the mineral wealth of the solar system.

**MIDWAY** Recreates the decisive Pacific carrier battle of 1942.

### NORTH ATLANTIC CONVOY RAIDER

Simulates the legendary breakout and pursuit of the Bismarck, the pride of Hitler's fleet.

**B1** Allows you to fly a nuclear bomber to attack a city in the USSR through the world's deadliest defenses.

**NUKEWAR** Simulates a tense arms race between 2 superpowers and the resulting hot war.

£11.95 each incl. P&P.

Orders and enquiries to:

**GAMES PEOPLE PLAY, FREEPOST,**  
**LONDON E12. TEL: 01-928 1984.**

**WANTED:** ZX's, must work, Best Prices, send details for serious offer. A.Quinn, Heckenrosenweg 6, 3170 Gifhorn, W.Germany.

**RML380Z 32K C100** dual cassette, RML software, Sargon, Cesil, own software, £950 ono (list £1288) or exchange Apple. Weston, Rayleigh Q268 742128 eve, 0277 253000 X2261 day. Free ZX80 included.

**UK101 GALACTIC ADVENTURE** with real time graphics. £6. SAE for details. Richard Tomlinson, 27 Peplins Way, Brookmans Park, Hatfield, Herts.

**COMPUKIT SOFTWARE:** Astrosled- fly through the jagged space canyon; Invaders- full feature version of the pub game; Asteroid- blast them into fragments. Also Space fighter, Life and Hangman. All programs 8K on cassette. Only £1.95 each from Arcadia Software, 4 Chestnut Avenue, Swansea SA3 5NL.

**UK101, S/BOARD** (48x32 and 24x24), Galactica, Invaders, Cosmic Invasion, Space Defender, Computerball, £3 per or £2.50 more, 8 way Joystick (RS) Cased and ready for connections to k/board (free game) £18 or £32 pair. Catalogue (SAE) Caedata, 19 Stafford Road, Caldicot, Newport, Gwent.



**ZX81 (16K) TELEPHONE INDEX** on cassette. Caters for input of 300 items/32 characters or 150 items/64 characters or any combination. Lists items by scrolling. Deletes by user selecting appropriate line number. Waits when user presses "W". No need to enter "GOTO" on every run. Gives "SAVE" option. ORDER NO. ACTEX 2 PRICE £3.50. Cheque with order to ROSE CASSETTES, 148 Widney Lane, Solihull, West Midlands B91 3LH.

### COMPUTER COURSE

Multi-part self-teach course for complete beginners upwards in non-technical language. No complicated maths. Full question/answer sections. Learn, understand and implement BASIC the easy way, for profit or pleasure, with or without a computer. Special sections for ZX81, PET. Certificate on successful completion of course. Master the computer before it masters you! Only £19.95. Barclaycard accepted.

**Sussex Software,**  
Wallsend House, Pevensey Bay,  
Sussex.

### ATTENTION TANGERINE OWNERS

I.B.M. I/O Typewriter interface board and power supply, wordprocessing and control programming and all leads just plug straight in ideal for small business £389 inc vat and carriage. Or purchase Word processing program separately £35 ACCESS / BARCLAYCARD  
Tel:- Bunwell (095389) 420.

Ralph Allen Eng. Co.,  
Forncett End, Norwich, Norfolk.  
S.A.E. for details.

**ZX80 GRAPHICS UPDATE.** S.A.E. for details. Petry, 3 Lester Drive, Worle, W.S.M. Avon BS22 0NG.

**ATOM, FULL M/C** debugging monitor in 2K. SAE data — L.Nolan, 99 Fir St., Cadishead, Manchester M30 5AR. £3.75.

**ACORN ATOM USERS:** Subscribe to "THE ATOM" — a bi-monthly magazine written exclusively for ATOM users. Covers BASIC and m/c programming, with complete, tested programs. Something for every ATOM user. One year's subscription £3.95, from BUG-BYTE, 98-100, The Albany, OLD HALL STREET, LIVERPOOL L3 9EG.

**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.

**UK101 8K** 16 rows only owners, a m.c. program adding extensive graphical commands to basic. Demonstration program illustrates the ease with which high speed graphics can be incorporated in programs. Mr. Lall, 22 Netley Dell, Letchworth, Herts. £4 incl. SAE for details.

**ZEAP 2.0 (RAM VERSION)** extension program. Allows object listings produced by ZEAP to be scrolled up and down, a must if no printer. Features: Restrict limits of stored lines; listing protect; assign RAM available to store listing; plus more. 300 Baud tape plus documentation, £3 to M.Hughes 57 Repton Dr. Haslington Near Crewe, Cheshire.

**SHARP PC1211** Unused. Suppliers guarantee to Jan 1983. £88. Cassette interface £12. includes postage. 042873 5793.

**NASCOM 2 32K RAM** PSU fully tested and cased. Graphics ROM and ZEAP ROM assembler. AY-3-8910 sound interface. Software including Space Invaders and Star Trek. Phone evenings WAT 48350 £575 o.n.o.

### 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

**SIXTY ZX81/80 PROGRAMS.** Specify which, listings only £4.95 Barclaycard accepted. Includes many games, Utility programs, Home Finance, Maths, Chequebook, plus more in our 'ZX81/80 Programs'. Includes Hints'N'Tips, from Sussex Software, Wallsend House, Pevensey Bay, Sussex.

**MICROTAN 65** + tanex + 10K basic PSU new style ASCII keyboard monitor + 7 programs tel. 042873 6224. Brand new worth over £309, £200 ono.

**ACORN ATOM** Quality high resolution graphic games (require 8K ROM + 12K RAM). Lunar Lander £5 (rotating ship, thruster flames, numeric speed & fuel indicators etc. etc.) Air Raid £4 (bomb buildings, but beware crashing into skyscrapers!) Games are written in machine code for fast action. From T.Hall, 319 John Nash Crescent, Manchester M15 5DT. Send SAE for further details.

**ATOM BREAKOUT** Exciting machine code game with advancing wall. Develop your play with 9 skill levels, 3 ball angles, 2 bat sizes, high score, sound effects. (4K RAM required). Cassette £3 inclusive. Cheque with order to:- C. Bulcock, 6 Hillcrest Road, Acton, London W3.

## ZX81 MINI INVADERS

1K RAM £4 for M/C code cassette.

ALSO ZX80/81 INVADERS (4K)

ZX80/81 GALAXY WARS (4K)

Continuous non-flicker display & fast moving graphics. S.A.E. for catalogue.  
J.EDMONDS. 29 Chestnut Ave., Grays, Essex.

### ZX81 16K

#### Brand new interactive graphics

DRAGON MAZE — An exciting game of skill	£5.95
PLANETOIDS — Blast through the asteroids	£3.95
LAP RECORD — Random circuit car racing	£3.95
SCROLL — Rolling large text display	£2.95

Introductory offer: £12.95 all four listings.

**Macronics, 26 Spiers Close,**  
**Knowle, Solihull, B93 9E5.**

**SHARP PC1211 POCKET COMPUTER,** MZ-80P3 Printer & MZ-80 I/O Unit. One off each only. All brand new & unused. Offers please to King Pin Computers, PO Box 40, Stevenage, Herts. Tel Stevenage 59677.

### RETRIEVER 2 for NASCOM

Cassette-based file storage system, ideal for indexes, references, addresses, or anything you want to remember. Stores 48-byte records with up to 8 user-definable fields. Features fast sorting (by any field), on-screen editing, retrieval of selected records by Keystring, with 'wild' bytes allowed. Reliable Read and Write routines plus selectable output to printer. With full documentation and demonstration file of Nascom magazine references. 4K M/C @ 1200 baud on high-quality tape; requires Nas-Sys. Price £9.95 from:

**A J Bentley,**  
7 Hastings Avenue, Upaven,  
Pewsey, Wilts SN9 6BP.  
(098 063) 619.

### ALGOR ZX-80/81 Programs on cassette

AL81/1 Missile launch, Maze battle, Sketcher, Mastermind

AL80/1 Missile launch, Maze battle, Sketcher, Mazer

AK81/1 Mines & Monsters, Stockmarket

AK80/1 Mines & Monsters, Stockmarket

Order cassettes by code, AL = 1K,80 for the ZX80 and 81 for ZX81. AK for 16K programs. All cassettes £3.20 including explanation.

**Listings only,** 60p for 1K or £1.80 for four. 16K listings £1.20

Also available \*1K listings for  
SOLITAIRE & HANGMAN.

Cqs or P/O to **ALGOR, DOVERCOURT,**  
**ST JAMES RD, NORTHAMPTON.**  
Tel (0604) 586462.

**MK14 ACCESSORIES.** SAE for price list. Redditch Electronics, 21 Ferney Hill Avenue, Redditch, Worcestershire B97 4RU.

### ZX81 1K PROGS

#### INVADERS

- \* 64 Manoeuvring alien spaceships
- \* Missile launcher auto repeat function
- \* Angled bombs that can hover or change direction.

#### REACT

- \* Destroy the missile bases
- \* Destroy the nuclear reactor before it's too late.

**BOTH** fast M/C programs on one cassette for £3.80.

M. Orwin, 26 Brownlow Rd.,  
Willesden, London NW10 9QL.

### ZX80 OR ZX81

"If, in any sense you are a beginner to programming or computing, this is **undoubtedly** the book to read. Full of insight, witty, sensible and extremely funny it eases you into programming practically from the word go." This review from PCW for

**MAKING THE MOST OF YOUR ZX80**  
by **TIM HARTNELL**

**£6.95 for over 60 programs**  
from Department CTC, COMPUTER PUBLICATIONS,  
UNIT 3, 33, WOODTHORPE ROAD, ASHFORD,  
MIDD.

## ZX81 ATOM!

The monthly magazine **INTERFACE** contains many programs, hints, tips, contact addresses for ZX81, ZX80, Acorn Atom and Proton. Send £1 for a copy of the latest issue, plus details of how to join the National ZX80 and ZX81 Users' Club or the Independent Acorn Atom/Proton Users' Group.

**Users' Clubs, Dept. CT,**  
**44-46 Earls Court Road,**  
**LONDON W8 6EJ.**



**BUSINESS & COMPUTER SERVICES**  
292, Caledonian Rd., London N1 1BA  
Tel: 01-607 0157  
(24 hour Answering Service)

**We are Micro-computer Consultants & Programmers and specialise in industrial & commercial programs written to clients' specifications.**

Cash Analyser £20.00  
Vehicle Cost Analyser £25.00  
Book Keeping (Min. 48K & 2 drives) £150.00

VAT & Post incl.

Please ask us for fuller details of the above. All are disk based for the TRS-80 Model I or III. Please state your DOS when ordering. Apple II versions soon.

BOOK OF TWENTY PROGRAMS FOR

**ZX81** ONLY £3.95.  
Magnificent value.

**SINCLAIR  
ZX80**

**SPECIAL OFFER**

**Moving Display Programs**

**INVASION £1.50 BREAKOUT £2**

BOOK OF TWENTY PROGRAMS FOR  
YOUR ZX80: ONLY £3.95.

from: G. Usherwood, 53 Marlborough Road,  
Stockton, Cleveland.

**QUALITY PET SOFTWARE** (Basic 2) on cassette. From the guy who wrote Super Basic and Apfel Basic published by Commodore. **SUPER SPACE INVADERS**. Over 180,000 game variations possible, sound, £6. Other games and utilities. Life, Boxes, Alien Attack, Air/Land War, Character Generator, Trace, Disc Merge and many more, £2.50 each or 4 for £5.00. Full list available. **POWER BASIC**. Adds 67 basic commands for graphics, CBM disks, formatting etc., — £20.00. **DISK MON**. Simplifies CBM disk usage by adding commands, £8.50. **EDIT 1000**. New editing environment for PET brings wordprocessing convenience to your programming, £8.50. These three programs for 32K/16K only. To order or for catalogue (send SAE) write to DS Software, 19 Reddings, Welwyn Garden City, Herts.

**ZX80 PROGRAM EXCHANGE**. S.a.e. for details. Nick Godwin, 4 Hurkur Crescent, Eyemouth, Berwickshire TD14 5AP. Tel: Eyemouth 50965.

**UK101 & SPRBD SOFTWARE (TAPES)**. 8K: Lunar Lander\*, X-Wing Fighters\*, Space Invaders\*, Chess Set (2 player, UK), Startrek, Zombies, Biorhythm (Printer advisable), Three Dimensional Mazes. 4K: Digiclock (large H/M/S)\*, Hangman. 16x48 and 25x25 displays only. **EXCELLENT GRAPHICS!** \* = real-time! 350p each from K. A. SPENCER, 74 DOVERS PARK, BATHFORD, NEAR BATH.

#### UK101 SOFTWARE

**ROAD RACER**: acceleration; running score, speed, laps; high score, bonuses; bollards. Eleven play modes, inc 1K m/c for speedy play. Sound Option! 8K. £4  
**BLACK BOX**: deduce the atom positions. Seven levels of play. Very popular. Only £3. 8K.

SAVE 28% — £5 both.

Ian Tresman. 18 Fir Tree Ct., Elstree, Herts.

**SHUGART SA400** minifloppy disc drives £95 Single sided. Can be used single/double density. Brand new, original boxes. Also 4K S-100 static RAM board with memory protect on 1K boundries £50 o.n.o. Twyford (0734) 342771 after 7pm.

**NASCOM SOFTWARE**: Cassette; 5.7K standard Z80 assembler £12, 2K position independent debug £9, 2K relocatable disassembler £11, Debug + disassembler in ROM £35, Hybrid basic 5.5K d/dos or cassette £4 (not sold separately). D/dos 8.5K assembler £18, 3K card index/catalogue £15. Details SAE Mr P. Watson, 101 Village Road, Bromham, Bedford.

**ZX81 FLICKER-FREE** games. 6 on cassette £3 (or SAE details). Bobker, 29 Chadderton Drive, Unsworth, Bury, Lancs.

**SHARP PC1211 POCKET COMPUTER** with cassette interface and all manuals. £75 o.n.o. Tel: 01-902 9030.

**MICROTAN 65** with Tanex, Xbug 5V/12V power supply etc. Offers Bognor Regis 827163 anytime or Portsmouth 737393 evenings.

**TANTEL ADAPTORS** £185 (post free) until 31st August. Also all Tangerine equipment at reduced prices. Send cheque or SAE for details. To Key Software, 85 Nottingham Rd, Nuthall, Nottingham 0602 272465.

**KEYBOARD FOR ZX81**. Full size keyboard kit for ZX80 and ZX81 £19.95. Keyboard connector £1.95. ZX80/81 connector £2.95. 24 line in/out port £14.50. Motherboard £10.44. P&P 40p under £10, 80p over £10. SAE for details. Redditch Electronics, 21 Ferney Hill Ave, Redditch, Worcs B97 4RU.

#### ZX80 OR ZX81

"If, in any sense you are a beginner to programming or computing, this is **undoubtedly** the book to read. Full of insight, witty, sensible and extremely funny it eases you into programming practically from the word go."

This review from PCW for

**MAKING THE MOST OF YOUR ZX80**  
by **TIM HARTNELL**

**£6.95 for over 60 programs**

from Department CTC  
COMPUTER PUBLICATIONS  
UNIT 3,  
33, WOODTHORPE ROAD,  
ASHFORD, MIDDX.

#### \* Z80 3K INTEGER BASIC

Very fast, will run on most Z80 systems. Supports:  
CLS Data Peek For  
Print Read Poke Next  
Input Restore Gosub Goto  
If Then And Or  
Let In(Port) Out(Port) Dim  
Tab Abs Rnd Size  
User Stop Rem List

Abbreviated commands and multiple statements per line are accepted Listing/Manual £10.75

\* **6800** Basics available, with Listing and User manual.  
3K INTEGER £9.65 4K F.POINT £14.50  
8K F.POINT £25.00

\* **6502** TINY ASSEMBLER 2K £7.95  
DISASSEMBLER 2K £7.95

Other 6800 Software available. Send 50p for catalogue. All prices inclusive. Strictly cash with order.

J. MORRISON/MICROS. 2, Glensdale St. Leeds LS9 9JJ. TEL. LEEDS (0532) 480987.

**ZX81**

**ZX80**

join

**ZX-GUARANTEED**

**ALL GAMES/PROGS GUARANTEED ERROR FREE.  
INCLUDES HINTS, TIPS, FREE ASSISTANCE ETC.  
MEMBERSHIP £5 PER YEAR (OR SAE DETAILS)  
PLEASE MAKE CHEQUES/P.O.s PAYABLE TO:  
ZX GUARANTEED**

**G.A. BOBKER (C.T)**

**29 Chadderton Drive, Unsworth, Bury, Lancs.  
061-766 5712.**

**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.

**ATTENTION USERS OF  
APPLE II, TRS80, V GENIE,  
ATARI, SORCERER**

Original games, adventures, business utilities and simulations galore. All from £5.00. Send 50p (refundable with first order over £10) and state type of Computer for full catalogue.

**ITS, 68 MOFFAT ROAD,  
THORNTON HEATH, SURREY  
CR4 8PU**

**CENTURION BURGLAR ALARM** equipment. Send SAE for free list or a cheque/P.O. for £5.95 for our special offer of a full sized decoy bell cover. To: Centurion, Dept. CT, 265 Wakefield Road, Huddersfield, West Yorkshire. Access and Barclaycard. Telephone orders 0484 35527.

**PROGRAMMER'S TOOLKIT** for UK101, OSI Superboard and C1 (all monitors), and C2 (CEGMON only). 2K of fast machine code on tape, giving 14 new commands including RENUMBER, DELETE, TRACE and OLD. Only £10 inclusive, or SAE for more details. State computer and memory size. S.A. Smith, 36 Woodvale Avenue, London SE25 4AE.



**ZX80/81. 'RECORD'** — a tape record system. Create and read data-tapes with 96 byte records. Ideal for addresses etc. Listing for all 1K machines — £3. 'Directory' — lists program-names as it reads a tape. Listing — 8K ROM — £2. ZX81 'REVERSI' (othello) — all machine code. A challenging game with on-board scoring. A pleasure to play and runs on 1K machines. Listing £3. All three programs — £5. Logan Software, 24 Nurses Lane, Skellingthorpe, Lincoln LN6 0TT.

**EPROM/MICRO SERVICE.** All types. Erasing — 45p each. Copying — £2 each. Programming — £5/1K. Assembly, test and repair computer kits and peripherals. M. Heberd, 3 Queens Crescent, Horndean, Hants PO8 9NB. Horndean (0705) 596243.

**COMPUTHINK 400K** disk drive (3032 PET) plus toolkit on disk £450 o.n.o. Trendcom 40 column thermal printer with PET interface £100 o.n.o. Tele. Coventry 598801.

**VIDEO GENIE** memory upgrade, 16K to 32K. Includes all parts and fitting instructions £30. R.C.W. Gate, 30 Penfold Road, Clacton, Essex.

**IBM 735 GOLFBALL** typewriter ex-computer terminal complete with magnets. Non-standard keyboard easily converted £150. BRPE 110 CH/S punch £50. Suffolk 0787 76785.

**CIE ENHANCED VIDEO** superboard. Metal cased. 610 expansion total 32K. 4800 1300 baud cassette. RS232 fitted. Direct entry graphics. Latest basic ROMs. 2MHz CEGMON. Willacy Exeter 74762.

**ZX81/16K PROGRAMS** Startrek, graphics, 4 levels, 8x8 galaxy, Klingons, etc. Games Pack 1 Starwars, Hammurabi, Graphic Lander, Mastermind, Minefield. Cassettes £4.95 each. SILVER SOFT 40 Empress Av., Ilford, Essex.

**GE TERMIPRINTER** RS232 serial interface suitable baud rates 110, 150, 300. U/L case correspondents typeface. Good condition. Ring 061-832 8575.

**MICROTAN OWNERS** — disassembled listings — your software on cassette (cassette returned) £2.00/K (Min £3.00). SAE for sample listing. A.G. Lorimer 9, Braehead Cres., Hardgate, Clydebank.

**2708 — 2716 PROGRAMMING** On your eprom. From listing £2.50 per k. Copy up to 2 k £2. On our eprom add £3. — 2708 £4. 2716. Erasing free with programming, with 60p. J. Attfield, 8 Highcliffe Rd., Benfleet, Essex.

#### SOUND THROUGH T.V. FOR UK101/MICROTAN/NASCOM/ ZX80/TUSCAN/SUPERBOARD II/ ETC.

Any system with a UHF video modulator will benefit from this add on kit. Replaces the loudspeaker on your sound-board to get sound direct through your T.V. monitor.

**Only £10 inc. P&P**

Send cheque/P.O. or SAE for further details to:

**F. WOODCOCK, 32 LANGLEY CLOSE,  
REDDITCH, WORCS B98 0ET.**

#### ATOM ADVENTURE

**The Shifting Tower** — An amazing new adventure from Faulksoft. Through swamp & forest in constant gloom you hunt the Shifting Tower. Uses upper/lower text for 9K program. Cassettes £7.20 each.

**Faulksoft,  
42b Labworth Road,  
Canvey Island, Essex.**

#### ZX80/1 EXPANSION

The start of an expansion system comprises:- System Power Supply (replaces all other supplies). 32K RAM. Expansion Circuitry £98.95 inc P&P etc.

Future add-on boards include:- Serial, Parallel & Analogue Input, Output. Joysticks, RS232, Sound Generator. Floppy Disc, Cassette Controller. Floppy Tape, High Resolution Graphics, etc.

**Modern Innovations  
5 Branchley Close  
Rochester, Kent.**

#### PET GAMES

Chemin-de-fer, the casino card game. Hazard Park (with sound) Needs 16K, Hunters, Bats, etc. On tape, £5 each, £7.50 the pair. Please state model.

**K. Hutchin,  
66 Newtown Road,  
Bishop's Stortford,  
Herts.**

#### ATOM WORD PROCESSOR

A flexible **Word Processor** for use on a 12K **Acorn Atom**. Offers many sophisticated features including:

A real-time scanning Editor,  
A global search and replace facility,  
Block & character insert/delete/replace,  
Extremely flexible Hard/Soft formatting,  
Justified or ragged right margin,  
Variable width left margin,  
Fully variable line length with word-wrap,  
Cassette storage of text,  
Automatic centralization of headings.  
Price £20.00 from:

**D.P. Saville 16 Zulla Road, Mapperley  
Park, Nottingham NG3 5DB**  
SAE for further details.

#### RUBIK CUBE UNSCRAMBLER

Displays step-by-step solution from any start condition. BASIC listing with full supporting documentation — £5. Including cassette for PET TRS80 or NASCOM — £8.00.

Wray, 32 Church Green, Totternhoe, Beds.

#### MZ80 SOFTWARE PROGRAMMES WANTED HANDSOME ROYALTIES PAID

Reply to: Box No: CT 206  
CT Classified, 145 Charing Cross Road,  
London WC2H 0EE.

**ZX80 AS NEW** fitted with 8K ROM and 16K RAM £100. Also 8K ROM without manual but with keyboard overlay £10. B. Myers, 2 Cypress Walk, Sale, Cheshire. Tel: 061 681 4122.

**PET 2001** 8K perfect condition. Little used £310. Tel 01-464 7925 anytime.

**NASCOM 2 COMPLETE** with 16K RAM, graphics ROM, power supply, Verocase & keyboard case £405 ono. Weybridge 53680 evenings.

**FUTURA SOFTWARE — SMASH HITS!!**  
**BEAM ME UP SCOTTY** — Can you beam aboard the Enterprise with the urgently needed lithium crystals £5.00, X-WING STAR BATTLE — Chase Darth Vader through the Cosmos £6.50. Both programs for NASCOM 2 with 16K Basic & Graphics. SAE for details of other programs. Send Cheque/P.O. to FUTURA SOFTWARE, 63, Lady Lane, Chelmsford, Essex CM2 0TQ.

#### ZX80/81

Highest Quality software, largely machine code assisted, from  
**CAMPBELL SYSTEMS**

	ZX80	ZX81	£
DISASSEMBLER	3K	3K	8
INVASION *	1K, 2K	—	6
BAGATELLE *	1K	1K	5
MAGIC CUBE	3K	5K	3.50

\* = fast moving graphics

**NEW:** Sophisticated Client File Database, menu-driven, dynamic file size, feature-packed, for serious ZX81 16K owners, £10.

Full documentation and cassettes mailed within a day or two.

CWO, or SAE for detailed catalogue, to:

**CAMPBELL SYSTEMS Dept CT,  
15 Rous Rd, Buckhurst Hill,  
Essex IG9 6BL.**

**GAMES PROGRAMS** for ZX81. Flyswat, Lunar Lander, Simon, Duckshoot, etc. 5 listings for £1.30, 10 for £2.40. Send SAE for catalogue. Cadsoft, 24 St. James Street, Cheltenham, Glos.

#### LB ELECTRONICS 11 HERCIES ROAD, HILLINGDON, MIDDX.

TMS 2516 (single rail) full spec. £4.25. 2708 (450ns) £1.85 full spec. Special offer 2114, 4-£6.00, 8-£11.00 (450ns). Used (fully guaranteed) 2716 £2.00 and 2732 £4.00. SN 74116 60p, SN 74118 70p, SN 74194 50p, SN 74198 75p, SN 74LS 240 £1.50, 74LS 245 £2.40, 74LS 266 75p, 745260 40p, 710 (DIL) 25p, 711 (DIL) 30p, 2102 (650ns) 48p, FND 500 0.5 inch LED Display (col) 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.  
**Portable Data Terminal** Transdata 305 thermal portable printer. Built in acoustic modem, 80 columns, 94 characters, upper and lower case. ASCII 100, 110, 300 baud V24 interface, supplied fully working £185. Weight 22lbs. Carriage at cost. Leaflet S.A.E. 4116 (200ns) £1.50 each. All prices inclusive of VAT p&p on all components 45p.

**Telephone Uxbridge 55399**  
Access or Barclaycard accepted.

#### Software for MZ80K £8.50 each

Treasure	Word Power
Space Adventure	History
Impossible Maze	Geography
Cowboy Round Up	Memory Test
MZ80 Composer	Mult Tables
Grand Prix	French
One Man One Dog	German
Kaleido	Spanish
Spies	Welsh
The Pit	Math Test
Road Race	Maths Drill
Alligator	Master Mind

#### MORRISTON COMPUTER CENTRE

46 CROWN STREET,  
MORRISTON,  
SWANSEA. Tel. 795817.

**GREEN SCREENS** 11" x 9" TRS80 £4.95. Other sizes up to 12" x 12" £5.95. State size required. Price includes fixers, postage and packing. P.A. Young, 40 Willow Park, Wilberfoss, York.

#### SHARP POCKET COMPUTERS

CE122 Printer/Cassette Interface £74.95

PC1211 Pocket Computer £91.95

CE121 Cassette Interface £14.95

FREE Papermate pen with all orders.

All prices include (15%) VAT and UK delivery  
**ELKAN ELECTRONICS, 28 BURY NEW RD,  
PRESTWICH, MANCHESTER M25 8LD.**





## NORTH CHESHIRE COLLEGE

Turn your interest into a worthwhile career  
A new degree:

### COMPUTERS AND INDUSTRIAL SOCIETY

Starting late September 1981 for ARTS AND  
SCIENCE students alike, opening up careers  
in teaching and the professions. If you have  
TWO 'A' levels or equivalent WRITE  
WITHOUT DELAY for details and an  
application form to:

**ADMISSIONS: (CIS) CODE (CT)**  
**NORTH CHESHIRE COLLEGE,**  
**PADGATE CAMPUS,**  
**FEARNHEAD,**  
**WARRINGTON.**

### SERVICES

**DYSAN  
& MEMOREX**

WE STOCK  
THE BEST IN FLOPPIES,  
CARTRIDGES, W.P. SUPPLIES &  
STORAGE, BACKED UP WITH  
NATIONWIDE SERVICE ...  
CALL US ON 0934 416392  
ASK FOR DEPARTMENT C

**DRG**

**BUSINESS  
MACHINES**

THE FINEST WORLDWIDE  
SUPPORTED NATIONWIDE

**ABC 50th**

*1931-81 Anniversary*

### A fair deal for our advertisers

No guesses, no wishful thinking — our Circulation figures are independently audited to the strict standards required by the Audit Bureau of Circulations.

**ABC Jan June 1981 33 266**

We're proud of our membership of ABC — especially in this its Golden Jubilee Year.

### BACKUP DISK DUPLICATOR APPLE VERSION

This program can be used to backup your more valuable DOS 3.2, DOS 3.3, Pascal, APPLE III SOS, CP/M, & etc. 13/16 sector disks and so prevent any mishaps.

BACKUP DISK DUPLICATOR requires a 48K APPLE with 1 or 2 disk drives, and will boot directly with 13 or 16 sector prompts.

**£34.00 each incl. P&P**  
**BCM SOFTWARE — LONDON WC1N 3XX**  
**Dealerships Available**

### ATOM USERS

Memory expansion cards now available.  
From £48

Low cost printout system for Creed teleprinters. £36.50.

"Flat Rack" a reasonably priced case and backplane system for the Atom.  
SAE for full details please.

**Poundgate E.D.S.**  
**Beguildy, Knighton, Powys**  
**LD7 1UW**

### DISC DRIVES £135

5¼ inch double-density, 40-track disk drive giving you 250K bytes of unformatted storage. Shugart compatible. Removed from brand new equipment, fully tested and aligned. Three months' warranty. £135 each, post and packing £3. Manual and application notes included.

The above drives now available with power supply and cabinet. Please write or phone for prices.

### DISKETTES £2.95

Maxell 5¼ inch double density floppy disks. Compatible with all 35 and 40 track, single-sided, soft-sectored drives. £2.95 each, post and packing 30p. £28 for box of ten, p&p 80p.

### DOUBLE-SIDED DISKETTES £3.50

Maxell double-sided, double-density disks. £3.50 each, post and packing 30p. £33 for box of ten, p&p 80p.

Please add VAT to all prices.  
Send cheque or P.O. to:

**Helistar Systems Ltd.,**  
**150 Weston Road, Aston Clinton,**  
**Aylesbury, Bucks. HP22 5EP**  
**Tel: Aylesbury (0296) 630364.**

### ZX80 AND ZX81 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 'Datamanip' — 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.

**Zipprint, 418, Poole Rd, Parkstone, Poole,**  
**Dorset, BH12 1DF.**

Nascom (kits or built) accessories software. Thandar/Sinclair scopes multimeters. Tangerine computers, components.

**Ring Paul on (0487) 840710**  
**for this month's discount offer.**

**JPS** **9, East St., Colne,**  
**nr. Huntingdon, Cambs**

### PET UPGRADE

We can upgrade your large keyboard PET at a fraction of the "New Price" difference.

8K to 16K ..... £44.00  
16K to 32K ..... from £56.00  
8K to 32K ..... £69.00

If expansion area drilled with quarter inch holes ..... £10.00 extra

All new RAMs fitted sockets.

Fast, 2 hour while-you-wait service.

**Tel: Mick Bignell 01-953 8385.**

**FOR SALE** Poseidon 10 system as new comprising: LSI 11/03 system 64 Kbytes. 2 x DLV 11, 1 x LPV, 2 x ADM3A VDU, 1 x LS200 printer, 1 x 10 Megabyte Pertec D300 drive, 1 x Disc controller. Offers. Tel D. Mullett, Grays Thurrock (0375) 77402.

**ZX81 GAMES.** Six super games on cassette, £3.00. (Plus additional free game and other info.) Or SAE list/details. Bobker, 29 Chaderton Drive, Unsworth, Bury, Lancs.

**KEYBOARDS.** Brand new 79 switch encoded K/B with data for £20 incl. Also S 100 sockets, gold W/W £2 incl. We buy/sell second user gear. Newhaven Computers, 1, Bridge St., Newhaven. Tel: 3699.

**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.



# COMPUTAMART

**FOR SERVICE AND  
CONVENIENCE USE  
YOUR LOCAL SHOP  
LISTED BELOW**

**COMPUTING  
TODAY  
PRESENTS YOUR  
WHERE TO BUY  
GUIDE**

**RING  
JENNY NARAIN  
ON 01-437 1002  
TO BE INCLUDED**

## LANCASHIRE

**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.

## SURREY

**AERCO GEMSOFT**  
Aerco Corner, 171 Church Street,  
East Woking, Surrey.  
Tel: 0273 698424  
Open: 9.00am.

## WEST MIDLANDS

**MACRONICS (ZX80/81 Software)**  
26, Spiers Close, Knowle,  
Solihull B93 9ES  
Mail order only.

## MIDDLESEX

**L.B. ELECTRONICS**  
11 Hercies Road, Hillingdon,  
Middx. UB10 9LS.  
Tel: Uxbridge 55399  
Open: 9.30am-6.00pm Mon, Tues,  
Thurs, Fri. 24hr answerphone Sat.

## SUSSEX

**GAMER**  
18 Sydney Street, Brighton,  
E.Sussex.  
Tel: 0273 798424  
Open: Mon-Fri 10.00am-5.30pm.  
Sat. 9.00am-5.30pm.

**COMPUTAMART  
FOR THE BEST  
RESULTS**

## 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.

### AD INDEX

ACORN COMPUTERS LTD.	19 & 38
ACADEMIC PRESS	7
ADDA COMPUTERS	4
ANGLIA COMPUTER CENTRE	37
BITS & P.C.s	19
BRIGHTON COMPUTER CENTRE	29
T.J. BRINE	48
BUG BYTE	37 & 70
BUTTERWORTHS	81
CAMBRIDGE LEARNING	61
CATRONICS	48
CHROMASONICS	71
COMART	72
COMMODORE SYSTEMS	6 & 7
COMPUTECH SYSTEMS	64
COMPUTER PUBLICATIONS	48
COMP SHOP	98
CONTROL TECHNOLOGY	65
D.A.I.	51
DATA RITE	37
DK TRONICS	65
ELECTROCOMP SUPPLIES	91
FLETCHER WORTHINGTON	91
HAPPY MEMORIES	68
A.J. HARDING	14
HENRYS RADIO	15
I.C.S.	68
KRAM ELECTRONICS	58
LIVEPART DATA PRODUCTS	58
LOWE ELECTRONICS	99
MARICK	26
MAWSON ASSOCIATES	65
M.D.R. INTERFACES	38
MICROCOMPUTER APPLICATION	68
MICRODIGITAL	29
MICRO PERIPHERALS	50
MICROPRINT	26
MICRO VALUE	30 & 31
MIDWICH COMPUTER	26
M & M SOFTWARE	65
NEWBEAR	70 & 100
O.K. MACHINE TOOLS	29
P.C.W.	80
PEARCOM LTD.	36
PROGRAM POWER	16
Q TEK	65
SAPPHIRE SOFTWARE	62
SCIENCE OF CAMBRIDGE	42, 43 & 49
SHARP ELECTRONICS	11
SILICA SHOP	25
SUPERSOFT	34
TANGERINE	2 & 76
TECHNOMATIC	20
TEMPUS	62
TEX MICROSYSTEMS	24
TIMEDATA	24
THIS COULD BE FUN	38
VIC	56 & 57
WARD ELECTRONICS	62



**NOW IN STOCK**

## THE NEW & EXCITING TRS80 MODEL III

EXTENDED GUARANTEE BY COMPUKARE

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

**STOCKTAKE SALE**  
NEVER TO BE REPEATED AT THIS PRICE

★ 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

KIT ONLY £99.95 + VAT

Fully Assembled — £149 + VAT

DEALER ENQUIRIES INVITED

**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 Screen Editor Tape £1.90

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

## WE ARE NOW STOCKING THE APPLE II AT REDUCED PRICES

AUTOSTART EURO PLUS

48K

£599 + 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.

## 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

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

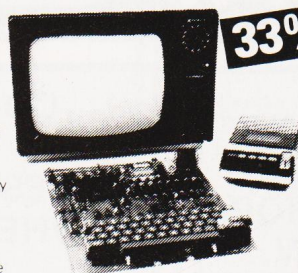
The Video Genie is a complete computer system, requiring only connection to a domestic 625 line TV set to be fully operational; or if required a video monitor can be connected to provide the best quality display. 51 key typewriter style keyboard, which features a 10 key rollover. Supplied with the following 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.

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER

# COMPUKIT UK101

**33% DISCOUNT**  
UNTIL STOCKS LAST

COMPUKIT WITH ALL THE FEATURES THAT MADE IT THE MOST PROFESSIONAL COMPUTER KIT ON THE MARKET. Now WITH FREE MONITOR (a saving), which includes Flashing Cursor, Screen Editing, & Save Data on Tape.



4K Upgrade Kit £15.90 + VAT

EXTENDED GUARANTEE BY COMPUKARE

NEW

## CENTRONICS 737 DOT MATRIX PRINTER

only £369 + VAT including cables

Standard Features  
• 80 CPS Proportional Spacing  
• 50 CPS

Monospaced Mode • Proportional Spacing Plus 10 CP1 and 16 7 CP1 • N x 9 (Proportional) or 7 x 8 (Monospaced) Dot Matrix • 7 x 8 Dot Matrix • 3 Way Paper Handling System • 96 Character ASCII plus 6 European character sets • Microprocessor Electronics • Expanded Print • Right Margin Justification • Print Underlining • 9 Wire Free Flight Print Head • Bidirectional Stepper Motor Paper Drive • Full One Line Buffer • 21 LPM With 80 Columns Printed • 58 LPM With 20 Columns Printed • 6 Lines Per inch Vertical Spacing • Paper Tear Bar • Centronic Colours and Logo

EXTENDED GUARANTEE BY COMPUKARE

SHARP PC1211

£79.90 + VAT

COMPUTER POWER THAT

ONCE FILLED A ROOM

CAN NOW BE CARRIED IN YOUR POCKET!

- Programs in BASIC • "QWERTY" Alphabetic Keyboard • 1.9K Random Access Memory
- Long Battery Life.

## 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.

**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).



"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:

CREDIT FACILITIES ARRANGED — send S.A.E. for application form.

14 Station Road, New Barnet, Hertfordshire, EN5 1QW (Close to New Barnet BR Station — Moorgate Line). Telephone: 01-441 2922 (Sales) 01-449 6596 Telex: 298755 TELCOM G

OPEN (BARNET) — 10am - 7pm — Monday to Saturday

## NEW WEST END SHOWROOM:

311 Edgware Road, London W2. Telephone: 01-262 0387

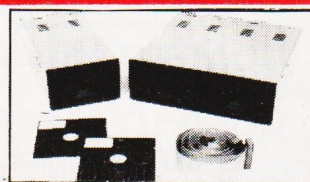
OPEN (LONDON) — 10am - 6pm — Monday to Saturday

★ IRELAND: 19 Herbert Street, Dublin 2. Telephone: Dublin 604155

★ COMP SHOP USA, 1348 East Edinger, Santa Ana, California. Zip Code 92705 Telephone: 0101 714 5472526

## TEAC DISK DRIVES

EXTENDED GUARANTEE BY COMPUKARE



- TEAC FD-50A has 40 tracks giving 125K Bytes unformatted single density capacity.
- The FD-50A can be used in double density recording mode.
- The FD-50A is Shugart SA400 interface compatible.
- Directly compatible with Tandy TRS80 expansion interface.
- Also interfaces with Video Genie, SWTP, TRS80, North Star Horizon, Superbrain, Nascom, etc., etc.
- Address selection for Daisy chaining up to 4 Disks
- Disks plus power supply housed in an attractive grey case.

40 TRACK Single Disk Drive £225 - VAT Double Disk Drive £389 - VAT

77 TRACK Single Disk Drive £299 - VAT Double Disk Drive £499 - VAT

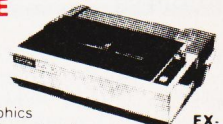
**SPECIAL SCOOP** GET YOURSELF A NEW MX70 PRINTER AND SAVE A FORTUNE

only £249 + VAT

Interface Cards for Apple

- 80 Column; • Upper & lower case • Apple dot Graphics
- Centronics Parallel • Uni-dimensional

TX80 — £229 + VAT MX80 — £299 + VAT



EX-STOCK





# VERSATILITY IS THE KEY

All microcomputers are versatile — some, however, are more versatile and expandable than others. The Video Genie System is now available complete with a range of expansion units to give a full 48K RAM, quad disk, business system with printer. Even this is further expandable via the two slot S100 bus contained in the expansion box.

Software is the most important component of any computer system — the Video Genie used the renowned Microsoft level II BASIC interpreter, so TRS-80 software will run on the Video Genie to further enhance its versatility, with a huge program library available.

Lowe Electronics are further enhancing the versatility of the Genie system: we have designed lower case adaptor, sound kit and now colour systems. This will be available from April and is shown in action below. The Video Genie range starts at a recommended retail price of just £325 plus VAT.

Contact Lowe Electronics for full details and a dealer list.



## LOWE ELECTRONICS

CHESTERFIELD ROAD, MATLOCK, DERBYSHIRE. TEL: MATLOCK 4995.





A

name \_\_\_\_\_  
 interest \_\_\_\_\_  
 address \_\_\_\_\_

# NewBear

Computing Store Ltd



**For the Best Deal from the  
 largest Sharp Dealer  
 Phone Newbear (0635) 30505**

North Star Horizon (Full field service available)

**SHARP**

S100 Bus  
 Cromemco Boards  
 Morrow/Thinker Toys  
 Comart Boards.

Exorciser  
 Compatible Boards.

Spectronics  
 U.V. Eprom Erasers

O.K. Tools  
 Wire Wrap Centre

Jimpak  
 Components

Disk Drives  
 Dri/Shugart/Tandon

Media  
 B.A.S.F. Discs  
 Acorn/Sym1/77-68  
 Keyboards.

I.C.S.  
 Z.80 6502, 6800  
 Memories, 74LS, etc.

Books  
 Widest range available

Apple II plus   
 For exstock Delivery  
 12 months warranty and  
 Bear Care  
 Bear Bargains

Many unique  
 Products,  
 Zen/Listings/  
 Word proc.

**SHARP**

**mz-80K**

**Better Prices!** for Sharp  
**Better Delivery!** for Sharp  
**Better Service!** for Sharp  
**Widest range of  
 Software!** for Sharp

For further information, phone call  
 at our showroom or cut off coupon  
 at the top of the page and send  
 to:-

Newbear Computing Store Ltd  
 (head office) 40 Bartholomew St  
 Newbury, Berks. Tel: (0635) 30505

First Floor Offices, Tivoli Centre, Coventry Road, Birmingham. Tel: (021) 707 7170  
 220-222 Stockport road, Chadda Heath, Stockport. Manchester Tel: (061) 4912290