# Personal Computer World




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January 1982 75p

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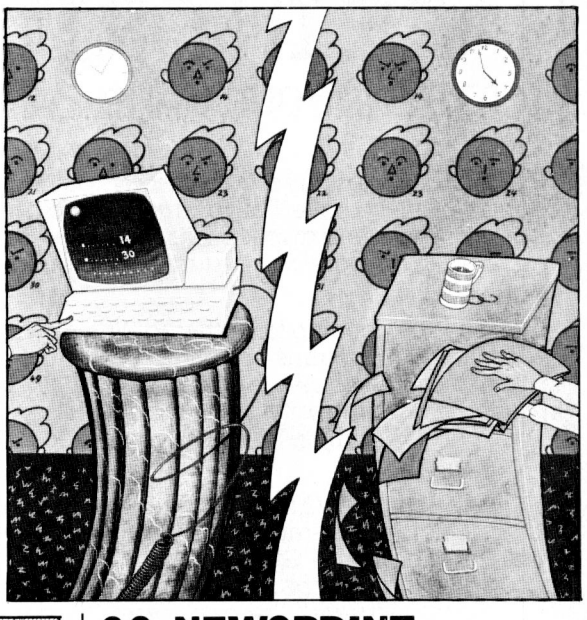
# INSIDE PCW

Volume 5 No 1 January 1982

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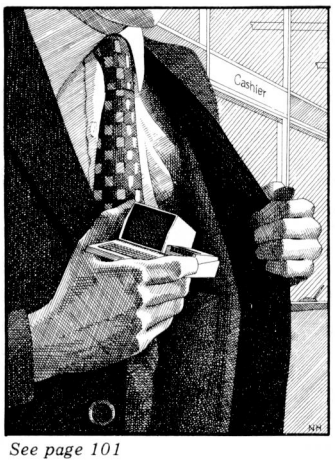


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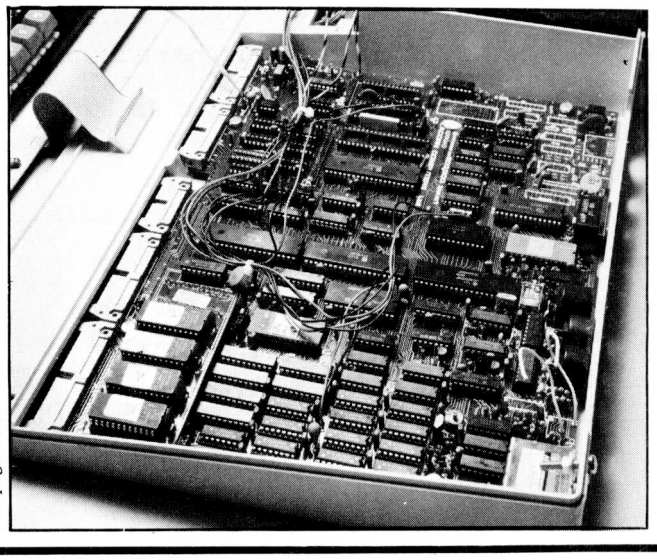

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Find out what happens to that line of Basic after you hit return; you can speed up your programs if you do.

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A closer look into the Explor graphics language, plus software hints for the DAI.

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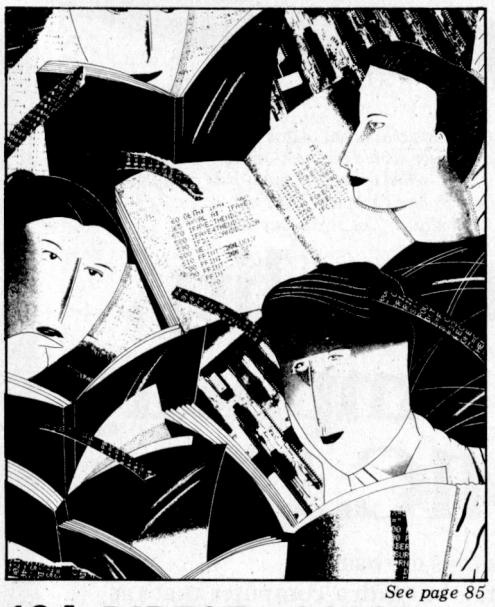
You have probably always wanted to compute pi to 600 decimal places on your personal computer. Even if you haven't, we'll still tell you how.

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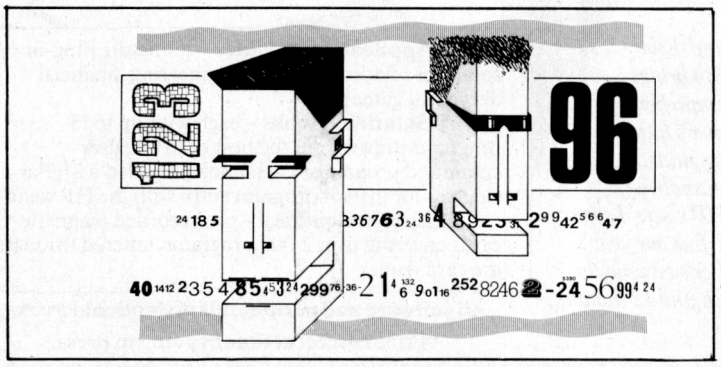

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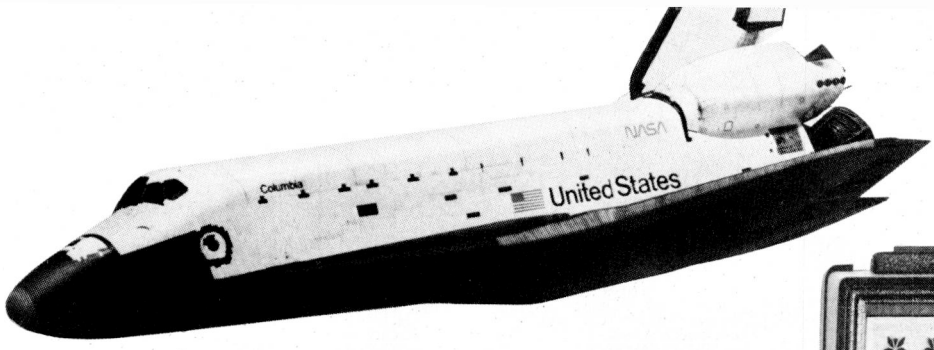



*On the edge of the atmosphere, space shuttle Columbia was about to lose all contact with Earth: for 21 agonising minutes, touch-down would be touch-and-go.*
*As the world held its breath, the £4½ billion project relied on a £165 hand-held calculator, small enough to live in the pocket of Robert Crippen's flight suit.*
*The Hewlett-Packard HP-41C. Unmodified. Just as you buy it today...*

# Astronaut quality. Everyday simplicity. The HP-41C. £184 inc VAT*

Sooner or later, a basic calculator is too basic.

Suddenly you need to 'compute' – but with a 'computer' that's as simple and pocketable as a hand-held calculator. And, as NASA found, that means an HP-41C.

Today, a broad-ranging companion to an A-level course. Tomorrow, a fully-fledged, advanced programmable system for the businessman, analyst, researcher, technician, engineer or scientist.

Whatever your job, here's a calculator that will grow with you and your needs step-by-step into a complete calculating system – yet will always stay simple, manageable and portable.

## The friendly calculator with power in reserve.

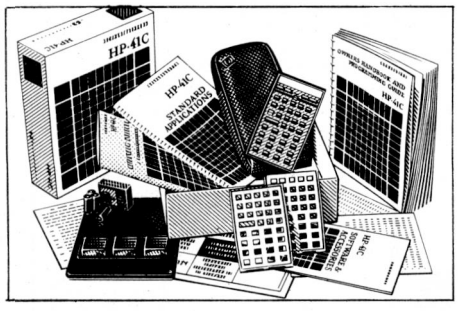
As a straightforward calculator, the HP-41C is a masterpiece of compact power.

It gives you read-out in letters, as well as figures and symbols, so the display can talk to you in an easy, simple way.

Yet, inside, it has the effortless, problem-solving power normally associated with computers.

Among other things, that means the HP-41C is fully programmable. You can feed its built-in 400-line memory with ready-made programs or develop your own. Its friendly style makes it surprisingly easy. And, because the memory is continuous, what you put into it stays in – even when you switch off.

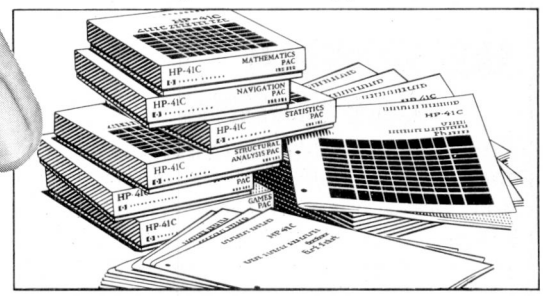
But that's not the end of the story by any means. Because, unlike any other advanced programmable calculator you are likely to see, the HP-41C has behind it a highly developed package of software support representing many years of heavy investment by Hewlett-Packard. So when you buy the HP-41C you don't just *own* a powerful system; you can put it powerfully to *work*.




*The HP-41C hand-held 'computer' in a box. £184 brings you the calculator, a comprehensive 270-page manual, owner's handbook, and programming guide, a standard applications handbook, customising overlays. HP Users' Library membership reply card, free one year's subscription to HP's User's Newsletter, batteries, carrying pouch and 12 months' full guarantee.*

## Proven software support – at your fingertips.

Here, the HP-41C really comes into its own with an unrivalled range of software support.




**17 Application Modules** – miniature plug-in solutions: maths, electrical engineering, financial decisions, games...

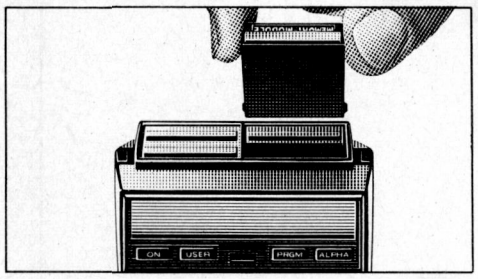
**29 Solutions Books** – each with up to 15 programs drawn from the best of 10,000 user-submitted programs. Each book provided with Bar Codes – for instant program entry with the HP wand.

**11 Application Pacs** – pre-recorded magnetic cards covering over 2,000 programs, entered through the card reader.

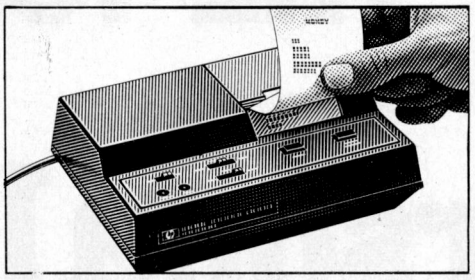
**All software and peripherals are optional extras.**

***Price correct at time of going to press.**

# Two ways to make your system grow...

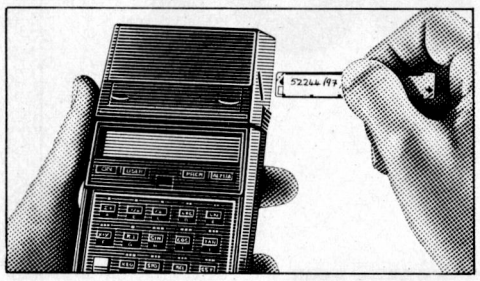


***Snap-in more memory.*** *A single module will double the memory available. A quad module adds no fewer than 256 registers at once. Suddenly you've over 1800 lines of memory at your command.*

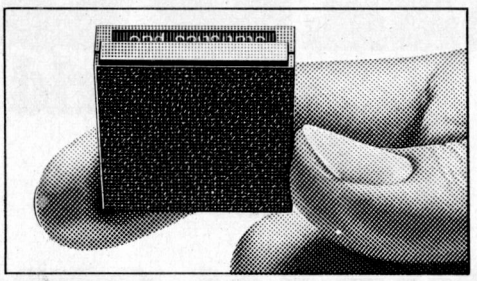


***Plug-in a printer.*** *The HP-41C printer handles upper and lower case, in alpha, numeric and graph-plotting modes. Use it for final hard copy, or to follow program execution.*

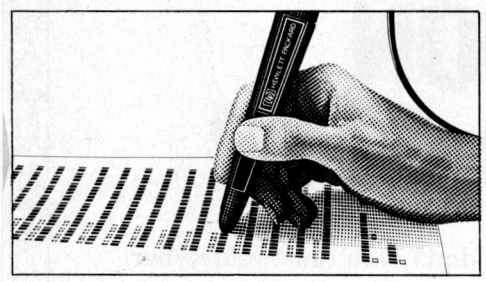
# Four ways to program your HP-41C...



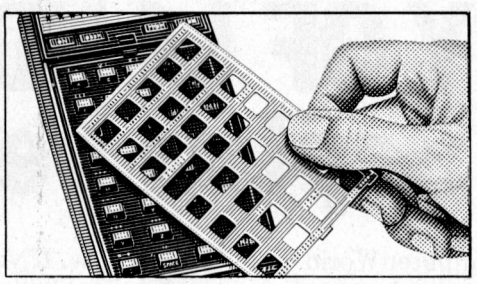
***Card reader.*** *This reads pre-programmed magnetic cards. It can also record and read your own programs and data.*



***Application modules.*** *These are plug-in modules each containing a whole range of ready-made programs on your chosen subject.*



***Bar code reader.*** *A quick and easy way of loading any one of the software packages. The wand simply 'lifts' the coded program straight off the page of your HP-41C solution books.*



***Keyboard customising.*** *Develop your own programs and enter them through the keyboard. You can assign any function or program to any key and mark them on your own customising overlay.*

## Thousands of easy ways to solve problems.

Think of a problem! As an HP-41C owner you won't have far to look for the solution – or long to wait before it's locked in your system's memory. Any of HP's hundreds of pre-programmed solutions can be easily entered in any of the four ways we illustrate above. You'll certainly want to devise your own solutions, too. The guidance manual in your basic pack tells you how. If you develop an original one you could submit it to the HP-41C Users' Library. It already contains thousands of tested programs which 10,000 users world-wide are happy for you to share.

## Quality from HP – the big computer manufacturer.

The HP-41C is made from the chip upwards by Hewlett-Packard, a world leader in computers. And you can tell! By the detail like the permanent inlaid key notations, tough ABS case, and gold-plated port contacts. By the elegant simplicity designed into the HP-41C's operating style. By the sort of software support only a computer giant would be capable of. By the utter reliability that is the HP hallmark throughout the world of computers.

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## The 5th Personal Computer World Show

## BARBICAN CENTRE CITY OF LONDON 9–12 September 1982

If you came to the 4th Personal Computer World Show this year you'll know exactly what we mean.

If you didn't, then you missed the spectacle of over 16,000 people cramming themselves into two halls filled with the most up-to-date hardware, software and peripherals going.

But we won't be caught again. For 1982 we are moving to the Barbican Centre in the City of London – *the* new exhibition venue with everything going for it. Excellent location, superb facilities, and lots of room for more exhibitors and more visitors.

Just like this year there will be one floor devoted to business and professional microcomputing and one devoted to home and hobbyist applications. But overall there will be almost twice as much exhibition space. And we're opening for four days instead of three.

Judging by the level of advance reservations from the 1981 Show, space is still going to be in short supply. So phone or return the coupon to Timothy Collins now. If you don't, you can be sure your competitors will.

Tim Collins Montbuild Ltd, 11 Manchester Square London W1 01-486 1951

Please rush me details of exhibiting at the 5th Personal Computer World Show

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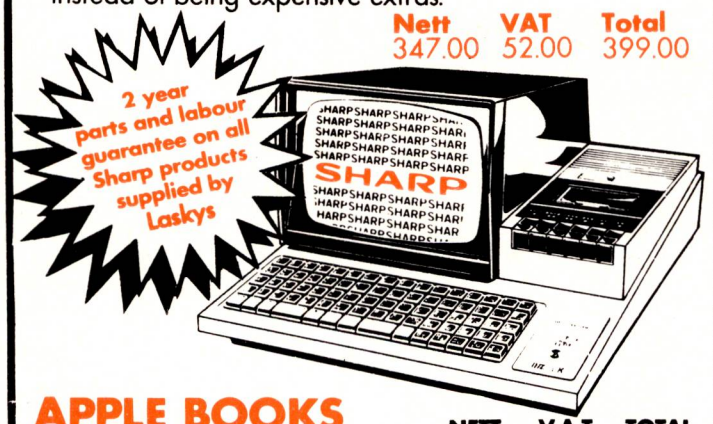


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| Mini Floppy DS/DD x 50 | 150.00 | 22.50 | 172.50 |
| Mini Floppy DS/DD x 100 | 275.00 | 41.25 | 316.25 |
| ● 4116, 200 N.S. | .66 | .10 | .76 |
| ● 2114, 300 N.S. | 1.30 | .20 | 1.50 |
| TI Programmer Calc | 45.00 | 6.75 | 51.75 |
| Paper 8½" x 11" 2000 Sheets | 12.00 | 1.80 | 13.80 |
| Paper 9½" x 11" 2000 sheets | 12.00 | 1.80 | 13.80 |
| Paper Delivery | 3.00 | .45 | 3.45 |

Laskys, the retail division of the Ladbroke Group of Companies

# Terms & Conditions

Laskys is the largest specialist Hi-Fi chain in Europe, in July 1980 they acquired Microdigital – an independent, specialist microcomputer store based in Liverpool. Since then specialist microcomputer departments have been set up within selected Laskys stores under the Microdigital name, these have now been renamed Microcomputers at Laskys.

**Our Conditions of Business**
In addition to cash we accept Access, Barclaycard, Stereo Club, American Express, Diners Club and cheques covered by a bankers card.
Official orders over £50 are welcome, with normal 30 days credit extended to bona-fide commercial and government organisations. All prices, specifications and terms are subject to change without notice at the discretion of the management. Offers subject to availability.
All previous Microdigital Advertisements are superseded by this. Not all stores carry every advertised item. Prices correct at time of going to press. E. & O.E.

**Computer Retailers Association**
We are founder members of the Computer Retailers Association, a voluntary organisation of leading micro-computer dealers and service organisations.
The purpose of the Association is to maintain and improve standards of trading and customer support within the industry and to present the industry's case to the outside world. The Association also acts as a forum where members can discuss common problems.

**A Better Guarantee**
The products are warranted against defects in material and workmanship for a period of one year from the date of purchase, two years for Apple and Sharp products.
During the warranty period, the company will repair (or at its own option, replace) at no charge, components that prove defective. This is provided the product is returned, shipping prepaid, or by person, stating when it was bought and enclosing proof of purchase.
This warranty does not apply if, in the opinion of the company, the product has been damaged by accident, misuse or misapplication.

**Laskys Stereoclub**
– the handy way to buy, from Laskys. Multiply your monthly payment to 24 to find out your credit limit. For instance, for the minimum monthly payment of £5 you would get credit up to £120. In some cases you may be able to get instant credit by paying a deposit of 10% of a purchase price. Current Stereoclub interest rate is 2.75% monthly equivalent to an APR of **38.5%** Rates may vary.
If you pay by Bankers' Order, apart from the extra convenience, you'll enjoy a LOWER INTEREST RATE – currently 2.45% monthly, equivalent to an APR of **33.7%.**
As a Stereoclub member we'll send you regular news and literature from Laskys. Laskys Stereoclub is probably the best thing that's happened to Microcomputers since the invention of the chip!

**Mail Order**
If you are unable to get to a Laskys shop then you can buy your requirements from our Mail Order Department at:
**MICROCOMPUTERS AT LASKYS MAIL ORDER DEPT. FREEPOST (No stamp required) LIVERPOOL L2 2AB**
The Conditions of Business are the same as the shops except:
1. Allow one week for personal cheques to clear.
2. Add £1 p&p to orders under £10.
3. Carriage free on orders over £10 within Mainland U.K. Overseas add 15%.

**Telephone Orders**
Just give your credit card number and requirements on our 24 hour 7 day Ansaphone Service: 051-236 0707. Mail Order Manageress – Lyn Major.

**Head Office**
Accounts, administration and engineering are at:
Microcomputers at Laskys, 14 Castle Street, Liverpool L2 0TA. Telephone 051-227 2535.
General Manager: Bruce Everiss, Operations Manager: Graham Jones.

# Mail Order Form

**Mail Orders to: MICROCOMPUTERS AT LASKYS MAIL ORDER DEPT. FREEPOST LIVERPOOL L2 2AB**

| Office Use only | Goods required | Price | |
|---|---|---|---|
| | 1 | | |
| | 2 | | |
| | 3 | | |
| | 4 | | |
| | 5 | | |
| | 6 | | |

VAT in this ad has been calculated at the rate of 15% current at the time of writing. Please allow for any changes.

Add £1 P & P to orders under £10

**Total**

If you require a Stereo Club application form tick this box ☐

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Barclaycard: 4929 ☐☐☐ ☐☐☐ ☐☐☐

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PCW/1/82

MICROCOMPUTERS AT LASKYS

ADD REAL POWER AND VERSATILITY TO YOUR

# ZX81

Announcing two new peripherals for both professional and personal use.

**INPUT-OUTPUT PORT:**

16 digital outputs, 8 digital inputs, 6 peripheral selects, 24-line programmable input-output port which plugs directly into your ZX81. This makes available the following applications. . . and many more!

e.g. Switching operations – relays, cassette recorder, model railway control, light sequencing, solid state buzzers, LEDs, 7 segment displays, domestic appliances etc.

Sound output – plug into your hi-fi for variable frequency sound.

Input operations – joysticks, switch closure, light presence etc.

FEATURING

Stackable connector allowing further peripherals to be added, e.g. 16K RAM pack and printer.

Unique experimenter area giving space for relays, I.C's etc.

On-board test LED and buffer.

Simple expansion to ADCs, DACs, etc, using peripheral selects.

Simple to operate using PEEK and POKE statements, ready built and tested. . .

**ONLY £22.50** inclusive of applications – programming manual and money back guarantee if not satisfied.

Add £1 post and packing.

**8 CHANNEL ANALOGUE TO DIGITAL CONVERTER, 8 LINE DIGITAL OUTPUT AND 5 LINE PERIPHERAL SELECT PORT**

This will measure up to 8 input voltages to an accuracy of 0.39% (8 bit), enabling the monitoring of e.g. light intensity, temperature, sound level, voltage level, position, moisture, strain, gas; in fact almost any transducer output may be readily interfaced to your ZX81 with this unit.

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The list is quite endless, limited only by the user's ingenuity!

FEATURING

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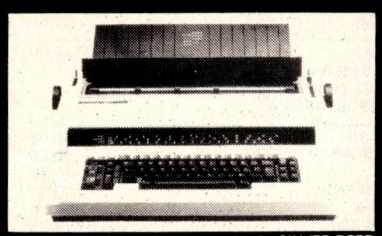
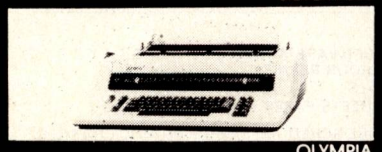


SILVER REED



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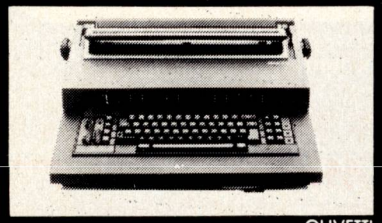

OLIVETTI

If you have one of these, your local typewriter/computer dealer can arrange for the upgrade.
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Worcestershire
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Address _____

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# (BUSINESS EFFICIENCY)

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INCLUDES INVENTORY, DATABASE MANAGEMENT, INVOICING, MAILING ADDRESSES, STATEMENTS, SALES/PURCHASE LEDGER WITH OR WITHOUT AUTO STOCK UPDATE AND DOUBLE ENTRY JOURNALS INCLUDING NOMINAL LEDGER; PLUS A/C RECEIVABLE AND PAYABLE MAKING AUTO BANK ENTRIES.

| | |
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| 02=STOCK CONTROL | 14=TAX REPORTS |
| 03=OPEN SALES LEDGER | 15=AGED ANALYSIS |
| 04=OPEN PURCHASE LEDGER | 16=MANAGEMENT ANALYSIS |
| 05=GENERAL SALES LEDGER | 17=CASHFLOW FORECAST |
| 06=GENERAL PURCHASE LEDGER | 18=PARAMETER SECTION |
| 07=BANK UPDATE | 19=DIARY REMINDER |
| 08=USER DATABASE AREA | 20=COMPUTE FUNCTIONS (+) |
| 09=INVOICE CREATION | 21=FILE MAINTENANCE |
| 10=ORDER FILES | 22=CALL OTHER PROGRAMS |
| 11=TEXT FILES | 23=AUTOMATIC DRIVE (+) |
| 12=EMPLOYEE FILES | 24=DISK SWAP/EXIT SYSTEM |

WHICH OPTION ... (LEVEL 8.00 at 975.00)
(LEVEL 9.00 at 1075.00)

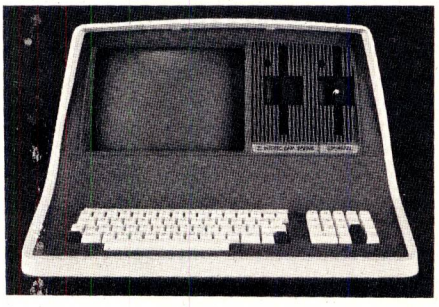
SUB-MENU EXAMPLES:
> Quit or .Random or .Sequential or .Key sorted field or .Other functions
> Quit or .All or .Part or .Specific
> Quit or .Fast screen or .Slow screen or .Rapid print or .Pausing print
> Quit or .Continue or .Amend or .Delete or .Print
> Quit or .Double entry or .Alter filename or .Echo input or .Print options
> Quit or .Mail ticket or .Columnated or .Raw data line
> Quit or .Add or .Subtract or .Multiply or .Divide
> Quit or .Greater or .Smaller or .Cross refer two files

**** SUPER-BUS ** A NEW HIGHER LEVEL OF THE ABOVE PACKAGE** . . . HAS BEEN REDUCED IN SIZE BY 50 PER CENT TO A SINGLE 15K BASIC PROGRAM, MAKING ALL FILE RETRIEVALS A MATTER OF NANOSECONDS WORKS UNDER COMPUSTAR FOR COMMON DATA RETRIEVAL LEVEL 10.00 ..... *****1475.00*****

DBMS (DATABASE) HAS 01=; 02=; 04=; 06=; 07=; 08=; 17=; 18=; 21=; 24=. PRICE 475.00

DATABASE FEATURES ARE FOR ANY SIZE RECORD UP TO TWENTY FIELDS FILE ARCHITECTURES CAN BE DESIGNED WITH COMPLETE FREEDOM OVER THE LINGUISTIC CONVENTIONS ASSIGNED TO EACH FIELD. THE FILE THEN CAN STORE 32,000 RECORDS WHICH CAN BE SEARCHED BY THE RANDOM ACCESS NUMBER (RETRIEVED IN LESS THAN ONE SECOND) OR 'KEY' RANDOM ACCESS ON SPECIFIED FIELD OR SEQUENTIALLY COMPARING FOR LEFT FIELD PARTS, FIELD-INKEYS, OR PARTS OF RECORD, AND THEN CHANGED, PRINTED, DELETED, SKIPPED.

## SUPERBRAIN



SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard SuperBrain features include two double density mini-floppies with 350K bytes of disk storage, 32K of ram memory (expandable to 65K) to handle even the most sophisticated programs, a CP/M Disk Operating System with a high powered text editor, assembler, debugger and a disk formator. And, with the SuperBrain's S-100 bus adaptor, you can add all the programming power you will ever need ... almost any type of S-100 compatible bus accessory.

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL, and APL. Whatever your application ... General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, SuperBrain is top in the class. And the SuperBrain QD boasts the same powerful performance but also features a double-sided drive system to render more than 700K bytes of disc storage and a full 64K or RAM. All standard!

Whatever model you choose, you'll appreciate the careful attention given to every engineering detail. A full ASCII keyboard with numeric pad and user-programmable function keys. A non-glare, specially focused, 12-inch CRT for sharp images everywhere on the screen. Twin Z-80 micro-processors to insure efficient data transfer to auxillary peripheral devices. Dual universal RS-232 communications ports for serial data transmission. And a single-board design to make servicing a snap!

GRAMA (WINTER) LTD/G.W. COMPUTERS LTD. ARE THE PRODUCERS OF THIS PACKAGE WHICH IS UNEQUALLED FOR ITS LEVEL OF TOTAL INTEGRATION, LINGUISTIC FLEXIBILITY AND MAXIMISED DISK/MEMORY CONSERVATION.
AUTHOR TONY WINTER (M.D.; B.A.Lit.; B.A. Hon. Phil.; and Lecturer).

IMPORTANT ! ! ! NO HARDWARE IS ANY VALUE WITHOUT THE SOFTWARE, AND OUR SOFTWARE IS UNEQUALLED. WE GIVE YOU A DISCOUNT TO SET YOU GOING. JUST DECIDE ON THE SYSTEM YOU INTEND PURCHASING, AND TAKE 10% OF ITS VALUE OFF THE PRICE YOU WOULD HAVE TO PAY FOR THE SOFTWARE. YOU COULD GET THE SOFTWARE FREE WITH THE HARDWARE IF YOU CHOSE THE BEST SYSTEM WE SELL.

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CONTACT TONY WINTER ON 01-636 8210 or 01-631 4818 AND IF UNAVAILABLE THEN LEAVE A CALL-BACK MESSAGE (CLEARLY STATING YOUR TELEPHONE NUMBER AND NAME) ON THE 24-HOUR ANSWER-PHONE, WE CALL BACK ANYWHERE IN THE WORLD.
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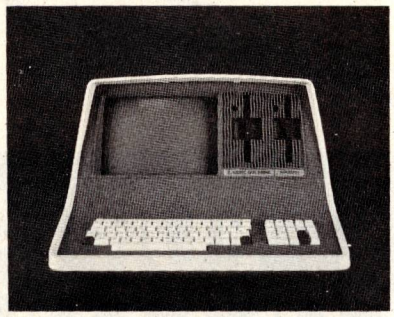
# COMPUSTAR TERMINAL



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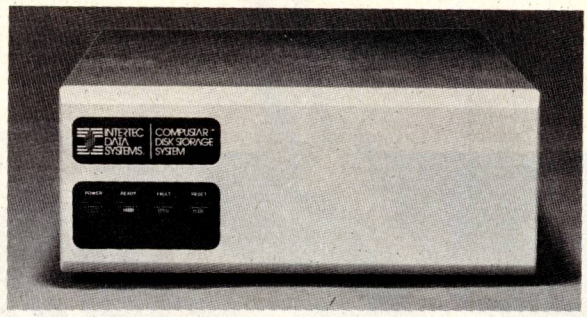


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| 10–DBMS2 (DATABASE) | 575.00 |
| 11–MAGIC WAND | 190.00 |
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| 10–DBMS2 (DATABASE) | 575.00 |
| 11–MAGIC WAND | 190.00 |
| 12–MBASIC-80 | 150.00 |
| 13–SUPER CALC | 150.00 |
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**EXTRA SPECIAL SUPERBRAIN PROGRAM MAIL ORDER OFFER OF THE 5 MAIN PROGRAMS DBMS2 + SORTS + MAGIC WAND+MBASIC 80+SUPER-CALC NORMALLY 1140 POUNDS**
**OUR PRICE**********595.00**********+ VAT**

WARRANTY NOTE: WE HANDLE ALL REPAIRS OURSELVES.
WARRANTY COVERS FREE REPLACEMENT EQUIPMENT IF DEFECTIVE IN FIRST THREE WEEKS. THEREAFTER UP TO 12 MONTHS THE COVER PROVIDES INSURANCE ON ALL SPARE PARTS AND LABOUR COSTS (EXCLUDING CARRIAGE). CALL OUT MAINTENANCE IS ALSO AVAILABLE AT 25.00 MINIMUM (LONDON) 50.00 MINIMUM ELSEWHERE IN U.K. PLUS MILEAGE.

*****THE NEW DBMS (DATABASE)******

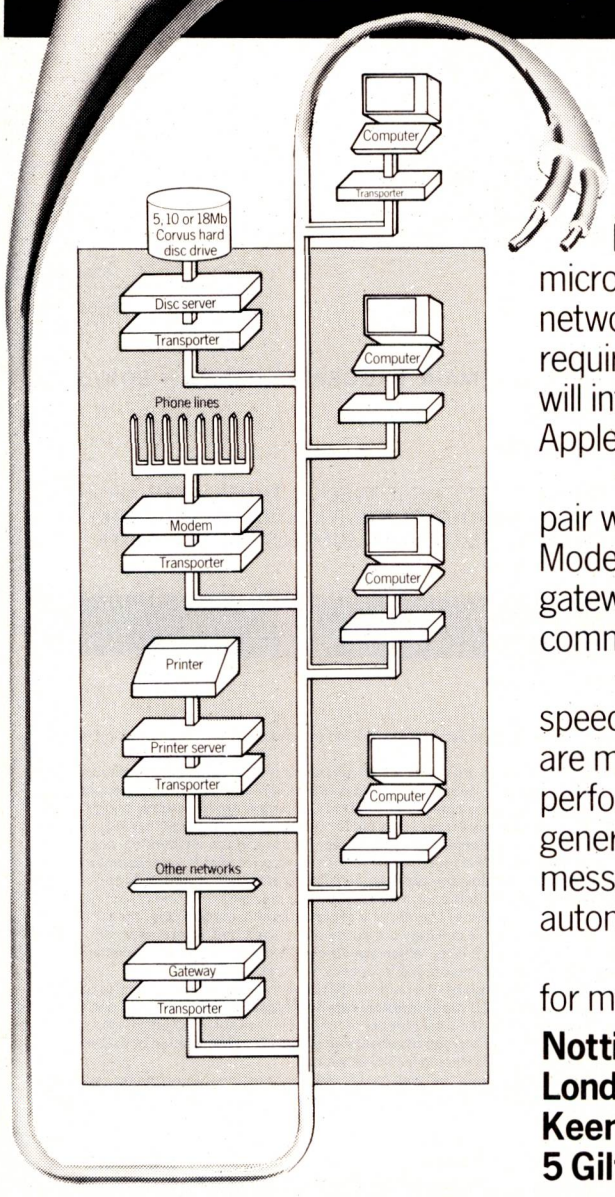
DBMS2 is a *record relational* as well as a *file relational* database management tool that is capable of being at different times, many different things. **The one core program** can be set up to perform tasks normally associated with the following list.

| | | |
|---|---|---|
| Accounting | Budgeting | Cashflow |
| Stock control | Address mailing | Letter writing |
| Simulations | Time recording | Filing |
| Calc-type predictions | Hospital indexing | Profit analysis |
| Bureaux services | General analysis | Mathematics |
| Answer *what-if's* | Employees records | Tabulate values |
| Print reports | Sort files | Edit records |

Within hours perform all the above in **French** or **German**.
The list is as endless as that which meets the requirements of your own imagination.
**Within the appropriate frames of reference** you could ask questions like the following.
Find someone whose name begins with W, who is either in London or Birmingham, and available for work at a salary of less than 10,000.00; and is under 40 years of age, not married, of credit worthiness grade 1, with a car, prepared to travel, and who likes horses, does not mind the hours he works, is congenial and has good references. *When you find such persons* produce a printed list of them showing their names, telephone numbers, and what their salaries are as well as their salary *if increased by 10%* and show their availability for work. At the end of the list enumerate the total of such persons.
Find all stock items that are codes *micro-computers* that are either in warehouse 1 or warehouse 2, where the quantity on hand is more than 50 units, the cost is less than 1000.00, the selling price higher than 2000.00; that are not in cartons, bought from supplier 52, allocated more than 20, rated for tax at .15% and weigh less than 50 lbs. *When you find such categories* then print a report showing the description, cost price, quantity on hand, lead time for refills, what the selling price *should be if raised by 12.3%* as well as the profit in either per-cent or round figures of that projected selling price.
Find all patients who suffered from cold, that are either girls or women younger than 23 years old, and who live in London at a socio-economic grade higher than 3; do not smoke; have more than 3 children, are currently at work and where treatment failed to effect a cure in under 6 days. **When yoy find such persons** then print a list showing their age, marital status, income, and frequency of illness in the past 2 years.
Currently you can ask **5 types** of questions **20 times** for a single selection criterion, and then you can compute **10 mathematical relationships** between the questions for the individual **as well as** for the total number of matches. In all some **60** bits of information relating to **one** record or a **group of records** on simply one permutation of the selection criterion, with a cross referencing facility as well.
**Every word** in the system, as well as the file architectures, print masks, and field attributes, is capable of alteration by you **without** programming expertise (but with some thought).

**ALL IN ONE PROGRAM FROM G. W. COMPUTERS.** *THE DBMS2 !!.*

# FOR FAST, LOW-COST LOCAL NETWORKS OMNINET PROVIDES THE CLEVER TWIST.




Omninet is the intelligent way of linking up to 64 different microcomputers or peripherals into a fast, low-cost local network. And the intelligence is in the microcomputer-based transporters. These manage the total network operation, without stealing processing power or requiring significant software support from the host – and will interface with a wide range of popular micros, including Apple, Onyx, DEC and IBM.

The rest is simple. Data is transmitted through twisted-pair wires at 1 million bits per second. Over 4,000 feet. Modems will link to the GPO telephone system and gateways to other networks will bring international communications to every office.

Other networks just can't match up to Omninet – on speed, price or ease of installation. Coaxial-linked systems are much more expensive. And jobs which have to be performed by the host computer in other networks – generating and receiving acknowledgements, retransmitting messages, and detecting duplicate messages – are all automatically performed by the Omninet transporter.

Sounds too good to be true? Check it out by phoning for more information today.

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## The Product:
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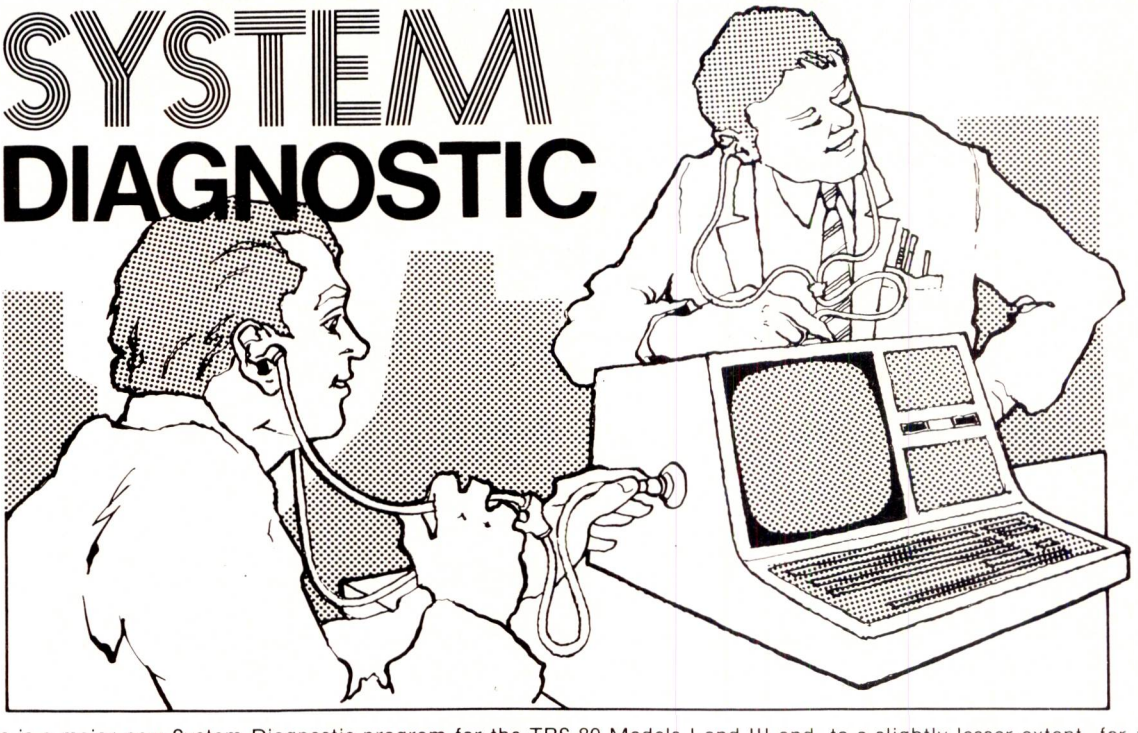

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It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

| | | | | | | |
|---|---|---|---|---|---|---|
| APPEND | COPY | DEVICE | DIR | DO | FILTER | KILL |
| LIB | LINK | LIST | LOAD | MEMORY | RENAME | RESET |
| ROUTE | RUN | SET | SPOOL | ATRIB | AUTO | BOOT |
| BUILD | CLOCK | CREATE | DATE | DEBUG | DUMP | FREE |
| PROT | PURGE | SYSTEM | TIME | TRACE | VERIFY | XFER |

All of the useful abbreviations in Newdos are included and the System Commands in Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a "sleep" state until such time as the system clock matches the time specified. And so on!

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| PATCH | RS232 | KEY STROKE/MULTIPLIER | PRINTER FILTER |

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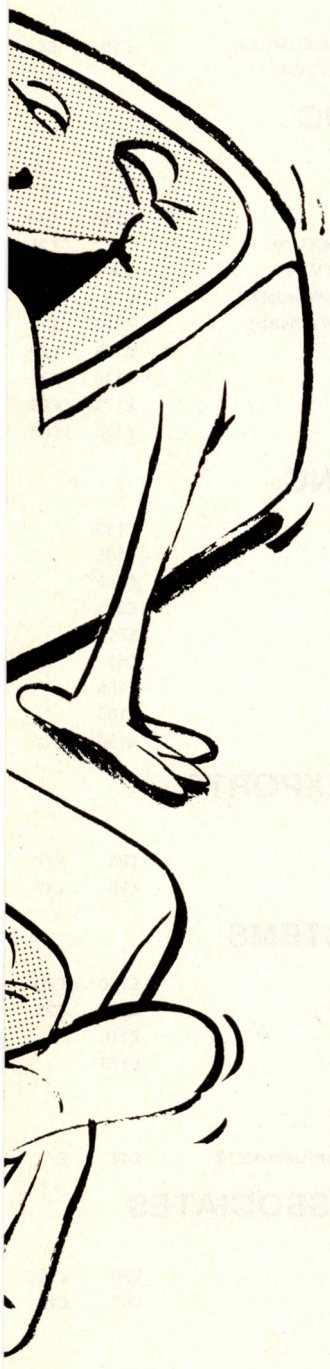

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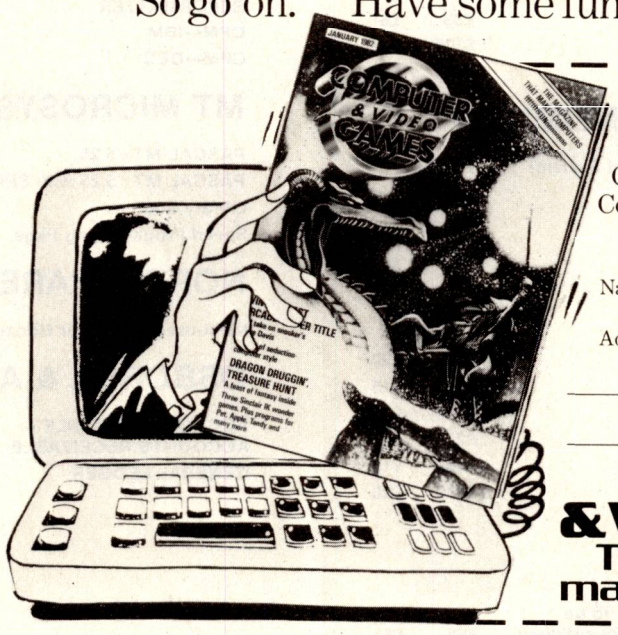


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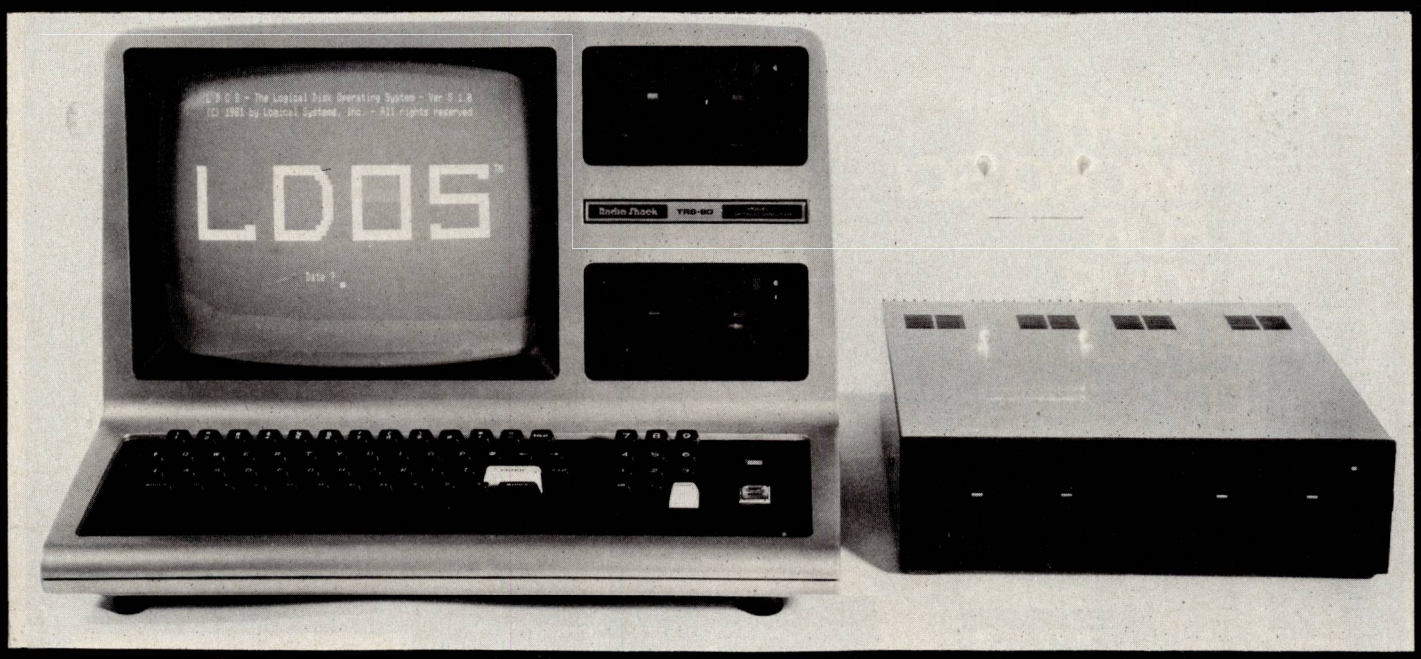


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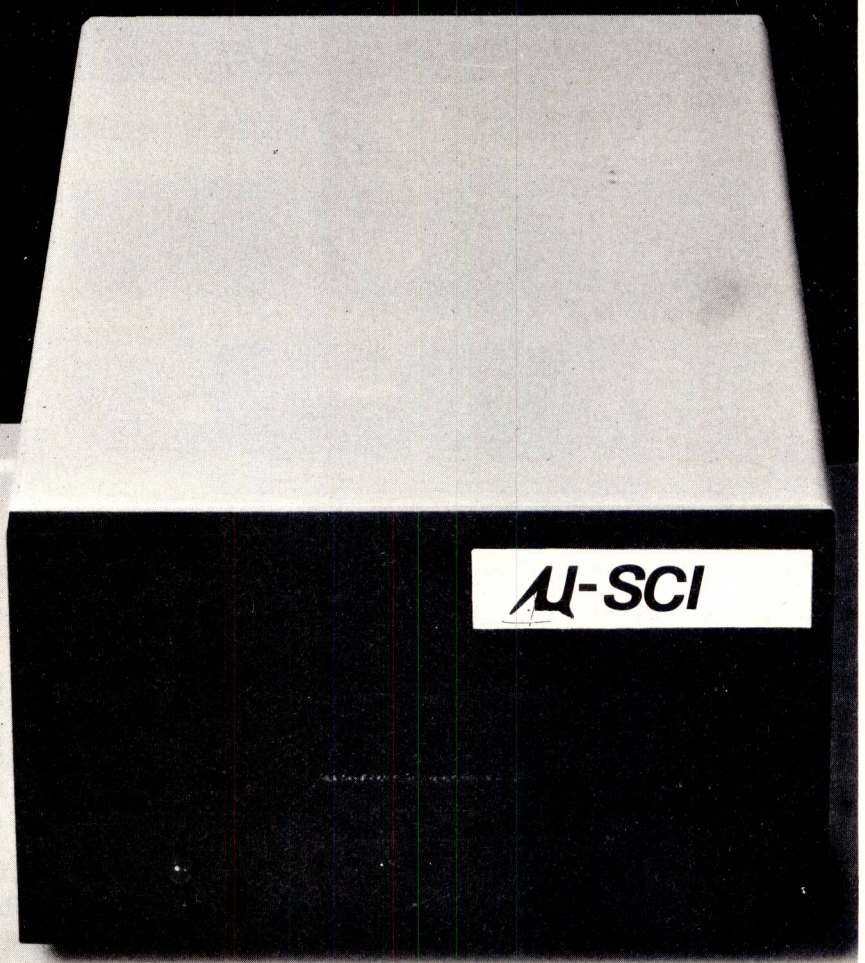


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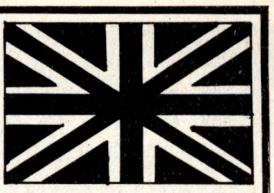

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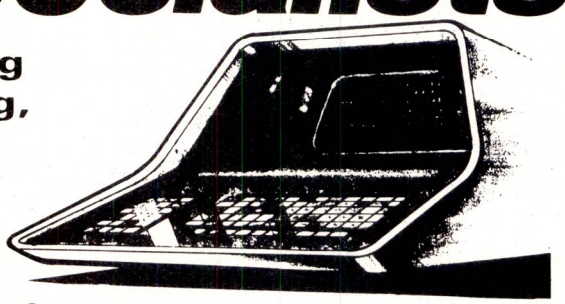

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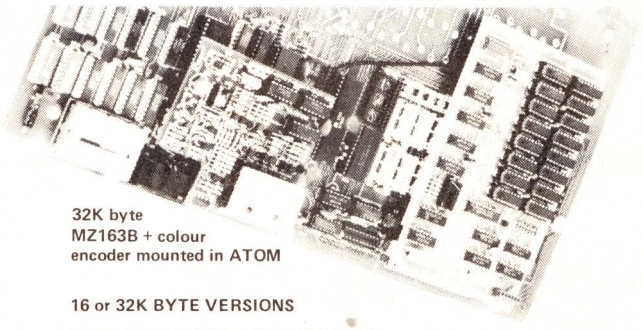

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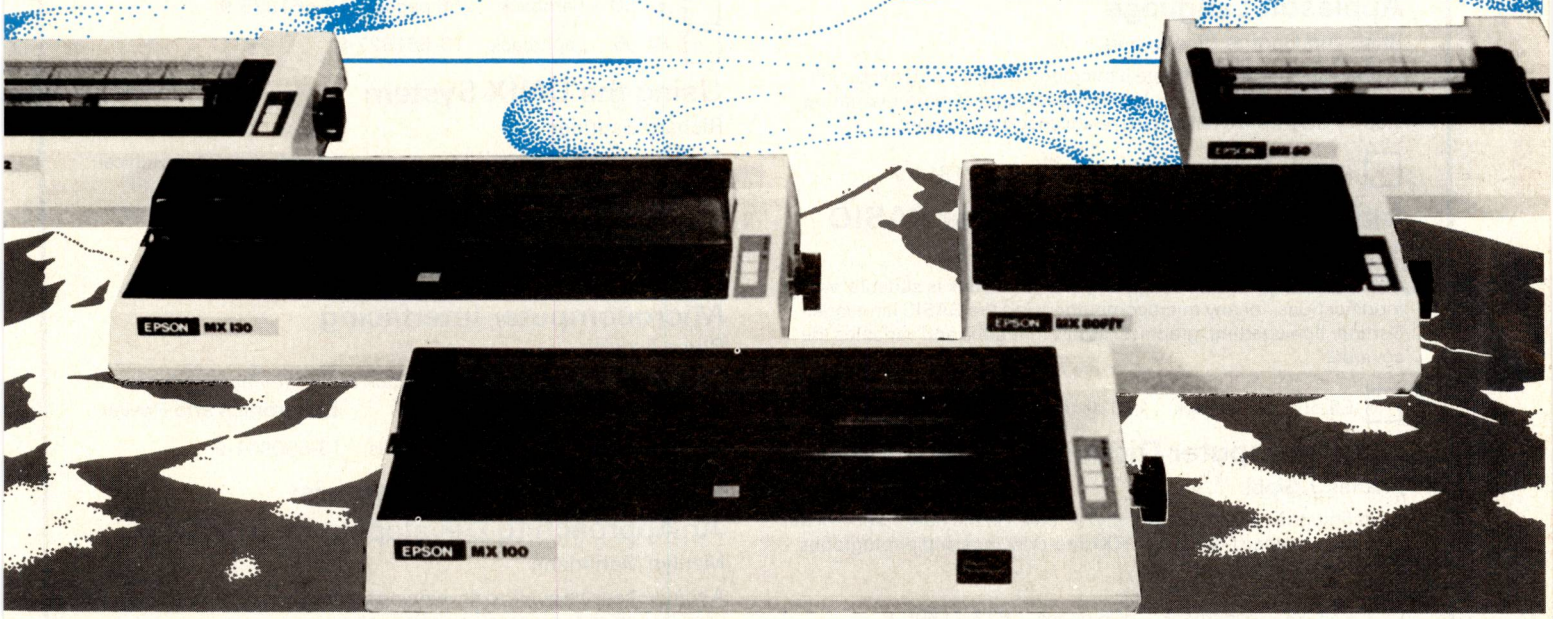


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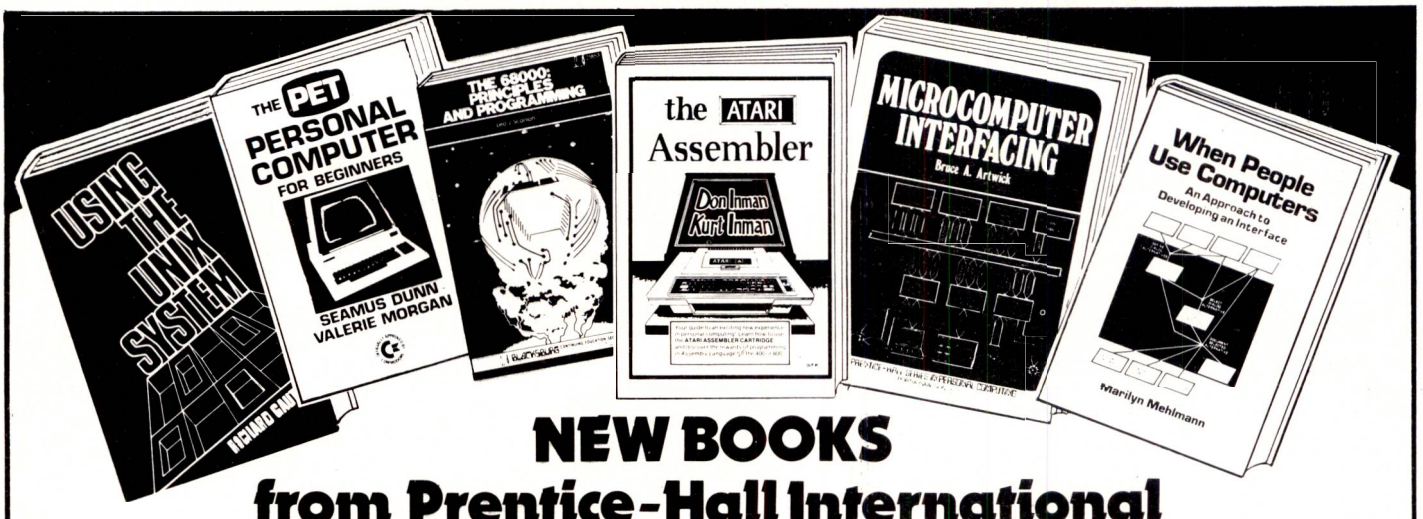


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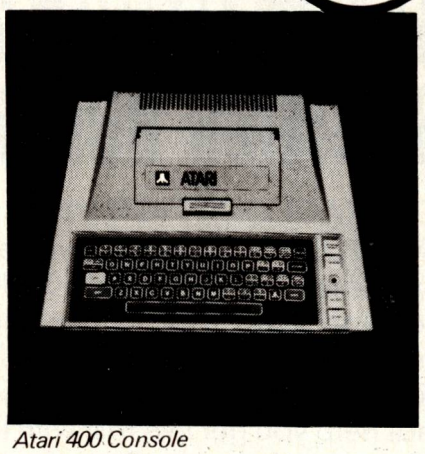

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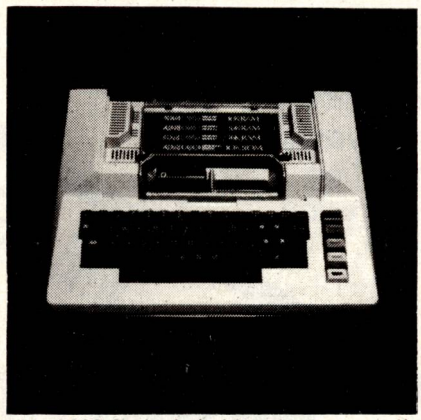

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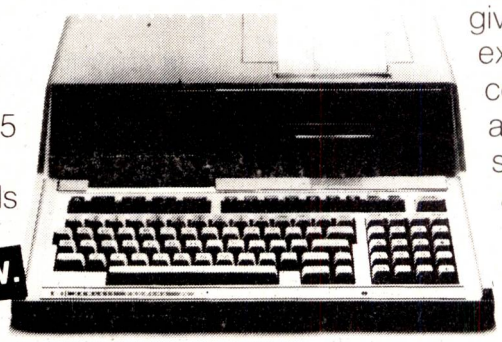

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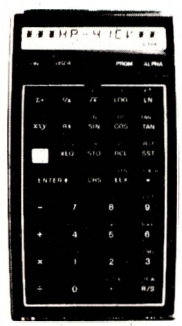

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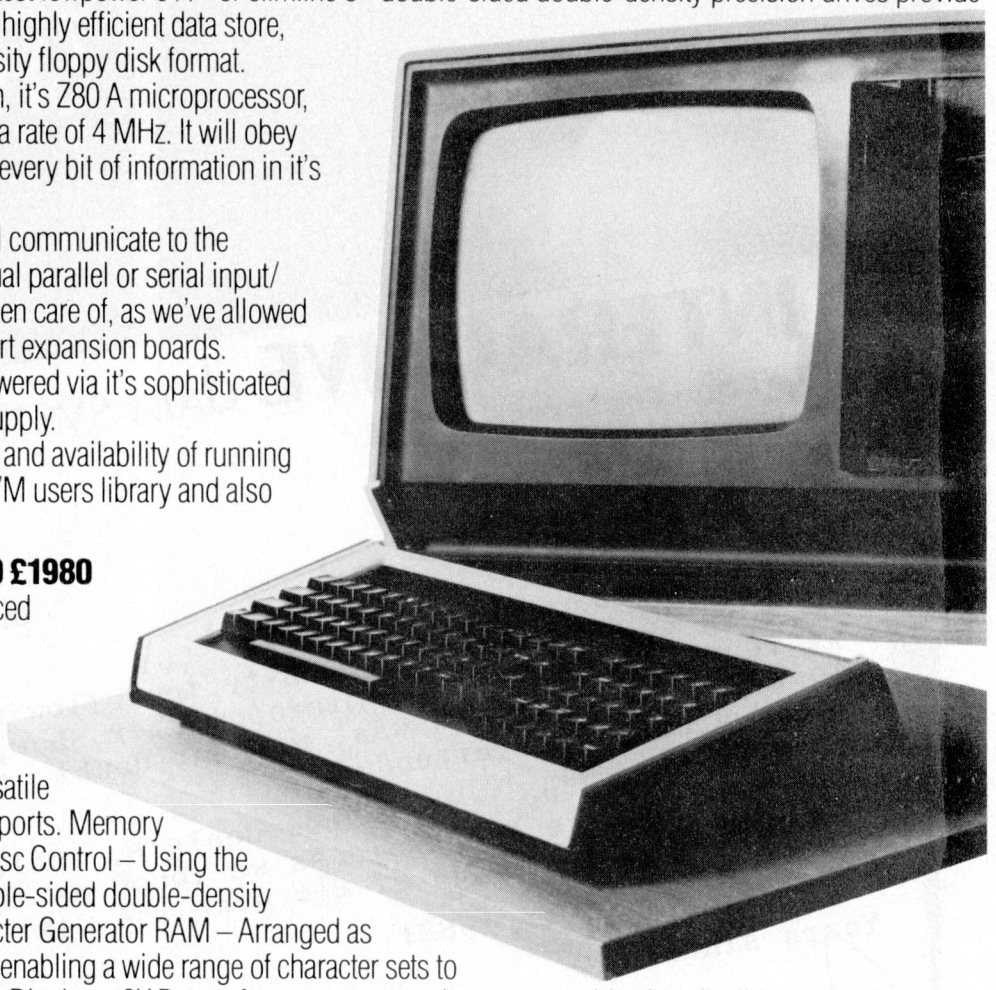

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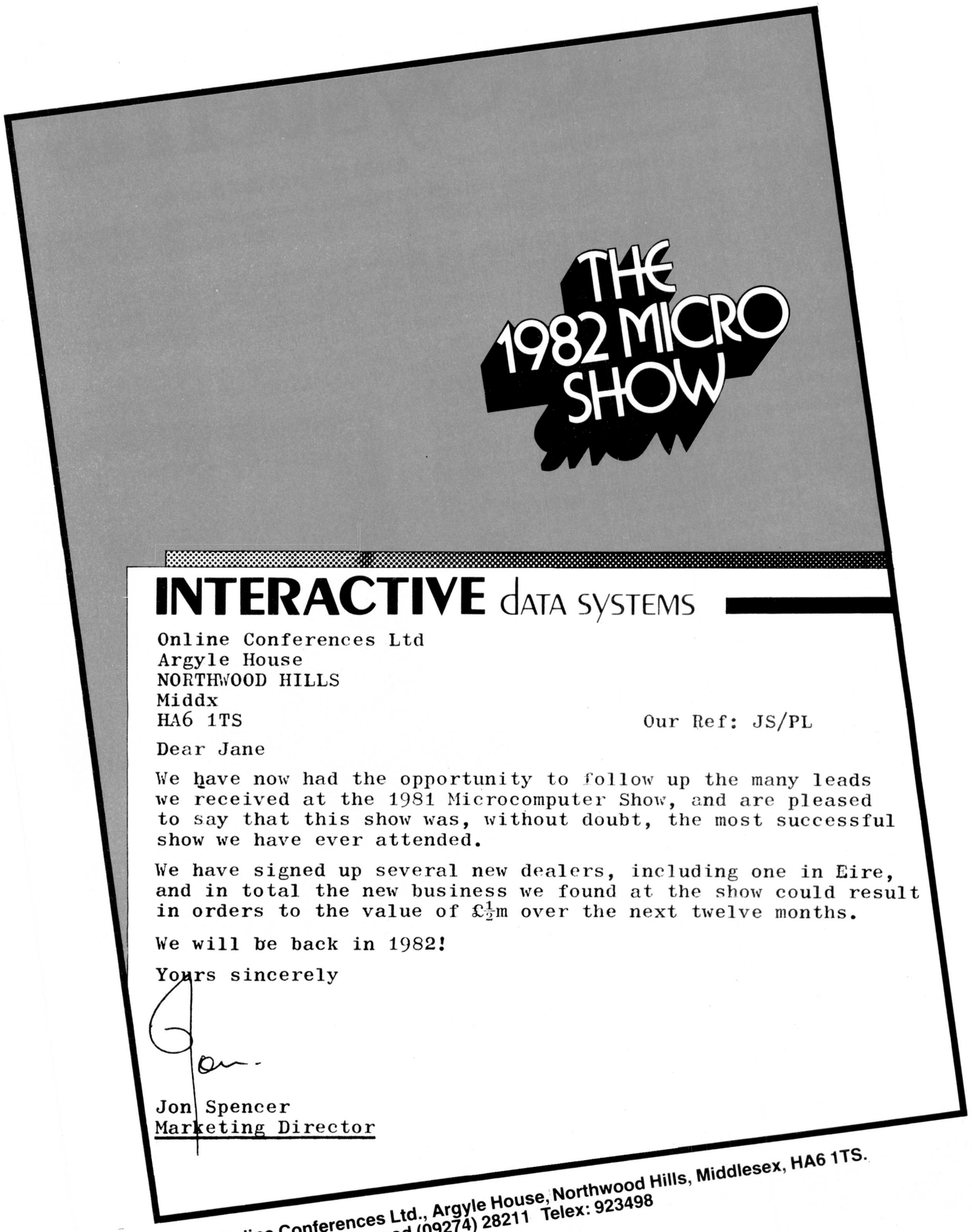
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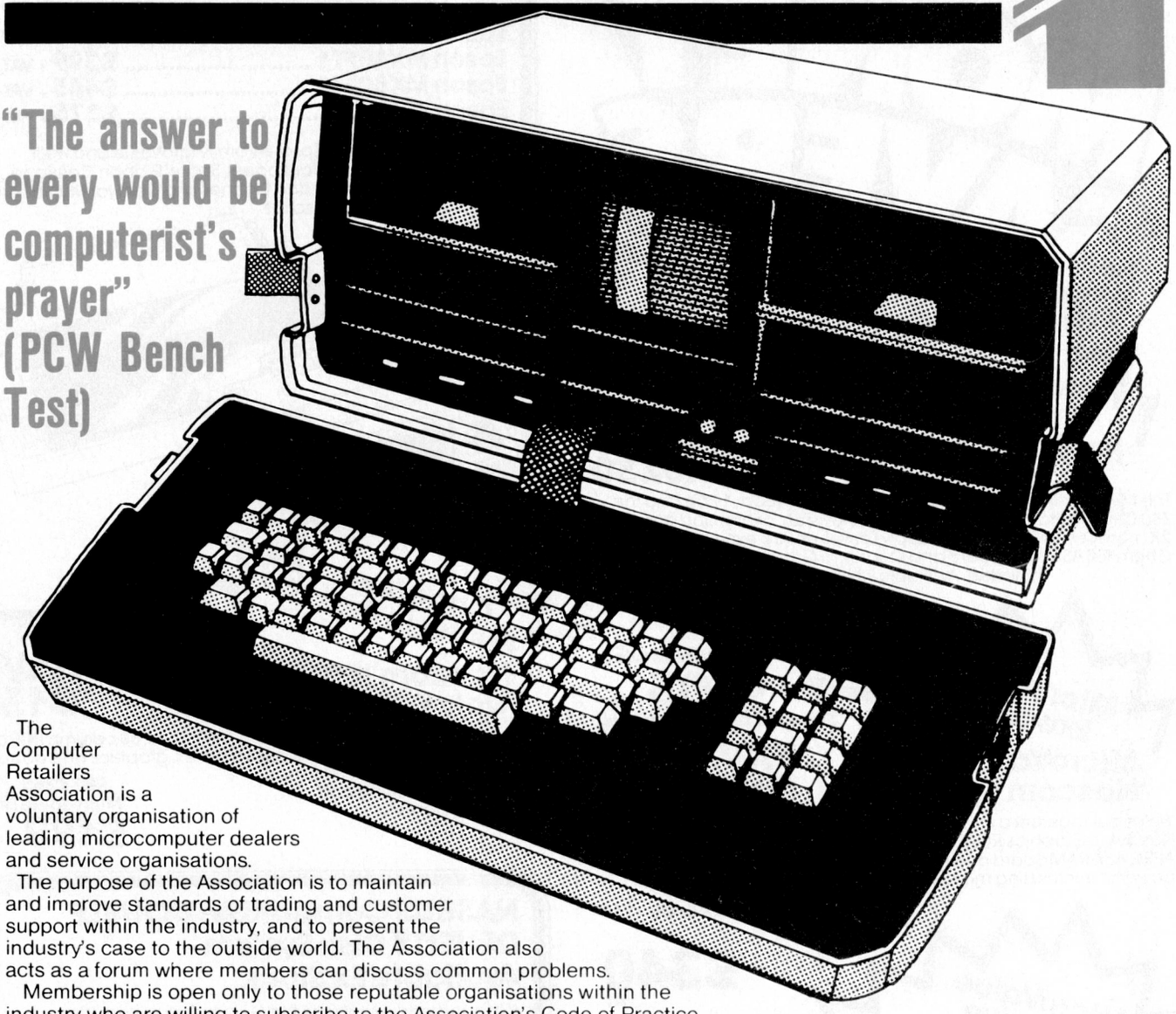
We have signed up several new dealers, including one in Eire, and in total the new business we found at the show could result in orders to the value of £½m over the next twelve months.
We will be back in 1982!
Yours sincerely
Jon Spencer
Marketing Director
Online Conferences Ltd., Argyle House, Northwood Hills, Middlesex, HA6 1TS.
Telephone: Northwood (09274) 28211 Telex: 923498

# OSBORNE



**"The answer to every would be computerist's prayer" (PCW Bench Test)**

The Computer Retailers Association is a voluntary organisation of leading microcomputer dealers and service organisations.

The purpose of the Association is to maintain and improve standards of trading and customer support within the industry, and to present the industry's case to the outside world. The Association also acts as a forum where members can discuss common problems.

Membership is open only to those reputable organisations within the industry who are willing to subscribe to the Association's Code of Practice, and who meet the Conditions of Membership.

## See it at your nearest CRA dealer

**Xitan Systems Ltd.**
23 Cumberland Place,
Southampton,
SO1 2BB
Tel: 0703 38740

**Datron Micro Centre**
2 Abbeydale Road,
Sheffield S7 1FD
Tel: 0742-585490/585400
Telex: 547151

**Microcomputers at Laskys**
10 stores within selected Laskys
Phone 051-227 2535
for details

**Crystal Electronics**
40 Magdalene Road,
Torquay, Devon.
Tel: 0803 22699
Telex: 42507 XTAL G

**Lion Microsystems**
Lion House,
227 Tottenham Court Road,
London W1
Tel: 01-636 9613

**Byteshop Computerland**
5 Shops Nationwide
Phone 0480 215005
for details

**Digitus Ltd.**
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Covent Garden,
London WC2
Tel: 01-379 6968

**Adda Computers Ltd.**
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## COMPUTER RETAILERS ASSOCIATION

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# MicroValue

# MONEY SAVERS

with the exclusive MicroValue 12 Months Warranty*

MicroValue Exclusive

## MV1 - a Z80 computer

**SAVE £107.50**

The MV1 computer kit uses the ubiquitous Nascom 1 Pcb and the Z80 CPU. Interfaces are included for television, printer and cassette. 2K memory, Gemini power supply (drives up to 3 extra boards). Cherry full ASCII keyboard and Quantum Graphics dre also included. Available with either an ASCII version of the Nas-Sys 3 monitor, or a Tiny BASIC. MV1 is expandable to Gemini 80-BUS specification.

**MicroValue price**
**£105** + VAT

MicroValue Exclusive

## MicroValue's 'Nascom Special'

**SAVE OVER £65**

We've put together a microcomputer kit containing the Nascom 2, Nas-Sys 3, Graphics ROM, Bits & P.C.'s programmers aid, Gemini 3 APSU, 16K RAM Board and mini motherboard. The result is a powerful micro using market proven boards and components.

**RRP OVER £405 + VAT**

**£340** + VAT

MicroValue Exclusive

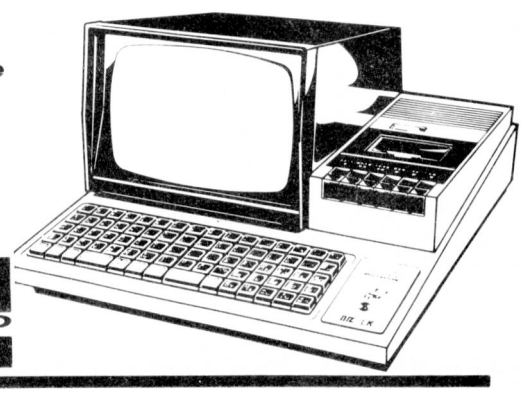
## SHARP MZ80K with Super Graphics

**SAVE £200!**

The 48K RAM System is offered at a rock bottom price with the Quantum Micros Hi Res Graphics which gives resolution down to a single dot and high res. plotting. Characters are user definable and the pixel characters actually *join*. Five free games packages are included too!

**RRP £645 + VAT**

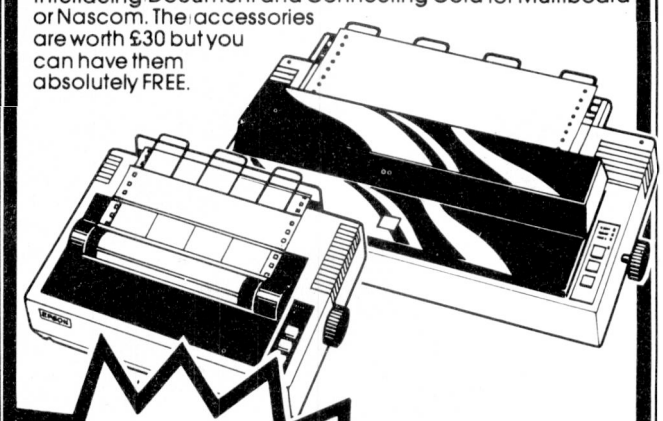
**MicroValue price**
**£445** + VAT




## £30 worth of accessories FREE with every Epson Printer

| | MicroValue price |
|---|---|
| Epson MX80T | £359 + VAT |
| Epson MX80FT1 | £399 + VAT |
| Epson MX80FT2 | £465 + VAT |
| Epson MX100 | £575 + VAT |

Buy one of the above Epsons from MicroValue and we'll give you a Pack of Fanfold paper, Spare Ribbon Cartridge, Interfacing Document and Connecting Cord for Multiboard or Nascom. The accessories are worth £30 but you can have them absolutely FREE.



Cheapest Printer in the UK!

## Nascom IMP + Graphics Only £199 + VAT

**SAVE £156**

MicroValue has slashed the price of the 80cps, 80 column IMP dot matrix printer. And added Imprint's high res. graphics and double width character option. IMP has bi-directional printing and friction/tractor feed.

**RRP £355 + VAT**
**MicroValue price**
**£199** + VAT

## NASBUS Compatible DOUBLE DENSITY Disk System - Available Ex Stock

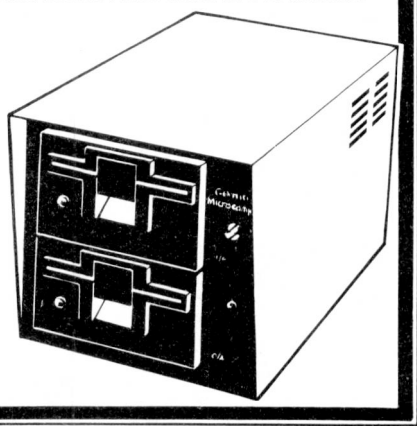
With hundreds in daily use the Gemini Disk system is now the standard for Nascom and Gemini Multiboard systems. Single or twin drive configurations are available, giving 350K storage per drive. The CP/M 2.2 package supplied supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers, and auto single-double density selection. An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 2 it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

**Single drive system (G809, G815/1)**
**£465** + VAT

**Double drive system (G809, G815/2)**
**£690** + VAT

**CP/M 2.2 package (G513)**
**£100** + VAT

**Polydos 2**
**£90** + VAT



# MicroValue MONEY SAVERS

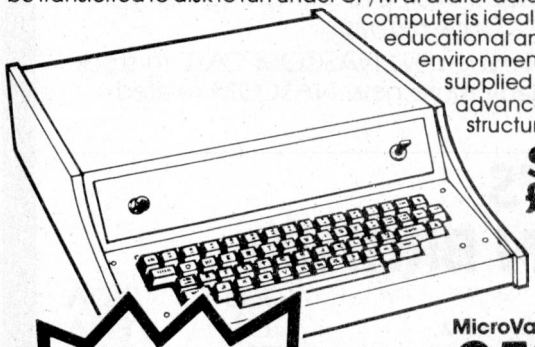
MicroValue Exclusive

with the exclusive MicroValue 12 Months Warranty*

## MV2-Twin Z80A Controlled Development Computer

The fully built and tested MV2 microcomputer is controlled by two Z80A microprocessors. Interfaces include RS232, cassette, 2 × 8 bit parallel ports, and graphics including programmable graphics. It provides 80 × 25 screen format and includes 64K RAM, Integral PSU and full ASCII keyboard.

Software written to run under the RP/M ROM based monitor can be transferred to disk to run under CP/M at a later date. This rugged computer is ideal for educational and industrial environments and is supplied with the advanced COMAL structured BASIC.



**SAVE £76.50**

MicroValue Exclusive

**MicroValue price £595 + VAT**

## 80 × 25 Video for Nascom

Nascom owners can now have a professional 80 × 25 Video display by using the Gemini G812 Intelligent Video Card with onboard Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Built and tested. **£140 + VAT**

MicroValue Exclusive

## NEW I/O Board for Nascom & Gemini Multiboard Systems

## Quantum I/O

The new Quantum Micros I/O board takes the unique approach to the problems of interfacing your Nascom or Gemini Multiboard to external devices. This 80 Bus and Nasbus compatible card is supplied fully built, populated and tested and includes three Z80 PIOs, a CTC and a Real Time Clock with battery back-up. In addition, a range of "daughter" boards that attach straight to the I/O board are under development catering for a wide variety of interfacing requirements.

**Quantum I/O board** MicroValue price – **£140** + VAT

**Prototyping daughter board** MicroValue price – **£20** + VAT

## IEEE-488

The EV Computers' IEEE-488 card is an 80 Bus and Nasbus compatible card designed to fully implement all IEEE-488 interface functions. This built and tested card gives the user a very cost effective and versatile method of controlling any equipment fitted with a standard IEEE-488 or GPIB interface.

**MicroValue introductory price**

**£140 + VAT**

MicroValue Exclusive

## New Software for Nascom Systems

**POLYDOS 1** A disk operating system for use with Nascom 1 or 2 and Gemini G805 Disk Systems. An incomparable and extremely well presented DOS that includes an editor and assembler and adds disk commands to the Nascom BASIC. MicroValue price **£90 + VAT**

**MATHSPAK** Double precision maths package on tape. MicroValue price – **£13 + VAT**

**MATHSPAK Handler** Used in conjunction with MATHSPAK. MicroValue price – **£9.95 + VAT**

**Command Extender** For use with MATHSPAK it extends BASIC's reserve word list. MicroValue price – **£9.95 + VAT**

**Logic Soft Relocater** An integrated assembler and disassembler package which allows disassembly and reassembly from anywhere on the memory map. MicroValue price – **£13 + VAT**

## SAVE MORE MONEY

### Standard Firmware for Nascom at Reduced prices

| | | |
|---|---|---|
| NASPEN | RRP £30 + VAT | **MicroValue price £20 + VAT** |
| Nas-Sys 3 | RRP £25 + VAT | **MicroValue price £20 + VAT** |
| NasDis + D-Bug (EPROM) | RRP £50 + VAT | **MicroValue price £30 + VAT** |
| NasDis + D-Bug (TAPE) | RRP £40 + VAT | **MicroValue price £20 + VAT** |
| Imprint | RRP £30 + VAT | **MicroValue price £20 + VAT** |
| Bits & PCs Prog. Aid | £28 + VAT | **MicroValue price £20 + VAT** |

## *MicroValue Warranty

All products, except kits, sold by MicroValue dealers are supplied with 12 months' warranty and will be replaced or repaired by any dealer (even if you didn't buy it from him) in the group in the event of faulty manufacture.

## YOUR LOCAL MICROVALUE DEALER

All the products on these two pages are available while stocks last from the MicroValue dealers listed on right. (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.**

**ELECTROVALUE LTD.**
**700 Burnage Lane, Burnage, Manchester M19 1NA.**
**Tel: (061) 431 4866.**

**28 St Judes, Englefield Green, Egham, Surrey TW20 0HB.**
**Tel: (0784) 33603. Tlx: 264475.**

**SKYTRONICS,**
**2 North Road, The Park, Nottingham.**
**Tel: (0602) 45053/45215**

**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).**

**LEEDS COMPUTER CENTRE,**
**62 The Balcony, Merrion Centre, Leeds.**
**Tel: (0532) 458877**

# NASCOM USERS

Take a look at the NASCOM APPROVED HS-IN STORAGE SYSTEM. Where else can you get features like these . . .

* **A full on screen instant display of the catalogue.**
* **Auto verification of each file as it is written.**
* **CRC error checking.**
* **Link selectable 2Mhz or 4Mhz option.**
* **Fast data transfer rate of 6000 bps.**
* **Powered from NASBUS.**
* **8" sq NASBUS compatible PCB.**
* **Far more reliable than any floppy disk system.**
* **112K on-line storage with 2 drive system.**

The HS-IN has a Command Set which makes it a floppy-disk "look-alike". It can load an 8K program in under 11 seconds and can store up to 56K (28 files) on each side of tape. Why spend £700 on a floppy disk system when the less expensive HS-IN system has a command set like this . . .

**B— Write a Basic file**
**C— Instant display of catalogue.**
**D— Delete file.**
**J— Jump to Basic.**
**N— Jump to NAS-SYS.**
**Q— Warm start to NASPEN text editor.**
**R— Read a file.**
**T— Transfer file to another drive.**
**W— Write a file.**
**X— Exit and rewind cassettes.**
**Z— Warm start to Basic.**

This Mini-Cassette Storage System is technologically far ahead of anything like it on the market and is extremely reliable into the bargain. AND THE COST? Because we have been successful in quantity component purchases we have been able to lower the price until January 31st 1982 (the old price is in brackets).

Single Drive System built and tested **£199** (£230)

Double Drive System built and tested **£279** (£299)

Carriage **£3.50**.

We are Scotland's foremost NASCOM Dealers and keep in stock the full range of NASCOM products as described in the Lucas Logic Advert in this magazine. For the Christmas period and up to January 31st 1982 we are offering a **FREE Statistical Calculator** (without battery) with every NASCOM product worth more than £100 or each series of NASCOM products with a value totalling £100 or more in the same order. AND if you don't want the calculator . . . just 'phone and see if we have something else you need FREE – a book perhaps!

We now have the new NASCOM CASE in stock as well as many more new NASCOM related products.

# COMPONENTS AT THE BEST PRICES IN BRITAIN

MICRO-SPARES now have a vast selection of Logic I.C.'s including 74; 74LS and CMOS full range. There are Z80's and support chips as well as resistors, capacitors etc. etc. . . . far too many to list on this page. But to give you an idea of the prices just compare these . . .

| | 1-199 | 200+ |
|---|---|---|
| **2114's (all speeds)** | **99p** | **POA** |
| **4116's (all speeds)** | **69p** | **POA** |
| **2708's** | **1.73p** | **POA** |
| **2716's Single +5v** | **2.15p** | **POA** |
| **4118's** | **3.80p** | **POA** |

All components are fully guaranteed and are in stock as at 15th December 1981. Orders under £30 please add 50p p. & p. VAT not included. Send SAE for current price list. Official orders from all establishments welcome.
**All components in stock sent same day.**

# NEW

Very shortly now MICRO-SPARES will be selling the all computer RS232C version of the HS-IN. The Mini-Cassette System is just as fast and files can be any length. The machine can be connected to computers, V.D.U.'s, Printers and and other RS232C device. They will take the place of paper tape in loading engineer test programs for instance. Other communication modes are 20mA current loop, IEEE and Z80 bus.

# SECOND HAND COMPUTERS

MICRO-SPARES keep a register of users that are buying or selling a computer. Stocks of second-hand machines – all in working order – are available from the very small to the very large at extremely keen prices.

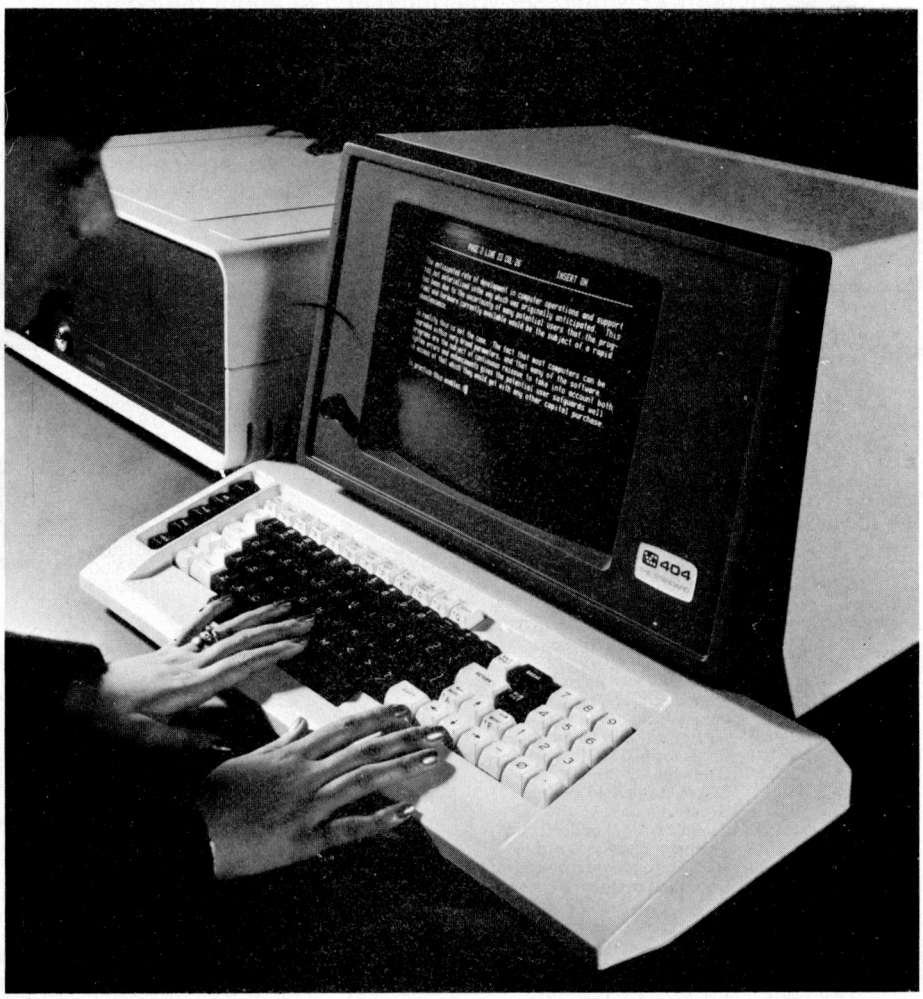


**Micro-Spares**

19 Roseburn Terrace, Edinburgh EH12 5NG.
Tel: 031-337 5611.



# Xitan
# South Coast Leaders in Microcomputer Support Application and Service



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Xitan's specialised Administrative and Operational Microcomputer Systems provide cost effective computer support for wide ranging business organisations; from low entry level, stand alone systems for the smaller business, to integrated multiuser/multitasking systems to meet the more specific needs of the larger business enterprise.

**Xitan – First in Science and Research**

Xitan support the more personalised requirements of the scientific and research users universities and colleges, and in government and independent research establishments with comprehensive practical experience embracing hardware, system, and applicational software.

**Xitan – First in Industry**

Xitan's depth in microcomputer experience is playing an increasing role in the rapidly developing industrial applications for production and process control, and in product and production development operations.

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Xitan's local reputation is founded securely on Service– both in system development– software and hardware support, and service in the field.

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**Cromemco** **SHARP** North Star Horizon **comart**

PCW 45

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We could simply scream at you 'Get a Sharp MZ-80K personal computer for only £399!'

But you know, and we know, that there's more to it than that. As your interest increases or your business grows, you will want to exploit the unique versatility of your Sharp system – MZ-80K, MZ-80B or PC-3201.

So we thought we would set your mind at rest about the cost of expansion. We print here *all* the prices relevant to system expansion on these three popular and widely recognised computers.

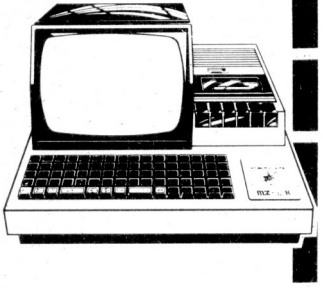
If you think this demonstrates a straightforward and workmanlike attitude on our part, just look at the prices. You will see that they are just as down-to-earth as the rest of our approach.

Butel-Comco support for Sharp users is *complete*. Advice is freely available. Maintenance contracts can be arranged. A wide range of supplies and software can be supplied.

## THE BUTEL PRICE GUIDE

### Sharp MZ-80K Personal Computer

| | | |
|---|---|---|
| MZ-80K | Computer 20K. 25cm CRT. Tape cassette. ASCII keyboard. | £399.00 |
| MZ-80K | Computer 48K. | £460.00 |
| MZ-U/G | 28K upgrade. | £80.00 |
| MZ-80 I/O | Interface unit. | £82.00 |
| MZ-80FD | Dual disk drive. | £693.00 |
| MZ-80FDK | Additional dual disk drive. | £616.00 |
| MZ-80 | RS232 interface. | £110.00 |
| MZ-80P3 | Matrix printer. | £395.00 |
| CP/M | Operating system. | £196.00 |
| MZ-80 I/O-1 | Universal interface card. | £50.00 |
| MZ-80BM | BASIC manual. | £7.00 |
| MZ-80T10B | BASIC tape. | £9.00 |
| MZ-80T20C | Machine language tape and manual. | £19.00 |
| MZ-80TU | Assembler tape and manual (System Program). | £38.00 |
| MZ-80T40E | PASCAL interpreter manual and application tape. | £50.00 |



### Sharp MZ-80B Personal Computer

| | | |
|---|---|---|
| MZ-80B | Computer 64K. 23cm CRT. Tape cassette. ASCII keyboard. | £1095.00 |
| MZ-80FD | Twin floppy disk unit. | £590.00 |
| MZ-80FDK | Additional twin floppy disk unit. | £590.00 |
| MZ-80P5 | Matrix printer, 80cps. 80col. | £415.00 |
| MZ-80FI | Floppy disk interface card. | £100.00 |
| MZ-80MDB | Master diskette and manual. | £31.00 |
| MZ-80F15 | Cable for MZ-80FD. | £9.00 |
| MZ-FO5 | Cable for MZ-80FDK. | £7.00 |
| MZ-BCJ | Floppy disk cable jointer. | £15.00 |
| MZ-80EU | Expansion unit. | £50.00 |
| MZ-80GMK | Graphic RAM-II option. | £120.00 |
| MZ-80 I/O-2 | Universal interface card. | £45.00 |
| MZ-80T10C | MZ-80K to MZ-80B converter tape. | £7.00 |
| CP/M. | Operating system. | £65.00 |



### Sharp PC3201 Business Computer

| | | |
|---|---|---|
| PC-3201 | Computer 64K. ASCII keyboard. | £1500.00 |
| CE-320C | 80x25-character display terminal. | £250.00 |
| CE-332P | 80cps, 80/132col matrix printer. | £450.00 |
| RP-1600/5 | 60cps, 132col daisywheel High-Q printer. | £1495.00 |
| CE-331M | Twin floppy diskette unit. | £670.00 |
| CE-341M | Floppy diskette interface. | £125.00 |
| CE-350L | Additional diskette drive cable. | £30.00 |
| CE-332A | 48K RAM upgrade. | £150.00 |
| CE-340R | RS232 interface card. | £150.00 |
| CE-340G | General purpose I/O parallel interface card. | £145.00 |
| CE-350R | Printer ribbon for 332P. | £8.00 |
| | 10x5¼in diskettes. | £30.00 |
| CE-330G | Direct program generator. | £120.00 |
| | Sales Ledger program and manual. | £300.00 |
| | Purchase Ledger program and manual. | £300.00 |
| | Nominal Ledger program and manual. | £450.00 |
| | Invoicing System program and manual. | £300.00 |
| | Stock Control program and manual. | £300.00 |



Note: All prices quoted exclude VAT, freight costs and insurance.

All items are available through our fast and efficient Mail Order Service or come and collect it from our 'computer centre' counter. We accept Access and Barclaycard and can arrange Citibank hire purchase. Simply ask for a quotation.

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COMPUTER: "Working . . ."

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- ⁂ **UNLIMITED VOCABULARY**
- ⁂ **EASY TO PROGRAM**
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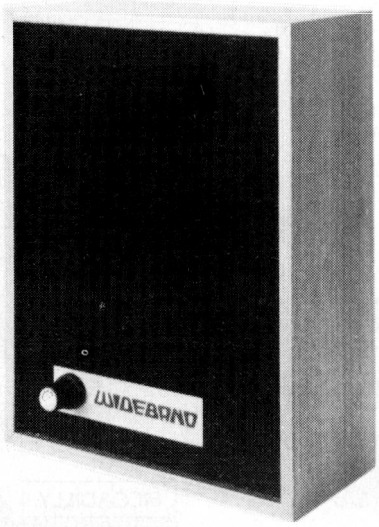
- ⁂ **COMPLETE MANUAL WITH DICTIONARY, SAMPLE SOFTWARE AND TUTORIAL ON SPEECH PRODUCTION.**




Also includes high flux speaker and power supply, all housed in high quality wood cabinet, with volume control and rear pitch control.

Programmed with simple phonetic codes. Apart from the obvious applications of voice response in manufacturing, testing, blind terminals etc., this product also teaches a great deal about linguistics and speech production.

Software is available in BASIC and Z-80 and 6502 assembly for direct input in PHONETIC SPELLING closely related to the ARPABET international phonetic alphabet.

For your nearest dealer contact:

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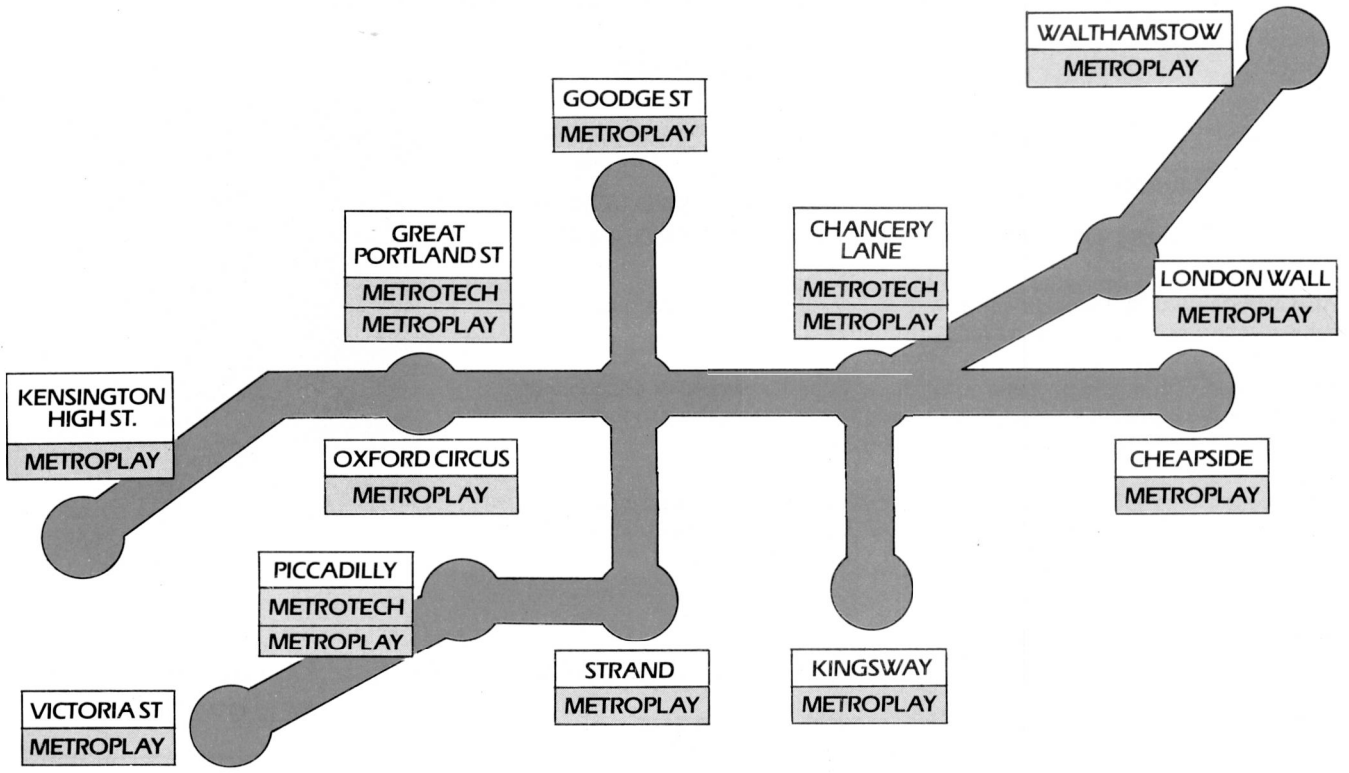


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A new generation of home/personal computers to combine normal computing with audio/visual educational and TV game facilities.

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Complete Atari Video Computer System with 27 game 'Combat' cartridge **PLUS FREE** 112 game 'Space Invader' cartridge.

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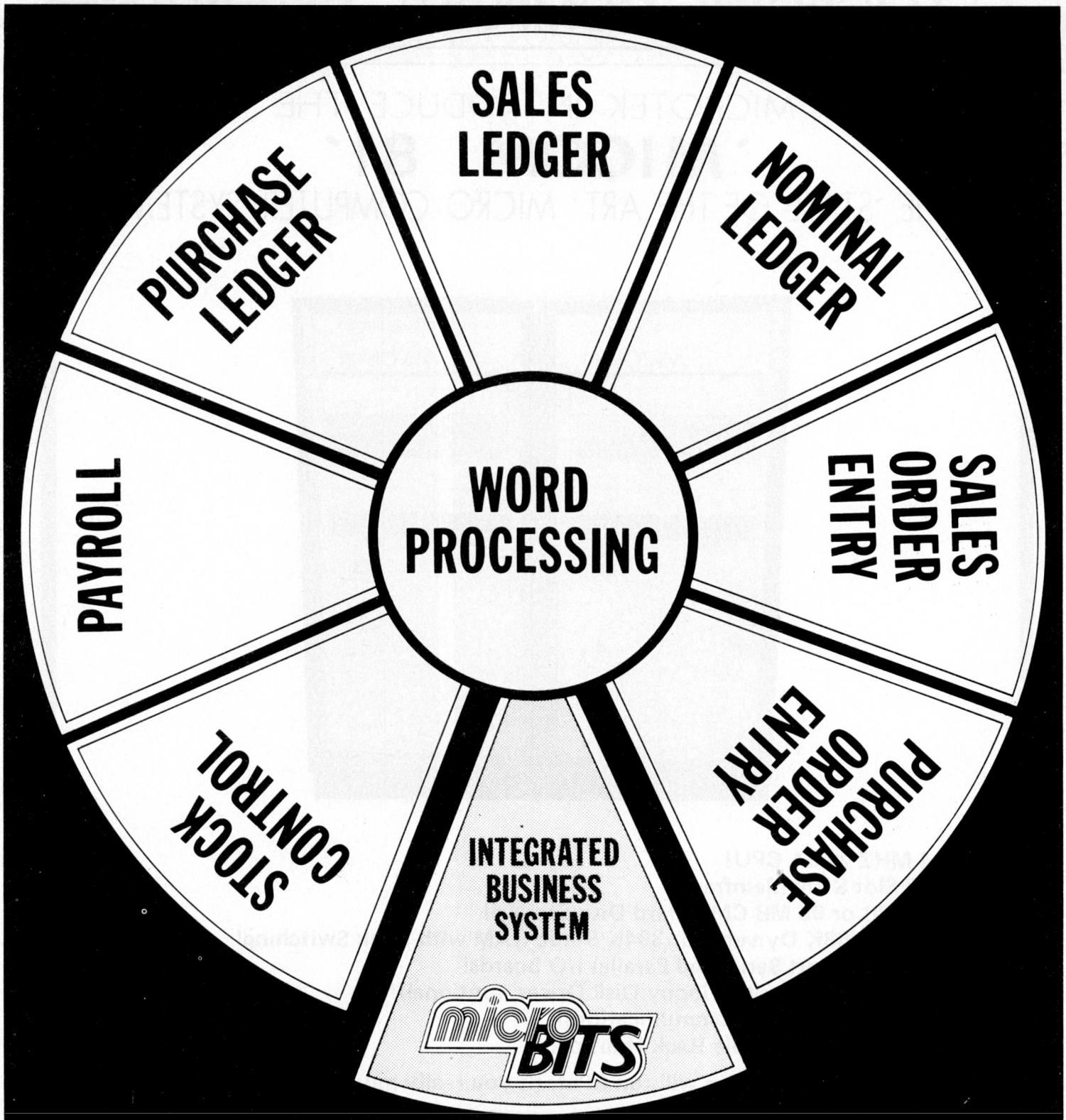


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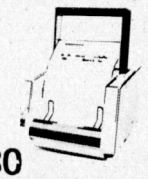

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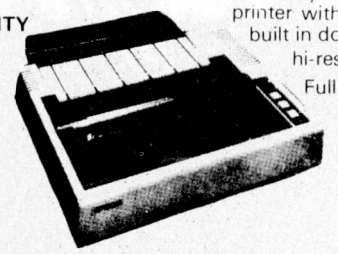

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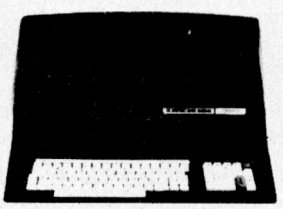

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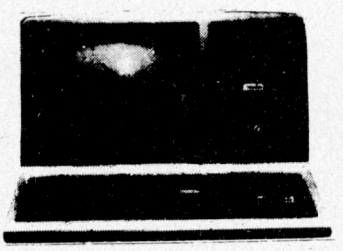

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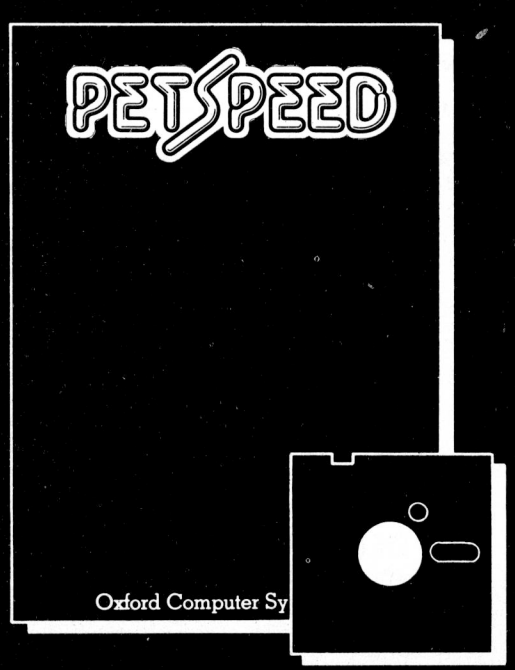


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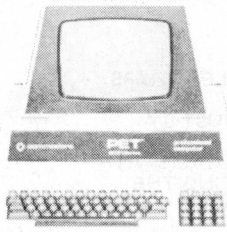

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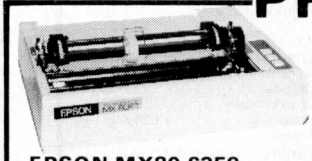

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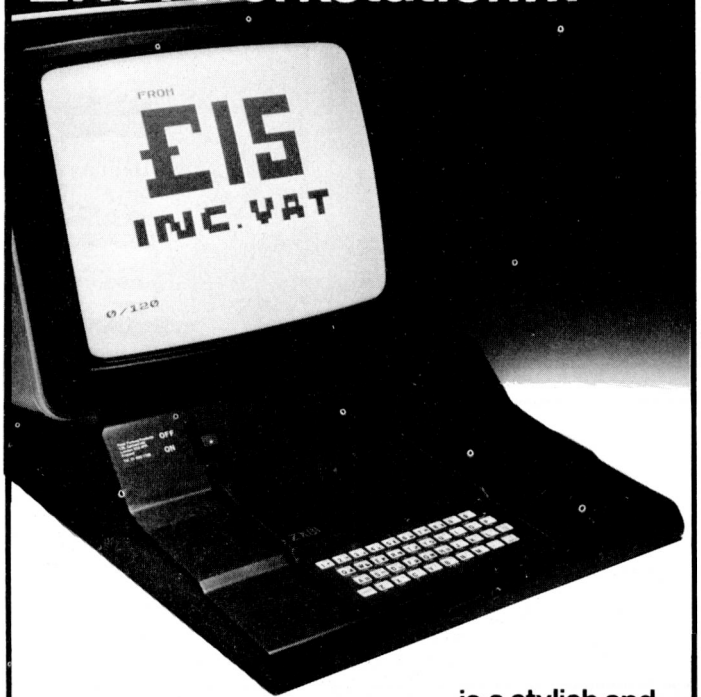


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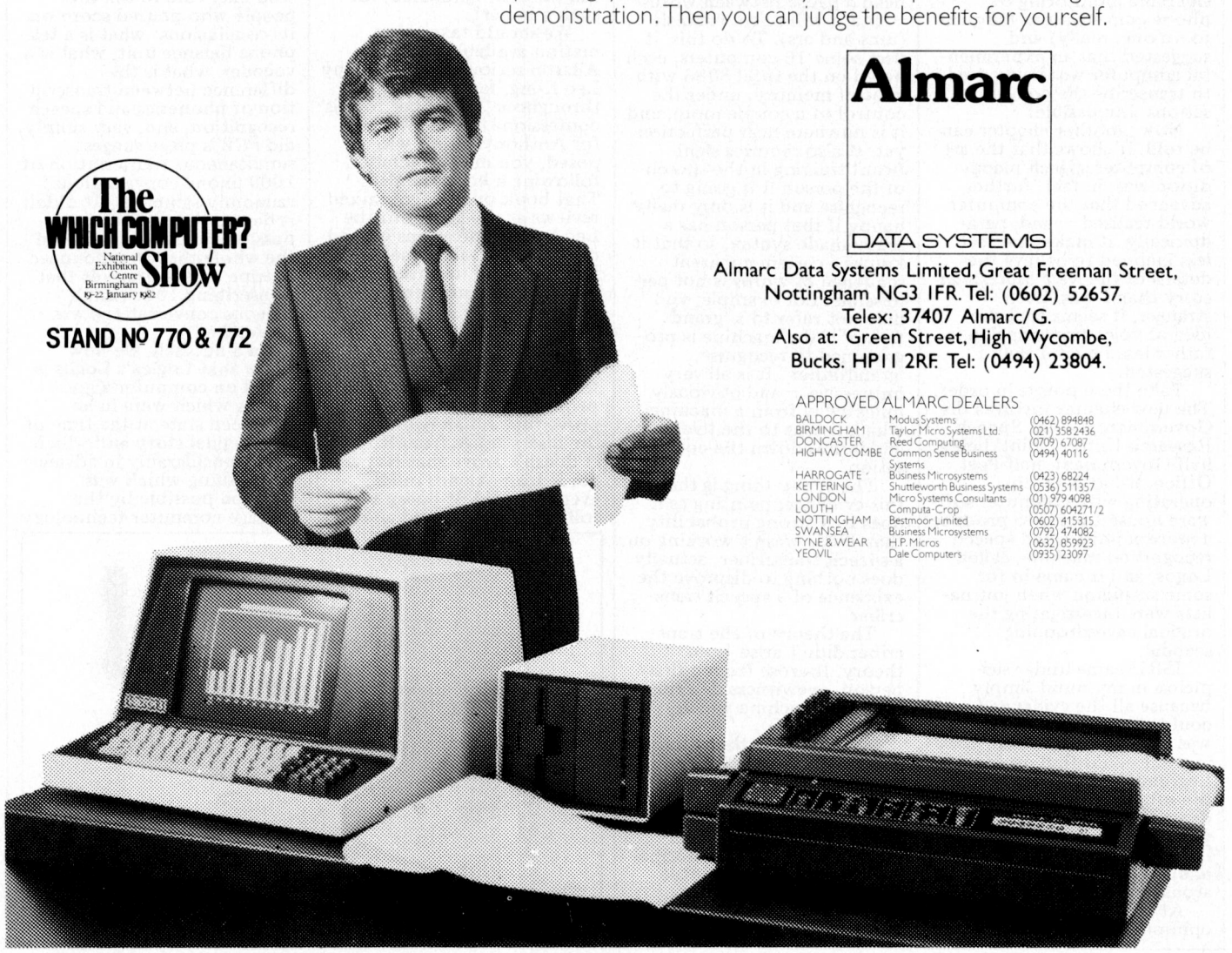

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# NEWSPRINT

## Compiled by Guy Kewney, editor of Datalink.

# Are you listening, Buzby?

Government eavesdroppers were using computers (it was said a year or so ago) to monitor telephone conversations. It is now universally accepted that I was wrong to pass on this report as a serious possibility. It is also accepted as equally obvious that I must have been daft as a brush to consider it.

At the time of the scandal, it was known in the computer world that computers could understand small bits of speech but with incredible limitations. The story put out in *New Statesman* went a lot further: it spoke of considerable monitoring of phone conversations (surprise to no one, really) and suggested that an experimental computer was being used to transcribe the conversations. Impossible!

Now, another chapter can be told. It shows that the art of computer speech recognition was, in fact, further advanced that the computer world realised — and, paradoxically, it makes me feel less inclined to believe the details of the *New Statesman* story than I was. Even stranger, it seems that the idea of voice transcription is rather less fanciful than I suggested.

Take these points in order. The new chapter involves the Government's Joint Speech Research Unit — 'joint' being half-Government, half-Post Office. It has been co-operating with computer software house Logica to produce a more sophisticated speech recognition machine, called Logos, and it came in for some suspicion when journalists were investigating the original eavesdropping scandal.

JSRU came under suspicion in my mind simply because all the evidence I could get indicated that it was doing sophisticated work — and I could find no trace of Learned Papers published on the subject. One possible deduction was that its work was being classified — not, on its own, much of a probability, but enough to arouse initial curiosity.

At this stage, however, my opinions remained simple: that the most sophisticated speech recognition units I knew of would not be able to recognise the word 'five' if spoken in a different tone of voice from normal; that it needed a silence before and a silence after the word; and that microphone, place and speaker all had to be virtually identical.

What JSRU and Logica have now released is very detailed evidence that they were a lot more sophisticated in their abilities then than the computer industry realised. Logos, the new product (still not perfected), can recognise 200 to 2000 words. It doesn't need a pause between words — and it will reject rubbish (ums and ers). To do this, it uses some 16 computers, each based on the Intel 8086 with a lot of memory, under the control of a couple more, and it is nowhere near perfection yet. It also requires significant training in the speech of the person it is going to recognise and it is only really happy if that person has a ready-made syntax, so that it knows a certain apparent sequence of words is not permissible. For example, you may not refer to a 'grand father' if the machine is programmed to recognise 'grandfather'. It is all very impressive — and obviously miles away from a machine which listens to the telephone and writes down the conversation.

The funny thing is that this evidence, pointing as it does to a strong probability that JSRU wasn't working on a speech transcriber, actually does nothing to disprove the existence of a speech transcriber.

The theory of the transcriber didn't arise from theory. It arose from a first-person, eyewitness description of a machine which existed.

According to the witness, the machine was attached to tape recorders which phone-monitoring services are known to use. It stored speech in some computer-readable form, not in normal audio form, and it printed out, said this source, a phonetic approximation. Furthermore, he said, it wasn't very good: only 30 per cent of what it was fed could be turned into intelligible printout and even that wasn't instantly recognisable as speech, because it was very difficult even for a trained reader to interpret the phonetic conventions.

Since those days, word has leaked out of official circles to Julian Allason, formerly director of PET software house Petsoft and now proprietor of a fun-to-read micro magazine called *Printout*, that this was an understandable error. What *really* happened, *Printout* recently told us, is that the voice was digitised (not much of a trick, any codec can do it) and the digits stored on a disk. Some silly ignoramus, we should deduce from this, thought that the computer was actually interpreting the speech! How silly of him, and how gullible of the press to fall (in their ignorance) for such a boner!

We should take information available to Julian Allason seriously. Former spy Leo Long, famous throughout November for his confessions that he worked for Anthony Blunt, was exposed, you may remember, following a book on MI5. That book on MI5 got mixed reviews at the time, but the Leo Long confessions proved that it wasn't all horse-feathers. And its author, Nigel West, is not really called Nigel West. He is, in private life, Rupert Allason — Julian Allason's brother.

Now I know perfectly well that this relationship doesn't prive anything. It doesn't prove that Julian heard about the disk storage from Rupert. It doesn't prove that Rupert got it from friends in MI5, even if he did. It doesn't follow, even if he did and they did, that his friends knew what was going on and, if they did, it doesn't follow that they were being honest.

All that apart, there is some indication, behind all the possibilities and doubts, that there is some kind of digitisation of voice inside a building in Ebury Bridge Road. And there is the old, unbelieved but still undisproved, report that somebody in there was trying to transcribe speech automatically.

The *PCW* piece which suggested this was a possibility was not written in ignorance, despite the patronising platitudes that rival computer writers produced in response. It started from a simple assumption: that somebody was trying to transcribe speech. And it set out a few possible conclusions, deduced from some detailed research, both here and in America. You may care to ask the people who poured scorn on its conclusions: what is a telephone balance unit, what is a vocoder, what is the difference between transcription of phonetics and speech recognition, and, very simply, did *PCW*'s piece suggest simultaneous transcription of 1000 phone conversations, randomly sampled? (It didn't, it denied the merest possibility, but I have heard the whole theory denounced as tripe on the grounds that transcribing 1000 simultaneous conversations was far-fetched.)

In a nutshell, we now know that Logica's Logos is based on computer algorithms which were in an advanced state at the time of the original story and which were considerably in advance of anything which was believed possible by the average computer technology



*'They may not be able to read and write but they certainly know how to push buttons by the time the leave here.'*

writer. We also knew that this is a project which is attempting a very much more difficult job than transcription — it is trying to understand speech, detect 2000 specific English words and to screen everything else out.

A transcription unit has its own problems. In the end, however, it is an attempt to ensure that a hissing sound made by a voice gets represented by the letter F or S or SH. . . and so on. It relies on human intelligence to scan the scribble and turn it into words.

And I must admit that if I were to start a research project on such a device the first thing I would arrange would be to digitise the speech, and store it on a disk. . .

## ACT peddles new Sirius

Chuck Peddle is the man who designed the 6502 processor. Having done that, he went on to design a whole system to wrap around it and started the personal computer industry with the result - the PET.

Now Chuck - no longer with Commodore — has designed another computer which could have an even bigger impact than the PET, although in a different way. Called the Sirius 1 (I'm sure that's a deliberate pun), it will be marketed in this country from January by software house ACT.

The PET was an instant success because it was the first true personal computer; it had an integral screen, keyboard and (in those days) cassette deck, and was small enough to fit on your desk or lounge table. There were no trailing wires or exposed boards and, when you switched it on, there was a proper easy-to-learn Basic complete with graphics and ready to go. There was nothing around to match it. Other companies, sensing there was a fortune to be made with similar products, leapt onto the micro bandwagon and made fortunes; the personal computer industry was launched.

The PET, Apple, Tandy and other machines of that ilk were what Chuck calls 'first generation micros'. Later came the second generation, offering more sophistication and user-friendliness, backed up by a mushrooming software industry which provided some really useful systems and applications packages. But these machines were all based around eight-bit micros while, for the third generation machines, you need 16 bits, asserts Chuck. And his new Sirius happens to fit his definition of a third generation machine quite closely.

It's certainly a very nice micro. It's based around the 8088 processor, which is a 16-bit engine internally, but looks like an eight-bit machine to the rest of the system. It's the one chosen by IBM for its Personal Computer and one which will also be appearing in a couple of major Japanese machines due out soon. The appeal of the 8088, though, isn't just its processing power; it's software compatible with the 8086, a true 16-bit processor, which looks certain to take a very hefty chunk of the 16-bit micro market in the near future. The software compatibility means that Sirius and IBM software can be moved on to the '86-based micros with no trouble at all when the time comes to upgrade.

The 'basic' Sirius comes with 128 kbytes of RAM and twin 5¼in disks holding 600 kbytes each — per side. Currently only single-sided drives will be available, but double-sided are on their way, giving 2.4 Mbytes of online disk storage on mini-floppies. This very high capacity is achieved by, among other things, varying the disks' rotational speed according to which track the heads are reading.

The 128k RAM can be expanded to half a megabyte inside the Sirius, and there's an expansion box on the way to take the RAM total to over 1 Mbyte. And a 10 Mbyte hard disk will be available to replace one of the floppies.

There's more, though: the screen has a standard 80 by 25 lines display but, like *everything else* on the machine, is under software control. You can have several different character sets in memory at the same time and you can define your own. Graphics are truly high resolution at 800 by 400 pixels and there's a hefty list of fancy things you can do with the screen. There are two RS232 ports, 8-bit parallel and an IEEE-488 port, and there's even a Codec audio controller with loudspeaker which allows you to use disk-stored, digitised speech as prompts instead of flashing messages on the screen.

The Sirius runs CP/M-86, which is available for the IBM PC (Chuck describes the Sirius as 'upwards compatible' to the IBM) and, with Digital Research cranking out packages like XLT-86 (which translates 8080 source code into optimised 8088/8086 code), there will be no shortage of applications packages to run. Already available for launch time will be ACT's own Pulsar integrated accounting package, together with Micromodeller and Wordstar and its support packages. Microsoft Basic comes with the machine and you can also buy Cobol, Pascal, Fortran and an assembler.

You may have noticed that I haven't mentioned a price. Well, it's an incredible £2349 for the 128k model, which will really put the cat among the pigeons as it's bang in the middle of the most hotly contested area of 8-bit business machines. More from ACT on 021-501 2284.

*Peter Rodwell*



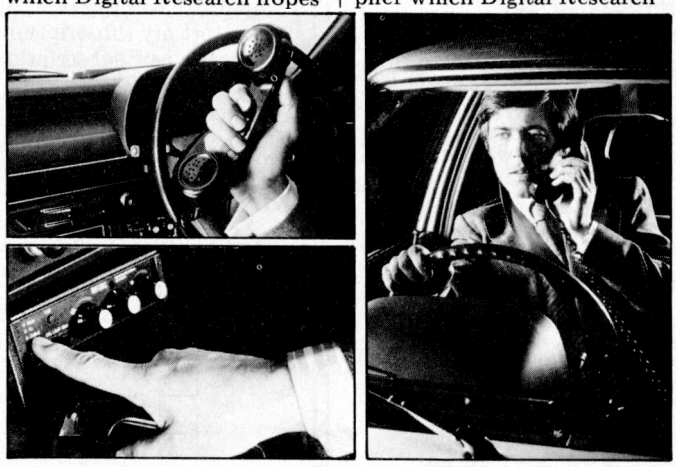
*The ACT Sirius 1*

## Which PL/I?

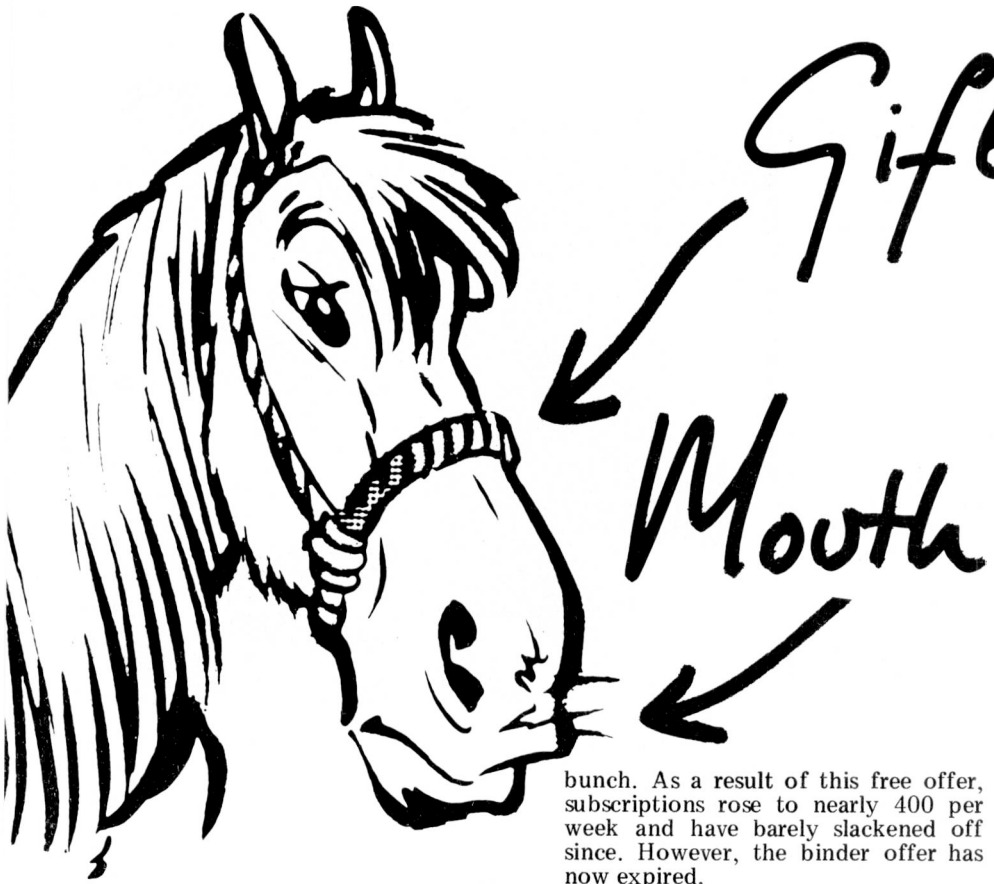
At least two CP/M-based micros in the UK are now available with the PL/I programming language. It has been implemented on the Altos system (single- and multi-user) and on the Rair Black Box. Both are Digital Research compilers, which don't produce code from all the words that PL/I normally accepts. Instead, they will accept words in Subset G, which Digital Research hopes will be accepted by the American National Standards Institute. Rair describes this as 'including all necessary features of PL/I while eliminating useless and redundant forms, to provide a compact and efficient language implementation'.

However trivial it may be, it is worth noting that at the time Digital Research and Rair were claiming that this language was Subset G, my sources inside the British Computer Society specialist group on the language were insisting that there would almost certainly be changes to its specification. My own money lies on Digital Research: if it has produced PL/I-80, then that will become the standard, whatever the ANSI committee thinks.

In either event, the language could be important, since it seems certain that PL/I-80 programs written under CP/M will run easily if fed into the PL/I-86 compiler which Digital Research



*These pictures give me a horrible vision of a future where we no longer have nice, carpeted offices but live in our cars. They show the new Air Call (£75 per month, £27 to install) car phone, which Air Call says will put you in touch with anybody, anywhere in the country, allowing you to virtually run your business from the vehicle. Plug an Osborne into the cigarette lighter and you can spend so much time behind the wheel that your legs will probably fall off. It remains to be seen if you can connect a computer to the system — when I find out, I'll tell you.*




# SUBSCRIBE TO PCW

Regular readers of this magazine will know that a small tableau has been enacted on this page in the past few months.

*PCW*'s subscriptions are a major source of income for our publisher and in a wayward attempt to increase them he recently ran a revolting shot of a person with an exploding head. As a result of this gross advertisement (which increased our subscription rate from approximately 140 per week to 170 per week) he was forced by the editorial staff to offer a free gift to all full paying subscribers. This gift was a free binder costing approximately £3.25 under normal circumstances.

You may be interested to learn that our readers are as greedy as the next bunch. As a result of this free offer, subscriptions rose to nearly 400 per week and have barely slackened off since. However, the binder offer has now expired.

Now, 400 subscribers per week would, if the rate were kept up, give us 20,000 subscriptions per year approximately, compared with our recent total of around 7,000 per year. . . itself an increase of over 100 per cent from the same time last year. (We hope the publishers of rival magazines are taking notes on all this.)

Therefore, we have decided to offer new or renewal subscribers a new incentive. We won't bother with all the usual blurb about how *PCW* is Britain's largest selling microcomputing magazine, the key to your future, the one that brings you genuine scoops, the most authoritative Benchtests, news and features. We assume you know this already. But we will send a £5.00 gift voucher to every person subscribing (whether a new subscription, a renewal or a renewal in advance) who encloses full payment with their order. This £5.00 voucher is redeemable as a part of a purchase at any branch of MICROCOMPUTERS AT LASKYS who used to trade under the company name of MICRODIGITAL. A full list of its branches is to be found in the panel containing the rules governing the use of this voucher. This offer will close next issue but we have printed only a limited number of these vouchers (2,500 to be exact) and it's first come, first served!

We are also happy to tell you that you can pay for your subscription using a cheque, postal order, cash in a registered envelope, or your ACCESS, BARCLAYCARD or AMERICAN EXPRESS card. Use the coupon below or the subscription card stuffed somewhere in the magazine which has probably already fallen onto your lap. You must include your remittance if you wish to receive your £5.00 gift voucher (use of a credit card counts as 'remittance included', of course). Read the panel governing the use of the voucher with any handy magnifying glass. *PERSONAL COMPUTER WORLD* would only offer you a genuine gifthorse, but it costs nothing to check out its mouth. And, while we're on the subject of gifthorses, you don't even need to put a stamp on your envelope.

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is producing for the Intel 8086 chip — the one inside the Future Technology microsystem, and compatible with the one inside IBM's micro. In other words, people with Rair and Altos (and any other CP/M machine with an implementation of PL/I-80) can start developing programs for the IBM machine, in the knowledge that only a little refining and polishing will be needed to get them to run. You should also notice that although Digital Research boss Gary Kildall wrote Intel's language, PL/M, it has virtually no compatibility with PL/I-80 or -86.

## Laskys expand micro business

Carefully and cautiously, hi-fi chain Laskys is expanding in the microcomputer world, with the six Microdigital shops it took over and absorbed now being renamed. From now on, Microdigital disappears as a name and instead there will be departments called Microcomputers at Laskys. Four more departments will be open before the end of 1981 and two more, in Kingston and Nottingham, will start up early in 1982.

It is interesting to note that, although Laskys is Europe's biggest hi-fi chain, it in no way resembles the American market leader, Radio Shack, which actually manufactures its own brands and was therefore able to launch a single (TRS-80) brand computer straight into the number one slot. That slot was lost because the machine was replaced by the Model III when the Model I was abruptly withdrawn from the US market because it transmitted too much radio interference for US authorities. Laskys may not have that ability to dominate the market, but the other side of the coin is that Laskys can't lose it all overnight, either.

## VIC music

There should be no serious doubts about the cheap Commodore colour computer, the VIC, despite the justifiable rage of retailers who ran expensive ads proclaiming 'IT'S HERE' only to find it wasn't and their customers had to be sold Acorn Atoms instead. It will be here — and software for it is already on the shelves from independent suppliers.

Most interesting package so far is a music writer from American software firm Abacus Software in Michigan. VIC Piper takes the nasty number POKEing out of writing tunes and replaces it with simple instructions: you enter notes as: A F♯ C G D and so on. This package costs $25 in America, $30 overseas.

The company has also released a language for writing games programs on the VIC (the package includes nine full-length programs already written), again to eliminate the colour PEEKing and POKEing. This costs $35 in the USA, $40 foreign. All Abacus software for the VIC comes on cassette or disk but presumably if it sells well Commodore will produce a plug-in cartridge one day.

Details on (616) 241 5510.



*Exercises to improve the bustline? No, merely an attempt to make a Dysan disk pack look photogenic so that we will mention that HAL Computers now sells Dysan media from Farnborough. Why the running shorts, you may ask? Why, indeed? Next time, HAL, send a nice, amusing, non-sexist shot of your sales team (holding disk packs if you want to show the range) so that we can recognise faces at the next exhibition and then we'll print your phone number.*

## Apples in the home

Nobody should be deceived by my comments to the effect that the Apple II is obsolete into thinking that it is going to fade away. The product will be effectively replaced sometime in late 1982 (my guess) by the Apple V but, even then, Apple II sales will continue and, what is more, will increase.

Apart from the fact that a great many machines will be sold as follow-ups or add-ons, Apple has still to bring out a potentially long list of life-extending marketing ideas and so, too, will its dealers. Latest example (still US-only, but no doubt soon to appear here) is a Family Pack, plug-in-and-run, with hard- and software bundled up into a domestic system. There will be more.

Software included in the $2500 package includes Apple Writer, Personal Filing System, Personal Finance Manager, Typing Tutor, Apple Invaders, Olympic Decathlon (the most impressive, probably, to the average buyer), Apple Adventure and 'a new keyboard tutorial, a friendly program which acquaints the user with the computer and its use'. Manuals included in the bag provide not only guidance to usage but also an educational software directory. My only real reservation is the inclusion of Apple Writer, which is truly horrible: I'd much rather see the 80-column card as a standard item in the pack. Perhaps Apple Writer is the way to sell the card? It certainly shows up the normal display! (Yes, I know: it's better than no word processor at all.)

## MP/M first

A large number of American suppliers of programming languages have endorsed Digital Research's decision to produce a second version of MP/M, its multi-user micro operating system. In this country, first off the mark to make the product actually available is Comart, which has announced it on the Communicator. This, it thinks, is the first UK implementation and certainly I haven't heard of another.

MP/M II should allow users to load and run all their old CP/M 1.4-based programs, and also its version 2.2 software. Comart has also made sure that its implementation understands the difference between floppy and hard disks, both 5in and 8in. Limitations of the system suggested by Comart are that only two users should use it together on the CP100 or CP200 Communicator models, while four can use the CP500 or hard disk HD200 models. This is worth writing down, because it's a fair bet that other MP/M II suppliers will be far more (unrealistically) optimistic about how many users they can load up, when they get around to announcing the product. Details on 0480 215005. Comart, incidentally, took me to task for not making it clear the other month that the North Star Advantage, which it imports, is competing against Superbrain-type computers, not against its own Communicator.

## Early notice

First time in ages, someone has told me of a conference — Viewdata '82 — in time for me to get it into print. This one is next October, at the Wembley Conference Centre, and it is true that I don't normally need quite that much notice. But it is nice to get it! Details from Online on (09274) 2811.

## Backward Telecom

You may hear it said that the new British Telecom is not the backward, obstructive organisation it was in the bad old monopoly days. If you hear this said, contradict it on my say-so.

In the same week that I discovered something fascinating about the new dial-tone that System X will bring (that it is the same frequency as a commonly used modem carrier signal), I tried to set up a link, using the Osborne 1 which is on review at my office, to an American database called The Source.

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If so, PET, the Commodore microcomputer, is the natural choice. It has a range of memories from 16K to 96K, full size typewriter keyboard and integral display that gives upper and lower case plus graphics, with ease of connection to a full range of peripherals including printers and floppy disk drives. There is also an enormous library of software which includes everything from the sciences and education to business applications – as well as fun and games. All that you'd expect from a company that has been in electronics for over 20 years.

It's very simple to use and should you need any assistance or advice there's the reliable back-up of our nationwide dealer network. There's bound to be one near you so you can be confident that help will never be far away.

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The Source is in America. Transmissions to America, even at the cheap rates possible with the International Packet Switching network, cost less if you can speed them up, so naturally I wanted to use a fast (1200 bits per second) modem to send the messages. No problem technically: the Osborne transmits down its RS232 link at 1200 baud, and plugs straight into a 1200 bps modem. 'No, you can't do it,' said Telecom.

Why not? 'We've never heard of the Osborne, and it isn't approved for connection to the network.'

The Osborne, like any other microcomputer, is not going to suddenly go berserk and boost its five-volt power supply to 500 volts, plug this into the RS232 port, and electrocute some hapless Telecom engineer in one of those candy-stripe tents by the roadside. Telecom knows this perfectly well because, even if the computer tried to, the modem is approved and has been proved to be a reliable barrier to several times the voltage. There is a PO-specified barrier inside it.

Apart from the sheer stupidity of this, and the fact that it does rankle to be charged the extra involved in using an acoustic coupler (which will inevitably increase the amount of faulty data and slow things down four times), there is the sheer shame of having to explain to one's American contacts that the British 'Authority' on telecommunications has 'never heard of the Osborne', which was announced nine months ago as the first micro to have a modem socket on it and which has been the subject of considerable attention and controversy ever since. It is as pitful a statement as it would be if the secretary of the MCC claimed never to have heard of Ian Botham. If it isn't Telecom's job to hear of things which could earn enormous revenue and expand the communications business, what is it there for?

The answer is, 'to make sure there isn't chaos'. To make sure that bone-headed private enterprise doesn't do something that could foul up the whole network. To act as a watchdog, to set standards — for example, to make sure that nobody (say) introduces a new dialling tone which cannot be distinguished from a modem carrier signal.

The really fascinating bit about this saga is that BT was, according to its own pathetic standards, trying to be helpful. It was a publicity stunt, designed to involve BT's packet-switching service in the first known attempt to get hot news from a reporter in Vegas to a newspaper in London. I recall a trade rag once commenting that Telecom was addicted to sawing off the branch on which it sat (that was the occasion it installed a demonstration Prestel set in the British Library despite the Library's reluctance, then cut off the phone for non-payment of rental) but it isn't often quite so keen to call in the bright lights, cameras and microphones before bringing the branch down with dynamite.

I'm sorry I lost my temper there. I feel better now.

## Brewer's scoop

Our old friend Michael Brewer, managing director of Microsense, is now our *rich* friend Michael Brewer, managing director of Apple UK. His successful (£15 million turnover in 12 months up to 30 September) Apple distribution outfit has been taken over by its supplier 'for an undisclosed amount of cash', and is now an expanding European operation with all its production based in Cork, Eire.

## Prestel prize

The title of 'Most Entertaining Database' on Prestel went to Mills and Allen, an advertising group specialising in Prestel, in last year's 'Pressy' awards. This is supposed to be the Viewdata Industry's version of the Emmy or the Oscar. The prize, which was also awarded to the *Birmingham Post and Mail* (most informative) and GEC (best graphics) was — wait for it — a bronze keypad.

Wot, no gold turkeys?

## Upgrade

Replace the old 6800 board in your SEED or SWTPC computer with a 6809 board, supplied by Windrush. It has a 2 kbyte system monitor ('provides all the usual features'), memory manager which can access 16 pages of 64 kbytes (one megabyte in all), a real time clock and automatic interrupt timer. Price on application on (06924) 5189.

## Rising software

American software expert David Ferris reckons that the Japanese are soon going to start selling software packages.

Ferris and an associate by the name of Karl Drexhage have just helped Hitachi launch 'the first Japanese-developed software package to be announced in the US' through agent Syncsort of New Jersey.

Normally it is regarded as axiomatic that the Japanese will (eventually) wipe out American and European hardware manufacturers by producing cheaper computers that are more reliable than the competition — the way Japanese motorbikes, cars, radios and televisions have upstaged Western products. It is also generally thought unlikely that the Japanese software industry will move fast enough to catch up; this theory, says Ferris, is false.

He notes that Japanese software producers don't have it all their own way: 'Japanese vendors, like Europeans, have a native environment less conducive to the development of strong software package vendors than the US' (a reference to the fact that there are fewer users, and also to the fact that computers like to be programmed in English-like languages). 'But the facts are that the would-be exporter in Japan has substantial amounts of money available from a variety of sources to ease the pain of distribution abroad.'

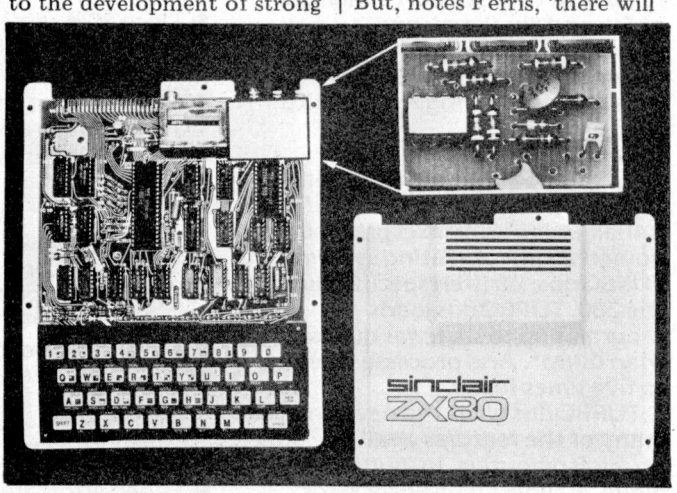
This Hitachi deal is not for micro software: SYDOC is a package to help Cobol programmers on big IBM computers in their tedious job of producing documentation. But, notes Ferris, 'there will



*There has never been any secret about my opinion of the price of Micromodeller but the question of whether it was really worth the money has been answered by this agent, Planning Consultancy Ltd. Graham Summers (one of the people shaking hands here) of Planning Consultancy said: 'I have been installing financial modelling systems for nearly ten years, and I have never seen anything like Micromodeller on a small computer. The reason blue chip companies buy Micromodeller from U is that it provides just the facilities they expect, but at dramatically reduced cost.'*

*Mind you, he wasn't likely to be contradicted, was he? The man he is shaking hands with is the 1000th customer this year and, as a result, was presented with a free copy of the program. Still, if you can sell a thousand in a year, the price can't be all that much of a disincentive.*

*Details from ACT on 021-454 8585.*




*Welsh Sinclair addicts Gwynedd Computer Services have 'designed and implemented', so they claim, 'the definitive solution to the perennial Sinclair ZX80 cassette interfacing problem.' This pic shows where their little circuit fits into the white box, costing £9; and there is an installation and testing service which costs an extra £3. Details on (0248) 810748.*

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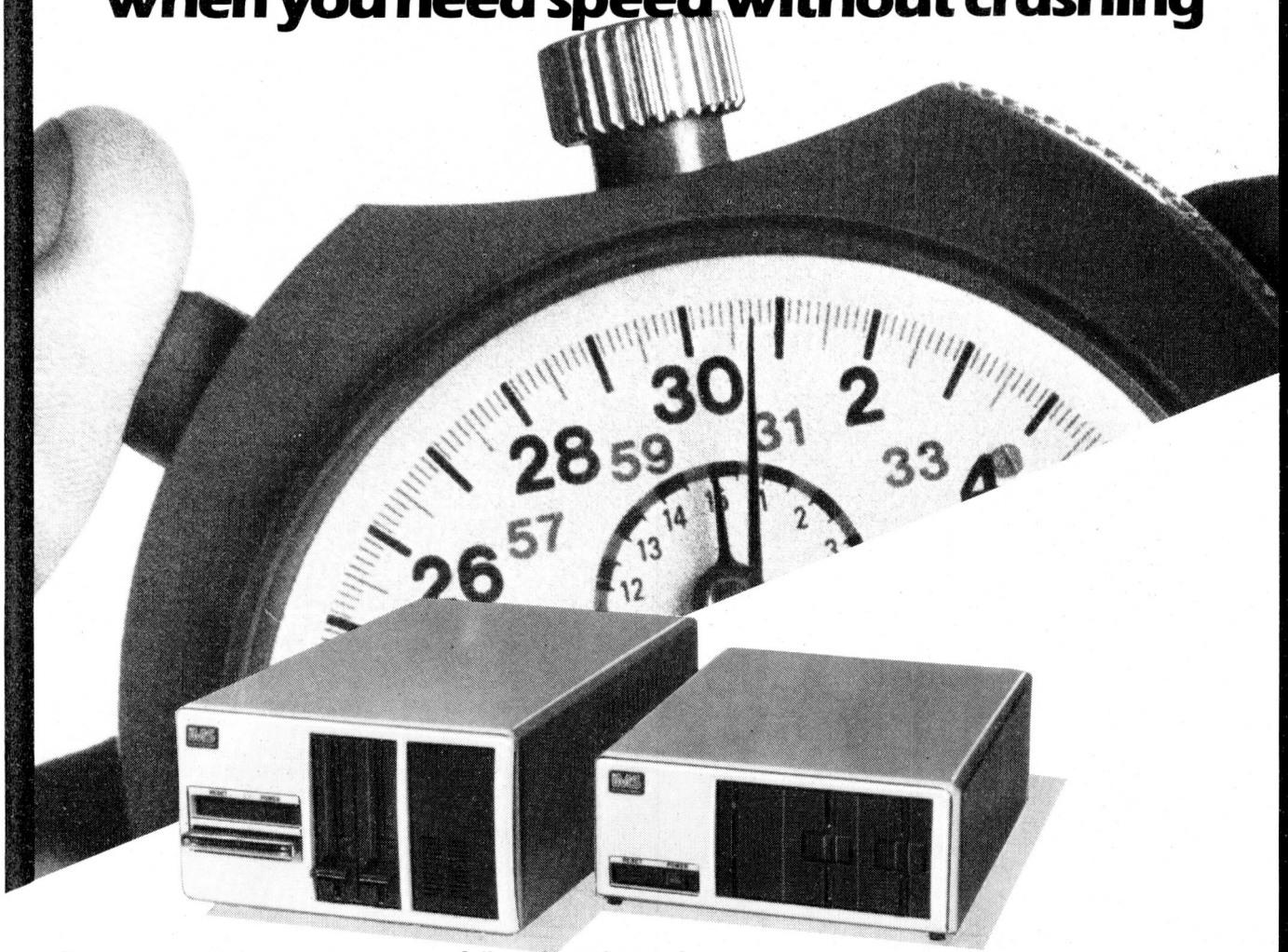


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*CP/M is a trademark of Digital Research

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be others'. And he added, 'The package software business still includes almost no micro package producers — but next year it will be different, and they will have to start waking up to the enormous growth possible in micros.'

## Slough micro courses

People who know nothing about micros should not, of course, buy them. It is quite feasible to become an expert first: evening workshops like the one held on Thursday evenings at Slough College of Higher Education can immerse the non-technical in an in-depth understanding very fast. At Slough, they now have more space on their workshops because they've expanded the facilities: organiser Dr Eva Huzan (a committee member of the British Computer Society's specialist group on micros) is also anxious to extend outside the Slough area by linking up with people elsewhere who are eager for knowledge. Details on (0753) 34585.

## Brown on brown

For some reason, human eyes find it easiest to look at amber-coloured letters on a brown background. This was discovered by DataSaab, the Swedish terminal maker, and it is again suggested by Datapoint, the American computer network builder. Datapoint has incorporated this brown-on-brown feature as part of its 8600 system, calling it merely one of many ergonomic extras designed to make the user's life easier.

From a computing point of view, there is little one can say to put the machine in context. Certainly it isn't small — and it isn't usual. It doesn't have CP/M, but it does run a multi-user operating system called Resource Management System (RMS) and it will compile Cobol programs if you have any.

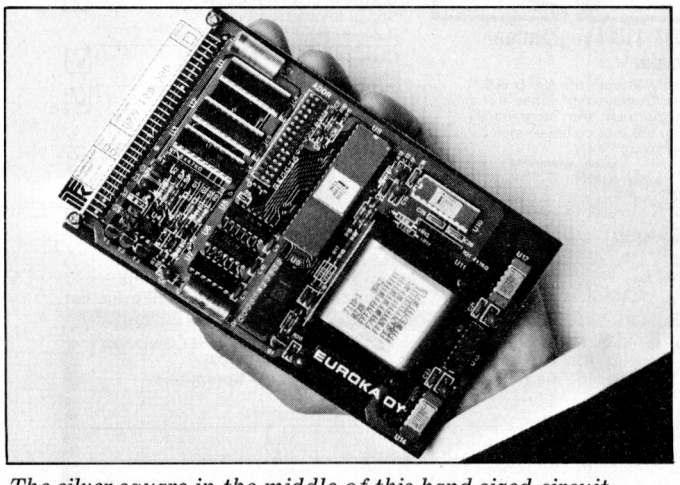
Better known than the computer is the Attached Resource Computer networking system which Datapoint introduced a couple of years back. It's a local net, a way of linking several machines together to share unique features such as printers, special processors and so on.

Anyone who does want a CP/M computer from Datapoint can always try the Datapoint 1550, for which Lifeboat Associates now supplies CP/M software, some 200 programs in all.

Details of the Lifeboat deal on 01-836 9028. Details of the new Datapoint ergonomic 8600 on 01-459 1222.

## Unix choice

If we want to run the Unix operating system, we now have a choice of machines. The Onyx we all know and have seen sold to Independent Television News, in place of a big Digital Equipment mini (VAX 780) which was originally planned. Now, Ithaca Intersystems has released its system, the DPS-8000, with an operating system called Coherent and this, too, is really Unix on a Zilog Z8002 processor. As of now, I can't say how similar the one is to the other and how easily programs can be moved from one to the other. I know that the 6809 machine from South West Technical Products has a very similar Unix-like operating system in Uniflex, and Cromemco has one called Cromix, but as long as these machines are all quite costly compared to Apples and Acorns, the problem of transferring software from one to the other won't affect many people. But if anyone would like to volunteer to enlighten me, I'd be pleased to hear. Ithaca is on 01-341 2447.




*The silver square in the middle of this hand-sized circuit card is not a display but a bubble memory unit. On this card, supplied through Hawke Cramer and by Euroka Oy, the bubbles are organised by a program in permanent memory on the card, and the program does all the hard work of finding the right bubble as it spins round and round inside the capsule, either detecting it or creating it — which makes the bubbles 'as easy to use as RAM memory' says Hawke. Details on 01-979 7799.*




*It has always puzzled me to find people buying one of the more expensive rack-and-cards type of microsystem and then spoiling the effect by adding the cheapest, grottiest display that cheap money can buy. So there is something fitting about this £525 Hazeltine Esprit terminal, available from Rair to complement its elegant Black Box micro. Details on 01-836 6921 — and don't spoil the chip for £100 worth of tar.*

## New portable

One of the most interesting new micros at Compec was a small machine sitting discreetly on a stand, keeping a very low profile.

The Attache, made by Otrona of Boulder, Colorado, is the neatest portable micro out yet. Although it won't be available here until the second quarter of '82, its designer Rene Teo was giving it an airing here to test people's initial reactions.

The obvious comparison, of course, must be made with the Osborne 1, now available, and the nearest thing you can get to a portable, grown-up system. The Attache, frankly, is a lot better in most respects. For a start, the tiny screen is perfectly legible, not only in its high resolution graphics mode but even when running Wordstar on an 80 by 24 display! There are twin floppy disks, each holding 180 kbytes, and it has a full-sized typewriter keyboard complete with a chart showing the Wordstar control keys. Not only is it considerably smaller than the Osborne (but there's no space to store disks as on the O1), but at 19½lb it's much lighter, despite its diecast metal case.

It runs CP/M, naturally, and comes with Wordstar-Plus, Basic-80, a chart-plotting utility and something called Valet, which lets you stop whatever you're doing to exchange messages with another computer, do a quick calculation or check a diary for meetings and appointments.

The 64k, Z80-based machine communicates through two serial ports, has a sound synthesiser and will have a range of options including a rechargeable battery pack, a DC power adaptor, 240 by 320 graphics and an accessory pouch.

There's a snag, though. It looks as though, by the time it becomes available here, the Attache will cost in the region of £2500. This means that, if you really need a portable that's truly portable and can afford the extra £1000, the Attache is the machine to go for - but many people will be willing to put up with the Osborne's greater size and weight and far less legible screen.

Details from Otrona on (303) 444 2274.

*Peter Rodwell*

## Connect-a-PET

Microconnection is a device invented for Commodore PETs to enable them to get in touch with each other using the phone lines. It was invented in America and will make money for an American firm because the sheer red tape involved in getting something like it approved here is beyond most small entrepreneurs. This particular modem includes the ability to dial numbers automatically, or answer the phone when data is coming in. So you can load and run a program from another phone, if necessary. Microconnection costs $249 from Micro-peripheral Corporation; details on (206) 881 7544.

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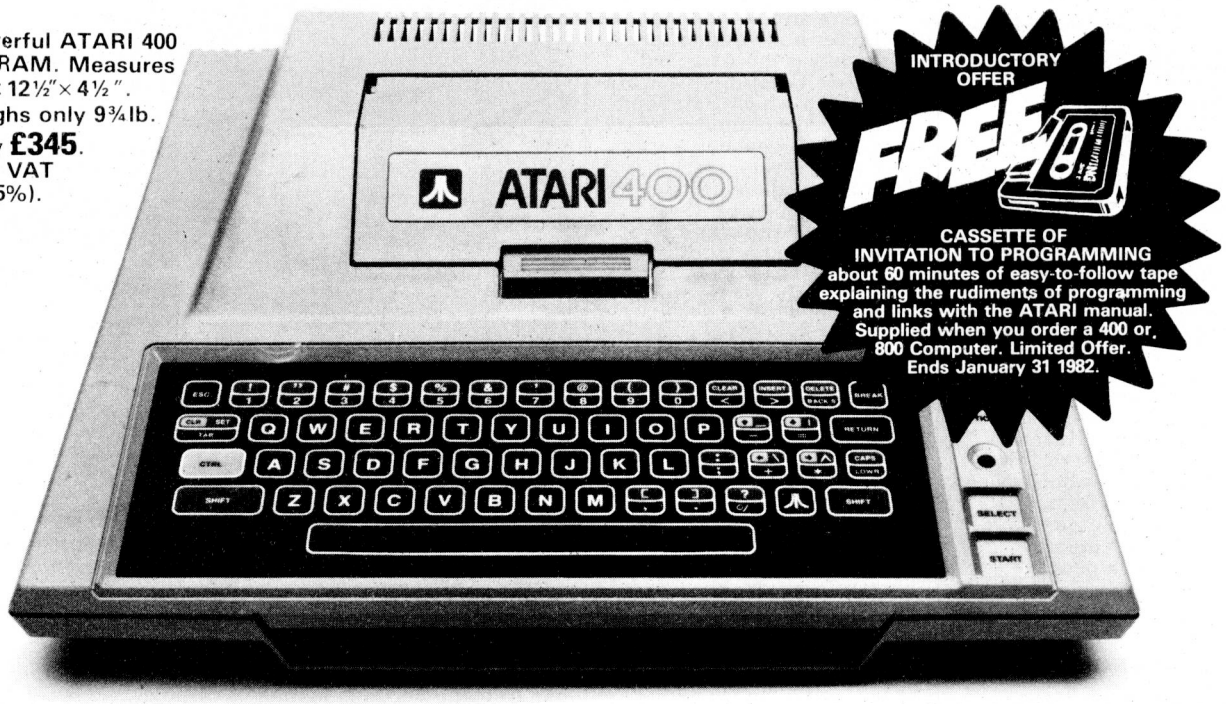


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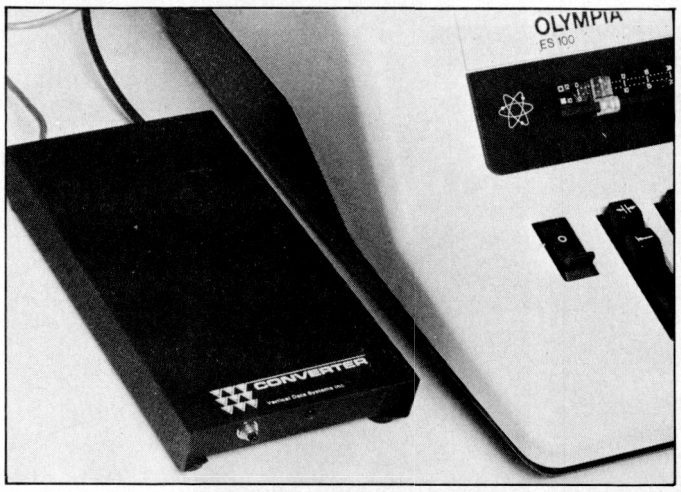
# NEWSPRINT




*Normally I'm very nervous about mentioning those clever devices which turn electric typewriters into printers. In my opinion, many of them run faster than the electric typewriter really ought to be pushed. This seems to be true whether they work by operating the levers under the typewriter or whether they have little electric fingers that plug over the board and push down the keys.*

*In the case of this little black box from Datarite Terminals, however, I feel a little happier — because the device is intended to convert the Olympia ES 100 electronic typewriter into a printer. This particular typewriter is built like a tank, and is also virtually identical to Olympia printers, apart from the interface which Datarite supplies, so it would be hard for Olympia to claim it was being pushed beyond its design speed.*

*Nonetheless, be warned — if you pay the £300-odd, the typewriter may not fall to bits the way old IBM golfballs can do if driven too fast, but it isn't really intended to be used for hours at a stretch, either. So don't feed continuous stationery through it. Details on 01-590 1155.*

## Star gazing

For the last four or five years, a professor of psychiatry has been investigating astrology at London University, we are told by GBS Software, a company which sells software for astrologers.

Director of this software distributor is Andrew Taylor, who is obviously aware that some people might regard astrology as a little unscientific because he sent us a really amusing press release about it, quoting the professor as one of several points illustrating how seriously the subject should be taken.

My own feeling (that I know why the professor is talking to astrologers and I think he'll get very interesting material) is further strengthened by the discovery that GBS has access to nearly 300 different programs for astrologers, all supplied by the US writers, a firm called Matrix Software, for which GBS is (yes, you guessed) sole distributor.

Details of Apple, Commodore, Atari, Tandy, Ohio, North Star and other programs on 01-404 5011 – and lie about your birthday.




*'I don't mind you collecting beer mats but I'm not having you collecting space invaders.'*

## Visimore

The formula behind the way the famous program Visicalc presented information to humans has been extended into subsequent Personal Software programs, the latest of which to be launched in this country (by ACT) is VisiFile.

VisiFile is a personal record-keeping program costing £160 and running on expanded Apple computers. Information kept in VisiFile can be transferred to other 'Visi' programs (even by phone, using VisiTerm), which should save the tedious chore of entering duplicate data into Visicalc or Visiplot — where entering the data to start with is easily the worst part of using them. Full details of the family of software from ACT on 021-454 8585.

## ZX81 programs

The *Giant ZX81 Program Book* is now being written. The people who hope to publish it want 500 programs, of which perhaps yours may be one, providing you don't need financial reward. 'The authors of all programs accepted would receive full credit, with prizes for the best programs as chosen by the book buyers — voting forms will be in each book,' notes M J Connolly, managing director of MJC (Publishing) on (024 03) 22769. Write to his London address for details: BCM Primal, London WC1C 6XX.

## LSI range

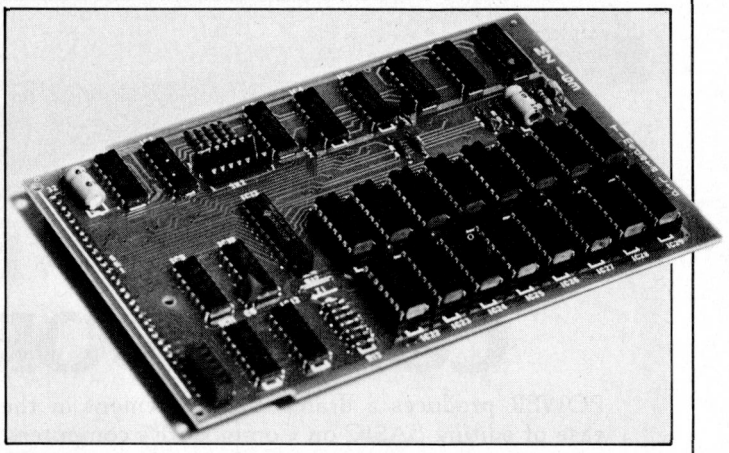
British personal micromaker LSI Computers just thought it would mention that its M-Three system 'now comes in seven different models catering for users requiring from 350 kbytes to 10 Mbytes of storage'.

The smallest model has a single disk drive and a nice display for the £2000-plus price. The largest is rather better value for money, at under £6000, but obviously this company isn't out to be bargain basement.

Details of the range on 04862 23411.

## Apple cards

Bill Unsworth's UK-built add-in cards for Apple have been extended. Most knew of his Pascal card: now there is an interval timer, an 80-column display board, a panel meter interface, an eight-port serial board and a slot extender

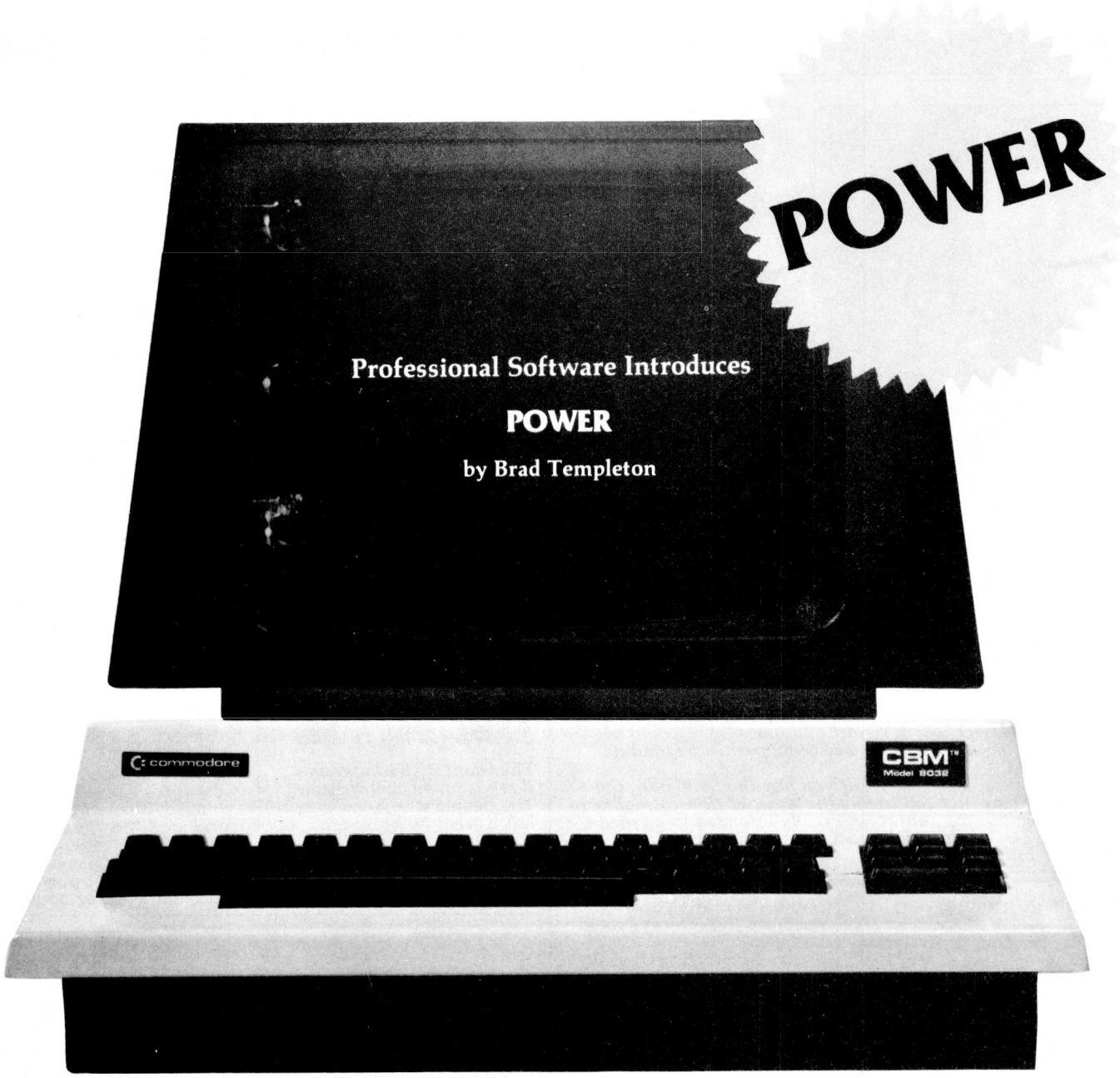


*Mike Lord, once king of the Amateur Computer Club, is now bound to become king of the Atom. He already produces the best book on the machine (*The Atom Magic Book *— and yes, Mike, I did know you wrote it) and has now given up his respectable career as a salaried worker inside Standard Telephones and Cables to start making add-on boards for that popular British micro.*

*Currently available are memory expansion boards. These are available in 16 kbyte and 32 kbyte versions, allowing the Atom's memory space to be extended to 28 kbytes or 38 kbytes, says Lord. It doesn't matter whether the Atom is already expanded or not, because the address of the add-on memory can start from any 1k boundary by adjusting the decode logic.*

*The boards can be fitted inside the Atom (at £60 or £74 respectively) or into your own rack with DIN 41612 connectors (£62 and £77 respectively) and those prices include not only VAT but also postage. Bare boards are available for the DIY enthusiast, as well as a DC/DC converter which will derive the required power from an unregulated 8 V DC source — such as the Atom mains adaptor.*

*Details from Timedata, 57 Swallowdale Road, Basildon (0268) 23234. Those numbers are also the ones to use for details of Timedata 'Magic' books, mentioned in this column earlier.*

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£49

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

POWER's special keyboard 'instant action' features and additional commands make up for, and go beyond the limitations of CBM BASIC. The added features include auto line numbering, tracing, single stepping through programs, line renumbering, and definition of keys as BASIC keywords. POWER even includes new "stick-on" keycap labels. The cursor movement keys are enhanced by the addition of auto-repeat and text searching functions are added to help ease program modification. Cursor UP and cursor DOWN produce **previous** and next lines of source code. COMPLETE BASIC program listings in memory can be displayed on the screen and scrolled in either direction. POWER is a must for every serious CBM user.

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board. The Z80 card and the memory extension cards are now being exported, he says, as is the serial interface card U-S232. Details of all these from Apple dealers, or from U-Microcomputers (0925) 54117.

## Vector goes west

A new agent for Vector Graphics machinery in the west of England: Dale Computer Systems of Princes St, Yeovil. It has been set up by former Regional Computer Services Officer for Yorkshire Health Authority, John Dale. Details on (0935) 72000.

## Win £1000

If you're into hardware design, Prestel and the ZX81, you could win yourself £1000 by designing a low-cost Prestel adaptor for the Sinclair.

The competition. sponsored by British Telecom, closes on 14 March, by which time you'll have had to have submitted a working prototype 'capable of being modified so as to receive approval for attachment to the telephone network'. The prize, says BT, will go to the designer 'of the ZX81 adaptor which combines best the elements of low price, elegant design and practical robustness.'

If you win, the design will remain your property. Of course, you'll still have to get the thing approved by British Telecom before you can market it — the £1000 should pay off some of the cost of the lengthy approval process.

More on 01-583 9811.

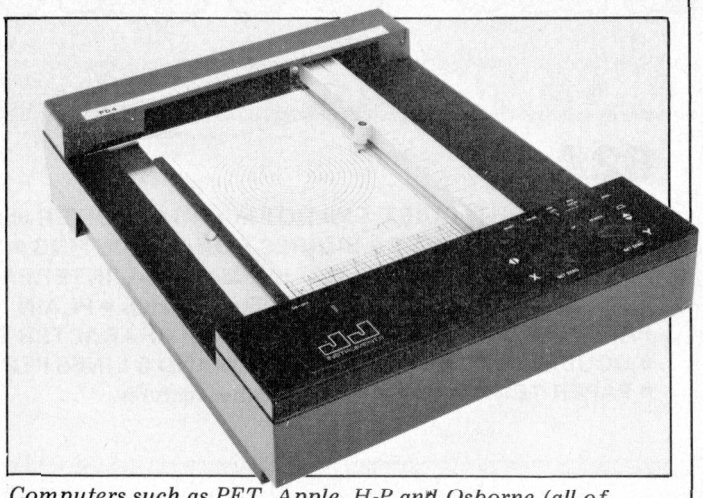
## Cache in your chips

If you are running a disk-based system with an 8080, 8085 or Z80 processor and find it too slow, read on.

For years now, the big boys in the DP industry have been using 'cache memory' to speed up disk accessing. A cache memory is a chunk of extra RAM which sits between disk drive and main RAM, together with clever software which vets your use of the disk and finds out which records you are accessing most often. It then stores these records in the cache RAM so that they are available in nanoseconds rather than seconds; which records are 'cached' can vary dynamically as your application dictates. This software is totally transparent to your own programs and doesn't require them to be modified.

Microcosm Research Ltd of Holborn has just announced a cache interface for microsystems which, it claims, will speed disk data transfers by from five to 500 times. It requires CP/M 2 or MP/M and the ability to accommodate bank switched extra memory (you supply the RAM). The software package costs £395, which could be cache (groan) well spent if yours is a time-critical application.

Details from Microcosm Research Ltd on 01-580 9792.



*Computers such as PET, Apple, H-P and Osborne (all of which use the universal IEEE-488 interface bus) can drive this digital plotter from J J Lloyd Instruments. The plotter costs £641 and the manufacturer also supplies a software package for PET users, to drive the machine. The program is in a read-only chip. Details on Locks Heath (048 95) 4221.*

## ZX81 standards

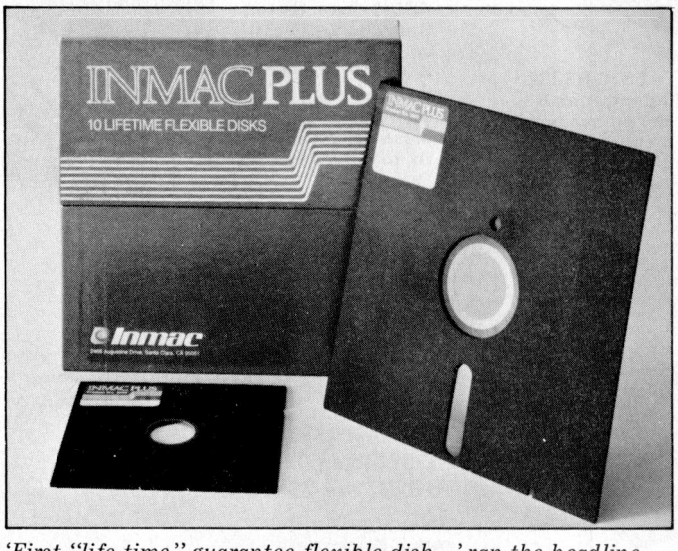
If you're thinking of designing an add-on for the ZX81, how do you know whether somebody else's add-on uses the same memory addresses, thus ensuring that it won't work with yours?

The answer is, of course, that short of buying every add-on available (and it's a rapidly expanding field), you can't know.

Nick Lambert of Quicksilva ('produces high-quality hardware/software for the ZX80 and ZX81') has this problem. And to solve it, he's suggesting that all '81 add-on manufacturers get together and agree a common memory map to ensure their products don't compete (for memory space, that is). This seems eminently sensible and I hope they do all agree — as quickly as possible, before there are too many in the game to make such a standard viable. Contact Lambert on Southampton 771248.

## Chess bulletin

Full details of the 2nd European Microcomputer Chess Championship — held at last September's *PCW* Show — are now available. The complete bulletin costs £10 inc p&p (£15 outside the UK) and is available from 1 January. Write, enclosing payment, to: Chess Offer, *PCW*, 14 Rathbone Place, London W1P 1DE.




*'First "life-time" guarantee flexible disk...' ran the headline to the press release accompanying this picture. Oh yes, I thought, whose lifetime — the disk's? Well, surprisingly, no: the disks, from Inmac and called Inmac Plus, are guaranteed 'to read and write to your satisfaction for as long as you own the product'. And if a disk fails, Inmac promises to replace it free, provided the damage doesn't arise from neglect or abuse. Either they're selling some really good disks or they've hit on a sure-fire way to go bust in double-quick time. Unfortunately, they didn't enclose a pack of disks for us to put their claims to the test, though. More on (09285) 67555* — PR

## UNIQUE £250 'JUST FOR THE HELL OF IT' COMPETITION!!!

£250 WORTH OF MICROCOMPUTING EQUIPMENT TO BE WON (PLUS 40 FREE TICKETS TO THE NEXT PERSONAL COMPUTER WORLD SHOW) IN A UNIQUE 'JUST FOR THE HELL OF IT' COMPETITION.

*PCW* offers readers the chance to win £250 worth of any microcomputing equipment currently available — just for the hell of it! Here's what you do. . .

Hidden within the editorial pages of the December Issue of *PCW* was a desperate message from our typesetter to Phoebe Cresswell-Evans, our Art Editor.

Find this message and print it on a postcard together with your name and address. Send it to *PCW* Just-for-the-hell-of-it Competition, 14 Rathbone Place, London W1P 1DE and the first correct entry to be taken out of the sack will win the sender £250 worth of microcomputing equipment. The winner will be able to choose any hardware or software available in the UK up to £250 and *PCW* will obtain it for him or her. The next 20 correct entries will win free tickets for two persons to the Fifth Personal Computer World Show to be held early September 1982 at the Barbican Centre, City of London.

Here's a hint. The message contains ten words and begins: 'Phoebe this. . . . .' You do *not* need a magnifying glass to read it. Send in as many postcards as you want. The draw will be conducted by *PCW*'s founder, Angelo Zgorelec, at the February monthly *PCW* editorial meeting, so entries must be in by Friday, February 12th. Good luck!

# The Printer People

## OKI MICROLINE

### 82A

SMALL, LIGHT, QUIET, 9X9 DOT MATRIX PRINTER with • TRUE DESCENDERS • BIDIRECTIONAL PRINTING • 120 CPS • 80/132 COLUMNS • GRAPHICS • DUAL INTERFACES • OPERATES WITH TRS-80, APPLE, and others • PLAIN PAPER - UP TO 4 PART • FULL 96 ASCII CHARACTER SET • DOUBLE WIDTH CHARACTERS • 6 AND 8 LINES PER IN. • PAPER TEAR BAR • And many other features.

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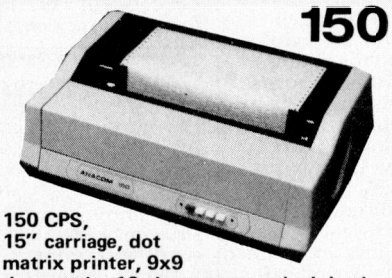
The unbelievable quality printer from the world's largest print head manufacturer. A whole stable of machines to suit a wide variety of applications: MX80/1, MX82, MX 80FT/1 & MX80 FT/New Type 2.

## ANACOM

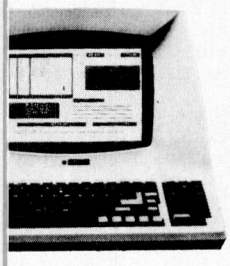
### 150



150 CPS, 15" carriage, dot matrix printer, 9x9 dot matrix, 10 characters per inch horizontal, 6 or 8 characters vertical, 136 cols.

## TVI

### 912/910/950



Fully intelligent terminals with 24x80 display & dual intensity, blinking, reversed, underlining and protect fields, 96 ASCII chrs etc.

## OKI

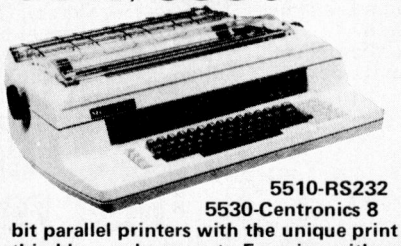
### 83A



Serial dot matrix printer with an impressive list of features including: 136 cols, 120 cps bidirectional, short line seeking,graphics,dual interfaces,96ASCII

## NEC

### 5510/5530



5510-RS232
5530-Centronics 8 bit parallel printers with the unique print thimble, produces up to 5 copies, with friction or tractor feed.at 55 chrs.per sec.

## HAZELTINE

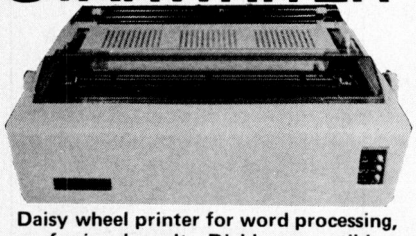
### ESPRIT

The Hazeltine Esprit is a buffered terminal capable of displaying the complete 128 ASCII character set. Based on a 12" diagonal non-glare CRT, the video is crisp and clear with each character presented on a large matrix to reduce eye fatigue.



## TEC

### STARWRITER



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## RICOH

### FLOWRITER



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# 'TOWN ON T.V.

## David Tebbutt brings you the latest update.

It's been a good month for ComputerTown. Three more have started up and we've been promised another early in the New Year. As, always, I'll tell you about the new 'Towns first.

Dorchester swung into action on 31 October and, having read about the Worcester lemmings, hardly mentioned the event beforehand. The result was that a healthy dozen or so people turned up, which bodes well for the future. Thinking back, I seem to remember Eastcote only managed about five people on its first night. Meetings are held every Saturday in the Dorchester Youth Centre (behind the museum). Chris Donaldson and Derek Moody are the people responsible for this initiative — well done, chaps.

R L Saunders wrote from Hemel Hempstead to tell me that he has launched the Hemel 'Town with the help of colleagues Ian Gibson and Gerry Browne. Thirty people and six computers turned up for the first event at The Arts Centre for Young People on 12 October. Another event was staged at the local library on Saturday, 3 October. Thanks to a lot of cooperation from the library staff, Mr Saunders and friends were able to run a public demonstration of microcomputers in action. If you'd like to join in the fun, I know that more volunteers and computers would be welcome.

Remember Mike Baker — the man who lives in Hanwell, used to run a ComputerTown in Acton but moved it to Southall? Well, he's done the decent thing and opened a ComputerTown in his home territory of Hanwell. Anyone needing further information can contact Mike at 5 Edinburgh Road. He's still running the Southall ComputerTown a as well.

Watch out for a ComputerTown starting soon in Southampton. The man to contact is Roger Shears of the Southampton Amateur Computer Club. You'll find him at 181 Woodmill Lane, Bitterne Park, Southampton, Hants SO2 4PY. The first event looks as if it will be something of a show, with local businesses sponsoring the hire of the local Guildhall, and the Mayor opening the proceedings.

Last month I promised to tell you what happened when CT Thanet popped into the local TV station. They trotted along to Southern ITV's Dover Studios and got themselves on 'Scene South East'. Unfortunately the TV session was on the same day as ComputerTown, so Len Randall and John Hislop kindly stepped in to keep things ticking over. Jon Finegold, one of the Thanet prime movers, has written a ZX81 feature demonstration program and would be happy to let *bona fide* ComputerTowns have a copy on receipt of a cassette tape and an appropriately stamped SAE. Peter Kiff, another Thanet organiser (is there no end to them?), saw a letter in the *Radio Times* from the 'Grapevine' people so he sent off a swift missive to tell them all about ComputerTown. I'll report developments as they occur.

London duly had its get-together, which was organised by Mike Baker. We welcomed the opportunity to swap views and exchange ideas. The newsletter idea was discussed, and the upshot was that Peter Rodwell is now expecting 'Towns to write to him at *PCW*, where he will put together the newsletter early next year. Production and distribution costs for the first issue will come from the central (small) ComputerTown funds. We'll probably include some sort of proposal for funding in the first issue. Newsy stuff is best sent to me for publication in 'ComputerTown News' each month. I think that the letter should contain more solid information derived from your experiences of running ComputerTowns. The letter is aimed primarily at people trying to run 'Towns and clearly anxious to benefit from the experience (good and bad) of others who may have trodden the same path before them. Keep that copy rolling in.

Newnes Technical Books sent me a bit of bumf on one of its new titles called *Questions and Answers on Personal Computing* by Peter Lafferty. Now I wouldn't normally mention this sort of thing except that, this time, the bumf quotes me as saying 'An excellent starting point for the newcomer'. I can't remember the book in detail but I would suggest it's worth a look.

We got ourselves a lovely mention in *Educational Media International* recently. In fact, it reproduced the ComputerTown Guidelines and added a very positive and encouraging editorial note. So often, CTUK! is criticised for its lack of formality. At last someone out there recognises that an approach which minimises the barriers to entry can be worthwhile. Particular emphasis was given to the 'discovery' approach adopted by most 'Towns.

Now for 'serious enquiries' time. These are people who I suspect are quite interested in setting up a ComputerTown in their own areas. Apart from Alan Belshaw I'll simply list the names and addresses so that if you'd like to help you can contact them direct. Alan gets a special mention because he kindly sent a donation to the ComputerTown central kitty with his letter. Here they are then:
Alan Belshaw, 5 Wyvern Way, Carlton, Poulton Le Fylde, Lancs FY6 7LR. Malcolm Osman, 18 Isis Close, Long Hanborough, Oxon OX7 2JN. Douglas Hunt, 1 Love Street, Kilwinning, Ayrshire KA13 7LQ. Gwyn Jones, 55 Stanley Avenue, Ealing Road, Wembley, Middlesex. Mr R Skinner, 62 Central Avenue, Billingham, Cleveland TS23 1LN. L Mulhall, Richmond Youth Club, Princes Road, Richmond, Surrey. Peter Deamer, 94 West Street, Stonehouse, Glos GL10 2NA. Allan J Lowe, Youth & Community Officer, Dudley Metropolitan Borough Education Services, 2 St James' Road, Dudley, West Midlands DY1 1JQ. Stephen Simpson, 15 Holmside Walk, Salters Lane Estate, Stockton, Cleveland.

Finally, here's a list of the other towns from which we've received enquiries this month: Winchmore Hill, Harlesden, Southward, Whetstone, Totnes, Cirencester, Newent, Carrickfergus, Leicester, Dublin and Eastbourne. So, if you are interested in starting a ComputerTown and you live in one of these areas, send an SAE and I will send you more information about these kindred spirits.

Thank you all for your splendid efforts. Keep up the good work and don't forget to write and tell me how you're getting on.

ComputerTown UK! is an ever-growing network of computer literacy centres, where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. ComputerTowns might be found anywhere: in a church hall, a library or maybe in a school after hours. The emphasis is on making computing enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL and remember to enclose a large SAE (A4 would be fine) for your reply. Please don't try to telephone *PCW* for information because this project is entirely a spare-time activity.

# COMMUNICATIONS

*PCW welcomes corespondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software – these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to:* **'Communications',** *Personal Computer World,* **14 Rathbone Place, London W1P 1DE.**

## Fortran overlays?

R D Redmen ('Computer Answers', October) and others might be interested to learn that a method for creating overlaid Fortran programs has been described in the following paper: A T Clemenston, 'Fitting a gallon into a pint pot! or creating overlaid programs under CP/M', *Journal of the Operational Research Society*, volume 32, number 4, pages 319-325.

As this is a relatively obscure journal, I would suggest enquiring at a university or college library, or asking a contact who works in an OR group. Failing that, the journal is distributed by Pergamon Press, Oxford.

**Steve Withers, Coventry**

## Peeking and lust

Sean Morgan ('Communications,' *PCW*, October 1981) intends to modify some of the keywords in his school's RML 380Z Basic interpreter. The keyword table can be found easily enough by PEEKing through the interpreter (in BASFG it starts at 5F9E), and changing as desired. I partially disassembled BASGF with a view to adding some keywords for radio-teletype and Morse transmission and reception (see my article in *PCW*, June 1981).

As I frequently type LUST instead of LIST, it occurred to me that nobody has yet written an obscene computer language. This might be useful for venting one's anger on software that won't work and might even find a market in Soho. . .

**George Sassoon, Isle of Mull**

## Microtan monotune

Here's a 'one liner' for the Microtan 65 that produces a tune through the cassette output and can be heard by listening through the earphone while the player is in the record mode.

```
1 A=49099
:POKEA,255
:POKEA—9,255
:POKE+3,0
:POKEA—6,2+RND(1)*12
:GOTO1
```

Owners of Acorn Atoms can try making the variable A=47115.

**Frank Woodcock, Redditch**

## 3 year warranty

I found the letter from Melvyn Franklin regarding the Tandy 90-day warranty of special interest. My husband and I have just purchased a personal computer. After a lot of debating and reading, we narrowed our choice down to three or four computers, one of which was the new Tandy Color but decided against this partly because of the 90-day warranty.

We did purchase an Atari 400 (also an American product) and found that not only did Ingersoll, who is marketing the Ataris, give a 12 month warranty, but that by buying from a local TV/hi-fi shop we were able to obtain an extended warranty of three years for an extra £40. This type of warranty, which is quite common on expensive electrical equipment, seems a worthwhile form of insurance.

Cynics may say the value of such a warranty depends on the firm and in many cases they would be right, but I feel that a local firm, from which I have bought good for many years, is more worthy of my trust than a mail-order firm chosen from an advertisement.

**DRC Wilson, Redcar**

## Brickbats....

You have in your magazine an advertiser who supplies RAM pack kits for various computers, namely Audio Computers, 87 Bournemouth Park Road, Southend on Sea.

I have had the misfortune of buying one of these RAM packs for my ZX81 in kit form. While the PCB looks good, my particular one was covered in various copper shorts under the green resist and this was only evident after I had assembled most of the kit.

To find the shorts, I had to disassemble the I/C sockets and various components, this being quite a job on this small PCB.

I have written to these people twice, but have had to date no response. The documentation supplied is poor and without any form of circuit diagram, so fault finding is difficult. It took a month to supply in the first place! If I have to return it, it may cost me as much as a fully assembled kit, so I might well have bought a fully assembled kit anyway.

However, I write to ask you if you have had any complaints about this company from other people for it seems rather a let-down to me.

There would appear to be no form of reddress if, say, the supplier chooses to completely ignore letters and telephone calls.

Can you help, or at least highlight this in your magazine?

**S F Wiltshire, Bournemouth**

## ... and bouquets

After considerable hassle trying to get my hands on hardware, software & computer publications for the past year, I have just had a very pleasant surprise.

I needed a 16k RAM extension from Audio Computers (*PCW* September) in a hurry. I was most impressed by their promptness, courtesy and helpfulness, and would like your readers to know of my experience.

**A C Barnes, Durham**

## Dongles v thingies

I have noticed over the past few months that the word 'dongle' has been appearing in many articles with reference to security systems for computer software.

Before the word abandons its inverted commas and formally enters the buss-word dictionary of computing, I would like to stake a claim as cooriginator of the term.

At a meeting held about 18 months ago in the development department of Analog Electronics of Coventry, Peter Dowson, author of Wordcraft 80, Graham Heggie, managing director of Analog and myself, spent a pleasant hour devising the 'thingy' that we were to use to protect Wordcraft 80. When the device had been designed the conversation went something like this:

*Graham:* 'What are we going to call this dongle thingy?' (Dongle being Graham's word for anything without a name, or for anything whose name had been temporarily mislaid!)

*Peter & myself:* 'That will do — it's a dongle.'

The three of us therefore claim to be the originators of the term as applied to computer protection systems. A regrettable side effect has been to deprive Graham of one of his favourite 'whatsit' words. We would welcome suggestions for a new word fo for him to use.

**Mike Lake, Derby**

## Missing manual

No, you can't get a useable recording of CEEFAX data on a home video recorder — the speed stability just isn't good enough to maintain the clock rate within limits. I tried it last January, with a Sony C7, and I reckon if the C7 couldn't do it, others are not likely to either.

Incidentally, when Purley Computers, of 21 Bartholomew Street, Newbury (sounds familiar!) advertised in your September issue that the would sell ICL KSR Termiprinters for £150 plus VAT and carriage (about £190 in all), did they also mention that there would be no manual, no instructions, and no refunds if the thing didn't work? It does seem rather remiss of them, and I'm now stuck with a printer which has never printed, which they won't touch again unless I bring it back (a round trip of 300 miles), along with my computer, interface, and open chequebook (cost undisclosed).

Perhaps we need a warning on Government anti-smoking lines, that purchasers of Sale Goods (to quote Nick at Purley Computer) need not expect any help in making the goods fit for their own uses. I'm glad it wasn't the Anadex 8000 at £450 which I bought.

**Ian Sinclair, Halstead**

## SWTP Benchmarks

It is always good to see objective comparisons of computer performance (cf, *PCW* Nov 81 page 147). *PCW* does everyone a great service in publishing regular *Kilobaud* Benchmarks. You

may be interested in corresponding figures for the SWTP S/09 (all times in seconds);m
BM1 — 0.5
BM2 — 2.0
BM3 — 5.7
BM4 — 5.8
BM5 — 6.3
BM6 — 9.2
BM7 — 13.9
BM8 — 3.5
These data were collected using the S/09 with TSC Basic under the Flex oper operating system.

The SWTP S/09 uses the Motorola M6809 processor running at 2Mhz.

Let's have lots more articles on the 6809 — based machines.

**Tim Benson, Abies Informatics Ltd, London W1.**

## Editor gripes

I have recently installed a Z80 Softcard. The Basic is excellent and in many ways an improvement on Applesoft. However, much of this is nullified by the major defects of the commands EDIT and RENUM. Both lead one to suspect that the designers have shares in new keyboards and programmers' overtime.

The RENUM command doesn't permit overlaps of other lines but, far worse, doesn't allow small blocks of lines to be renumbered, within themselves, to insert a few extra lines. Use of RENUM completely wrecks any systematic program layout and its relationship to documentation.

Editing in Applesoft, with IJKM, is messy but completely flexible. It is difficult to find an editing problem that cannot be solved with a minimum of key operations. Most insertions are easy with the open format of listed lines and done at high speed. EDIT, on the other hand, is highly frustrating. The unedited line is invisible so one has to guess or pre LIST on the line above. The listing is only a partial help as, especially for long lines, edited lines don't match and eye movements are uncoordinated. The end result is many more keystrokes and much wasted time. The worst feature of EDIT is its inability to access the line number. One often finds lines wrongly placed which a simple renumber would quickly correct but no, a complete retype must be done with a risk of further errors.

Complex lines often repeat during a program, in whole or in part. Applesoft permits one line to be duplicated endlessly anywhere in the program with a minimum risk of mistakes and keystrokes. Complex amendments can be made by block duplication, listing, and cursor editing.

EDIT permits none of these and also editing errors, followed by a RETURN, often need a retype instead of a screen copy. The need for spaces around Basic commands is highly irritating and easily forgotten. Apart from wasting time it wastes memory and perhaps accounts for the fact that MBasic runs 50 percent slower than Applesoft.

Are there any patches to eliminate these design weaknesses or is Microsoft proposing to issue amended disks?

Using special editing programs is hardly the point. They waste even more time. Most of my programs may run for weeks on end with frequent stops for minor amendments. Disks are usually filed for security and avoidance of damage due to static head pressure for long periods.

**R G Silson, Tring**

## Stringy Scriptsit

One of your writers mentioned his personal preference for the TRS-80 with Scriptsit as a word processor. He also mentioned that he had the disk version and that it was better than the cassette program because it cured the key-bounce and loaded without the problems associated with tape. It is worth mentioning that the new ROM machines that have been on sale since last year do not seem to have a KEY-bounce problem and there is a free-of-charge fix for tape loading if it is needed.

I have the Exatron Stringy Floppy and have the patch obtainable from the Exatron Users Group to load Scriptsit and to save files onto ESF wafers (I prefer the Acculab tapes and move the write protect markers to the ESF position). The ESF has a switchable keyboard fix if required and Scriptsit will load in 10/15 secs. It is more reliable than many disk units and incomparably faster and easier to use than tapes. Files are automatically verified and can be numbered numbered.

The ESF patch cost about £6 by airmail but does not include Scriptsit. I obtained mine from the London Computer Store when I purchased a printer and found that they are considerably cheaper than Tandys. When using Scriptsit with a 16k machine I have found that there is only enough memory for one and a half pages of A4. At this point I find the chain command very useful. If each page is filed and numbered in sequence it is possible to produce documents of almost unlimited length. If large insertions are made the overflow from one page can be 'chained' onto the next page.

**Derek Trayler, Hornchurch**

## Activities

I am writing to inform you that my brother and I are planning to operate a computer network based in Aylesbury. This scheme is aimed at the small (micro) computer although not specifically dedicated to the private user. There will be a small charge for useage to cover the telephone line cost, etc, but the operation is entirely non-profit making.

Before we commission the system we wanted to ascertain just what the users would like in the way of database and facilities generally. To that end I would be most grateful if you would publish this letter inviting all, and any, comment.

I might add that the Britannica will be available as soon as a volunteer types it in!

**Steve Somers, Aylesbury**

It is hoped to restart the Cosmac Users Group originally proposed by Jim Cunningham if there is sufficient interest. The group will cater for users of the Cosmac series of microprocessors, ie, the CDP1802, 1804, 1805 and for computers using this processor such as the ELF, Edukit, etc. Anyone interested in joining the club should send a stamped addressed envelope to me at the address below.

**Peter Hibbs, 54 Runnymede Avenue, Bournemouth, Dorset BH11 9SE.**

## Aircraft Rescue

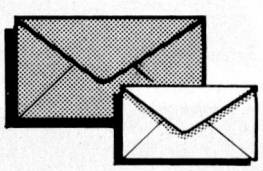
The November issue of *PCW* must, surely, be the best yet with the reviews of the Osborne and IBM machines and the study by Alan Sutcliffe of randomness. I congratulate you.

With reference to the enquiry by B M Neary of Coventry about programs for the simulation of instrument flying, I believe that I can help. The October issue of the US journal *Creative Computing* contains a simulation game by J Hitchcock called 'Aircraft Rescue', written in Basic for the Apple. One of the purposes of the program is precisely to simulate instrument flying in order to fly a plane of a rescue mission.

This information is taken from the *Small Computer Program Index* which provides a bi-monthly listing of printed program listings appearing in a wide range of US and UK magazines and newsletters (including *PCW*). It thus provides a handy source of reference to over 2000 programs per year.

Further details may be obtained from ALLM Books, 21 Beechcroft Road, Bushey, Herts WD2 2JU.

**Alan Pritchard, Editor, *Small Computer Program Index*, Watford.**



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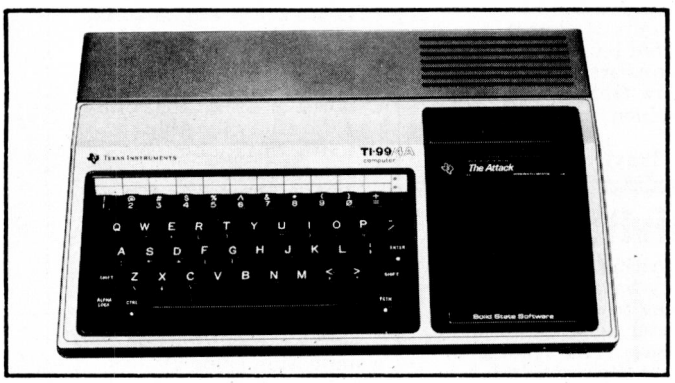


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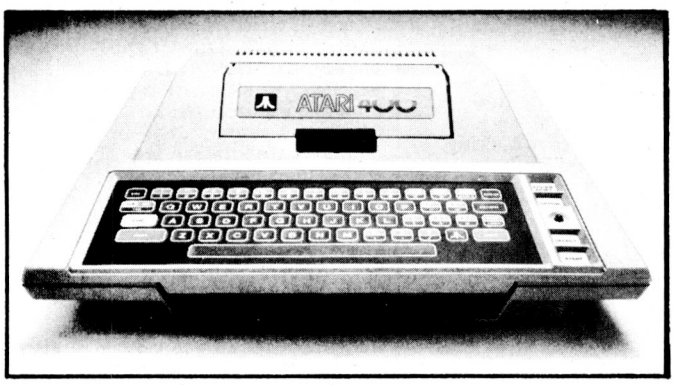


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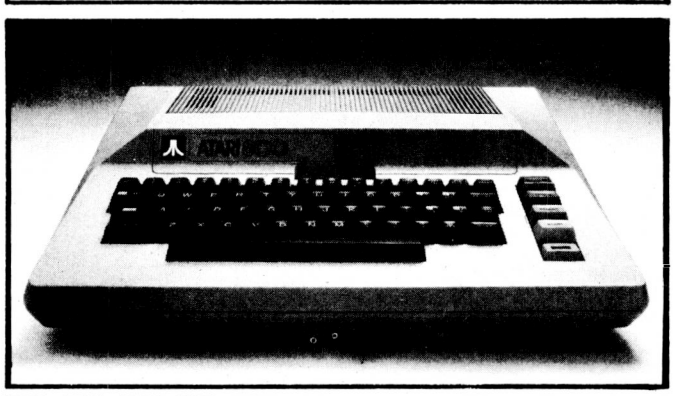

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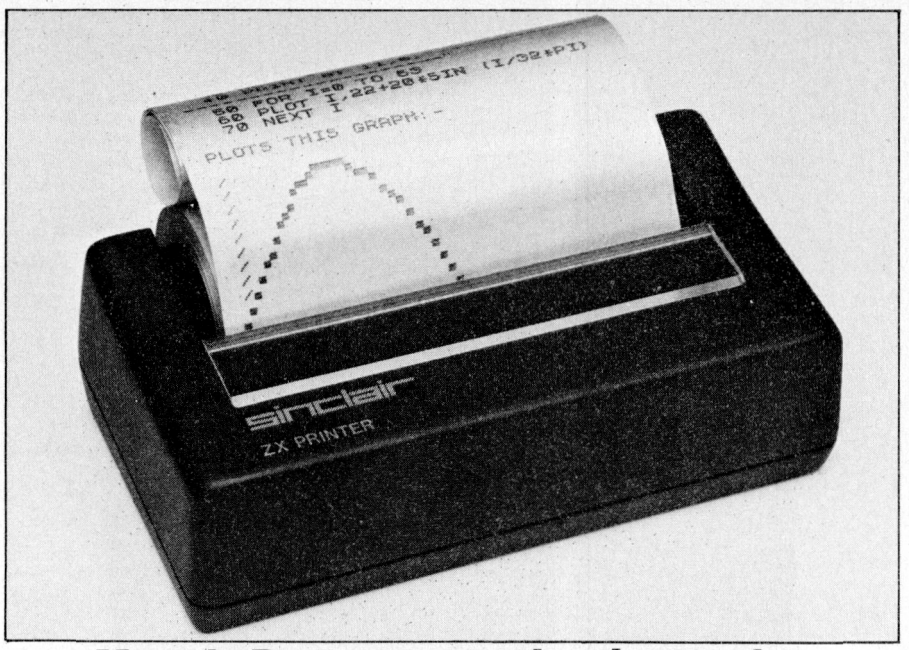
# ZX81 PRINTER




## Maggie Burton tests the cheapest printer on the market.

Last spring, Sinclair Research launched its ZX81 personal computer. This enabled anyone who could rake together £50 to own a computer, and gave those with a small budget access to larger amounts of computing power than ever. However, the ZX81 (and its predecessor, the ZX80) always lacked one vital peripheral — a printer. Programs have had to be typed or handwritten and the only way of keeping a convenient record was to use a cassette recorder. Now, after having been heralded ever since the ZX81 launch, the printer is available to complete the system.

It is an electrostatic printer — that is, it prints on metallic (aluminium-coated) paper using conductive styli to evaporate the metal coating where a dot is wanted, thereby revealing a black layer in the appropriate places underneath. However, unlike other electrostatic printers, which have a whole row of styli, the Sinclair only has two, one on either side of a revolving belt. One stylus prints a line of dots from left to right, while the other returns to start the next one.

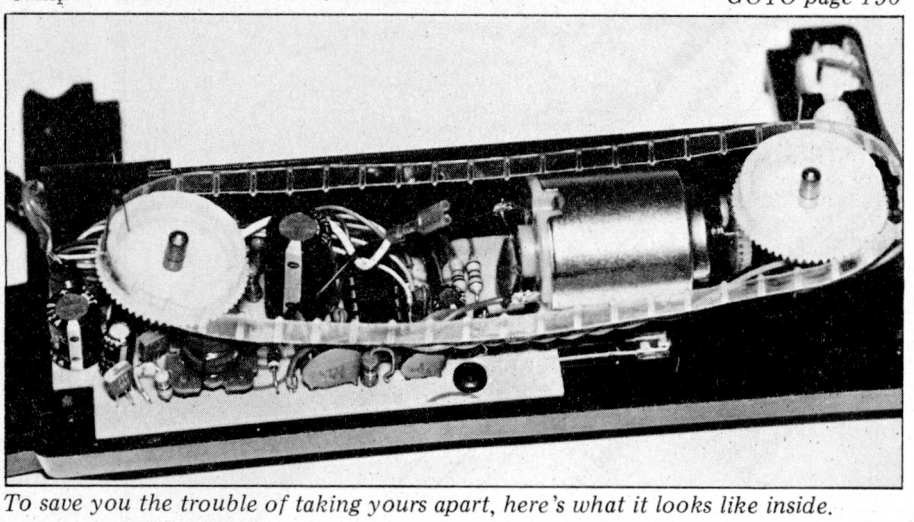
By normal standards, it doesn't print at all fast — about 21.5 cps, in fact — but for what it has to do this is quite adequate. I thought, until I actually timed it, that it was fast but that's how it looks when it's working. Obviously the graphics characters are printed more slowly than the normal ones as they have more dots in them. This is demonstrated effectively by a program in the manual which prints out the whole character set. All the graphics are printed out in succession so the printer slows down considerably while it is printing them. The cps timing I mentioned just now was the average timing for five runs of this program (and a few nifty calculations to boot).

It reacts almost instantaneously to a COPY or LLIST command from the computer. You can print out anything with it that will display on the screen and it will keep going almost indefinitely without any apparent ill effects apart from a rather strange smell if you put your nose close enough to the print head. Somehow, I can't see it being used for word processing or some other such application but a printout of a pretty graphics program would certainly not be out of place on some young computerist's bedroom wall. It is also useful from our point of view because, hopefully, from now on we won't be wading our way through reams and reams of untidy handwritten ZX81 listings! It certainly makes it a lot easier to keep an organised record of what you last did with the computer when you had to stop half way through doing something. All you have to do is press COPY (NEWLINE) and it will record everything from the TV screen for future reference. LLIST will list a program onto the printer instead of the screen. The paper will photocopy well so you can send copies of your favourite programs to your friends.

Now on to maintenance. The manual says you have to clean the print head from time to time as it tends to get clogged up with the black stuff from underneath the metal on the paper. This is done with the reel carrier out and is not a difficult undertaking, although it should be done with a soft tissue or brush and without using any chemicals or hard objects. Apart from cleaning, it doesn't need any maintenance at all so it isn't exactly demanding to look after. Changing a reel of paper is easy as well: the whole reel carrier slides out when you press it underneath and the reel simply clips into it. Paper is available from Sinclair by post at about £12 for five rolls. No other paper is suitable — I shouldn't think it would be possible to find another make that would fit the bill in any case. As a last warning, I wouldn't take it to bits unless you really know what you're doing because you'll have terrible trouble putting it back together again, as our editor found out when he had finished looking inside it!

After using it for a while, I felt myself sufficiently acquainted with it to make a few complaints, all of which are relatively small. The first is the amount of exposed wiring. The connector is open at the side so you can see the pretty coloured wiring in it. I'm sure this isn't an overwhelmingly serious fault but it looks shoddy and if you spilt your coffee on it while computing it wouldn't do it much good. The connector, by the way, slots in where the RAMpack goes and has a socket incorporated at the back of it for the RAMpack to plug in as well. This leads me to my next complaint. As any ZX81 owner or user will probably know, the RAMpack is a bit stroppy and may well crash the whole system if it touches

*GOTO page 190*



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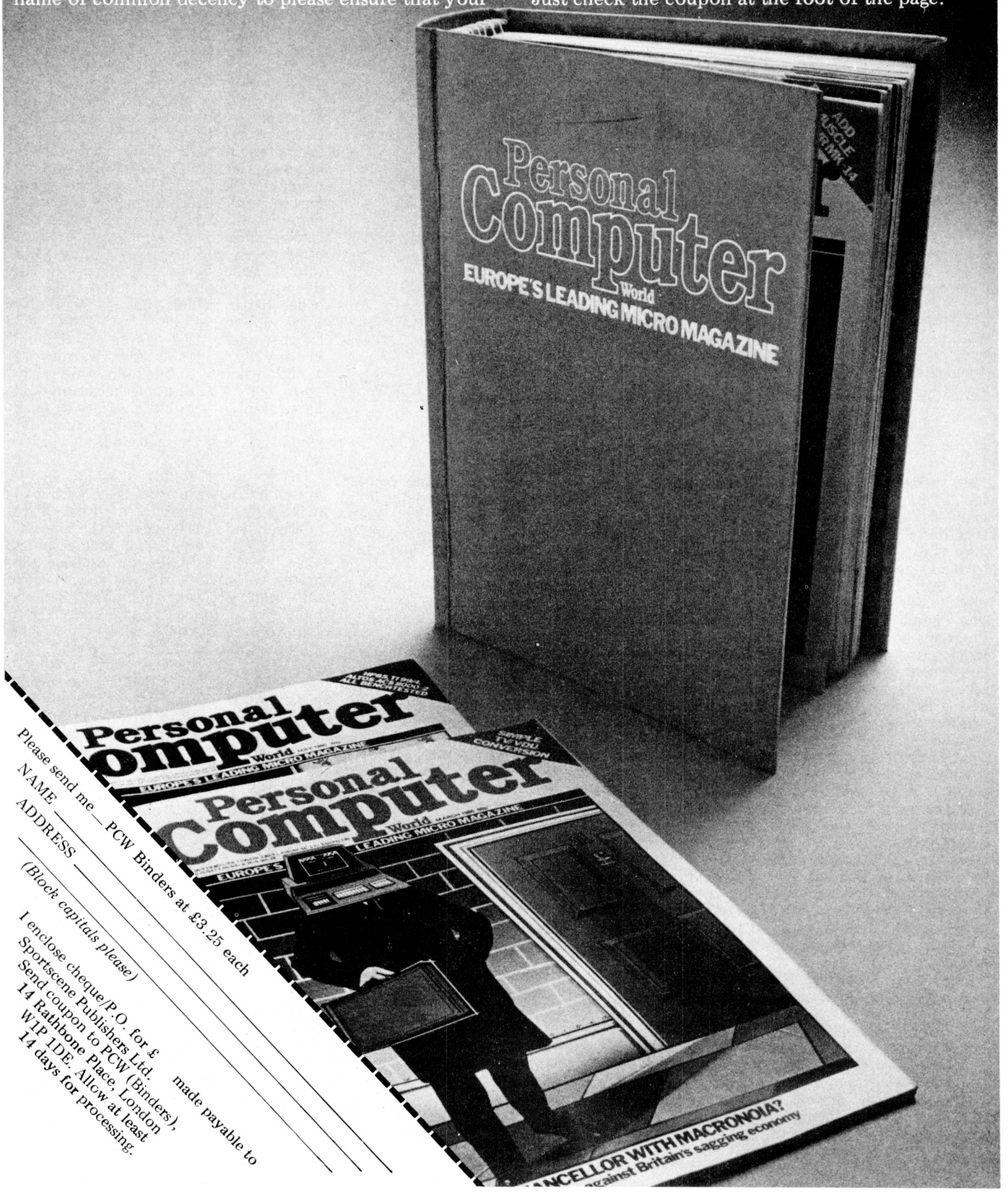


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# INSIDE THE INTERPRETER

## Understanding how your Basic interpreter works can speed up your programs. A F T Winfield shows how.

The command 'RUN' is a sort of incantation among computer users — it is the word that magically transforms a couple of hundred Basic statements into that new space invaders game, or flight simulator! But what happens when you type RUN? Why are some Basic interpreters slower than others? How can I speed up my programs? In this article, I shall take a peek inside a number of Basic interpreters, to try and throw some light upon these questions.

## Interpret?

Firstly, what *is* a Basic interpreter? Well, most interpreters contain two parts: an editor and an interpreter (although the two are lumped together under the term 'interpreter'). The editor allows you to enter the program into the machine and modify it if necessary, but the interpreter takes over completely when you type RUN. The interpreter then reads the program from memory, statement by statement, examining each statement to identify reserved words, check syntax, and determine the operation to be performed by the statement, and then it actually carries out the operation.

A feature of the Basic language is that all statements start with a reserved word (the only exception is in the case of a LET statement where the LET may often be omitted). This feature simplifies RUN time processing considerably, since the interpreter need only identify the first word in the statement — to determine the operation to be performed by the statement. Thus, a flowchart for the RUN-time part of an interpreter might be as in Figure 1.

The word LET is tested for first, because it is the most frequently occurring statement in Basic programs, IF is the second most frequently occurring statement and so on. PRINT and other I/O statements are usually low down in the list because speed of execution is limited by the input/output peripherals, not the interpreter.

If the interpreter cannot identify the first word in the statement, then it assumes the statement is a LET statement, without the LET. Thus in interpreters of this kind the statement LET A=42, say, is executed much more quickly than the statement A=42.

This outer flowchart for the interpreter contains no syntax-checking — all of the syntax checking is done in the routines for the individual statements. This can cause some peculiar error messages if you have mistyped the first word in the statement. For example, PRIMT A

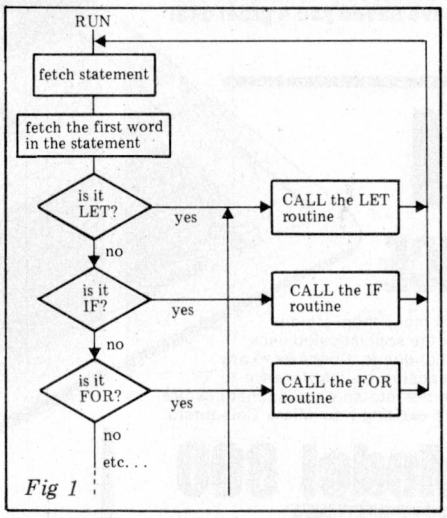

*Fig 1*

is likely to cause the error message 'missing ='. (Although most interpreters will produce the distinctly unhelpful message 'syntax error'!)

## The LET statement

The flowchart for the LET routine might be as in Figure 2.

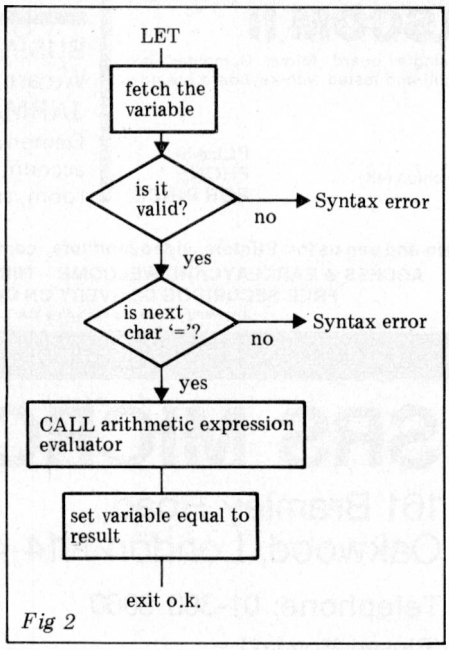

*Fig 2*

Other statements than LET may, of course, include arithmetic expressions — and so the arithmetic expression evaluator is likely to be a sub-routine which is called by a number of different statement routines. By far the largest part of the time spent during execution of most programs is in evaluating arithmetic expressions — and so understanding how an expression evaluator works can often result in worthwhile speed improvements, as I hope to show later in this article.

But now an example from Denver Tiny Basic [1]; Denver is the smallest Basic interpreter I have come across, being a little over 2 kbytes! It has a structure similar to the one I have just described and no pre-processing by the editor, so that programs are stored in memory exactly as they are typed in.

The program:

```
10 A=1
20 A=A+1
30 IF A<1000 GOTO 20
40 END
```

executes in 8.9 seconds on a 4 MHz Z80. But replace line 20 by LET A=A+1 and the execution time reduces to 7.4 seconds. An improvement of over 10 percent!

## Tokens and links

Most extended Basic interpreters *do* preprocess the program as it is entered in two important ways: tokenising and link listing.

Tokenising means replacing each reserved word in the program by a single byte token, for example, Crystal Basic 2.2, would store the line,

```
10 LET A=1
```

(starting at memory address 2D00) as,

```
2D00: 09  2D  link
      0A  00  10
      88      LET
      41      A
      B0      =
      31      1
      00      terminator
```

with the reserved words LET and '=' replaced by the tokens 88, and B0 respectively. So that tokens are never confused with non-tokenised parts of the program, like 'A' and '1', all tokens have bit 7 set high, and all ASCII characters have bit 7 set low.

Apart from the minor benefit of conserving memory, the objective of tokenising is to simplify the RUN time processing, and therefore speed up execution. This is achieved by using the tokens, at RUN time, to point into a table of addresses of statement routines. Let me illustrate this with a new RUN flowchart:

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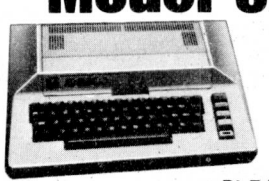

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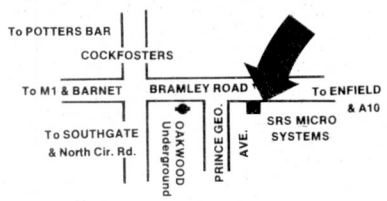

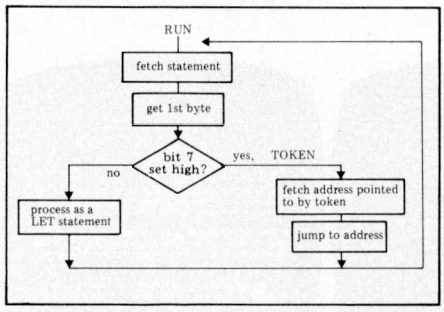


The ability to process LET statements without the LET still exists here, but often in interpreters of this type, LET statements without the LET are now marginally faster!

The RUN time speed improvement is, of course, achieved at the expense of editor complexity, since the editor must now perform all of the complex ASCII string comparisons, to identify reserved words. Also the LIST command must de-tokenise the program to make it readable!

An interesting aside is that tokenising is *not* the same as syntax checking. In fact, surprisingly few Basic interpreters perform true syntax checking on program entry. Surprising because this feature is often hailed as one of the major advantages of 'interactive' languages! One of the few popular languages that does is the ubiquitous ZX81 Basic interpreter, which stubbornly refuses to accept an ill-formed line! The syntax checking is simplified considerably in this machine by the single word 'keyword' entry — which means that tokenising is done automatically. Some of the hairiest problems of syntax checking like, for example:

```
10 LET BTO=1
20 FOR ATO=BTO TO 100 (!!)
```

are alleviated because the keyword TO is unambiguously defined by the single key TO entry. Despite the syntax checking, the ZX81 internal representation of the program is identical to the [link address], [line number], [tokenised line] format already described. Arithmetic expressions are stored unaltered (apart from tokenisation), and are then still subject to the RUN-time speed improvements I describe in this article.

Link listing is the second technique for speeding up program execution. A linked list Basic program is one in which the start of each line contains a pointer to the start of the next line. Looking again at the internal representation of the example in Crystal Basic, the very first pair of bytes in the stored line make the address 2D09, which point to the start of the next line in the program. The pair of bytes immediately after the link address are the line number, in binary, and to find any given line in a program means simply skipping directly from link to link, comparing the following line numbers, until the right one is found. GOTO statements are then very much faster in interpreters of this type.

Denver Tiny Basic executes the program:

```
10 A=1
20 A=A+1
30 GOTO 40
40 IF A<1000 GOTO 20
```

in 10.7 seconds. Remove the superfluous GOTO in line 30, and the execution time becomes 8.9 seconds. Crystal Basic executes these two programs in 6.1 and 5.6 seconds respectively, a smaller proportional improvement because of the linked list storage of the program in Crystal and, hence faster GOTOs. It is worth remembering that superfluous GOTOs take up significant execution time — and should be avoided.

The GOSUB statement executes in a similar way to the GOTO, with a search through the linked list for the destination line number. The time taken to execute a GOSUB then depends, like the GOTO, largely upon the position of the destination line in the program — particularly if the program is a large one. An example will illustrate this — the Crystal program:

```
10 FOR A=1 TO 1000
20 GOSUB 1000
30 NEXT A
40 END
50 REM
51 REM
   . . . 50 lines altogether
1000 RETURN
```

executes in 3.9 seconds. But place the subroutine at the start of the program:

```
10 RETURN
20 REM
21 REM
   . . . 50 lines
1000 FOR A=1 TO 1000
1010 GOSUB 10
1020 NEXT A
```

and execute by typing 'GOTO 1000', and we see an execution time of 1.9 seconds — a dramatic halving of execution time just by rearranging the program! In fact, amazing speed improvements can often be made simply by placing the subroutines at the start, and the main body of the program at the end, rather than the usual practise of subroutines at the end!

## Arithmetic evaluation

As I mentioned earlier, the average Basic program spends most of its time evaluating arithmetic expressions — particularly if floating point, or, worse still, trigonometric functions are involved. Some examples using Crystal Basic will illustrate this:

The program:

```
10 FOR A=1 TO 1000
20 LET B=1
30 NEXT A
```

executes in 2.0 seconds. Replacing line 20 by LET B=1*1 slows the program down to 3.1 seconds and replacing line 20 again by LET B=SIN(1) results in an execution time of 12.1 seconds. So that 83 percent of the time is spent calculating sines!

# INSIDE THE INTERPRETER

Most Basic interpreters evaluate arithmetic expressions using the method of 'recursive descent'. This method has the enormous advantage that it will work directly on the arithmetic expression that was typed in, so that no pre-processing of arithmetic expressions is necessary. The method works like this: arithmetic expressions may be divided into a succession of one or more 'terms', separated by '+' or '—'. Each 'term' can consist of one or more 'factors', separated by '*' or '/' and each 'factor' may be either a function, a variable name, a number, or another expression (in brackets). You can see that this is a 'recursive' definition since a 'factor' may be an 'expression', in brackets. This sub-expression can then be thought of as dividing down in the same way, into its own 'terms' and 'factors'.

A flowchart of an expression evaluator could then be as in Figure 4. A term evaluator would be as in Figure 5 and a factor evaluator as in Figure 6. For clarity I have omitted the

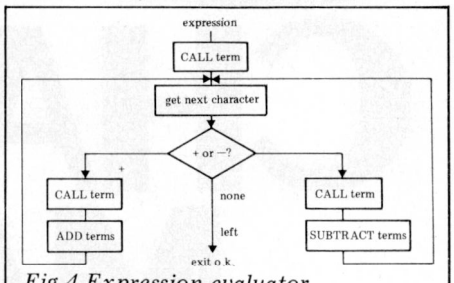


*Fig 4 Expression evaluator*

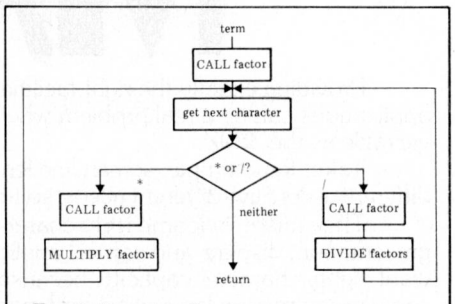


*Fig 5 Term evaluator*

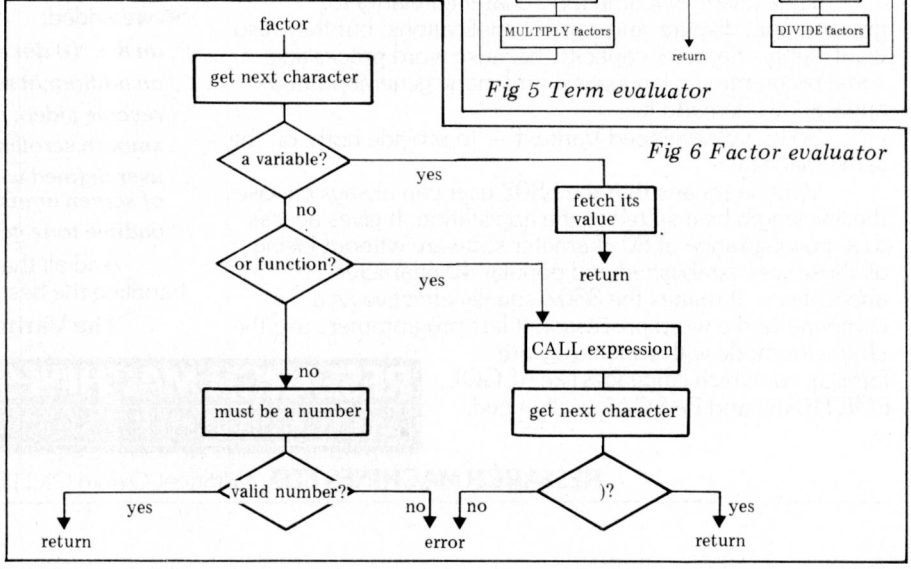


*Fig 6 Factor evaluator*




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intermediate result pushes onto the stack, before each CALL, and pops off the stack after each return.

An interesting feature of this algorithm is that the structure of the algorithm automatically guarantees that bracketed expressions have the highest priority, * and / the next highest priority, and + and — the lowest priority, consistent with normal algebraic convention.

An alternative method of arithmetic expression evaluation — favoured in Microsoft Basics [2] is known as the 'Operator Precedence Parse'. This is more complex than 'recursive descent', and relies on each operator (+, —, *, / . . . ), having a 'precedence' value associated with it. Operators with the highest priority have the highest precedence. As an arithmetic expression is scanned, whole chunks of the expression, including operators, are pushed onto a stack, until the highest precedence operator is found — parts of the expression are then removed from the stack and evaluated in reverse order of operator precedence. This method uses recursion to cope with brackets and overall the same constraints on speed apply whichever algorithm is used.

There are a number of consequences of either algorithm which affect speed of execution. The first thing to notice is that each time an open bracket occurs in the expression, the expression evaluator CALLs itself (recurses). This involves extra work and unnecessary brackets should be avoided, or expressions re-written to reduce the number of brackets.

For example, in Crystal Basic:

```
10 FOR A=1 TO 1000
20 LET B=1000+(1000*1000)
30 NEXT A
40 END
```

executes in 8.6 seconds. But replace line 20 by LET B=1000+1000*1000 (since the brackets are unnecessary here) and the execution time becomes 8.2 seconds, almost 5 percent better.

Looking further at the 'factor' routine in the method of recursive descent, if the next item in the expression is not recognised then it is assumed to be a number; numbers are, then, tested for last of all in the routine. So, if constants are pre-defined as variables, further speed improvements may result. For example:

```
 5 LET ZZZZ=1000
10 FOR A=1 TO 1000
20 LET B=ZZZZ+ZZZZ*ZZZZ
30 NEXT A
```

executes in 3.8 seconds, an astonishing 50 percent improvement over the previous example! (I have used a four-letter variable so that line 20 remains the same length, for a valid comparison — a single letter variable in fact improves the speed again — to 3.5 seconds.)

These test programs are somewhat contrived, so let me give an example of the sort of alteration to an actual program which could result in faster execution. If you have any arithmetic expressions which look like this:

LET B=10*(X+2*Y),

involving two multiplications, one addition, and a recursion for the bracketed expression, multiply out:

LET B=10*X+20*Y,

and there are still two multiplications and one addition, but no recursion. A five percent improvement already. Then try defining some constants at the start of the program —

LET A1=10 : LET A2=20

(do this right at the beginning so that these statements are executed once only), and rewrite the expression as:

LET B=A1*X+A2*Y

and this is probably significantly faster than the original expression. Of course, the program is slightly longer now, but then memory is cheap these days!

## True or false?

Most Basic interpreters will allow the 'IF' statement construction:

IF variablename THEN . . . .

without any actual relational test. If you first determine how the values 'true' and 'false' are internally represented in your interpreter, you can often take advantage of this faster 'IF' statement. Try running this program on your machine:

```
 5 REM notice the multiple NEXT's,
   for speed!
10 FOR A=—5 TO 5
20 PRINT A;
30 IF A THEN PRINT "true": NEXT A
40 PRINT "false"
50 NEXT A
60 END
```

Providing your interpreter does allow the IF statement in line 30, then you may get the following result:

```
—5 true
—4 true
—3 true
—2 true
—1 true
 0 false
 1 true
 2 true
 3 true
 4 true
 5 true
```

And so, any statements that test for A not equal to 0, like

IF A<>0 THEN . . .

may simply be replaced by

IF A THEN . . .

To test if any speed improvement is achieved, run:

```
10 FOR A=1 TO 1000
20 IF A<>0 GOTO 30
30 NEXT A
```

and then replace line 20 by:

20 IF A GOTO 30

and run again. Crystal Basic shows times of 2.7 seconds, and 1.9 seconds, respectively — an improvement of 30 percent.! Of course, by the same token, 'IF A=0' could be replaced by 'IF NOT (A)' but in this case the complexity of the statement has not really been reduced — and a speed improvement is unlikely.

## Interpreter v Interpreter

The classic and time-honoured means of testing and comparing Basic interpreters

# INSIDE THE INTERPRETER

is by using 'Benchmark' programs. These are fine for comparison of overall systems, but tend to be misleading when what you really want to test is the 'cleverness' of a Basic interpreter. After all — you do not want the issue clouded by hardware differences like different processors, or clock speeds, or memory timing! The technique I have proposed in this article is to determine what proportion of the total RUNtime is taken up by a particular operation, by subtracting the time for an identical program without that operation. Thus, a 'standard' test for arithmetic expression evaluation might involve:

Test program 1:

```
10 FOR A=1 TO 1000
20 NEXT A
```

Test program 2:

```
10 FOR A=1 TO 1000
20 LET B=1
30 NEXT A
```

Test program 3:

```
10 FOR A=1 TO 1000
20 LET B= 'an expression'
30 NEXT A
```

The proportion of the time taken to do the 'LET' statement is

Plet = (T2—T1)/T2 * 100%

And the proportion of time to perform the arithmetic expression is

Pexpr = (T3—T2)/T3 * 100%,

where T1, T2 and T3 are the execution times of the three test programs.

These tests are not perfect, but do give a good indication of the efficacy of the arithmetic expression evaluation algorithm in an interpreter. Some examples of Plet and Pexpr for line 20:

```
20 LET B=1000+(1000*1000)
```

reveal some surprising differences between well-known interpreters, see Figure 7.

## Interpreter v Compiler

Okay — so you've decided that you have made your latest Basic program go as fast as it possibly can, but it still just isn't fast enough. Should you scrap your faithful Basic interpreter and buy a new Basic or Pascal compiler? Well, the answer depends very much on what your particular program actually does. Here is an example of a Hisoft Pascal 3 program:

```
1 Program test;
2 Var  i: integer;
3      a: real;
4 Begin
5    For i: =1 to 1000 do
6    a: =1;
7 End.
```

This program executes in 0.2 seconds, a tenfold improvement over an equivalent

*GOTO page 189*

| | T1 | T2 | T3 | Plet | Pexpr |
|---|---|---|---|---|---|
| Crystal Basic 2.2 | 1.0 | 2.0 | 8.6 | 50% | 76% |
| Microsoft Level 2 | 2.7 | 5.9 | 15.0 | 54% | 60% |
| Applesoft | 1.4 | 3.1 | 15.2 | 54% | 80% |
| ZX81 (in fast mode) | 4.4 | 5.9 | 9.7 | 25% | 39% |

Unless your computer has a timer, it is probably a good idea to replace the line 10s by: 10 FOR A=1 TO 100000, and then divide your readings by 10.

*Fig 7.*

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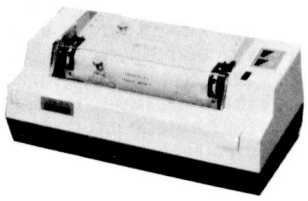

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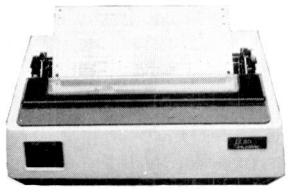

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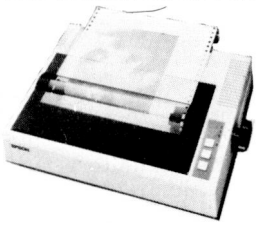

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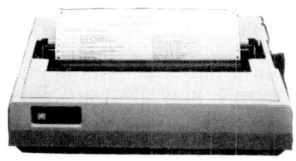

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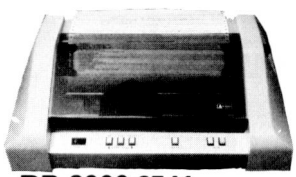

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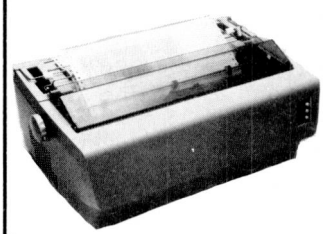

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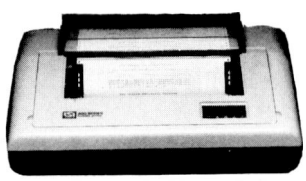

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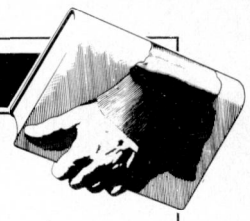

## Malcolm Peltu looks at the latest micro literature

# How to choose a language book

If you want to learn a new computer language, which is the best book to read? Having been overwhelmed this month by a veritable tidal wave of language books, I thought it would be a good idea to offer some advice on how to go about selecting one. Then I will begin picking my way through the latest bunch of books. (I write mainly about high-level language books, but similar advice also applies to books about assembler languages.)

*A sense of direction.* Before looking for a book, you must have an objective and a starting point. This sense of direction should be matched with the aims of the book. Your starting point is as important as what you want to get out of the book at the end. If you are a novice to all computer languages, you will want a book that introduces computing and programming concepts as well as particular language characteristics. But if you are, say, an experienced Basic programmer who wants to learn about another language, you will want something that dives into the heart of that language.

What you want to do with the new language will also determine the type of book you need. If you are planning to use the language, you will want something which places the language into its applications and real world context (standards, compiler availability, etc). But if your primary wish is to gain an insight into the new language or study it out of general interest, you will be more concerned with its design characteristics than practical applications.

If you are sure of your own sense of direction you can usually discard many potential books by simply reading the blurb and preface to see how the book defines its potential readership. This may be misleading because publishers like to puff their wares, but a quick glance through the contents list and a flick through the pages usually gives a good feel for whether the book is roughly going down your way. Unless it has been personally recommended, never buy a book unless you have had your hands on it. There are now so many books on the main languages (Basic, Pascal, Cobol, Fortran in particular) that personal taste and comfort can be indulged in the security that you will find something that both gives the facts and dovetails with what you want. For the less widely used or newer languages, like Ada or Lisp, the choice at present is more limited. so you might have to make do with something less than ideal.

Provided you have a wide enough choice, make sure that the book looks good and the text and diagrams are well presented. I am not suggesting that you try to tell the book by looking at its cover, but a book with good clear print which is pleasing to the eye is likely to be easier to understand. I particularly dislike books with typed (or word processed) text rather than a proper typeface. It may make the book easier to produce but I find such rudimentary type tedious and often confusing to read through. I also generally dislike self-tutors books which expect you to read the book with a piece of card covering the next chunk of text to ensure you do not see the answer to a question that has just been posed. You may feel differently, but it is important to try to indulge your foibles because you will learn more from a book that you are comfortable with.

*A shapely form.* A common fault of language books is to have a structure based on a language definition or lecture notes rather than being shaped into a more appropriate format. Of course, if the book is to be used primarily as a classroom aid, the lecture note format may be adequate.

A book should be structured in a way which puts a language in some context. The emphasis will vary depend-



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ing on the nature of the book, but the language being described should not drift in a vacuum.

However, too many books merely describe language facilities without reference to the language's historical development; its design objectives; the application to which it has been put; its suitability for writing good, well-structured programs; the readability and ease of maintenance of programs; relationships to other languages; international standardisation; comparative merits versus other languages; and so on. I therefore favour books with a wider perspective. A book which discusses nothing but the language capabilities can be effective in training you in writing programs in that language, but will contribute little to a wider understanding of the computing scene and the characteristics that add up to *good* programming principles.

Look at the introduction and the final chapters. These usually give a good indication of the scope of the book and its attitude to programming.

*Readable and factual.* Any technical book must be accurate and factual. But this doesn't mean it needs to be dull. One of the major breakthroughs of personal computing was the way in which the micro pioneers revolutionised computer publishing. Books about computing became fun to read, had jokey titles (like *The Peanut and Jelly Guide*) and made a good 'read' as well as being informative. Personal computing also opened up the computing market to 'ordinary people' (as opposed to 'extraordinary' computing boffins). American writers and publishers led the way in democratising computing with many lively books aimed at business people, young people, students and others.

The readability is most frequently found with books oriented towards applications. The writer of an application book has in the forefront of his or her mind a reader who has to be tempted to read about computing in the first place. As applications take place in real world situations, such a book is also likely to seem more 'relevant', with examples oriented towards what the program does, not just how it does it.

But such readability is also possible with books concerned more with the technical aspects of the language. Much of this readability comes from attributes I have already mentioned, particularly the way the book has been shaped and the writer's awareness of the broader context in which the language is used. In addition, of course, there is the clarity and style of the writer. Often it takes little more than a few anecdotes, asides, analogies or quotations to 'lift' the text and to sharpen the impact of the book.

*Language scope* It is important to determine whether the book covers the appropriate slice of the language or the language dialect appropriate to your requirements. Some books describe only a subset of the language, one implementation (particularly true of Basic) or a particular variation of the language. Introductory books frequently opt for a 'simple' or 'basic' version of the language. Where international standards exist, say with Cobol and Fortran, the book must either describe the standard language or be explicit about any deviations.

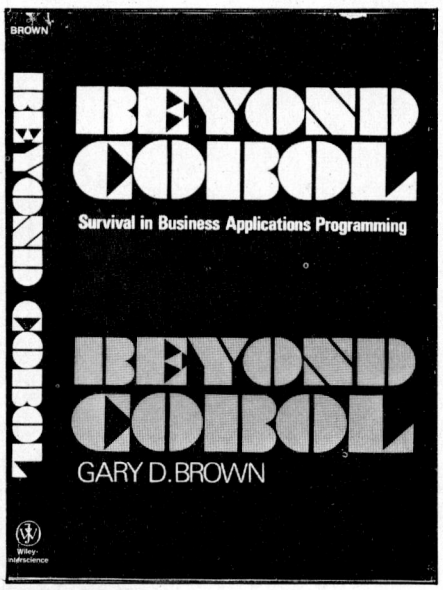
The important point is that the language scope must be clearly defined. Look at the blurb and introduction. Unless you have a particular implementation requirement, or interest in a particular dialect, go for the books which emphasise standard language facilities; if no official standards exist, as with Basic, some books try to define common subsets and clearly explain where differences are likely to occur in widely used implementations. It is a black mark if you have difficulty in finding out what language variation is being described becuase it shows the author is insufficiently aware of the crucial importance of standards and implementation needs.

*Getting it all together.* In summary, first make sure you know why you want to read the book. Consider what you want to get out of it, where you want to use it (on your own, in a classroom, in a project team, etc) and your level of knowledge or ignorance. Then match your aims with the stated aims of the book and with the way the author goes about achieving the objectives. The initial scan can be effective although superficial. Look at the chapter titles, the introduction, the index and appendices. Consider the structure of the book and the style you can glean from reading bits at random. Look at how examples are laid out. Are they clear? Is there text close by which seems to discuss them adequately? Are there enough examples?

Of course, a superficial look will not tell you if there are many blunders in examples. If you are reading the book primarily to learn general language principles rather than copying programs for your own use, blunders are not important unless they actually get language techniques wrong. The qualifications of the author(s) and the whole approach of the book can provide a good idea of whether the book is on the right lines. If in doubt, and if you spot sloppy mistakes in the text, give the book a miss.

As I said in November *PCW* when offering a guide to beginners' guides, make sure you feel comfortable with the book. This means that style, presentation and general feel of the book can be as important as the technical content, provided the technical content covers the range of activities you want. A book with vision and awareness beyond the narrow confines of the language is usually likely to be rewarding.

Finally, read book reviews, speak to friends, ask teachers, chat up computer buffs. . . Whatever you do, try to find out what people who have used the book think about it. News spreads quickly about any particularly good or bad book. As the majority of books fill the middle ground, you are unlikely to go far wrong if you follow my guidelines plus, preferably, comments from people who have already read it.




## Gary sets a good example

*Beyond Cobol* by Gary D Brown gets most things right. Its subtitle gets straight to the heart of the matter: 'Survival in Business Applications Programming'.

The book is aimed primarily at computer science graduates who are about to enter careers as commercial DP programmers. It would be equally useful to anyone who has learnt programming in a non-commercial environment, whether it is as a personal computing Basic freak, in a classroom or by reading books.

As the blurb says, Brown 'cogently demonstrates there's much more to programming then writing programs. . . and this practical guide steers you through the hazy area between knowledge of a programming language and a customer's request to have something programmed.'

Brown has given the book the shapely form that I recommend. It is structured around business programming applications rather than around language facilities. Important advice on 'good' programming practices, such as concern about maintenance, documentation, structured programming, etc, is built into the mainstream of the text. Brown never loses sight of his main objective, which is to provide an insight into the flesh, blood and tears of DP life. His introduction is particularly good. If you are interested in a DP career, try to get hold of it. This is the best summary of what life is actually like as a DP programmer that I have read.

On structured programming, for example, he points out the value of the techinques *and* their limitations. He uses top-down design and structured techniques throughout the book but does not make a song and dance about it. He also points out that management methods used to organise projects based on structured programming, such as chief programmer teams and structured walkthroughs (techniques recommended by IBM) often fail in practice

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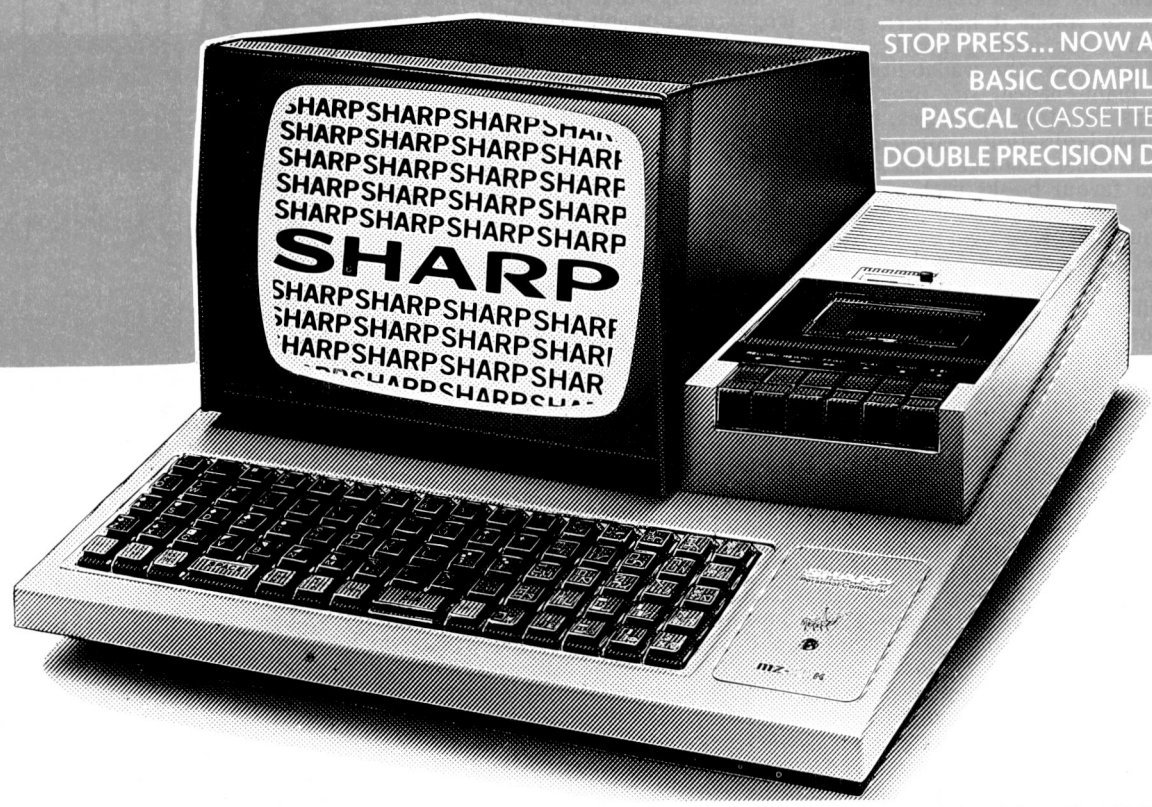


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because there aren't enough good programmers to manage them or because the organisation needed to sustain them are too complex and become a problem of their own.

Brown comments: 'Techniques that require an inordinate effort and superhuman dedication have limited use. We pay lip service to such techniques, but little else. They are like the advice we have probably all heard to chew each bite of food 30 times before swallowing. Yes, we all should, but who does? Would you even like to dine with someone who did?' This passage is typical of Brown's style: fluent, readable, witty, practical and relevant to practical commercial programming. 'You don't do anything in computing without bleeding,' is another typical quote.

On planning DP systems, he suggests that systematic studies are important but points out: 'you will never be able to anticipate all the changes that might occur.' He says that good programmers have learned humility — if not paranoia. 'Almost any system you work on will be changed during its development, it will take longer than planned, and the customer will never be entirely satisfied with the results,' he warns.

My main criticisms are that Brown focuses almost exclusively on a traditional batch IBM mainframe environment for most of the book and provides no background to the development of Cobol and to Cobol standards. He doesn't mention the growth of Cobol on microcomputers, such as Micro Focus's CIS Cobol. He doesn't mention the Codasyl Committee which governs Cobol developments, or the fact that a new international Cobol standard is being discussed. Brown has a chapter on on-line systems but it is presented as if it is out of the ordinary, although on-line systems (as he does say) are growing in popularity.

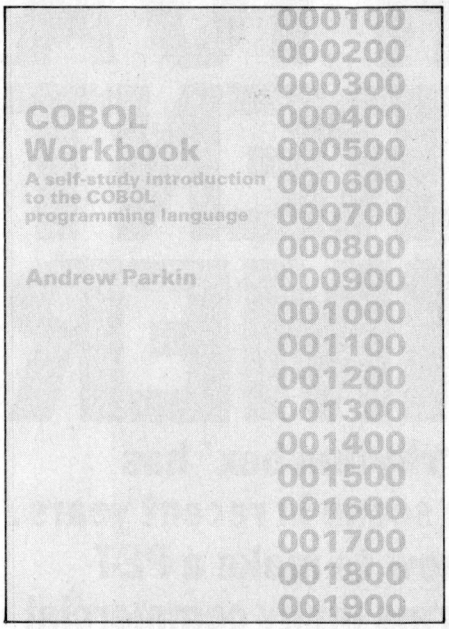
These faults are primarily the result of the rapid changes in technology. It is only two or three years since micros in commercial computing really took hold. Given the long time needed to write and publish a book, it is little wonder that they are omitted.

I hope that soon Brown and other authors will recognise that micros and on-line systems are an intrinsic part of commercial DP. In the meantime, *Beyond Cobol* is a pretty good starting point if you want to learn about Cobol and DP programming.

## Lukewarm on Cobol

The only advantage of this month's other Cobol book is that it is about £10 cheaper than Brown's book. *Cobol Workbook* by Andrew Parkin is a self-study introduction which aims to be 'concise but comprehensive and precise'. I found it hard going with too narrow a focus. The text revolves around 'concept charts' which show the interrelation of various aspects of the topic under discussion.

The typescript text, which is cramped and tiresome to read, asks questions about the concept charts and provides the answers underneath, so that you have to cover up the

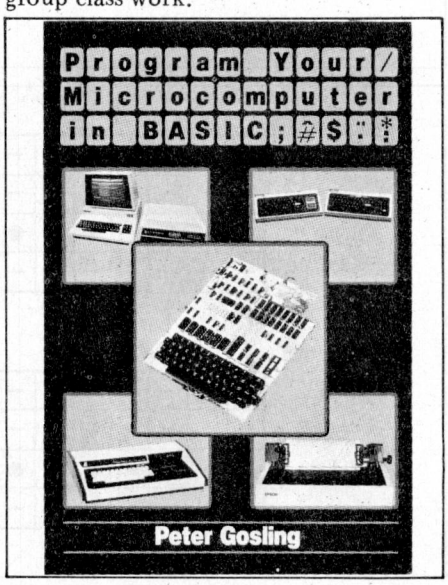



answers while you are reading the questions. I generally dislike this approach and use of typescript and I have seen far better self-study books. The concept charts are complicated: you have to keep flicking pages to look at the chart and the stodgy format means that progressing through the book will require a great deal of self-motivation.

Parkin covers most basic facilities of standard ANS Cobol with a brief general introduction to computing concepts. The structure of the book is oriented to introducing particular capabilities, like data division and I/O, rather than, as Brown does, according to user functions such as transactions and validation.

As the main text is an almost continuous stream of over 100 question and answers, Parkin doesn't provide any real sense of structure or perspective. You will learn how to write Cobol programs, if you are able to plough your way through the workbook. But you will not get close to the sense of what Cobol programming is like in the real world which Brown offers.

Parkin's book may be useful as an adjunct to a Cobol course, although its self-study approach is not designed for group class work.




## A practical approach to Basic

One of the problems faced by authors of Basic language books is to decide which dialect to use. Peter Gosling neatly side steps this obstacle in *Program your Microcomputer in Basic*. He assumes that you already have a microcomputer and that you will read the book in conjunction with the manufacturer's manual to modify the program examples, which are in Microsoft Basic.

The first 20 or so pages discuss general computing and programming principles. The bulk of the book then consists of 16 'activities'. Each activity aims to describe a particular aspect of Basic by providing coded examples. The reader is expected to key the program into his or her own microcomputer. Gosling discusses aspects of the program and its results.

Activities include mathematical functions, particular instructions (AND, OR and NOT is one activity and FOR. . . NEXT loops another) and other programming facilities such as lists, arrays and strings. There is also a practical guide to bug hunting and information on operating systems.

Within its own terms, the book is quite useful. But if you already have a manufacturer's manual which covers basic Basic, you will probably already know many of the facilities shown and will be looking for a book which examines Basic more comprehensively. I also found that the activity examples were in too small a type (reduced printouts) which may be a little annoying when typing in the code.

A book with limited goals, of most use if your microcomputer comes with a lousy manual.

## Two for Pascal

Two books on Pascal illustrate the truth of that old adage: you get what you pay for. *A Primer on Pascal* by Richard Conway, David Gries and E Carl Zimmerman is the most comprehensive, both in terms of Pascal itself and as a general introduction to programming. It is also almost three times more expensive than *Simple Pascal* by James J McGregor and Alan H Watt.

The *Pascal Primer* is intended to be a general introduction to programming and has over 400 pages packed with information. It has five parts. Part 1 looks at fundamental programming concepts, such as the use of variables, assignments, flow control and program execution and output. Part 2 looks at program structure. Part 3 examines program development aspects, such as the phases of development and top-down design. Part 4 is about independent sub-programs. Part 5 is a particularly interesting and detailed examination of techniques for program testing and proofs of correctness. This is followed by three useful appendices, including details of UCSD Pascal.

*Simple Pascal* is a terse, straightforward description of basic Pascal capabilities. This is done primarily

*GOTO page 190*

# MARCH TO A DIFFERENT DRUMMER

## The programmable 'rhythm box' has exploded onto the music scene in recent years. Jeff Aughton shows how to make a PET add-on, which outperforms many commercial units, for £10.

This add-on allows you to compose rhythms, store them using the computer and then play them back through a 'drumbox'; that is, a set of circuits capable of imitating conventional percussion instruments. If required, the contents of the computer memory may be stored on tape and reloaded at a later date — this facility is particularly useful for stage work. Software for the project consists of a program, written in Basic for an 8k PET, which provides a series of control pulses at the user port. Hardware requirements are the drumbox itself, whose construction is described later, plus, of course, an amplifier to replay the music. At current prices, the total cost of the project, including connectors, is about £10.

Keyboard instruments, such as electronic organs, often include a rhythm section capable of playing a number of preset rhythms, eg, waltz, Latin and disco. Figure 1 shows the layout of a typical unit: rhythm patterns are taken from the memory by the controller which then provides trigger pulses for the instrument generators. When the pattern is complete, the controller resets and starts the cycle all over again. Although this system is cheap and reliable, it suffers from the major drawback that the patterns produced are repetitive and cannot be easily changed. Normally, the controller/memory combination comprises a number of discrete components; in our case it is replaced by the computer.

Early rhythm units used a diode matrix as the memory and, while this method is rather cumbersome, it does at least allow 'reprogramming' with a soldering iron. More recently, custom-designed ICs (effectively ROM chips) have been used to control up to eight instruments for, typically, 16 rhythm patterns.

This project allows control over four instruments — bass drum, snare drum, hi-hat and cymbal — which form the basis of most modern rhythm backing. We now look in detail at the facilities offered by the program.

Nine rhythms (numbered 1-9!) may be stored at any time. Of these, 1-6 contain 16 beat measures and are suitable for 4/4 and 2/4 time signatures, while 7-8 contain 12 beat measures (for 3/4 and 6/8). Rhythm 9 allows each bar of the music to be individually selected from any bar stored in the first eight patterns. This is obviously the most versatile arrangement and is best suited to recording or experimental work.

Each pattern consists of two bars (A and B) which can be replayed in one of the following modes: A, in which the A bar is repeated continually; AB when the A bar is followed by the B bar and the AB pattern is repeated continually; and fill-in when the A bar is played several times followed by a one bar fill-in of the B bar — this pattern is then repeated.

Part of the screen display is shown in Figure 2. The (moving) arrow indicates the progress of the music and the ● s prepresent beats. Rests are indicated by —s.

The music may be stopped and restarted from the beginning of the first bar by pressing the space key. Pressing any key other than space will cause the program to reset to the selection menu — note that this will not affect the memory in any way, as the rhythms can only be changed when the program is in the 'write' mode.

Storing the memory contents on tape, or loading patterns from tape, is done simply by selecting the correct mode ('file' and 'load' respectively) and following the instructions contained in the program.

Before looking at how the program works, we will consider briefly the operation of the user port. This is the central set of connectors at the rear of the machine (Figure 3) and the input/output port itself comprises pins C through L.

The address of this port is 59471 decimal and POKEing this with, for example, 13 (=00001101 binary) would cause pins C,E and F to go high (+5 V) assuming that these lines are configured as outputs. In this project, only pins C to F are used (see Table 1) and these four channels are set as output lines by POKEing 59459 with 15 (=00001111).

Thus, POKEing 59471 with 13 (= 8+4+1) would cause the cymbal, hi-hat and bass drum to sound simultaneously.

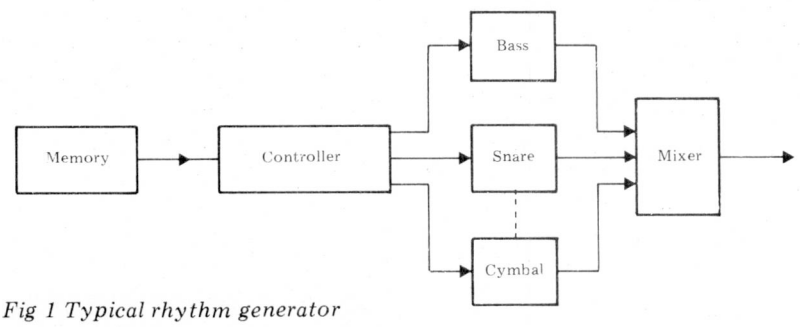



*Fig 1 Typical rhythm generator*

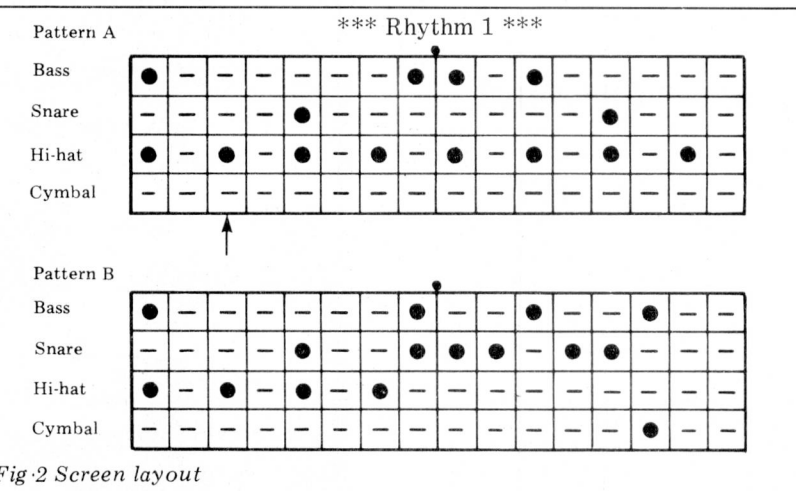



*Fig 2 Screen layout*

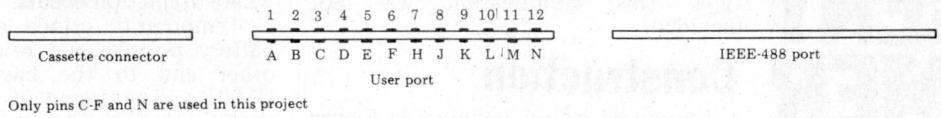



*Fig 3 Rear view of PET ports*

| Instrument | Triggered by POKEing port with | Pin |
|---|---|---|
| Bass drum | 1 | C |
| Snare drum | 2 | D |
| Hi-hat | 4 | E |
| Cymbal | 8 | F |

*Table 1 I/O port use*

The actual POKEing is done at line 4020. Notice that the lines are immediately POKEd off at line 4030. This is because the instrument generators only need very short pulses to trigger them.

Within the program, one of the most important features is data storage. Data is held in two arrays:

1. B%(32,8) These are integers in the range 0-15 which are POKEd into the user port, thus triggering the various sounds. The '8' denotes the eight rhythms and the '32' represents the contents of the two bars associated with each rhythm (1-16 for A and 17-32 for B);
2. C%(200) This array contains the contents of 'rhythm 9' that is, the sequence of bars to be played for that rhythm as chosen by the operator.

One unusual feature of the program is the way in which the contents of the screen are written to memory. This occurs at line 5190 onwards and the computer actually reads the line as seen on the screen (in the same way that the Basic interpreter does each time a program line is entered). This means that however many changes are made during editing, the line is read *once* and stored only when RETURN is pressed.

As stated, the purpose of this program is to provide a series of short positive-going trigger pulses at pins C—F. To test the program properly obviously requires the drumbox itself, but a preliminary test is possible at this stage.

Load the program, type in the rhythm pattern shown in Figure 2 and then replay it (see instructions later in the article). All should be visually correct

To check the operation of the I/O port, add line:

4025 FOR J = 1 TO 1000 : NEXT

and re-run the program. Now, during playback, a 0-10 V meter connected between pins N (—ve lead) and one of C—F (+ve lead) should register approximately 5 volts in time with the moving arrow. Thus, when a bass drum beat is present, pin C should go high, etc. This test should be carried out carefully as the PET is rather delicate in this area and is not tolerant of electrical errors on the user port.

Now, if all is well, delete line 4025, switch off the computer and plug in your soldering iron — to complete the project the drumbox has to be constructed.

## Hardware

The instrument generators and mixers are mounted in Veroboard and housed in a small plastic box. Although the layout is not critical, the unit should not be placed too near to transformers (or computers!) or other possible sources of interference. If this is unavoidable, the circuit-board should be mounted in a screened metal box. The unit is powered by a 9 V battery.

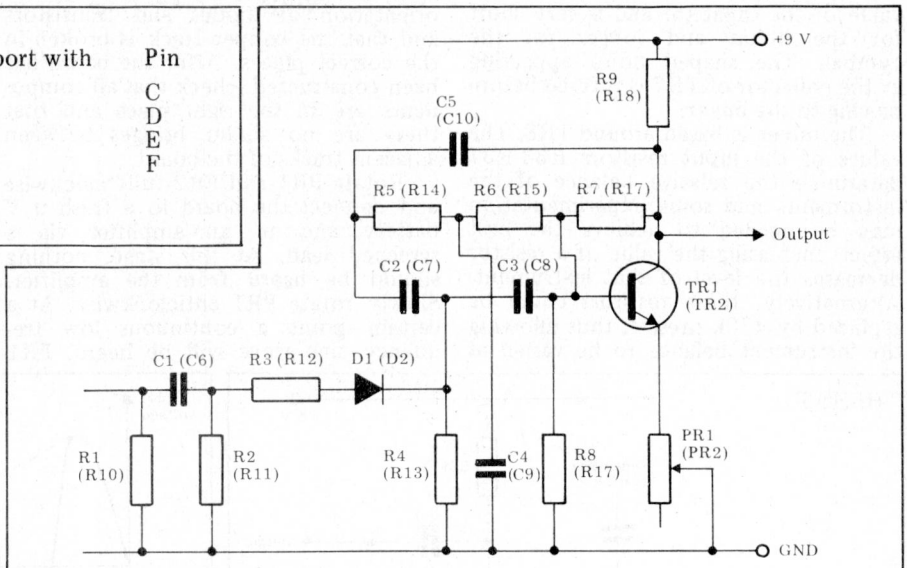



*Fig 4 Bass drum. The snare drum uses the same circuit with the component number in brackets.*

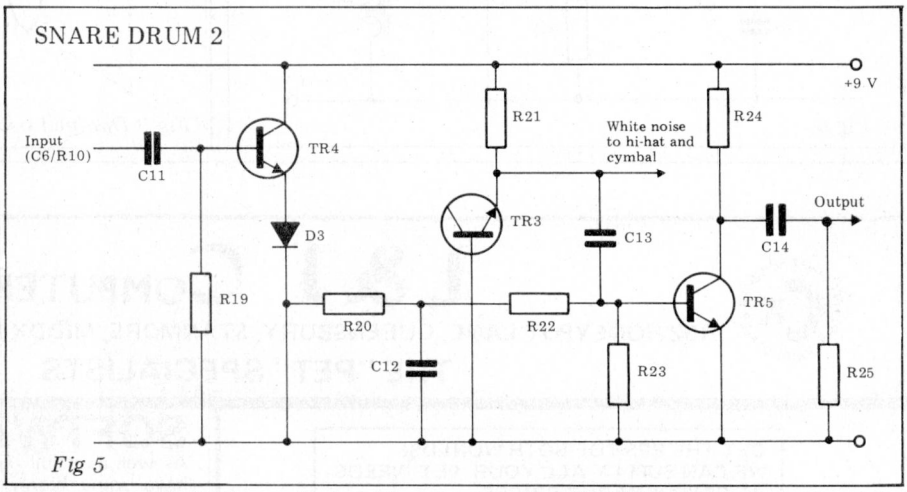



*Fig 5*

The generators themselves are of two types: pitched sounds such as those of a bongo or bass drum are produced by the damped oscillations of a 'twin-T' oscillator, while unpitched sounds such as the cymbal use shaped and filtered white noise.

The snare drum uses one circuit of each type to produce the two distinct tones which make up the snare sound — oscillations for the 'plonk' and white noise for the 'tizz'.

Both of the 'twin-T' oscillators behave in the same way, the only real difference between them being the frequency-determining capacitors in the Twin-T networks, so that the snare drum is pitched approximately two octaves above the bass drum.

In Figure 4 PF1 adjusts the gain of the circuit and is set so that the oscillator is held just short of resonance. When an input pulse is received, it is differentiated by C1/R2 and the negative-going edge (when the pulse is removed) is eliminated by D1. The remaining short pulse causes the circuit to oscillate, but since the oscillations are damped, the waveform produced decays rapidly, thus producing the required envelope for the sound (see Figure 9).

White noise is produced by reverse-biasing the base-emitter junction of a transistor, TR3. Noise is taken from the emitter and fed to the three noise-shaping circuits. Note that the amount of noise produced depends on the transistor and it may be necessary to experiment with different transistors, or to adjust the value of R21, to achieve the right effect. To avoid too much soldering, a transistor socket could be mounted in place of TR3 to make it easy to change transistors. The first transistor I tried was a BC108A, but most small-signal NPN transistors stand a chance of working.

Taking the cymbal as an example Figure 8, the input pulse charges capacitor C18 via diode D4 and the decaying voltage at C18/R29 junction controls the level of the white noise through the transistor.

# DIFFERENT DRUMMER

The decay time depends on the value of the capacitor and is very short for the hi-hat and longer for the cymbal. The shaped noise appearing at the collector of TR7 is filtered before passing to the mixer.

The mixer is based around TR8. The values of the input resistors R33-R37 determine the relative balance of the instruments and some experimentation may be needed to achieve the best effect. Increasing the value of a resistor decreases the level of that instrument. Alternatively, these resistors could be replaced by 470k presets, thus allowing the instrument balance to be varied at will. As space was limited in the prototype, this modification was not included.

## Construction

A Veroboard layout is shown in Figure 10. Assemble the components, with the exception of R35, noting carefully the orientation of diodes and transistors and that the copper track is broken in the correct places. After the board has been constructed, check that all components are in the right place and that there are no solder bridges between adjacent tracks of the board.

Rotate PR1 and PR2 fully clockwise and connect the board to a fresh 9 V battery and to an amplifier via a screened lead. At this stage, nothing should be heard from the amplifier. Slowly rotate PR1 anticlockwise. At a certain point a continuous low frequency sine wave will be heard. PR1 should be set just below the point where oscillation occurs.

Temporarily attach a lead to the battery positive and briefly touch the other end to the bass drum input (R1/C1). The sound of the bass drum should now be heard. It is possible to make small adjustments to PR1 to damp the sound of the drum in the same way that a real drummer will pad the inside of the drum to produce the sound he most prefers.

Repeat the process for the snare drum, adjusting PR2. Notice that the sound is higher pitched than the bass drum and that this is only part of the snare sound (ie the sound that a drummer gets by disconnecting the snare).

Resistor R35 can now be fitted to the board. On retriggering, the snare drum should sound much more realistic now that the sound of white noise has been added.

Triggering the cymbal and hi-hat

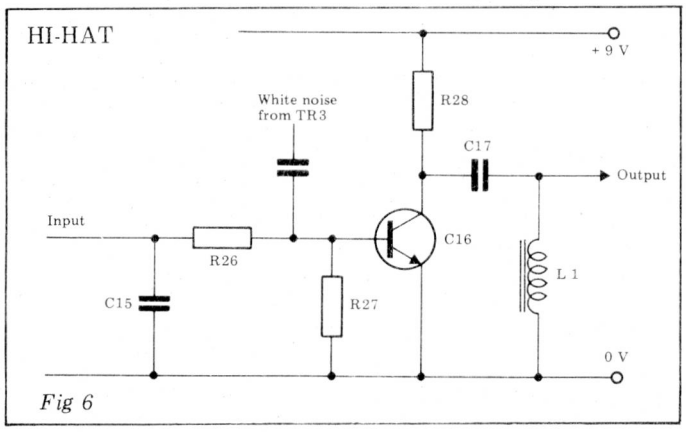


*Fig 6*

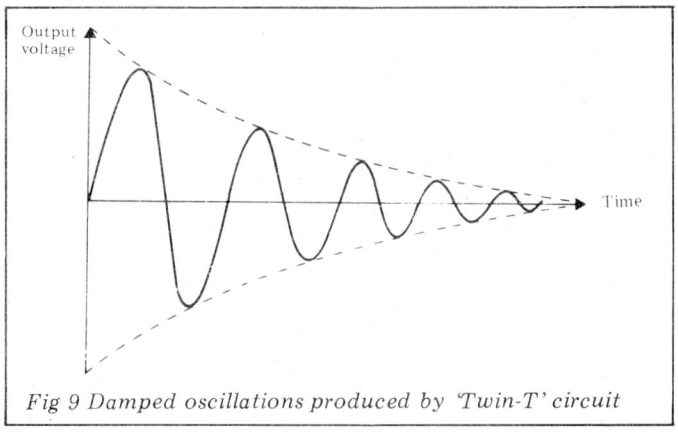


*Fig 9 Damped oscillations produced by 'Twin-T' circuit*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should produce rushes of white noise, with a noticeable decay time on the cymbal envelope. Notice that, in practice, the unit is triggered by a very short pulse from the computer and that these sounds begin to decay almost as soon as they are switched on.

If these tests are satisfactory, switch off and wire the unit to the user port connector as shown in Figure 11a. A 100 uF 16 V electrolytic capacitor is shown connected across the switch terminals; the siting of this capacitor is not critical — there is simply no room for it on the circuit-board.

Final adjustments, if required, can be made after the generator has been connected to the computer.

## Using the unit

Connect the drumbox to a suitable amplifier (see note later) and to the user port. Load and run the program and select the 'write' option (1) as, at this stage, no rhythms have been stored. Select Rhythm 1, a 4/4 pattern. The contents of Rhythm 1 (blanks) will be written to the screen. Write Rhythm 1 using the pattern shown in Figure 2, and the following keys: Space to write a rest (-) in the music; Delete to Delete the last beat before the cursor; and Return to move the cursor to the next line or recall the selection menu after the last line has been written. Any other key writes a beat (.) in the music. Note that after return is pressed, no more editing is possible on the line just written as the cursor passes to the next line. Now select the 'read' option (2), select Rhythm 1, select 'fill-in'

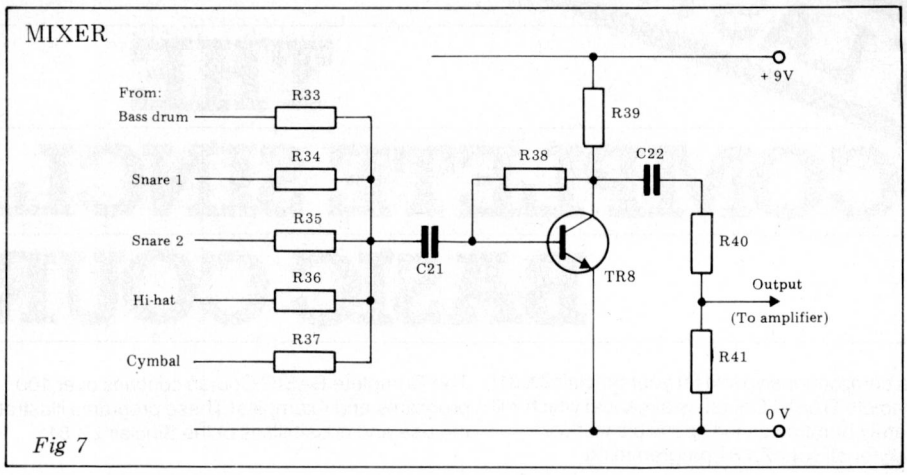



*Fig 7*

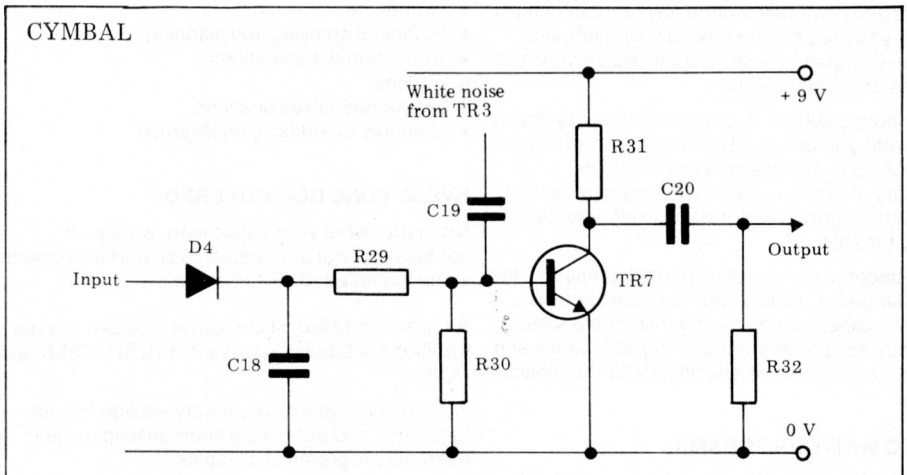
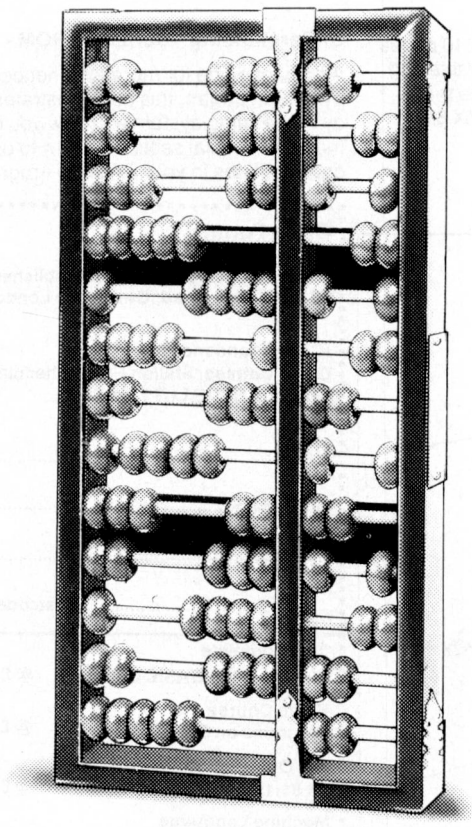



*Fig 8*

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# DIFFERENT DRUMMER

mode (3) and select a fourth bar fill-in (1). Choose a tempo in the range 80 to 85 and press space.

The moving arrow shows the progress of the music which will now be playing. After three bars of A, the arrow will move to bar B and play that pattern for one bar. The whole process now repeats.

The rhythm can be stopped and restarted from the beginning of bar A by pressing space. To stop the run and recall the selection menu, press any key (not 'stop!) other than space while the rhythm is playing. This rhythm pattern will remain in the computer until it is switched off or until it is overwritten with a new Rhythm 1.

To edit the pattern, call it with 'write' and make the necessary changes. For example, to add a cymbal to the first beat of bar B, press return seven

```
100 REM DIGITAL DRUMMER
110 REM
120 REM BY J.AUGHTON
130 REM
140 DIMB%(32,8),C%(200)
150 L1=33455:L2=33735:P=59471
160 POKE59459,15
170 PRINT"□"
180 REM
200 REM **** MENU ****
210 POKEP,0:GOSUB2000
220 PRINT"   1) WRITE"
230 PRINT"   2) READ"
240 PRINT"   3) FILE"
250 PRINT"   4) LOAD"
260 PRINT"   5) QUIT"
270 PRINT"■WHICH MODE? ";
280 X=5:GOSUB3000
290 ONXGOTO5000,6000,7000,8000
300 POKE59459,0
310 PRINT"□":END
320 REM
1000 REM **** DRAW BOARD ****
1010 PRINT"□■■■■■■■■■■■■          *** RHYTHM";R;"***□"
1020 V=0:FORI=65TO66:RESTORE:X=1
1030 PRINT"■■ PATTERN ";CHR$(I);"
1040 PRINT:READA$:PRINTA$;
1050 FORJ=1TO16
1060 IFB%(J+V,R)ANDXTHENPRINT"● ";:GOTO1080
1070 PRINT"- ";
1080 NEXTJ
1090 X=X*2:IFX<9THEN1040
1100 V=16:PRINT:NEXTI
1110 RETURN
1120 REM
1500 REM **** WAIT... ****
1510 GETA$:IFA$<>" "THEN1510
1520 RETURN
1530 REM
2000 REM **** CLEAR TOP ****
2010 PRINT"■";:FORI=1TO9
2020 PRINT"
2030 NEXT:PRINT"■";:RETURN
2040 REM
3000 REM **** INPUT ****
3010 POKE158,0:POKE167,0
3020 GETA$:IFA$=""THEN3020'
3030 IFA$<"1"ORA$>"9"THEN3020
3040 IFVAL(A$)>XTHEN3020
3050 X=VAL(A$):PRINTX
3060 POKE167,1:RETURN
3070 REM
3500 REM **** TEMPO ****
3510 GOSUB2000:PRINT"■■TEMPO 1(SLOW)-99(FAST)";
3520 INPUT"■■■■■";A$
3530 S=VAL(A$):IFS<1ORS>99THEN3510
3540 S=397-4*S
3550 PRINT"■USE ■ SPACE ■ TO START AND STOP"
3560 PRINT"■USE ■ R ■ (DURING RUN) TO RESET"
3570 RETURN
3580 REM
4000 REM **** PLAY ****
4010 FORI=1TOV:POKEL,30
4020 POKEP,B%(I+X,R)
4030 POKEP,0
4040 GETA$:IFA$=""THEN4070
4050 IFA$=" "THENPOKEL,32:N=2:RETURN
4060 N=3:RETURN
4070 FORJ=0TO5:NEXTJ
4080 POKEL,32:L=L+2:NEXTI
4090 RETURN
4100 REM
5000 REM **** WRITE ****
5010 L=33293:S=1:X=9:V=0
5020 PRINT"■WHICH RHYTHM (1-9)? ";
5030 GOSUB3000:R=X
5035 IFR=9THEN5500
5040 GOSUB1000:V=16:IFR>6THENV=12
5050 PRINT"■■■■■■■■■■■■"
5060 T=1:PRINT:PRINT"■■■■■■■■";
5070 POKE167,0:POKE158,0
5080 GETA$:IFA$=""THEN5080
5090 X=ASC(A$)
5100 IFX=20THEN5170
5110 IFX=13THEN5190
5120 IFX=32THEN5150
5130 IFT<V+1THENPRINT"● ";:T=T+1
5140 GOTO5070
5150 IFT<V+1THENPRINT"- ";:T=T+1
5160 GOTO5070
5170 IFT>1THENPRINT" -←←← -←";:T=T-1
5180 GOTO5070
5190 REM ENTER
5200 IFPEEK(PEEK(196)+256*PEEK(197)+PEEK(198))>128THEN5200
5210 POKE167,1
5220 FORI=1TO16
5225 B%(I+Y,R)=B%(I+Y,R)ANDNOTS
5230 IFPEEK(L+2*I)=45THEN5240
5235 B%(I+Y,R)=B%(I+Y,R)+S
5240 NEXT
5250 L=L+40:S=S*2:IFS<9THEN5060
5260 L=L+120:S=1:Y=16
5270 IFL>33727THEN200
5280 PRINT"■■":GOTO5060
5290 REM
5500 REM **** WRITE RHYTHM 9 ****
5510 PRINT"□SELECT EACH BAR OF THE MUSIC FROM THOSE■"
5520 PRINT"ALREADY PROGRAMMED. INPUT EACH BAR IN THE"
5530 PRINT"FORM 1A- MEANING RHYTHM 1/PATTERN A ETC."
5540 PRINT"FINISH THE LIST BY TYPING XX■■"
5570 B=0
5580 IFB<200THEN5610
5590 PRINT"□YOU HAVE WRITTEN 200 BARS-THAT IS THE■"
5600 PRINT"MAXIMUM ALLOWED":GOTO200
5610 B=B+1:PRINT"BAR #";B;
5620 INPUT"■■■■■";A$
5625 IFLEN(A$)<>2THEN5680
5630 IFA$="XX"THENC%(0)=B-1:GOTO170
5640 X=ASC(A$)-48
5650 IFX<1ORX>8THEN5680
5660 B$=RIGHT$(A$,1)
5670 IFB$="A"ORB$="B"THEN5690
5680 PRINT"■ ** ERROR-TRY AGAIN **■":GOTO5610
5690 IFB$="B"THENX=-X
5700 C%(B)=X:GOTO5580
5710 REM
6000 REM **** READ ****
6010 PRINT"■WHICH RHYTHM (1-9)? ";
6020 X=9:GOSUB3000:R=X
6030 IFR=9THEN6500
6040 GOSUB1000:V=16:IFR>6THENV=12
6050 GOSUB2000:PRINT" 1) A"
6060 PRINT" 2) AB"
6070 PRINT" 3) FILL-IN"
6080 PRINT"■WHICH MODE? ";
6090 X=3:GOSUB3000
6100 ONXGOTO6110,6300,6400
6110 Q=1E9
6120 GOSUB3500
6190 GOSUB1500
6200 FORK=1TOQ
6210 N=1:L=L1:X=0:GOSUB4010
6220 ONNGOTO6230,6190,200
6230 NEXTK
6240 N=1:L=L2:X=16:GOSUB4010
6250 ONNGOTO6200,6190,200
6300 Q=1:GOTO6120
6400 REM FILL-IN
6410 GOSUB2000:PRINT"FILL IN AT:■
6420 PRINT" 1) 4TH BAR
6430 PRINT" 2) 8TH BAR
6440 PRINT" 3) 16TH BAR
6450 PRINT"■ WHICH? ";
6460 X=3:GOSUB3000
6470 Q=2↑(X+1)-1:GOTO6120
6480 REM
6500 REM **** READ RHYTHM 9 ****
6510 GOSUB3500:GOSUB1500
6515 PRINT"■          RHYTHM 9"
6520 FORK=1TOC%(0)
6525 PRINT"■   ■";K
6530 N=1:X=0:IFC%(K)<0THENX=16
6540 L=4E4:R=ABS(C%(K)):V=16+4*(R>6)
6550 GOSUB4010:ONNGOTO6560,6600,200
6560 NEXTK:GOTO200
6600 GOSUB1500
6610 GOTO6520
6620 REM
7000 REM **** FILE ****
7010 PRINT"□PLACE A BLANK TAPE IN THE CASSETTE UNIT"
7020 PRINT"■HIT SPACE WHEN YOU ARE READY"
7030 GOSUB1500
7040 OPEN1,1,1
7050 FORI=1TO32:FORJ=1TO8
7060 PRINT#1,B%(I,J)
7070 NEXTJ,I
7075 FORI=0TOC%(0):PRINT#1,C%(I):NEXT
7080 CLOSE1:PRINT"■FILING COMPLETE"
7090 FORI=1TO2000:NEXT
7100 GOTO170
8000 REM **** LOAD ****
8010 PRINT"□PLACE A DATA TAPE IN THE CASSETTE UNIT"
8020 PRINT"■HIT SPACE WHEN YOU ARE READY"
8030 GOSUB1500
8040 OPEN1
8050 FORI=1TO32:FORJ=1TO8
8060 INPUT#1,B%(I,J)
8070 NEXTJ,I:INPUT#1,C%(0)
8075 FORI=1TOC%(0):INPUT#1,C%(I):NEXT
8080 CLOSE1:PRINT"■LOADING COMPLETE"
8090 GOTO7090
9000 DATA "BASS   ","SNARE  ","HI-HAT ","CYMBAL "
```

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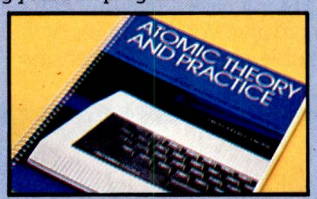


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# DIFFERENT DRUMMER

times (the first seven lines are correct and need not be rewritten) and then any key (to write the beat) followed by return.

When the rhythms have been written they may be saved on a data tape. To do this, select the 'file' mode (3) and follow the instructions provided. Rhythms may be retrieved from the tape by selecting the 'load' mode (4). The contents of Rhythm 9 (if any) will also be saved by the file command. With a little practice, the unit becomes very easy to use.

Readers who are into, say, 7/4 rhythms (although personally, I have enough trouble with 4/4) can change:
IF R)6 THEN V=12 in lines 5040 and 6040 to:
IF R ⟩ 6 THEN V=14
This will produce 14 beat measures in Rhythms 7 and 8 and should enable them to indulge in their own particular whims.

To ensure successful operation of this project, the following points should be noted: The amplifier/speaker combination should be capable of handling the low frequencies generated by the bass drum. An amplifier of at least 20 watts feeding a 12in (or more) speaker is recommended. Further, the character of the sound produced depends very much on the settings of the amplifier tone controls and some experimentation will be needed to produce the best sound. If an 'earth-loop' occurs — which is apparent by the noise from the amplifier when the unit is not playing (or even when it is switched off) — disconnect the amplifier mains lead in the mains plug. *Don't*

*GOTO page 189*

## Components list

| Resistors (all 5%, ¼W) | | Capacitors (disc or polyester) | |
|---|---|---|---|
| R1, R4, R10, R13, R39 | 10k | C1, C4 | 150nF |
| R2, R3, R11, R12, | 100k | C2, C3, C6, C12, C19, C13 | 47nF |
| R5, R6, R14, R15. | 68k | C5, C9, C10 | 33nF |
| R7, R16, R22, R23, R26, R27, R29, R30, R36 | 1M | C7, C8, C15 | 10nF |
| R8, R17, R37 | 470k | C11, C21, C22 | 100nF |
| R9, R18 | 56k | C14, C16 | 2nF |
| R19 | 150k | C17, C20 | 1nF |
| R20 | 3k3 | C18 | 330nF |
| R21 | 47k | C23 (see text) | 100uF, 16 V W electrolytic |
| R24, R28, R31, R40 | 4k7 | Semiconductors | |
| R25 | 22k | | |
| R32 | 15k | D1-4 | 1N4148 |
| R33 | 1M8 | TR1, 2, 4, 5, 6, 7, 8 | BC108C |
| R34, R38 | 2M2 | TR3 | BC108A |
| R35 | 270k | | |
| R41 | 1k | Misc | |
| PR1, PR2 horizontal-mounting presets | 2k5 | L1 | 100 mH |
| | | Battery, connectors, on-off switch, wire, Veroboard, screened lead | |

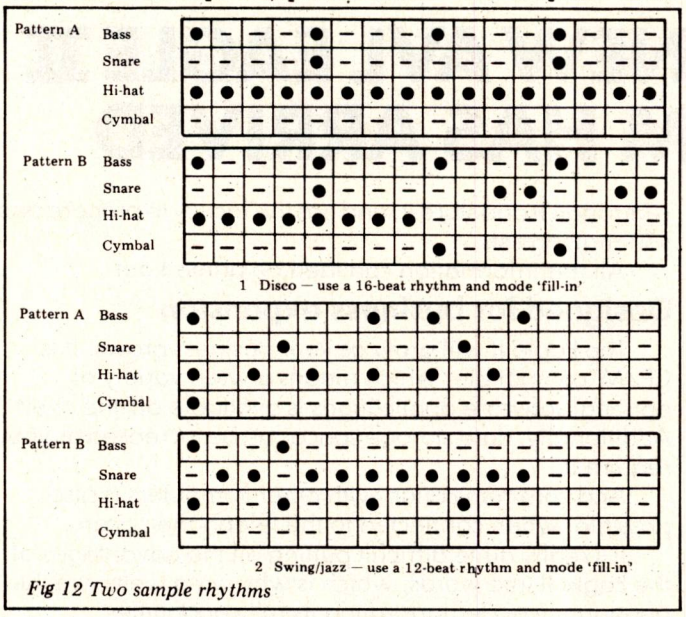


*Fig 12 Two sample rhythms*

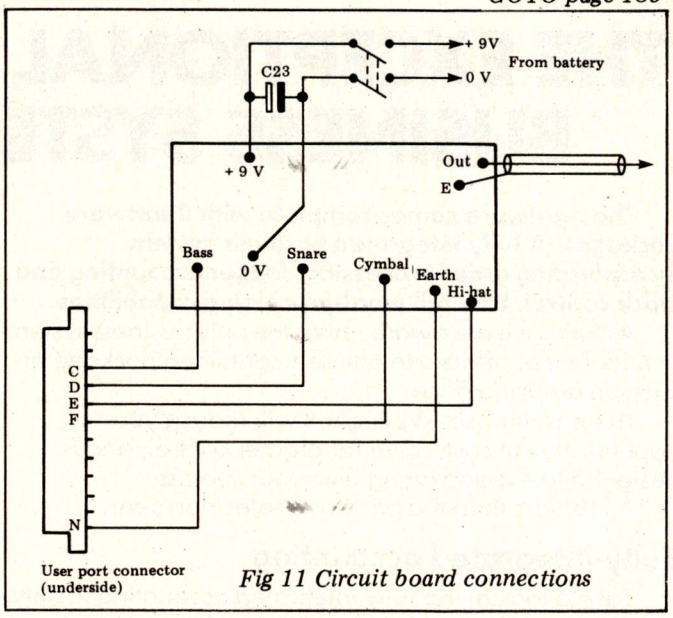


*Fig 11 Circuit board connections*

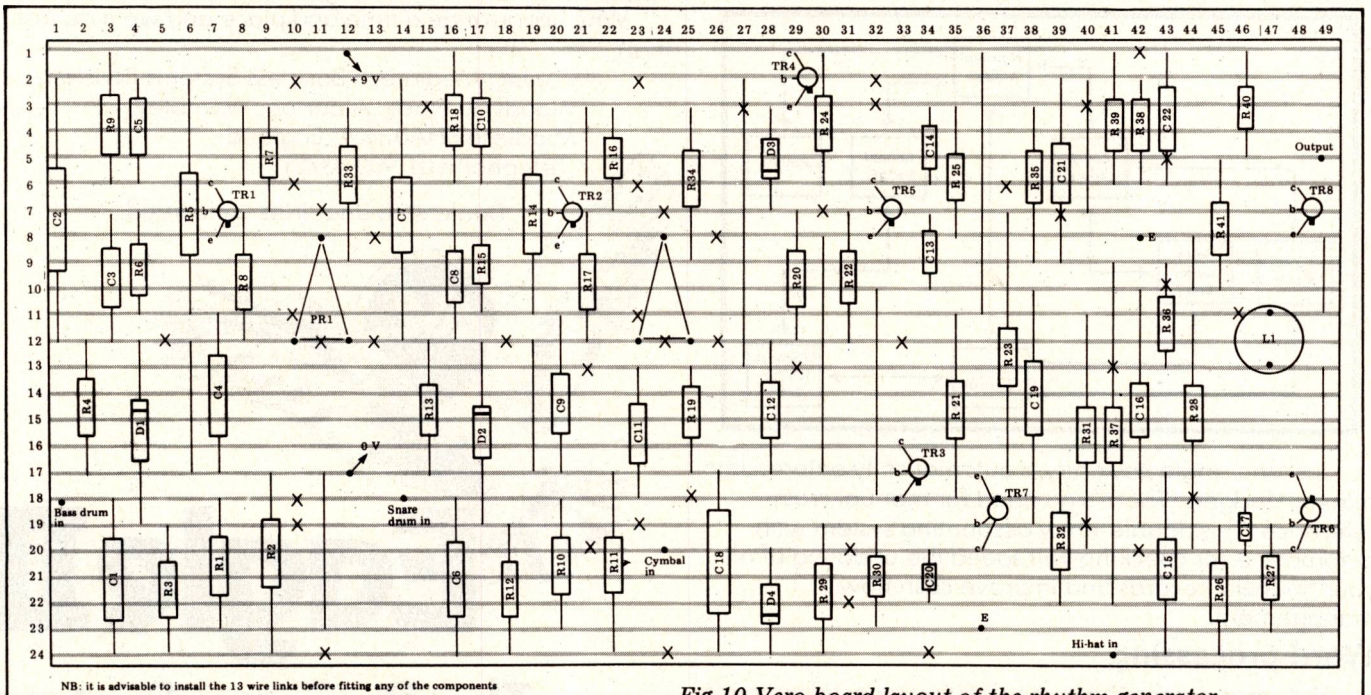


*Fig 10 Vero board layout of the rhythm generator*



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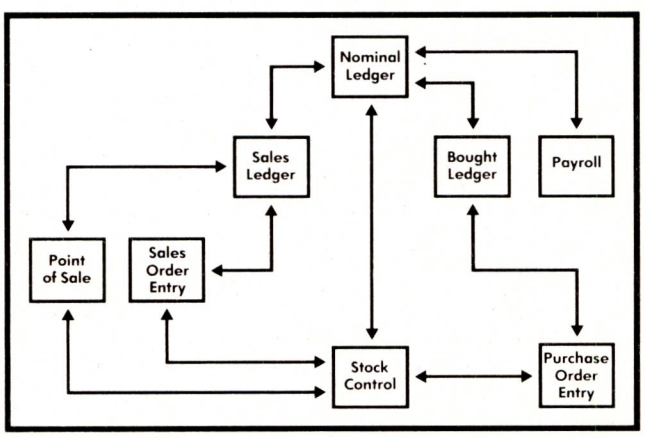


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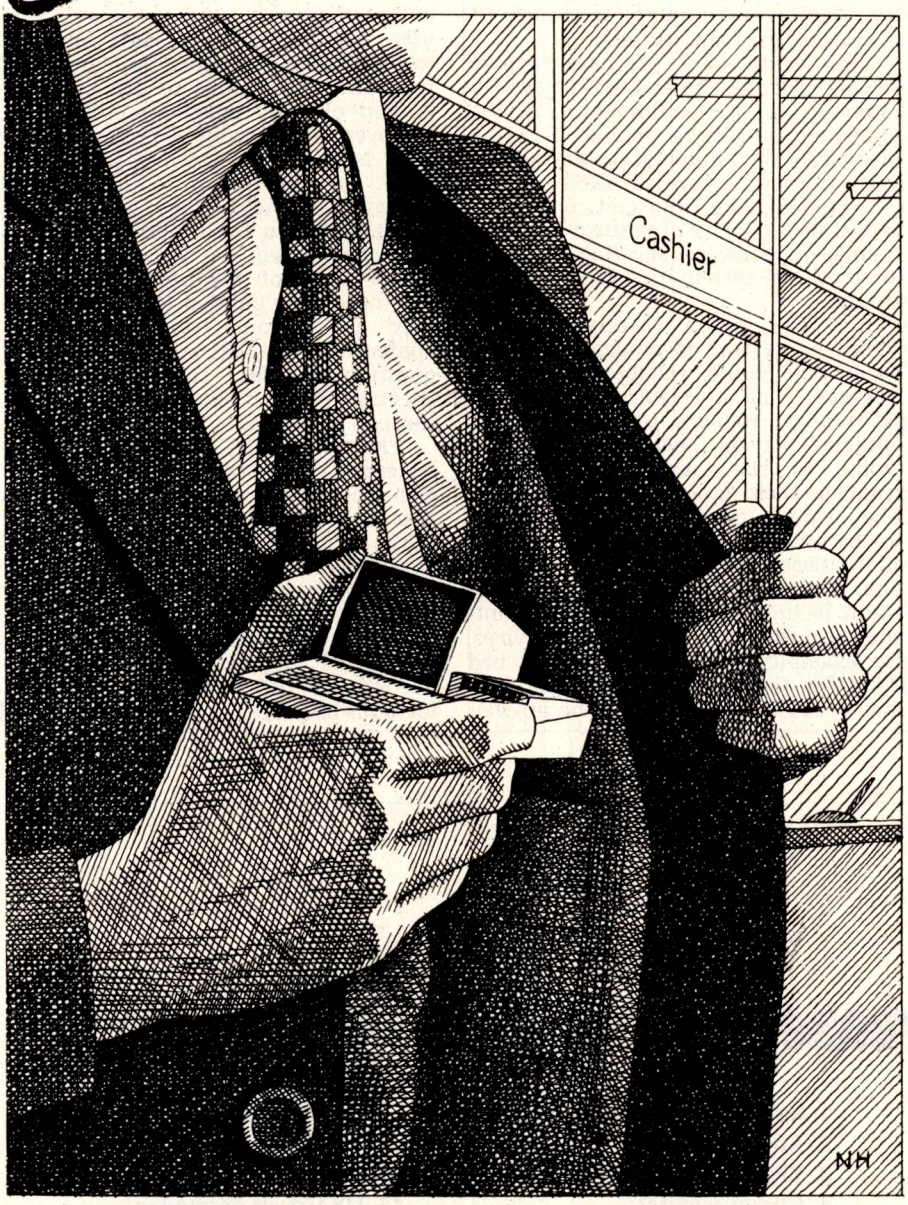
# Eagle II

## The Business System

# Banks Statement




## SOMETHING TO BANK ON

### Martin Banks talks about some of his relatives

Many of my relatives have, over the years, made considerable sums of money by providing financial services to a broad spectrum of industrial and individual customers. I have a great many of these relatives spread all over the world and the amount of money they have made over the years is gargantuan. I am definitely the poor relation.

You may have heard of some of them. For example, in this country my relatives include Barclay, Lloyd and Williams and Glyn. There are also the obscurely named National Westminster and Trustee Saving (what their parents were thinking of I dread to think).

Abroad, there are cousins such as Amro in Holland, Credit Lyonnaise in France and Citi and First National in America (the Americans are nothing if not arrogant).

All of them have made a quiet, respectable and decidely lucrative living out of their skill and at financial manipulation. They have managed to lock up vast amounts of money for themselves with a simple sales message — security. The message runs along the lines of: 'you give your money to us and we will keep it safe'. Sounds fine, doesn't it? What they then do is lend it to others at extortionate interest rates, the proceeds from which they keep. It is only in certain circumstances that they give any back. These are called deposit accounts and are controlled by rules about when, how and if you can get hold of your money. The other money, held in current accounts, gets no interest even though the banks get it for lending the stuff out. They levy a charge for keeping it for you and charge even more interest if they decide to let you have a little bit more than their arithmetic says you are entitled to (why is their arithmetic always right?). They have also devised some quite clever tricks for controlling the outflow of money — especially to what they consider to be profligate individuals (which is everybody, without exception). One trick is the cheque book, a collection of bits of negotiable paper that can be turned, by some secret and miraculous process, selectively into rubber. Another is only being open at times when customers have great difficulty in getting there. Yet another is to strictly limit the number of potential interface ports for those customers that do make it.

But all this is going to change — the revolution cometh, etc, etc.

This month, I would like to briefly look at a use for personal computers that has been discussed a little and investigated even less, but is, I feel, likely to become one of the fundamental changes that are eventually wrought on our industrialised society by these beasties.

It is a use that is not totally out of court. No less a personage than Steve Jobs of Apple has said that his company has had some discussions with its local banking fraternity in California about the potential for using personal computers in financial management.

The discussions, however, have not been about using them as microcosms of the data crunching roles of mainframe systems in banking. Several banking institutions are already dabbling with this approach, especially now that the concepts of local area networking are beginning to creep through into reality. Instead, this is about something different — a replacement for the good old cheque book.

There would appear to be a considerable opening for the banking fraternity to offer their customers personal computers in exactly the same way that they currently offer them cheque books. Though the economics of such an idea might seem to militate against it, it does stand up to closer examination.

While it is an idea that would not be suitable for all customers of the major clearing banks, (particularly the individual private customer who tends to use a cheque book 'on location' as much as at home), it would suit the vast number of business customers that make use of banking services.

Here, a cheque book is normally

kept at base as part of the overall accounting and financial management system of a company. It is 'provided' by the bank as a lever to use its services, offering security of funds transfer, etc. Each customer is charged for the cheques used, the charges being intended to cover all the relevant processing involved in actioning the required fund transfers and maintaining the records of an account. All of this can be done by computer, especially a small personal computer operating on a communications or networking system. The economics of providing such a service to customers involves the bank in a high front end charge to buy the equipment and software, but this can be spread over two or three years of use. The current bank charges accrued by companies using cheque books over the same period of time are almost certainly comparable to the cost of buying and installing the system.

Such an approach would have several advantages, both for the customer and the bank, though admittedly, most of them would go the latter. If the hardware and software were provided by the bank, the customer would have a 'proved' system to work with. It would be an essential part of the sales story for the bank that 'its' system is the best, most complete, most accurate, most reliable, etc. If it wasn't, the customer would have an immediate comeback; unlike today, where the bank's maths is *right* and the customer's isn't always. The customer would have access, through the network, to any and all of the bank's financial services. This, of course, would be at a price, dependent on the service involved.

With an approach like this, these services could not only include the more esoteric financial management offerings, such as investment portfolios and taxation, but also all data storage and printing functions. The bank could easily offer a full invoice, statements and whatever printing service to its customers, together with complete storage of all relevant data and records.

This would allow the bank to pare down the front end cost of the system hardware to the minimum, for the customers would be able to function adequately on a minimal system, almost to the point of a glorified ZX81 coupled to a modem. The front end cost would be further reduced by the sheer potential volume of hardware, allowing the banks to screw the system unit price into the ground.

For the banks themselves there would be several advantages. The two major ones could well be described as Revenue, and Control. They would get similar revenues to those already obtained via the cheque book service (while, at the same time, probably reducing their internal operating costs). They would, however, be able to add to the services available a wide range of alternatives. The printing service is just one, but there are many others. They could include a wide range of accountancy and financial management services, for example, which would be no bad thing for the software industry. I say that because there seems to be no way yet around the dilemma facing personal computer software, where the customer wants something brilliant for nothing, or very close, while brilliant software costs someone an arm and a leg to develop.

The banks could afford to fund such developments, and with the approach I have outlined here, have a large enough captive market to more than justify the investment.

In what might appear to be a momentary digression, the personal computer industry and the large body of existing users know that the number of potential applications of the beast are limited only by imagination. There is, however, a vast army of potential users who have yet to grasp that concept. They see no reason to spend good money on a technology they cannot understand and for which they see no immediate need. To get to the point where some of the utopian scenarios that have been painted for new technology can become realisable (and I appreciate that that could be a highly questionable place to be) it is first necessary to hand-hold the uninitiated through the basics.

The possibility of the banking fraternity using the opportunities for gain set out here is just one of the ways that this hand-holding process can be achieved, and from this spread of knowledge who knows what might transpire. For example, someone must have hand-held a Polish gentleman by the name of Joseph Conrad through the rigours of English before he became one of the best writers ever in that tortuous language. END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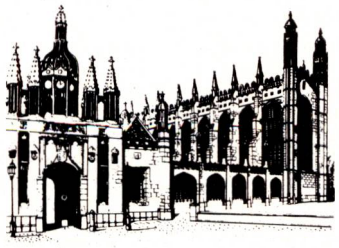

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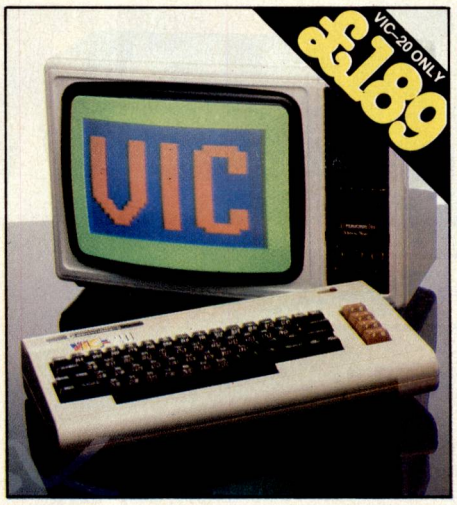


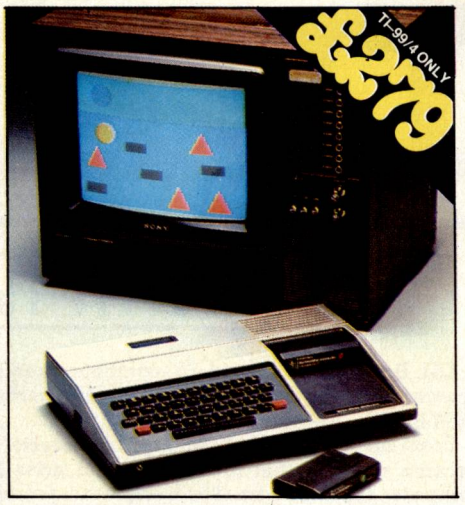


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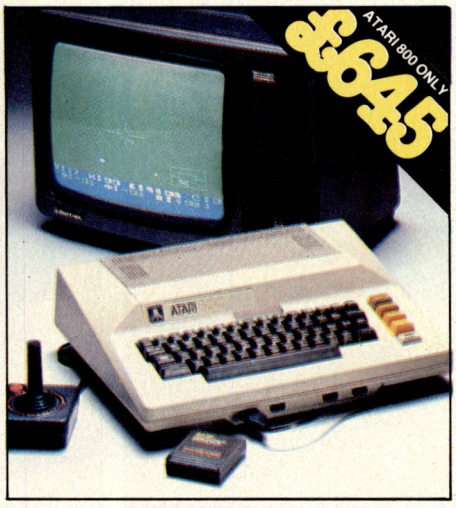


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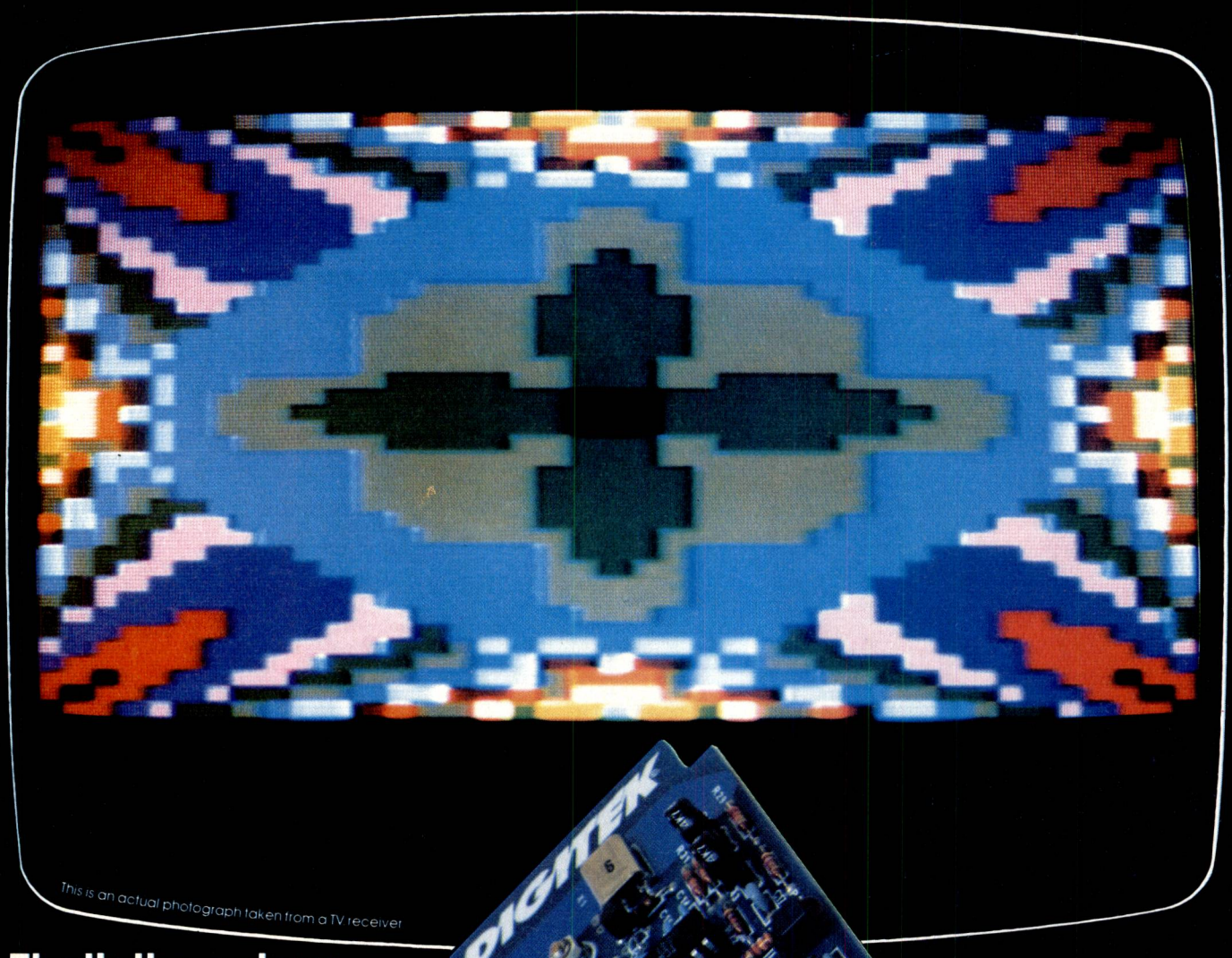

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# PATTERNS

**Alan Sutcliffe continues his thought-provoking series.**

Last month in 'Patterns' I wrote about Ken Knowlton's remarkable digital pictures constructed with complete sets of dominoes. To show the effect when the individual spots on the dominoes are hardly visible, Ken's portrait of Joseph Scala is reproduced again as Figure 1 in very small scale: the original is about 4ft by 5ft. It may illustrate some of the details better than in the larger scale photograph shown last month. For example, at the left of the picture there is a wine bottle, while Joseph Scala is holding up in front of his chest — you should have guessed — a domino.

This month I'd like to continue discussing Ken Knowltons special graphics language and give an example of a program unit; then on to a problem arising from arranging dominoes. But firstly, and by request, some details of Ken's graphic language Explor.

*EX*plicit 2-d *P*atterns, *L*ocal *O*perations, and *R*andomness both names and describes the language. This outline of it is based on Ken's report on Mini-Explor, a version he developed for 16-bit machines in Fortran. It could be implemented on a micro with something like 32k of store. The language is presented in the form of two functions and seven subroutines. All the variables are integers.

Programs operate on an array of cells representing a picture. Each cell contains a value 0 to 3, which may represent a colour or a grey-scale value when the picture is displayed. The size of the array can be set according to the store available.

## EXPLOR statement

NUM(x,y) returns the value currently in cell x,y.

NE(m,n) returns a random integer from m to n. It is pronounced 'any'.

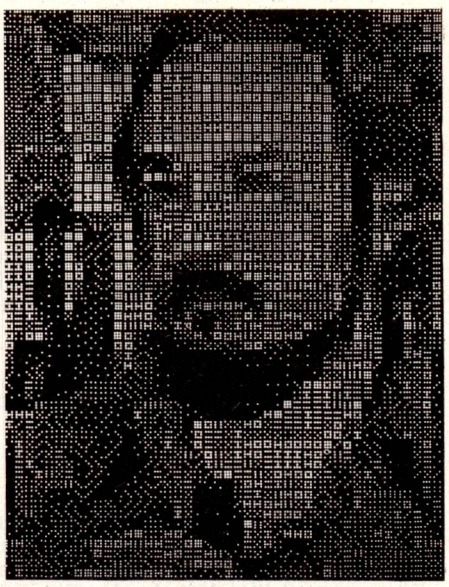
CALL SHOW(x,y,w,h) gives a printout or display of the area centred at x,y with width (w) and height (h). These parameters have the same meanings in the other subroutine calls.

CALL PUT(x,y,n) puts the value n in cell x,y.

CALL PUT4(x,y,n), where n is a four-digit number, puts the first digit in x,y, the next in x+1,y and so on.

CALL PUT16(x,y, n1,n2,n3,n4), where n1 to n4 are four-digit numbers, puts their digits into 16 successive locations starting at x,y.

CALL CHANJ(x,y,w,h,%,rule) causes cells in the specified rectangle to be changed according to the specified rule, which is a four-digit number showing, from left to right, what the values 0, 1,



2 and 3 become. For example, rule 1220 changes 0 to 1, 1 to 2, 2 to 2 and 3 to 0. % is an integer up to 100 which indicates what percentage of the cells in the area, chosen at random, should be changed.

CALL LOCOP(x,y,w,h,%,OK-counts, nabors,these,rule) is a local operation that alters the value of each cell in the area according to the values of its immediate neighbours, and subject to % as above. If the number of neighbours that satisfy the test is equal to one of the digits of OK-counts, then the rule is applied. 'nabors' is a three-digit number specifying which neighbours are to be considered, coded as the sum of the numbers in this chart:

```
400   200   100
 40          10
  4     2     1
```

'these' is an integer of up to four digits, each digit being a value that a specified neighbour must have to pass the test.

CALL LOCOP(x,y,w,h,50,340,505,12, rule) says in the area apply the following test to 50 percent of the cells and change those that pass according to the rule. If 0,3 or all four of the diagonal neighbours have the values 1 or 2, the test is passed. All the tests are carried out with the old values in the cells, the changes being made when all the cells have been tested, so that the order in which cells are tested does not affect the results. Otherwise, values could be propagated across the array as cells were progressively changed.

CALL COMBN(x,y,w,h,%,xf,yf,orient, r0,r1,r2,r3) combines the values in the area specified with those in an equal area centred at xf,yf: the TO and FROM areas respectively. 'orient' indicates which of the eight possible combinations of reflection and rotation through 90 degrees is to be first applied to the FROM area: 1 for no change, up to 8 for reflect and rotate 90 degrees anticlockwise. The value in the FROM cell is then used to determine which of the rules r0 to r3 is to be applied to the corresponding cell in the TO area. All kinds of combination and change can be made with this powerful statement.

The rules 0000,1111,2222,3333 ensure that the cell in the TO area is altered to the value in the FROM cell, regardless of its original setting: a straight copy.

The rules 0123,1123,2223,3333 cause the larger of the two cell contents to be stored in the TO cell.

The rules 0123,1111,2222,3333 make a copy of the FROM cells except that those FROM cells with value 0 are not copied: they are transparent and the original TO values still show.

## An example from life

These few statements, together with simple Fortran, give a comprehensive set of facilities for generating and transforming pictures. They could equally be implemented and embedded in Basic. To illustrate the power of Explor, it takes only eight statements to realise Conway's well-known game of Life, as shown in Program A. The first three statements set up the original pattern and the next three express the laws of the game. If an empty cell has just three live neighbours, then it comes alive. If a live cell has two or three neighbours, then it survives; otherwise it dies. To prevent interaction between the two parts of the laws, the first LOCOP call sets cells which are to be brought alive from 0 to 1, while the second call sets cells that are to survive from 3 to 2. The call to CHANJ then sets the new live cells, temporary values 1 and 2, to 3, and clears the remaining, killed-off cells from 3 to 0.

## Counting dominoes

While talking to Ken Knowlton about his domino pictures, a simple-sounding problem occurred to me. How many ways are there of arranging dominoes in a given rectangle? In this problem the spots on the tiles are ignored: suppose them to be face down. It is a matter of dividing a rectangle into 2x1 double cells.

In an MxN rectangle, no arrangement is possible if M and N are both odd,

since there will always be an odd cell left over. So either one or both of M and N are even. More difficult to see, but true, is the fact that if there are V vertical dominoes and W horizontal ones; then again, either one or both of V and W must be even: they cannot both be odd. It follows that it is only necessary to count the cases with an even number of, say, vertical dominoes. The first case is very easy to dispose of. With no dominoes vertical, they are all horizontal, and there is only one way of arranging them, whatever the size of rectangle.

The next case is for two vertical dominoes. Program B counts the number for each rectangle, up to 10x10, skipping those with both dimensions odd. When the width, X, is even for two vertical dominoes, the number of cases equals all those with the first domino on the bottom row plus the total of cases for the rectangle with one fewer row. This is what line 1150 does. When X is odd this is not true, but the program still works because it skips over the cases with Y also odd and so the value of R(X,Y-1) is always zero.

Strictly for the purposes of counting cases with two verticals and with X even, the second domino could also be confined to the bottom row, but the program is so written that it can easily be extended in two ways. First, by jumping over lines 500 to 640, the test to see if the rest of the rectangle can be filled with horizontal dominoes, the program will count all possible ways of placing two vertical dominoes, regardless of how the remaining area can be filled.

Second, the program can be extended for any larger number of verticals by putting in pieces of code similar to lines 200 — 270 and 1000 — 1030, plus extra display code like lines 750 — 770, all for each extra domino. I have carried out both these extensions for cases up to four vertical dominoes.

Returning now to the program as printed, line 200 ensures that if the first domino is already at the end of the bottom row the second one starts on the second row up, otherwise it starts on the same row. Line 220 ensures that if the second domino is on the same row as the first it starts to the right of it, otherwise it starts at the beginning of the row.

When both dominoes have been placed the remaining area is tested, starting at line 500, to ascertain whether it can be filled with horizontal dominoes. For this to be possible, any gap of empty cells in a row between filled cells, or filled cells and the edge of the rectangle, must be even in number.

# Results

Table 1 shows the results from the program for different number of tiles for 2xN rectangles. It shows a surprising relation between Pascal (his famous triangle), dominoes (arrangements of) and Fibonacci (his series). For a particular value of N, the numbers of arrangements form a diagonal of Pascal's triangle. And the sum of these numbers for each N gives a Fibonacci number.

```
                1
              1   1
            1   2   1
          1   3   3   1
        1   4   6   4   1
      1   5  10  10   5   1
    1   6  15  20  15   6   1
```

Table 2 gives the results for more general rectangles: I have not got the formula for these numbers. I have noticed that if trominoes — tiles of 3x1 cells — are used, then the number of possible arrangements in a column of 3xN cells is derived from a steeper diagonal of Pascal's triangle, and their totals for each rectangle form the Fibonacci-like series

1 1 1 2 3 4 6 9 13 19 28 ..

in which each term is the sum of the one immediately before it, plus the next but one before that.

# DAI - aid

This is the first of an occasional column on tips for the DAI personal computer, which is the machine I happen to have. The system I like, but the documentation leaves a few things to be desired and discovered and I hope these notes will be useful to other DAI users. I will be glad to consider your comments and questions: these may appear under the sub-sub-heading 'DAI-quiri', so you can expect some rum answers.

This month I am giving a routine for software character generation. On the

| N | 0v | 2v | 4v | 6v | total |
|---|---|---|---|---|---|
| 0 | 1 | — | — | — | 1 |
| 1 | 1 | 1 | — | — | 2 |
| 2 | 1 | 2 | — | — | 3 |
| 3 | 1 | 3 | 1 | — | 5 |
| 4 | 1 | 4 | 3 | — | 8 |
| 5 | 1 | 5 | 6 | 1 | 13 |
| 6 | 1 | 6 | 10 | 4 | 21 |

*Table 1 The number of arrangements in a 2xN rectangle arranged by number of vertical dominoes*

| M / N | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | — | | | |
| 2 | 1 | 1+1 | | |
| | 1 | 2 | | |
| 3 | — | 1+2 | — | |
| | | 3 | | |
| 4 | 1 | 1+3+1 | 1+4+6+1 | 1+9+16+9+1 |
| | 1 | 5 | 12 | 36 |
| 5 | 1 | 1+5+6+1 | — | 1+12+37+36+9+1 |
| | 1 | 13 | | 96 |
| 6 | 1 | 1+6+10+4 | 8+20+12+1 | 1+15+67+?+71+18+1 |
| | 1 | 21 | 41 | ? |

*Table 2 Number of arrangements in an MxN rectangle*
*? indicates the unknown number of arrangements with six vertical and six horizontal dominoes in a 4x6 rectangle.*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# PATTERNS

DAI there are three levels of resolution for graphics and for each of these there is a mode in which the bottom four lines of the screen are available for text, while the rest of the screen is for graphics. Apart from this, the hardware character set cannot be mixed with graphics using Basic. This is a nuisance for labelling diagrams, game scores and many other uses.

Characters can be built up with the DOT statement but this is slow — no more than one or two characters per second. It also uses up a lot of store for each character: say a six by eight array. If the bit map for each character is kept in a more compact form, then it has to be unpacked for the dot statement, slowing down the plotting even further. Some improvements can be got by plotting straight lines and, though the data is then in an awkward form, up to ten characters per second is possible in this way.

## Fast characters

A much quicker method is to POKE values into the store map of the screen, giving 20 to 30 characters per second. The following method applies to the four-colour modes and needs slight modification for the 16-colour modes, but the same data can be used. In the lowest resolution with four colours, MODE 2, there are 65 rows of cells on the screen, each row containing 88 cells. Each block of eight cells on a row is controlled by a pair of bytes. The two

| | Upper Byte | |
|---|---|---|
| Lower Byte | Not Set | Set |
| Not Set | 0 | 2 |
| Set | 1 | 3 |

*Figure 3 Colour selection*

Nth bits in these bytes together control the Nth cell; both bytes are set with the same bits to get the appropriate cells set to colour 3, for example. For colours 1 and 2, one or other of the bytes is left clear.

Thus the letter R can be represented by the bit map:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 62 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 33 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 33 |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 62 |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 40 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 36 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 34 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 33 |

This gives a character of six by eight dots with two columns left as an automatic blank. The characters are lined up with the blocks of eight dots. The program below does not allow other alignments, but this can be done by shifting the data values, possible across byte boundaries.

As each block of eight cells takes two bytes of data, each line of 88 cells takes 22 bytes. In addition, there are two bytes of control data per line, giving a total of 24 bytes per line. In the two higher resolution modes there are 44+2=46, and 88+2=90 bytes per line. The top left of the screen is always at the same location in store, #BFED, preceded at #BFEF by the two control bytes for the top line on the screen. Successive locations across and down the screen are stored in decreasing addresses and because of this it is natural to address the screen in decreasing store locations. In Basic, the screen is addressed in the normal way from the bottom left, so that DOT 0, YMAX 1 refers to the top left element of the screen, but this is not the same position referred to in the screen map by the top bits in bytes #BFED and #BFEC. This is because there are eight columns of cells at each side of the screen which cannot be accessed by DOT, DRAW and FILL, but can be by POKE. This remains true at any resolution.

Program C puts the characters RR in the first two blocks of eight cells at the top left of the screen and repeats this four further times immediately beneath them, giving an array 2x5 of the letter R. Line 290 puts two blank lines between each vertical repeat. To get the same result at medium and high resolution, the constants should be changed as follows:-

| | Low | Medium | High |
|---|---|---|---|
| Line 140 | 2 | 4 | 6 |
| Line 270 | 24 | 46 | 90 |
| Line 290 | 48 | 92 | 180 |

The expression (XMAX+25)/4 just happens to take on the values 24,46 and 90 in the three modes. Once the basis of the routine has been grasped it can be generalised to put any character at any location in any available colour and any resolution. END

*PROGRAM A*

```
 10 CALL PUT4(10,11,3330)              Set the
 20 CALL PUT4(10,10,3030)              starting
 30 CALL PUT4(10,9,3030)               pattern
 40 CALL LOCOP(10,10,20,20,100,3,757,3,1123)  Create live cells
 50 CALL LOCOP(10,10,20,20,100,23,757,3,0122) Kill cells
 60 CALL CHANJ(10,10,20,20,100,0330)   Erase last pattern
 70 CALL SHOW(10,10,20,20)             Display
 80 GOTO 40                            Next generation
```

*EXPLOR program for the game of Life.*

*PROGRAM B*

```
 50 DIM A(10,10)                       Main array of cells
 60 DIM R(10,10)                       Array for results
 70 COLORG 0 3 6 9                     Set colours on DAI
 80 X=1                                Start rectangle 1 cell wide
 90 Y=2                                Start rectangle 2 cells high
100 MODE 6A                            High resolution with text on DAI
                                       (clears screen)
102 IF (X*Y MOD 2) = 1 THEN 1200       If X and Y both odd, next case
110 T=0                                Initialise total of cases for this
                                       rectangle
120 IY=1                               Y coordinate of the bottom row,
                                       1st domino
130 FOR IX=1 TO X                      X coordinate runs across the
                                       rectangle
140 A(IX,IY)=1                         Set the cell for the lower half of the
                                       domino
150 A(IX,IY+1)=1                       and for the upper half
200 FOR JY=IY+1—SGN(X—IX) TO Y—1       Y coordinate for the 2nd domino
210 IF JY=Y THEN 1030
220 FOR JX=1+IX—IX*SGN(JY—IY)TO X      X coordinate for the 2nd domino
240 IF A(JX,JY)=1 THEN 1020            Test if lower and
250 IF A(JX,JY+1)=1 THEN 1020          upper cells already filled
260 A(JX,JY)=1                         Set lower and
270 A(JX,JY+1)=1                       upper cells
500 FOR N=1 TO Y                       Test even gaps for each row
510 B=0                                Initialise gap count
520 FOR M=1 TO X                       Move along each row
530 IF A(M,N)=0 THEN 610               If a cell is unused, go to
                                       increment count
540 IF (B MOD 2)=1 THEN 1000           If cell is used, and if count is
                                       odd, test fails
600 B= —1                              Reset count
610 B=B+1                              Increment
620 NEXT M                             Next cell
630 IF (B MOD 2)=1 THEN 1000           End of row: if count is odd,
                                       test fails
640 NEXT N                             Next row
700 T=T+1                              Test passed, increment total
710 FILL 10,10,10+10*X,10+10*Y 3       Display arrangement: draw
                                       rectangle
720 XX=10*IX+2
730 YY=10*IY+2
740 FILL XX,YY,XX+6,YY+16 6            Draw 1st domino
750 XX=10*JX+2
760 YY=19*JY+2
770 FILL XX,YY XX+6,YY+16 9            Draw 2nd domino
1000 A(JX,JY)=0                        Clear lower and
1010 A(JX,JY+1)=0                      upper cells of 2nd domino just
                                       tested
1020 NEXT JX                           Next X coordinate for 2nd
                                       domino
1030 NEXT JY                           Next Y coordinate
1100 A(IX,IY)=0                        Clear
1110 A(IX,IY+1)=0                      1st domino
1120 NEXT IX                           Next X coordinate
1150 T=T+R(X,Y—1)                      End of this rectangle: add in
                                       total for preceding one
1160 PRINT X;Y,T                       Print result
1170 R(X,Y)=T                          and store it
1200 Y=Y+1                             Increment height of rectangle
1210 IF Y < 11 THEN 100                up to 10 cells
1220 X=X+1                             Same for
1230 IF X < 11 THEN 90                 width
1240 MODE 0                            All text on screen
1250 FOR Y=2 TO 10                     Print results for
1260 FOR X=1 TO 10                     all rectangles
1270 PRINT R(X,Y)
1280 NEXT X: PRINT
1290 NEXT Y
1300 END
```

*PROGRAM C*

```
 100  DIM A(8)                         Array for 1 character
 110  FOR I=0 TO 7                     Read the data
 120  READ A(I)                        for 1 character
 130  NEXT I
 140  MODE 2                           Set resolution
 150  COLORG 0 1 2 3                   Set 4 colours
 200  B=BFED                           Set base address top left of screen
 210  FOR J=1 TO 5                     For 5 pairs of characters
 220  FOR I=0 TO 7                     For 8 lines per character
 230  R=A(I)                           Get 8 bits for this line
 240  POKE B,R                         Upper byte, 1st block on line } Colour 3
 250  POKE B—1,R                       Lower byte, 1st block on line }
 260  POKE B—3,R                       Lower byte, 2nd block on line:
                                       Colour 1
 270  B=B—24                           Move to next lower line
 280  NEXT I                           For 8 lines per character
 290  B=B—48                           Skip 2 blank lines
 300  NEXT J                           For 5 pairs of characters
 800  DATA 62,33,33,62,40,36,34,33     Bit map for letter R
 900  END
```




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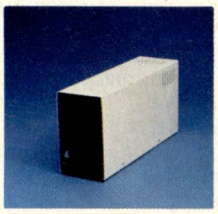

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BENCHTEST
COMPUTER SYSTEM

# THE BBC MICRO

## Chris Sadler and Sue Eisenbach probe the innards of the most talked about machine in the history of the micro.

Our first hint that a BBC Computer might be available for a Benchtest came with a tentative phone call from the Editor. A second call a few days later disclosed that a member of the *PCW* staff had been dispatched to Acorn Computers with instructions not to return until he was in possession of a review machine. That evening we were able to collect an early production model (the serial number on the board is 10) of the 'B' system and a piece of co-axial cable. At a party later that evening, we cornered Chris Curry of Acorn and got a photocopy of a pre-release version of the manual. At last we had a chance to see if the system we'd been advising hobby purchasers to hang on for was worth the wait.

The User Guide describes how to get started — which sockets to use when linking the system to the TV set; how to select a spare channel to tune in; seeing a 'snowstorm' and tuning until 'words appear on the screen'. The manual handles everything methodically and reassuringly — first, when one is concentrating on the tuning, one is just told to expect 'words'; then, when one is (presumably) successful, the manual reproduces the 'banner':

BBC Computer 32k

BASIC

>

(Incidentally, this title puts paid to 'Proton' and 'Beebon' and all the other names that have been bandied about.) At this point, the means to correct erroneous keyboard input or entirely reboot the system is described. Rather charmingly, the BBC Computer signals a genteel 'Mistake' rather than the customary and more peremptory 'Error' encountered on every other system.

The guide then passes on to the details of connecting up the tape recorder and running the 'Welcome' cassette which will be supplied with each system. Since we didn't have a on to investigating the screen-handling software and some of the more arcane aspects of the Basic. It was only when we tried to save something on cassette that we ran into problems — instead of saving or loading, the system devoted its energies to scrolling an endless array of white rectangles up the screen. Our closest Acorn employee at the time happened to be manning the Acorn stand at Compec, where we cornered him and scrounged a tape drive for the evening. The problem appeared to be that the prototype firmware on our system expected to use an Acorn System III as backing store. This could be redirected with an (undercommented) command 'TAPE' after which all was well. The production machines should default to the cassette filing system.

The borrowed drive came complete with 'Welcome' tape. Once it's loaded, it asks whether the tape connection has motor control or not and then proceeds to run through a series of demonstration programs. All of these seem well-written and some are very good. The first, called 'Keyboard', is a game designed to familiarise the user with the keyboard. There is an outline of the keyboard at the top of the screen, below which the user is asked to type selected characters. Confusions (like 'O' and '0') are ironed out with reference to the keyboard outline and the function of the CAPS and SHIFT locks are explained.

The next program is 'Sketch', which uses the cursor keys to create simple line-drawings in four colours. This is followed by 'Calculator', which features all the functions of an elementary scientific calculator in the same syntax to the same precision (only the keys are in different places). This is a useful program for the first-time user since it can relate the computer's operation to that of something more familiar (namely, the calculator). Here the function keys along the top of the keyboard are used for storing in and recalling from up to nine memory locations, together with square-root and other functions.

The next sequence of programs shifts the emphasis to different types of applications — all of them excellent computer literacy material. The first offers an alphabetic sort of 20 words. The user can choose the 'slow-motion' option and watch the algorithm swapping items as it works its way down the list. The second is 'Poem' and it gets our vote as Demonstration Program of the Year. It features a personalised poem by Roger McGough. The narrator is the machine and the poem uses several computerised tricks to achieve its effects. It would be unkind to divulge any more of its delights but we cannot resist quoting the final couplet which goes:

'A plastic daffodil in a Grecian Urn
Goodbye Chris. Now press RETURN.'

The third program in the sequence features a 32-entry telephone directory which can be sorted and manipulated in a variety of ways. This is an introduction to a typical (if vestigial) interactive, data processing package and it isn't difficult to imagine it being used as a starting block for a 'build your own telephone directory program' programme when the BBC starts its programming series.

The succeeding programs were all demonstration programs with names like 'Clock', 'Music', 'Patterns' and 'Biorhythms'; and a couple of classic games — 'Bat and Ball' and 'Kingdom'. These are important components and, taken as a whole, the tape is well-balanced offering for the new user. It is to be hoped that future application software emanating from the BBC will follow the standards set both in quality and scope.

The cassette filing system (CFS) has some interesting features. Data is recorded in blocks, each block being tagged by a filename and the block number. When LOADing or CHAINing (= LOAD followed by RUN), after each block is read, the following information is output: (filename) (blocknumber) (size). In the case of intermediate blocks (ie not the last one) the size field is always 100H (that being the block-size in user-hostile hex) but once the last block has been read, the true size of the program is inserted. If the file currently being read is the sought file (and LOAD must be followed by a 'filename'), then an asterisk is appended after the last field in the output record. Several special cassette-based messages exist, including 'Press record' (after a SAVE) and 'Please Rewind' (usually after 'Checksum!'). During loading the signal can be heard over the cassette loudspeaker, unless the speaker can be disconnected in some way (eg plugging a jack plug into the remote socket).



In this Benchtest, as in all others, we are reviewing the system as delivered. This was an early production model in which some components were not in their finalised form, and a few peripheral ones were completely absent. The systems at Compec (only one week maturer than our version) were demonstrably more complete. As the review progresses, we will try to speculate as to how our machine differs from the

version of which the potential purchaser is likely to take delivery. However, some of the negative remarks we may make will not apply to the ultimate system. It would be a pity if production delays were allowed to obscure a good design. Nevertheless, those readers who have already ordered their BBC computer will know what to look for.

## Hardware

The BBC Computer comes packaged in a biege, slightly knobbly plastic moulded keyboard cabinet. There is a horizontal slot at the back for ventilation (large enough for fingers — although they won't get hurt as the power supply is fully encased in plastic). The actual cabinet is not supported internally across the top and is too flexible to support a small TV set. Apart from a keyboard of a quality rather superior to that found on the Atom, the cabinet features three LEDs, a power switch and a staggering catalogue of entrances to and exits from the inside. The keyboard is a 74-key qwerty arrangement with a cluster of grey cursor-control keys on the right-hand side and ten orange function keys (labelled F0 to F9) across the top. On the models we saw at Compec there was a clear plastic strip across the top which would protect legends for the function keys. Next to F9 is a key labelled BREAK (called RESET in the documentation) which gives a re-boot. It is well out of the way of the crucial RETURN key and it is good to see that DELETE has been moved to a less accident-prone spot than on the Atom. All keys have auto-repeat.

There is a CAPS LOCK and a SHIFT LOCK which operate two of the three LEDs situated just under the keyboard. All in all, the keyboard felt like a robust high-quality product. The power switch is on the extreme left-hand side at the back and at the right-hand side is the first output port, the UHF coaxial socket. Next door to this, moving leftwards, is the video output, although this was not installed in the review machine. (See the 'Board Silhouette' — Figure 1 — for further details). Still moving leftwards, there are three DIN plugs respectively for RGB output, an RS423 port (upwards compatible from the RS232 standard) and the cassette interface (300 or 1200 baud — the 'Welcome' tape we had ran at 300 baud). This is followed by a 15-way D-plug for analogue inputs, a hole for a reset switch and a DIN socket for the Econet, although on the review machine these last two were not installed. Apparently, the 16k 'A' system will not feature all of these optional connections while the 32k 'B' system will. We had a 32k system but inspection revealed that not all the options (notably the Econet interface) had been socketed in.

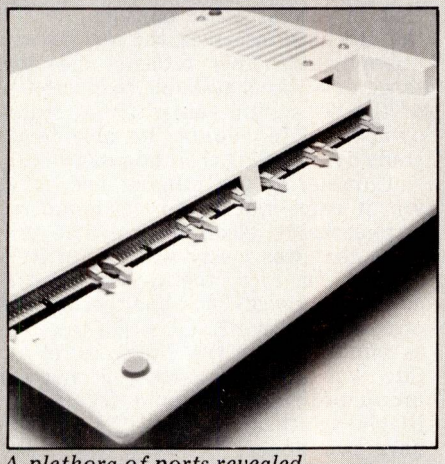
As if that were not enough, by turning the BBC Computer upside down, a sequence of edge connections can be seen protruding from a slot directly beneath the keyboard itself. From left to right (and upside down) these include the 'Tube', the 1 MHz bus (for connection to Prestel or Teletext) the User I/O bus, the parallel printer port (currently used by Acorn for downline loading software off its large systems) and the disk port. Of these, the most exciting is probably the Tube which is going to be the BBC Computer's pathway to a second processor. In its current configuration the cable from the Tube will go directly under one of the supporting feet. The analogue input bus will support four paddles and the 1 MHz extension bus features two mysterious lines labelled JIM and FRED. Every one of these interfaces is fully documented and it is possible to imagine that a whole industry will be set up to produce and market add-on kit utilising one or the other.

After that, there's nothing to do but open up the cabinet and see what's inside. The keyboard rests above the main board to which it is connected by a ribbon cable and the speaker leads. Once these are detached the full board comes into view (see the 'Board Silhouette' again). First let it be said that the review system was socketed everywhere except in the Econet section but that in several other sections, notably the disk interface area, the sockets were unpopulated. This reflects the wide range of options available to purchasers of the 'B' system (although 'A' system owners will no doubt, be able to upgrade by returning their boards).

Considering the number and variation of chips stuck onto this board it is a remarkably clean design. The only thing that was messy was in the ROM section. In fact, the review machine contained a piggyback board which was populated with EPROMs. We took this as implying that the firmware, at any rate, was still being debugged and that production models would feature real ROMs in these sockets. This would have two effects — firstly, the higher packing density would imply that the piggyback board became unneces-



sary; and second the system would run a bit cooler. This is necessary as the review machine had the capacity to run hot and the suddenly start corrupting the contents of the RAM with the alarming side-effect of altering random bits of the screen memory. On a blank screen, this is simply amusing but if you have a program listed there, this has the effect of editing your program! The heating problem reduced, however, when we ran the system with the top off, although the problems did not go away entirely (maybe the BBC computer is susceptible to spikes on the mains). We hope that when the ROMs are installed such drastic cooling will become unnecessary. That was the only serious hardware complaint, although the quality of the UHF output was poorer than could have been obtained by a more upmarket modulator.



*A plethora of ports revealed.*

Everything else should be clear from the 'Silhouette' — note the ADC chip for the paddles and the Voice Synthesis kit. Finally, the Video and Serial processors are a pair of Ferranti Uncommitted Logic Array (ULA) chips. One can only assume that the extremely fancy graphics is supported by the former of these while the latter looks after the RS423 port and perhaps the cassette. Finally, the keyboard includes provision for a device to accept a ROM cartridge which will be used by the voice synthesis unit in due course.

## Software

At the moment, the BBC Computer can be programmed in Basic and Assembler, with promises of Pascal and Forth. As most people will control the machine in Basic and as this is the dialect that the BBC viewers will learn, it seems important to spend some time on it.

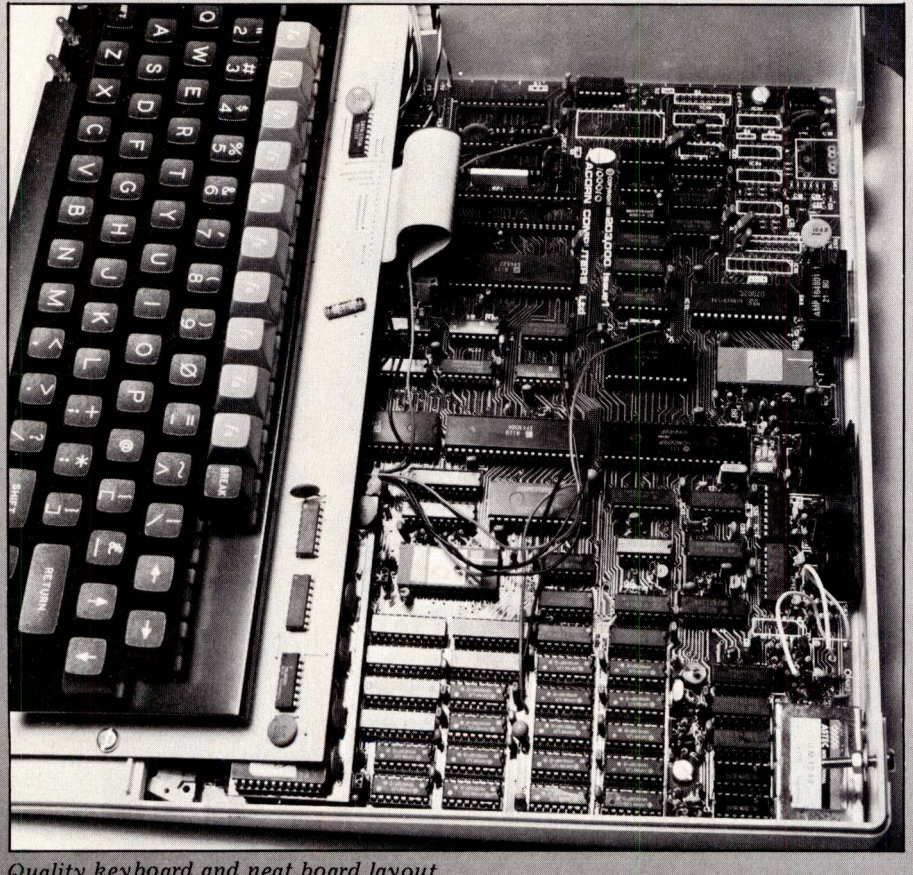
Acorn has said that it is Microsoft-like — that is, the BBC wouldn't let it use its own eccentric Atomic Basic but didn't require it actually to buy Microsoft Basic, just to make it fairly compatible. It takes up 16k and is a superset of Microsoft's 8k interpreter (as found on the PET, Nascom, Superboard etc) but it is substantially different from Version 5 in the more powerful features.

The first thing we noticed was that it is a 'structured' Basic. Most impressive is its ability to reference functions and procedures (subroutines) by name. Although GOSUB exists in the language to ensure compatibility with Microsoft, it probably won't be used much. Both procedures and functions (any number of lines) can take parameters (passed by reference) and can have local variables declared using the world LOCAL. This means that general purpose procedures and functions can be written without programmers having to worry about what variable names to use within subroutines and the local variables really are local. If you try to access a local variable outside its procedure or function, the error message 'No such variable' appears on the screen (unlike Comal). The Basic interpreter will complain about the use of any variable until it has been given a value, rather than assuming the value zero — an irritating feature of most Basics since mistyping a variable name will result in the creation of a spurious variable.

Identifiers (variable names), used anywhere in a program, can be of any length and each character is significant. The first character must be a letter but after that almost any character is acceptable (including underscores for readability). Upper case and lower case letters are recognized as being different and reserved words must be in upper case. This means that lower case versions of the reserved words are legal identifiers. It might make for nice program layout to have reserved words in upper case and the rest in lower case but it is undesirable to allow programmers to use 'if, then', etc as identifiers. Also it means that in practice most programmers will stick to upper case for convenience.

For a structured Basic, BBC Basic is short on control structures. It has IF. . . THEN. . . ELSE but only an ON. . GOTO(SUB) instead of a CASE statement. Although there is a REPEAT . . . UNTIL loop as well as the standard FOR loop, there is no WHILE. . . DO loop. We hope that a general loop with the test at the top and a CASE statement will be added to later versions of the language. Layout is aided by an instruction LISTO, which will insert spaces to indent the loops.

The BBC computer has exceptional graphics capabilities for its price. The screen can be configured in eight different modes (four on the less expensive model A) for graphics and text (see Figure 2). Unlike most systems with a choice of resolutions (including the Research Machines 380Z, noted for its superior graphics), all graphics modes are on the same coordinate scheme — 0,0 in the lower left-hand corner up to 1280, 1024 in the upper right-hand corner. In a given mode, lines will be mapped to the best resolution available (much nicer than having to scale everything when switching resolutions), so programs with graphics will run under every graphics mode and only the coarseness of the plotting will change. The command MODE N is used to change modes. This clears the screen but retains any program in memory. PLOT and VDU are machine-code subroutines which can be called from Basic and, as such, do not make for particularly readable code. For instance, PLOT 4, X,Y has the effect of simply moving to coordinates X,Y whereas PLOT 86,X,Y fills in a triangle whose vertices are the points X,Y and the last two points visited, the fill colour being the inverse of the current foreground colour. In fact, PLOT has 88 different options (the first parameter is the option number), of which numbers 32 — 63 require the Graphics Extension ROM in order to function. PLOT deals with general purpose drawing, while VDU (which has 33 options) controls the more generalised whole-screen characteristics like text and graphics window,



*Quality keyboard and neat board layout.*

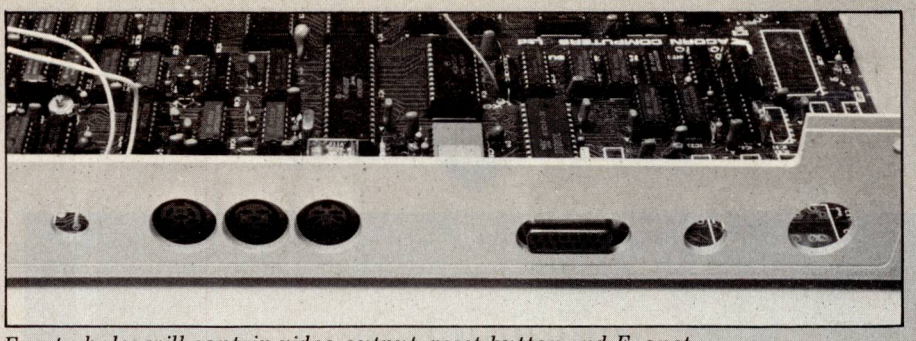
character fonts and colours, etc. Some of the more common options are embodied in commands in their own right — and it's a shame that there aren't more of these. They include COLOUR which selects the colour of text or background on a textual screen; GCOL which selects the current colour on a graphics screen; CLS and CGS which clear text and graphics screens respectively; MOVE and DRAW which respectively plot dark and light vectors and POINT which returns the colour at the current screen position.

Acorn's programmers seem to be very fond of low level programming. One of the nicest features of Atomic Basic is the way it interfaces to assembler. Instead of the usual nasty PEEK and POKE from Microsoft, BBC Basic provides the capability of writing assembler code (enclosed in square brackets) within a Basic program complete with Basic line numbers for easy editing. To start the execution of a segment of low level code from Basic, either CALL or USR is required. CALL is general-purpose and can take a variable number of arguments while USR initiates a function call when one result is required. The command OPT gives the user some control over the Assembler output when this has been initiated from within a Basic program.

It is frequently difficult to get a detailed memory map for many microcomputers on which a POKE may interfere with system or screen memory with unexpected results (hence the need for books such as *'The Pet Revealed'*). Since Acorn seems to want to encourage low level programming, it gives the programmer a full memory map. Assembler programmers are given four variables in Basic — HIMEM (the highest address a user's Basic program can use), LOMEM (where the user's variables are stored), PAGE (where a user's Basic program starts) and TOP (the first free location after the user's program) — which can be accessed or altered to allow the assembler programmer to find somewhere for low level code.

The file handling on the BBC computer is via MOS (Machine Operating System) routines which are called from Basic. Unfortunately there was very little documentation on MOS (probably because it was rather incomplete). Regardless of whether the filing system is on tape or disk, the commands are the same. Files must be opened with OPENIN (for reading) or OPENOUT (for writing) and closed with CLOSE. Once the file is opened, the next record to be accessed can be chosen with PTR. So random access files are supported on both tape and disk. Bytes can be read or written with BGET and BPUT. Numbers or strings can be put into files with PRINT and retrieved with INPUT. EXT, the only instruction that doesn't work on both types of files, gives the size of a disk file.

On the review machine, sound had not yet been implemented in Basic but the instructions SOUND and ENVELOPE rivalled PLOT and VDU for power and lack of readability. ADVAL, the instruction to get input from one of the four analogue to digital convertors standard (Why are there no D to A convertors?) on the model B machine, also didn't produce useful information as the A to D convertors were not yet connected to the Real World.



*Empty holes will contain video output, reset button and Econet.*

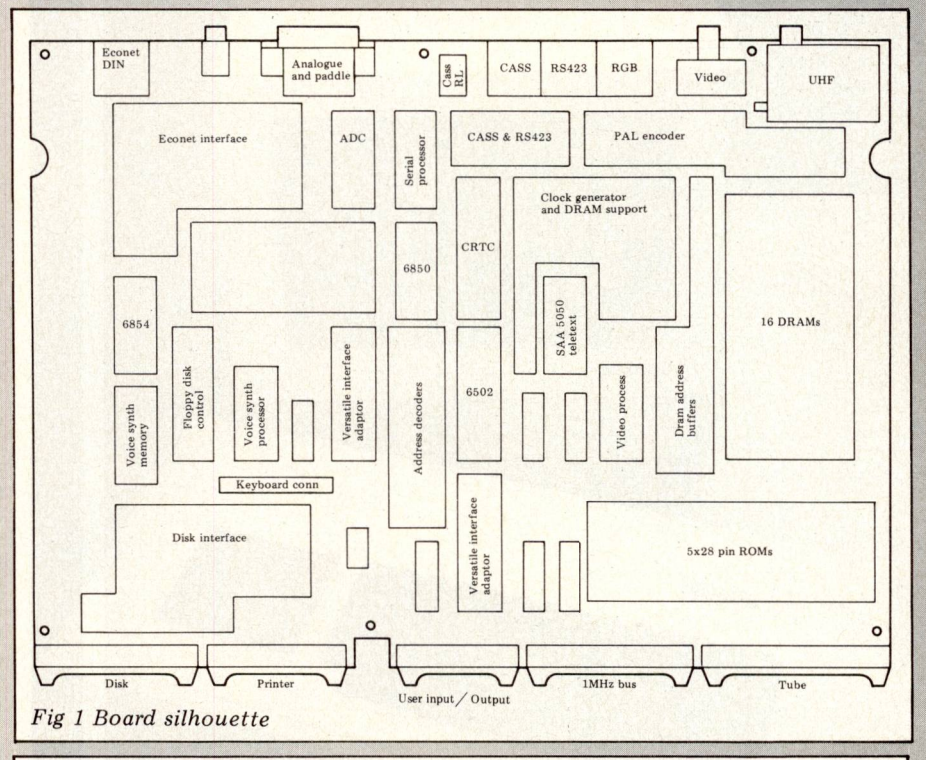
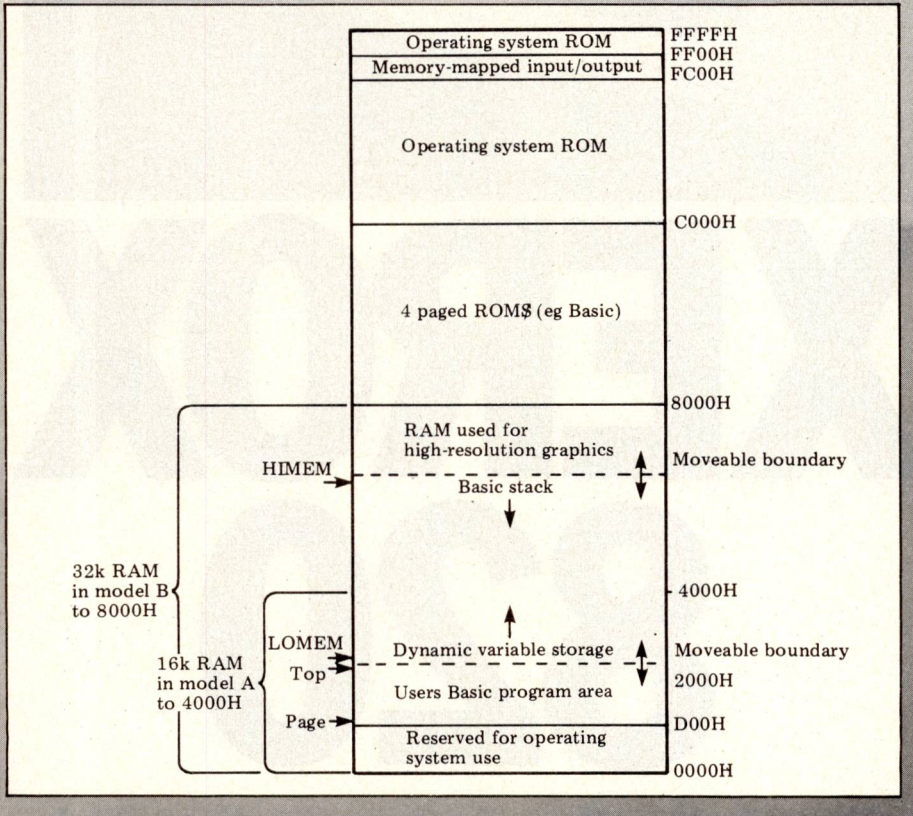



*Fig 1 Board silhouette*




One entertaining command that was implemented is EVAL (borrowed from Comal), which enables a user to type in a mathematical equation that is dynamically evaluated while the program is running. Another is OLD, the opposite of NEW, which even works after the BREAK key has been hit.

Although the syntax of BBC Basic is quite close to Microsoft's (the string handling seems the same), it has a differ-

*GOTO page 186*

BENCHTEST
BUSINESS SYSTEM



# XEROX 820

**Xerox is the other giant corporation which entered the micro market in 1981. Steve Withers investigates its offering.**

Dubbed 'The Worm' (an allusion to the success of the Apple II), the 820 is the Xerox entry to the personal computer market. Built around well-tried components like the Z80 CPU, there is nothing radical about this system; instead, it is a solid, no-frills computer with virtually no software included in the price.

## Hardware

Virtually all the electronic components of the 820 are housed within the moulded plastic monitor cabinet which is finished in the same off-white paint as the rest of the system. A single printed circuit board carries the processor, memory, and all the input/output devices. The full 64k of 4116 dynamic RAM is available, as the monitor EPROMs and video memory are switched out when they are not being accessed.

The video display was generally sharp and clear, but it regularly developed a severe wobble about half an hour after switching on. Fortunately, this would only last a few minutes and I suspect that the rough handling the machine received on its way to me might have been responsible. The monitor also produced the high-pitched whistle so often generated by these devices, but there were no problems with TV or radio interference.

The display provides the usual 24 rows of 80 characters on a 12in black and white screen. Provision is made for two character sets (each of 128 symbols) with software selection, but both sets were the same on the review machine. The only way of highlighting characters is by setting the high-order bit of the code which causes the symbol to flash. A block cursor is used, except when it is over a character — in which case its position is indicated by making the character flash. This can be confusing when flashing characters are being used for emphasis, and so the absence of inverse video and reduced intensity is particularly noticeable. A small selection of extra symbols, including several types of arrowhead and the copyright sign, may be obtained by prefixing the control codes with code 1F (ASCII 'VS'). The existence of true descenders — however small — adds to the overall quality of the display, but it is unfortunate that nothing has been done to minimise reflection from the plain glass screen.

A useful feature of the system is that the display emulates a Lear Seigler ADM-3A terminal, providing cursor-addressing, erase to end of line and to end of screen. The ADM-3 is a very popular device which is supported by most software suppliers whose products make use of the special features provided by some terminals. As an example, the standard version of the UCSD p-system drives an ADM-3.

The controls are scattered about the lower edges of the cabinet. The brightness control is a slider conveniently

mounted under the front left corner of the case and the on/off switch is on the right hand side, about halfway back. Tucked well away on the back panel is the reset button, easy to find if your arms are long enough.

The keyboard is mounted in a separate case and connected to the main unit by a rather inflexible multicore lead. While the action of the keyboard is not the best I have experienced, it is certainly not the worst, but I would have expected an office products manufacturer like Xerox to pay more attention to this aspect of the design. To give you some idea, it's about the same as the SuperBrain keyboard. One problem I experienced was that some keys needed a greater pressure than others, leading to several lost characters. Another snag was that, contrary to the description in the manual, the 'LOCK' key is actually a shift lock rather than a capitals lock, so the punctuation marks and numbers are reversed as well. I hope that the manual corresponds with production machines, as capitals lock is far more useful. A separate number and function keypad is fitted, but this useful feature has a strange quirk: typing control-1 (or any other digit) on the number pad does not generate the same code as control-1 on the main keyboard. The significance of this will become apparent when I discuss the software.

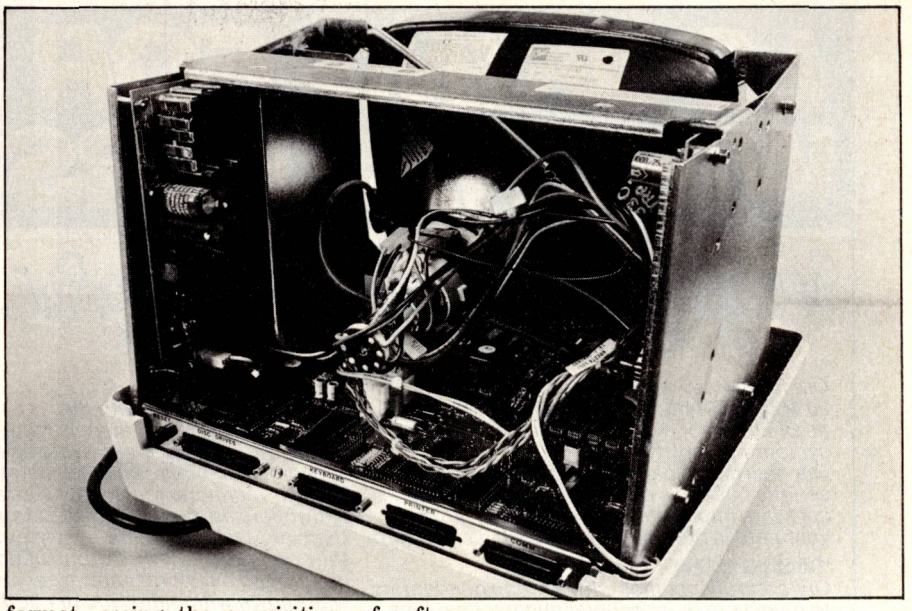
In addition to all the usual keys, there is a 'HELP' button at the top left of the keyboard which generates control-shift-6; this is, of course, only useful when the software recognises this code as a request for help, and could cause confusion when running programs which use a different key for this purpose. A very sensible departure from common practice is the provision of two control keys, one each side of the space bar, beneath the shift keys. Another thing I liked was that the delete, backspace and cursor control keys all repeat when held down, as does the space bar.

Overall, the keyboard is adequate for most purposes and is very stable due to its soft rubber feet.

Either 5¼in or 8in disk drives may be used with the 820, although they cannot be mixed. Both types are Shugart products and are supplied in cabinets containing two drives, although it is possible to daisy-chain a third and fourth drive onto these. The mini-floppies are compact enough to fit on a desktop with the rest of the system, but the larger drives are fitted with their own power supply, so they might be better placed on a separate shelf.

The compactness and lower price of the 5¼in drives are probably their only advantages. Being single-sided, single-density units, they only offer 81k of storage per disk, despite using 40 tracks. They are significantly slower than the 8in drives, taking 15 seconds to load a certain program, compared with 10 seconds on the larger system (NB, the disk test timings are for the 5¼in drives).

A major advantage of the 8in disk system is that it uses the IBM 3740 format, easing the acquisition of software and the interchange of data with other systems. This format gives a net capacity of 241k per disk, a far more practical proposition than the smaller size.



*Monitor case also houses CPU.*

A disadvantage shared by both types of disk unit is that, due to their hard plastic feet, they tend to slide about when one closes the drive doors. Both are reasonably quiet in operation, helped by the fact that the 5¼in drive motors switch off 15 seconds after they are used.

The Diablo 630 daisywheel printer supplied with the test system is an optional extra. It has all the usual features associated with this type of printer, including provision for tractor and sheet feeders. While I cannot provide any objective evidence, this printer seems to be quieter in operation than some other daisywheels I have used.

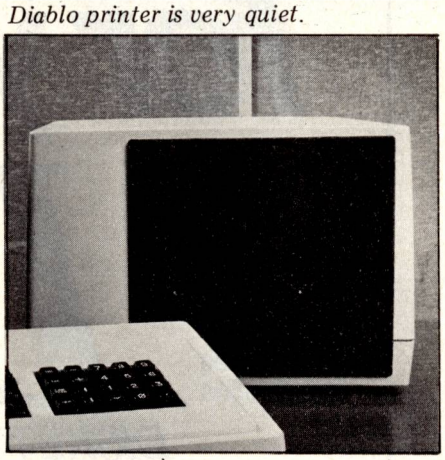


*Diablo printer is very quiet.*

Printer, keyboard and disk drives all plug into clearly labelled D-type connectors mounted on the back panel of the main cabinet. A second RS-232 port is also provided which may be configured for connection to a terminal or modem by altering the positions of a number of clips on the pins of a connector fitted to the circuit board. A number of other options may be exercised in this way. The printer and communications channels are controlled by a single Z80 SIO, plus a dual programmable baud rate generator, although the communications port is also capable of accepting clock signals from the external device.

A completely uncommitted PIO is fitted, providing 16 bits of I/O with four handshaking lines. These lines are not brought out to the case; instead, they are terminated by a connector on the circuit board. As with the communications port, certain options must be selected by fitting clips within the cabinet.

Reference is made to a circuit diagram in the documentation, but it was not present in the binder. In any case, unless the user was familiar with the chips used, additional manuals or datasheets would be needed to make use of the options presented.



*8in disk drive by Shugart.*

## Software

The only software included in the price of the 820 is the EPROM-resident monitor and a diagnostics package. The monitor contains all the input/output routines (including the disk drivers), but I was unable to extensively investigate the commands it provides as the manual seemed to describe a different version to that fitted to the computer. For example, the command to boot up the system is given as 'A', but the power-on display indicated that 'L' was the key to press. The manual also describes a real-time clock and calendar

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maintained by the monitor from the one-second interrupts produced by a timer chip, but when I examined the specified memory locations they never changed. The timer was obviously working, as the disk time-out feature was functioning, so presumably some sort of initialisation is needed — or has the memory map changed?

On the subject of interrupts, the whole I/O subsystem is interrupt driven, so characters zip in and out smoothly (except during disk operations, as the processor is halted at these times). As an example, the monitor responds to keyboard interrupts by collecting the character and placing it in a 16-byte buffer. The keyboard input routine then collects the character from the buffer as required, thus providing a type-ahead feature.

The diagnostics disk exercises the display, printer and disk drives, and tests the computer's memory in two blocks. The whole cycle takes only a few minutes to complete, and would be of value when trying to determine whether the hardware or software is the cause of some obscure problem. It would then probably be worth running the suite regularly to bring to light any faults before they cause difficulties.

CP/M is the only operating system offered by Xerox, so why isn't it included in the price? It is a sensible choice, but offering customers a disk-based system without including an operating system is rather like selling a car without wheels. However, I was pleased to see that the source code for the complete BIOS module is supplied on the system disk, along with the usual CP/M utilities and programs to initialise and copy disks. This permits user modifications, ie, to accommodate new devices.

A small selection of software is already available, with other items still under evaluation by Xerox. Of course, there is nothing to stop you going along to your friendly local dealer and picking up whatever CP/M-compatible product you like, although there could be problems with availability if you choose the 5¼in disks.

Xerox currently offers Microsoft Basic version 5 (all I shall say is that the Benchmark times are perfectly respectable), SuperCalc, and Xerox Word Processing.

SuperCalc is the spreadsheet program described in November's Benchtest of the Osborne-1. Something I particularly liked about the program is the way it allows conditional expressions, making it easier to deal with things like the higher rates of our tax system (no, *PCW* doesn't pay that well!). These statements have the form:

IF (conditional expression, arithmetic expression 1, arithmetic expression 2).

The conditional expression is evaluated first and, if it is true, arithmetic expression 1 is evaluated to give the result, otherwise expression 2 is used.

Xerox Word Processing (XWS) is a heavily customised version of Wordstar. The menus, error messages, and control keys have all been changed — the error messages are friendlier, but the mnemonic nature of some of the commands has been lost. An example is the prefix key for *on*-screen formatting commands: control-o with Wordstar, but control-4 under XWS. Numbers are used extensively as command keys, so the fact that the number pad generates different codes to the digit keys on the main board can cause some confusion.

Unlike SuperCalc, XWS appears to directly access the memory mapped display, resulting in high-speed screen updating.

## Documentation

The main documentation is supplied in three-ring binders with thumb-index dividers for easy reference. Clear, illustrated instructions are provided covering the unpacking and connection of the system. Novice users are catered for on the 'this is how to put a disk into the drive' level (important if there is no one around to demonstrate the essentials) as well as a description of the process of formatting and copying disks. These points are covered in both the Word Processing and CP/M manuals.

More advanced users are catered for by a section in the CP/M manual which gives details of the monitor commands and the entry points and parameters of its major routines. This also gives an overview of the hardware's operation, including port utilisation, user-strappable options, and pin assignments. I believe the inclusion of this portion in the CP/M manual underlines my point about Xerox's failure to include the operating system as part of the basic package.

In addition to Xerox's own documentation and the standard manuals produced by Digital Research, a copy of Murtha and Waite's *CP/M Primer* (published by Sams) is supplied with the CP/M package. This is a pleasant introduction to the system, going a long way to describe why a certain process is necessary, rather than simply giving a list of instructions. Unlike the notorious Digital Research manuals, this book is a tutorial rather than a reference work.

The manuals for SuperCalc and Microsoft Basic are those provided by the software companies, although I got the impression that they will normally be supplied in the same format as Xerox's own documentation. The SuperCalc documentation includes a handy reference card.

The Word Processing manual has been extensively rewritten by Xerox to cover their customisation of the software and to provide a 'tutorial' approach. I must admit that I didn't bother with the Wordstar manual when I bought that program (except for the installation instructions) as the menus showed all I needed to get started, so I really can't compare the two except to say that the typeface used by Xerox is much more attractive!

A useful extra is the small introduction and reference manual. I found it very helpful while getting used to the system.

## Users

The Xerox 820 is another of those computers designed for use with software intended to make boring tasks quicker and easier. I can't really see anyone buying it for other than business or professional use, but such people are likely to require the extra storage capacity of the 8in disk drives. However, they should be attracted by the fact that maintenance is available from the manufacturer (at approximately one percent of hardware price per month). Xerox claims its field engineers have an average response time of four hours, which is far better than my experience with two well-known maintenance companies. It is also reasonable to expect Xerox engineers to know enough about their own equipment to correct any faults efficiently.

## Prices

The pricing of the 820 is reasonably competitive, but not especially impressive when it is remembered that all software is charged separately.

| | |
|---|---|
| 820 with 5¼in drives | £1750 |
| 820 with 8in drives | £2250 |
| Diablo 630 printer | £1590 |
| CP/M | £95 |
| Word Processing Software | £255 |

Other software prices have not been fixed, but the preliminary price list suggests that they will be broadly in line with those charged by other suppliers (all prices are VAT exclusive).

The 820 will be sold in three ways: through dealers, through Xerox shops, and by the company's sales force.

## Future plans

Apart from enlarging their range of software, the only expansion mentioned by Xerox staff was a Winchester disk

*GOTO page 189*

Benchmark Timings

| | |
|---|---|
| BM1 | 1.7 |
| BM2 | 5.5 |
| BM3 | 15.5 |
| BM4 | 15.1 |
| BM5 | 16.2 |
| BM6 | 28.9 |
| BM7 | 46.1 |
| BM8 | 8.0 |
| DT1 | 1.6 |
| DT2 | 33.6 |
| DT3 | 35.8 |
| DT4 | 32.7 |
| DT5 | 34.7 |

## Technical specifications

| | |
|---|---|
| CPU | Z80, 2.5MHz |
| Memory | 64k dynamic RAM, plus monitor EPROM and video RAM |
| Disks | 2-4 drives, either 5¼in (81k net per disk) or 8in (241k) |
| Cassette | n/a |
| Ports | 2 RS-232, 16-bit parallel I/O |
| Screen | 12in black and white, 24 x 80 characters |
| Keyboard | 75 key, auto-repeat on some non-printing keys, number pad includes cursor control keys |

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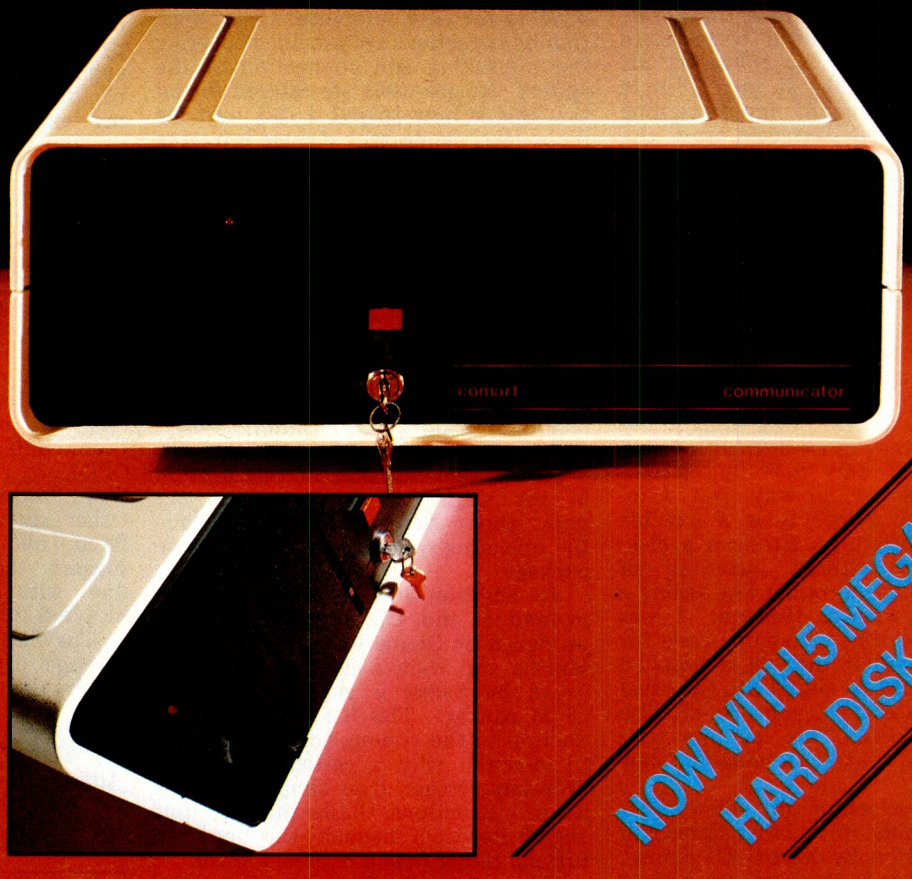


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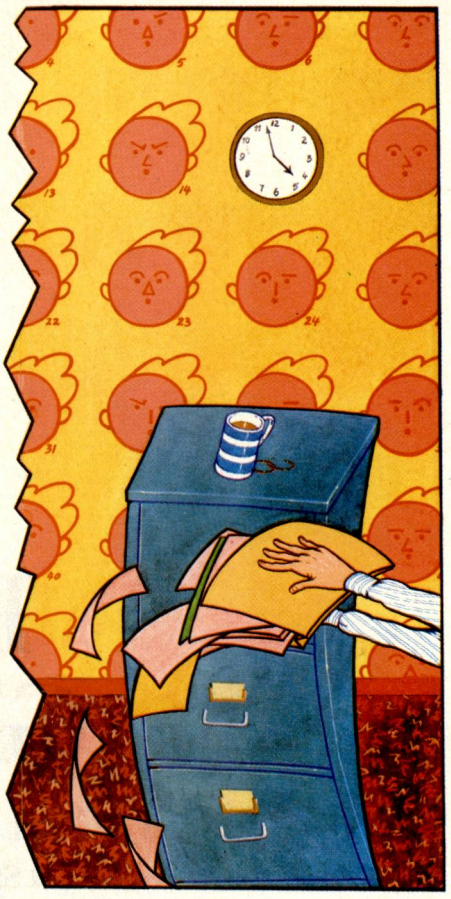
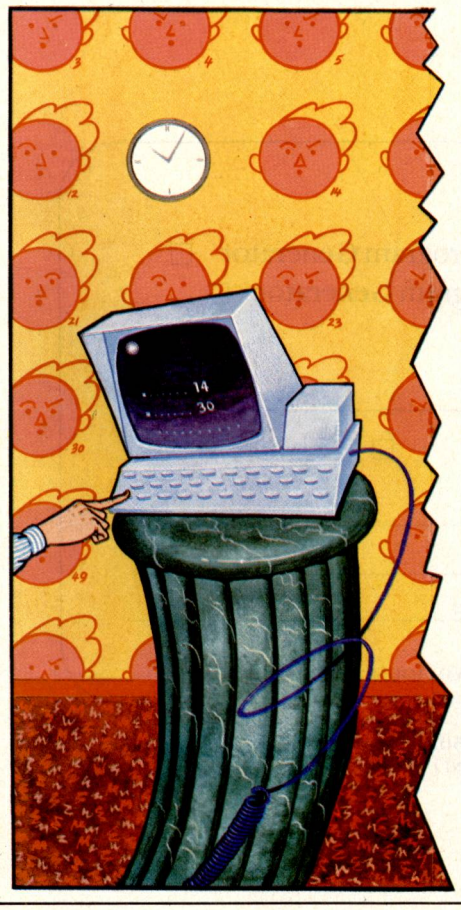
# MICROCOMPUTER DATABASES

**What is a database and how does it differ from an ordinary file handling system? Lyn Antill explains the principles involved. In forthcoming issues PCW will be putting some of the existing micro database packages through their paces.**



A database, in principle, is simply a collection of data — my diary, for instance, is a database of my activities over the year. In principle, the data need not be stored in any given fashion; in practice, however, database material is stored on a computer in a particular way, with the advantage that the data can be interrogated in a variety of ways. One need not, for instance, start reading from the beginning to the end to find the answer to a specific question; on the contrary, a special suite of programs called a Database Management System (DBMS) will enable such a task to be performed.

You can ascertain whether a DBMS will suit your requirements by looking hard at the sort of data you wish to store and the way in which you want to be able to get at the information. This is known as data analysis, and is the first task carried out in designing a large computer installation. I therefore propose to begin with a couple of examples of data processing programs in order to give a feel for what is involved.



Firstly, I want to look at payroll programs. During the course of a week, or a month, all amendments to payroll data — rises, overtime, etc — are collected on file. This is sorted into similar order to the main file and, as each payslip is produced, a quick look at the update file will show whether there are any amendments to be made before processing.

There is a very good reason why this was one of the first applications to be computerised in many organisations, which has nothing to do with whether it would save time or money, or make the business more efficient. It is simply that the first method of computer data storage was to use magnetic tapes with the records stored in sequence. This is precisely what you want when you are producing one payslip after another for each of your employees.

A different record-keeping problem is posed by a stock control system in a warehouse. At any moment, you may want to know whether any one of your lines is in stock, but there may be no time to start your search at the beginning of a file. Thus, a direct access method was introduced with the advent of the disk. If you know the part number, you can arrange the physical location of the records so that the part number corresponds to the position, or you can keep an index of which records are stored where, which will enable you to read the required record directly.

But what if you don't know the part number? Perhaps the question that needs to be answered is: 'How many different types of nail do we stock?' If you were regularly having to answer questions like that you would want a quicker way of getting the answer than trawling through the whole file in the hope of getting the few records that you needed. This is where DBMS will enable you to keep track of your data records from more than one point of view. The more questions your database system can answer for you, the more efficiently you can run your business and the more flexible you can be in these difficult times.

Before launching into a discussion of how a DBMS works, it is probably worth bringing the non-programming reader up to date on the way in which conventional file handling is carried out by some of the more common programming languages and operating systems.

## Background

The Basic language treats file storage as though it is just one long list of data items which are read one at a time into program variables. Although a Read instruction might permit several of these to be collected at once, they still have to be named individually. They also have to be named individually when they are written on to tape or disk in the first place. This makes for program statements which are longer than necessary, and it also demands of the programmer that he always bear in mind every field on the file, even if he is only interested in a few of them.

Pascal, Cobol and many enhanced Basics have 'records' which are logical groupings of data items. These are read or written as a single instruction. Cobol has particularly sophisticated record-handling features because it was designed specifically for record processing.

Records can be arranged in different ways within a file. In a serial file the records are written one after the other as they occur, and they are written nose-to-tail on the tape. A sequential file is also nose-to-tail, but the records are in some logical sequence, eg, alphabetical order; the sequence is determined by reference to some 'key' field. The CP/M operating system also supports 'relative' files. These are not arranged nose-to-tail but are at specific locations on the disk, so that they can



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# MICROCOMPUTER DATABASES

be located directly. This means that the program can pick out, say, record number 23.

Cobol often also includes indexed files, in which the records are stored more or less in sequence on a key field, but with gaps left to slot in later additions, and each has an associated index file. This has a list of the keys and their respective addresses in the main file and, being much smaller than the datafile, it can be searched far more quickly.

Sequential (and serial) files are the easiest to program, the most compact, and the quickest to read right through. Relative files (which are sometimes erroneously called random files) are still fairly easy to program, provided your language and operating system support them. They do rely on your knowing the position of each record you want to access, although it is possible to start at record 1 and search through if you have to. Indexed files involve an operating system overhead in that the system has to search through the index first before locating the record. Every time you insert a new record or delete an old one, the index has to be updated. As with relative files, it is still possible to start at record 1 and go right through. Indexed files are not difficult to program provided your language has them — indeed, they are the most common arrangement on large computers. They are better than relative files in that they permit the use of naturally occurring keys such as account numbers or part codes which saves you altering your manual procedures to fit in with the computer.

## Disadvantages of conventional file handling

If you are using a sequential file, all processing must be performed in the order in which the records are stored, so you might have to read through the whole file in order to answer a question about one record. You will also have to rewrite the whole file if you change a single field. With the payroll example, we actually wanted to plough through each record in turn and create a new copy of the file with the updated figures. We deliberately kept changes and overtime payments on a serial file of their own — adding new items onto the tail of the file as they cropped up, and then sorting the whole 'change file' into the same order as the payroll file. This saves having to make new copies of the payroll file other than on pay day. If we have to answer the occasional query like 'How much does Dr Watson earn?', then we resign ourselves to spending five minutes reading through from Miss Adams.

Relative and indexed files both presuppose that you know the key of the record you're looking for so that if a file's keyed on account number and you only know the person's name then you're back to searching the whole file again. If this only happens occasionally it might not matter, but in some situations you are continually asking questions about your data where it would obviously be nonsense to expect to know the key of a particular record in advance.

An example of this is provided by our student records system. The following questions are asked regularly:

— Has John Smith paid his fees?

— Has anybody dropped out of HND1 Computer Studies?

— Is anybody in room 463 on Wednesday afternoon?

— How many married women are there on engineering courses?

— Do we have any black South African students?

Each of these requires a different searching technique. The first requires that we locate a particular record. The second requires that we locate all records of students registered on HND Computer Studies and seeing whether any of them carried the code which indicated that they had withdrawn. We can only find whether room 463 is occupied if our database carries records about rooms and timetables as well as students — it would obviously be useful if it could. To find out about married women engineering students, we have to search on three keys — sex, marital status and course. Which order we do these in will depend on which order the records are stored in. Since students are often recognised by the course they're on, we'd probably trawl through all the engineering courses totting up all the records where sex = F, and marital status = M. The question about black South African students would in principle be answered in the same way except that we would not keep records on a student's racial origins. This takes us away from the mechanics of database handling to the social questions of what data ought to be stored and who ought to have access to it.

We have 10,000 students and their data could all be fitted on to a micro with a hard disk, though it's obvious that when we have a queue of students and teachers wanting information from the system, we would have insufficient time to read through the file from the start every time someone asked a question.

## What is a database?

The word 'database' covers a range of ways of holding data on a computer. It differs from a conventional file in that you can retrieve any piece of data in more than one way. You are not obliged to know beforehand the unique key number of a record or to start at the beginning and keep going until you find it.

It takes a bit of tricky programming to keep track of data in a complex database, so only in extreme circumstances would a programmer bother to write his own routines. You can buy a Database Management System which will cope with most of your needs, although nobody would be rash enough to say that his system would cope perfectly with everything — if it did, it would either be too large or too expensive, or probably both!

The very simplest sort of DBMS is an extension to your language and operating system, permitting you to keep more than one index to an individual file. I haven't seen a micro system like this yet, but many minis offer ten or more different indices. It won't be long before many micros offer two or three. This would be enough for many micro-sized information handling problems. A really sophisticated DBMS will permit you to store complicated interrelationships of different types of records. It will have its own data dictionary to let

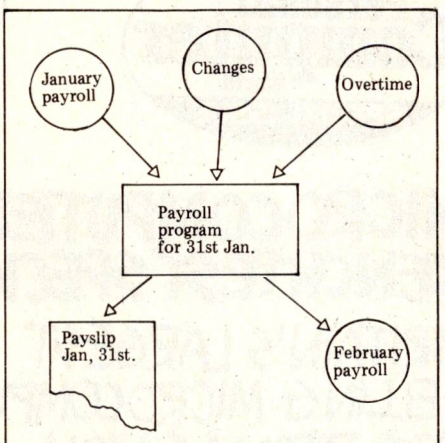


*Fig 1 Run chart for payroll program. This is a traditional batch process using sequential files.*

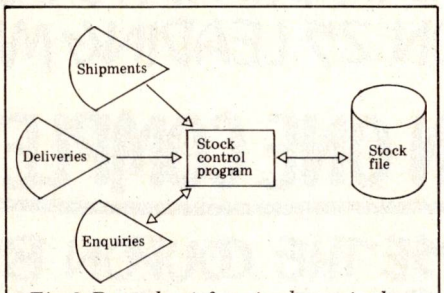


*Fig 2 Run chart for stock control. This uses random access disk files which can be accessed by several different programs at the same time.*

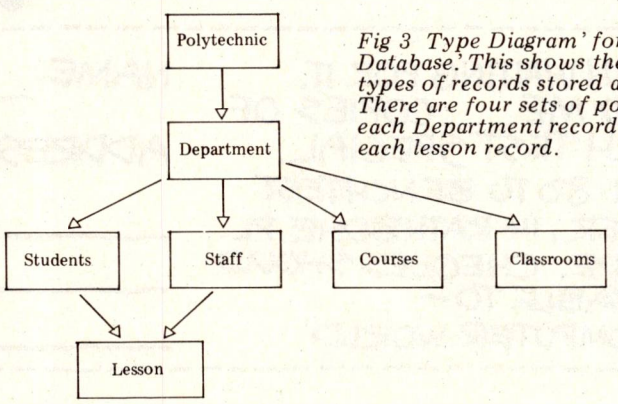


*Fig 3 Type Diagram' for the Polytechnic Database.' This shows the different types of records stored and the pointers. There are four sets of pointers from each Department record and two to each lesson record.*

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# MICROCOMPUTER DATABASES

you define the data you want to store and its own 'query language' to enable questions to be typed in at the keyboard and answers displayed without the need to write any programs at all.

There are several ways of arranging the data so that it can be retrieved in a variety of ways. Experts argue about the exact categories but there are three common types — multi-indexed (also known as inverted), hierarchical, relational. All sorts of terms are thrown about by the manufacturers, and it is often difficult to tell what exactly you're being offered.

## Multi-indexed

This is the simplest to implement and, on a micro, is probably the most satisfactory for general use. One of the fields in the record is nominated as the primary key, and the records are stored in sequence on that key. This key might be a relative address or it may be the key to a primary index (as with indexed sequential files). Other fields may then be nominated as secondary keys. An index is kept for each of these keys. Primary keys often have to be unique, secondary keys do not. The most serious limitation of this system is that all your records must be of the same type, ie, they must all have the same fields in the same places. On my student database it would prevent me answering the question about which students were in room 463, because I could have student records but not timetable records.

An example of a database system of this type is Microcobol's Auto-Index. This is a stand-alone information storage and retrieval system (ISR for short). It interrogates you to find out what data formats, keys, etc, you want in the first place, then it gives you a menu of possible actions — insert and delete records, search on keys, sort on keys. In fact, it has three types of key. The primary key is purely arbitrary and refers to the record's physical location within the file. Each record may then have up to about five 'key fields'. Records can be retrieved on these fields and the file can also be sorted on them. Suitable candidates for key fields would be Name, Date of Birth. Finally there are 'attribute fields'. You can list a large number of possible attributes (nearly 200 on my version) of which an individual record may have as many as ten. The system keeps a list of which records have which attributes. Finally, each record has room for several lines of text which could be anything you wanted to include in the record.

The demonstration disk that came with the program held a personnel file. The primary key was the employee number, the sort keys were surname, first name, date of birth, department, and the attribute fields included things like relevant skills (plumber, carpenter, French, oil-wells). If a vacancy came up for an electrician to work on an oil-well in Algeria, you would first ask the system to find all the electricians, select from those all who had worked on oil-wells, then all those who spoke French or Arabic. Hopefully, it would then be able to give you a list of suitable people. Only at this point would you start looking at complete records. You could also ask it who had the highest salary, because salary is a sorted field.

This sort of database is also known as inverted and the process of listing which records have a certain value in a certain field is known as inversion.

## Hierarchical

The same standards people who wrote Cobol came up with the Codasyl extensions to Cobol to define a standard database. There have been attempts to put this onto a microcomputer database. There is, somewhat to my surprise, a Codasyl database for CP/M. It is called MDBS. It is expensive (nearly £11,000) and slow on floppy disks, but it is worth knowing about because it points up the limitation of inverted files.

The major advantage is that a variety of records can be kept. On the polytechnic example, we could have records on departments, students, staff, classrooms, courses. The logic of the system goes as follows: The poly owns a set of departments, each department owns a set of courses and each course owns a set of students. Each department also owns a set of staff. But there are more relationships than this. A staff member owns a set of students, ie, all the students he teaches. This will be some or all of the students on one or more courses.

A set is essentially part of a file. The owner of a set and its members are linked together by means of pointers, ie, alongside the poly record is the address of the first department record (Accountancy), next to this record is the address of the next department record (Architecture) and so on until the last department record which points back to the poly record (just so you know you've got to the end and haven't lost anything).

You've already discovered the first disadvantage of this method — it's complicated. If you're setting up a large database, anything you do is going to be complicated, but you probably won't want to be bothered on a micro, unless it is important to you to be able to link records of several different types. If you do see a package which permits you to define several different types of records with a 'this owns that which owns the other' relationship between them, then it could well be a Codasyl database.

## Relational

The relational database is a theoretical construction. The underlying work is heavily mathematical — indeed a whole new branch of mathematics (the relational calculus) was invented to describe it. Although it works amazingly in principle, it has proved difficult to implement in practice. The intention is to be able to relate any data item to any other data item, with none of the artificial limitations that are imposed by the files and records of traditional data processing. I should just be able to pour all my data into the computer without any presuppositions about relationships. This means that I have to get rid of all the assumptions that have already been made, consciously or not, in my existing system. This leads to the systems analyst's biggest hassle — getting the data into fourth normal form, which means that all the fields in a record are dependent on 'the key, the whole key and nothing but the key.' and, moreover, that there are no significant relationships between the subordinate data items except their dependence on the key. For instance, Name and Address are firmly related in most people's minds, but if you are ever to be able to change someone's address then they must *not* be related in the database.

I don't propose to launch into a full description here — there are plenty of textbooks on database design that cover the subject in the sort of detail that is required to understand it. The important point for the potential user is that the relational database — if it truly deserves that name — is not something that can be set up by an amateur. Even a small system requires a professional data analysis — that's even harder to come by than a professional programming job.

There are, however, several microcomputer databases that call themselves relational. I very much doubt if the purist would accept them as such. This hardly matters, because they will stand or fall by what they enable the user to do with his data. They are only likely to be useful to the non-professional if they are used for data which is already 'normalised', ie, where you want to keep a lot of straightforward records with a minimum of analysis required to get them into different types. The ones that I have seen are not obviously very different from inverted file systems.

## Conclusion

Successful implementation of a database system depends on a clear understanding of the records that are to be kept, and the questions that are to be asked about them. You may find, particularly with an inverted file, that you can only keep one type of record. If you have several types of records with complex relationships between them, you need a hierarchical system or a network system which is even more complex.

For the user, there is also a major decision to be made, namely whether the system is to be used as a stand alone — ie, an electronic filing cabinet — with its own data definitions and query procedures, or whether it is to be accessed by programs for further processing of the data. The type of database doesn't really matter here because all three types could be interfaced to programs or to their own query languages, or indeed to both. Programming is generally managed by means of calls to external subroutines to perform database functions. Each call includes a parameter list which includes such things as the keys which are being searched on, and the storage location into which the answer is to be put.

One difficulty for the prospective purchaser is that few of the software salesmen have experience of databases, which have been the preserve of big machines until now. This means that you are quite likely to find someone who can't answer technical questions. However, it is probably just as effective to stick to the pragmatic questions: 'What sort of records can I store?'; 'How can I access those records?' END

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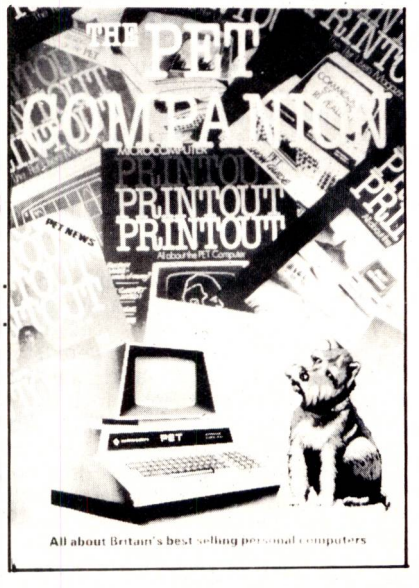

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# TJ's WORKSHOP

*Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to:* **'TJ's Workshop'**, *PCW*, **14 Rathbone Place, London W1P 1DE.** *Please keep your contributions as concise as possible. We will pay £10 for any tips we publish (think how much solder and/or Elastoplast that would buy).*

## PET PRINT AT

One statement not provided in PET Basic is PRINT AT, which is very handy when arranging screen layouts without messing about with TAB or cursor movements. It can, however, be implemented quite easily with a small machine code routine via the USR function. The routine numbers the 1000 screen locations from 0 to 999 (which are a lot easier to work with than 32768 — 33767) and enables not only single characters, but complete strings and variables to be printed at the required locations. It does this by first printing a HOME character and then a specified number of CURSOR RIGHTS leaving the cursor at the correct spot to print the next item.

The machine code is shown here residing in the second cassette buffer but is fully relocatable without any alterations to the routine itself, though the USR vector in locations 1 and 2 must, of course, be altered.

To load the routine, either use the Basic loader program or the machine code monitor and then type:
POKE 1, 58 : POKE 2, 3
Then, to print a string (A$) at, say, screen location 840:
X = USR (840) : PRINT A$
The X is just a dummy variable; its contents are not used but USR will not work without it. You can also use a variable instead of the number inside the brackets. See the examples for more details.

Care is needed when printing on to the bottom line of the screen (locations 960 to 999) as it can cause screen scroll, but this can be suppressed with a semicolon after the string. Using numbers over 999 will always cause scrolling and over 32767 will give a SYNTAX ERROR message.

Some changes will be required for the routine to work on new ROM or Basic 4 machines. I have shown the changes for New ROMs but Basic 4 users will have to check the differences for themselves.

Here's an example to print a ten-string array in a column:
100 FOR Q = 1 TO 10
110 X = USR (15+Q*80) : PRINT A$(Q)
120 NEXT
To centralise each string, alter line 100 as follows:
110 X = USR ( (20 — (LEN (A$(Q) )/2 ) ) + Q*80) : PRINT A$(Q)

*David Viner*

Old ROM listing:

```
033A  20  A7  D0    JSR  D0A7   Floating-point to Integer conversion.
033D  A9  13        LDA # 13    print cursor
033F  20  D2  FF    JSR  FFD2     home.
0342  E6  B3        INC  Z B3
0344  A4  B3        LDY  Z B3   Get Hi byte into Y reg.
0346  A9  1D        LDA # 1D    Set Acc as 'cursor right'
0348  A6  B4        LDX  Z B4   Get Lo byte into X reg.
034A  F0  08        BEQ  0354   Branch if X is 0
034C  CA            DEX
034D  20  D2  FF    JSR  FFD2   Print a cursor right.
0350  E0  00        CPX # 00    Is X zero?
0352  D0  F8        BNE  034C   No, then loop back.
0354  88            DEY
0355  D0  F5        BNE  034C   If Y is not zero then loop back
0357  60            RTS           else exit back to BASIC
```

Changes for new ROMs:

```
033A  20  9A  D0    JSR  D09A
 : :   :   :         :    : :
0342  E6  61        INC  Z 61
0344  A4  61        LDY  Z 61
 : :   :   :         :    : :
0348  A6  62        LDX  Z 62
```

Basic loader for old ROM:

```
100 DATA 32, 167, 208, 169, 19, 32, 210, 255, 230, 179
110 DATA 164, 179, 169, 29, 166, 180, 240, 8, 202, 32
120 DATA 210, 255, 224, 0, 208, 248, 136, 208, 245, 96
130 FOR X = 826 TO 855 : READ Y : POKE X, Y : NEXT
140 POKE 1, 58 : POKE 2, 3
```

For new ROMs, change lines 100 and 110:

```
100 DATA 32, 154, 208, 169, 19, 32, 210, 255, 230, 97
110 DATA 164, 97, 169, 29, 166, 98, 240, 8, 202, 32
```

*David Viner*

## ZX81 TIPS

A problem with the ZX81's screen is that its constant movement in memory and variable line length makes it difficult to see what is in it by PEEKing. This short routine reads the position of the screen (R, C) into P:

```
10 PRINT AT R, C;
20 LET P = PEEK (PEEK 16398 + 256+PEEK 16399)
30 LET P=P* (P <> 118)
```

Line 30 is required to prevent newline characters being returned when the line has not been extended as far as C.

Follow this procedure to place a REM at the end of a program so that even someone who has read this magazine will have great difficulty in removing it:
a) Before typing in your program, type in a REM line with your name, etc. in it;
b) POKE 16509,50;
c) Type in the rest of your program.

The line is given a high line number as opposed to zero as line zero is always in the same position in memory and therefore can be unPOKEd. The above method makes sure that the line can only be removed by either re-typing the program into the machine, or by a series of guesses to the line's position, which will either crash the system or corrupt the program.

Fans of spectacular crashes may enjoy this series of direct commands:
FAST
POKE 16400,0
and then press any key

*Grenville Manuel.*

## MZ-80K DISABLE

Phil Clark's SAVE and LIST disable commands (November 'TJ's) do in fact *enable* them. The correct disable instructions are POKE 4360, 1: POKE 10680, 1.
*Orph Mable*

# NOISE FREE GRAPHICS ON THE ACORN ATOM

The problem of 'noise' on the screen of the Acorn Atom when in graphics mode arises because the plotting routines and the video generator access the graphics memory simultaneously. By sensing when the video generator is not using the video memory and performing the update during this period, graphics routines can be written which do not cause the 'noise' effect. In the Atom, bit 7 of port C (B002H) (see page 194 of *Atomic Theory and Practice)* is set low during flyback; this gives a window of about two milliseconds in which to update the memory without causing noise. This is ample time for an assembler program to update the graphics memory.

The address of the Point Plotting Routine used by the Atom Basic is kept in the RAM (Locations 3FEH, 3FFH). By changing these, it is possible to write a replacement Point Plotting Routine; this also allows a 'front end' to be inserted, ensuring that the Acorn Point Plotting Routine is not branched to until the start of the 'window'. The technique can only be used when programs are run in the lower text space, as the upper text space also contains the screen memory. The following is an example of such a 'front end'. Note that it caters for all graphics modes (including colour). It is necessary to call Subroutine c after each clear or colour statement in order to reset the address of the Point Plotting Routine. The example program can be used to draw random lines in graphics modes 1-4. Large graphics programs may be noticeably slowed down, because a single-plot statement may invoke the Point Plotting Routine several times. Animated graphics, therefore, require careful consideration, however, programs can be structured to minimise the delays. Assembler programs (or routines) using the technique described provide a more effective solution because more of the graphics memory can be updated during each 'window'.

*S J Dawes*

```
90 DIM V(4)
95 DIM LL (12)
97 FOR N=1 TO 2 (Loop for assembly)
100 DIMP (-1), Q(-1)
110
130: LL1 LDA @ # 80  Synchronise with video
140 AND B002
150 BEQ LL1
160:LL2 LDA @#80
170 AND #B002
175 BNE LL2
196 LDA #B0000  Determine graphics mode and branch accordingly
197 AND @ #FO
198 BEQ LL11
200 CMP @#FO
210 BEQ LL3
220 CMP @#DO
230 BEQ LL4
235 CMP @ #BO
240 BEQ LL5
245 CMP @ #90
250 BEQ LL6
265 CMP @ #50
267 BEQ LL8
270 CMP @#30
273 BEQ LL9
275 CMP @ #10
277 BEQ LL10
280 RTS              Return if invalid graphics mode
290:LLS JMP #F7AA    (Jumps to appropriate point-plotting routines)
291:LL4 JMP #DFA0
292:LL5 JMP #F76D
293:LL6 JMP #DF88
295:LL7 JMP #F754
296:LL8 JMP #DF70
297:LL9 JMP #F73B
298:LL10 JMP #DF52
299:LL11 JMP #F6E2
300
310 NEXT N
490 INPUT "ENTER GRAPHICS MODE"A
500 INPUT "ENTER NUMBER OF RANDOM LINES"B
510 IF A=0 C=64:D=48;GOTO p     (Set C and D for graphics)
515 IF A=1 C=128:D=64:GOTO p
520 IF A=2 C=128;D=96;GOTO p
530 IF A=3 C=128;D=192;GOTO p
531 IF A=4 C=256;D=192:GOTO p
532 GOTO 490
534p CLEAR A
535 GOSUB c
539 FOR I=1 TO B
540 DRAW (ABSRND%C),(ABSRND%D)
545 NEXT I
550 END
600c?#3FE=Q;?#3FF=Q8FFFF/256
601 RETURN
999 END
```

# ACORN GHOST RAM

With the recent fall in the price of semiconductor memory, it's now necessary even for penniless students like myself to consider the time when our ancient 8-bit micros will run out of address space. This simple modification to the Acorn 8k RAM + 8k EPROM memory board, in conjunction with a single bit from an output port, will stave off the evil day for a while.

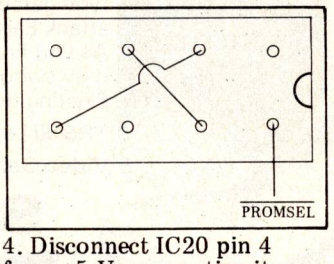
The Acorn board is a Eurocard which carries 8k of 2114 static RAMs and has space for two 2732 EPROMs. In its normal configuration, these two 8k memory blocks must occupy separate areas of address space. However, if an extra control line is added to switch between them, the RAM and EPROM can use the same 8k block. Such a line exists on the S100 bus, where it's known as PHANTOM.

The idea is that system software is stored in the EPROM, which is normally not selected. When it's required to use, say, a text editor, a bit is sent to an output port which turns on the EPROM, thus deselecting the RAM. The program can then be copied into an area of RAM which is not switched. Toggling the output port will restore the RAM which was hiding behind the EPROM. Such a system gives more flexibility than would be obtained if the text editor was in an EPROM which is permanently in the processor's address space.

The modification procedure described here applies to issue 3 of the Acorn board. The circuit which actually appears on this PCB is slightly different from that which is given in issue 3 of the Technical Manual. The latter has not been modified to include IC25.

The following changes should be made:

1. Disconnect IC22 pin 9 from IC20 pin 3, connecting it instead to IC20 pin 11;
2. Disconnect IC19 pin 12 from RAMSEL, connecting it instead to IC20 pin 3;
3. Disconnect IC25 pin 9 from +5 V, connecting it instead to IC20 pin 6;




4. Disconnect IC20 pin 4 from +5 V, connecting it instead to a spare pin on the Euroconnector.

The spare connector pin goes to the output port bit which is to switch between RAM and EPROM. The wire links on the board which select the EPROM should be altered to the configuration shown in the diagram.

The wire links which select the addresses for EPROM and RAM should both be wired to give the same 8k block. With these modifications, the board will appear as a single 8k block of RAM if the output port bit is high, or a block of EPROM if it's low.

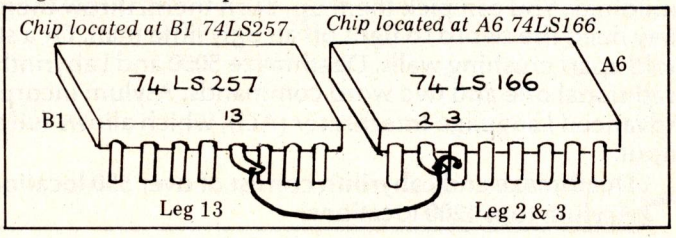
*R Yorston*

# ITT 2020 MODS

Modification to suppress 'Tramlines' in Apple Hi-res programs.

1. Locate chips B1 (74LS257) and A6 (74LS166); these are under the keyboard and will necessitate taking off the outer casing of the 2020 by removing the screws in the baseplate.
2. Remove chips B1 and A6, or provide replacement chips if you wish the process to be easily reversible.
3. Carry out modification and linkage as shown in diagram and replace chips. Note: Leg 13 of B1 is *no longer* located in chip holder; leg 3 of A6 *is still* located in chip holder.
4. The effect of this modification is to continue the colour adjacent to the tramline through the tramline so, in essence, the tramlines are 'smeared out'. The resultant effect is quite amazing.
5. For the 'sophisicated', a hardware modification called 'Jailbreak' is now available (£35.00 excluding VAT) which physically changes the ITT 2020 to give a 280 x 192 to dot screen in Hi-res. Text and low-res graphics are unaffected.

*Paul Jenkins*



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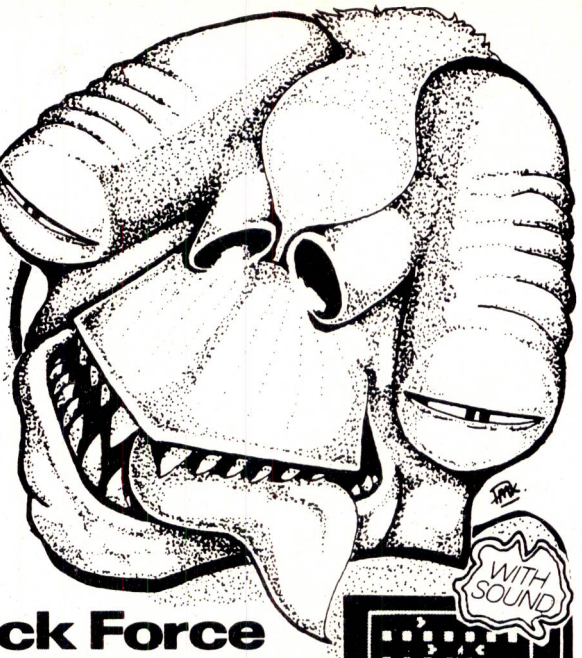
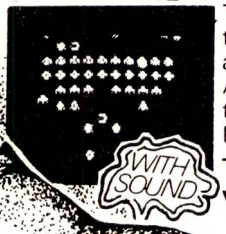


## Galaxy Invasion

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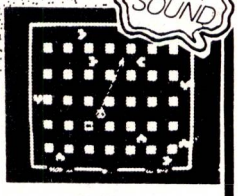


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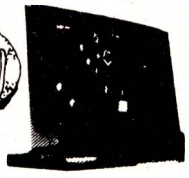

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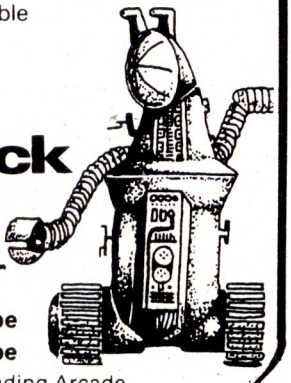

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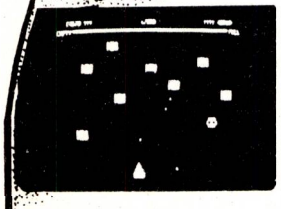

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# SIMPLE RESET SWITCH FOR PET

Reset switches are readily available for large keyboard PETs, but I was unable to find one to use on my small keyboard PET, upgraded with new ROMs and extra memory.

James Strasma's article in the September 1980, issue of *Kilobaud Microcomputing*, together with information from Nick Hampshire's *PET Revealed* and the old Commodore *PET Users' Handbook* provide the answer to the problem. A reset switch can be made from a small DPDT, double biased, centre-off, gold contact switch, a 1/8 Watt 1KR resistor and four lengths of thin, flexible, insulated wire.

*1 The Theory.* On switch on, the 6502 *reset* is held low so that it can go through its housekeeping and memory-checking routine and then advertise its parentage and tell you how many bytes are free for you to mangle in your programs. The timing capacitor on the NE555 then charges up and sends an output pulse from pin 3 and PET then is in its Basic mode. Any attempt to physically connect the *reset* pin to earth to persuade PET to reset may take out some gates. Parallelling the 1.0uF timing capacitor, connected to pins 6,7 and earth of the 555, with a 1KR resistor to discharge it, will convince PET that it is power-up time and send it into its normal routine. This will lose all programs except those nestling in the protected womb of the second cassette buffer. Owners of old ROM PETs may find this preferable to subjecting the electronics to shock by switching the power off and on. If PET senses that pin 5 on the User Port is grounded via pin 1 on power-up, it will go into its diagnostic routine rather than into its normal one. If new ROMs are fitted this means that PET will enter TIM(monitor) at 'call' (C*).

Putting these two together enables us to devise some hardware that will restart a ruminating PET without switching off the power and also preserve programs (unless the crash was such that it mangled the program).

*2 The Hardware.* Procure a DPDT, double-biased, centre-off, gold contact, switch and note which terminals are shorted in the up position and those shorted in the down position. Above all, check that there are no connections made when the switch is in the normal centre-off position. Mount the switch on the side panel of PET or in an outboard box.

Fit a temporary connector to the outside of the User Port and note how much connector track is free on the inside of the port. Solder a twisted pair of flexible leads to pin 1 and pin 5 of the User Port. Remove the outside connector. Solder one of the leads to one central pole of the switch and solder the other to the terminal that is shorted to it with the dolly in the 'up' position.

Switch PET on while holding the reset switch up. PET should go into the monitor if new ROMs are fitted.

Next, find the NE555, which is the only eight-legged IC on the board just to the right (as you look at it from the front) of the power supply chips on the left hand side of the board and behind the ROM/RAM areas. Just behind and to the right of the 555 is a 1M resistor soldered flat on the board and lying parallel to the front of the board. A 1k should be taken to the other centre pole of the switch. The terminal that is shorted when the switch is 'down' should be linked to a convenient earth point on the PET. The metal straps holding in the cassette have convenient screws to which leads may be attached firmly.

Switch on PET, then press down the switch. PET should go into its normal 'switch-on' routine and display its normal logo. This is the modification that owners of old ROM PETs could do to provide a restart without turning off power.

*3 Testing.* Type or LOAD a small program into PET. Send PET into an introverted introspection of its own innards by a SYS command to a non-existent program or to a loop in ROM. When it is well and truly away in a land of its own, press the switch down for a brief period and then press it up until PET displays the pointers in its monitor. Type in ';' (RETURN) to force PET to ask you what you think you are doing, by displaying a '?'. Move the cursor to the figure below the Stack Pointer (SR) and alter it to 'FF' (RETURN). Exit from the monitor by typing 'X'(RETURN). If you now ask PET to LIST you should see your original program there.

*4 Warning.* Always completely disconnect PET from the AC mains before opening it up and make sure it is disconnected between each test. Although the total cost of the hardware is around £2, you could cause a lot of expensive damage if you short out tracks with solder splatter or pieces of swarf and wire or if you lift tracks by applying too much heat for too long. Above all, make sure that you are not carrying charges of static electricity when you touch the board and your soldering iron doesn't leak any appreciable charges. Before you put the screws in, make sure that there are no bare pieces of wire showing on the flying leads by using sleeving or insulating tape. Keep wires away from the heat fins on the regulators as these do sometimes get very hot in use.

*Bibliography.* Strasma, J (1980), 'Add a Reset Button to any PET', *Kilobaud Microcomputing*, September, pp 36-37; Commodore, (1978?) *PET Computer Users' Handbook*, pp 87-88, 99-100; Hampshire, N (1980), *The PET Revealed*, Nick Hampshire Pub, pp 168, 84, 83, 4, 5, 30.

*W Austin*

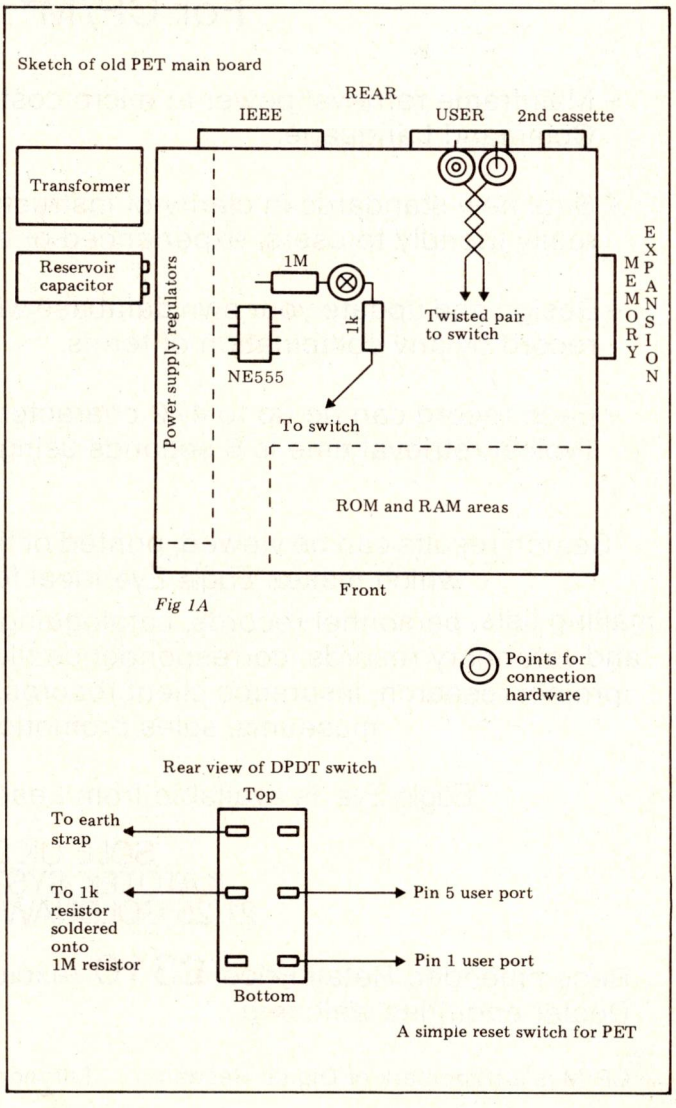


*Fig 1A*

A simple reset switch for PET

KSD in association with Kent Barlow Information Associates present



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# CP/M SCREEN MODS

There are many command files supplied as a standard part of the CP/M operating system. Two of these, ED and DDT, are designed particularly to handle and display text and data. One drawback of these two programs is that they both expect a VDU with a screen format of 24 lines of 80 characters. Smaller formats can lead to fold-over of datalines and to lines being lost when the screen scrolls during output.

The particular commands that produce these effects are the P command in ED and the D and L commands in DDT. The following modifications can be made to adapt the two programs to cope with different screen sizes.

## ED P-command

This command prints a page of text on the screen and is normally set to print 23 lines, the 24th line displaying the prompt. The following location should be changed to reduce the number of lines on a page.

The address above is for ED 2.2. The appropriate address for ED 1.4 is 161CH.

| Location | Old Data | New data |
|---|---|---|
| 17DBH | 17H | 0FH 16-line screen |
| 17DBH | 17H | 0DF 14-line screen |

## DDT D-command

There are two changes that can be made to this command — reduce the number of bytes printed on one line and change the default block size from the usual 192 bytes to a smaller number.

The number of bytes per line is controlled by checking for overflow from the lowest four bits of the address counter. By changing this to test for overflow from the lowest three bits, only eight bytes will be printed on one line instead of 16.

The same address is used in both DDT 2.2 and DDT 1.4.

If no end address is specified in the D-command, a default block size of 192 bytes is assumed. After the previous modification has been made it is necessary to reduce the default block size significantly. The size should be reduced to 96 bytes for a 14-line screen or 112-bytes for a 16-line screen. The following address must be changed:

| Location | Old data | New data |
|---|---|---|
| 0A15H | 0FH | 07H 40 or 64 chars/line |
| Location | Old data | New data |
| 09EDH | 0BFH | 05FH 14-line screen |
| 09EDH | 0BFH | 06FH 16-line screen |

## DDT L-command

As in the D-command, if no end address is specified in the L-command, a default value is assumed. This affects the number of lines displayed on the screen and not the amount of memory disassembled, the default value being 11 lines. This value can be increased for a 16-line screen or indeed for a 24 line screen

| Location | Old data | New data |
|---|---|---|
| 09BCH | 0CH | 010H 16-line screen |
| 09BCH | 0CH | 018H 24-line screen |

*J Baraclough*

# UK101 REVERSE

Here is a fairly simple modification, using four ICs to fit reverse video to the UK101/ Superboard computers.

On these machines, CHR$ (96) is a 'space' and this character can be conviently used as a software switch to produce reverse video. Two of the ICs, U101 and U102, are used to detect the presence of this character for display. The correct code produces a low going pulse at U102 pin 8. This is used to toggle a flip-flop in U103. The output of this flip-flop is used to control the inversion of video in U104 a and b. One output is used to control the existing video output of the computer, while U104 a and b invert the video signal. The reverse video is turned off at the end of each VDU line by the line sync pulse from U70 pin 12.

Some games use CHR$ (96) as a second space and this is where U103a comes in. This is set or reset as required by using some spare outputs of a memory decoder on the computer board. By setting this latch, reverse video is turned on: resetting inhibits it. The decoder outputs used read or write to a non-existent block of memory at D800H, so that by PEEKing or POKEing to this location (55300 decimal), the reverse video can be turned on or off.

The circuit was built on a 2in x 2in piece of Veroboard, and mounted in the space above the MPU using double-sided foam sticky tape. The only modification to the main board is to remove U70 and to carefully bend pin 5 horizontal. The IC can then be replaced. The connections to the main board were done by *very* carefully soldering direct to the required pins of the ICs (not a job for the nervous!).

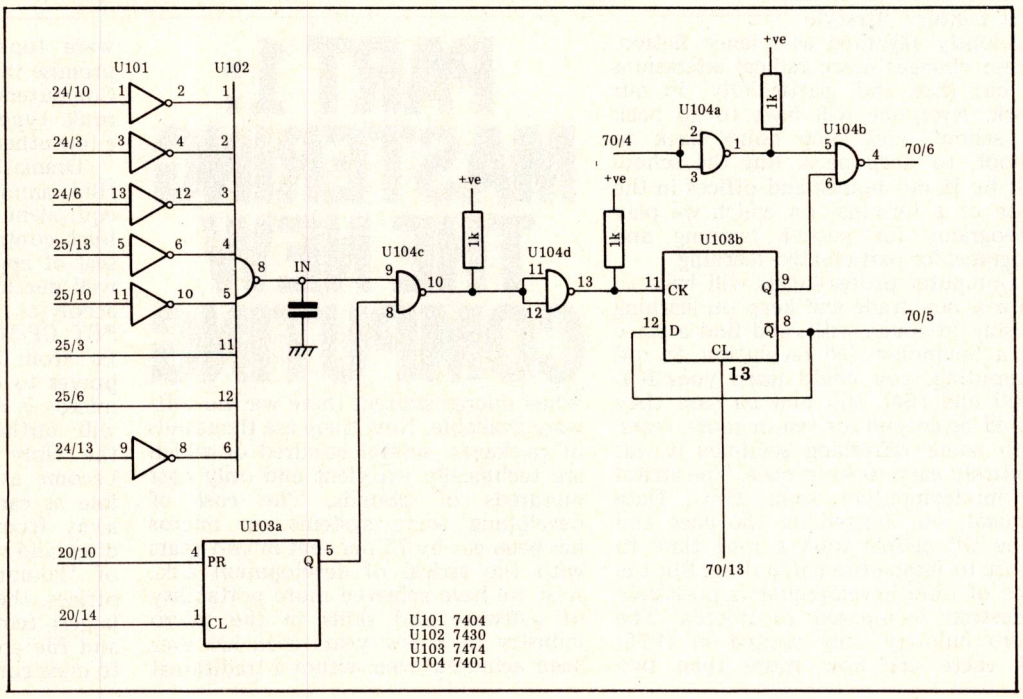
The facilty can be used quite simply by assigning CHR$(96) to a variable, and then using this to turn the inverse video on and off, ie:

```
10 R$ = CHR$ (96)
20 . . .
30 . . .
1000 PRINTER$;"TITLE"; R$

POKE 55300, X
   turns reverse on
X=PEEK (55300) turns it off
```

On the diagram, 70/12 means U70 pin 12, etc.

*A Rowsby*



# FRAMES OF REFERENCE:

# A DP MANAGER'S GUIDE TO MICROS

*Many series have been written to introduce microcomputers to the new computer user; some are valuable to computer people as guides to micro computing, but none are addressed to the computer professional's dilemma: how to manage in the micro age when technology is developing at a bewildering pace, microcomputers are sprouting everywhere in user departments and no one is quite sure where micros stop and mainframes start. For the last four years Alan Wood, who is associated with four microtechnology companies and came to micros from a traditional DP background, has been installing micro systems and advising large firms on micros. This series reflects his own continuous adjustment to micro shock and the practical applications of microtechnology within the existing computing framework of the large organisation. It has been written expressly for the heads of management services, computer managers and computer professionals in user and supplier companies. Its object is to provide a framework in which the rapid developments in microtechnology can be placed and viewed in the context of other computing. It provides pegs on which the professional can hang information and it includes guidelines for the application and control of microcomputing. Such is the pace of development that those responsible for establishing strategy face the necessity of a continuing review to assimilate the impact of the new technology on their plans. The series provides a useful start to the process of assimilation and, for those who have already begun, a valuable second opinion to confirm and sometimes question their views.*

The last decades of the 20th century will be remembered as an era of new departures. The concentration on reducing our calorific intake has created the new cuisine; the search for alternative energy sources is harnessing the sun and the sea; interest in the paranormal may be heralding a new science; the polarisation of political parties is creating new politics; the departure of the war generation is breathing fresh air into business and industry; and the arrival of the microchip is the start of new computing.

By the end of the 80s, computers will be as commonplace as calculators were at the end of the 70s. By the end of the 90s, we will be living in a computerised video society. The combining forces of computing and communications technology, the development and sophistication of existing channels — television, telephone, telecoms, video and microtechnology — are inexorably moving us towards a 21st century lifestyle previously regarded as science fiction. These changes mean radical alterations in our lives and, particularly, in our work. Everyone will have to go back to school, and keep going back to school, to keep pace. But the school will be in our homes and offices in the guise of a terminal on which we play videograms for passive learning and programs for participative learning.

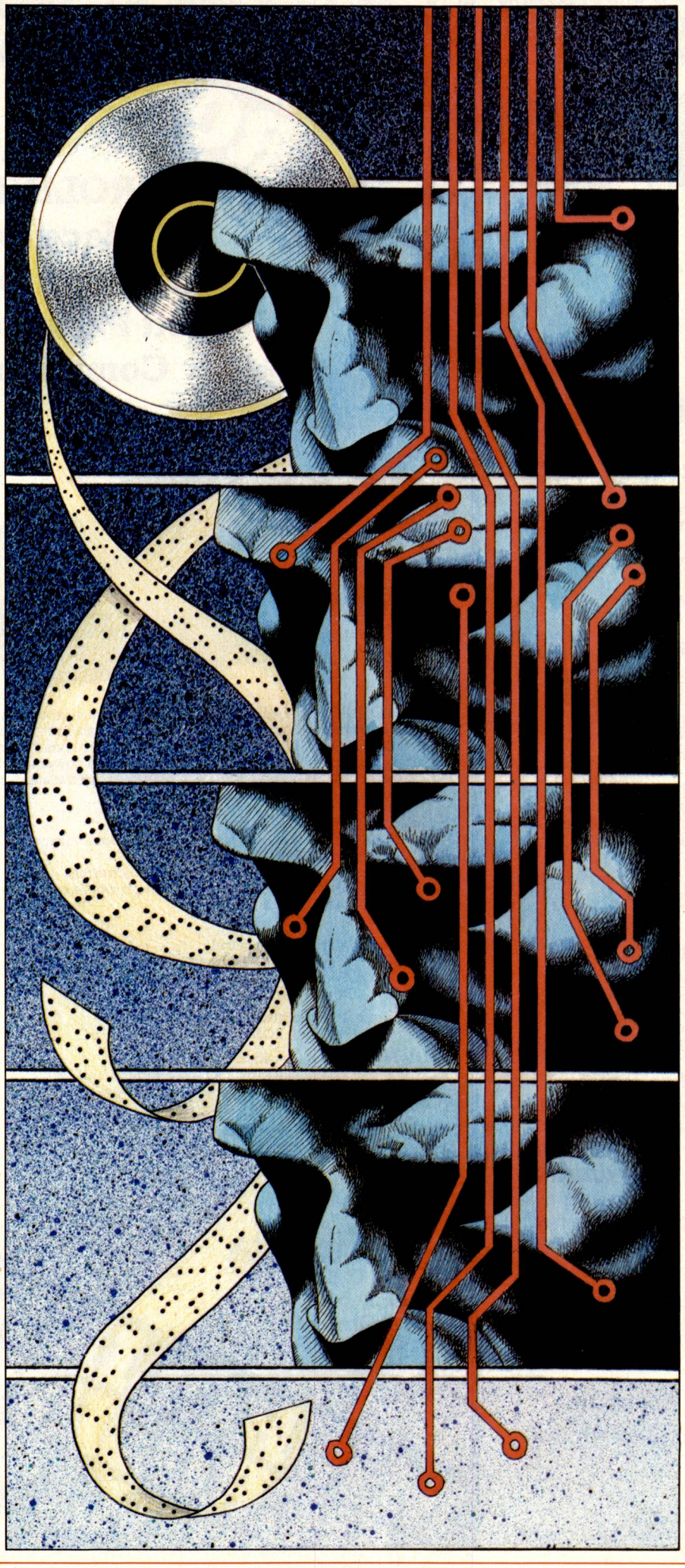
Computer professionals will have to learn a new trade and keep on learning to stay in touch with, and find a place in, a technology-led revolution. In old computing, you could learn your ICL 1900 and IBM 360 and be sure they would be around for ten or more years. With some refreshing seminars it was relatively easy to keep pace. The arrival of minicomputers from DEC, Data General, etc, hotted up the pace and some DP people took a long time to adjust to interactive computing. But the pace of mini development is positively pedestrian compared to micros. The micro industry only started in 1975, yet there are now more than two million machines installed worldwide. Apple began in a garage in 1977 and has sold 300,000 machines. The micros of two years ago have already been superseded by second generation micros: the micros of today will be superseded by a third generation in another two years.

## PART 1: MASTERING THE NEW COMPUTING

When micros started, there was no software available. Now there are thousands of packages, several hundred of which are technically excellent and only cost hundreds of pounds. The cost of developing some systems on micros has been cut by 75 per cent in two years with the arrival of development aids. And we have achieved more portability of software and skills in the micro industry in a few years than has ever been achieved even within a traditional computer manufacturer's own line. The computer professionals who ignore these trends are heading for a future dole queue; the DP manager who turns away is on the road to early retirement.

In August last year, IBM announced its Personal Computer and, overnight, micros were not just fashionable but respectable. Apple Computer, the company that had rocketed to a billion-dollar stock exchange valuation in just four years, welcomed the announcement by taking a full page advertisement in the *Wall Street Journal*. DP managers, eager that micros were a passing fad or that IBM would come up with an answer to the upstarts, had one of their wishes fulfilled. The burgeoning software industry got its biggest lift since unbundling with the information that the IBM machine would come with industry classics — Microsoft Basic, Personal Software's Visicalc and the Peachtree accounting packages. The market for hardware and software took a quantum leap with the promise that IBM would put its Personal Computers everywhere there were electronic typewriters and terminals — and a few other places besides.

Dramatic though the impact of the IBM announcement was — the sales equivalent of the Pope endorsing birth control products — it only set the seal of approval on an industry already well developed with missionary zeal by accolytes of such strange gods as Tandy, PET, CP/M and the S100 bus. Moreover, far from answering the DP manager's prayer to conformity, IBM's entry into micros is one more development which will further fragment, if not shatter, the Holy DP Empire as computers become as easy to use and as accessible as cars. We are only a small step away from taking 50 megabyte video discs and video input cameras right out of 'Tomorrow's World' and into our offices, thereby decimating two of the largest remaining costs — bulk storage and file creation — that are a deterrent to mass computerisation.



After the early pioneering days when they were the catalysts for change, data processing departments, like their mainframe suppliers, have been resistant to new technology. In the late 60s, the emerging timesharing services were first taken up by users, with DP dragging along some years later. In the early 70s, the suitability of minis to interactive applications attracted users frustrated with mainframe inadequacies. Many bitter battles with DP departments ensued, although those same departments are now bringing in the super-mini to replace obsolescent third-generation mainframes. When word processing arrived in the late 70s, DP managers again turned their backs and referred the problem to O & M, or those responsible for office equipment. After all, word processors were only replacements for electronic typewriters, weren't they? Many companies now looking at integrated office and data processing systems are regretting DPs' early *laissez faire* attitude towards word processing.

DP departments have fallen behind again with the introduction of micros. Computer managers are finding to their embarrassment that they know less about the subject than users in their companies. The number of DP departments with their own micros is still in the minority. When micros first began to see the light of day in the UK, few DPMs noticed them. As the publicity bandwagon for PETs and Apples got rolling, they had little impact on DP. Today, computer people still often associate the word 'micro' at worst with a trivial games playing device and, at best, with a super-calculator. Too few DPMs have reconsidered or altered their computing strategy, set up micro groups or got seriously to grips with the technology that has already turned the computer industry on its head and will progressively do the same to those making their careers in it. It is users who again have pioneered the application of microcomputers and, just in case there are residual feelings that what they are doing is trivial, it is worth pausing to quote some facts.

— *Fact 1:* You can save thousands of pounds on timesharing bills and increase productivity by using micros *now* for budgetting, forecasting, linear programming, PERT, modelling and other management tasks.

— *Fact 2:* For under £10,000, you can purchase *today* a 16-bit desktop computer with 256k RAM (upgradeable to1 megabyte) plus 10 megabytes of store

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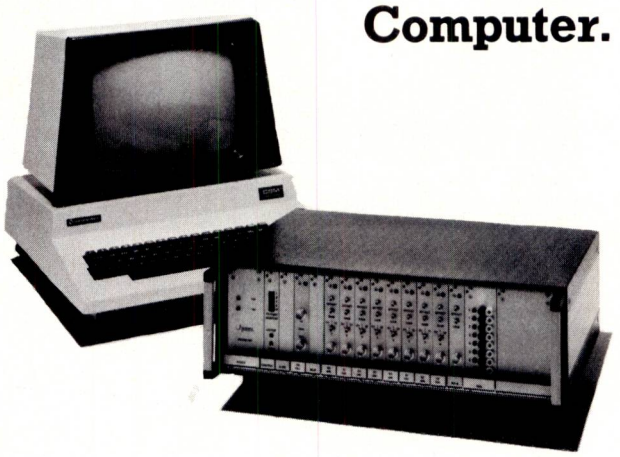

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|---|---|
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**Modules for experimental control:**

| | |
|---|---|
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**Modules for data collection from instruments:**

| | |
|---|---|
| BCD-8 | 8 decade BCD input. |

**Modules for signal generation or displays:**

| | |
|---|---|
| 8D-A | 8 bit digital to analogue converter. |
| SCOPE | 2 channels + trigger for oscilloscope displays. |
| 8D-XY | 2 channels + pen lift relay for analogue XY plotter. |

**Modules for specialist applications:**

| | |
|---|---|
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# MICROLINK MICROLINK MICROLINK

## The DPM's micro survival kit

| | |
|---|---|
| Acquire: | a personal computer, eg, Apple or SuperBrain |
| Select: | some packages: Visicalc, Wordstar, Datastar |
| Appoint: | a Micro Project Manager in your department |
| Subscribe to: | *Byte, Personal Computer World, Infoworld, Electronics* |
| Read: | *The Mighty Micro* (for stimulation), Osborne series (for detail), Zak's *Your First Computer* (simple introduction), this series (practical advice) |
| Retain: | a microsystems company as advisor and supplier |
| Maintain: | register of all micros and applications in your company |
| Implement: | pilot stand-alone and comms-to-mainframe projects |
| Run: | courses on micros for DP department staff and users |
| Revise: | computer thinking and five year plan to incorporate new technology |

and the processing power of a PDP 11/44.

— *Fact 3:* At one half the cost of the conventional mini, you can replace a 24-station shared processor minicomputer with a 24-station local area micro network and give every user his own processor.

Some DP people have recently embraced micros with all the enthusiasm and blinkered vision of new converts, neither looking to the left of them at the weaknesses in the current machines, nor to the right of them where they would find first generation micros being superseded by second generation machines. Others have stood back and watched their users get on with it, waited, and sometimes prayed for them to fall into the snakepit of undersizing, inadequate software and hardware breakdowns.

Once some pegs have been established on which to hang and relate information, the transition to new technology is achievable for those who want to make it. Apart from their physical size and the software available, 8-bit microcomputers have similar power and memory size to those old 1401s, although they are used in interactive rather than batch mode. Working in micros is also like very old computing, providing closeness of the systems worker to the machine and to the user. Most micro systems are implemented by one-man teams working directly for a user and employing prototyping techniques. Few micro projects need more than three or four people, or a timescale greater than six months. Micros lend themselves to rapid interactive development (compute time on micros is amazingly cheap compared to mainframes) and the use of development aids to prototype systems. You can easily show the user what his screen will look like before you implement his systems. A partnership with the user is formed during the development stage and the systems engineer, who designs, programs and uses software tools, also trains the user to run his systems after completion. The user will typically go on to use some of the tools, report writers, sorts, etc, to access his system. In micros we were reversing the trends we started 15 years and more ago. We are giving users back their filing cabinets — but automating them first.

## The DPM's micro survival kit

The first law of survival is education. Read some books on micros, such as *The Mighty Micro* and *Your First Computer*. Obtain magazines regularly, eg, *Personal Computer World, Micro Decision, Electronics, Interface Age* (the last two are American). Attend courses on micros, preferably of the workshop variety. Obtain a personal computer and either use it in your office or, until the embarrassment has worn off, at home. With your personal computer, say an Apple, an Osborne or a Superbrain, acquire some packages. A good shopping list will include word processing (Wordstar, Magic Wand) a rows-and-columns product (Visicalc, SuperCalc), an information manager (Selector IV, Datastar). You should also include in your repertoire the industry-standard languages, Microsoft Basic and Micro Focus CIS Cobol. The next sensible action will be to appoint one of your bright young staff to take a special interest in micros. If you are a manager in a large company, a micro group with a team of people will be needed. Then you should find a microsystems company and professional dealer from whom you can obtain sensible advice, buy equipment software, training and support services. The best dealer companies operate as surrogate micro departments and their resources are drawn on as and when needed.

## Micro strength

Whatever we say about micro limitations today becomes quickly dated. The 32-bit Mainframe Micro has already been announced by Intel. The 16-bit Mini-Micro is with us. In 1980 the norm was a 48k RAM single user, 8-bit micro. In 1981 the four-user, 256k RAM and 10 megabyte micro became commonplace. In 1982, the powerful 16-bit machines put a megabyte of memory on the desktop. These will be followed by revolutions in storage, most exciting of which, the video disc, could provide offices with storage for as little as £1 per megabyte!

The outstanding advantages of today's micros can be summarised as: a) low cost, (b) rapid delivery, (c) minute size and (d) software availability.

The low cost of micro systems is not due to the fall in processor prices alone but also comes from the collapse in peripheral prices, brought about by the microchip itself and the massively increased sales it has engendered. In the space of two years, some printer prices have fallen to one third their former level and visual display screen prices have been chopped in half. You can buy an 80-cps, 132-column printer for £595 and a VDU for as little as £395. Nor are these shoddy goods: NEC, Ricoh and Epson printers have the traditional Japanese reputation for reliability. (It is significant in this regard that many American suppliers are badge engineering Japanese products as part of their own offerings!).

The second virtue of the micro is its ready availability. The waiting times associated with mainframes or even minis simply do not apply in the micro industry. The small personal computers, Apple, PET, Tandy, Sharp, are instantly available. The more powerful business machines are delivered typically ten to 30 days from order. You could put in a local area network to replace a mini in 30 days and some companies have done so. This rapid delivery really does encourage the use of microcomputers and assists management to make things happen quickly. Users are universally fed up with the tediously long time it takes their computer departments to deliver systems.

The third virtue of the micro is its minute size. When you can literally put a computer on your desk, the saving in space is significant. And with office rentals ever on the increase, the cost of the space is no small consideration. Micros will continue to produce greater power in smaller spaces. The practical limitation is the size we humans need to read in comfort and, until voice entry becomes the norm, keyboards have to fit fingers.

The fourth virtue of the microcomputer is the software library available to achieve practical working systems in a very short space of time. Most micros are used with existing packages and development aids, and the number and sophistication of software products is growing daily. The low cost of micros

## Things I wish I had known five years ago

1. CP/M (Control Program Microprocessor) would become the de facto industry standard micro operating system and sell more than 250,000 copies.
2. Apple Computer would sell more than 300,000 machines and be valued at over one billion dollars on the New York Stock Exchange.
3. Peripheral prices would quarter as new technology cut costs and volume sales when new markets took hold.
4. Systems Software Manufacturers would become the norm for the supply of operating systems and languages, eg, Micro Focus, Microsoft, Digital Research.
5. Software Publishers would sell packages in tens of thousands, eg, Lifeboat, Personal Software.
6. Chip prices would fall from £8 for 4k dynamic RAMs to 80p for 16k dynamic RAMs; from £40 for an 8080A processor to £3 for a Z80A processor.

# FRAMES OF REFERENCE

also means you can use them in dedicated development, an approach which improves programmer productivity. Some DP departments have found that it is cheaper and quicker to employ micros for Cobol program development and subsequently transfer the programs to their mainframes.

## Micro weakness

What are micros not good for? Presently, the practical disk storage limitation of the microcomputer is about 100 megabytes. Micros are generally not suited to large file handling and manipulation. The software is not available for such applications, nor is suitable hardware. Neither are micros suited to the bigger multi-user applications. The operating systems on micros are not yet good enough to handle dozens of terminals with high transaction volumes. However, the low cost of micros has led to a completely different solution to the multi-user need: the local area network. On a local area network each user gets his own processor and shares the central disks and line printers. Local area networks are still limited in their disk capacities — around 200 megabytes — but these boundaries will soon be extended. A local area network is a real alternative to the multi-user mini, being both cheaper and more resilient.

The main weaknesses associated with micros are not technical. The greatest problem is that the proliferation of micros in larger companies is likely to lead to a liquorice allsorts of machines and incompatible systems. The proliferation can also produce a terrible waste in expensive man time as new users re-invent the wheel. Moreover, the tendency to put micros in the hands of undisciplined users can create embarrassing situations when a member of staff leaves a company and he or she is the only person who knows the system. It is essential that companies have a planned strategy for microcomputing to minimise waste, insure against expensive errors and get the best out of the new technology.

## Strategy for microcomputing

Medium and larger-sized organisations should establish a strategy for microcomputing which sets the new technology in the context of what is already in their companies. Such a strategy will include policy guidelines which are revised annually. It will consider in depth and detail the positioning of microcomputing in relation to mainframes, minis, word processing, time-sharing and communications. It will express standards for microcomputing with special reference to software. It will insist on a fast response to user needs and a mechanism that produces a fast response, without which disillusioned users will find their own way to microcomputerise. It will establish criteria for justification and payback on microsystems. (Micros are typically written off over three years and show a payback in not more than two years.) It will contain an action programme to educate DP staff and users to implement pilot systems.

## The software gateway

DP has been consumed for many years with applying hardware standards or standardising on particular manufacturers' equipment. In microcomputing, it is far more important to establish software standards, and to use existing tools and packages, than it is to establish hardware standards. It is likely that the hardware you will be taking on in three years time will bear little relationship, except in the software which runs on it, to that which you have today. In implementing systems on micros, it is important to start with the user requirements and not with the hardware you have. It is not a case of how one can implement this system on one's ICL or IBM machine under such and such operating systems and language; rather, it is very much a case of finding the shortest software route to solve the problem. What package fits the bill? Or what development aids are available to speed the implementation? And if you are using programming languages, then it should be either Microsoft Basic, CIS Cobol or Pascal, to provide you with a gateway to future technology. These are the industry-standard languages and if you use others you do so at your own peril. Not only will you be investing time in learning, but you may be limiting your future options and tying yourself into obsolete technology. For the first time in the history of computing, computers are being designed to fit the software available not vice versa. The semiconductor manufacturers, Intel, Zilog and Motorola, have adopted Unix both to get their 16-bit technology to market faster and to provide a route to their 32-bit offerings. CP/M, the single user operating system from Digital Research, has sold in millions and is the industry standard. Its multi-user brother, MP/M, is being adopted by many of the commercial manufacturers both for 8-bit and 16-bit multi-user applications. There are other operating systems, including the manufacturers' own. But all the independent operating systems worth using have also got Microsoft Basic and CIS Cobol on them. The IBM machine comes with Microsoft Basic; CIS Cobol is generally available on MP/M and Unix. These languages provide a genuine software gateway to the future.

### Software gateways to the future

| | |
|---|---|
| Microsoft Basic: | Available on: 8-bit 8080, Z80, 6502; 16-bit 8086, M68000, Z8000<br>Under: CP/M, MP/M, Xenix (Unix) |
| Micro Focus CIS Cobol: | Available on: 8080, Z80, LSI II, 8086, CP/M, MP/M, Unix, etc. |
| Digital Research: | CP/M single user operating system; MP/M multi-user operating system. |
| Bell Labs: | Unix, C and derivatives: multi user development and operating environment |
| UCSD Pascal: | For portable software packages. |

## Hardware standards

The most common processor for hobby computers is the Mostek 6502, used in the Apple, PET and Atari. All these machines have their own languages and operating systems. Software written on one is not readily portable to the others. They are at their best when used for education, numeric applications, low volume files and word processing. They are most often employed by using existing packages and tools.

By far the most popular processor for business microcomputers is the Zilog Z80. This contains the instruction set of the Intel 8080 and is compatible with it. CP/M runs on the Z80 and 8080, providing access to a vast range of software. Z80 machines have commonly been adopted as the standard to provide portability of expertise and software in the larger company.

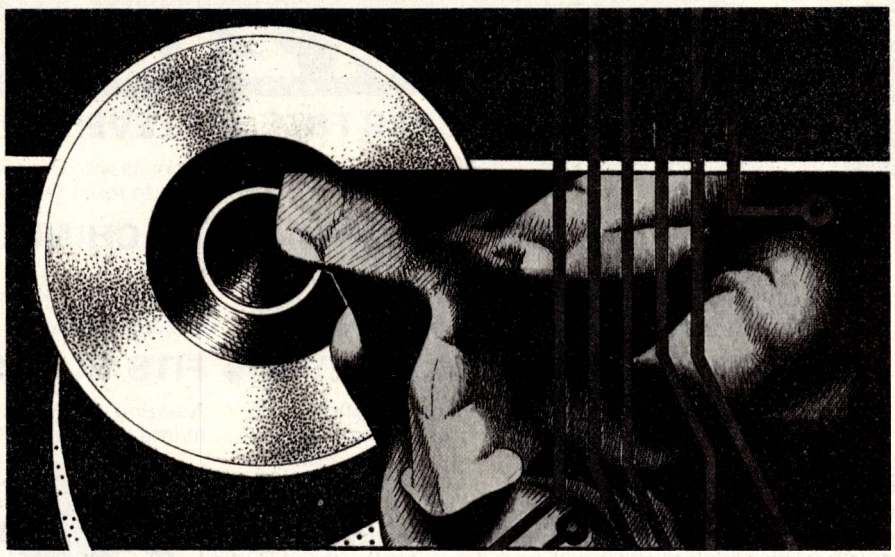
The Z80 computer comes in two implementations: the S100 bus version and the 'own bus' version. The bus is simply the internal communications system of the computer. The S100 bus has



100 common communications or connecting lines. It provides the facility to plug in additional hardware cards, much as you can plug in three-pin plugs. Some microcomputer suppliers have developed their own bus structures, eg, Altos, Intertec, and Zilog. A greater number have adopted the S100 bus, which has now been taken up by the IEEE and become an international hardware standard. Manufacturers using the S100 bus include Dynabyte, Cromemco, Micromation, North Star, Industrial Micro Systems, Comart, Vector Graphic. Single or own bus machines have a reputation for greater reliability and are simpler, but it is more difficult to change their configuration. S100-bus machines are easy to re-configure and you can add or change their internal boards very readily. They also have access to an ever-growing variety of additional hardware: colour graphics, viewdata, emulation and other plug-in boards. Some newer implementations of the S100 bus are more reliable than the older machines.

So far, we have been talking about 8-bit processors, processors that will continue to be useful for some time to come. The newer 16-bit processors are just coming into the market place and it isn't yet clear which will become the industry standards as the Z80 became the 8-bit standard. It seems likely, however, that the Intel 8086 and Intel lookalikes are going to capture the early volume market. Several of the existing suppliers, Altos, Micro V and Vector, have opted for Intel. Cromemco has switched to the Motorola 68000 and so, it is rumoured, has Apple. It seems probable that Intel will get the lion's share of the market and Motorola seems set to pick up the more sophisticated, but less voluminous, portion. Zilog is presently showing third, with its own computer and most notable Z8000 machine available.

The profusion of processors, both 8- and 16-bit, emphasises the need for managers to establish software standards. All these processors can be programmed with the languages already mentioned. If you want rapid implementation of an interactive system,



Microsoft Basic is a good choice. If you want good file handling and processing, as well as maintainable code, CIS Cobol will suit for now and the future. If you're building software tools and packages, Pascal is increasingly favoured.

You will also be well advised to limit the choice of peripherals since it becomes very difficult to support hundreds of different devices. Of the newer manufacturers, Anadex, Epson, Ricoh and NEC have made a mark in printers, alongside Diablo, Texas Instruments and Centronics. The VDU market is highly competitive, with Lear Siegler, Volker Craig, Hazeltine, ADDS, Newbury, Televideo and now even IBM, all slugging it out. The most important word in peripherals is reliability: do not go for the cheapest or the latest, for this reason alone. Ask the supplier and heed his advice when he tells you what works day-in and day-out.

## First commandment of microcomputing

Thus far we have provided some comfort to the computer professional with familiar references to software and hardware standards. These points are valid as a starting ground to understanding and to planning. But they are only an introduction to the first commandment of microcomputing: *Thou shalt not treat a microcomputer as a computer.* Thou shalt treat it as an application device.

Word processors are not microcomputers, they are application machines. Hi-fis are not electronic consumables; they are music players. Microcomputers are not computers. . . they are stock machines, budgeting machines, mailing machines. They are music centres to play the tunes of your choice available from Virgin Software and Our Price Programs. When you are considering micros, you look at the languages, packages and tools first, last and always. Then you decide on which reliable micro you are going to play them.

If you want a membership record and subscription system, with mailing and word processing, you could hand-program it for £15,000 using Basic, or you could build it with the Micro Pro products Datastar, Wordstar, Mailmerge and Supersoft or with Magic Wand for around £3000. And you could use those tools for other applications, too. Aids of this class are literally slashing as much as 80 per cent off traditional development costs for small systems.

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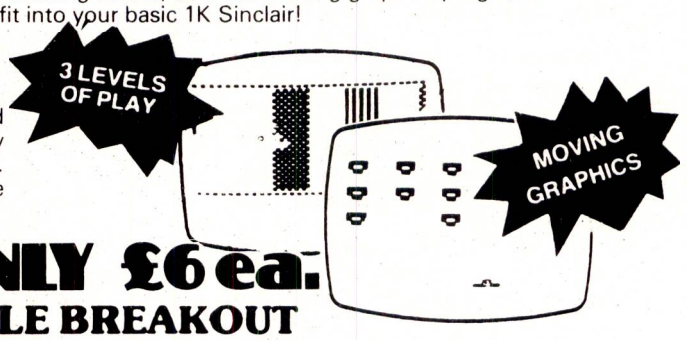


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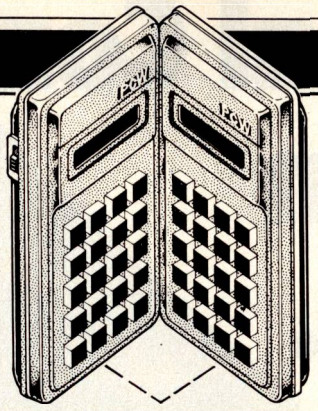

## Compiled by Dick Pountain

## Calculator Benchmark defended!

When I first adopted (more correctly, stole) my new calculator Benchmark algorithm in September's 'Corner', I fully expected it to generate a certain amount of controversy. As ever, the readers have not let me down and I have received several pointed letters criticising the new routine in no uncertain manner.

Before leaping to its defence I shall recap for those who missed the original issue. The Benchmark (which I found in an article in the US magazine *Microcomputing*) consists of a program to evaluate the expression:

$$P=I\sum_{J=1}^{N}(1+Y)^{-J}+M(1+Y)^{-N}$$

with M=20,000, I=1400, N=50 and Y=0.08. (Answer is 17553.30307.) The formula is, in fact, used to calculate bond yields in the financial world. I was attracted to this formula for two reasons, the first being that I liked the idea of a complex expression similar to those encountered in real life applications and the second being that the author listed Benchmark timings for several popular calculators using this expression and, in addition, a figure for the size of the program and the percentage of total memory used. In particular, he quoted figures for the Texas TI-59, the Hewlett-Packard 41C and the Sharp PC-1211 which I have reproduced so far in two Benchtests. Since then I have redone the Sharp figures myself but have been unable to perform the test on the other two machines. Several readers have written to point out that both the TI and HP memory used figures which are inconsistent with the quoted number of program steps and, indeed, on closer inspection I agree that they appear to be wrong, though I can't place the source of error since I don't know what program the original author wrote and don't have access to either machine just now. Either he miscounted the steps or assumed a wrong value for the total memory available and I reprinted his figures without checking them (slap or wrist).

## What are Benchmarks?

To rectify the situation I propose to define more fully the standard for the Benchmark program and then invite you lot out there to send in your figures for whatever machinery you have, including, I hope, the 59 and 41C. But first I have to defend the algorithm itself since this has also been criticised.

Benchmarks as used in computer tests in *PCW* and elsewhere are intended to examine the speed of the interpreter/compiler for a given language and for a range of different operations. They consists of a number of short programs which perform the particular operation, eg, filling an array 1000 times using a loop. They derive their interest and significance from two circumstances, namely that:

a) The implementations of the language, say Basic or Pascal, on different computers are sufficiently similar that such small and simple test programs can be expressed by identical code. The Benchmarks are 'standard' in the sense that they can be typed straight in to any machine;

b) The modes of operation of different interpreters and compilers are sufficiently different that the Benchmarks provide revealing information which can suggest how fast real life applications are likely to execute.

Unfortunately, in the world of programmable calculators neither of these circumstances obtain. Calculator languages are more like Assembler than high level languages and each manufacturer has a different language and architecture which may even differ between machines in their own catalogue. This renders a truly standard set of Benchmarks in the sense stated above quite impossible. In addition, memory space is at a premium even on the largest calculators (and there are still machines on the market with only 50 steps) so that the economy of steps provided by a language is as important to the user as speed of execution; this consideration is not so important on computers and is in any case not tested by standard Benchmarks. My early attempts to emulate standard computer Benchmarks for calculators, some of which have appeared in this column, were highly unsatisfactory. Take a single example: the Casio 502/602 models support a special search algorithm for GOTO statements which starts searching backwards through program memory, rather than forwards as on other machines. This leads to very fast execution of backward loops, which are precisely the basis of a Benchmark test; this, in turn, gave timings up to five times faster than rival machines. This magnitude of speed advantage is not likely to be achieved in real applications, however, and so the test is unrealistic.

For this reason, I decided to choose a single formula sufficiently complex to include several functions and to produce a program long enough to compare the economy of steps realistically. A much longer formula could have been chosen including trig and log functions, but the one above appeared to have the advantage that results existed already for some major machines (ho hum!). However, this formula can only give an objective comparison if it is implemented in a standard way in each language and so I shall now give you the conditions under which I propose to use it in future.

The fundamental criterion is realism, ie, it is intended that real-life considerations of convenience and error prevention should apply.

## Inputting the data

The four parameters — M, I, N and Y — must be input to the running program from the keyboard. Embedding them in the program or pre-storing them in memories saves steps but is unrealistic and hence forbidden. On machines which possess an alpha facility, the inputs should be asked for by simple single letter prompts. (I will confess that I failed to do this on the 602p; I ran the same program as the 502 and must therefore alter it.) Timing is from the beginning of execution, not the input sequence, of course.

Hardware permitting, execution must be by a single keystroke to initialise/select the program, followed by data entry with a single keystroke to enter each value and a single keystroke to run (this may be the last data entry stroke). The result need not be stored, but only displayed, and on alpha machines the result need not be labelled.

The formula must be implemented in a straightforward literal way using exponentiation and iterative summation, though the order of evaluation of the terms can be altered. Mr M J Hall, the most cogent of my critics, pointed out that the formula can be programmed in such a way as to avoid exponentiation, for instance by the substitution

$V = 1/1+Y.$

This defeats the purpose; we have to imagine a naive but competent user who knows his language perfectly, but codes the formula as written without any mathematical manipulations. However, any hardware or software tricks which are a feature of the calculator are fair; this is exactly what is being tested. So on an HP you can certainly use stack operations to input and store the variables and if you have a single step loop-counter instruction it should be used. Quirks which aren't in the manual are forbidden, however. Equally, a trick like requiring the user to enter 1+Y instead of Y to save steps is unacceptable as it would be a potential error source in a real program.

Mr Hall also suggests that the number of data registers used should be counted in determining memory usage. I agree in spirit with this suggestion but feel that it complicates things too much on certain machines. Since all the machines I have tested have some reserved data memory which is not convertible into program memory, I prefer to exclude this from the total memory count and confine all the variables to it, but to add another column to the chart for Number of Variables/Registers Used. The rationale is that the test is for economy of use of program space by the language; nevertheless, the number of variables should be minimised by use of memory arithmetic or stack operations if only to save program steps.

*GOTO page 189*

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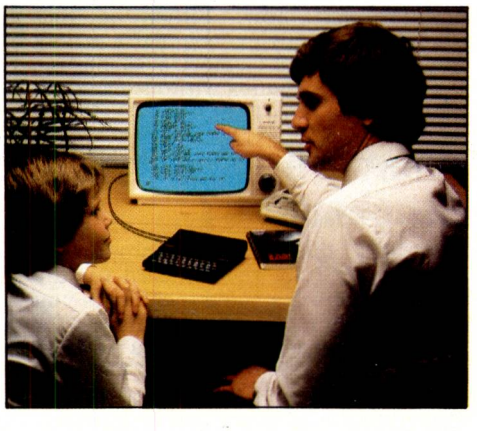




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*For this month, Jim Chance of Birmingham University's Microsystems Laboratory takes over 'Sub Set' to share some CP/M-compatible I/O routines and give Alan some breathing space to process your contributions. Jim is one of 'Sub Set's' earliest supporters and a frequent contributor. Others who have already contributed to 'Sub Set' are invited to send in proposals for a complete article.*
*If you'd like to contribute your assembler-language routines (for any of the popular processors), send them to: 'Sub Set', PCW, 14 Rathbone Place, London W1P 1DE.*

When Alan first put out his call for subroutines in May 1980 I was already thinking along the same lines — subroutines could be written in such a manner that they were as general purpose as possible. My own experience of using a subroutine library has taught me a number of things that I did not realise at the beginning. Firstly, surprising as it may seem, it is very much easier to get programmers to contribute to a subroutine library than to use it. I think that the main reason for this is that all of us, whether professionals or amateurs, enjoy writing computer programs — understanding somebody else's documentation is not nearly as much fun! Also, most of us do not really trust programs written by others, usually on the basis of only one or two unfortunate experiences. 'Sub Set' has concentrated on standardisation and documentation of subroutines. I believe that two other qualities are required of anything in a genuine library: a package from which people take routines to use in real programs and *proven* tested performance and usefulness. I quote an experienced colleague at Birmingham University whose reaction was, 'No routine should be in a library until it has been called 20 times!' He meant, of course, in different programs. I would be most interested to hear from anybody who actually writes programs using library routines.

The listings here have probably been called in 20 different programs but are still capable of improvement. However, this does show that they are useful, at least to me! These two packages of subroutines are both designed for those who write in Z80 assembler code for a CP/M disk operating system.

The first Datasheet contains basic file handling routines to open a read file, create a write file, delete a file, read or write a standard CP/M record (128 bytes) and close a write file (create a directory entry for the file on disk). CP/M only uses a

## Datasheet

```
;= CP/M FILE HANDLING PACKAGE
;/ CLASS: 2 (not ROMable)
;/ DESCRIPTION:   NEWSTK saves CP/M stack, gets new one
;/                OPEN opens read file
;/                READ reads record
;/                CREATE makes file if doesn't exist
;/                WRITE writes a record
;/                ERASE deletes a file
;/                CLOSE closes write file
;/                RETCPM restores CP/M stack, exits
;/
;/ ACTION:  See individual routines
;/          Call NEWSTK before any other action
;/          All routines save all regs except AF
;/          Errors give message & return to CP/M
;/ SUBROUTINE DEPENDENCE: None
;/ INPUT:   FCB refers to a CP/M file control block
;/          with parsed filename, (DE)=FCB where
;/          appropriate
;/ OUTPUT:  See individual routines
;/ STACK USE: 2 (creates new stack)
;/ LENGTH: 510 bytes inc 256 for stack
;/ PROCESSOR: Z80
ENTRY:     EQU   5H          ; CP/M entry addr
;
;= CREATE: makes disk file
;/ INPUT: (DE)=FCB containing file name
;/ OUTPUT: completed FCB with disk map, etc
;/ REGS USED: DE, AF
;
CREATE:    PUSH  HL          ;                    E5
           PUSH  DE          ;                    D5
           PUSH  BC          ;                    C5
           CALL  QFILE       ;                    CD  YY  YY
           JR    NZ,XMSG1    ; File exists, exit  20  66
           LD    C,22        ; Make file          0E  16
           CALL  ENTRY       ;                    CD  05  00
           INC   A           ;                    3C
           JR    Z,XMSG2     ;                    28  62
           POP   BC          ;                    C1
           POP   DE          ;                    D1
           POP   HL          ;                    E1
           RET               ;                    C9
;
;  QFILE:  DE -> FCB, opens read file if possible
;          On return Z if no file
;          Only saves DE
;
QFILE:     PUSH  DE          ;                    D5
           LD    HL,32       ; Nr place           21  20  00
           ADD   HL,DE       ;                    19
           LD    (HL),0      ;                    36  00
           LD    HL,12       ; Zero contents      21  0C  00
           ADD   HL,DE       ;                    19
           LD    (HL),0      ; Zero Nr            36  00
           LD    C,15        ; Open file          0E  0F
           CALL  ENTRY       ;                    CD  05  00
           INC   A           ;                    3C
           POP   DE          ;                    D1
           RET               ;                    C9
;
;= OPEN: Opens a read file
;/ INPUT:   (DE)=FCB
;/ OUTPUT: Points FCB to file start
;/ REGS USED: DE,AF
;
```

# PCW SUBSET

very small stack of its own so that it is good practice for every program you write to create its own stack. There are two ways to exit from a program back to CP/M, either to jump to address zero to reboot the system or to restore CP/M's own stack pointer and return. As this operation is always part of a program, the routines NEWSTK and RETCPH are also included. First-time CP/M programmers should realise, that although returning to CP/M is much faster than a reboot, the console command processor (CCP) must be left intact in memory.

Using this package allows the programmer to forget about such housekeeping chores as error messages and by saving all registers (except AF) it makes life easier. Rules, I believe, are made to be broken, even in programming. One rule that is not worth keeping when using CP/M is to write 'PROMable' code. A program is always going to reside on disk as a COM file and be loaded into RAM for execution. This allows for convenient features like putting a stack in the middle of a program.

The first Datasheet is useful when perhaps a whole file is to be read to or written from memory — I have used it on its own for such applications as an 8048 simulator, binary to Intel hex format translation, file comparison, etc. However, for some jobs it isn't enough. I have used for about 12 months now, a package which uses the just mentioned Datasheet, together with the first-in first-out buffer package from 'Sub Set' (Jan 1981) to produce a useful character-by-character read/write package. The most dramatic proof of its usefulness has been the input/output file-handling routines for assembler programs. How else can you provide character-by-character read of a source file, separate output streams for object code, listing and symbol table files all with different buffer sizes in a morning and still have time for elevenses! Somebody is going to say: 'by using a high-level language' but that's another story.

Finally, to change the subject, has anybody found that using complex peripheral chips like counter timers, UARTs, PIOs, etc time-consuming and difficult? I

```
OPEN:       PUSH    HL          ;                       E5
            PUSH    BC          ;                       C5
            CALL    QFILE       ; Open file             CD  YY  YY
            JR      Z,XMSG3     ; Error                 28  46
            POP     BC          ;                       C1
            POP     HL          ;                       E1
            RET                 ;                       C9
;= CLOSE:    Closes write file
;/ INPUT:    (DE)=FCB
;/ OUTPUT:   File put to directory
;/ REGS USED: DE,AF
;
CLOSE:      PUSH    HL          ;                       E5
            PUSH    DE          ;                       D5
            PUSH    BC          ;                       C5
            LD      C,16        ; Close                 0E  10
            CALL    ENTRY       ;                       CD  05  00
            INC     A           ;                       3C
            JR      Z,XMSG4     ;                       28  3C
            POP     BC          ;                       C1
            POP     DE          ;                       D1
            POP     HL          ;                       E1
            RET                 ;                       C9
;
;= READ:   Gets 128-byte record
;/ INPUT:    (DE)=FCB
;/ OUTPUT:   Next 128 bytes at DMA
;/           Z=normal read
;/           NZ=past end of file
;
READ:       PUSH    HL          ;                       E5
            PUSH    DE          ;                       D5
            PUSH    BC          ;                       C5
            LD      C,20        ; Read                  0E  14
            CALL    ENTRY       ;                       CD  05  00
            CP      2           ; Error?                FE  02
            JR      Z,XMSG5     ;                       28  30
            POP     BC          ;                       C1
            POP     DE          ;                       D1
            POP     HL          ;                       E1
            OR      A           ; NZ=EOF, Z=normal      B7
            RET                 ;                       C9
;
;= WRITE:    Puts 128 bytes to disk
;/ INPUT:    128-byte record in DMA buffer
;/           (DE)=FCB
;/ OUTPUT:   None
;/ REGS USED: DE,AF
;
WRITE:      PUSH    HL          ;                       E5
            PUSH    DE          ;                       D5
            PUSH    BC          ;                       C5
            LD      C,21        ; Write                 0E  15
            CALL    ENTRY       ;                       CD  05  00
            OR      A           ;                       B7
            JR      NZ,XMSG4    ;                       20  1C
            POP     BC          ;                       C1
            POP     DE          ;                       D1
            POP     HL          ;                       E1
            RET                 ;                       C9
;
;=ERASE:     Removes file from directory
;/           Non-existent file is acceptable
;/ INPUT     (DE)=FCB
;/ OUTPUT:   None
;/ REGS USED: DE,AF
;
ERASE:      PUSH    HL          ;                       E5
            PUSH    DE          ;                       D5
            PUSH    BC          ;                       C5
            LD      C,19        ;                       0E  13
            CALL    ENTRY       ;                       CD  05  00
            POP     BC          ;                       C1
            POP     DE          ;                       D1
            POP     HL          ;                       E1
            RET                 ;                       C9
;
;   Error routines load message to HL
;   DD loads subsequent messages to IX
;
XMSG1:      LD      HL,MSG1     ;                       21  YY  YY
            DEFB    0DDH        ; Ignore next           DD
XMSG2:      LD      HL,MSG2     ;                       21  YY  YY
            DEFB    0DDH        ;                       DD
XMSG3:      LD      HL,MSG3     ;                       21  YY  YY
```

know plenty who do. In fact, my advice to any student dedicated system builder is to give up the advantages of such a chip and use a TTL latch if possible because he will make it work in about four days' less time! If you feel that you have some *working* peripheral driver routines, how about producing some 'Sub Set-compatible' documentation for them and sending them to *PCW* Sub Set, *PCW*, 14 Rathbone Place, London W1P 1DE.

```
                DEFB    0DDH        ;                       DD
XMSG4:          LD      HL,MSG4     ;                       21  YY  YY
                DEFB    0DDH        ;                       DD
XMSG5:          LD      HL,MSG5     ;                       21  YY  YY
                EX      DE,HL       ; DE -> msg             EB
                LD      C,9         ; Print                 0E  09
                CALL    ENTRY       ;                       CD  05  00
                LD      DE,XCRLF    ; New line              11  F7  00
                LD      C,9         ; Print it
                CALL    ENTRY       ;                       0E  09
;                                                           CD  05  00
;=RETCPM: Restores CP/M stack & exits
;
RETCPM:         LD      SP,(=LDSP)  ;
                RET                 ;                       ED  7B  YY  YY
;=NEWSTK:       Gets new stack, saves CP/M stack pointer     C9
;/ OUTPUT:      CP/M SP at (OLDSP)
;/              SP=STACK
;
NEWSTK:         EX      (SP),HL         ; Ret addr to HL
                LD      (STACK-2),HL    ; To new stack      E3
                LD      HL,2            ; For call          22  YY  YY
                ADD     HL,SP           ;                   21  02  00
                LD      (OLDSP),HL      ;                   39
                POP     HL              ; Get HL            22  YY  YY
                LD      SP,STACK-2      ;                   E1
                RET                     ;                   31  YY  YY
;                                                           C9
MSG1:           DEFM    'Write file exists$'
MSG2:           DEFM    'No directory space$'
MSG3:           DEFM    'I cannot read file$'
MSG4:           DEFM    'Write error$'
MSG5:           DEFM    'Read error$'
XCRLF:          DEFM    0DH,0AH,24H ; CR, LF, $
;
OLDSP:          DEFS    2               ; Store CP/M SP here
;
                DEFS    100H            ; Stack area
STACK:          DEFW    0               ; Initial SP addr
```


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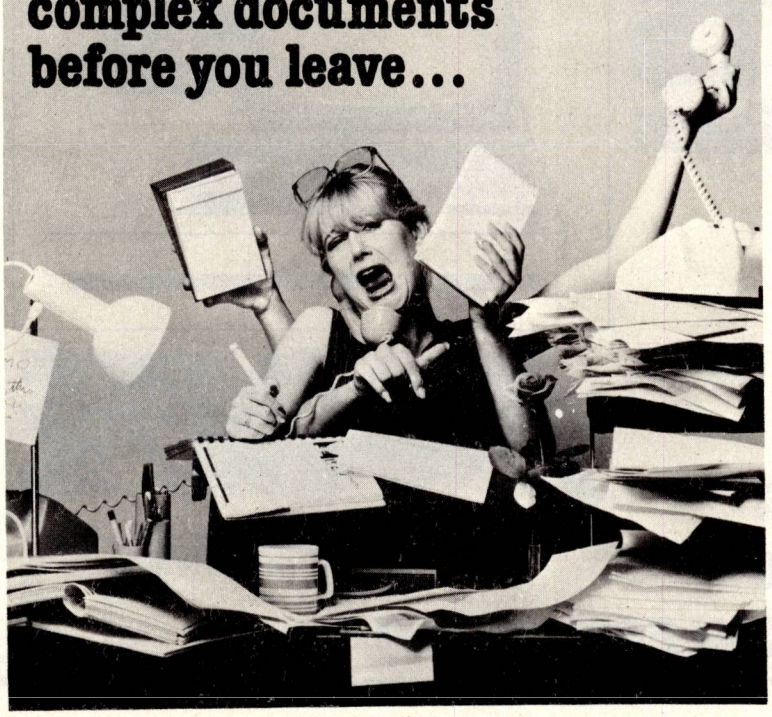

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# Datasheet

```
RECLEN:     EQU   128              ; CP/M record length
TBUF:       EQU   80H              ; CP/M default DMA
EOF:        EQU   1AH              ; CP/M end of file character
;
;= RDCH: Buffered read from disk
;/ CLASS: 1
;/ TIME CRITICAL: No
;/ DESCRIPTION: Buffered read
;/              Buffer is a multiple of 128 bytes
;/              Eg, to set up buffered read,
;/              LD IX, BUFFER (IX)=N*128, buffer
;/              LD,DE,BUFLEN  DE=N*128 size
;/              CALL SFIFO    Create buffer
;/              LD DE,FCB     (DE)=FCB
;/              CALL OPEN     Open read file
;/              Now call RDCH to get a character
;/ ACTION:      Gets character from buffer
;/              If none, fills buffer
;/ SUBR DEPENDENCE:    Uses RFIFO, WFIFO
;/                     User needs SFIFO first in, first
;/                     out buffer handlers, also CP/M
;/                     file handling package
;/ INPUT: FCB at (DE), buffer at (IX)
;/ OUTPUT: Character returned in A
;/ NC=0.K.CY=read past end of file
;/ REGS USED: AF,DE,IX, others saved
;/ STACK USE:  Depends on CP/M
;/ MEMORY USED: See FIFO
;/ PROCESSOR: Z80
;
RDCH:       CALL  RFIFO  ;         ;                    CD  ZZ  ZZ
            RET   NC     ;         ; Normal exit        D0
            PUSH  HL               ; None in buffer     E5
            PUSH  BC               ;                    C5
            CALL  WFIFO            ; Write dummy char   CD  ZZ  ZZ
RDC1:       LD    B,RECLEN         ;                    06  80
            CALL  READ             ;                    CD  ZZ  ZZ
            JR    NZ,RDC3          ; Past EOF, exit     20  0A
            LD    HL,TBUF          ;                    21  80  00
RDC2:       LD    C,(HL)           ;                    4E
            INC   HL               ;                    23
            CALL  WFIFO            ; CY = full buffer   CD  ZZ  ZZ
            JR    NC,RDC4          ;                    30  0B
RDC3:       CALL  RFIFO            ; Remove dummy       CD  ZZ  ZZ
            CALL  WFIFO            ; Write last character CD ZZ  ZZ
            POP   BC               ;                    C1
            POP   HL               ;                    E1
            JP    RFIFO            ; CY=EOF, no char    C3  ZZ  ZZ
RDC4:       DJNZ  RDC2             ;                    10  EC
            JR    RDC1             ; Loop another record 18  E0
;
;= WRCH: Buffered write to disk
;/ CLASS: 1
;/ TIME CRITICAL: No
;/ DESCRIPTION: Writes character to buffer,
;/              empties disk if full
;/              To create a buffered write:
;/                 LD IX,BUFFER
;/                 LD DE,BUFLEN      Desired size (N*128)
;/                 CALL SFIFO
;/                 LD DE,FCB
;/                 CALL ERASE        Delete file if exists
;/                 CALL CREATE       Make new file
;/                 CALL WRCH         Put char in C
;/ ACTION:      Puts character in C to buffer;if full, empties
;/              empties to disk
;/ SUBR DEPENDENCE:  Uses FIFO BUFFER PACKAGE & CP/M
;/                   file handling package
;/ INPUT: Character in C, buffer at (IX), FCB at (DE)
;/ OUTPUT:  Error exists to CP/M
;/ REGS USED: DE,IX,C,AF
;/ STACK USE:  Depends on CP/M
;/ MEMORY USED:  See FIFO
;/ PROCESSOR:  Z80
;
WRCH:       CALL  WFIFO            ;                    CD  ZZ  ZZ
            RET   NC               ; Normal exit        D0
TODSK:      PUSH  HL               ; Buffer full, empty it E5
            PUSH  BC               ;                    C5
WCH1:       LD    B,RECLEN         ;                    06  80
            LD    HL,TBUF          ;                    21  80  00
WCH2:       CALL  RFIFO            ;                    CD  ZZ  ZZ
            JR    C,WCH3           ; None left          38  09
            LD    (HL),A           ; Put to DMA         77
            INC   HL               ;                    23
            DJNZ  WCH2             ;                    10  F7
            CALL  WRITE            ; DMA to disk        CD  ZZ  ZZ
            JR    WCH1             ; Loop next record   18  ED
WCH3:       LD    A,B              ;                    78
            CP    RECLEN           ; Empty DMA?         FE  80
            CALL  NZ,WRITE         ;                    C4  ZZ  ZZ
            POP   BC               ;                    C1
            POP   HL               ;                    E1
            JR    WRCH             ; Put char & exit     18  DD
;
;=WRFIN:  Terminates write file
;/ TIME CRITICAL: No
;/ DESCRIPTION: Writes end of file
;/              Empties buffer to disk
;/ SUBR DEPENDENCE:  Requires WRCH (local)
;/ INPUT: (DE)=FCB,(X)=buffer
;/ OUTPUT:  None
;/ REGS USED:  AF,C destroyed, DE,IX used
;/ STACK USE: Depends on CP/M
;/ PROCESSOR:  Z80
;
WRFIN:      LD    C,EOF            ; Write end of file  0E  1A
            CALL  WRCH             ;                    CD  YY  YY
            CALL  TODSK            ; Empty buffer       CD  YY  YY
            JP    CLOSE            ;                    C3  ZZ  ZZ
```


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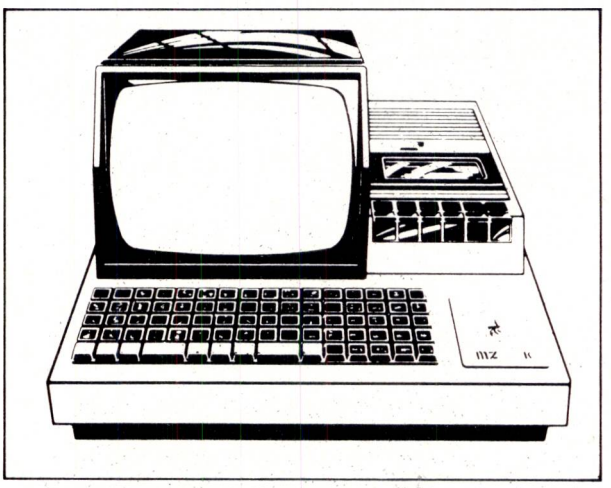

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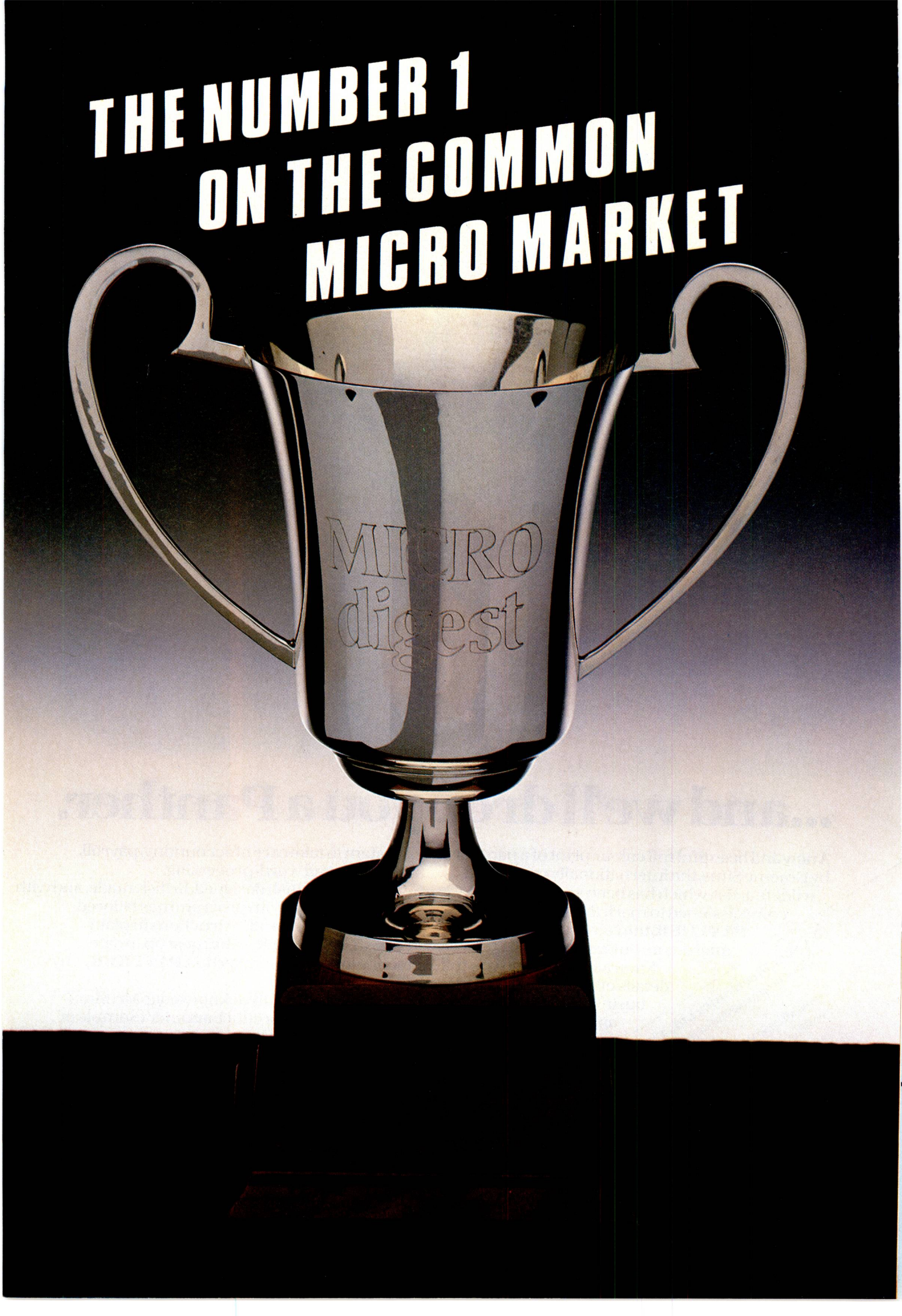
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Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

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.

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| | 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 | |
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_____ PCW 01

# NEWCOMERS START HERE

***This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in* PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!***

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex.** The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0 = 0000, 1 = 0001, 2 = 0010, 3 = 0011, 4 = 0100, 5 = 0101 .... E = 1110 and F = 1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex **(machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

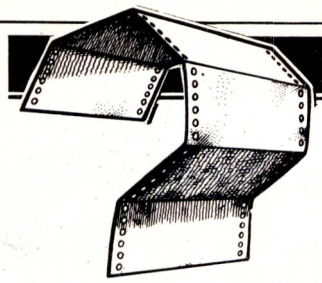
Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24)** while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.



# COMPUTER ANSWERS

*Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.*



## Books

**I am having problems with file handling in Basic. All the books I know of stop just short of what I want. I use MBasic on a Sorceror.**
*M MacDonald Offaly, Ireland*
**Do you know of any books about *building* computers; books about designing computers are plentiful enough?**
*E Grimley Evans, Gosforth, Newcastle-upon-Tyne*
**I wish to find books on modular design and structured programming. Do you know of any?**
*S Pateson, RCT, BFPO 40*
**I require a book that shows how to write computer games. Also how to write mathematical programs.**
*J Smith, Banff*
**I am interested in Forth — can you recommend a book?**
*G Jones, Wimborne, Dorset*

Books are a difficult thing to recommend because they are very subjective — one that I may like, other people may dislike — but here are a few: file handling in Microsoft Basic: *Data File Programming in Basic* by Finkel & Brown; modular/structured programming: *Software Engineering for Microcomputers*, subtitled 'The Electrifying Streamlined Blueprint Speed Code Method' by T G Lewis; Forth: *Starting Forth* by Leo Brodi; games: *Inside Basic Games* by Mateosian (Sybex); maths: *Advanced Basic* by J. Coan; building computers: I have heard that the TAB range of books available from W Foulsham of Slough is good.
*SW*

## Business Atom

**Your correspondent R Lowis said that there was no software known to him for the Atom dealing with business: I enclose a copy of *Atom Business*, and there is an advertisement in the November issue on page 200. Could you please enlighten him?**
*J G W Phipps (Phipps Associates), 3 Downs Avenue, Epsom, Surrey KT18 5HQ. Tel Epsom 21215*

Many thanks for the book. I will not only enlighten him but also all Atom users in business. The book is available from the above address — no price was given but the advert says £6.95, or £15.57 for cassette and book. These seem entirely reasonable to me. The book appears to be full of very useful programs and I would welcome comments from people who have bought it.
*SW*

## Getting into micros

**I am involved to some extent with a PDP-11 computer at work. Can you suggest a route that I should take to involve myself more in microcomputing?**
*B Curtis, Control Tower, Heathrow*

Why limit yourself to microcomputing? After all, a computer is a computer. A popular myth, one that worries a great many mainframe computer users, is that micros are going to take away their jobs. Most of the techniques being discovered by readers of *PCW* and others new to computing were discovered dozens of years ago. Microcomputers are merely computers of ten years ago but reduced in physical size and price — there is very little actually *new* in microcomputing. For example: Basic has been going since 1964, assembler language since 1940, disk drives are nothing new, compilers are 'old hat', 'microcomputers' were on the moon 12 years ago.

I suggest that you enquire at all the local colleges and try to find a course that starts in January. Unfortunately, your best bet would have been to take an A-level in Computing Science, but you'll have to wait until September for that. You can study at evening classes and you won't need any entry qualifications. You should also find a local computer club. Whatever you do, don't buy a micro until you have had a chance to sort out what you want to do with it.

Apart from reading *PCW* regularly, a good book to buy would be *Your First Computer* by Rodnay Zaks.
*SW*

## Frustrated

**Writing as a frustrated ex-owner of a ZX81, I note the following points relating to the VIC-20 review:**
**1. The cassette port can only be used with Commodore's own cassette deck, bringing the total cost to something over £230. I already have a perfectly good mono cassette recorder which cannot be used. Perhaps your magazine could print an article on the innards of the PET/VIC recorder, how it works and, hence, how to modify an existing recorder.**
**2. I saw a number of VICs in operation at the *PCW* Show and I noticed with all of them the occurrence of vertical 'interference' bands on the TV screen window. There was no mention of this in your test, so is it just that every one at the Show coincidentally had a fault in its RF modulator?**
*Jeremy Hall, Farnborough, Hants*

I expect you have noticed that the ZX81 doubles in price if you add memory expansion. However, if you shop around you can get both VIC-20 and cassette for under £200, especially if you are in the user group (VIC users are catered for by the Independent PET Users Group at Commodore's request).

Since you have a perfectly good mono cassette recorder, why not keep it that way? To modify it to incorporate the appropriate circuitry would save little in the way of cash, and few have the expertise and necessary test equipment to build and set up the casette circuitry. THE PET/CBM/VIC systems do not use one of the poor man's analogue recording formats, but a system with error detection and correction and with compensation for tape speed variations.

The 'interference' bands that you noticed could be the result of mutual interference from all other equipment present at the Show, or from the use of an improvised modulator which some dealers had with their 'demo' models. The production modulator is to a high standard and the picture quality is excellent.
*Ron Geere, Editor, IPUG*

## Damaged Tandy

**I have damaged my TRS-80 while trying different tape recorders so that the remote is now permanently on. I think the output device has failed. Could you tell me which part that is and what I can do about it?**
*Marty Haffendon, Bath*

The TRS-80 has a small reed relay which can only handle a very small current. The contacts bond together when a high current tape recorder is used.

You can open the contacts by flicking the body of the reed relay with your finger nail. If this doesn't work, then you can replace this with a Tandy relay which works off 5 Volts. This is a standard miniature relay and not a reed relay. The reed relay is on the back left of the board, looking from the component side of the board.
*Stephen Bird, Oxfordshire Micro Club*

## Genie puzzle

**I recently received my fourth Video Genie II, the previous three being damaged in transit. On first power-up, I noticed the characters were slightly different from the previous ones. I loaded an 'Adventure' into the new machine and found it gave lower case where the others had not. Does this mean that the computer has lower case built in? If so, how can I get it permanently in normal programming mode?**
*Kenneth Morley, Denby Dale, W Yorks*

In the EG3008 Video Genie Model II, the lowercase driver can be obtained by typing:
SYSTEM
/12288
This will give you the built-in lower case driver.

In the EG3003 Video Genie Model I mk III, lower case can only be obtained by POKEing the lower case into the screen RAM or using a tape/disk based driver!
*Stephen Bird, Oxfordshire Micro Club*

## Floppy for VIC?

**Is Floppy Tape any good and would I be able to use, say, the Aculab machine on my VIC-20 when I get it?**
*J Collins, London E18*

Floppy Tape is a compromise in price and performance between cassette and disk media. The version marketed by Aculab would not be suitable for the VIC-20 but the model 220M from Currah Computer Components Ltd is fully compatible with 6502-based systems such as VIC, PET, AIM-65, etc.
*Ron Geere, Editor, IPUG*

## Assembler wanted

**I have recently bought an Apple Europlus and am very pleased with it. I am interested in assembler programming but the mini assembler of the integer ROMs isn't available on my machine. I have heard that it is listed in the reference manual but have been unable**

**to find it. Do you know where it is?**
*Neil Ryder, Fleet, Hants*

Your machine, the Apple II Plus has the version with the Autostart ROMs. This means that if you have a disk drive it will automatically try to boot the disk when you switch the machine on. If you only have tape, it will set up Applesoft. This routine took up more space than the previous monitor. Consequently, some routines were lost. They were the machine code step and trace facility in the monitor (the TRACE routine in Basic is still present). In a similar way the larger Applesoft routines didn't have space for the mini assembler which was part of the integer code. (Steve Wozniak, the co-inventor of the Apple is said to have written Integer Basic using the mini assembler.) But to return to your question, the only listings in the reference manuals are the monitors (old and new), so the mini assembler is not there. So how can you get it? Well, by joining BASUG (British Apple Systems User Group). Part of our membership package is a set of software known in the group as the Introductory Disk (or set of tapes if you only have tape), and on this among the games, utilities and novelties, is the mini-assembler. If you are reaching out for your pen, the address to write to is: BASUG, PO Box 174, Watford WK2 6NF. Write for details — there are a whole host of benefits. If you are a non-Apple owner, look for your own User Group. Sheridan is doing a great job on this page, but there just isn't enough room for lots of technical queries on all machines, so why not join a specialist club like BASUG for the Apple or IPUG for the PET? There is a regular list in *PCW*, which gets bigger with every issue, so you should find something to match your needs.
*John Sharp, Secretary, BASUG.*

## Typecorder

**I haven't seen any mention yet in *PCW* of the Sony Typecorder, a type of portable word processor marketed by Sony in the Far East. It has a standard typewriter keyboard, but records onto a micro-cassette tape, after editing on a liquid crystal display. I have been unable to get any further information on this interesting product in the UK, and wonder if you can throw any light on it.**
*D Digan, London WC1*

The Typecorder was exhibited at the recent IBS exhibition. For further details contact: Sony (UK) Ltd, Commercial and Industrial Division, Pyrene House, Sunbury on Thames, Middx TW16 7AT.

There is a British competitor, the Microwriter, which as well as being a portable word processor, has also broken new ground by using a novel keyboard using only six keys. Not only does this make for compactness, but it speeds up the typing process, as the fingers stay on the keys instead of moving around all over the board. This new keyboard is surprisingly quick to learn (I speak from personal experience).

The Microwriter holds a considerable amount of text in non-volatile memory but has provision for dumping onto micro-cassette should the memory be filled. All the contents of memory are available for editing and this can be simplified by plugging the Microwriter into a TV through an adaptor, so that full paragraphs can be viewed at a time. The text can be printed by plugging the unit into an ordinary daisywheel or similar printer, or the output can be to a word processor for further editing and printing by a skilled typist. My experience is that this latter facility is most useful with long, and usually heavily formatted, technical reports. See the review in *PCW*, December 1980.

## Tax on Apples

**Can you tell me whether there has been a program written for the Apple or other microcomputer, which tells you how to complete a tax form?**
*Neville Ash, Wembley*

There doesn't appear to be such a program on the market, but it would be a very good idea if someone could spend the time to write one. It is very amenable to programming, lots of GOTOs and IF. . . . . THENs spring to mind. If anyone knows of one, write in and let us know. If not maybe this will set someone in the frame of mind to sit down and write it.
*John Sharp*

## High-flying ZX81

**I will be taking my microcomputer (Sinclair ZX81) and cassettes in hand baggage on frequent flights abroad. Is there any danger to the hardware, ROM or cassette recordings from airport security systems, and what precautions, if any, should I take?**
*Name and address supplied*

The security systems to which you refer are, of course, based on X-rays, and the earlier versions of these quickly gained a reputation for fogging photographic film and possibly causing damage to electronic calculators. Since that time, the total exposure used has been very much reduced and the latest units should not affect any but the very fastest of films. By the same token, these modern units are unlikely to damage calculators.

Thinking in terms of your ZX81, even the old type of security X-ray would not be likely to damage data held on magnetic tape, nor programs held in normal 'burnt-in' ROM. Data held in EPROM, or in powered-up RAM, is another matter and might well be corrupted. Physical damage to components of the ZX81 is not very likely to cause trouble and you should be able to rely on these not causing physical damage. I would still be a little unhappy about data in EPROM and more so as regards data in RAM.

In practice, as far as you are concerned, you are unlikely to have EPROM in a ZX81 and even less likely to have packed it with a battery supply to keep data in RAM! The big problem must obviously be how you know whether the airport X-ray equipment is the old high dose type, or the latest low-dose. This I have no answer to and suggest that you play safe by leaving your cassettes packed, but take out the Sinclair ZX81 when you come up to the check and ask for it to be passed through without X-ray, as a calculator would be. I would not anticipate you having any problems with this request, especially in view of the small size of the ZX81.
*P L McIlmoyle*

## Basic copyright

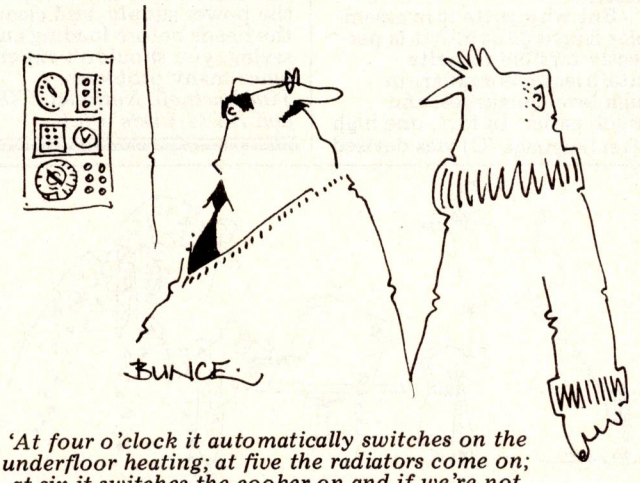
**A friend and I are thinking of starting a small software business. Programs to be sold would include Basic tutorials, written by ourselves. Are there any copyrights on Basic which would affect us and how would we go about making our programs copyright? Has the ZX81 printer got the full ZX81 character set?**
*P Coan, Southport, Merseyside*

There is no copyright as such on Basic, although the actual comments and explanations of it given in various books and magazines are copyright and could not be copied by you. Your programs, like any original work in any medium in Britain, is automatically copyright — you do not have to register it, or anything. You can protect your programs against people finding out your secret routines on the ZX80, by loading a 'time bomb' in the form of a character greater than 64 and less than 127 into a REM statement. The display will be hopelessly corrupted if they try to list this line. Anything which the ZX81 can display on the screen will be reproduced by the printer.
*Tim Hartnell, National ZX80 and ZX81 Users' Club*

## Sinclair limit

**Could you tell me if 16k of RAM is the maximum memory that can be used with the ZX80/81? Having read of the many crashes people seem to be having with the Sinclair RAM pack, could you tell me if there is any way around it?**
*D Valnetine, Shirebrook, Notts.*

16k is, for practical purposes, the most you can have with a ZX computer, although I've seen a ZX80 owned by club member Stephen Adams with something like 21k made up of a 16k pack piggybacked with a modified memory expansion board. There appear to be more crashes with the 16k pack on the ZX81 than on the ZX80, apparently due to imperfect contact with the computer;




*'At four o'clock it automatically switches on the underfloor heating; at five the radiators come on; at six it switches the cooker on and if we're not home by ten it automatically rings for the Fire Brigade.'*

# COMPUTER ANSWERS

the contacts where the memory board slots in on the back should be clean, or power fluctuations from the Sinclair power pack which seems, on some machines, to drop below the required output needed to hold the RAM contents.
*Tim Hartnell, National ZX80 and ZX81 Users' Club*

## Plan for interpreter?

**I am currently writing an interpreter for my own high-level language. Could you tell me of any suitable books on compiler/interpreter writing?**

**I am hoping to write my interpreter in Plan assembler language but could use other assembler languages, including those of the RML 380Z, the PET and the PDP 11/34A. Should I stick to Plan, or would one of the others be better?**
*T A Kayani, London E11*

I can thoroughly recommend *Writing Interactive Compilers and Interpreters* by P J Brown (John Wiley & Sons). You might also like to look at *Compiler Construction* by F L Bauer and J Eickel (Eds) (Springer-Verlag, Berlin); *An Introduction to Compiler Writing* by J S Rohl (Macdonald/Elsevier), and articles in the *Hewlett-Packard Journal* (Van Dyke, 28, 11, 17-24) and *Computing Surveys* (Glass, R L, 1, 1, 55-77) if you can find these in a library.

As to the relative suitability of different assembler languages for interpreter-writing, the first essential is, of course, that the assembler language in question should run on the machine for which you wish to use your own language. Apart from this, the other main consideration would be that the higher the level of the assembler language (ie, the more macros, etc, it supports) the easier it will be to write your interpreter.

But why write it in assembler language at all? It is perfectly feasible to write interpreters/compilers in high-level languages, and much easier. In fact, one high level language (C) was devised primarily for writing operating systems and interpreters/compilers.
*P L McIlmoyle*

## '81 machine code

**Can I program the Sinclair ZX81 in machine code and assembler language. If yes, how can I learn right from basics. If not, what is the next cheapest computer/kit and its appropriate book that I can use to learn the above programming technique.**
*George Ng, Perival, and A Hamilton, Croydon*

You can program the ZX81 in *machine code*. Two books you may find useful are *Mastering Machine Code on your ZX81 or ZX80* by Tony Baker, which assumes no prior knowledge of the subject at all. It is £5.95 and available from the users club at 44-46 Earls Court Road, London W8. Another useful book is *Machine Language Made Simple for your ZX80 & ZX81*, available for £9.45 from Melbourne House, 131 Trafalgar Road, SE10. Bug Byte (251 Henley Road, Coventry, CV2 1BX) sells a machine code assembler on cassette for £3.95.
*Tim Hartnell, National ZX80 and ZX81 Users' Club*

## Loading problems

**I decided recently it would be a good idea to buy a microcomputer, and after thinking for a while, decided to get a Sinclair ZX81. I have been put off, though, by the reference in many places to loading problems. Is this very common with the machine?**
*Douglas Kerr, Oswestry*

The ZX81 loads far more reliably than did the ZX80. Provided you use good quality computer tapes (C12s or C20s), make sure the leads from the cassette player do not cross over the lead to the power supply, and clean the heads before loading and saving, you shouldn't experience many problems.
*Tim Hartnell, National ZX80 and ZX81 Users' Club*




*'You will meet a tall, dark stranger. In all probability within 2.73 days. Apparently 9.2 people out of ten always do.'*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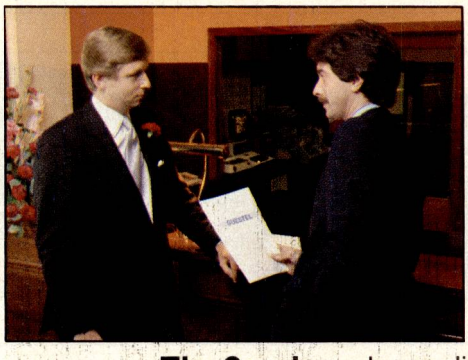

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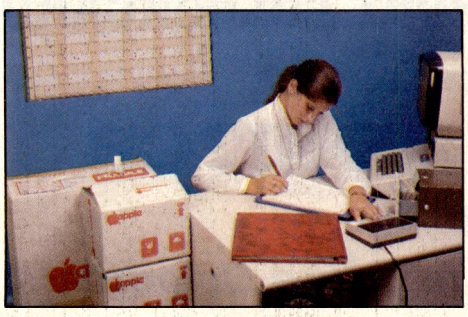

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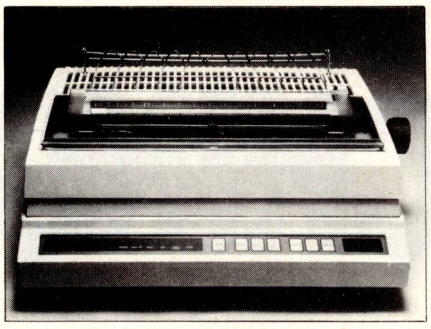

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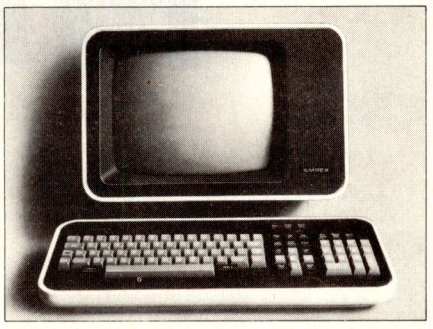

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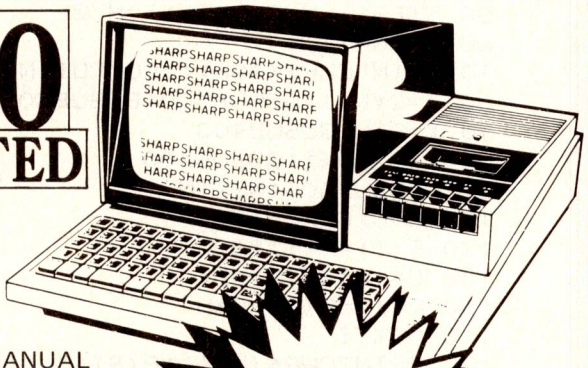

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## Jeff Aughton explains how to achieve multiple precision arithmetic via Basic

# NUMBER CRUNCHING

It is a popular myth that a computer will automatically perform huge calculations to any required degree of accuracy. In fact, most microcomputers use no more significant figures than a pocket calculator (typically ten) and even large computers working in 'double precision' can only manage about 40 significant digits.

Of course, for any practical work this sort of accuracy is perfectly acceptable and not likely to lead to errors — it is only when undertaking theoretical work that this limitation may cause trouble. A famous theoretical problem which we consider in this article is that of evaluating pi as accurately as possible. As the decimal expansion of pi is non-terminating and non-repeating, its exact value will never be known. The 'fun' lies in calculating more decimal places than anyone else, although the fame afforded by this task tends to be brief. Someone who did better than most was William Shanks who spent 20 years from 1853 in evaluating pi to 707 decimal places. Unfortunately, he made a mistake in the 528th place and all of the remaining figures are wrong.

Clearly, a computer could help with the calculations — but how can it be used to evaluate pi? The usual method is to employ an infinite series which converges to a multiple of pi. There are many such series, two well-known examples being:

$$\frac{\pi}{2} = \frac{2 \times 2 \times 4 \times 4 \times 6 \times 6 \times 8 \ldots}{1 \times 3 \times 3 \times 5 \times 5 \times 7 \ldots}$$

(Wallis)
and

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots$$

(Leibniz)

Now, by taking enough terms of such a series, we should be able to evaluate pi as accurately as we please. However, these series converge painfully slowly and we still have our ten significant figures limitation on the accuracy of any calculations. A computer is fast enough to sum the Leibniz series but not accurate enough to compute the terms, which get progressively smaller.

Working by hand and equipped with a knowledge of multiplication tables up to 9x9, it is possible to evaluate any of

```
10 L=5:H=100000
20 INPUT"NO.OF BLOCKS?";B
25 PRINT
30 INPUT"NO.OF TERMS?";T
40 DIMP(B),T(B)
50 T(B-1)=H/2:P(B-1)=H/2
60 FORN=1TOT
70 PRINTCHR$($06);"COMPUTING TERM";N
80 X=2*N-1:GOSUB300:GOSUB300
90 X=8*N:GOSUB400
100 X=2*N+1:GOSUB400
110 GOSUB500:NEXTN
120 C=0:FORI=1TOB
130 P(I)=P(I)*6+C
140 C=INT(P(I)/H)
150 P(I)=P(I)-C*H
160 NEXTI
180 PRINTCHR$($06);P(B);".";
190 FORI=B-1TO1STEP-1
200 PRINTRIGHT$(STR$(P(I)+10*H),L);
210 NEXT
220 END
300 C=0:FORI=1TOB
310 T(I)=T(I)*X+C
320 C=INT(T(I)/H)
330 T(I)=T(I)-C*H
350 NEXT:RETURN
400 C=0:FORI=BTO1STEP-1
410 Z=T(I)+C:C=0
420 Q=INT(Z/X):T(I)=Q
430 C=H*(Z-Q*X)
440 NEXT:RETURN
500 C=0:FORI=1TOB
510 P(I)=P(I)+T(I)+C:C=0
520 IFP(I)<HTHEN540
530 P(I)=P(I)-H:C=1
540 NEXT:RETURN
```

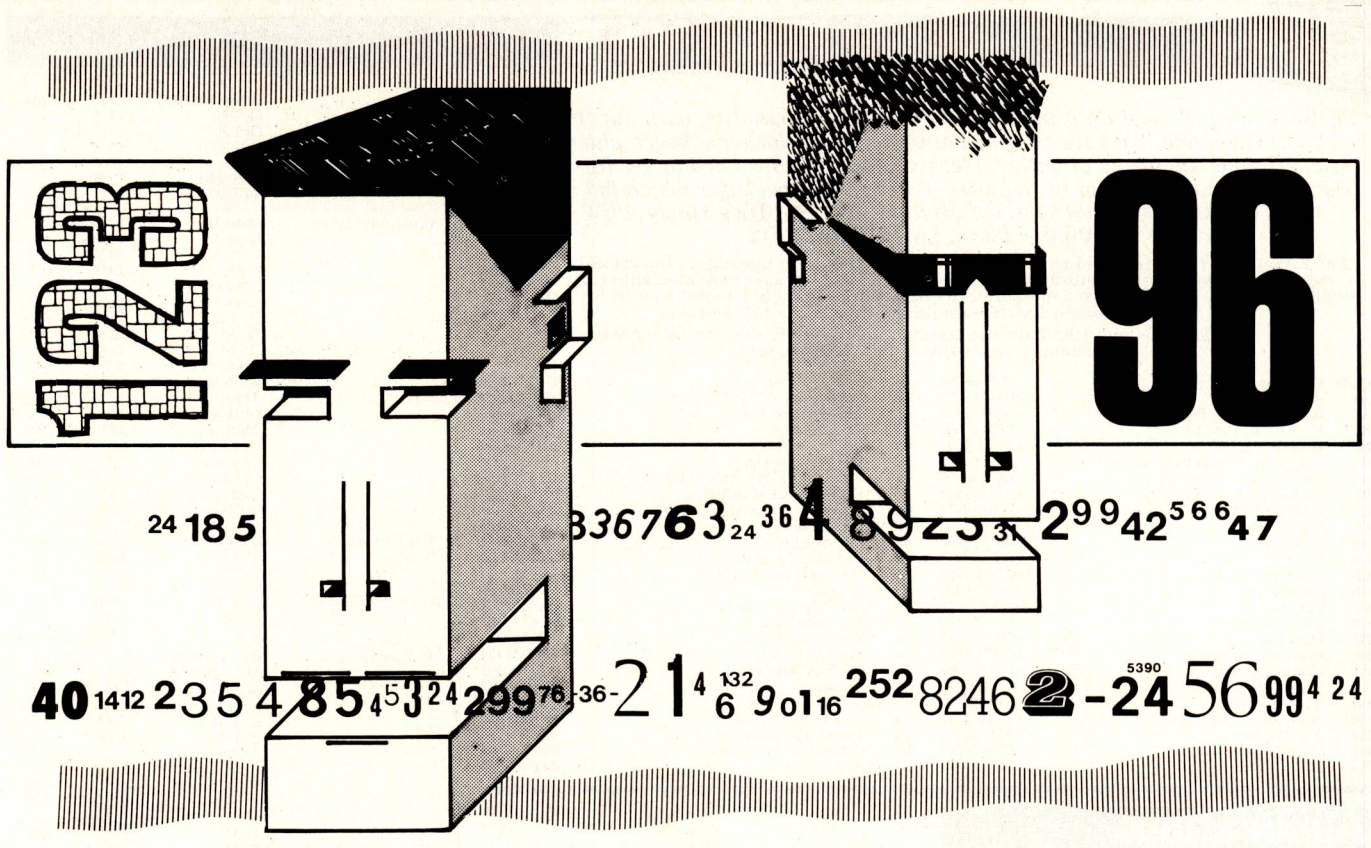
*Listing 2 Pi-evaluation program. Note that CHR$ ($06) in Lines 70 and 180 should be replaced by whatever corresponds to 'clear screen' in your own Basic.*

```
300 C = 0
310 FOR I = 1 TO B
320 T(I) = T(I) * M + C
330 C = INT (T(I)/100000)
340 T(I) = T(I) — C * 100000
350 NEXT I
```

*Listing 1 Basic program to implement the flowchart in Table 1. The T(I)'s are the five digit blocks.*

```
50 T(B) = 1 : P(B) = 2
80 X = N + 1 : GOSUB 400
115 GOTO 180
DELETE LINES 90 AND 100
ALL OTHER LINES REMAIN
UNALTERED
```

*Listing 3 Modifications to enable program to evaluate e*



these terms by breaking the calculation down into small units. This is the method used in the program given later. While we won't be challenging for the record (over one million decimal places) we should be able to improve on Shanks's 528 places.

Long numbers are split into blocks of five digits each and we operate on each block separately, carrying and borrowing between the blocks. Table 1 shows the flowchart for multiplying a number expressed in this way by an integer M — readers may recognise this as being the usual method of 'long' multiplication applied to five digits as opposed to single digits. Table 2 shows a Basic program to implement this flowchart: it is used as a subroutine of the main program.

Using these techniques and in a series which converges quickly, we can easily evaluate pi. The formula used by this program is:

$$\frac{\pi}{6} = \frac{1}{2} + \frac{2}{2} \cdot \frac{1}{3.2} + \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{1}{5.2^5} \ldots$$

which is the Taylor series for arcsin ½.

It should be noted that no attempt has been made to design an efficient program and it could be speeded up in many ways. However, the program is very versatile and, with small modifications, can evaluate any number which is expressed as the sum of a converging series. For example, the number e defined by:

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \ldots$$

can be evaluated by using the modification given in Table 3.

## Using the program

The number L (line 10) represents the length of each block and should be as large as possible but no greater than half of the significant figure capacity of your machine. H is set equal to 10 to the power of L. Now we decide on the accuracy required and choose the number of blocks accordingly — for example, if we want 100 dp accuracy we must take 100 ÷ 5 = 20 blocks plus two further blocks, making a total of 22 blocks. The two extra blocks are the very first, which contains only the integer part of the answer, and the last which is inaccurate due to 'carry' errors.

Finally, we choose to evaluate enough terms to do justice to the number of blocks we have taken — a safe number being:
1.66 x number of decimal places
Thus, in the previous example, we would evaluate 166 terms.

Now we can sit back and relax because the answer will take some time to arrive — a typical figure being 30 minutes for 200dp accuracy. Readers may like to experiment with the two formulae given earlier to see just how slowly they do converge and perhaps to compare their performances with the rapidly converging

$$\frac{\pi}{4} = 4 \arctan \frac{1}{5} - \arctan \frac{1}{239}$$

Happy number crunching!

END

```
3.14159265358979323846264338327950288419
71693993751058209749445923078164062862089
98628034825342117067982148086513282306647
09384460955058223172535940812848111745028
41027019385211055596446229489549303819
63108
```

*Fig 1 Pi to 200 decimal places produced by the program.*

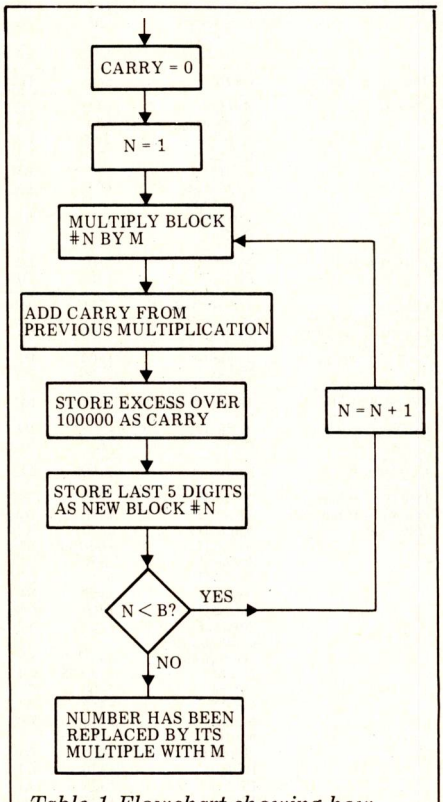



*Table 1 Flowchart showing how the program multiplies a number consisting of B5-digit blocks by M*

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# PACKAGES

*PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to:* Dick Olney, *PCW*, 14 Rathbone Place, London W1P 1DE.

**The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.**

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| | Apple II | £125 | T2 |
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| | PET | £10 | D1 |
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| | Apple II | £125 | A1 |
| | CP/M | £125 | A1 |
| | PET | £125 | A1 |
| General ledger/NL | Apple II | £300 | A2 |
| | Apple II | £300 | S5 |
| | Apple II | £300 | K2 |
| | Apple II | £455 | P2 |
| | Apple II | £225 | V1 |
| | Apple II | £295 | C6 |
| | Apple II | £250P | S4 |
| | Apple II | £600 | T2 |
| | CBM | £200 | H3 |
| | Commodore/ Computhink | POR | S3 |
| | CP/M | £500 | L3 |
| | CP/M | £375 | L1 |
| | CP/M | £500 | C4 |
| | CP/M | £400 | G1 |
| | CP/M | £400 | M3 |
| | CP/M | £400 | B5 |
| | CP/M | £275 | S6 |
| | CP/M | £275 | S7 |
| | CP/M | £350 | B3 |
| | Cromemco | £400 | B5 |
| | North Star Horizon | £250 | B3 |
| | North Star Horizon | £400 | M3 |
| | PCC 2000 North Star Horion | £400 | B5 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET/CBM | £200 | C2 |
| | Sharp PC3201 | £450 | P2 |
| | Superbrain | £400 | M3 |
| | Superbrain | £400 | S6 |
| | Tandy Model I | £90 | M1 |
| | Tandy Model II | £90 | M1 |
| | TRS-80 | £225 | H1 |
| | TRS-80 I | £225/325 | T1 |
| | TRS-80 II | £425 | T1 |
| | Vector | £400 | C5 |
| | 8080/Z80 | £357 | L1 |
| | 8080/Z80 | £275 | G3 |
| Incomplete records | Apple II | £250 | S2 |
| | Apple II | POR | K2 |
| | Apple II | £425 | P2 |
| | Apple II | £450 | P1 |
| | Commodore/ Computhink | £750 | S3 |
| | CP/M | £750 | M3 |
| | CP/M | £250 | B5 |
| | CP/M | £975 | B3 |
| | Cromemco | £250 | B5 |
| | North Star Horizon | £750 | M3 |
| | North Star Horizon | £250 | B5 |
| | North Star Horizon | £975 | B3 |
| | Superbrain | £750 | M3 |
| | Tandy Model I | £40 | M1 |
| | TRS-80 | £40 | H1 |
| Industry Factory loading | Apple II | £360 | X1 |
| | CP/M | £360 | X1 |
| | PET | £300 | X1 |
| Industry work study | Apple II | £990 | X1 |
| | CP/M | £990 | X1 |
| | PET | £750 | X1 |
| Integrated accts | Altos (CP/M, MP/M) | £300 | B1 |
| | Apple II | £450 | P1 |
| | Apple II | £300 | P2 |
| | Apple II | £855 | V1 |
| | Apple II | £600 | T2 |
| | Commodore/ Computhink | POR | S3 |
| | CP/M | £950 | L1 |
| | CP/M | £1500 | C4 |
| | CP/M | £1100 | G1 |
| | CP/M | £990 | M3 |
| | CP/M | £690 | B5 |
| | CP/M | £850 | S7 |
| | CP/M | £900 | B5 |
| | CP/M | £1450 | B3 |
| | Cromemco | £690 | B5 |
| | Cromemco | £900 | B5 |
| | Famos | £2000 | M2 |
| | MZ-80K | £150 | P2 |
| | North Star Horizon | £950 | B3 |
| | North Star Horizon | £690 | B5 |
| | North Star Horizon | £900 | B5 |
| | PET/CBM | £300 | B1 |
| | North Star Horizon | £990 | M3 |
| | PET/CBM | (£50) | C2 |
| | PET/CBM | £650 | J1 |
| | PET/CBM | £650 | G2 |
| | Superbrain | £990 | M3 |
| | Superbrain | £1200 | S6 |
| | Tandy Model I | £350 | M1 |
| | Tandy Model II | £350 | M1 |
| | TRS-80 | £75 | J1 |
| | Vector | £1000 | C5 |
| | 8000 Series | POR | C2 |
| | 8080/Z80 | £950 | L1 |
| | 8080/Z80 | £995 | G3 |
| Investment portfolio | TRS-80 | £20 | S2 |
| Invoicing | Apple II | £295 | S2 |
| | Apple II | £300 | P1 |
| | Apple II | £300 | P2 |
| | Apple II | £140 | V1 |
| | Apple II | £300 | T2 |
| | Challenger | £25 | C7 |
| | Commodore/ Computhink | POR | S3 |
| | CP/M | £325 | L1 |
| | CP/M | £150-350 | C4 |
| | CP/M | £250 | M3 |
| | CP/M | £150 | S7 |
| | CP/M | £100 | B5 |
| | CP/M | £200 | B3 |
| | Cromemco | £100 | B5 |
| | North Star Horizon | £100 | B3 |
| | North Star Horizon | £250 | M3 |
| | North Star Horizon | £100 | B5 |
| | PET | £350 | A1 |
| | PET/CBM | £25-50 | B1 |
| | PET/CBM | POR | J1 |
| | Superbrain | £250 | M3 |
| | Superbrain | £150 | S6 |
| | Tandy Model I | £90 | M1 |
| | Tandy Model II | £90 | M1 |
| | TRS-80 | £25 | H1 |
| | TRS-80I | £75 | T1 |
| | TRS-80II | £125 | T1 |
| | 8080/Z80 | £325 | L1 |
| Job costing | Apple II | £300 | P1 |
| | Apple II | £990 | X1 |
| | CP/M | £700 | C4 |
| | CP/M | £350 | M3 |
| | CP/M | £990 | X1 |
| | North Star Horizon | £350 | M3 |
| | PET | £750 | X1 |
| | Superbrain | £350 | M3 |
| | Tandy Model I | POR | M1 |
| | Tandy Model II | POR | M1 |

# PACKAGES

DIRECT ACCESS

| Application | Machine | Price | Code |
|---|---|---|---|
| Job order control | 8080/Z80 | £275 | G3 |
| Legal precedents | CP/M | £1100 | C4 |
| Letter writer | Apple II | £80 | V1 |
| | CP/M | £150 | M3 |
| | North Star Horizon | £150 | M3 |
| | Superbrain | £150 | M3 |
| Lisp | PET/CBM | £75 | C2 |
| Lotteries | PET | £45 | H2 |
| Mailing List | Altos (CP/M, MP/M) | £75 | B1 |
| | Apple II | £300 | A2 |
| | Apple II | £50-150 | S2 |
| | Apple II | £300 | S5 |
| | Apple II | £300 | K2 |
| | Apple II | £40 | P2 |
| | Apple II | £50 | D1 |
| | Apple II | £100 | S4 |
| | CBM | -35 | H3 |
| | Commodore/ Computhink | £100 | S3 |
| | CP/M | £50-150 | C4 |
| | CP/M | £250 | G1 |
| | PET | £45 | H2 |
| | PET | £50 | D1 |
| | PET | £15 | A1 |
| | PET/CBM | £75 | B1 |
| | PET/8032 | £75/150 | S1 |
| | Tandy Model I | £40 | M1 |
| | Tandy Model II | £75 | M1 |
| | TRS-80 | £50-150 | S2 |
| | TRS-80 | £25/38/55 | H1 |
| Mail shot | Apple II | £14 | S2 |
| | Apple II | £40 | P2 |
| | Apple II | £25 | T2 |
| | Challenger | £25 | C7 |
| | Commodore/ Computhink | £125 | S3 |
| | CP/M | £200-360 | C4 |
| | CP/M | £90 | M3 |
| | CP/M | £75 | S7 |
| | MCZ Zilog | £250 | I1 |
| | North Star Horizon | £90 | M3 |
| | PCC 2000 Simplec Triton 3 | £450 | B2 |
| | Superbrain | £90 | M3 |
| | Tandy Model I | £75 + | G4 |
| | Tandy Model II | £75 | M1 |
| | Tandy Model II | £75 + | G4 |
| Membership accting | Apple II | £75 | P2 |
| | PET | £85 | H2 |
| | MCZ Zilog | £250 | I1 |
| Motor Dealer | Famos | £5000 | M2 |
| Order entry/invoicing | CP/M | £350 | G1 |
| Order processing | CP/M | £550 | L1 |
| | 8080/Z80 | £550 | L1 |
| Office admin | Apple II | £100 | S4 |
| Packages | | | E1 |
| Pad to plotter systems | Apple II | £250 | P2 |
| | Apple II | £180 | C8 |
| Pascal | Apple II | £299 | P2 |
| | PET/CBM | £120 | C2 |
| Payroll | Apple Ii | POR | A2 |
| | Apple II | £200 | S2 |
| | Apple II | POR | S5 |
| | Apple II | POR | K2 |
| | Apple II | £200 | P2 |
| | Apple II | £375 | V1 |
| | Apple II | £375 | C6 |
| | Apple II | £10 | D1 |
| | Apple II | £250P | S4 |
| | Apple II | £400 | T2 |
| | Challenger | £24 | C7 |
| | CBM | £10 | H3 |
| | CP/M | £450 | L3 |
| | CP/M | £475 | L1 |
| | CP/M | £495 | C4 |
| | CP/M | £500 | G1 |
| | CP/M | £390 | M3 |
| | CP/M | £500 | B5 |
| | CP/M | £450 | B3 |
| | Famos | £1500 | M2 |
| | North Star Horizon | £350 | B3 |
| | North Star Horizon | £390 | M3 |
| | PET | £200/350 | C5 |
| | PET | £200/25 195 | A1 |
| | PET | £50/195 | I2 |
| | PET | £10 | D1 |
| | PET/CBM | £150 | G2 |
| | PET/CBM | £150 | J1 |
| | PET/CBM | £150 | C2 |
| | Scorcerer | £250 | L2 |
| | Superbrain | £390 | M3 |
| | Superbrain | £400 | S6 |
| | Tandy Model I | £249 | M1 |
| | TRS-80 | £200 | H1 |
| | TRS-801 | £218 | T1 |
| | TRS-8011 | £375 | T1 |
| | 8000 Series | £250 | C2 |
| | 8080/Z80 | £475 | L1 |
| | 8080/Z80 | £275 | G3 |
| | PET/CBM | £150 | G2 |
| | PET/CBM | £150 | J1 |
| | PET/CBM | £150 | C2 |
| | Sorcerer | £250 | L2 |
| | Tandy Model I | £249 | M1 |
| | TRS-80 | £200 | H1 |
| | TRS-801 | £218 | K1 |
| | TRS-801 | £218 | T1 |
| | TRS-8011 | £375 | T1 |
| | 8000 Series | £250 | C2 |
| | 8080/Z80 | £475 | L1 |
| | 8080/Z80 | £275 | G3 |
| Perpetual Inventory | £150 | B5 | |
| Perpetual Inventory | CP/M | £150 | B5 |
| | Cromemco | £150 | B5 |
| Personnel records | Apple II | £98 | P2 |
| | CP/M | £450 | C4 |
| | MCZ Zilog | £400 | I1 |
| | PET | £85 | H2 |
| Petaid report generator | Commodore/ Computhink | £125 | S3 |
| Petsoft programs | PET/CBM | £160 | J1 |
| Planning/Maintenance | PET/8032 | £595 | S1 |
| Postal advertising response package | Apple II | £350 | S2 |
| PR/advertising package | Commodore/ Computhink | £1000 | S3 |
| Price lister | CBM | £12 | H3 |
| Printers job control | Commodore/ Computhink | £250 | S3 |
| Production analysis | Apple II | £75 | P2 |
| | CP/M | £700 | C4 |
| | PET/CBM | £300 | B1 |
| Prof appts groups | 8080/Z80 | £275 | G3 |
| Prof appts individ | 8080/Z80 | £220 | G3 |
| Prof client billing | 8080/Z80 | £330 | G3 |
| Programming aids | Apple II | £40 | P2 |
| Property management | CP/M | £450-1000 | C4 |
| | CP/M | £400 | M3 |
| | North Star Horizon | £400 | M3 |
| | Superbrain | £400 | M3 |
| Purchase ledger | Apple II | £300 | A2 |
| | Apple II | £300 | S5 |
| | Apple II | £300 | K2 |
| | Apple II | £295 | C6 |
| | Apple II | £300 | P1 |
| | Apple II | £300 | P2 |
| | Apple II | £315 | V1 |
| | Apple II | £250P | S4 |
| | Apple II | £300 | T2 |
| | CBM | £350 | H3 |
| | Challenger | £25 | C7 |
| | Commodore/ Computhink | POR | S3 |
| | CP/M | £500 | C4 |
| | CP/M | £450 | G1 |
| | CP/M | £500 | L3 |
| | CP/M | £425 | L1 |
| | CP/M | £400 | M3 |
| | CP/M | £400 | B5 |
| | CP/M | £275 | S7 |
| | CP/M | 350 | B3 |
| | Cromemco | £400 | B5 |
| | North Star Horizon | £250 | B3 |
| | North Star Horizon | £400 | M3 |
| | North Star Horizon | £400 | B5 |
| | Superbrain | £400 | M3 |
| | Superbrain | £300 | S6 |
| | PCC 2000 Simplec Triton 3 | £350 | B2 |
| | PET | £300 | B4 |
| | PET | £95/120/ 350 | A1 |
| | PET/CBM | £200 | C2 |
| | PET/CBM | POR | J1 |
| | PET/8032 | £395 | S1 |
| | Sharp PC3201 | £300 | P2 |
| | Tandy Model I | £90 | M1 |
| | Tandy Model II | £90 | M1 |
| | TRS-80 | £225 | H1 |
| | TRS-801 | £225 | T1 |
| | TRS-8011 | £375 | T1 |
| | Vector | £400 | C5 |
| | 8000 Series | £250 | C2 |
| | 8080/Z80 | £275 | G3 |
| | 8080/Z80 | £425 | L1 |
| Quotation estimating | Apple II | £300 | P1 |
| Sales ledger | Apple II | £300 | A2 |
| | Apple II | £300 | S5 |
| | Apple II | £300 | K2 |
| | Apple II | £295 | C6 |
| | Apple II | £300 | P1 |
| | Apple II | £300 | P2 |
| | Apple II | £315 | V1 |
| | Apple II | £250P | S4 |
| | Apple II | £300 | T2 |
| | CBM | £350 | H3 |
| | Challenger | £25 | C7 |
| | Commodore/ Computhink | POR | S3 |
| | CP/M | £500 | C4 |
| | CP/M | £450 | G1 |
| | CP/M | £500 | L3 |
| | CP/M | £425 | L1 |
| | CP/M | £400 | M3 |
| | CP/M | £400 | B5 |
| | CP/M | £275 | S7 |
| | CP/M | £350 | B3 |
| | Cromemco | £400 | B5 |
| | North Star Horizon | £250 | B3 |
| | North Star Horizon | £400 | M3 |
| | North Star Horizon | £400 | B5 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET | £12/25/ 350 | A1 |
| | PET | £10 | D1 |
| | PET | £195 | I2 |
| | PET | £300 | B4 |
| | PET | £15 | A2 |
| | PET/CBM | £300 | B1 |
| | PET/CBM | £150 | C2 |
| | PET/CBM | £150 | J1 |
| | PET/CBM | £150 | G2 |
| | PET/Computhink | £250 | R1 |
| | PET/8032 | £395 | S1 |
| | Sharp PC3201 | £300 | P2 |
| | Superbrain | £900 | M3 |
| | Superbrain | £300 | S6 |
| | Tandy Model I | £30-50 | M1 |
| | Tandy Model II | £300 | M1 |
| | TRS-80 | £48 | S2 |
| | TRS-80 | £200 | H1 |
| | TRS-80 | £115 | J1 |
| | TRS-801 | £200 | T1 |
| | TRS-801I | £375 | T1 |
| | 8080/Z80 | £275 | G3 |
| | 8080/Z80 | £325 | L1 |
| | North Star Horizon | £400 | M3 |
| | North Star Horizon | £400 | B5 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET | £300 | B4 |
| | PET | £800 | C1 |
| | PET | £95/350 | A1 |
| | PET/CBM | POR | J1 |
| | PET/CBM | £200 | C2 |
| | PET/8032 | £395 | S1 |
| | Sharp PC 3201 | £300 | P2 |
| | Superbrain | £400 | M3 |
| | Superbrain | £300 | S6 |
| | Tandy Model I | £90 | M1 |
| | Tandy Model II | £90 | M1 |
| | TRS-80 | £225 | H1 |
| | TRS-801 | £225 | T1 |
| | TRS-801I | £375 | T1 |
| | Vector | £400 | C5 |
| | 8000 Series | £250 | C2 |
| | 8080/Z80 | £275 | G3 |
| | 8080/Z80 | £425 | L1 |
| Salesman | Apple II | £10 | D1 |
| | PET | £10 | D1 |
| S/L, P/L & stock control | Apple II | £900 | P2 |
| | Apple II | £1000 | T2 |
| | CP/M | £1000 | L3 |
| | CP/M | £900 | B5 |
| | Cromemco | £900 | B5 |
| | North Star Horizon | £900 | B5 |
| Solicitor's complete record accounting | Apple II | £3000 | S2 |
| Solicitor's package | PET/8032 | £750 | S1 |
| Statistics | Apple II | £150 | G3 |
| | Apple II | £100-195 | P2 |
| | Apple II | £140 | C8 |
| | TRS-80 | £45 | S2 |
| Stock control/ recording | Altos (CP/M, MP/M) | £300 | B1 |
| | AppleII | POR | A2 |
| | Apple II | POR | K2 |
| | Apple II | POR | S5 |
| | Apple II | £150 | G3 |
| | Apple II | £80 | S2 |
| | Apple II | £75/300 | P2 |
| | Apple II | £10 | D1 |
| | Apple II | £285 | V1 |
| | Apple II | £300 | P1 |
| | Apple II | £500 | S4 |
| | CBM | £35/25 | H3 |
| | Challenger | £25 | C7 |
| | Commodore/ Computhink | £100/250 | S3 |
| | CP/M | £325 | L1 |
| | CP/M | £500-1500 | C4 |
| | CP/M | £350 | G1 |
| | CP/M | £900 | M3 |
| | CP/M | £700 | B5 |
| | CP/M | £550 | B5 |
| | CP/M | £550 | B3 |
| | Cromemco | £700 | B5 |
| | Famos | £1500 | M2 |
| | MZ-80K | £150 | P2 |
| | North Star Horizon | £450 | B3 |
| | North Star Horizon | £900 | M3 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET | £12/25/ 350 | A1 |
| | PET | £10 | D1 |
| | PET | £195 | I2 |
| | PET | £300 | B4 |
| | PET | £15 | A2 |
| | PET/CBM | £300 | B1 |
| | PET/CBM | £150 | C2 |
| | PET/CBM | £150 | J1 |
| | PET/CBM | £150 | G2 |
| | PET/Computhink | £250 | R1 |
| | PET/8032 | £395 | S1 |
| | Sharp PC3201 | £300 | P2 |
| | Superbrain | £900 | M3 |
| | Superbrain | £300 | S6 |
| | Tandy Model I | £30-50 | M1 |
| | Tandy Model II | £300 | M1 |
| | TRS-80 | £48 | S2 |
| | TRS-80 | £200 | H1 |
| | TRS-80 | £115 | J1 |
| | TRS-801 | £200 | T1 |
| | TRS-801I | £375 | T1 |
| | 8080/Z80 | £275 | G3 |
| | 8080/Z80 | £325 | L1 |
| TAP business system | PET | £125 | H2 |
| Text file librarian | Apple II/ITT 2020 | £125 | S4 |
| Time/cost recording | Apple II | £450 | S2 |
| | Apple II | £300 | P1 |
| | Commodore/ Computhink | POR | S3 |
| | CP/M | £400 | G1 |
| | CP/M | £200 | M3 |
| | CP/M | £350 | B3 |
| | North Star Horizon | £250 | B3 |
| | North Star Horizon | £200 | M3 |
| | PCC 2000 Simpelec Triton 3 | £350 | B2 |
| | PET/CBM | £300 | B1 |
| | Superbrain | £200 | M3 |
| | Tandy Model I | POR | M1 |
| | Tandy Model II | POR | M1 |

# PACKAGES

| Application | Machine | Price | Code |
|---|---|---|---|
| Travel agency accts | Superbrain | £800 | S6 |
| | Tandy Model I | £225 | G4 |
| | Tandy Model II | £225 | G4 |
| Travel Agents Dairy | Tandy Model I | £100 | G4 |
| | Tandy Model Ii | £100 | G4 |
| Travel Ticket Sales | Tandy Model I | £225 | G4 |
| | Tandy Model II | £225 | G4 |
| Utilities | Apple II | £40 | P2 |
| | Apple II | £20 | C6 |
| | CP/M | £50 | B5 |
| | ITT 2020 | £20 | C6 |
| Utility set | CBM | £78 | H3 |
| Various engineering | Tektronix | | E1 |
| VAT | PET | £17.50 | A1 |
| VAT master | CBM | £25 | H3 |
| VAT register | TRS-80 | £15 | H1 |
| Vet package | PET/8032 | POR | S1 |
| Video message | Apple | £200 | G3 |
| Warehousing | PET/8032 | POR | S1 |
| Word processing | ACT 800 | £375 | H4 |
| | Apple II | £60 | S2 |
| | Apple II | £75 | K2 |
| | Apple II | £75 | S5 |
| | Apple II | £75 | A2 |
| | Apple II | £150-300 | P2 |
| | Apple II | £75 | J1 |
| | Apple II | £120 | V1 |
| | Apple II | £40 | D1 |
| | Apple II | £180/95 | S4 |
| | Apple II | £30 | C8 |
| | Apple II | £500 | T2 |
| | CBM | £35 | H3 |
| | Commodore/ Computhink | £120 | S3 |
| | CP/M | £150-260 | C4 |
| | CP/M | £400 | G1 |
| | CP/M | £250 | M3 |
| | Famos | £500 | M2 |
| | North Star Horizon | £250 | M3 |
| | PET | £85/65/ 40/20 | H2 |
| | PET | £40 | D1 |
| | PET | £375 | H4 |
| | PET | £25/325 | A1 |
| | PET | £325 | C5 |
| | PET/CBM | £75/150 | C2 |
| | PET/CBM | £75/150 | J1 |
| | PET/CBM | £75/150 | G2 |
| | Superbrain | £250 | M3 |
| | Tandy Model I | £50/75 | M1 |
| | Tandy Model II | £175-240 | M1 |
| | TRS-80 | £30/60/90 | S2 |
| | TRS-80 | £45/95 | J1 |
| | TRS-80 | £15 | H1 |
| | Vector | £400 | C5 |
| | 8000 Series | £250 | C2 |
| Work In Progress | CP/M | £850 | B5 |

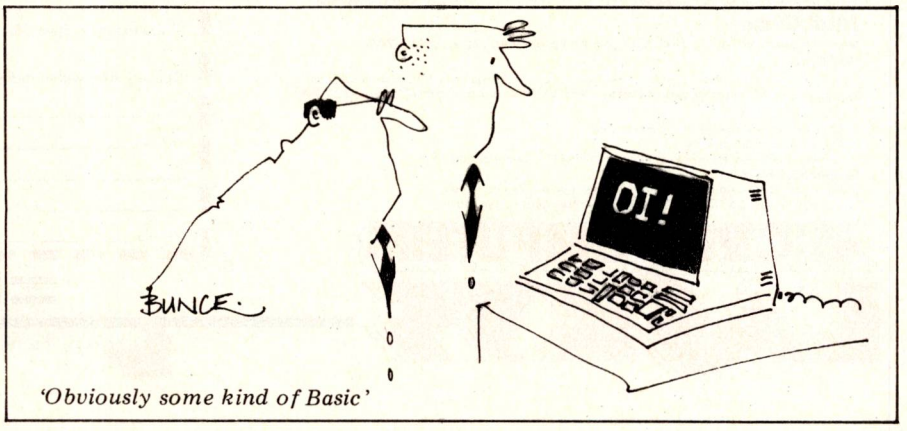
## Machines

| Machine | Application | Price | Code |
|---|---|---|---|
| ACT 800 | Database management/ | £225 | H4 |
| | Word processing | £375 | H4 |
| Altos (CP/M, MP/M) | Integrated accts | £300 | B1 |
| | Mailing list | £75 | B1 |
| | Stock control/recording | £300 | B1 |
| Apple II | Bank account | £10 | D1 |
| | Budgeting | £125 | T2 |
| | Cash flow | £80 | V1 |
| | Cash flow | £75 | P2 |
| | Cash flow | £100 | C8 |
| | Cash register | £10 | D1 |
| | Contract costing | £450 | P1 |
| | Database management/ information retrieval | £150 | K2 |
| | Database management/ information retrieval | £150 | A2 |
| | Database management/ information retrieval | £60-140 | S2 |
| | Database management/ information retrieval | £150 | S5 |
| | Database management/ information retrieval | £98 | P2 |
| | Database management/ information retrieval | £100 | S4 |
| | Database management | £75 | P2 |
| | Database management | £100 | C8 |
| | Database management | £125 | T2 |
| | Estate agent | £850 | S5 |
| | Estate agent | £850 | A2 |
| | Estate agent | £850 | K2 |
| | Estate agent | £750 | S4 |
| | Estate agent | £130 | C8 |
| | Financial modelling | £360 | C8 |
| | Financial modelling | £425-535 | A1 |
| | Financial planning | £250 | S4 |
| | Financial planning | £125 | A1 |
| | General ledger/NL | £300 | K2 |
| | General ledger/NL | £300 | A2 |
| | General ledger/N/L | £450 | P2 |
| | General ledger/NL | £300 | S5 |
| | General ledger/NL | £225 | V1 |
| | General Ledger/NL | £295 | C6 |
| | General Ledger/NL | £250P | S4 |
| | General Ledger/NL | £600 | T2 |
| | Incomplete records | POR | K2 |
| | Incomplete records | £250 | S2 |
| | Incomplete records | £450 | P1 |
| | Incomplete records | £450 | P2 |
| | Industry factory loading | £360 | X1 |
| | Industry work study | £990 | X1 |
| | Integrated accts | £885 | V1 |
| | Integrated accts | £450 | P1 |
| | Integrated accts | £300 | P2 |
| | Integrated accts | £600 | T2 |
| | Invoicing | £295 | S2 |
| | Invoicing | £300 | P2 |
| | Invoicing | £140 | V1 |
| | Invoicing | £300 | P1 |
| | Invoicing | £300 | T2 |
| | Job costing | £450 | S2 |
| | Job costing | £990 | X1 |
| | Job costing | £300 | P1 |
| | Mailing list | £300 | K2 |
| | Mailing list | £300 | A2 |
| | Mailing list | £40 | P2 |
| | Mailing list | £50-150 | S2 |
| | Mailing list | £300 | S5 |
| | Mailing list | £50 | D1 |
| | Mailing list | £100 | S4 |
| | Mailing List | £25 | T2 |
| | Mail shot | £14 | S2 |
| | Mail shot | £225 | P2 |
| | Pad to plotter system | £250 | P2 |
| | Pad to plotter system | £180 | C8 |
| | Payroll | POR | S5 |
| | Payroll | POR | K2 |
| | Payroll | POR | A2 |
| | Payroll | £200 | S2 |
| | Payroll | £375 | V1 |
| | Payroll | £200 | P2 |
| | Payroll | £375 | C6 |
| | Payroll | £10 | D1 |
| | Payroll | £250P | S4 |
| | Payroll | £400 | T2 |
| | Personal records | £75 | P2 |
| | Postal advertising response package | £350 | S2 |
| | Production analysis | £75 | P2 |
| | Programming aids | £40 | P2 |
| | Purchase ledger | £300 | K2 |
| | Purchase ledger | £300 | P2 |
| | Purchase ledger | £300 | A2 |
| | Purchase ledger | £300 | S5 |
| | Purchase ledger | £315 | V1 |
| | Purchase ledger | £300 | P1 |
| | Purchase ledger | £295 | C6 |
| | Purchase ledger | £250P | S4 |
| | Purchase ledger | £300 | T2 |
| | Quotation estimating | £300 | P1 |
| | Sales ledger | £300 | A2 |
| | Sales ledger | £300 | K2 |
| | Sales ledger | £300 | S5 |
| | Sales ledger | £300 | P2 |
| | Sales ledger | £315 | V1 |
| | Sales ledger | £300 | P1 |
| | Sales ledger | £295 | C6 |
| | Sales ledger | £250P | S4 |
| | Sales ledger | £300 | T2 |
| | Salesman | £10 | D1 |
| | SL, PL stock control | £1000 | T2 |
| | Solicitor's complete record accounting | £3000 | S2 |
| | Statistics | £150 | G3 |
| | Statistics | £100/195 | P2 |
| | Statistics | £100-195 | P2 |
| | Statistics | £140 | C8 |
| | Stock control/recording | £150 | G3 |
| | Stock control/recording | POR | K2 |
| | Stock control/recording | £300 | P2 |
| | Stock control/recording | POR | A2 |
| | Stock control/recording | £80 | S2 |
| | Stock control/recording | POR | S5 |
| | Stock control/recording | £285 | V1 |
| | Stock control/recording | £300 | P1 |
| | Stock control/recording | £10 | D1 |
| | Stock control/recording | £500 | S4 |
| | Text file librarian | £125 | S4 |
| | Time/cost recording | £450 | S2 |
| | Time/cost recording | £300 | P1 |
| | Utilities | £20 | C6 |
| | Video message | £200 | G3 |
| | Word processing | £75 | K2 |
| | Word processing | £75 | A2 |
| | Word processing | £60 | S2 |
| | Word processing | £300 | P2 |
| | Word processing | £75 | S5 |
| | Word processing | £120 | V1 |
| | Word processing | £40 | D1 |
| | Word processing | £75 | J1 |
| | Word processing | £180/95 | S4 |
| | Word processing | £30 | C8 |
| | Word processing | £500 | T2 |
| CBM | Bureau de change | £8 | H3 |
| | Estate agent | £30 | H3 |
| | General ledger/NL | £200 | H3 |
| | Mailing list | £35 | H3 |
| | Payroll | £10 | H3 |
| | Price lister | £12 | H3 |
| | Purchase ledger | £350 | H3 |
| | Sales ledger | £350 | H3 |
| | Stock control/recording | £35/25 | H3 |
| | Utility set | £78 | H3 |
| | VAT master | £25 | H3 |
| | Word processing | £35 | H3 |
| Challenger | Appointment Planner | £25 | C7 |
| | Invoicing | £25 | C7 |
| | Mail Shot | £25 | C7 |
| | Payroll | £25 | C7 |
| | Purchase Ledger | £25 | C7 |
| | Sales Ledger | £25 | C7 |
| | Stock Control | £25 | C7 |
| Commodore/ Computhink | Appointments planner | £100 | S3 |
| | Bank accounts | £100 | S3 |
| | Bonds/pension quotations | £100 | S3 |
| | Database management/ information retrieval | £45-250 | S3 |
| | Estate agent | £250 | S3 |
| | General ledger/NL | POR | S3 |
| | Incomplete records | £750 | S3 |
| | Integrated accts | POR | S3 |
| | Invoicing | POR | S3 |
| | Mailing list | £100 | S3 |
| | Mail shot | £125 | S3 |
| | Petaid report generator | £125 | S3 |
| | PR/advertising package | £1000 | S3 |
| | Printers job control | £250 | S3 |
| | Purchase ledger | POR | S3 |
| | Sales ledger | POR | S3 |
| | Stock control/recording | £100/250 | S3 |
| | Time/cost recording | POR | S3 |
| | Word processing | £120 | S3 |
| CP/M | Bill of materials | £500 | B5 |
| | Budgeting package | £95 | B5 |
| | Cash flow | £250 | L3 |
| | Cash flow | £95 | B5 |
| | Company secretary | £450 | C4 |
| | Contract costing | £2000 | L3 |
| | Database | £350 | B3 |
| | Database management/ information retrieval | £150-750 | C4 |
| | Database manatement/ information trerieval | £100 | G3 |
| | Equipment lease/rent/ HP | £400 | G1 |
| | Estate agents | £750 | C4 |
| | Estate agent | £700 | B5 |
| | Financial modelling | £400 | G1 |
| | Financial modelling | £95 | B5 |
| | Financial modelling | £425/535 | A1 |
| | Financial planning | £125 | A1 |
| | General ledger/NL | £500 | L3 |
| | General ledger/NL | £500 | C4 |
| | General ledger/NL | £400 | G1 |
| | General ledger/NL | £375 | L1 |
| | General ledger/NL | £200 | B5 |
| | General ledger/NL | £275 | S7 |
| | General ledger/NL | £400 | M3 |
| | General ledger/NL | £350 | B3 |
| | Incomplete Records | £250 | B5 |
| | Incomplete Records | £750 | M3 |
| | Incomplete Records | £975 | B3 |
| | Industry factory loading | £360 | X1 |
| | Industry work study | £990 | X1 |
| | Integrated accts | £1500 | C4 |
| | Integrated accts | £1100 | G1 |
| | Integrated accts | £950 | L1 |
| | Integrated accts | £690 | B5 |
| | Integrated accts | £850 | S7 |
| | Integrated accts | £990 | M3 |
| | Integrated accts | £900 | B5 |
| | Integrated accts | £1450 | B3 |
| | Invoicing | £325 | L1 |
| | Invoicing | £150-350 | C4 |
| | Invoicing | £150 | S7 |
| | Invoicing | £250 | M3 |
| | Invoicing | £100 | B5 |
| | Invoicing | £200 | B3 |
| | Job costing | £700 | C4 |
| | Job costing | £990 | X1 |
| | Job costing | £350 | M3 |
| | Legal precedents | £1100 | C4 |
| | Letter Writer | £150 | M3 |
| | Mailing list | £50-150 | C4 |
| | Mailing list | £250 | G1 |
| | Mailing list | £75 | S7 |
| | Mail shot | £200-360 | G4 |
| | Mail shot | £90 | M3 |
| | Order entry/invoicing | £350 | G1 |
| | Order processing | £550 | L1 |
| | Payroll | £450 | L3 |
| | Payroll | £495 | C4 |
| | Payroll | £500 | G1 |
| | Payroll | £475 | L1 |
| | Payroll | £500 | B5 |
| | Payroll | £390 | M3 |
| | Payroll | £450 | B3 |
| | Perpetual Inventory | £150 | B5 |
| | Personnel records | £450 | C4 |
| | Production analysis | £700 | C4 |
| | Property management | £450-1000 | C4 |
| | Property management | £400 | M3 |
| | Purchase ledger | £500 | L3 |
| | Purchase ledger | £450 | G1 |
| | Purchase ledger | £425 | L1 |
| | Purchase ledger | £500 | C4 |
| | Purchase ledger | £200 | B5 |
| | Purchase ledger | £275 | S7 |
| | Purchase ledger | £400 | M3 |
| | Purchase ledger | £350 | B3 |
| | Sales ledger | £500 | L3 |
| | Sales ledger | £500 | C4 |
| | Sales ledger | £450 | G1 |
| | Sales ledger | £425 | L1 |
| | Sales ledger | £200 | B5 |
| | Sales ledger | £275 | S7 |
| | Sales ledger | £400 | M3 |
| | Sales ledger | £350 | B3 |
| | S/L, P/L + stock control | £1000 | L3 |
| | S/L, P/L + stock control | £900 | B5 |
| | Stock control/recording | £325 | L1 |
| | Stock control/recording | £500-1500 | C4 |
| | Stock control/recording | £350 | G1 |
| | Stock control/recording | £500 | B5 |
| | Stock control/recording | £900 | M3 |
| | Stock control | £550 | B3 |
| | Time/cost recording | £400 | G1 |
| | Time/cost recording | £200 | M3 |
| | Time ledger | £350 | B3 |
| | Utilities | £50 | B5 |
| | Word processing | £400 | G1 |
| | Word processing | £150-260 | C4 |
| | Word procesing | £250 | M3 |

# PACKAGES

DIRECT ACCESS

| Machine | Application | Price | Code |
|---|---|---|---|
| | Work in progress | £850 | B5 |
| Famos | Customer file | £1000 | M2 |
| | Data base | £1500 | M2 |
| | Integrated accts | £2000 | M2 |
| | Motor dealer | £5000 | M2 |
| | Payroll | £1500 | M2 |
| | Stock control | £1500 | M2 |
| | Word processing | £500 | M2 |
| MCZ Zilog | Mail shot | £250 | I1 |
| | Membership accting | £250 | I1 |
| | Personnel records | £400 | I1 |
| MZ-80K | Integrated accounts | £150 | P2 |
| | Stock control/recording | £150 | P2 |
| North Star | Budgeting package | £95 | B5 |
| | Cash flow | £95 | B5 |
| Horizon | Database management/ information retrieval | £250 | B3 |
| | Estate agent | £750 | B5 |
| | Financial modelling | £95 | B5 |
| | General ledger/NL | £250 | B3 |
| | General ledger/NL | £400 | M3 |
| | General ledger/NL | £400 | B5 |
| | Incomplete records | £750 | M3 |
| | Incomplete records | £250 | B5 |
| | Incomplete records | £975 | B3 |
| | Integrated accts | £950 | B3 |
| | Integrated accts | £990 | M3 |
| | Integrated accts | £690 | B5 |
| | Integrated accts | £900 | B5 |
| | Invoicing | £100 | B3 |
| | Invoicing | £250 | M3 |
| | Invoicing | £100 | B5 |
| | Job costing | £350 | M3 |
| | Letter writer | £150 | M3 |
| | Mail shot | £90 | M3 |
| | Payroll | £350 | B3 |
| | Payroll | £390 | M3 |
| | Property Management | £400 | M3 |
| | Purchase ledger | £250 | B3 |
| | Purchase ledger | £400 | M3 |
| | Purchase ledger | £400 | B5 |
| | Sales ledger | £250 | B3 |
| | Sales ledger | £400 | M3 |
| | Sales ledger | £400 | B5 |
| | SL, PL + stock control | £900 | B5 |
| | Stock control/recording | £450 | B3 |
| | Stock control/recordng | £900 | M3 |
| | Time/cost recording | £250 | B3 |
| | Time/cost recording | £200 | M3 |
| | Word processing | £250 | M3 |
| PCC 2000 Simpelec Triton 3 | Estate Agent | £350 | B2 |
| | General ledger/NL | £350 | B2 |
| | Mail Shot | £450 | B2 |
| | Purchase ledger | £350 | B2 |
| | Sales ledger | £350 | B2 |
| | Stock control/recording | £350 | B2 |
| | Time/cost recording | £350 | B2 |
| PET | Bank account | £10 | D1 |
| | Cash flow | £8 | A1 |
| | Cash register | £10 | D1 |
| | Credit control | £650 | B4 |
| | Database management/ information retrieval | POR | C1 |
| | Database management/ information retrieval | £325 | A1 |
| | Database management/ information retrieval | £225 | H4 |
| | Database management/ information retrieval | £170 | C3 |
| | Estate agent | £25 | A1 |
| | Financial modelling | £425-535 | A1 |
| | Financial planning | £125 | A1 |
| | General ledger/NL | £1000 | C1 |
| | Industry factory loading | £300 | X1 |
| | Industry work study | £750 | X1 |
| | Invoicing | £350 | A1 |
| | Invoicing | £400 | C1 |
| | Job costing | £750 | X1 |
| | Lotteries | £45 | H2 |
| | Mailing list | £15 | A1 |
| | Mailing list | £50 | D1 |
| | Mailing list | £45 | H2 |
| | Membership accting | £85 | H2 |
| | Payroll | £50/195 | I2 |
| | Payroll | £10 | D1 |
| | Payroll | £50/25/ 195 | A1 |
| | Payroll | POR | C1 |
| | Payroll | £200/350 | C5 |
| | Personnel records | £85 | H2 |
| | Purchase ledger | £95/120/ 350 | A1 |
| | Purchase ledger | £1000 | C1 |
| | Purchase ledger | £300 | B4 |
| | Sales ledger | £300 | B4 |
| | Sales ledger | £800 | C1 |
| | Sales ledger | £95/350 | A1 |
| | Salesman | £10 | D1 |
| | Stock control/recording | £195 | I2 |
| | Stock control/recording | £10 | D1 |
| | Stock control/recording | £12/25/ 350 | A1 |
| | Stock control/recording | £15 | A2 |
| | Stock control/recording | £300 | B4 |
| | TAP business system | £125 | H2 |
| | VAT | £17.50 | A1 |
| | Word processing | £40 | D1 |
| | Word processing | £85/65/ 40/20 | H2 |
| | Word processing | £375 | H4 |
| | Word processing | £25/325 | A1 |
| | Word processing | 325 | C5 |
| PET/CBM | Assembler dev | £50 | C2 |
| | Database management/ information retrieval | £75 | B1 |
| | Database management/ information retrieval | £50/150 | C2 |
| | Database management/ information retrieval | £150 | G2 |
| | Database management/ information retrieval | £150 | J1 |
| | Disk operating system | £150 | B1 |
| | File handling | £225 | H4 |
| | General ledger/NL | £200 | C2 |
| | Integrated accts | £300 | B1 |
| | Integrated accts | £(50) | C2 |
| | Integrated accts | £650 | G2 |
| | Integrated accts | £650 | J1 |
| | Invoicing | POR | J1 |
| | Invoicing | £25-50 | B1 |
| | Lisp | £75 | C2 |
| | Mailing list | £75 | B1 |
| | Pascal | £120 | C2 |
| | Payroll | £150 | G2 |
| | Payroll | £150 | J1 |
| | Payroll | £150 | C2 |
| | Petsoft programs | £160 | J1 |
| | Production analysis | £300 | B1 |
| | Purchase ledger | £200 | C2 |
| | Purchase ledger | POR | J1 |
| | Sales ledger | POR | J1 |
| | Sales ledger | £200 | J1 |
| | Stock control/recording | £150 | C2 |
| | Stock control/recording | £300 | B1 |
| | Stock control/recording | £150 | G2 |
| | Stock control/recording | £150 | J1 |
| | Time/cost recording | £300 | B1 |
| | Word processing | £75/150 | J1 |
| | Word processing | £75/150 | G2 |
| | Word processing | £75/150 | C2 |
| PET/ Computhink | Stock control/recording | £250 | R1 |
| PET/8032 | Mailing list | £75/150 | S1 |
| | Planning maintenance | £595 | S1 |
| | Purchase ledger | £395 | S1 |
| | Sales ledger | £395 | S1 |
| | Solicitor's package | £750 | S1 |
| | Stock control/recording | £395 | S1 |
| | Vet package | POR | S1 |
| | Warehousing | POR | S1 |
| Sharp PC-3201 | General ledger | £450 | P2 |
| | Sales ledger | £300 | P2 |
| | Purchase ledger | £300 | P2 |
| | Stock control | £300 | P2 |
| Sorcerer | Payroll | £250 | L2 |
| Superbrain | Database | £300 | S6 |
| | Estate agent | £800 | S6 |
| | General ledger | £400 | M3 |
| | General ledger | £400 | S6 |
| | Incomplete Records | £750 | M3 |
| | Integrated Accts | £1200 | S6 |
| | Integrated Accts | £990 | M3 |
| | Invoicing | £250 | M3 |
| | Invoicing | £150 | S6 |
| | Job costing | £350 | M3 |
| | Letter writer | £150 | M3 |
| | Mail shot | £90 | M3 |
| | Payroll | £400 | S6 |
| | Payroll | £390 | M3 |
| | Property management | £400 | M3 |
| | Purchase ledger | £300 | S6 |
| | Purchase ledger | £400 | M3 |
| | Sales ledger | £300 | S6 |
| | Sales ledger | £400 | M3 |
| | Stock control | £300 | S6 |
| | Stock control | £900 | M3 |
| | Time recording | £200 | M3 |
| | Word processing | £250 | M3 |
| | Travel agency accts | £800 | S6 |
| Tandy Model I | Database management/ information retrieval | £25-80 | M1 |
| | General ledger/NL | £90 | M1 |
| | Incomplete records | £40 | M1 |
| | Integrated accts | £350 | M1 |
| | Invoicing | £90 | M1 |
| | Job costing | POR | M1 |
| | Mailing list | £40 | M1 |
| | Mail shot | £75 + | G4 |
| | Payroll | £249 | M1 |
| | Purchase ledger | £90 | M1 |
| | Sales ledger | £90 | M1 |
| | Stock control/recording | £30-50 | M1 |
| | Travel Agency Accts | £225 | G4 |
| | Travel Agents Dairy | £100 | G4 |
| | Travel Ticket Sales | £225 | G4 |
| | Time/cost recording | POR | M1 |
| | Word processing | £50/75 | M1 |
| Tandy Model II | CBasic | £70 | M1 |
| | CP/M + utilities | £150 | M1 |
| | General ledger/NL | £90 | M1 |
| | Integrated accts | £350 | M1 |
| | Invoicing | £90 | M1 |
| | Job costing | POR | M1 |
| | Mailing list | £75 | M1 |
| | Mail shot | £75 | M1 |
| | Mail shot | £75 + | G4 |
| | Purchase ledger | £90 | M1 |
| | Sales ledger | £90 | M1 |
| | Stock control/recording | £300 | M1 |
| | Time/cost recording | POR | M1 |
| | Travel Agency Accts | £225 | G4 |
| | Travel Agency Diary | £100 | G4 |
| | Travel Ticket Sales | £225 | G4 |
| | Word processing | £175-240 | M1 |
| Tektronix | Various engineering Packages | | E1 |
| TRS-80 | Database management/ information retrieval | £60 | S2 |
| | Database management/ information retrieval | £32.50 | H1 |
| | Database management/ information retrieval | £150 | J1 |
| | General ledger/NL | £225 | H1 |
| | Incomplete records | £40 | H1 |
| | Integrated accts | £75 | J1 |
| | Investment portfolio | £20 | S2 |
| | Invoicing | £25 | H1 |
| | Mailing list | £25/38/ 55 | H1 |
| | Mailing list | £50-150 | S2 |
| | Payroll | £200 | H1 |
| | Purchase ledger | £225 | H1 |
| | Sales ledger | £225 | H1 |
| | Statistics | £45 | S2 |
| | Stock control/recording | £200 | H1 |
| | Stock control/recording | £48 | S2 |
| | Stock control/recording | £115 | J1 |
| | VAT register | £15 | H1 |
| | Word processing | £45/95 | J1 |
| | Word processing | £15 | H1 |
| | Word processing | £30/60/ 90 | S2 |
| TRS-80I | General ledger/NL | £225/325 | T1 |
| | Invoicing | £75 | T1 |
| | Payroll | £218 | T1 |
| | Purchase ledger | £225 | T1 |
| | Sales ledger | £225 | T1 |
| | Stock control/recording | £200 | T1 |
| TRS-80II | General ledger/NL | £425 | T1 |
| | Invoicing | £125 | T1 |
| | Payroll | £375 | T1 |
| | Purchase ledger | £375 | T1 |
| | Sales ledger | £375 | T1 |
| | Stock control/recording | £375 | T1 |
| Vector | General ledger/NL | £400 | C5 |
| | Integrated accts | £1000 | C5 |
| | Purchase ledger | £400 | C5 |
| | Sales ledger | £400 | C5 |
| | Word processing | £40 | C5 |
| 8000 Series | Database management/ information retrieval | POR | C2 |
| | Integrated accts | POR | C2 |
| | Payroll | £250 | C2 |
| | Purchase ledger | £250 | C2 |
| | Sales ledger | £250 | C2 |
| | Word processing | £250 | C2 |
| 8080/Z80 | General ledger/NL | £275 | G3 |
| | General ledger/NL | £375 | L1 |
| | Integrated accts | £950 | L1 |
| | Integrated accts | £995 | G3 |
| | Invoicing | £325 | L1 |
| | Job order control | £257 | G3 |
| | Order processing | £550 | L1 |
| | Payroll | £475 | L1 |
| | Payroll | £275 | G3 |
| | Prof appts groups | £275 | G3 |
| | Prof appts individ | £220 | G3 |
| | Prof client billing | £330 | G3 |
| | Purchase ledger | £425 | L1 |
| | Purchase ledger | £275 | G3 |
| | Sales ledger | £275 | G3 |
| | Sales ledger | £425 | L1 |
| | Stock control/recording | £325 | L1 |
| | Stock control/recording | £275 | G3 |




*'Obviously some kind of Basic'*

# SHARP MZ-80K SPECIAL OFFER!

A proper full size microcomputer for less than the real cost of a toy microcomputer.
The Sharp comes with **48k** of RAM and the screen and cassette are built in, instead of being expensive extras.

| Nett | VAT | Total |
|---|---|---|
| 347.00 | 52.00 | 399.00 |

SHARP




## OTHER PRICES

| | NETT | V.A.T. | TOTAL |
|---|---|---|---|
| MZ80 I/O Expansion Interface | 96.00 | 14.40 | 110.40 |
| MZ80 F.D. Dual Disks | 560.00 | 84.00 | 644.00 |
| MZ80 F I/O Disk Interface | 52.00 | 7.80 | 59.80 |
| MZ80 FMD Master Disk and Manual | 20.00 | 3.00 | 23.00 |
| MZ80 F15 Disk Cable | 8.00 | 1.20 | 9.20 |
| MZ80 FOS Extra Disk Cable | 7.00 | 1.05 | 8.05 |
| MZ80 P3 Dot Matrix Printer | 365.00 | 54.75 | 419.75 |
| MZ80 T20C Machine Language | 18.00 | 2.70 | 20.70 |
| MZ80 TU Assembler | 36.00 | 5.40 | 41.40 |
| MZ80 T40E Pascal | 40.00 | 6.00 | 46.00 |
| MZ80 I/O-1 Universal Interface Card | 40.00 | 6.00 | 46.00 |

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Manager: Peter Stallard. 300 yards from Bullring Centre.

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The Forum, Northgate Street, Chester, CH1 2BZ. Tel: 0244 317667. Manager: Jeremy Ashcroft.
Next to the Town Hall.

**EDINBURGH**
4 St. James Centre, Edinburgh, EH1 3SR. Tel: 031-556 6217. Manager: Colin Draper.
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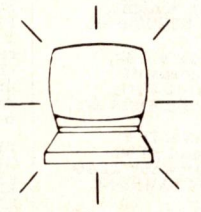

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Casio FX602p . . . 512 step prog plus alphanumerics. One month old. £70 ono. or exchange for Sharp PC-1211. Tel: Martin on Cardiff (0222) 384 399 Mon to Thurs. after 7.

PET 32k . . . 2040 disk, 3022 printer, toolkit, cables, manuals, paper, etc. Little used. £1500 ono Tel: Woking 67839 after 7.

Acorn Atom . . . 12k RAM 8k ROM PSU leads, manual. 6 months old £230 ono 5 Meriton Rd, Lutterworth, Leicestershire Tel: (04555) 57577.

PET 8k . . . New ROMS, green screen, integral cassette deck, soundbox, some software, little used, as new. £375 ono. Tel: Southampton 25625.

TRS-80 16k . . . L2 Includes PSU, leads to connect to own TV and cassette recorder, manuals, assembler book. Many games on tape including space-invaders, chess, adventure. £320 ono Tel: 01-267 7124 eves.

S100 . . . 16k dynamic memory board for North Star Horizon. Perfect condition. £60 or offers. Tel: 02434 5740.

Commodore printers . . . model 4022 — £295. Model 3022 — £245
both as new. Tel: 01-778 5357.

CBM 8032 . . . and 1 Meg 8050 Drive and Ricoh RP1600 Daisy Wheel (with four typefaces) and Wordcraft 80 and 10 disks, hardly used. Cost £3,600 only £2,790. Telephone: 01-941 0838.

PET . . . 3032 computer/3022 printer, in original packing, complete with toolkit, cassette, dust cover, manuals, PET Revealed, and some tapes. All for £825 ono Luton (0582) 422253.

DAI Personal Computer . . . 48k colour, high resolution, superb sond. One month old (September) perfect condition. Worth £720. Quick sale £600 including new Sony cassette recorder 01-464 9102 (Bromley).

ASR33 . . . Complete with stand, paper tape punch/reader and diagrams, needs some adjustment £50 Tel: 037 45 2940 (Benfleet).

PET 8K . . . Small keyboard + 40 col thermal printer + printer interface + second cassette interface. Games (chess, invaders startrek, bridge, more). Good condition £450 or will split. Tel: 01-584 6321 after 5.

ZX80 . . . Sinc built, 3k RAM exp mains adaptor, manuals, leads, cassettes, Decca cassette player. 2 hours total usage £90 ono. Ring 01-658 3937 work 01-658 5183 home.

PET 32k . . . new ROM, green screen, cassette, plus selection of games. Ideal for small businessman or personal user. Any offers? Tel: Steve 0734-790695 (Reading).

ZX81 . . . Sinc built + 16k RAM all leads, manual, many books and programs £120 Tel: Emsworth (02434) 4458.

ZX80 . . . with manual, PSU and leads £40, ZX81 with manual, PSU for 16k memory & leads £60, ZX 16k memory £45. 16k memory + I/O port for ZX80 £30. PSU for ZX80 memory board £10 ZX81 Games cassettes x 2 £5 ZX80 Games cassettes x 2 £5 Casio 502p with interface £50 Ring Tony 0226 384495 after 6 weekdays.

UK101 . . . In metal case — plenty of room for expansion. Wemon monitor fitted. 8k memory little used — no longer required due to access to Hewlett Packard 9845B £180 ono. Ring Lincoln 31861 after 6.

Superboard II . . . OSI built, cased, manuals, all leads, PSU, modulator, 8k RAM, 48x32 display + Cegmon (prof fitted), some tapes, VGC, £270 ono Tel: Paul Manning 01-778 6402 (eves).

# DIRECT ACCESS

# TRANSACTION FILE

ZX80 . . . 16k RAM pack . . + leads manual and book 'Making the Most of your ZX80' PSU also cassette of games. £110 Mr. K. Ostapenko, 54 Mansel St., Port Talbot, West Glam, South Wales, SA13 1BH.

77-68 VDU board . . . Fully built and tested. 40x24 character display with keyboard input port. Complete with edge connector £30. Phone Pontypool 4104 after 7.

Acorn Atom . . . 12k RAM, 8k ROM including manual, leads, PSU and software — £195. Also Atari Video Computer — under guarantee, 6 cartridges, PSU . wroth £260 — only £185. Tel: Leicester 708402 after 5.

ZX-81 . . . Sinc built inc leads, PSU, manual, book of 30 programs + Hartnell book — £65 ono Ring 0253/725374.

Sinclair ZX81 . . . As new, Sinc built, including all leads, PSU and Manual, VGC £55. Tel: 0277 223387.

ZX80 . . . + new 16k memory, new PSU exceleent working order, All leads and manual. £100 or swap for 2k Acorn Atom. Ring Blackburn (0254) 56911 after 4.

Microtan 65 . . . in Vero case, manual, Hex keypad, PSU, mag articles, book: "Programming the 6502" (Zaks). Genuine reason for sale. £100 ono Tel: Blidworth (06234) 4446.

Superboard 8k . . . 1.5MHz, 32x32 display, 1200/300 baud cassette, Cegmon. In smart steel case with PSU and modulator. Software inc. Assembler, Asteroids £240 ono Tel. Tim, 0278 785845.

ZX81 . . . with 16k RAM pack, perfect working order, inc all leads, PSU and manual. Boxed as new. £100. Tel: Frinton 77586.

Superboard II . . . Cased with 8k ROM and 8k RAM. Full PSU and documentation. Cegmon and Oldmon. Complete with progs, leads and cassette recorder — £190 or offers. Tel: Shoeburyness 3984.

Microtan 65 . . . Graphics, L-case, Tanex, 8k RAM, Basic, Xbug, MK2 KBD, PSU, keypad and software £200 ono Tel: Med (0634) 47321.

Sharp MZ-80K . . . 48k, cover, P3 printer, interface unit, Sharp editor/assembler, word processor (m/c), many games — some m/c, Basic enhancements, listings, manuals, £900. Tel: Reading 584497.

Acorn Atom . . . 12k + 12k — new PSU manuals, leads, etc. Lots of software eg invaders, breakout Good cond £235 ono. Tel: 863 2501 (Harrow) after 7.30

TRS-80 L1 . . . 4k keyboard/CPU, monitor, cassette recorder. As new in original boxing. Complete with manual and tapes. Cost £289, accept £200. Tel: Ash Green (Kent) 872504 eves.

8" Floppy disc drives . . . Brand new double sided units £160, two single sided units £100 each. 30, Meyrick Drive, Wash Common, Newbury, Berks. Tel: 0635-43855.

8k PET . . . 1yr old (new ROM), plus space invader tape etc £300. Bedford 43560 after 5.30.

Atari . . . Video computer cartridges — Adventure, Superman - £17, Chess - £22, Outlaw, Basketball, Video Olympics, Sky Diver, Golf, Bowling, Brain Games, Spacewar. all £11. Brian Dally 01-402 4222 ext 2449 (Day).

4K ZX80 . . . fully working, includes PSU complete 3k RAM extension, all leads, manual, 20 programs on cassette and Magic Book. £50 including p+p. Tel: Langport 251080 eves.

ZX81 . . . inc leads, PSU & manual £65. Also Binatone colour TV game, 10 games £17 Tel: Erith 31051 (eves).

Sharp MZ-80k . . . exc cond. Only 6 months old. 36k RAM, 116 programs including invaders, asteroids, and Xtal Basic, manuals, newsletters and other information included. Only £395. Tel: (01)-959 3116 after 5. Ask for Danny.

Atari. . . Video computer system complete with missile command and combat cartridges. £50 Tel: 851 5942, after 7.

TRS-80 Level II . . . 16k with VDU, cassette, PSU, numeric keyboard, leads, manuals + lots of software (space invaders etc). £350 ono Tel: Waltham Cross 27111, eves only, after 6.

PET 2001 . . . Old 8k ROM with small keyboard and built in cassette deck, comes with space invaders and blackjack programs and two manuals. Hardly used. £250 ono. Tel: 0865-739231.

Mattel Intellivision . . . The ultimate TV game, as new, complete with 12 cartridges, cost new over £400 will except £320. Tel: Peterborough 75923.

ZX81 . . . 16k 2 months old, in box & under g/tee, with £35 wroth programs incl space invaders, defender etc. £120 ono Phone 051 928 1245 after 6.

ZX81 . . . with 16k RAM plus manual and leads, 20 tapes (some with programs), 3 program books, Interface magazines, no waiting for delivery. £120 ono Tel: 01-337 5302.

Sharp PC1211 . . . Pocket computer c/w cassette interface, as new £60 ono. J. Moss 66 Littleheath, Charlton, London SE7 Tel: 01-316 0054.

ZX81 . . . + 16k RAM, complete, sinc built, Sinclair tapes 3 and 4, Homegrown software on 2 Memorex C90's, ZX81 Pocketbook, delivery in Glasgow area, £120 ono Tel: John (041) 632 4730.

Sinclair ZX80 . . . exc cond. Mnaual, mains adaptor, leads, £30 ono Tel: 01-764 5699 after 6.

Sharp PC1211 . . . programmable calc. + cassette interface. Leads, manuals etc £85 ono Phone Bob on Warwick 496848 (day) or Harbury (613414 (eve./w/end).

Centronics P1 printer . . . box, instructions, spare head. Six rolls paper: £140 Centronics parallel interface: £25. Steve, Potters Bar 52294, eve or work 01-387 6500.

Teletype ASR 33 . . . with Punch and Reader, and sound proof cover. Also RENA 132 CPS Matrix printer. Any offer considered. Tel: 07017-24805.

Sharp PC1211 . . . + printer + cassette interface + manuals + programs on tape. Quick sale, because I'm starving! Offers? Write Julian May, H217 Westwood, Warwick University, Coventry, or tel: (0203) 465311, ask for H217.

ZX81 . . . 3 months old. Exc cond. Incl 16k RAM, software & PSU; £115 Tel: Tim (01) 866 7173.

HP-85 . . . Extras include; 16k RAM (32k altogether), ROM drawer, matrix ROM and HP-1B interface. plus some useful programs. Price: £2200 ono Tel: 01-229 4284.

PET 32k . . . New ROM, toolkit, assembler large keyboard, manuals, many games, 1 year old, VGC, £550 — R Downs, Leicester 704859.

Texas Instruments . . . PC 100B print/security cradle for TI58/59. Perfect cond. £90 ono. Tel: (0422) 244373 after 6.30.

Radio Shack Video Monitor . . 12in screen, £50 Tel: 0734 341610

Ohio Superboard . . . Metal case, 48x32 display, switchable 1/2 MHz, sound generator. Software inc graphic startrek, Machine Code facilities. Portable TV included £275. 84, Manor Road, Stetford, Manchester.

Acorn Atom . . . 7 months old complete with PSU, manuals, software inc galaxian, 3D maze etc £196. Tel: Robert Newtonards 815371 co Down after 6.

Sinc built ZX81 . . . Inc leads, power supply, manual, games cassette, £60. Tel: Rugby 815975. Only 5 months old.

ZX81 . . . Sinc built with 16k RAM pack. As new with all leads etc. Books and software. £120. Tel: 0438 811082 (Datchworth, Herts.).

Sharp MZ-80K . . . (48k RAM) £395 including manuals, dust-cover & over £100 software (Ardensoft Tool Kit, Space Invaders, Asteroids, etc). Exc cond. Tel Shoreham-by-Sea (Sussex) 62296.

Sinclair ZX81 . . . in Vero Saturn case, with full size keyboard plus print keys, with onboard power supply. £85 ono. Tel: Cannock (054-35— 6339.

32k Exidy Sorcerer . . . + Green screen monitor, Toolkit Basic, Greatly extended operating system other software including games. All manuals and leads. £550 the lot. Tel Keresley 7822. R Woodfield after 5.

ZX81 . . . + mains adap and leads + manual + flicker free space invaders + Sinc: games cassette. 3 mths old. Still guaranteed. Boxed as new £65 Gosport 26258.

PET 2001 8k . . . Small keyboard, games programs, star trek, breakthrough, rhino, alien attack, Rubik's cube, mastermind etc. manual. Only £300 ono. Tel: Shilbottle 287 after 6.

Nascom 2 . . . 32k, built and tested by Nascon advanced monitor, Basic upgrade, IO Systems' hi-res graphics, many games and other programs. £375ono. Tel: Cleobury Montimer (0299) 270 467.

Wanted . . . ZX80 case, must be in good condition. Good price paid. Tel: Blackburn (0254) 56911 After 4.

Acorn Atom . . . 12k RAM, 8k ROM inc. PSU, leads, manual, hi-res graphics, Magic Book. Over 100 programs on cass., inc. space invaders, Asteroids etc. As new £230 ono. 021-351 1730 eves.

Nascom 1 . . . 32k RAM, printer basic ROM, 20k EPROM board, Hexpad, colour graphics, cased & working £250 may consider a swap for an 80 column printer. Phone Chris, Plymouth 335735.

TRS80 16k L2 . . . Keyboard, cassette recorder TV modulator with or without TV (£40) and over £250 worth of software, £350 ono Tel Hull (0482) 658412 after 6.

Cheap Keyboard and printer . . . ITT Envoy, similar to ASR33. Immaculate cond, RS232. Offers 125. S100 (Nstar) S/density disk controller + DOS + Basic, offers 75. Tel: 0743 72519 (nr Leeds)

TRS-80 L2 . . . 16k with leads, manuals, cassette and some programs. Good cond. £275 ono Tel: 0933 (Wellingborough) 223971.

Video Genie . . . New style keyboard + portable black + white TV/monitor £290 the pair or will separate. Tel: 01-552 3043 eve or w/ends.

UK101 . . . 8k RAM, Compshop built iwth microcase, only 9 months old inc. software and cassette recorder £180 ono Tel: Harpenden (05827) 62540, w/ends and eves only.

Video Genie EG3003 . . . 16k level II, 10 months guarantee. Integrated cassette and extra keys, manuals. Complete with £900 worth of software (games and utilities) £550 ono 01-542 4707 eves.

Apple II Europlus . . . 48k with two disk drives, controller, 9in Hitachi monitor, manuals, software including Visicalc & Applewriter, disk files, 6 months old £1,500 ono tel: Nigel, Leicester 881037, day.

ZX81 . . . Sinc built, exc cond including: adaptor, manual, leads and a machine code Space Invader' game on cassette. All for £69. Tel: 01-864 4581 ask for Kamran. After 7 except w/ends.

TRS-80 level II 16k . . . Complete with green screen, CTR80 cassette recorder, plastic covers, manuals and all accessories, hardly used. £370 ono. Tel: Neville, Medway (0634) 668093 (home) (0634) 34422 ext 92 (work.)

For UK101 . . . surplus to requirements — Compshop Mono2 EPROM £5, assembler/editor cassette £8 or £10 for both. Would cost over £25 in shops. Tel: Geoff 01-505 3193 after 7.

TRS-80 LZ 16k . . . With programs, including space invaders and battle of Britain. £330 ono Tel: Colchester 47118.

ZX81 . . . Sinc built, 16k RAM pack, PSU, leads, manual, books, cassettes. £100 Tel: 0524 (Morecambe) 418406.

PET 2001-8 . . . 8k old ROM. Built-in cassette, with games tapes, m/chess tape, user manual, PET Revealed, PET Computer Guide etc. £325 ono. Tel: North Walsham 402873 eve.

Superboard II . . . 8k RAM, 300/600 Baud cassette, 2MHz, cased, in-built 5V 5A PSU. Extended monitor ROM giving CLS, CLW, INKEY, GET, MSAVE, TRACE etc. £150. Tel: Rochdale (0706) 40825.

Sinclair ZX80 . . . As new, perfect working order. Factory built. Including manual and ZX80 Pocket Book and 30 progs for ZX80 cost £10. £50 the lot. Tel: Brighton 732086.

PET 4008 . . . 8K, large keyboard, new ROMS, under 1 year old, inc. cassette deck, 20 games, Commodore manual, PET Revealed, PET Graphics, and other books. The lot for £430, negotiable. Tel: 01-730 2838 after 5.

UK101 . . . cased 8k RAM 8k ROM 48x32 screen + newmon (48x32) 1/2MHz switchable, 300/600 Baud switchable cassette deck, all leads, plenty of programs £220 ono. Tel: Northwich (0606) 77871 after 6 (Mon-Fri).

TRS-80 . . . 16k Level II with VDU, CTR.80 cassette recorder, manual & games tape. £350 ono. Tel: 061 834 8539 day or 061 430 3611 after 7.

Teletype . . . Data Dynamics ASR390 complete with paper tape reader/punch, stationery, ribbons, manuals, diagrams vgc £100 Eastbourne (0323) 642559.

Nascom 2 . . . 48k RAM, 8k Basic, NAS-SYS 1, graphics ROM, NAS PAS 3, Naschess, toolbox, various action games, D-A sound board. Boxed, fully working £515 Tel: (04865) 3276.

Video Genie . . . 9 months old, hardly used, plus games (corplan business, Adventure etc.) £250 ono. Tel: 01-373 9289 eves.

Acorn Atom . . . 12k + 12k with 3A PSU. Acornsoft utility packfastcos/disassembler/renumber. User Group newsletters. Boxed with leads + manuals £200 01-581 4689 after 6.

ZX81 . . . + 16k RAM. Sinc built. PSU manual, 3 prog books, 3 cassettes, Still guaranteed. (0494) 711223 (High Wycombe) £120.

# TRANSACTION FILE

DIRECT ACCESS

32k Sorcerer . . . Amazing space-invadgrs and asteroids. All leads and manuals, cassette with motor control. High-res graphics software, adventure and other games. All VGC £500 ono. Tel: Twyford (0734) 340366.

TRS-80 . . . Level II, 48k, L/C mod., Disk & Interface, Recorder, Disk Instruction course, manuals, best offer up to £899: Melville, 23 Woodlands, Colchester CO4 3JA (0206) 862677.

ZX80 . . . Sinc built — 16k RAM, 8k ROM, manual, leads and ass progs. Tel: Aycliffe 313802 after 5 with offers.

ITT 2020 . . . 48k, colour, Palsoft in ROM, with Apple disk drive and controller (DOS 3.3). Computer £400, disc drive and controller £300. Tel 01-841 8857.

Aculab Floppy tape . . . No longer needed as I have disks — eat your heart out! As new, with wafers & documentation. £100. No offers. 0622 891387 (Kent).

Challenger 1P. . . 8k RAM, new Wemon monitor, RS232, 1&2 MHz operation, all manuals and leads, many progs £240 ono, buyer collects. Bristol (0272) 660221.

UK101 . . . 8k RAM, new monitor, manual, sample games. Little used £180 o.n.o. Tel: Phil (01) 985 2788.

UK101 . . . 8k RAM, microtype 3 case, many programs; TV and cassette recorder inclusive; programmable inverse video, buzzer etc £300 ono Tel: Andy Harlow (0279) 417923.

Centronics . . . Electrostatic Microprinter P10. As new, with manual, cleaning paper and four rolls printing paper. 80 characters per line, 150 lines per minute. Centronics interface £155. Phone (0742) 745027 eves.

ASR33. . . with stand, exc cond. £100 ono. Tel: Watford (Herts) 35078, after 7.30.

ZX80 . . . 8k ROM, 16k RAM, non-flicker slow mode add-on, program tapes/books (over 70 programs), manual, PSU leads etc. Cost over £200 will sell for £115 ono Tel: (0224) 322936.

Mektronic. .. 8 channel I/O communicator for PET (fits user port) with documentation £25. Also first 2 volumes of Microcomputer Printout in official binders £18. Tel: Kirkby Lonsdale (0468) 71634.

DEC LA30. . . printer/terminal believed working, good PSU's, keyboard and cabling. £80 ono. Tel: Bristol (0272) 821828 eve.

UK101. . . 8k, cased (beige colour) perfect working order, using new Wemon monitor, complete with leads for TV and cassette. Mr Gordon 041-634 3480 after 6. £150.

Sharp MZ-80K. . . 48k RAM 6 months old, manual, some games programs — £400 ono. phone Chesterfield 37916.

ZX81 . . . Sinc built, complete with 16k RAM pack, P.S.U., manual leads plus 3 books and 2 Sinclair cassettes. £120. Tel: John (0698) 53392.

ZX81. . . 1k with all leads, transformer, original packing, manual and 4 parts Computer Programming in Basic. Worth £70 but only £55. Plot 6 Ospringe Place, Faversham, Kent, ME13 8TB.

WANTED

TCL Pascal. . . programs for CBM3032. Anyone interested in exchange programs/games? Write: John Douglass, Gimenenstr 1, CH6300, Zug, Switzerland.

Zilog MCB, MDC. . . (even Z8001 dev. mod.) wanted, any cond. 1st Z-compatible printer letter-Q under £200. Editions Lombardi, Via Die Campani 14, 00185-Rome, Italy.

Wanted. . . Printer and interface for Tandy TRS-80 level II micro. Phone Sunderland 226754.

# ACC NEWS

*Rupert Steele of the Amateur Computer Club surveys the club scene.*

This month we're featuring the North London Hobby Computer Club which must rate as one of the largest computer clubs in the country with very comprehensive facilities. It is based in the Polytechnic of North London and is run as a cross between a local club and a polytechnic evening course. It meets on most days of every week and has a large range of different machines, owned by the Poly, for the use of its members. There are a large number of groups in the North London Club, which include a commercial users' group, a PET users' group, a novices' evening, a software group, an educational users' group and a ZX80/81 users' group. The only catch for all you in North London is that the subscription is either £5 or £20, depending on where you live (I understand that this is due to some technicality in the local government of the area).

The North London Club is a member of the Association of London Computer Clubs (ALCC) which has a Prestel number — 456489 — and gives you information on all the clubs in ALCC.

Richard Larkin, a prominent member of the North London Club and ACC Real Ale Rep, has asked me to mention that he has a 'thing' about standards and standardisation, and would like to hear from others afflicted with the same problem. He says that he may be able to give suggestions that avoid reinventing the wheel. Richard is also drafting a set of simple guidelines for equipment reviewers who need an *aide-memoire* on electrical safety. He hopes to bring this down to one side of A4; if this interests you, then write to him c/o the North London Club and he may be able to help.

Recently, a couple of North London Club members did a heart transplant on a UK-101, kitting it out with a 6809. They claim to be producing a monitor for it. When they get it going, I'll try to persuade them to publish the details (either in a mag or *ACCumulator*). North London is also running a communications and networks group, which is holding regular meetings at the Poly. The ACC is interested in networks, too, and we are considering holding a national workshop/conference on the subject, possibly in Oxford next spring. Does anybody out there have any interesting ideas for this? Networks have not really hit the public's imagination yet, but it must only be a matter of time . . . certainly some of the big manufacturers are very interested in the idea. Maybe I'll write something about them in *ACC News* one month.

If you want to know more about the North London Computer Club, then write to: Robin Bradbeer, Computer Dept, Polytechnic of North London, Holloway Road, London N7 8BD.

Clubs: please send information in to the ACC at every possible opportunity. One of our main functions is to bring your potential members in touch with you and we can't do this if we don't know about you. Also, if you're doing anything exciting that wants a mention in ACC News, then please write to me, Rupert Steele, St John's College, Oxford OX1 3JP, with all the details (deadline 24th of month for publication two months later). If you think your club is special and merits a feature spot in *ACC News*, then write and tell me all about it.

The ACC is considering a new Club Affiliation scheme and would welcome comments from any clubs or individuals concerning this. The idea would be that the affiliated club would receive one copy of *ACCumulator* for each member and members of the club would publish articles in *ACCumulator* alongside the normal ACC contributions. The club would insert something like a meetings list in each copy and then distribute them to their members. The club would obviously pay ACC a *per capita* affiliation fee, which would be somewhat less than the normal ACC membership, as the distribution costs to ACC would be lower. This would help those clubs who cannot afford to produce a high quality technical newsletter, but have many suitable articles submitted. Please write and let us know what you think of the scheme.

*Rupert Steele.*

# NETWORK NEWS

*Here is a list of all British (and one Dutch) personal computer networks. As more networks appear — and as more facilities are added to existing ones — we'll report them in this section, which appears monthly.*

**Forum-80 Hull. . . Operator: Frederick Brown, tel 0482 856169. Facilities: electronic mail, software up/down loading, Forum-80 Users' Group, PET users' section, shopping list. Hours: 7 days/week, midnight-0800, Tues & Thurs 1900-2200, Sat & Sun 1300-2200.**

**Forum-80 London. . . Operator: Leon Jay, tel 01-286 6207. Facilities: electronic mail, program downloading. Hours: Tues, Fri, Sat & Sun 1900-2300.**

**80-NET . . . Operators: Leon Heller & Brian Pain, National TRS-80 Users' Group, tel 0908 566660. Facilities: electronic mail, software for downloading, newsletter, TRS-80 information. Hours: 7 days/week, 1900-2200.**

**CBBS London. . . Operator: Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.**

**Forum-80 Holland. . . Operator: Nico Karssemeyer, tel 010 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.**

DIRECT ACCESS

# CTUK! CENTRES

*Here's an updated list of people organising ComputerTowns. Don't forget to enclose an SAE if you write to your nearest 'Town for details.*

Lyn Antill,
1 Defoe House,
Barbican,
London

Peter J Kiff,
52 Stone Road,
Broadstairs,
Kent CT10 1DZ

Patrick Colley,
52 Queensway,
Caversham Park Village,
Reading,
Berks RG4 0SJ

Pete Shaw,
15 St Vincent Road,
Clacton-on-Sea,
Essex C015 1NA

Steven Christian,
51 Burnstones,
West Denton,
Newcastle-on-Tyne NE5 2DF

Derek Moody,
2 Victoria Terrace,
Dorchester,
Dorset DT1 1LS

David Tebbutt,
7 Collins Drive,
Eastcote,
Middx HA4 9EL

Vernon Gifford,
111 Selhurst Road,
Croydon,
London SE25 6LH

John Stephen Bone,
2 Claremont Place,
Gateshead,
Tyne & Wear NE8 1TL

Mike Baker,
5 Edinburgh Road,
Hanwell,
London W7 3JY

Vernon Quaintance,
50 Beatrice Avenue,
Norbury,
London SW16 4UN

R L Saunders,
14 St Nicholas Mount,
Hemel Hempstead,
Herts.

Pete Rowan,
10 Lambton Road,
Jesmond,
Newcastle-on-Tyne NE2 4RX

Steve Haynes,
5 Guinea Street,
Kingsholm,
Gloucester GL1 3BL

Ted Broadhead,
27 Cardinal Road,
Leeds LS11 8EY

Andrew Holyer,
10 Masons Field,
Mannings Heath,
Horsham, Sussex RH13 6JP

Brigitte Gorton,
18 Purbright Crescent,
New Addington,
Croydon CR0 0RT.

Susan Kelly,
Head of Reference Services,
PO Box 4,
Civic Centre,
Harrow,
Middlesex.

Bill Gibbings,
3 Longholme Road,
Retford,
Notts DN22 6TU

Philip Joy,
130 Rush Green Road,
Romford,
Essex.

Richard Powell,
22 Downham Court,
South Shields,
Tyne & Wear

Derrick Daines,
18 Cuttings Avenue,
Sutton in Ashfield,
Notts

Keith Taylor,
Carter Hydraulic Works,
Thornbury,
Bradford BD3 8HG

Roger Shears,
18 Woodmill Lance,
Bitterne Park,
Southampton SO2 4PY

Alan S Waring,
50 Drayton Gardens,
Winchmore Hill,
London N21 2NS

Alan Northcott,
Rushmoor,
464 Reading Road,
Winnersh,
Wokingham,
Berks RG11 5ET

Alan Sutcliffe,
4 Binfield Road,
Wokingham,
Berks RG11 1SL

Tony Cartmell,
54 Foregate Street,
Worcester WR1 1DX

Tom Graves,
19a West End,
Street,
Somerset BA16 0LQ

# USER GROUPS INDEX

INTERNATIONAL
Irish ZX80/81 Users Club, the first club in Ireland. Open for all owners of Sinclairs. For info send two 22p stamps (six counties 40p). Users Club, c/o M Cronsten, 73, Cnoc Crionain, Baile Atha, Cliath 1.

Post-Sharp: International exchange and contact club on the Sharp MZ-80K. Has over 100 members. Contact: Mr Daniel Joly, 207, Rue sur les Thiers, B-4400 Herstal, Belgium.

NATIONAL
80 UK — User group for all TRS-80 owners, including VG/Colour/Level 1. Bimonthly magazine. Write for details to: N Rushton (ref 80UK), 123, Roughwood Drive, Northwood, Kirkby, Merseyside L33 9UG.

The Home Computing Special Interest Group of British Mensa Ltd. Six eight-page newsletters per annum, subscription £2. Circulation is restricted to Mensa members. Details may be obtained from Gordon Grant, Flat 3, 63, Cleveland Rd, Crumpsall, Manchester M8 6GT. Please send sae.

COUNTY
Cornish Radio Amateur Club. Computer section meets on third Monday of each month at the SWEB social clubroom, Pool, Redruth at 7.30. New members and visitors welcome — contact Bob Reason, 24, Mitchell Rd, Camborne, Cornwall TR14 7JA.

Thames Valley Amateur Computer Club. Meets first Tues of every month at 'The Griffin', Caversham, Reading (just NW of Caversham bridge). Start 7.30. Contact: Roger Bird, Newbury 43855 or Phil Warn Reading 594874.

West Herts 80 User Group. Membership not restricted to Herts residents — many members are also in National TRS-80 User Group. Meetings fortnightly at St Stephens Parish Centre, Station Rd, Bricket Wood, North of Watford. Contact: Terry Bradbury, 20, Spruce Way, St Albans, tel Park Street 73633 or Reg Smith, 24, Sempill Rd, Hemel Hempstead, tel Hemel Hempstead 60085.

TOWNS
Brighton, Hove & District Computer Club — first meeting held on Friday 31 Oct. We are interested in corresponding with other societies, exchanging software and attracting new members. Many existing members have access to hardware. Info from Rod Phillippe at Hobbyist, 3, The Broadway, Southwick, Brighton BN4 4ND.

Crew Computer Users Group. Meetings monthly (Thurs) at Crewe Library. Details of meetings in local press. Contact: Bram Knight, Nantwich 623375

MKMUG-Milton Keynes Microcomputer Users Group. Weekly meetings Tuesdays 7.30-10.00. Lectures, etc, frequently arranged. For further information contact Brian Pain, 0908 566660 (w) or 564271 (h) 40a, High Street, Stony Stratford, Milton Keynes.

North London VIC-20 Users Group to be formed. People interested please contact Jim Chambers 01-387 7050 (day).

London-based Atom/Proton User Group. Regular newsletter incl software and hardware tips, listings, reviews. Problems answered when possible. Meetings arranged. Membership £3.50 pa. Details from M Jaffer, 71, Mill Farm Close, Pinner, Middx. Tel 01-429 8042 or C Holt 01-427 6088.

Peterborough Amateur Computer Club — recently formed. Meets on first and third Mondays monthly at the Adult Education Centre, Brook Street, Peterborough.

Taunton Computer Club. Meets weekly at Somerset College of Art & Technology (Tuesdays 1800, term time). Other occasional general meetings outside, eg, visits, demonstrations. Beginners welcome. Contact: Mrs D Walker, Glenleigh, Whiteball, Sampford Arundel, Wellington, Somerset.

# DIARY DATA

*Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.*

| | | |
|---|---|---|
| Southampton | (Polygon Hotel) Computer Open Day Exbn. Contact: Couchmead Communications Ltd 01-653 1101. | 13 Jan |
| Birmingham | (NEC) *Which Computer?* Show. Contact: Clapp & Poliak Europe Ltd, 01-747 3131 | 19-22 Jan |
| Tokyo, Japan | Data & Telecommunications Exbn. Contact: Cashners Exposition Group, Guildford 38085. | 20-23 Jan |
| San Diego, CA, USA | Pacific Computer Expo. Contact: Judco Enterprises (Arizona), (602) 990 1715 | 21-23 Jan |
| Eindhoven, Holland | Int Microelectronic Subsystems Trade Fiar | 27-29 Jan |
| Cheltenham | (Queens Hotel) Computer Open Day Exbn. Contact: Couchmead Communications Ltd, 01-653 1101 | 27 Jan |
| London | (Barbican) Information Technology & Management Exbn & Conf. Contact: BED Exbns Ltd, 01-647 1001 | 9-12 Feb |
| Harrogate | (Majestic Hotel) Computer Open Day Exbn. Contact: Couchmead Communications Ltd, 01-653 1101 | 10 Feb |
| Dublin, Eire | Int Computing Exbn. Contact: SDL Exbns Ltd, Dublin 763871 | 16-19 Feb |

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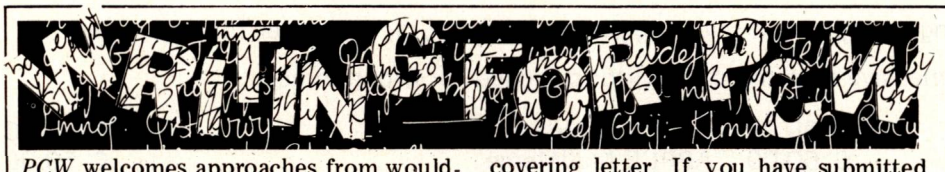



*PCW* welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and 'phone number appear on both the article and the covering letter. If you have submitted the same work to other magazines you should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

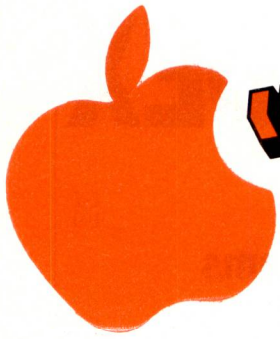
If you have an idea for an article or a series, write us a letter outlining your ideas. A one or two page synopsis giving the proposed structure, sequence and content will give us a sound basis for discussion. Please give us a daytime 'phone number if possible.

If you have nothing specific in mind but feel qualified to conduct case studies, Benchtests or whatever then drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications — experience carries just as much weight.

Dick Pountain is always on the look-out for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading *PCW* will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — *PCW* does pay for all published work.



# "WORDSTAR GOES APPLE!"

**Q: What additional equipment do I need to run WordStar on my Apple computer?**
*A: WordStar 3.0 and later versions require a Microsoft SoftCard and a minimum of 48K RAM. Earlier releases of WordStar require both, plus an 80-column VIDEX Videoterm card.*

**Q: What about "shift-key" modifications to the 80-column video board? Do I need these to run Wordstar?**
*A: Not necessarily. All WordStar functions run without modification. Upper/lower case characters can be generated using the escape key.*

**Q: What Disk-Sector format do I need to run WordStar on the Apple computer?**
*A: WordStar is available on both 13-Sector and 16-Sector Apple formats — but please specify when ordering.*

**Q: Are there any differences between the Apple version and the standard CP/M version of WordStar?**
*A: No, there are no functional differences between the two versions. The Apple version supports all WordStar and MailMerge functions. The Apple version can be installed only on Apple computers.*

**Q: What printers are compatible with WordStar on the Apple?**
*A: WordStar supports letter-quality and teletype-like printers, including dot-matrix, line, and thermal devices. While WordStar provides full functions for quality daisy-wheel printers (e.g. NEC, Ricoh, TEC, Qume, and Diablo), it can also take advantage of many lower priced non-daisy-type printers.*

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*4. Disk-biffered text entry — the size of your document is limited only by the storage capacity of your disk.*

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# LEISURE LINES

*By JJ Clessa*

Sorry for the mix-up folks but, as most of you guessed, we got the Quickie and the Prize Puzzle crossed — what a blunder!

Anyway, we decided to allow either puzzle to qualify for prize selection, but even the intended 'Quickie' must have been difficult because there were only about 50 replies to the competition. The winner, by random selection, did, as it happened, give the answer to the intended Prize Puzzle — 50 relatives, six charities. Congratulations to Mr Tether of Stoke-on-Trent. Your prize is forthcoming.

Incidentally, although this month's winner comes from this island, we do get and are pleased to receive many entries from overseas. Keep them coming — we can assure you that all correct entries have an equal chance of winning a prize, regardless of origin.

## Quickie

No answers, no prizes. Three boys have 20 conkers between them. Billy has three more conkers than Alan but five fewer than Charlie. How many conkers do they each have?

## Prize puzzle

Using the ten digits 0-9, construct two numbers such that the first is the cube and the second is the fourth power of the same number, x. What is the value of x?

Answers on *postcards*, please, to: Leisure Lines, *PCW*, 14 Rathbone Place, London W1P 1DE to arrive not later than 31 January 1982.

# PROGRAMS

*We are interested in Basic or Pascal programs for any of the popular micros — please specify which one you wrote your program on and how much memory it uses up. Assembler language subroutines are covered in 'Sub Set'. We'd also prefer more 'serious' software: games are all very absorbing, but the programs section of* PCW *does seem rather one-sided. Make sure programs submitted are fully debugged before they're sent in, preferably on cassette with a clear listing enclosed. A short explanation of your program's function would also be desirable. If you want it returned, enclose an SAE and write your name and address on each piece of paper you send. Don't worry if you don't hear anything for a month or two — programs take a long time to evaluate. And we pay for all programs we print. Send contributions to* Maggie Burton, PCW *Programs, 14 Rathbone Place, London W1P 1DE.*

This month we have a rather mixed bag, for various machines and from different areas of computing. 'Apple Letters' by Vic, Sanjay and Ashe Upadhyaya is designed to introduce the alphabet to young children. It does this by requesting alphabetical input (including full stops and spaces) which it then displays in enlarged form on the screen. This display consists of five lines of 14 characters each. It runs on a 48k Apple II. 'MZ-80K Fortune' by Philip Hickin is more lighthearted altogether. I had a happy half-hour playing with this at Eurocalc on Tottenham Court Road. My thanks to them for the use of their MZ-80K. Fortune needs 11k of memory and is amusing to say the least, if not accurate. It requests the birthdate and name of the user and will answer a question about the future. Be warned — it's not to be taken literally!

'Labyrinth' for the 1k ZX80 (by B Cope) generates a random labyrinth through which you have to move a cross until you reach an objective (marked 'O'). This is done using the directional arrow keys 5, 6, 7 and 8. If you win the game or simply wish to start again, enter 99 for a random labyrinth or a higher number which will give a specific pattern which can be recalled.

Mr M G Green of Chesham sent us a program which measures the time taken to react to a cross appearing on a screen (signified by pressing a key) and then


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# PROGRAMS

compiles a histogram after a specified number of tries and calculates the mean and standard deviations which appear at the same time as the histogram. This one is in TRS-80/Video Genie Basic and needs 14k.

Finally, we have been saying for quite some time now that we want to see more interesting programs, but we haven't said how we check what we get, have we? Well, very often we don't, as this would involve the creation of a new department just for that purpose. So we've come up with a compromise: any reader who knows a fair bit about Basic or Pascal and their particular computer, and who has access to a printer, is welcome to write to Maggie Burton at *PCW* if they would like to join our newly resurrected referee register. Naturally, we pay for services rendered.

I hope to be deluged with replies by New Year's Day.

## MZ-80K Fortune

By P Hickin

```
1 REM------FORTUNE BY P.HICKIN-------
2 REM This program is based on a trick
3 REM invented by a magician named
4 REM R.Hummer.The trick is described
5 REM in Scientific American Feb.1981
10 DIM P$(7),PT$(7),AN$(64),A0$(7),N$(20)
20 DATA"111","101","100","001","010","011","000"
30 FOR I=0 TO 6:READ P$(I):PT$(I)=P$(I):NEXT
40 AN$(0)="You will dream about a relative."
41 AN$(1)="You will have an argument on the        telephone."
42 AN$(2)="You will dream about elephants."
43 AN$(3)="You will exchange angry words with a    plumber."
44 AN$(4)="You will find a lost ring."
45 AN$(5)="Something you say will harm you."
46 AN$(6)="You will find the weather abominable."
47 AN$(7)="Be alert for an injury to your foot."
48 AN$(8)="You will dream about an old friend."
49 AN$(9)="Yes,but it will be a fight YOU did not  start."
50 AN$(10)="You will dream about an aeroplane."
51 AN$(11)="Not if you can control your temper."
52 AN$(12)="You will find a coin on the street."
53 AN$(13)="Only a slight nick while shaving your   face or your legs."
54 AN$(14)="You will find a lost object in the     pocket of an old bathrobe"
55 AN$(15)="No,but you will injure someone else."
56 AN$(16)="No,because you know counterfeiting is   illegal."
57 AN$(17)="You will make a trip to the pub."
58 AN$(18)="Just the usual amount."
59 AN$(19)="You will make a short journey south."
60 AN$(20)="You will fall in love with a cat."
61 AN$(21)="Maybe."
62 AN$(22)="You will fall in love with a stranger in a self-service laundry."
63 AN$(23)="Absolutely not."
64 AN$(24)="An unexpected cheque will come by post."
65 AN$(25)="You will trip over a beer can."
66 AN$(26)="Not more than £500."
67 AN$(27)="You will visit an out of town friend."
68 AN$(28)="You will fall in love with a new car."
69 AN$(29)="Positively yes."
70 AN$(30)="You will fall in love with an estate    agent."
71 AN$(31)="Foolish question."
72 AN$(32)="You will dream you are a bird."
73 AN$(33)="You NEVER get in fights."
74 AN$(34)="A dream will wake you in the middle of  the night."
75 AN$(35)="You will fall out with an old friend."
76 AN$(36)="You will find a lost key."
77 AN$(37)="No injury of any sort for the next seven days,but be careful on "
78 AN$="the eighth.":AN$(37)=AN$(37)+AN$
79 AN$(38)="You will find something unpleasant in   your bed."
80 AN$(39)="Watch out for a punch on your nose."
81 AN$(40)="You will dream of coconut pie."
82 AN$(41)="Avoid arguments on a bus."
83 AN$(42)="You will dream about a flying saucer."
84 AN$(43)="Be careful not to antagonize anyone    named Harvey."
85 AN$(44)="You will find this trick puzzling."
86 AN$(45)="It is a dangerous week to stand on     stepladders."
87 AN$(46)="You will find the news tomorrow        disturbing."
88 AN$(47)="Climbing stairways can be dangerous."
89 AN$(48)="Yes,LOTS of money."
90 AN$(49)="You will not leave your neighbourhood  all week."
91 AN$(50)="On the contrary,you will LOSE some money."
92 AN$(51)="You will take a marvellous trip in your  imagination."
93 AN$(52)="You will not fall in love with anyone   for a change."
94 AN$(53)="YOU can answer that as well as I can."
95 AN$(54)="You will fall for someone in show       business."
96 AN$(55)="Whom do you think you are kidding?"
97 AN$(56)="Yes,but most of it will go for taxes."
98 AN$(57)="Yes,but you will not enjoy the trip."
```


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# PROGRAMS

```
99 AN$(58)="Some,but you will spend it immediately."
100 AN$(59)="You will go on a long trip by plane."
101 AN$(60)="You will fall in love TWICE."
102 AN$(61)="I don't know."
103 AN$(62)="You will fall OUT of love."
104 AN$(63)="You should be ashamed to ask such a     question."
110 AQ$(1)="Will I fall in love?"
111 AQ$(2)="Will I make some money?"
112 AQ$(3)="Will I take a trip?"
113 AQ$(4)="Will I have a strange dream?"
114 AQ$(5)="Will I be injured?"
115 AQ$(6)="Will I find something ?"
116 AQ$(7)="Will I get into a fight ?"
200 REM*********************************
201 REM------DEFNITIONS---------------
210 DEF FNR(N)=INT(RND(9)*N)
900 REM*********************************
910 RESTORE
920 FOR I=0 TO 6:READ P$(I):NEXT
1000 REM*********************************
1001 REM------INTRODUCTION------------
1010 PRINT"■     The miracle of electronics and the"
1011 PRINT"■micro-chip bring you the ancient art"
1012 PRINT"■of Ko njood intii."
1013 PRINT"■      A series of questions will be"
1014 PRINT"■presented,choose which you want "
1015 PRINT"■answering or ask a question which can "
1016 PRINT"■be answered by a yes or no."
1017 PRINT"■■Please enter your name";:INPUT" ";N$
1018 PRINT"■and your date of birth";:INPUT" ";B$
1020 A$=N$+B$
1030 FOR I=0 TO NA:IF N$(I)=A$ THEN 1200
1040 NEXT
1050 NA=NA+1:IF NA=21 THEN PRINT"■The session is now at an end.":GOTO 4060
1060 N$(NA)=A$
1070 PRINT"■   Thank you these are very important"
1071 PRINT"■data in the calculations."
1072 PRINT"■   PRESS ANY KEY TO CONTINUE"
1080 GET A$:IF A$="" THEN 1080
1090 FOR I=1 TO VAL(A$):X=RND(9):NEXT
1100 REM------QUESTION LIST-----------
1110 PRINT"■■  1  Will I fall in love?"
1111 PRINT"■  2  Will I make some money?"
1112 PRINT"■  3  Will I take a trip?"
1113 PRINT"■  4  Will I have a strange dream?"
1114 PRINT"■  5  Will I be injured?"
1115 PRINT"■  6  Will I find something ?"
1116 PRINT"■  7  Will I get into a fight ?"
1117 PRINT"■  8  A question of your own."
1118 PRINT"■■   Enter the required number."
1120 GET A$:IF A$="" THEN 1120
1130 R=VAL(A$)
1140 ON R GOTO 2000,2000,2000,2000,2000,2000,2000,3000
1150 GOTO 1120
1200 REM------ONLY ONE QUESTION-------
1210 PRINT"■You have asked a question before."
1211 PRINT"Only one question is answered for you"
1212 PRINT"per session."
1220 FOR I=1 TO 3500:NEXT
1230 GOTO 1000
2000 REM*********************************
2001 REM------FIND ANSWER-------------
2010 N=6:Q=R:R=R-1
2020 GOSUB 5300
2030 FOR I=0 TO N:PT$(I)=P$(I):NEXT
2040 PRINT"■This needs some consideration.■■■"
2050 GOSUB 5002
2100 REM*********************************
2101 REM------PRINT OUT RESULTS-------
2110 PRINT"■You ask:-"
2120 PRINT"■";AQ$(Q)
2130 PRINT"■and by the rules of Ko njood intii the"
2131 PRINT"■answer is:-"
2140 PRINT"■";AN$(QU)
2150 GOTO 4000
3000 REM*********************************
3001 REM------ENTER-------------------
3002 REM------OWN QUESTION------------
3010 PRINT"■Please type in your question then"
3020 PRINT"■press the CR key."
3030 PRINT:INPUT" ";A$
3100 REM------FIND ANSWER TO----------
3101 REM------OWN QUESTION------------
3110 N=6:R=0:QUALITY=0
3120 FOR I=0 TO N:PT$(I)=P$(I):NEXT
3130 PRINT"■This needs some consideration.■■■"
3140 C2$=MID$(P$(R),I+1,1)
3150 FOR I=0 TO 2
3160 Q1=0:Q2=0:N=6
3170 FOR J=0 TO N:P$(J)=PT$(J):NEXT
```


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# PROGRAMS

```
3180 GOSUB 5200:REM--SHUFFLE PACK--
3190 R=FNR(N)
3200 C1$=MID$(P$(R),I+1,1)
3210 PRINT "■Ko njood intii";
3220 GOSUB 5300:REM--CONSOLIDATE PACK-
3230 R=FNR(N)
3240 C2$=MID$(P$(R),I+1,1)
3250 PRINT "■■■■■Ko njood intii";
3260 IF C1$=C2$ THEN 01=01+1:GOTO 3280
3270 02=02+1
3280 GOSUB 5300:REM--CONSOLIDATE PACK-
3290 IF N>0 THEN PRINT:GOTO 3190
3300 QU=QU+ABS(Q1-Q2)*4↑(2-I):PRINT
3310 NEXT
3400 REM*********************************
3401 REM------PRINT OUT RESULTS-------
3410 PRINT"■You ask:-"
3420 PRINT"■";A$
3430 PRINT"■and by the rules of Ko njood intii the"
3431 PRINT"■answer is:-"
3440 PRINT"■";AN$(QU)
3450 GOTO 4000
4000 REM*********************************
4001 REM------IF YOU BELIEVE THIS-----
4002 REM------THEN I CONNED YOU-------
4003 REM------DIDN'T I----------------
4010 PRINT"■■■ Are there more questions (Y or N)?"
4020 GET A$:IF A$="" THEN 4020
4030 IF A$="Y" THEN 900
4040 IF A$="N" THEN 4060
4050 GOTO 4020
4060 END
5000 REM*********************************
5001 REM------SUBROUTINES-------------
5002 REM------FIND POINTER TO--------
5003 REM------ANSWER-----------------
5010 QU=0
5020 FOR I=0 TO 2
5030 N=5:FOR J=0 TO N:P$(J)=PT$(J):NEXT
5040 GOSUB 5200
5050 R=FNR(N)
5060 C1$=MID$(P$(R),I+1,1)
5070 PRINT "■Ko njood intii";
5080 GOSUB 5300
5090 R=FNR(N)
5100 C2$=MID$(P$(R),I+1,1)
5110 PRINT "■■■■■Ko njood intii";
5120 IF C1$=C2$ THEN QU=QU+4↑(2-I)
5130 GOSUB 5300
5140 IF N>0 THEN PRINT:GOTO 5050
5150 PRINT
5160 NEXT
5170 RETURN
5200 REM------SHUFFLE PACK------------
5210 FOR J=0 TO N
5220 FL=FNR(N)
5230 I$=P$(J)
5240 P$(J)=P$(FL)
5250 P$(FL)=I$
5260 NEXT
5270 RETURN
5300 REM------CONSOLIDATE PACK--------
5310 N=N-1
5320 IF N<0 THEN 5360
5330 FOR J=R TO N
5340 P$(J)=P$(J+1)
5350 NEXT
5360 RETURN
```

# TRS-80 Reaction Timing

By MG Green

```
80 CLS:DIM A(50)
90 PRINT TAB(20) "REACTION TIME PROGRAM":PRINT:PRINT
100 PRINT TAB(10) "AS SOON AS THE CROSS APPEARS PRESS ANY KEY"
110 REM
120 REM  THE FOLLOWING SECTION READS THE TIMING ROUTINE
130 REM  AND CONVERTS IT INTO A STRING
140 DATA 110000012400CD600013D5CD2B00D1FE0028F0626BC39A0A
150 READ A$
160 M$ = ""
170 FOR I=1 TO LEN(A$) STEP 2
180 N1 = ASC(MID$(A$,I,1)): N2 = ASC(MID$(A$,I+1,1))
```


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# PROGRAMS

```
190 IF N1>57 THEN N1 = N1-7
200 IF N2>57 THEN N2 = N2-7
210 N = (N1-48)*16 + N2-48
220 M$ = M$ + CHR$(N)
230 NEXT I
240 REM
250 PRINT:PRINT:INPUT "HOW MANY TRIES";NT
260 FOR I=0 TO 50:A(I)=0:NEXT
270 S1=0:S2=0:SM=0
280 GOTO 300
290 PRINT:PRINT:INPUT"HOW MANY MORE TRIES";NT
300 CLS:PRINT TAB(25) "GET READY"
310 FOR I=1 TO 500:NEXT
320 CLS
330 IT=0
340 REM
350 REM  LOOP FOR EACH TRY BEGINS HERE WITH THE SELECTION
360 REM  OF A RANDOM TIME BEFORE THE CROSS APPEARS
370 REM
380 IT = IT+1
390 IF IT>NT THEN 690
400 N = 500 + RND(1000)
410 REM
420 REM  POKE THE ADDRESS OF THE START OF THE TIMING
430 REM  ROUTINE INTO THE CORRECT ADDRESSES
440 BE = VARPTR(M$)
450 POKE 16526, PEEK(BE+1)
460 POKE 16527, PEEK(BE+2)
470 FOR I=1TON:NEXT
480 REM
490 REM  THE TIMING ROUTINE IS CALLED HERE AND RETURNS
500 REM  THE DELAY IN MILLI-SECONDS.
510 PRINT@160,"X"
520 N=USR(0)
530 PRINT@284,N;"MSEC";CHR$(30)
540 FOR I=1 TO 500:NEXT
550 CLS
560 REM  INCREMENT COUNTERS FOR CALCULATION OF MEAN
570 REM  AND STANDARD DEVIATION
580 REM  AND STORE TIME IN HISTOGRAM
590 S1 = S1 + N
600 S2 = S2 +N[2
610 SM = SM + 1
620 N = INT(N/10) + 1
630 IF N<51 THEN A(N)=A(N)+1
640 GOTO 380
650 REM
660 REM  END OF TRIES
670 REM  SORT AND PRINT THE RESULTS AS A HISTOGRAM
680 REM
690 F3$="£££"
700 CLS
702 REM  MB NORMALISES THE HISTOGRAM
704 REM  MB = 20 IS MORE SUITABLE IF THE HISTOGRAMME
706 REM  IS OUTPUT TO A PRINTER.
710 MA = 0: MB = 10
720 FORI=0TO50
730 IF A(I)>MA THEN MA=A(I)
740 NEXTI
750 IF MA=0 THEN PRINT "NO DATA TO HISTOGRAMME": GOTO 1050
760 IX=INT((MA-1)/MB)+1
770 NA=INT(MA/IX)+1
780 FORI=1TONA
790 Y=IX*(NA+1-I)
800 PRINT USING F3$;Y;:PRINT":";
810 FORJ=1TO50
820 RE=Y-A(J)
830 CH$=" "
840 IF RE>=IX THEN 870
850 IF RE<=0 THEN CH$="X":GOTO870
860 CH$=CHR$(IX-RE+48)
```


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# PROGRAMS

```
870 PRINT CH$;
880 NEXTJ
890 PRINT
900 NEXTI
910 PRINT"    -";:FORI=1TO5:PRINT"---------+";:NEXTI:PRINT
920 PRINT"    0 ";:FORI=1TO5:PRINT"         ";I;:NEXTI:PRINT
930 PRINT"      ";:FORI=1TO5:PRINT"         0";:NEXTI:PRINT
940 PRINT"      ";:FORI=1TO5:PRINT"         0";:NEXTI:PRINT
950 REM
960 REM  NOW CALCULATE THE MEAN AND STANDARD DEVIATION
970 REM  AND PRINT THEM
980 REM
990 ME = INT(S1/SM)
1000 SD = (S2-SM*ME[2)/(SM-1): SD = INT(SQR(SD))
1010 PRINT:PRINT TAB(10) "MEAN";ME;TAB(40) "STD DEV";SD
1020 REM
1030 REM  SELECT CONTINUATION
1040 REM
1050 PRINT TAB(18) "HIT ANY KEY TO CONTINUE";
1060 AN$=INKEY$:IFAN$="" THEN 1060
1070 CLS
1080 PRINT "HIT A KEY AS FOLLOWS:-"
1090 PRINT TAB(10) "'A' TO ADD MORE TRIES"
1100 PRINT TAB(10) "'R' TO RESTART THE PROGRAM"
1110 PRINT TAB(10) "ANY OTHER KEY TO END"
1120 AN$=INKEY$:IF AN$="" THEN 1120
1130 IF AN$="A" THEN 290
1140 IF AN$="R" THEN 250
1150 END
```

# ZX80 Labyrinth

By B Cope

```
 10  DIM A(31)
 20  RANDOMISE 67
 30  FOR A = 0 TO 15
 40  PRINT , "eight spaces"
 50  LET A(2*A) = 2*RND(128) - 1
 60  LET A(2*A + 1) = RND(127) + 128
 70  NEXT A
 80  LET A(0) = 32767
 90  LET A(1) = 32767
100  LET A(30) = 32767
110  LET A(31) = 32767
120  LET C = 109
130  GOTO 220
140  LET A = PEEK(16396) + 256*PEEK(16397)
150  RETURN
160  INPUT C
170  IF C > 98 THEN GOTO 350
180  IF C < 5 OR C > 8 THEN GOTO 160
190  LET C = B + (C=5) - (C=8) + 17*((C=7) - (C=6))
200  GOSUB 140
210  IF PEEK(A + C) = 128 THEN GOTO 160
220  LET D = C - C/17
230  LET B = C
240  FOR C = 0 TO 8
250  LET E = B + (16 + C)*(C < 3) + (C=3) - (C=5) - (10 + C)*(C > 5)
260  LET F = E - E/17 - 1
270  GOSUB 140
280  POKE A + E , 9 - 119*((A(F/8) AND 2**(F - 8*(F/8))) > 0)
290  NEXT C
300  POKE A + 109 , 56
310  POKE A + 180 , 52
320  POKE A + B , 19
330  IF B = 180 THEN PRINT "O.K."
340  GOTO 160
350  CLS
360  RANDOMISE C - 99
370  GOTO 30
```

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# PROGRAMS

## Apple Letters

By V S & A Upadhyaya

```
45  HOME : SPEED= 20: PRINT "THE AIM OF THIS PROGRAM IS TO INTROD
    UCE THE ALPHABET TO A CHILD.": PRINT
50  PRINT "THIS PROGRAM WILL DISPLAY THE CAPITAL  LETTERS OF THE
     ALPHABET.": PRINT : PRINT "ANY LETTER ENTERED WILL BE ENLAR
    GED AND DISPLAYED ON THE HI-RES SCREEN": PRINT : PRINT "TO E
    XIT TYPE 'STOP'": SPEED= 255
60  FOR VZ = 1 TO 5000: NEXT VZ
70 AA = 0
100  HGR
105  VTAB 24
120 A$ = "ABCDEFGHIJKLMNOPQRSTUVWXYZ .":I$ =  CHR$ (13): GOTO 140

130  IF AA > 5 THEN  GOTO 139
131  IF AA = 1 THEN I$ = "LETTERS  BY  VIK..SANJAY.....AND...
    .....ASHE.....UPADHYAYA...": FOR VZ = 1 TO 5000: NEXT V
    Z: GOTO 150
132  IF AA = 2 THEN I$ = "HERE IS THE...ALPHABET.....ABCDEFGHIJK
    LMNOPQRSTUVWXYZ..": FOR VZ = 1 TO 400: NEXT VZ: GOTO 150
133  IF AA = 3 THEN I$ = "YOU MAY ENTER ANY SENTENCE  CONTAINING
       SPACES OR.....FULLSTOPS": GOTO 150
134  IF AA = 4 THEN I$ = "PRESS RETURN  ONCE YOU HAVE MADE AN ENT
    RY AND IT WILL BEDISPLAYED.": GOTO 150
135  IF AA = 5 THEN I$ = "...HAVE FUN...": GOTO 150
139  VTAB 21: INPUT I$
140  IF I$ = "STOP" THEN 1810
150  HGR
160 K = 1:N = 0:V = 0
170  IF  MID$ (I$,K,1) =  MID$ (A$,1,1) THEN 190
180  GOTO 230
190  HPLOT N + 2,V + 30 TO N + 10,V + 10 TO N + 18,V + 30
200  HPLOT N + 6,V + 20 TO N + 14,V + 20
210  GOSUB 1700
220  GOTO 170
230  IF  MID$ (I$,K,1) =  MID$ (A$,2,1) THEN 250
240  GOTO 300
250  HPLOT N + 5,V + 10 TO N + 13,V + 10 TO N + 16,V + 13 TO N +
    16,V + 15 TO N + 15,V + 16 TO N + 14,V + 17 TO N + 13,V + 18
     TO N + 12,V + 19 TO N + 13,V + 20 TO N + 14,V + 21 TO N + 1
    5,V + 22 TO N + 16,V + 23 TO N + 17,V + 24
260  HPLOT N + 17,V + 24 TO N + 17,V + 25 TO N + 17,V + 26 TO N +
    16,V + 27 TO N + 15,V + 28 TO N + 14,V + 29 TO N + 13,V + 30
     TO N + 5,V + 30 TO N + 5,V + 10
270  HPLOT N + 5,V + 19 TO N + 13,V + 19
280  GOSUB 1700
290  GOTO 170
300  IF  MID$ (I$,K,1) =  MID$ (A$,3,1) THEN 320
310  GOTO 350
320  HPLOT N + 16,V + 10 TO N + 9,V + 10 TO N + 5,V + 12 TO N + 2
    ,V + 15 TO N + 2,V + 25 TO N + 5,V + 28 TO N + 9,V + 30 TO N
     + 16,V + 30
330  GOSUB 1700
340  GOTO 170
350  IF  MID$ (I$,K,1) =  MID$ (A$,4,1) THEN 370
360  GOTO 400
370  HPLOT N + 3,V + 10 TO N + 11,V + 10 TO N + 13,V + 12 TO N +
    15,V + 15 TO N + 16,V + 18 TO N + 16,V + 22 TO N + 15,V + 25
     TO N + 13,V + 28 TO N + 11,V + 30 TO N + 3,V + 30 TO N + 3,
    V + 10
380  GOSUB 1700
390  GOTO 170
400  IF  MID$ (I$,K,1) =  MID$ (A$,5,1) THEN 420
```


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apple

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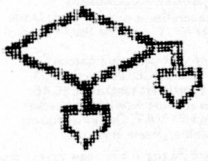

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# PROGRAMS

```
410  GOTO 460
420  HPLOT N + 16,V + 10 TO N + 3,V + 10 TO N + 3,V + 30 TO N + 16,V + 30
430  HPLOT N + 11,V + 20 TO N + 3,V + 20
440  GOSUB 1700
450  GOTO 170
460  IF  MID$ (I$,K,1) =  MID$ (A$,6,1) THEN 480
470  GOTO 520
480  HPLOT N + 18,V + 10 TO N + 5,V + 10 TO N + 5,V + 30
490  HPLOT N + 13,V + 20 TO N + 5,V + 20
500  GOSUB 1700
510  GOTO 170
520  IF  MID$ (I$,K,1) =  MID$ (A$,7,1) THEN 540
530  GOTO 590
540  HPLOT N + 15,V + 11 TO N + 13,V + 10 TO N + 8,V + 10 TO N + 5,V + 12 TO N + 3,V + 15 TO N + 3,V + 25 TO N + 5,V + 28 TO N + 8,V + 30 TO N + 13,V + 30 TO N + 15,V + 27 TO N + 15,V + 25
550  HPLOT N + 18,V + 25 TO N + 12,V + 25
560  HPLOT N + 18,V + 29 TO N + 15,V + 25
570  GOSUB 1700
580  GOTO 170
590  IF  MID$ (I$,K,1) =  MID$ (A$,8,1) THEN 610
600  GOTO 660
610  HPLOT N + 3,V + 10 TO N + 3,V + 20 TO N + 17,V + 20 TO N + 17,V + 10
620  HPLOT N + 3,V + 30 TO N + 3,V + 20
630  HPLOT N + 17,V + 30 TO N + 17,V + 20
640  GOSUB 1700
650  GOTO 170
660  IF  MID$ (I$,K,1) =  MID$ (A$,9,1) THEN 680
670  GOTO 730
680  HPLOT N + 8,V + 10 TO N + 12,V + 10
690  HPLOT N + 10,V + 10 TO N + 10,V + 30
700  HPLOT N + 8,V + 30 TO N + 12,V + 30
710  GOSUB 1700
720  GOTO 170
730  IF  MID$ (I$,K,1) =  MID$ (A$,10,1) THEN 750
740  GOTO 790
750  HPLOT N + 5,V + 10 TO N + 15,V + 10
760  HPLOT N + 10,V + 10 TO N + 10,V + 30 TO N + 9,V + 30 TO N + 8,V + 30 TO N + 7,V + 29 TO N + 6,V + 28 TO N + 6,V + 27
770  GOSUB 1700
780  GOTO 170
790  IF  MID$ (I$,K,1) =  MID$ (A$,11,1) THEN 810
800  GOTO 850
810  HPLOT N + 3,V + 10 TO N + 3,V + 30
820  HPLOT N + 15,V + 10 TO N + 3,V + 20 TO N + 15,V + 30
830  GOSUB 1700
840  GOTO 170
850  IF  MID$ (I$,K,1) =  MID$ (A$,12,1) THEN 870
860  GOTO 900
870  HPLOT N + 3,V + 10 TO N + 3,V + 30 TO N + 15,V + 30
880  GOSUB 1700
890  GOTO 170
900  IF  MID$ (I$,K,1) =  MID$ (A$,13,1) THEN 920
910  GOTO 950
920  HPLOT N + 3,V + 30 TO N + 3,V + 10 TO N + 10,V + 20 TO N + 17,V + 10 TO N + 17,V + 30
930  GOSUB 1700
940  GOTO 170
950  IF  MID$ (I$,K,1) =  MID$ (A$,14,1) THEN 970
960  GOTO 1000
970  HPLOT N + 3,V + 30 TO N + 3,V + 10 TO N + 17,V + 30 TO N + 17,V + 10
```

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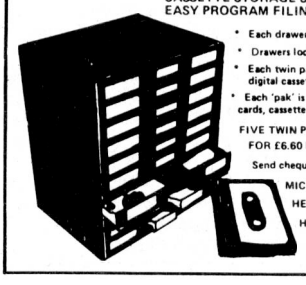

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```
980  GOSUB 1700
990  GOTO 170
1000  IF  MID$ (I$,K,1) =  MID$ (A$,15,1) THEN 1020
1010  GOTO 1050
1020  HPLOT N + 3,V + 10 TO N + 3,V + 30 TO N + 17,V + 30 TO N +
      17,V + 10 TO N + 3,V + 10
1030  GOSUB 1700
1040  GOTO 170
1050  IF  MID$ (I$,K,1) =  MID$ (A$,16,1) THEN 1070
1060  GOTO 1100
1070  HPLOT N + 3,V + 30 TO N + 3,V + 10 TO N + 15,V + 10 TO N +
      17,V + 15 TO N + 16,V + 20 TO N + 3,V + 20
1080  GOSUB 1700
1090  GOTO 170
1100  IF  MID$ (I$,K,1) =  MID$ (A$,17,1) THEN 1120
1110  GOTO 1160
1120  HPLOT N + 3,V + 10 TO N + 3,V + 30 TO N + 17,V + 30 TO N +
      17,V + 10 TO N + 3,V + 10
1130  HPLOT N + 5,V + 30 TO N + 8,V + 26 TO N + 12,V + 26 TO N +
      17,V + 33
1140  GOSUB 1700
1150  GOTO 170
1160  IF  MID$ (I$,K,1) =  MID$ (A$,18,1) THEN 1180
1170  GOTO 1220
1180  HPLOT N + 3,V + 30 TO N + 3,V + 10 TO N + 15,V + 10 TO N +
      17,V + 15 TO N + 15,V + 20 TO N + 3,V + 20
1190  HPLOT N + 10,V + 20 TO N + 17,V + 30
1200  GOSUB 1700
1210  GOTO 170
1220  IF  MID$ (I$,K,1) =  MID$ (A$,19,1) THEN 1240
1230  GOTO 1270
1240  HPLOT N + 17,V + 10 TO N + 8,V + 10 TO N + 3,V + 15 TO N +
      4,V + 20 TO N + 12,V + 20 TO N + 17,V + 25 TO N + 12,V + 30 TO
      N + 3,V + 30
1250  GOSUB 1700
1260  GOTO 170
1270  IF  MID$ (I$,K,1) =  MID$ (A$,20,1) THEN 1290
1280  GOTO 1330
1290  HPLOT N + 3,V + 10 TO N + 17,V + 10
1300  HPLOT N + 10,V + 10 TO N + 10,V + 30
1310  GOSUB 1700
1320  GOTO 170
1330  IF  MID$ (I$,K,1) =  MID$ (A$,21,1) THEN 1350
1340  GOTO 1380
1350  HPLOT N + 3,V + 10 TO N + 3,V + 30 TO N + 17,V + 30 TO N +
      17,V + 10
1360  GOSUB 1700
1370  GOTO 170
1380  IF  MID$ (I$,K,1) =  MID$ (A$,22,1) THEN 1400
1390  GOTO 1430
1400  HPLOT N + 3,V + 10 TO N + 10,V + 30 TO N + 17,V + 10
1410  GOSUB 1700
1420  GOTO 170
1430  IF  MID$ (I$,K,1) =  MID$ (A$,23,1) THEN 1450
1440  GOTO 1480
1450  HPLOT N + 3,V + 10 TO N + 5,V + 30 TO N + 10,V + 20 TO N +
      15,V + 30 TO N + 17,V + 10
1460  GOSUB 1700
1470  GOTO 170
1480  IF  MID$ (I$,K,1) =  MID$ (A$,24,1) THEN 1500
1490  GOTO 1540
1500  HPLOT N + 3,V + 10 TO N + 17,V + 30
1510  HPLOT N + 17,V + 10 TO N + 3,V + 30
1520  GOSUB 1700
1530  GOTO 170
```


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# PROGRAMS

```
1540  IF  MID$ (I$,K,1) =  MID$ (A$,25,1) THEN 1560
1550  GOTO 1600
1560  HPLOT N + 3,V + 10 TO N + 10,V + 20 TO N + 17,V + 10
1570  HPLOT N + 10,V + 20 TO N + 10,V + 30
1580  GOSUB 1700
1590  GOTO 170
1600  IF  MID$ (I$,K,1) =  MID$ (A$,26,1) THEN 1620
1610  GOTO 1642
1620  HPLOT N + 3,V + 10 TO N + 17,V + 10 TO N + 3,V + 30 TO N +
      17,V + 30
1630  GOSUB 1700
1640  GOTO 170
1642  IF  MID$ (I$,K,1) =  MID$ (A$,27,1) THEN  GOTO 1644
1643  GOTO 1650
1644  PRINT "     "
1645  GOSUB 1700
1646  GOTO 170
1650  IF  MID$ (I$,K,1) =  MID$ (A$,28,1) THEN 1670
1660  GOTO 1780
1670  HPLOT N + 10,V + 30 TO N + 9,V + 29 TO N + 10,V + 28 TO N +
      11,V + 29 TO N + 10,V + 30
1680  GOSUB 1700
1690  GOTO 170
1700 N = N + 20
1710 K = K + 1
1720  IF N = 280 THEN 1740
1730  RETURN
1740 N = 0
1750 V = V + 30
1760  IF V > 159 THEN 1780
1770  GOTO 170
1780  GOTO 1790
1790  HCOLOR= 3
1800 AA = AA + 1: GOTO 130
1810  TEXT : HOME :D$ =  CHR$ (4): PRINT D$;"CATALOG"
```

# THE BBC MICRO

*Continued from page 115*

```
10 REPEAT
20   INPUT A$
30   X = EVAL (A$)
40   PRINT X
50 UNTIL X = 0
RUN
? 4 + 3
      7
? SQR (4)
      2
? 0
      0
```

*Fig 3 Example program (with run) with EVAL*

ent feel. Firstly, the error messages are more detailed and helpful except for the rather obscure message 'ARRAY' which is output every time an expression with brackets fails. Secondly, most reserved words can be shortened (eg, P. for PRINT) in a manner similar to Atomic Basic rather than Microsoft. Thirdly, there is no command similar to Microsoft's CONT so once a program has been stopped there is no easy way to restart it. Finally, the 'Screen Editor' isn't: to alter a line, the cursor is moved to the offending line, which is copied to the bottom line a character at a time by pressing the COPY key. Characters can be inserted or deleted as the line is


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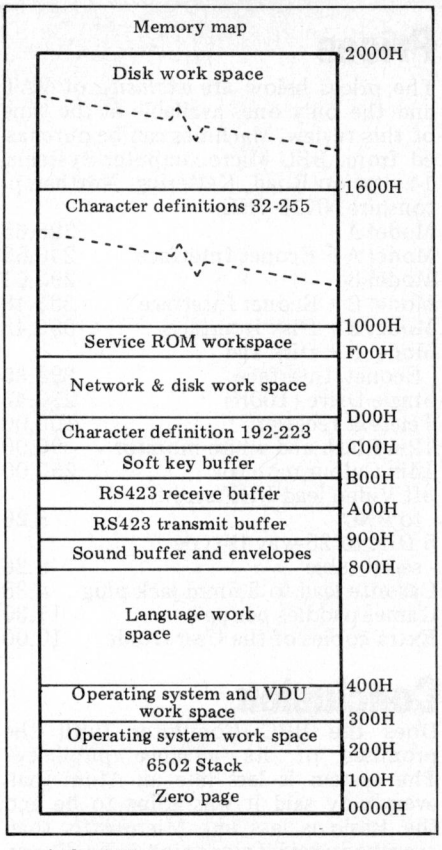


copied. Although this is faster than retyping lines, it is not up to the standard to be expected.

In contrast, programming the function keys is extremely easy. Strings of any length (up to a total of 1 kbyte for the ten keys) can be implanted. For example, to put PLOT 85, 5, 6 (CR) into function key nine $KEY 3 "PLOT 85,5,6 ;M" is typed at command level.

## Expansion and potential

If Acorn actually produces all the products that have been tentatively hinted at in the media, then this machine could be for everyone. How far the machine can be recommended, though, depends on which way Acorn's future developments go.

The system seems ideal for a home machine complete with colour graphics and expansion capabilities including paddles, Teletext and voice synthesis. We would be happier if the case was slightly more robust (perhaps a metal mesh strip across the back to cover the slot and support the top).

Turning to the schoolroom, a classfull of BBC machines connected to disks by an Econet (assuming Acorn's current release of Econet software is more extensive than our last view of it) would provide a great deal of hands-on experience for a reasonable cost (again the case needs to be stronger for this environment). With all its I/O channels and its graphics capabilities it should fit nicely into a lab. Without its promised disk drives, word processing and other applications software (all non-existent at the time of this review), the machine isn't suitable for a business environment.

As it stands, the BBC Computer is a highly competitive product with its immediate rivals (including the Ataris, VIC and Color Tandy). It really beats them with promises of second processors using the current system as a graphics terminal (or front end I/O processor). This whole area is filled with unknowns.

Our major forebodings have to do with Acorn's attitude towards software: it seems bent on reinventing the wheel. Currently its software is all written either in house or subcontracted, using only Acorn systems for software development. It may be able to get away with this on a system where there is one language (and Pascal and Forth will be offered as alternatives to Basic) in ROM. But Acorn has plans for a second, fast (3 MHz) 6502, a Z80 processor, a 68000 16-bit processor and a 32-bit 16032 (from National Semiconductor — it's supposed to be similar to a VAX instruction set and Acorn claims to have a development system for it). Already it has decided to write a CP/M look-alike to run on the Z80 processor. Will it feel more like CP/M than Acorn's Basic is like Microsoft's? It seems necessary, if it is going to be able to provide software support on a range of processors, that Acorn chooses someone else's machine-independent software and customises it to fully exploit the hardware. The obvious candidate for this must be the UCSD p system (with Unix as a possible contender for the larger processors if there are plans to provide hard disks). Acorn seems to be staffed by people who think it less expensive to pay for one-off compilers than to provide a coherent software product range. Until Acorn revises this stance, users who want to use the current BBC computer as an inexpensive graphics terminal to another system should consider looking elsewhere for their backend processor.

## Documentation

For documentation, we received a photocopy of a pre-release version of the User Manual. It was filled with typographical mistakes and references to page 000 and ZZZZ. Ignoring these


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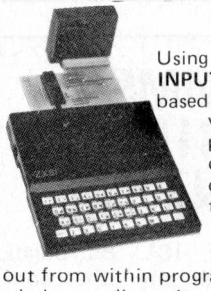

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# THE BBC MICRO

*Continued from previous page*

and assuming certain omissions are going to be rectified, the manual looked really first-rate. It is produced in a clear typeface (hopefully it will be ring-bound like the Atom manual) and has a comprehensive contents and index. There is an enormous section entitled 'Basic keywords: every keyword explained' — and that is what it does. Each word gets at least a page, which always contains a purpose, which is a lengthy explanation for the beginner; examples; a description, which is a briefer description for the experienced programmer and, if required, sample programs.

Most manuals are written either by programmers because they have to document their software (even if they don't have expressive skills) or technical writers who probably have little understanding of the material they are trying to explain. Acorn hired John Coll, formerly an electronics teacher and micro journalist, to write the manual. His experience in explaining technical information to new users shows.

Our version of the manual had only a small section (very good as far as it went) on programming. Chris Curry of Acorn said that this section will be expanded. We hope this is finished by the time the first machines are delivered. Similarly, the machine operating system chapter is skimpy — this time due to the fact that the MOS has not been finalised.

Benchmark Timings

All timings in seconds.

| | |
|---|---|
| 1 | 1.0 |
| 2 | 3.1 |
| 3 | 8.2 |
| 4 | 8.7 |
| 5 | 9.1 |
| 6 | 13.9 |
| 7 | 21.4 |
| 8 | 5.1 |

## Prices

The prices below are *exclusive* of VAT and the only ones available at the time of this review. Machines can be purchased from: BBC Microcomputer Systems, 14 Station Road, Kettering, Northamptonshire NN15 7HE.

| | |
|---|---|
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## Conclusion

Does the BBC Computer fulfil the promises of its advance publicity? The system is less like an Atom than everybody said it was going to be and the Basic is less like Microsoft's than everybody said it was going to be. Everybody may not agree, but neither of these is particularly important. On the other hand, it does seem to meet the advanced specification which almost everybody seems to have a copy of — and that is important. If the production models can overcome the heating/instability problem and if Acorn can succeed in continuing its development path so that the expansion options materialise, then there is no reason why the BBC Computer shouldn't make all its potential owners happy. This is the system through which many members of the public are going to obtain a glimpse of the world of computing; we are happy that this should be the case.

END

| Mode | Facilities | Memory usage |
|---|---|---|
| 0. | 640 x 256 2 colour graphics and 80 x 32 text | 20k |
| 1. | 320 x 256 4 colour graphics and 40 x 32 text | 20k |
| 2. | 160 x 256 16 colour graphics and 20 x 32 text | 20k |
| 3. | 80 x 25 2 colour text | 16k |
| 4. | 320 x 256 2 colour graphics and 40 x 32 text | 10k |
| 5. | 160 x 256 4 colour graphics and 20 x 32 text | 10k |
| 6. | 40 x 25 2 colour text | 8k |
| 7. | 40 x 25 Teletext display | 1k |

*Fig 2 Screen configurations*

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# INSIDE THE INTERPRETER

*Continued from page 83*

Crystal Basic program. That's fine — but replace line 6 by a: sin (1) and the execution time for compiled Pascal becomes 8.4 seconds — only a 30 percent improvement over interpreted Basic! This poor improvement is explained by the fact that both the interpreter and the compiled program must do more or less the same to evaluate a sine, which is taking up most of the time anyway. Thus compilers do give significant speed improvements if only simple arithmetic is involved — but these worsen as soon as floating point arithmetic is introduced.

## Conclusions

I hope that I have shown that it is worth getting to know your favourite interpreter — using the two techniques of examining the stored program and running test programs like the examples I have used (or studying the assembler source if you are lucky enough to have access to it). That knowledge can then be used to write more efficient, and faster programs. The techniques I have proposed are by no means definitive, or complete, and I would welcome any new ideas, or revelations, on this subject.

*I must thank my long suffering colleagues, who patiently waited while I attacked their machines with a stopwatch!*

## References

[1] Greeb, FJ, 'Denver Tiny Basic for 8080s', *Dr Dobbs*, March 1976.

[2] Farvour, J, 'Microsoft Basic Decoded, and other mysteries'. *TRS80 Information Series*, Vol. 2.

END

# DIFFERENT DRUMMER

*Continued from page 99*

leave the lead floating around inside the plug! It is best to quit the program (option 5) rather than stop, as quit resets the ports to normal before ending the program. Switch the drumbox off *before* quitting.

It should be apparent from the above description that there is a wide scope for producing interesting and complex rhythms using this project. Also, the visual display opens up the possibility of using the unit as a teaching aid to assist in the understanding of music and rhythm.

Finally, Figure 12 shows how disco and jazz rhythms might look when programmed. You the reader will no doubt be able to think of many other examples.

*For their help with this project, I would like to thank Al Ball, To Dodd, Martin and PK.*

END

# XEROX 820

*Continued from page 119*

unit. A 6-megabyte drive is already being used within the company, so it should be available very soon.

## Conclusions

The Xerox 820 is a vanilla-flavoured computer: not very exciting, but fine if that's what you want. I can't see it eating into Apple's user base, but some potential customers will be attracted by the idea of buying a computer from a company they already know and trust. Assuming that the documentation and firmware are brought into line with each other, my main reservations are the unusually low capacity of the 5¼in disk drives and the quality of the keyboard fitted to the review machine. END

# CALCULATOR CORNER

*Continued from page 143*

## Computing memory usage

The number of steps used must be found not from a paper listing but from the machine itself by the Steps Remaining counter or line numbers, or MEM command, or whatever. Total memory is to be counted as the number of steps free when the partition is set to maximum program area with an empty machine. The percentage, then is, obviously, 100x Steps Used/Total Memory.

Unfortunately, I didn't apply these criteria consistently at the start and so some Benchmarks will have to be revised; I hope to receive figures for machines I don't have from readers and to publish a comprehensive list soon.

END

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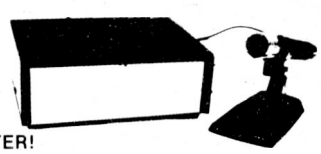

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# ZX81 PRINTER

*Continued from page 77*

anything apart from the computer. Connecting it to the back of the printer makes it stick out further and is more liable to surreptitious nudges from stray objects. This caused a great deal of swearing and cursing when I was using the system, but it can be overcome by putting the ZX81 on a pile of books so that the RAMpack doesn't droop and touch the table as it is inclined to do when the printer is being used. Really, though, I don't think Sinclair could have found another convenient place to join it all together apart from, perhaps, another socket at the other side, but then the system would still be just as likely to crash. Finally, I found the length of cable between a printer and ZX81 a bit short, which means they are rather too close together. Although this doesn't prevent you from doing anything that a long cable would promote, it can be rather annoying at times.

Still, brickbats delivered, I do think it's good value and, at the price, it's totally unique. I believe Hewlett Packard makes a similar product which is considerably more expensive but I don't know of any other tiny printers in this price range — the Sinclair costs £49.95 which includes a beefier PSU to power computer and printer and replaces the original one. It will, in the new year, be available through W H Smith so not everyone will be braving the perils of mail order! I can't see anyone having the slightest trouble setting it up and getting it working — it really is child's play and I'm sure many kids (and dads) will get many happy hours of LLISTing and COPYing from it. I wonder how many hardware freaks will find ways of hooking it up to their programmable calculators. . .?

END

# BOOKFARE

through presenting, and briefly discussing, coded examples.

Neither the *Primer* nor *Simple Pascal* describe the full language. Both are written in clipped lecture-note style rather than in free-flowing text and cover their chosen ground efficiently but unimaginatively. If you have money, the *Primer* is the better book because it has the wider scope, but for a straight-down-the-line Pascal intro, the cheaper *Simple Pascal* is adequate.

## Fortran goes to seeds or well structured Fortran

Harice L Seeds has produced a well thought-out, well structured introduction to Fortran. The title clearly explains Seeds' aim: *Structuring Fortran 77 for Business and General Applications.*

Fortran was originally developed (and is still mainly used) for scientific tasks. But Seeds shows how it can be applied to more general business computing problems. By shifting the applications emphasis he (she?) opens the subject to a broader audience who might otherwise be put off by stacks of equations.

Out of over 500 pages, the first 35 provide a general introduction to programming, with an emphasis on the structured variety. The next 27 chapters introduce Fortran by breaking up the facilities into digestible chunks. The book is well structured because thoughtful aids have been provided to assist the reader. Each chapter begins with a statement of objectives. Review questions are provided within chapters to indicate where the reader should pause and think. And there is also a liberal sprinkling of practical examples.

As Seeds has been given sufficient bookspace to spread the information, the reader can luxuriate in the well-presented, easy-paced material. The built-in emphasis on structured programming also means that good programming principles are inculcated. Fortran 77 is the current modern standard, so readers can also be sure that the language details are applicable to most computers.

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Of course, if you are primarily interested in the scientific bent of Fortran, this is not really your book. But if you have shied away from Fortran because you were frightened of its scientific bias, this is a good way of getting into the language.

## Here's tough Ada

Ada is one of the most important recent language innovations. It is important because the US Department of Defence will use Ada as its standard language for real time projects and it is likely to be adopted by other defence departments. This support is bound to mean that many manufacturers will support Ada. So Ada cannot be ignored, even if you are unlikely to bump into her in your personal computing strolling.

*The Ada Programming Language* by I C Pyle is not an everyman's guide to the subject. Pyle assumes the reader has a good knowledge of programming techniques. As Ada is a relative of Pascal, familiarity with Pascal is useful, as is knowledge of other languages like Fortran or PL/1. Pyle provides special notes for Pascal and Fortran programmers. For a Basic programmer, Ada will seem alien and complex. It has many facilities and concepts which are a far cry from easy-to-use Basic. But Pyle doesn't really attempt to provide a general, readable introduction. His approach is that of a programming professional and academic expert talking to others of his ilk.

The books is written in the concise prose usually found in manuals. If you have the knowledge to meet Pyle a bit more than half way, he will lead you into Ada's secrets. Although Pyle says the book could be used by teachers to illustrate general programming principles, he provides little guidance to assist those who are not already fairly well aware of Ada's significance.

As the Ada momentum gathers, I look forward to someone writing a more accessible book for a wider market. There is a fascinating history to Ada, its design objectives and the language research that has gone into it. Pyle, whose main concern is describing the language itself, barely attempts to fill in this background.

## Paperback writer

A paperback edition has been published of one of the most readable books on compilers, *Writing Interactive Compilers and Interpreters* by Peter Brown, reviewed in Bookfare in February 1980. Brown deals entertainingly and practically with his apparently complex subject matter. A very good buy.

This month's Bookfare included:
*Beyond Cobol — Survival In Business Applications Programming* by Gary D Brown (John Wiley & Sons, £12.25).
*Cobol Workbook — A self-study introduction to the Cobol Programming Language* by Andrew Parkin (Edward Arnold, £2.95).
*Program Your Microcomputer in Basic* by Peter Gosling (Macmillan, £3.95).
*A Primer on Pascal* by Richard Conway, David Gries and E Carl Zimmerman (Prentice-Hall International/Winthrop, £9.70).
*Simple Pascal* by James J McGregor and Alan H Watt (Pitman, £3.50).
*Structuring Fortran 77 for Business and General Applications* by Harice L Seeds (John Wiley & Sons, £10.85)
*The Ada Programming Language* by I C Pyle (Prentice Hall International, £8.95)
*Writing Interactive Compilers and Interpreters* by P J Brown (John Wiley & Sons, £5.95 paperback). END

# BLUDNERS

Two of last month's programs — 'ZX81 Battleships' and 'Sheepdog Trial' — contained errors. Unfortunately, we haven't yet been able to get the corrections from the authors but as soon as we get them we'll print them here — *please* don't ring us!


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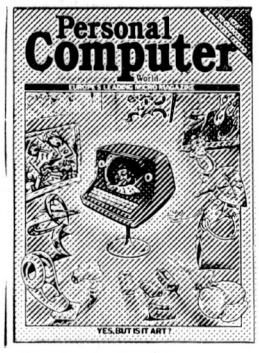


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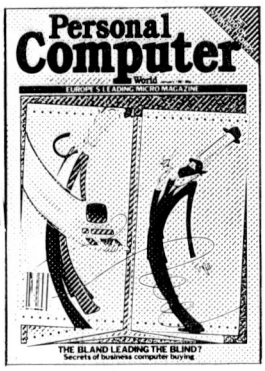


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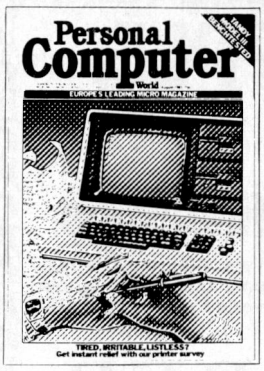


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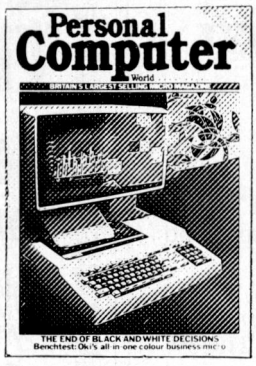


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Vol 4 No 12
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Benchtests: Sharp MZ-80B Philips P2000/School network/ BBC Micro inside story/ 'Turtle' Graphics for Apple/ Forth language/ Curve fitting/ Calc corner: HP14C review/ Programs: PET Fantasy, ZX81 Battleships and cruisers.

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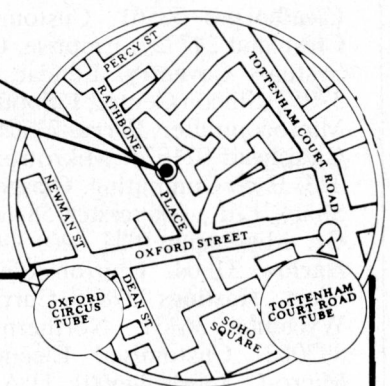


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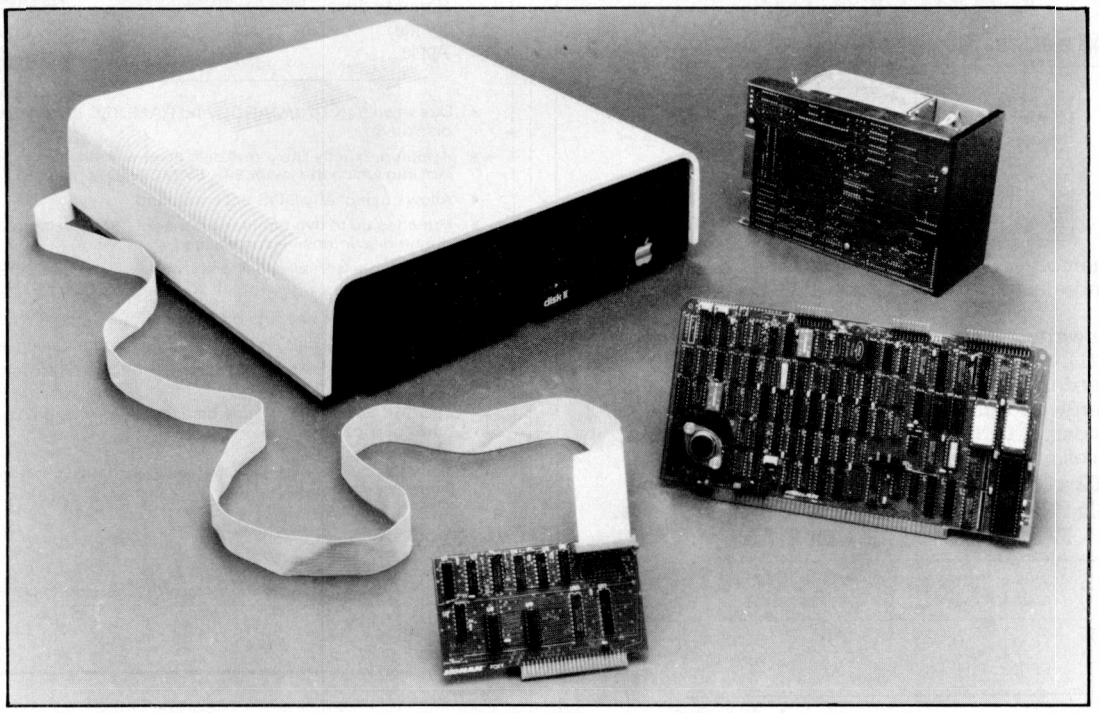

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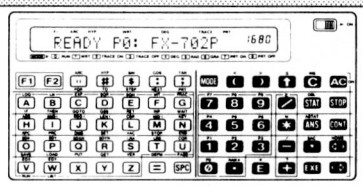


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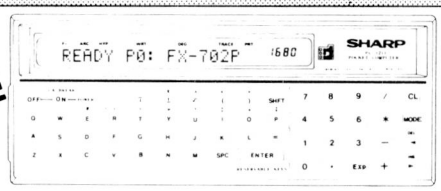


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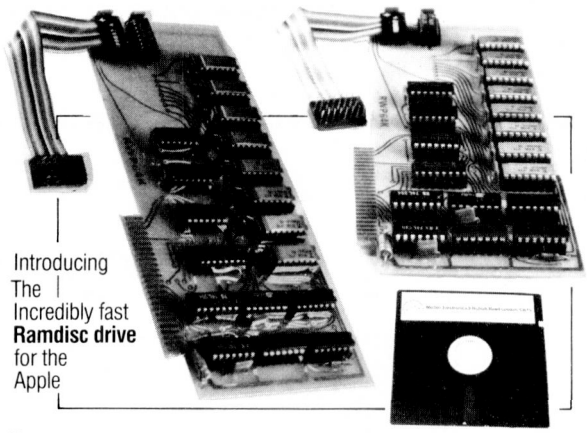


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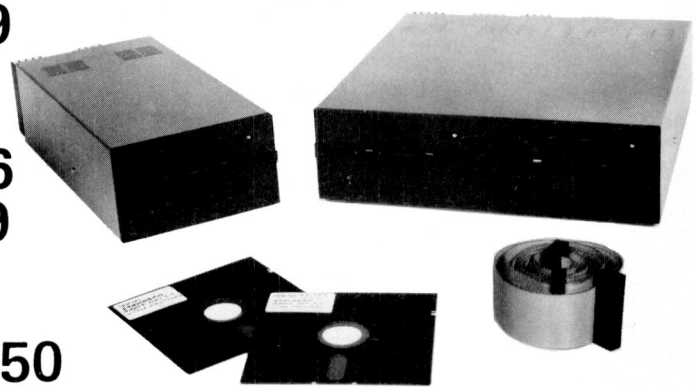

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(Described in PCW Oct/Nov 81)

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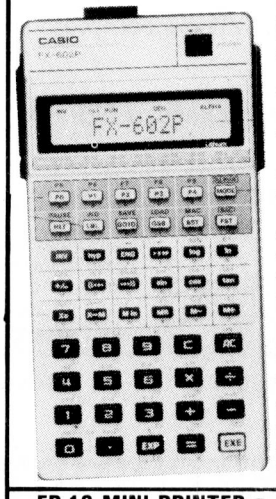


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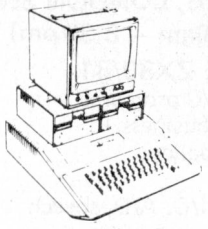

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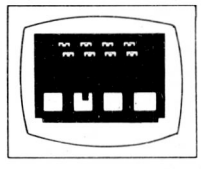

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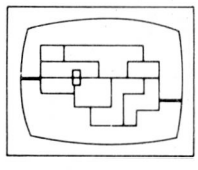

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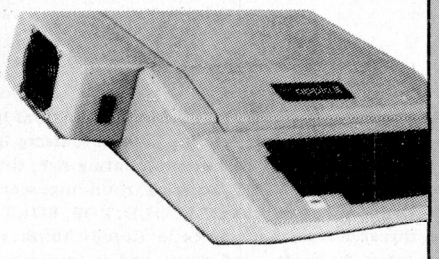

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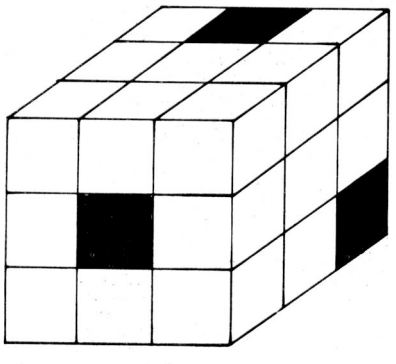

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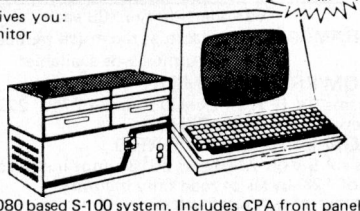

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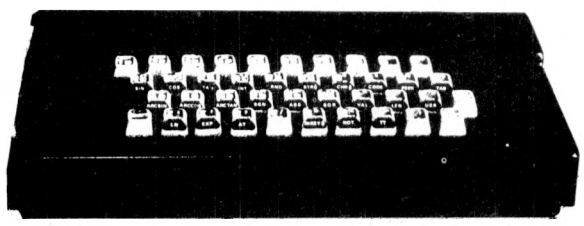

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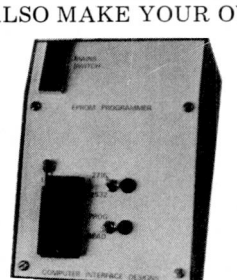

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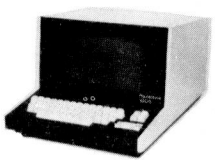

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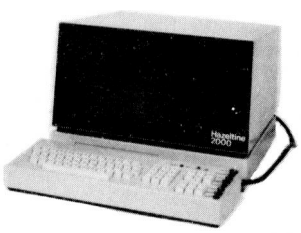

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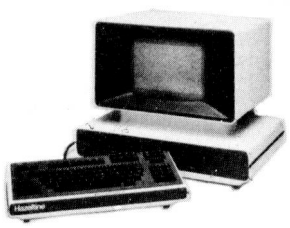

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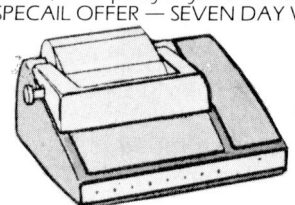

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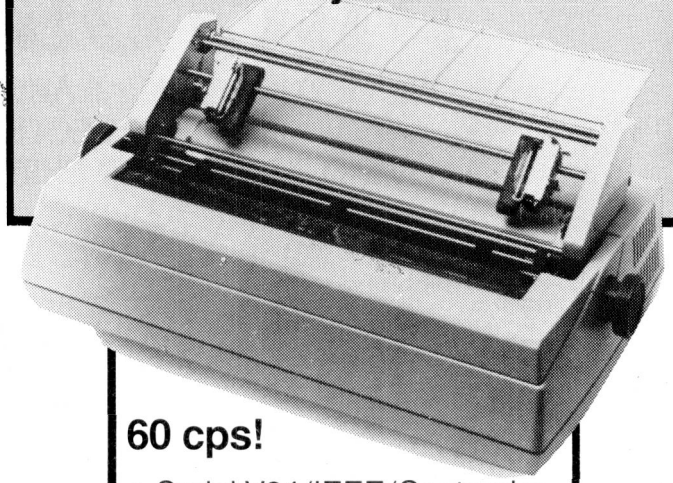

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| | |
|---|---|
| 1702 | 299 |
| 1802CP | 750 |
| 2101-2 | 110 |
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| 2114-450 | 90 |
| 2114L-300n | 99 |
| 2114L-200n | 130 |
| 2118-3 | 250 |
| 2118-4 | 200 |
| 2147-3 | 495 |
| 2532-450n | 525 |
| 2708 | 200 |
| 2716-5V | 250 |
| 2732-450n | 455 |
| 2147 | 00 |
| 4027 | 240 |
| 4116 | 85 |
| 4116-150n | 100 |
| 4116-200n | 85 |
| 4118-250IC | 450 |
| 4164-200 | 798 |
| 4315-4K | 795 |
| 4334-3 (CMOS 2114) | 325 |
| 4844-364K | 760 |
| 4864-3 64K | £12 |
| 6116-3 16K CMOS RAM | 855 |
| 6147-3 | |
| 6502 CPU | 450 |
| 6503 | 450 |
| 6504-250 | 295 |
| 6505 | 295 |
| 6520 PIA | 310 |
| 6522 VIA | 435 |
| 6530 RRIOT | 1350 |
| 6532 RIOT | 750 |
| 6545 CRTC | 1450 |
| 6551 ACIA | 785 |
| 6592 PC | £26 |
| 6800 | 375 |
| 6802 | 500 |
| 6803 | 1360 |
| 6804 | 160 |
| 6805 | 670 |
| 6808 | 520 |
| 6809 | 999 |
| 6810 | 175 |
| 6820 | 175 |
| 6821 | 150 |
| 6840 | 470 |
| 6843 | 1450 |
| 6845 | 975 |
| 6847 | 850 |
| 6850 | 175 |
| 6852 | 255 |
| 6875 | 550 |
| 8080A | 350 |
| 8085A | 650 |
| 81LS95 | 115 |
| 81LS96 | 115 |
| 81LS97 | 115 |
| 8166 | 00 |
| 8123 | 125 |
| 8202 | £25 |
| 8212 | 170 |
| 8214 | 425 |
| 8216 | 170 |
| 8224 | 250 |
| 8226 | 250 |
| 8228 | 250 |
| 8251 | 370 |
| 8253 | 799 |
| 8255 | 375 |
| 8257 | 800 |
| 8T26A | 99 |
| 8T27 | 150 |
| 8T28A | 135 |
| 8T31 | 350 |
| 8T95N | 135 |
| 8T97N | 135 |
| AM26L531C | 125 |
| AM26L532A | 125 |
| AY-3-1015 | 350 |
| AY-3-8910 | 620 |
| AY-3-8912 | 625 |
| AY-5-1013 | 350 |
| AY-5-2376 | 700 |
| FD1771 | £18 |
| IM6402 | 380 |
| MC1488 | 62 |
| MC1489 | 62 |
| MC14411 | 695 |
| MC14412 | 800 |
| MM5280D | 695 |
| RO-3-2513L | 700 |
| RO-3-2513U | 700 |
| SFF96364E | 800 |
| SFC71301 | 820 |
| TMS2716-3V | 875 |
| TMS6011 | 365 |
| ULN2003 | 85 |
| ULN2004 | 150 |
| UPD80C35C | £11 |
| Z80CPU 2.5 | 360 |
| Z80ACPU4M | 445 |
| Z80 P10 | 350 |
| Z80A P10 | 400 |
| Z80 CTC | 350 |

| | |
|---|---|
| Z80 CTC | 350 |
| Z80A CTC | 400 |
| Z80DMA | 999 |
| Z80S10-1 | £15 |
| Z80AS10 | £23 |
| Z80 DART | 726 |
| Z80A DART | 725 |
| ZN419CE | 190 |
| ZN423E | 195 |
| ZN424E | 130 |
| ZN425E | 350 |
| ZN426E | 325 |
| ZN427E | 625 |
| ZN428E | 478 |
| ZN429E | 210 |
| ZN1034E | 200 |
| ZN1040E | 775 |
| 74L00 | 68 |
| 74L30 | 50 |
| 74L47 | 380 |
| 74L75 | 145 |
| 74L85 | 349 |
| 74L121 | 165 |
| 74L123 | 325 |
| 74S132 | 138 |
| 74S138 | 240 |
| 74S188 | 210 |
| 74S189 | 158 |
| 74S194 | 360 |
| 74S201 | 350 |
| 74S241 | 540 |
| 74S262 | 850 |
| 74S287 | 325 |
| 74S288 | 210 |
| 74S470 | 325 |
| 74S471 | 620 |
| 74S472 | 1150 |
| 74S475 | 825 |
| 74S571 | 620 |
| 75150 | 140 |
| 75108 | 350 |
| 375154 | 150 |
| 75188 | 65 |
| 75189 | 65 |
| 75322 | 165 |
| 75450 | 95 |
| 75451/2 | 70 |
| 75454 | 225 |
| 75491/2 | 70 |

## TTL7400 (TEXAS)

| | |
|---|---|
| 7400 | 11 |
| 7401 | 11 |
| 7402 | 11 |
| 7403 | 14 |
| 7404 | 14 |
| 7405 | 18 |
| 7406 | 28 |
| 7407 | 28 |
| 7408 | 16 |
| 7409 | 16 |
| 7410 | 14 |
| 7411 | 20 |
| 7412 | 20 |
| 7413 | 24 |
| 7414 | 32 |
| 7416 | 25 |
| 7417 | 25 |
| 7420 | 16 |
| 7421 | 20 |
| 7422 | 20 |
| 7423 | 22 |
| 7425 | 28 |
| 7426 | 30 |
| 7427 | 27 |
| 7428 | 28 |
| 7430 | 16 |
| 8432 | 26 |
| 7433 | 27 |
| 7437 | 27 |
| 7438 | 27 |
| 7440 | 17 |
| 7441 | 68 |
| 7442 | 38 |
| 7443 | 90 |
| 7444 | 90 |
| 7445 | 65 |
| 7446 | 55 |
| 7447 | 50 |
| 7448 | 50 |
| 7450 | 16 |
| 7451 | 16 |
| 7453 | 16 |
| 7454 | 16 |
| 7460 | 16 |
| 7470 | 35 |
| 7472 | 30 |
| 7473 | 30 |
| 7474 | 25 |
| 7475 | 40 |
| 7476 | 30 |
| 7480 | 48 |
| 7481 | 120 |
| 7482 | 70 |
| 7483 | 50 |
| 7484 | 80 |
| 7485 | 95 |
| 7486 | 26 |
| 7489 | 205 |
| 7490 | 28 |

| | |
|---|---|
| 7491 | 45 |
| 7492 | 30 |
| 7493 | 30 |
| 7494 | 34 |
| 7495 | 50 |
| 7496 | 45 |
| 7497 | 120 |
| 74100 | 85 |
| 74104 | 54 |
| 74105 | 55 |
| 74107 | 32 |
| 74109 | 35 |
| 74110 | 40 |
| 74111 | 55 |
| 74112 | 170 |
| 74116 | 88 |
| 74118 | 80 |
| 74119 | 90 |
| 74120 | 75 |
| 74121 | 30 |
| 74122 | 45 |
| 74123 | 50 |
| 74125 | 42 |
| 74126 | 40 |
| 74128 | 42 |
| 74132 | 48 |
| 74136 | 35 |
| 74141 | 70 |
| 74142 | 190 |
| 74143 | 250 |
| 74144 | 250 |
| 74145 | 70 |
| 74147 | 99 |
| 47148 | 75 |
| 47150 | 80 |
| 74151 | 45 |
| 74153 | 45 |
| 74154 | 75 |
| 74155 | 75 |
| 74156 | 75 |
| 74157 | 45 |
| 74159 | 99 |
| 74160 | 60 |
| 74161 | 60 |
| 74162 | 62 |
| 74163 | 64 |
| 74164 | 64 |
| 74165 | 62 |
| 74166 | 65 |
| 74167 | 185 |
| 47170 | 168 |
| 74172 | 290 |
| 74173 | 65 |
| 74174 | 72 |
| 74175 | 72 |
| 74176 | 55 |
| 74177 | 75 |
| 74178 | 95 |
| 74179 | 68 |
| 74180 | 65 |
| 74181 | 140 |
| 74182 | 75 |
| 74184 | 99 |
| 74185 | 99 |
| 74188 | 290 |
| 74190 | 70 |
| 74191 | 70 |
| 74192 | 70 |
| 74193 | 65 |
| 74194 | 75 |
| 74195 | 65 |
| 74196 | 65 |
| 74197 | 65 |
| 74198 | 99 |
| 74199 | 99 |
| 74221 | 80 |
| 74246 | 150 |
| 74247 | 150 |
| 74248 | 150 |
| 74249 | 150 |
| 74251 | 80 |
| 74259 | 195 |
| 74265 | 65 |
| 74273 | 195 |
| 74276 | 150 |
| 74278 | 160 |
| 74279 | 90 |
| 74283 | 90 |
| 74284 | 199 |
| 74285 | 199 |
| 74290 | 105 |
| 74293 | 125 |
| 74297 | 236 |
| 74298 | 100 |
| 74351 | 195 |
| 74365 | 55 |
| 47366 | 55 |
| 74367 | 55 |
| 74368 | 55 |
| 74390 | 99 |
| 47393 | 99 |
| 74490 | 120 |

## 74LS

| | |
|---|---|
| LS00 | 12 |
| LS01 | 13 |
| LS02 | 14 |
| LS03 | 14 |
| LS283 | 45 |
| LS290 | 57 |
| LS293 | 46 |
| LS04 | 15 |
| LS06 | 15 |
| LS08 | 15 |
| LS09 | 15 |
| LS10 | 15 |
| LS11 | 15 |
| LS12 | 15 |
| LS13 | 30 |
| LS14 | 48 |
| LS15 | 15 |
| LS20 | 15 |
| LS21 | 15 |
| LS22 | 15 |
| LS26 | 18 |
| LS27 | 15 |
| LS28 | 20 |
| LS30 | 18 |
| LS32 | 15 |
| LS33 | 16 |
| LS37 | 16 |
| LS38 | 16 |
| LS40 | 16 |
| LS42 | 35 |
| LS47 | 40 |
| LS48 | 80 |
| LS49 | 60 |
| LS51 | 15 |
| LS54 | 15 |
| LS55 | 30 |
| LS63 | 150 |
| LS73 | 25 |
| LS74 | 25 |
| LS75 | 28 |
| LS76 | 20 |
| LS78 | 24 |
| LS83 | 50 |
| LS85 | 70 |
| LS86 | 38 |
| LS90 | 35 |
| LS91 | 80 |
| LS92 | 36 |
| LS93 | 36 |
| LS95 | 45 |
| LS96 | 120 |
| LS107 | 43 |
| LS109 | 30 |
| LS112 | 30 |
| LS113 | 40 |
| LS114 | 35 |
| LS122 | 44 |
| LS123 | 55 |
| LS124 | 105 |
| LS125 | 30 |
| LS126 | 30 |
| LS132 | 45 |
| LS133 | 35 |
| LS136 | 28 |
| LS137 | 35 |
| LS139 | 38 |
| LS145 | 75 |
| LS147 | 199 |
| LS148 | 99 |
| LS151 | 39 |
| LS153 | 39 |
| LS155 | 39 |
| LS156 | 39 |
| LS157 | 35 |
| LS158 | 36 |
| LS160 | 41 |
| LS161 | 41 |
| LS162 | 41 |
| LS163 | 41 |
| LS164 | 48 |
| LS165 | 145 |
| LS166 | 85 |
| LS170 | 170 |
| LS173 | 72 |
| LS174 | 72 |
| LS175 | 58 |
| LS181 | 130 |
| LS183 | 275 |
| LS190 | 58 |
| LS191 | 58 |
| LS192 | 58 |
| LS193 | 65 |
| LS194 | 40 |
| LS195 | 40 |
| LS196 | 58 |
| LS197 | 85 |
| LS200 | 345 |
| LS202 | 345 |
| LS221 | 60 |
| LS240 | 96 |
| LS241 | 96 |
| LS242 | 85 |
| LS243 | 85 |
| LS244 | 80 |
| LS245 | 90 |
| LS247 | 40 |
| LS248 | 65 |
| LS249 | 68 |
| LS251 | 40 |
| LS253 | 40 |
| LS257 | 48 |
| LS258 | 40 |
| LS259 | 85 |
| LS261 | 195 |
| LS266 | 25 |
| LS273 | 90 |
| LS275 | 290 |
| LS279 | 88 |
| LS280 | 250 |
| LS295 | 215 |
| LS298 | 130 |
| LS299 | 420 |
| LS300 | 157 |
| LS302 | 175 |
| LS320 | 270 |
| LS323 | 270 |
| LS423 | 200 |
| LS323 | 270 |
| LS324 | 200 |
| LS325 | 320 |
| LS326 | 330 |
| LS327 | 315 |
| LS347 | 150 |
| LS348 | 190 |
| LS352 | 185 |
| LS353 | 185 |
| LS365 | 37 |
| LS366 | 37 |
| LS367 | 37 |
| LS368 | 90 |
| LS373 | 75 |
| LS374 | 75 |
| LS375 | 48 |
| LS377 | 90 |
| LS378 | 69 |
| LS379 | 65 |
| LS384 | 250 |
| LS385 | 378 |
| LS390 | 62 |
| LS393 | 60 |
| LS395 | 199 |
| LS399 | 220 |
| LS445 | 140 |
| LS471 | 620 |
| LS490 | 245 |
| LS541 | 135 |
| LS640 | 225 |
| LS641 | 225 |
| LS645 | 210 |
| LS668 | 175 |
| LS669 | 150 |
| LS670 | 175 |
| LS673 | 550 |
| LS674 | 750 |

## CMOS

| | |
|---|---|
| 4000 | 14 |
| 4001 | 14 |
| 4002 | 14 |
| 4006 | 66 |
| 4007 | 18 |
| 4008 | 62 |
| 4009 | 35 |
| 4010 | 40 |
| 4011 | 15 |
| 4012 | 18 |
| 4013 | 34 |
| 4014 | 75 |
| 4015 | 66 |
| 4016 | 32 |
| 4017 | 48 |
| 4018 | 68 |
| 4019 | 42 |
| 4020 | 61 |
| 4021 | 70 |
| 4022 | 66 |
| 4023 | 20 |
| 4024 | 45 |
| 4025 | 19 |
| 4026 | 130 |
| 4027 | 38 |
| 4028 | 58 |
| 4029 | 77 |
| 4030 | 50 |
| 4031 | 170 |
| 4032 | 125 |
| 4033 | 165 |
| 4034 | 195 |
| 4035 | 95 |
| 4036 | 275 |
| 4037 | 115 |
| 4038 | 110 |
| 4039 | 290 |
| 4040 | 59 |
| 4041 | 78 |
| 4042 | 60 |
| 4043 | 70 |
| 4044 | 65 |
| 4045 | 170 |
| 4046 | 75 |
| 4047 | 75 |
| 4048 | 55 |
| 4049 | 30 |
| 4050 | 30 |
| 4051 | 78 |
| 4052 | 78 |
| 4053 | 78 |
| 4054 | 125 |
| 4055 | 125 |
| 4056 | 120 |
| 4057 | 1915 |
| 4059 | 480 |
| 4060 | 90 |
| 4061 | 1225 |
| 4062 | 995 |
| 4063 | 99 |
| 4066 | 36 |
| 4067 | 399 |
| 4068 | 22 |
| 4069 | 20 |
| 4070 | 26 |
| 4071 | 20 |
| 4072 | 20 |
| 4073 | 20 |
| 4075 | 20 |
| 4076 | 60 |
| 4077 | 26 |
| 4078 | 26 |
| 4081 | 26 |
| 4082 | 21 |
| 4085 | 65 |
| 4086 | 70 |
| 4089 | 140 |
| 4093 | 43 |
| 4094 | 168 |
| 4095 | 90 |
| 4096 | 90 |
| 4097 | 320 |
| 4098 | 88 |
| 4099 | 95 |
| 4160 | 95 |
| 4161 | 99 |
| 4162 | 99 |
| 4163 | 99 |
| 4174 | 99 |
| 4175 | 105 |
| 4194 | 105 |
| 4408 | 790 |
| 4409 | 790 |
| 4410 | 725 |
| 4411 | 695 |
| 4412 | 800 |
| 4415 | 480 |
| 4419 | 280 |
| 4422 | 770 |
| 4433 | 770 |
| 4435 | 850 |
| 4440 | 999 |
| 4450 | 350 |
| 4451 | 350 |
| 4490 | 350 |
| 4500 | 675 |
| 4501 | 28 |
| 4502 | 90 |
| 4503 | 50 |
| 4504 | 105 |
| 4506 | 65 |
| 4507 | 40 |
| 4508 | 265 |
| 4510 | 68 |
| 4511 | 68 |
| 4512 | 75 |
| 4513 | 199 |
| 4514 | 195 |
| 4515 | 198 |
| 4516 | 75 |
| 4517 | 415 |
| 4518 | 42 |
| 4519 | 29 |
| 4520 | 78 |
| 4521 | 200 |
| 4522 | 125 |
| 4526 | 95 |
| 4527 | 115 |
| 4528 | 80 |
| 4529 | 150 |
| 4530 | 90 |
| 4531 | 130 |
| 4532 | 110 |
| 4534 | 500 |
| 4536 | 295 |
| 4538 | 115 |
| 4539 | 115 |
| 4541 | 140 |
| 4543 | 135 |
| 4544 | 150 |
| 4549 | 395 |
| 4553 | 299 |
| 4554 | 190 |
| 4555 | 50 |
| 4556 | 55 |
| 4557 | 320 |
| 4558 | 120 |
| 4559 | 395 |
| 4560 | 180 |
| 4561 | 104 |
| 4562 | 495 |
| 4566 | 175 |
| 4568 | 250 |
| 4569 | 175 |
| 4572 | 76 |
| 4580 | 460 |
| 4581 | 250 |
| 4582 | 99 |
| 4583 | 99 |
| 4584 | 48 |
| 4585 | 99 |
| 4597 | 330 |
| 4598 | 290 |
| 4599 | 595 |
| 40097 | 88 |
| 40100 | 215 |
| 40101 | 130 |
| 40102 | 180 |
| 40103 | 175 |
| 40104 | 95 |
| 40105 | 115 |
| 40106 | 75 |
| 40107 | 60 |
| 40108 | 450 |
| 40109 | 100 |
| 40110 | 300 |
| 40114 | 240 |

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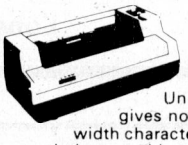

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|---|---|---|
| 2114L-450n | 90p | 85p |
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| 2114L-200n | 130p | 115p |
| 2708 | 200p | 185p |
| 2532 | 525p | 499p |
| 2716 | 230p | 199p |
| 2732 | 455p | 390p |
| 4027 | 240p | 215p |
| 4116 | 85p | 70p |
| 4334-3 | 325p | 290p |
| 6116-3 | 855p | 805p |
| 8216 | 120p | 80p |

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## CRYSTALS

| | |
|---|---|
| 32 768K Hz | 200 |
| 100K Hz | 270 |
| 200K Hz | 295 |
| 455K Hz | 370 |
| 1M Hz | 295 |
| 1 28M Hz | 392 |
| 1 6M Hz | 323 |
| 1 8M Hz | 323 |
| 1 008M | 290 |
| 1 8432M | 220 |
| 2 0M Hz | 240 |
| 2 4576M | 220 |
| 3 2768M | 220 |
| 3 57954M | 150 |
| 3 6864M | 300 |
| 4 0M Hz | 200 |
| 4 032M Hz | 290 |
| 4 80M Hz | 200 |
| 4 194304M | 200 |
| 4 433619M | 120 |
| 5 0M Hz | 200 |
| 5 185M Hz | 300 |
| 5 24288M | 390 |
| 6 0M Hz | 220 |
| 6 144M Hz | 240 |
| 6 5536M Hz | 200 |
| 7 0M Hz | 200 |
| 7 168M Hz | 250 |
| 7 68M Hz | 200 |
| 8 0M Hz | 200 |
| 8 867237M | 240 |
| 9 00M Hz | 200 |
| 10 0M Hz | 200 |
| 10 7M Hz | 220 |
| 10 24M Hz | 200 |
| 12 0M Hz | 290 |
| 14 31818M | 320 |
| 16 0M Hz | 275 |
| 18 0M Hz | 240 |
| 18 432M | 240 |
| 19 968M Hz | 325 |
| 24 0M Hz | 200 |
| 26 69M | 290 |
| 27 648M | 330 |
| 27 145M | 240 |
| 38 66667M | 290 |
| 48 0M Hz | 270 |
| 100 0M Hz | 375 |
| 116 0M Hz | 300 |

## 'D' CONNECTORS (Cannon type)

| | Plugs | Sockets | Covers plastic |
|---|---|---|---|
| 9 way | 55p | 125p | 145p |
| 15 way | 135p | 198p | 150p |
| 25 way | 170p | 250p | 130p |
| 37 way | 290p | 398p | 185p |

## 25 WAY 'D' CONNECTOR Jumper Lead Cable Assembly.

| | ft. | |
|---|---|---|
| 18" long single end Male | | 520 |
| 18" long single end Female | | 525 |
| 36" long double ended M/M | | 1020 |
| 36" long double ended F/F | | 1010 |
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## JUMPER LEADS (Ribbon Cable Assembly Single ended) DIP 24" length Cable

14 pin **145p** 16 pin **165p**; 24 pin **240p** 40 pin **380p**.

| Double ended DIP | 14 pin | 16 pin | 24 pin | 40 pin |
|---|---|---|---|---|
| 6" | 185p | 205p | 300p | 465p |
| 12" | 198p | 215p | 315p | 490p |
| 24" | 210p | 235p | 345p | 540 |
| 36" | 230p | 250p | 375p | 595p |

## DIL PLUGS (Headers)

| | |
|---|---|
| 14 pin | 44 |
| 16 pin | 49 |
| 24 pin | 88 |
| 40 pin | 255 |

## Ribbon Cable

| | ft. |
|---|---|
| 10 way | 22p |
| 20 way | 40p |

## VOLTAGE REGULATORS

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+5V, +12V, +15V, +18V 50p
1A 5V, 12V, 15V, 18V 55p
78H05 5A/5V 550p, 79HG 850p
78HG 650p, LM309K 135p

## DIL SOCKETS (TEXAS)

| | Low profile | Wire wrap |
|---|---|---|
| 8 pin | 8p | 25p |
| 14 pin | 10p | 35p |
| 16 pin | 10p | 42p |
| 18 pin | 16p | 52p |
| 20 pin | 22p | 60p |
| 22 pin | 25p | 70p |
| 24 pin | 25p | 70p |
| 28 pin | 28p | 80p |
| 36 pin | – | 105p |
| 40 pin | 30p | 99p |

## EDGE CONNECTORS double type

| | 1 | 156 |
|---|---|---|
| 2 x 10 way | – | 135p |
| 2 x 15 way | – | 140p |
| 2 x 18 way | 180p | 145p |
| 2 x 22 way | 199p | 200p |
| 2 x 25 way | 225p | 220p |
| 2 x 30 way | 245p | – |
| 2 x 36 way | 295p | – |
| 2 x 40 way | 315p | – |
| 2 x 43 way | 395p | – |

## IC Test Clips DIL Gold plated contacts.

| | |
|---|---|
| 8 pin **600** | 22 pin **1037** |
| 14 pin **368** | 24 pin **1130** |
| 16 pin **389** | 28 pin **1245** |
| 18 pin **815** | 36 pin **1630** |
| 20 pin **945** | 40 pin **1700** |

## ZERO Insertion Force DIL Sockets

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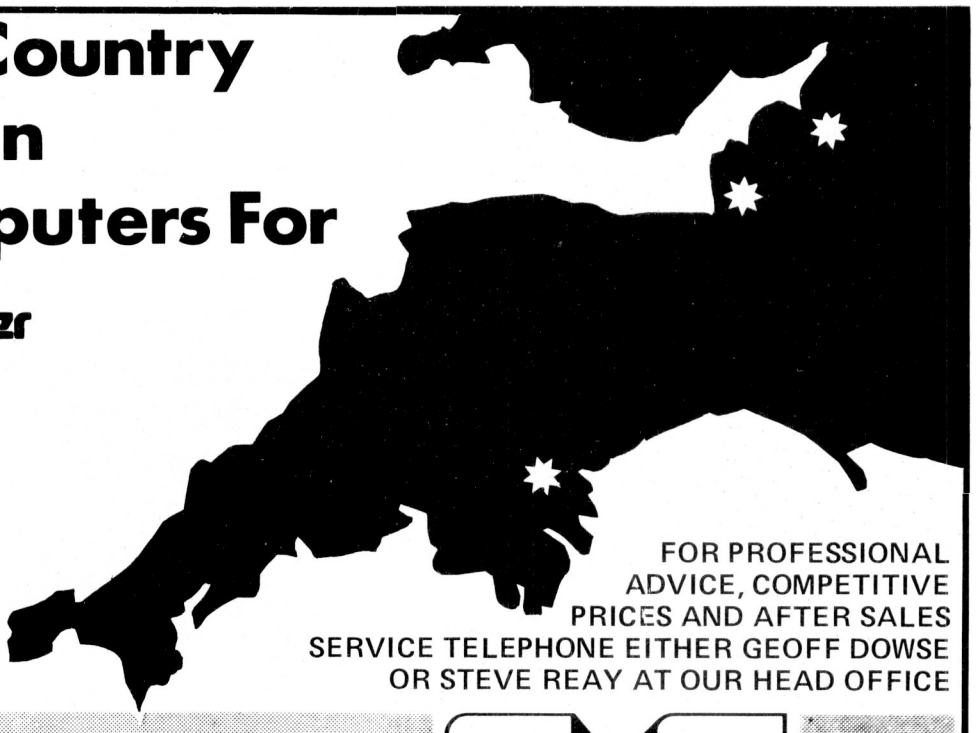

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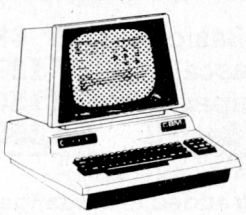

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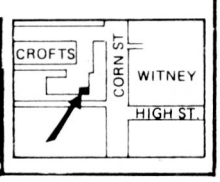


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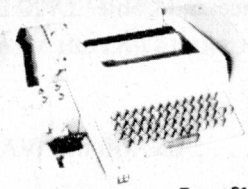

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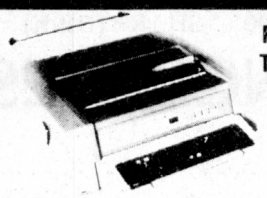

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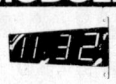


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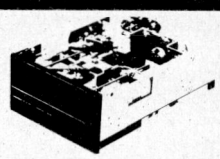

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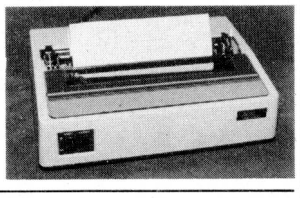

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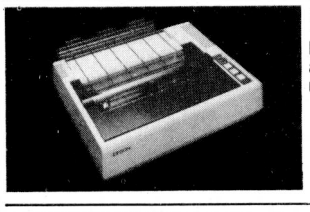

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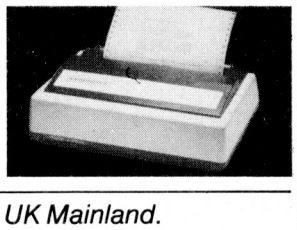

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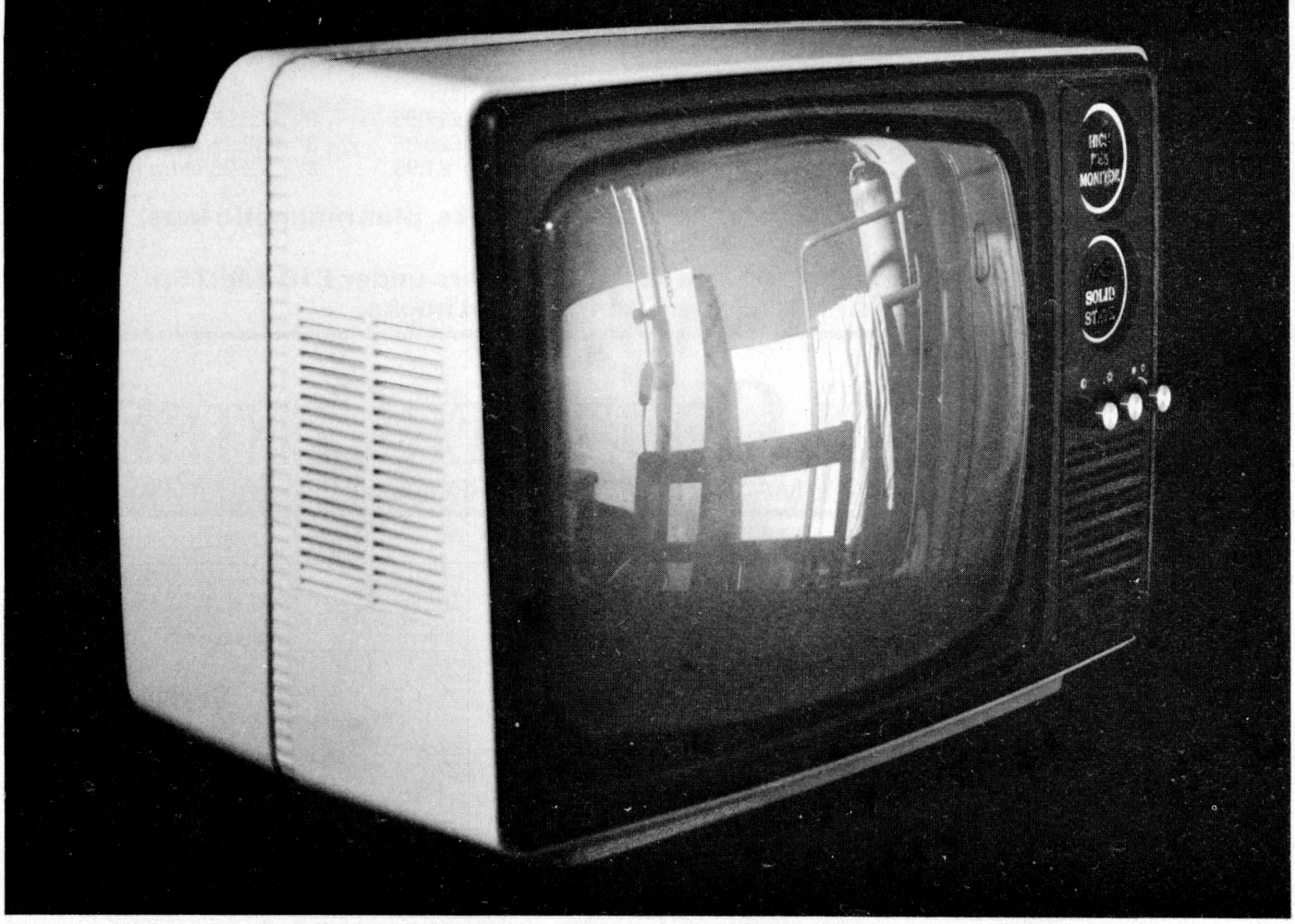

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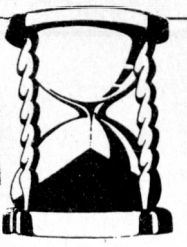

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22. All sections of the Programme and files are fully integrated.
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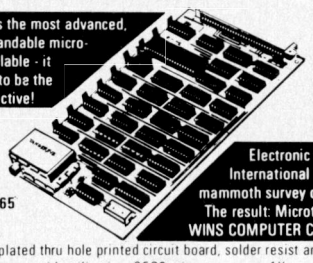
## MICROTAN 65

Microtan 65 is the most advanced, powerful, expandable micro-computer available - it also happens to be the most cost effective!



Electronic Today International held a mammoth survey of kits. The result: Microtan 65 WINS COMPUTER CLASS!

**MICROTAN 65 CONTENTS**

High quality, plated thru hole printed circuit board, solder resist and silk screened component identification. 6502 microprocessor. 1K monitor TANBUG. Now with 'V' Bug. 1K RAM for user programme, stack and display memory. VDU alphanumeric display of 16 rows by 32 characters. MICROTAN 65 system file binder. 136 page, bound, users hardware/software manual with constructional details and sample programmes. Logic and discrete components to fully expand MICROTAN 65.

The MICROTAN 65 kit has won widespread acclaim for its superb presentation. We pay attention to detail!

**KIT FORM £69.00** + £10.35 V.A.T., total £79.35.

**MICROTAN 65** assembled and tested.
Specification as above, but assembled and fully bench tested by ourselves.
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**TANBUG V2.3 KIT (separately) £21.95 incl.**

## MICROTAN 65 OPTIONS

**LOWER CASE PACK**
Two integrated circuits which connect into locations on MICROTAN allowing 128 displayable characters.
**£9.48** + £1.42, total £10.90.

**MINI MOTHER BOARD**
Used to connect Microtan to Tanex.
Built **£10.00** + VAT

**GRAPHICS PACK**
Five integrated circuits which connect into locations on MICROTAN allowing the display of chunky graphics (64 x 64 pixels). What are chunky graphics? Well, imagine a piece of graph paper with 64 squares vertically and 64 squares horizontally, a total of 4096. Each square can be made black on white.
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**20 WAY KEYPAD**
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*Space Invaders game (for use with keypad only)
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MPS 1: Input 120 or 240V AC. Output 5 Volts at 3 Amps Regulated. MPS 1 will power both MICROTAN and TANEX fully expanded. Built on the same size printed circuit board as MICROTAN etc. Available as a fully built and tested unit.
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We have produced a mini-system rack which accepts MICROTAN 65, TANEX and our mini-mother board. It has an integral power supply, just plug it into the mains and away you go! Finished in TANGERINE/BLACK, it gives your system the professional finish. Front panel access for I/O cables. **AVAILABLE AS AN ASSEMBLED UNIT.**
**£56.35** INCL.

## FULL SYSTEM RACK

For the man that has everything! 19 inch wide system rack which accepts: MICROTAN 65, TANEX, TANRAM, SEVEN FURTHER EXPANSION BOARDS, TANDOS and THE SYSTEM POWER SUPPLY. Available in many formats, e.g. Individual front panels, full width hinged front panel, back panel with or without connectors.
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**FULLY BUILT, TESTED, and housed**

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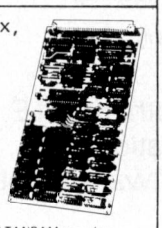
**System Rack Micron £550.00 incl.**

6502 based microcomputer VDU alpha numeric display. Powerful monitor TANBUG. 8K RAM. 32 parallel I/O lines. 2 TTL serial I/O lines. Four 16 Bit counter timers. Cassette interface. Data bus buffering. Memory mapping contol. 71 key ASCII Keyboard, including numeric keypad. Includes power supply. Also includes the first "10K MICRO-SOFT BASIC" available in the U.K. All the usual BASIC commands.

Full manuals. Microtan, Tanex, Basic, X Bug All £5.00 each.

## TANRAM



AVAILABLE NOW - TANRAM - 40K Bytes on one board! Single board of bulk memory offering: 7K Static RAM (2114), and 32K Dynamic RAM (4116). Onboard refresh is totally transparent to CPU operation and is unaffected by normal DMA's. TANRAM fully expands the available address space of the 6502 microprocessor. MICROTAN, TANEX and TANRAM together provide 16K RAM, 48K RAM, and 1K I/O - that's a lot of memory and a lot of I/O! Built and tested. TANRAM ASSEMBLED.

**40K RAM CARD with 16K DYNAMIC RAM £76** +VAT

CONTENTS: High quality plated thru hole printed circuit board, solder resist and silk screened component identification. Full complement of I.C. sockets for maximum expansion. 64 way D.I.N. edge connector. 1K RAM (2114). Data bus buffering. TANRAM users manual.

**EXTRA RAM:**
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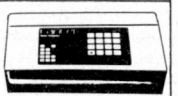

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Minimum Config Kit

**CONTENTS**
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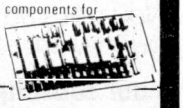

**TANEX** (Minimum configuration) Assembled
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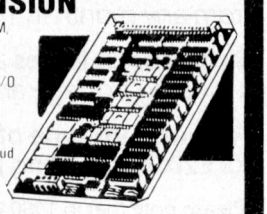
## TANEX EXPANSION



Expanded TANEX offers: 7K RAM locations for 4K EPROM (2716), locations for 10K extended MICROSOFT BASIC, 32 parallel I/O lines, two TTL serial I/O ports, a third serial I/O port with RS232/20mA loop, full modem control and 16 programmable baud rates, four 16 bit counter timers, cassette interface, data bus buffering, and memory mapping.

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DEC 81

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NO EXTRAS NEEDED.
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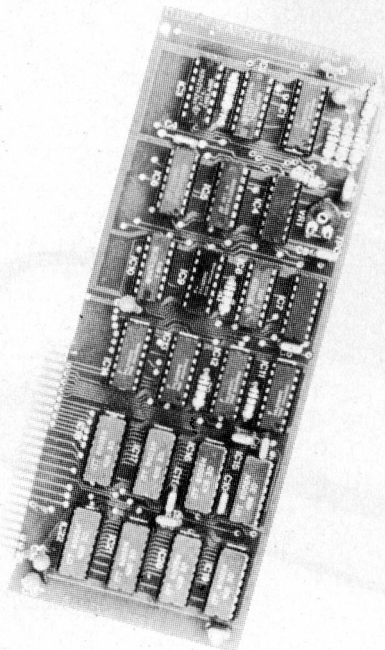

Now you can afford to extend your Apple II without taking up a mortgage. Now you can run Pascal, Fortran, 56K CPM with a Z80 Softcard, Integer Basic, Applesoft and other languages on your Apple. Now you can increase your usable memory for Visicalc.

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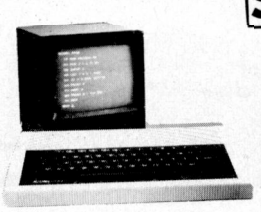

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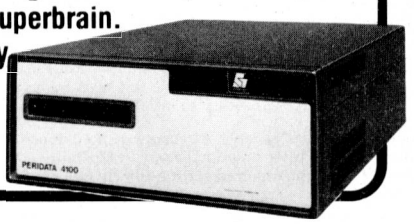


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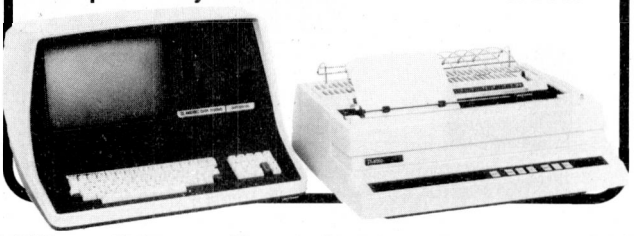

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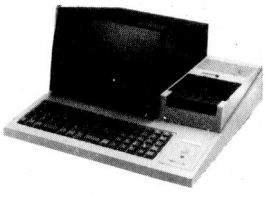

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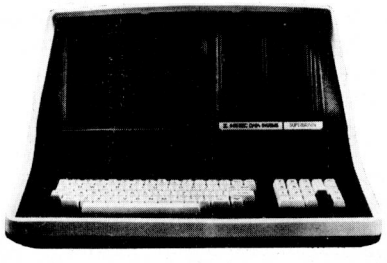

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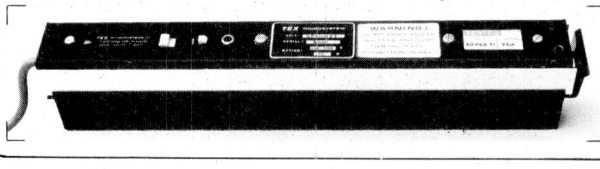

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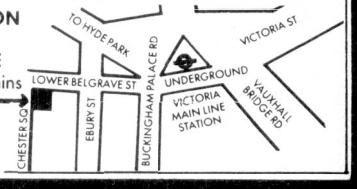


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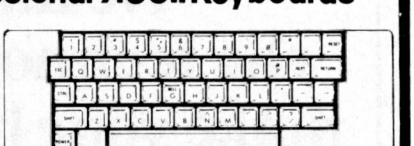

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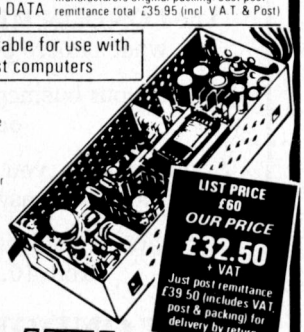

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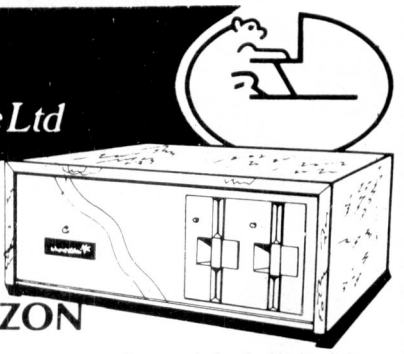

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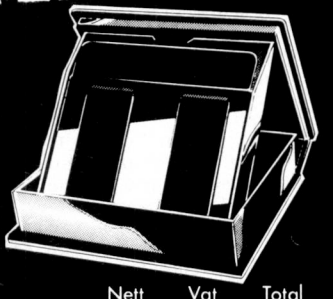

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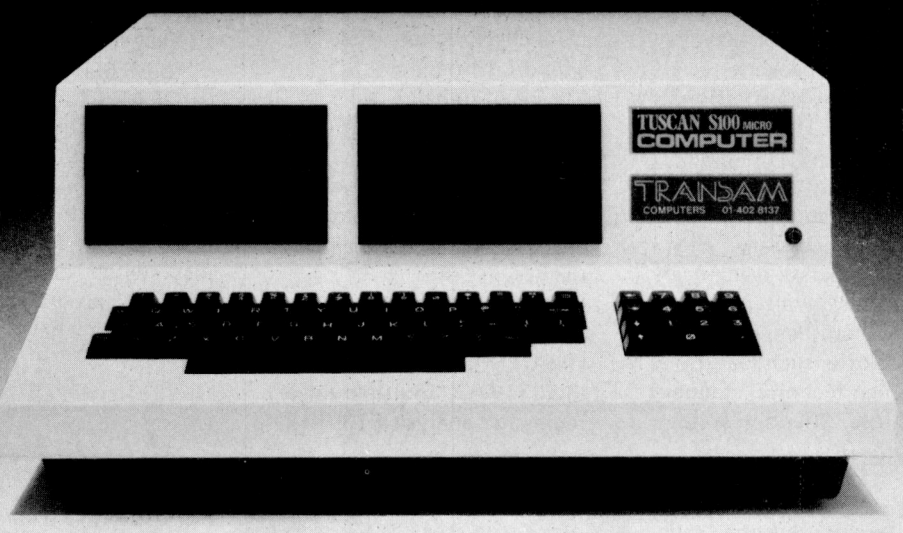


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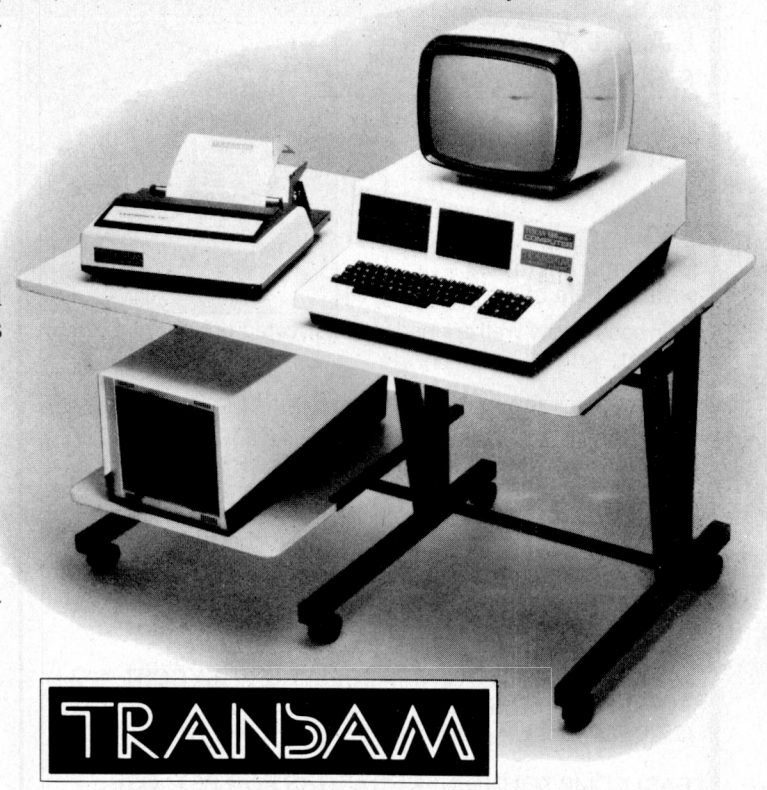

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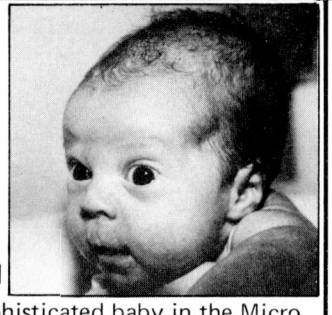

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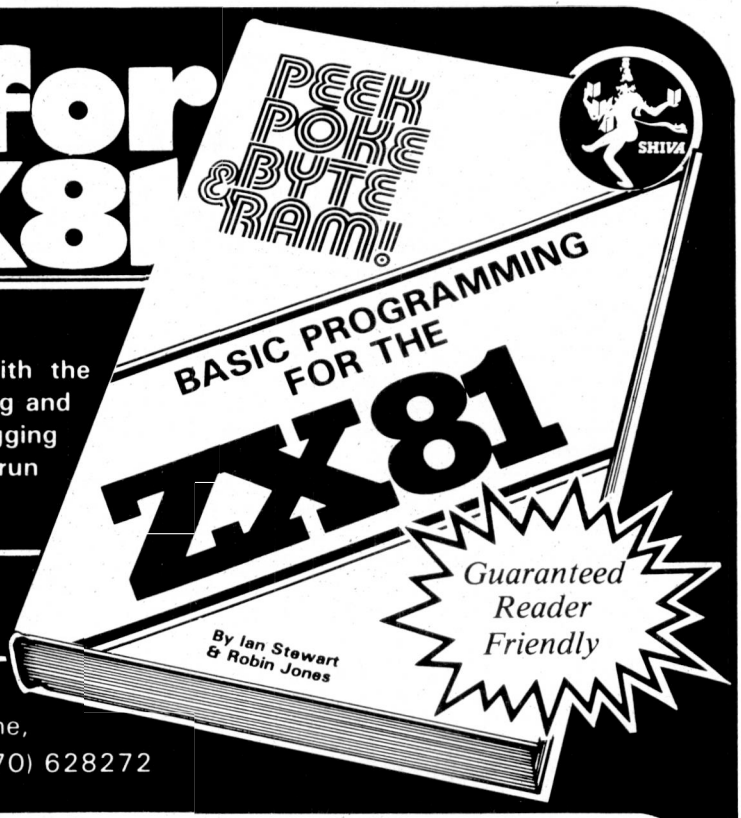


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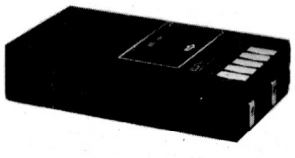

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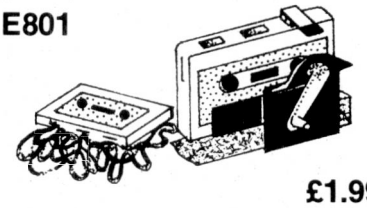

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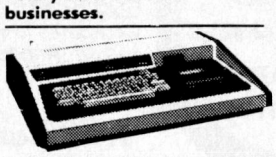

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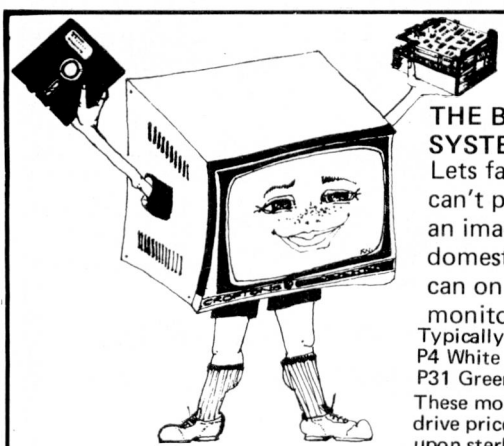

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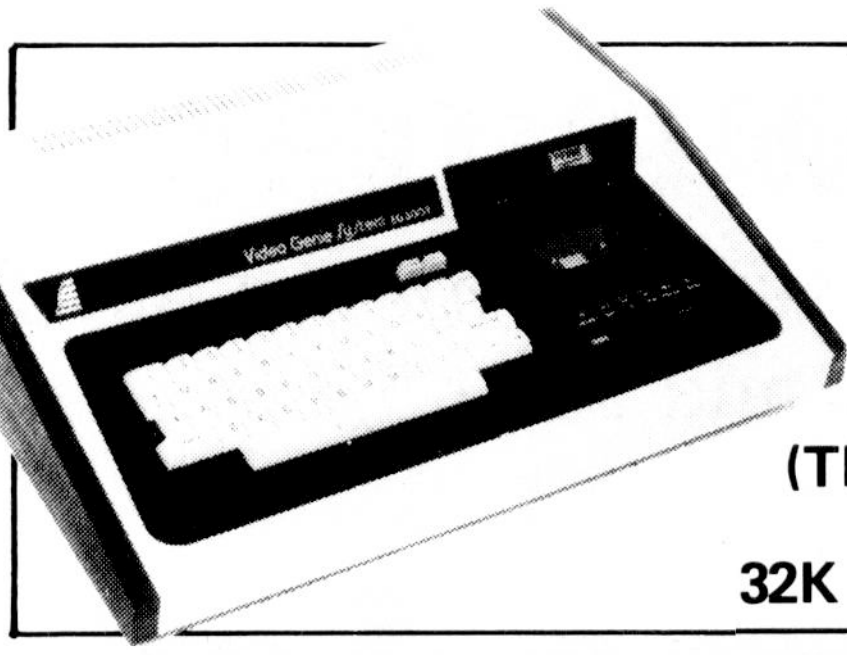


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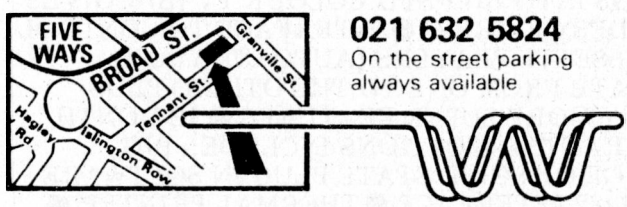


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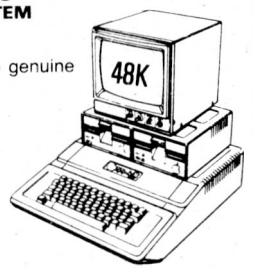


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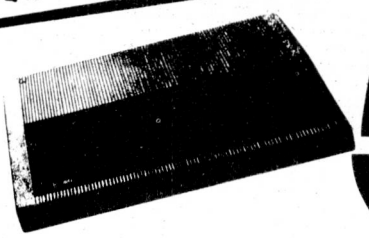

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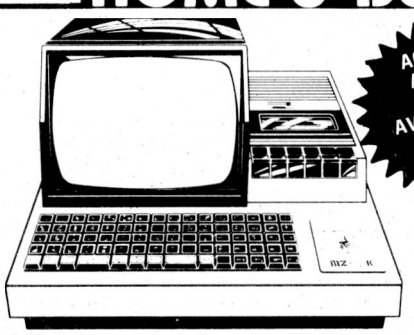

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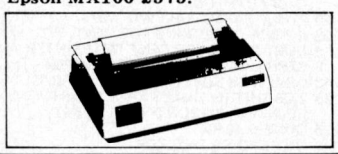

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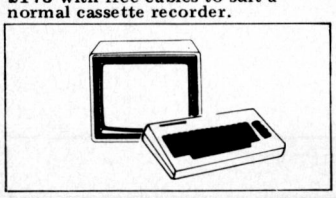

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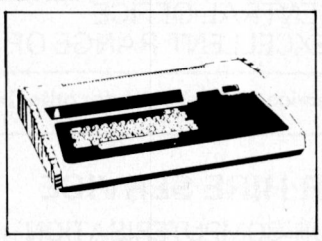

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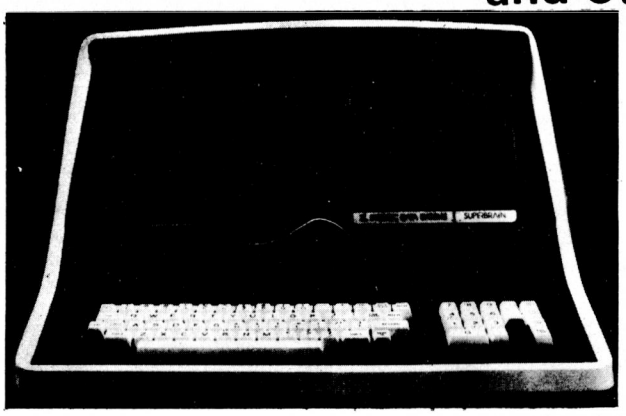

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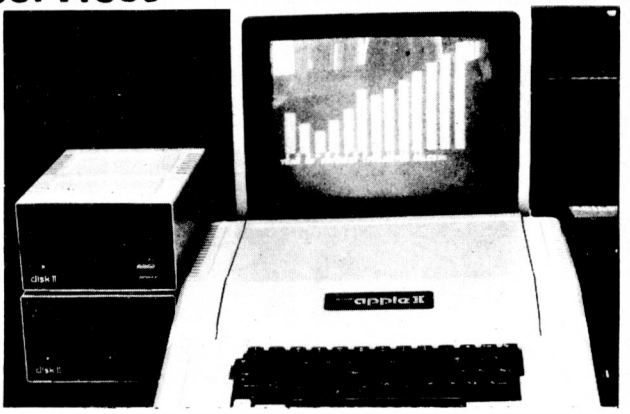

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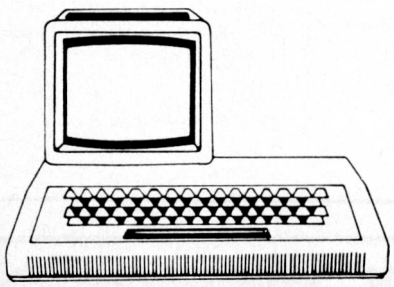

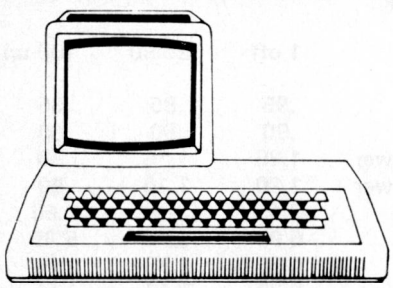

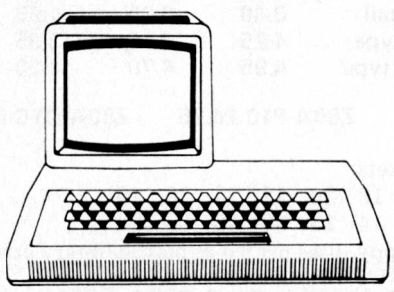

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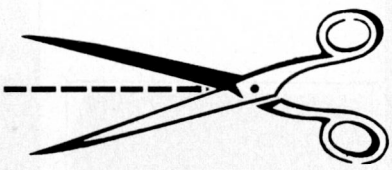

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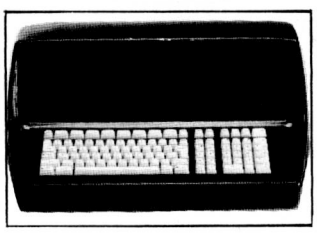

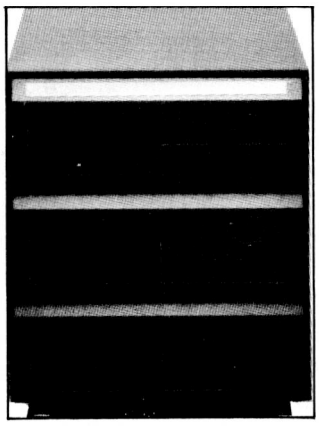

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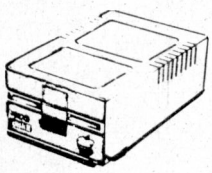

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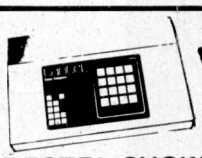

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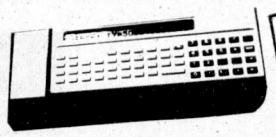

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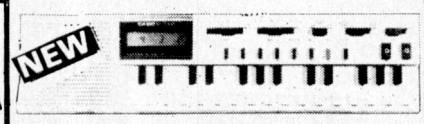

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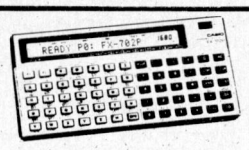

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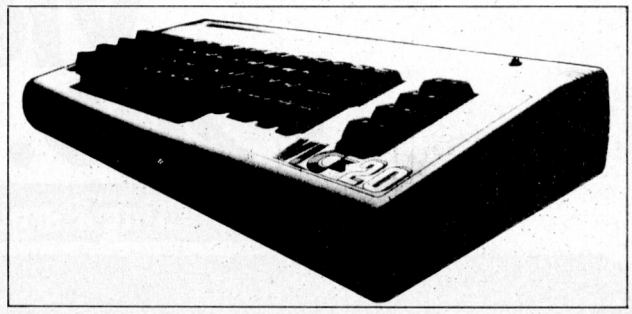

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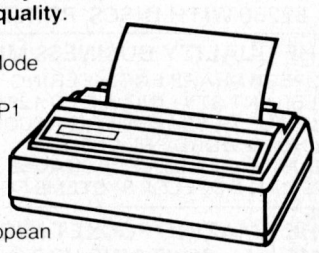

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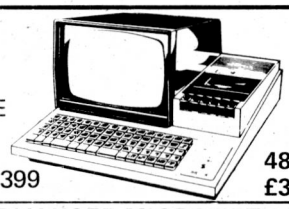

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# CHIP CHAT

CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT

Chuck Peddle, designer of the 6502 and the PET, jetted into London recently to launch his Sirius 1 system (see 'Newsprint') and had a few interesting comments to make about his former employer (Commodore) and other Silicon Valley bastions. About CBM: 'They spent 1981 developing the VIC 20. There's only one manager that stays constantly at CBM and he believes in the small end of the market.' And about Apple 'The Apple III was a mistake – they took my poor old 6502 and they rode it a little too far and a little too fast. The next offering from Apple will be better thought out but it will be much higher priced, not lower. . . . Strange news from wildest Berks where the 'Squire' is said to be indulging in his latest hobby – making hot-air balloons with plastic dustbin liners and sending them up to 15,000 feet, thereby causing much confusion in Air Traffic Control . . . Perhaps the 'Squire' could more profitably spend his time finding out who is sending us – anonymously – photocopies of each month's contents page of *Printout* with a red ring around the bizarre entries which have been appearing there over the last few months. . . An amusing tale reaches us about Roy Goodman, erstwhile boss of Infotech and, more recently, boss of an odd enterprise called Know Now. Apparently Goodman visited David Ahl, publisher of US mag *Creative Computing*, a while back, and stayed for a fortnight in the Ahl home. To avoid jet lag, Goodman insisted on keeping British hours, and made Ahl do the same. After two weeks of breakfasting at midnight and sleeping in the afternoon, Goodman departed refreshed, leaving Ahl with severe jet lag. . . Belated but sincere congrats to the Baroness, Ilona Uhl, for getting married . . . Overheard at the recent Las Vegas-style Sirius launch for dealers, one dealer unkindly remarking: 'Being sold to by these people is like being savaged by a dead sheep.' . . . We recently received an invite to the launch of a new company called Bonsai, which caused much speculation in the *PCW* ivory tower: was it a new Japanese outfit all set to hit us with another spectacular machine? Or a firm of market gardeners selling little trees to put on top of your computer? We re-read the invite: 'Bonsai is a new *British* company set up, with Government help, to market a broad range of microcomputer systems. . . ' it said. (Our italics.) . . . If you have been trying to telephone us recently and not had much luck, the blame rests squarely on our new Herald phone system. We were really excited when it was installed — it's all electronic, push-button, programmable, etc, with an 8085 in a box in the basement to control it all. We were looking forward to putting 'Space Invaders' up on it. But the damn thing keeps breaking down. When it works it's very nice but it crashes with monotonous regularity, leaving us incommunicado. Microelectronics? Don't trust 'em!

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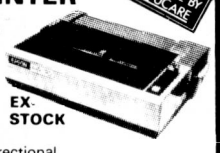

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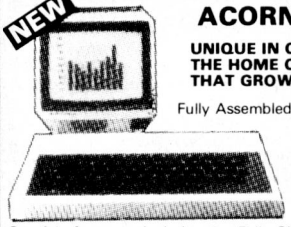

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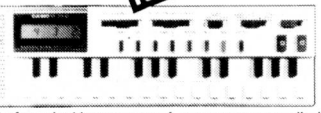

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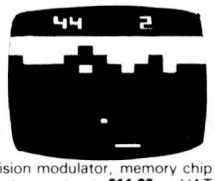

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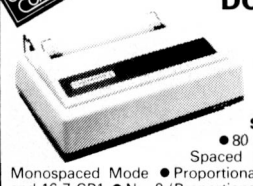

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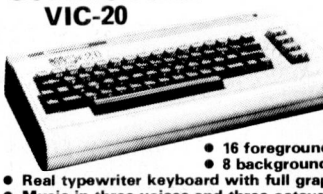

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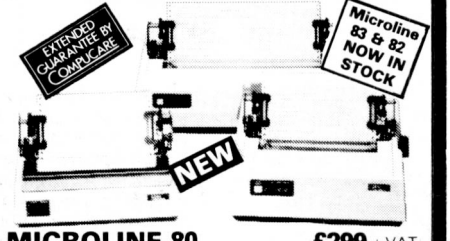

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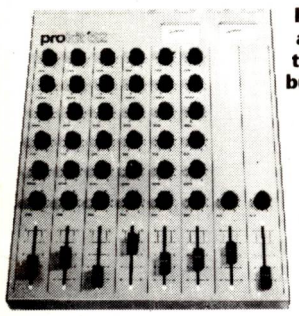

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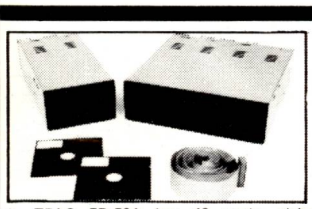

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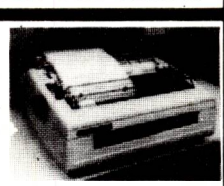

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