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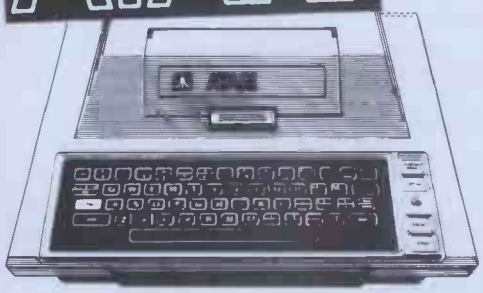

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Games

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Price – £4.95.
Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.
Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.
Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.
Description – Fives games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.
Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.
Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Galactic Invasion, Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.
Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)
Hardware required – ZX81.
Price: – £4.95.
Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.
Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Star Trail (plus blank tape on side 2).
Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – What are Biorhythms? Your Biohythms.
Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Programs – Backgammon. Dice.
Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Chess, Chess Clock.
Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.

Cassette G12: Fantasy Games (Psion)
Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.
Price – £4.75.
Programs – Perilous Swamp. Sorcerer's Island.
Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

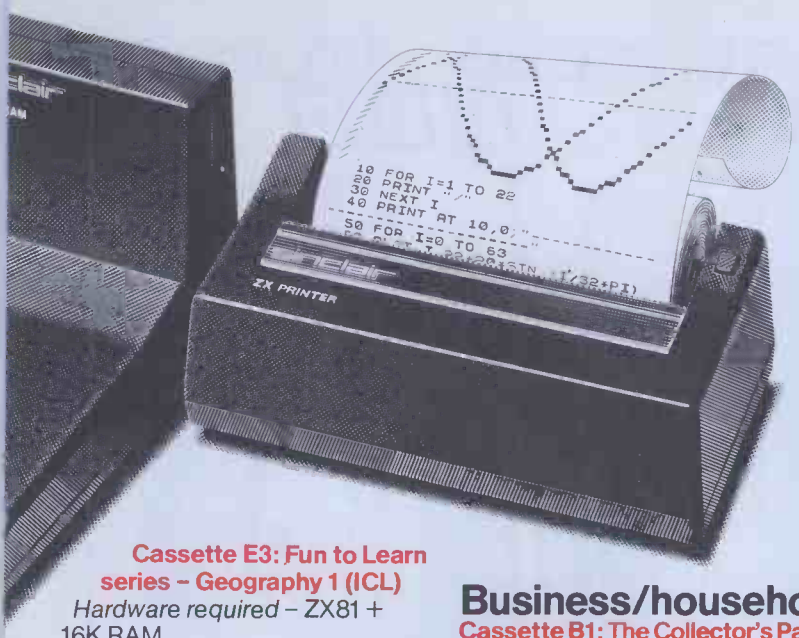
Cassette G13: Space Raiders and Bomber (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £3.95.
Programs – Space Raiders. Bomber.
Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Program – Flight Simulation (plus blank tape on side 2).
Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Novelists. Authors.
Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Poets, Playwrights. Modern Authors.
Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series – Geography 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Towns in England and ales. Countries and Capitals of Europe.
escription – The computer shows you map and a list of towns. You locate e towns correctly. Or the computer allenges you to name a pinpointed cation.

ssette E4: Fun to Learn series – story 1 (ICL)
ardware required – ZX81 + 16K RAM.
ice – £6.95.
ograms – Events in British History. itish Monarchs.
escription – From 1066 to 1981, find ut when important events occurred. ecognise monarchs in an identity arade.

ssette E5: Fun to Learn series – athematics 1 (ICL)
ardware required – ZX81 + 16K RAM.
ice – £6.95.
ograms – Addition/Subtraction. ultiplication/Division.
escription – Questions and answers n basic mathematics at different vels of difficulty.

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ardware required – ZX81 + 16K RAM.
ice – £6.95.
ograms – Composers. Musicians.
escription – Which instrument does ames Galway play? Who composed eter Grimes'?

ssette E7: Fun to Learn series – ventions 1 (ICL)
ardware required – ZX81 + 16K RAM.
ice – £6.95.
ograms – Inventions before 1850. ventions since 1850.
escription – Who invented television? hat was the 'dangerous Lucifer'?

ssette E8: Fun to Learn series – elling 1 (ICL)
ardware required – ZX81 + 16K RAM.
ice – £6.95.
ograms – Series A1-A15. Series B1-B15.
escription – Listen to the word spoken n your tape recorder, then spell it out n your ZX81. 300 words in total itable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Collector's Pack, plus blank tape or side 2 for program/data storage.
Description – This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Club Record Controller plus blank tape on side 2 for program/data storage.
Description – Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information – eg type of membership.

Cassette B3: VU-CALC (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Program – VU-CALC.
Description – Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Programs – VU-FILE. Examples.
Description – A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

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	G2: Super Programs 2	31	£4.95	
	G3: Super Programs 3	32	£4.95	
	G4: Super Programs 4	33	£4.95	
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	G6: Super Programs 6	35	£4.95	
	G7: Super Programs 7	36	£4.95	
	G8: Super Programs 8	37	£4.95	
	G9: Biorhythms	38	£6.95	
	G10: Backgammon	39	£5.95	
	G11: Chess	40	£6.95	
	G12: Fantasy Games	41	£4.75	
	G13: Space Raiders & Bomber	42	£3.95	
	G14: Flight Simulation	43	£5.95	
	E1: English Literature 1	44	£6.95	

Qty	Cassette	Code	Item price	Total
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	E3: Geography 1	46	£6.95	
	E4: History 1	47	£6.95	
	E5: Mathematics 1	48	£6.95	
	E6: Music 1	49	£6.95	
	E7: Inventions 1	50	£6.95	
	E8: Spelling 1	51	£6.95	
	B1: Collector's Pack	52	£9.95	
	B2: Club Record Controller	53	£9.95	
	B3: VU-CALC	54	£7.95	
	B4: VU-FILE	55	£7.95	
	ZX 16K RAM pack	18	£29.95	
	ZX Printer	27	£59.95	
	Post & packing – *only* if ordering hardware		£2.95	

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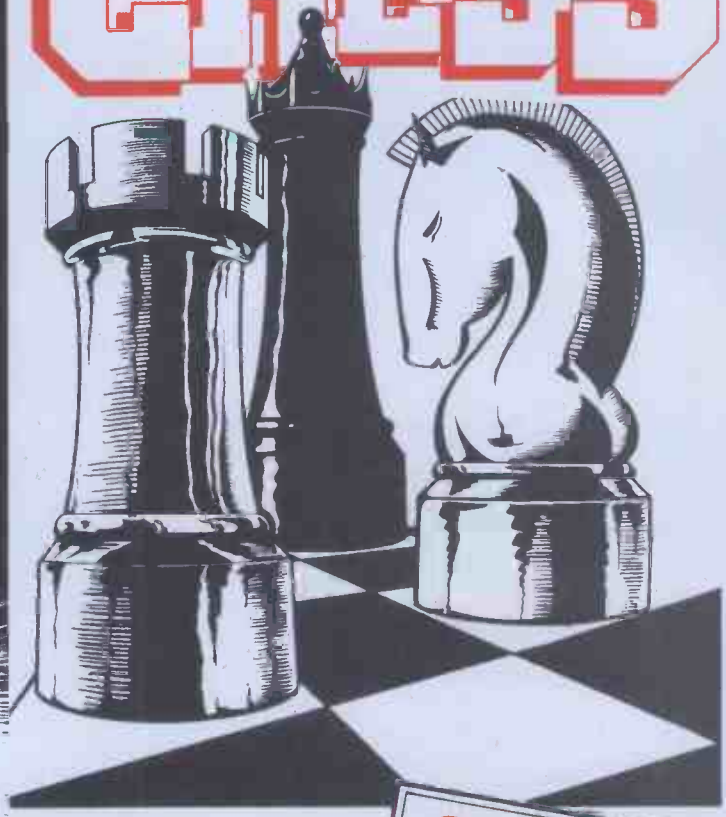

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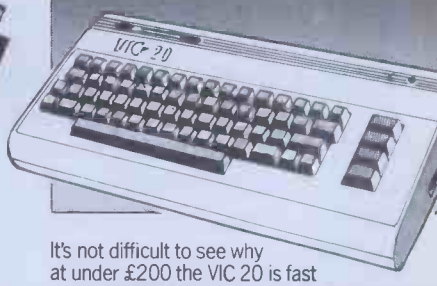

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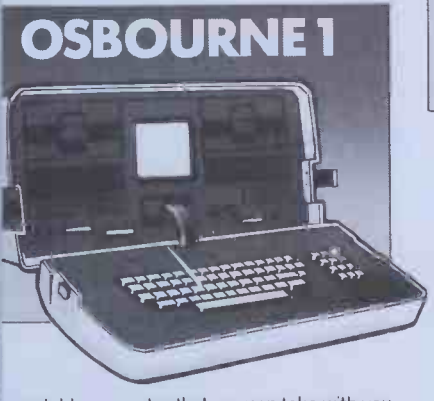

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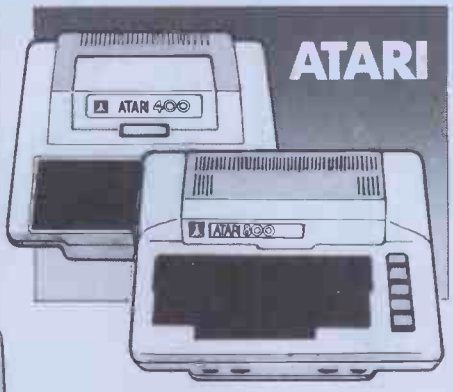

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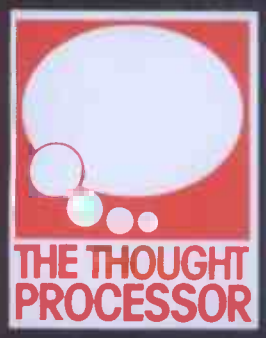

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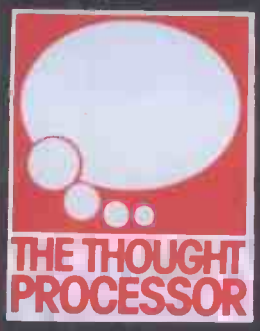

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Multi-user hard disks

Functional characteristics

The CompuStar 10 megabyte Disk Storage System (DSS) consists of read/write and control electronics, read/write heads, a track positioning mechanism, a spindle drive mechanism, dual disks, an air filtration system, and our exclusive 255 user controller – all packaged in a compact desktop enclosure. Although designed primarily to accommodate multiple CompuStar Video Processing Units (described at left), the unit can easily be connected to a single SuperBrain Video Computer System to facilitate additional disk storage. When used with CompuStar VDUs, however, the integral Z80 based controlle will permit up to 255 users to 'share' the resources of the disk with minimal CPU response degradation.

Read/Write Heads and Disks

The recoding media consists of a lubricated thin magnetic oxide coating on a 200mm diameter aluminium substrate. This coating for mulation, together with the low load force/low mass Winchester type flying heads, permits reliable contact start/stop operation. Data on each disk surface is read by one read/write head, each of which accesses 256 tracks.

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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.

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Simulations	Time recording	Filing
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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 you 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).

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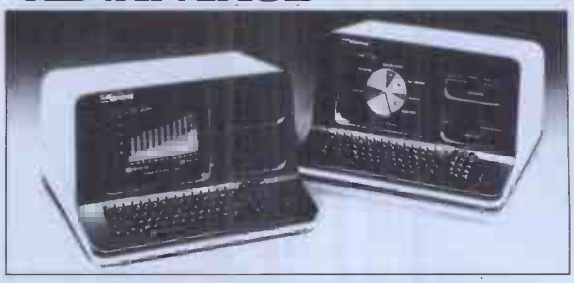

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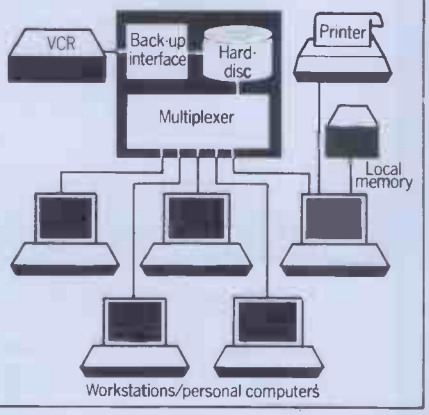

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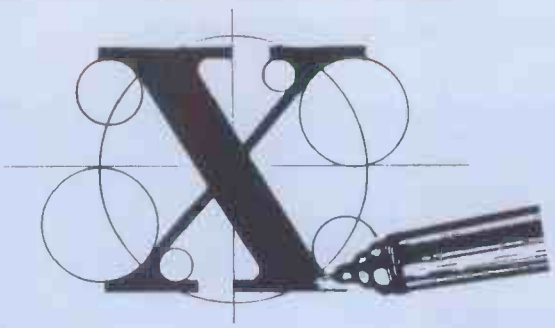

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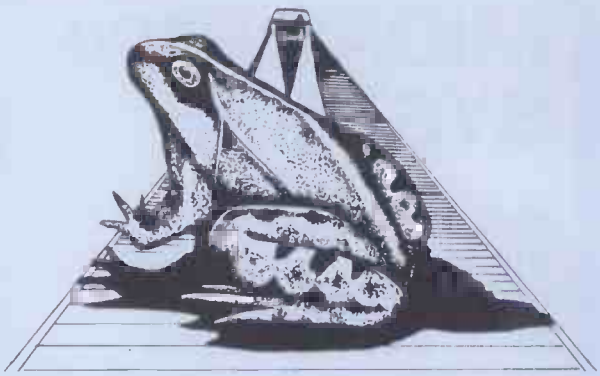

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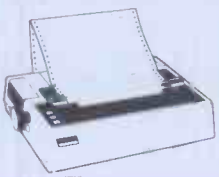

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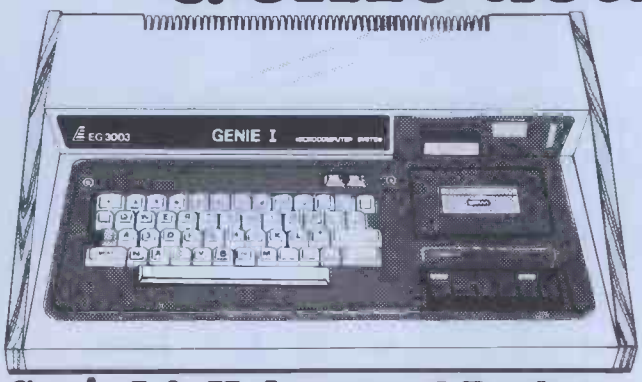

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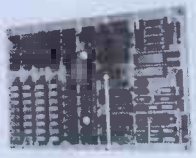

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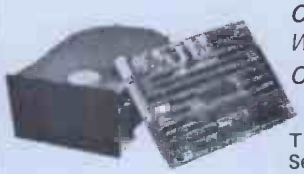

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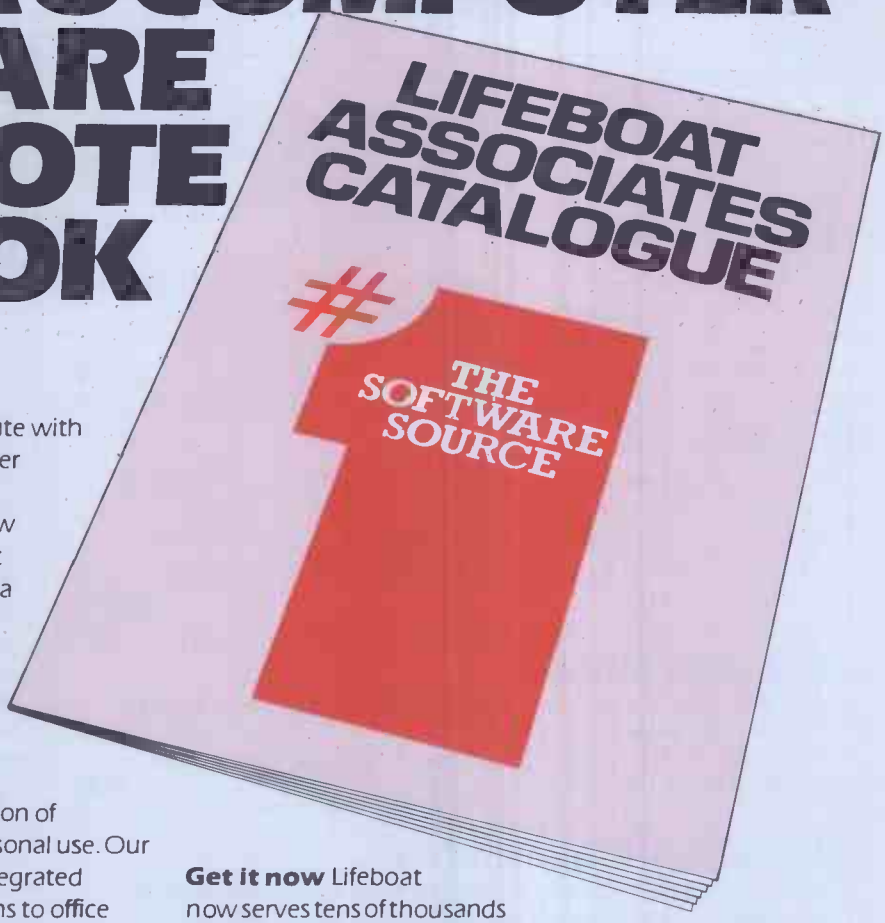

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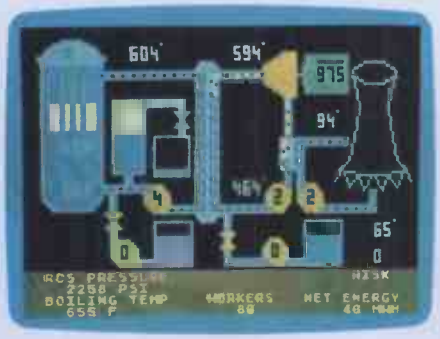

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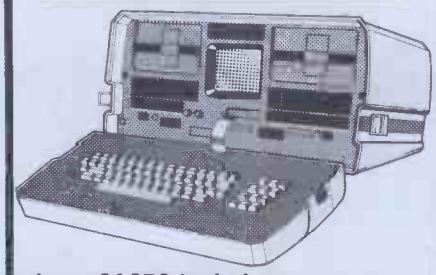

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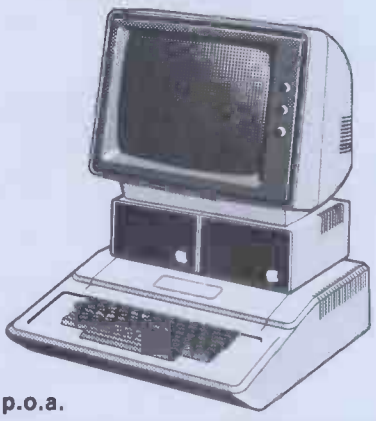

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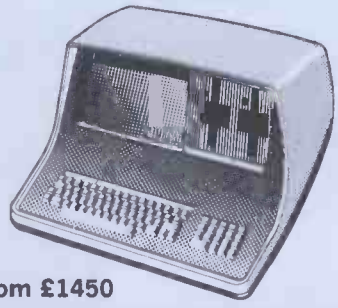

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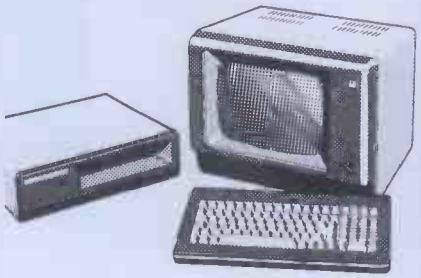

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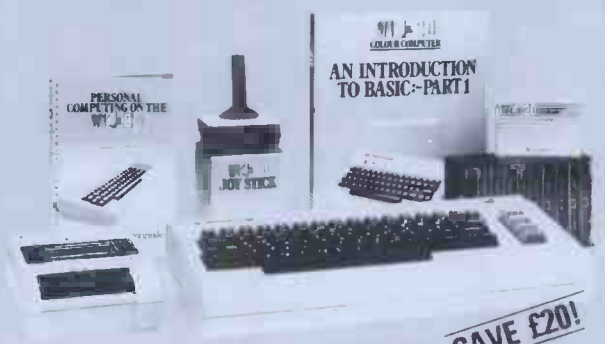

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SPECIFICATIONS
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PRICE	£199	£125	£175	£190	£199	£300
STANDARD RAM SIZE	32K	16K	8K	5K	16K	16K
STANDARD AVAILABLE RAM FOR HIGH RESOLUTION GRAPHICS	26K	9K	N/A	N/A	14K	3K
EXTENDED MICROSOFT BASIC AS STANDARD	YES	NO	NO	NO	NO	NO
PROFESSIONAL-TYPE KEYBOARD	YES	NO	YES	YES	YES	YES

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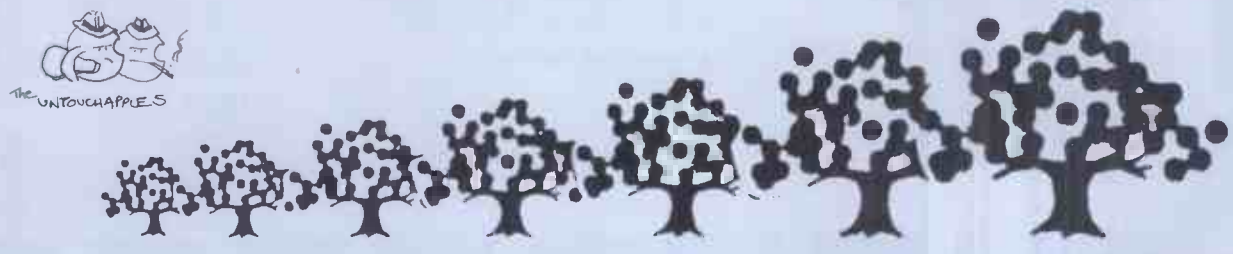

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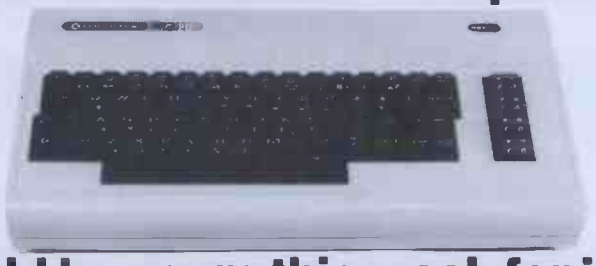

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The package consists of a powerful, compact and reliable microcomputer, with a full-size keyboard, built-in screen, 64K of RAM, and dual disk drives as standard. Also included is a quality matrix printer giving a choice of 80 or 136 characters per line, three different type-faces, and the option of using roll paper, single sheets or even multiple copies. Relevant software programmes for the Genie III have been specially produced by TABS, one of Britain's largest suppliers of business software packages, and the complete system is covered by a special one-year maintenance contract . . . all for around £3,250.

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If by now all this sounds too good to be true, come and see for yourself. You can meet the Genie III at one of the specially selected SUPERDEALERS, whose technical expertise and experience in the fields of installation, software and maintenance is proven. It could be the first step towards a more successful future for you and your business.

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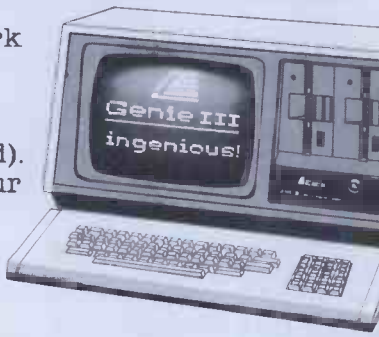

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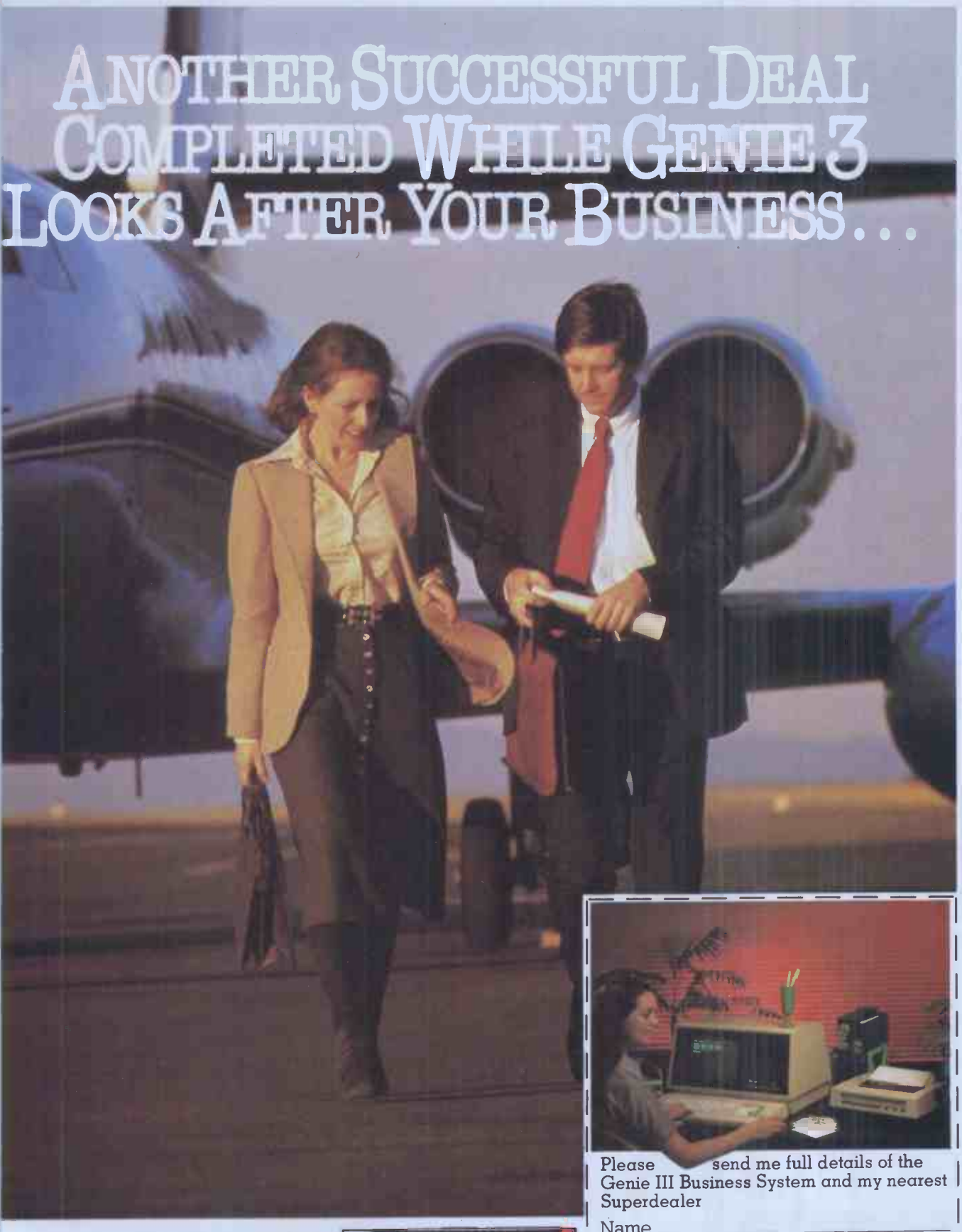

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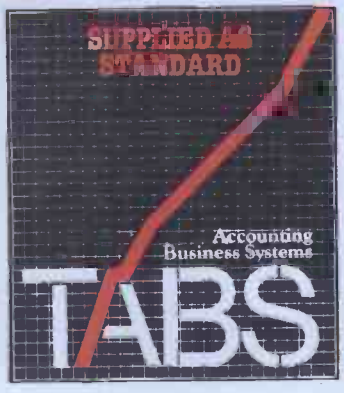

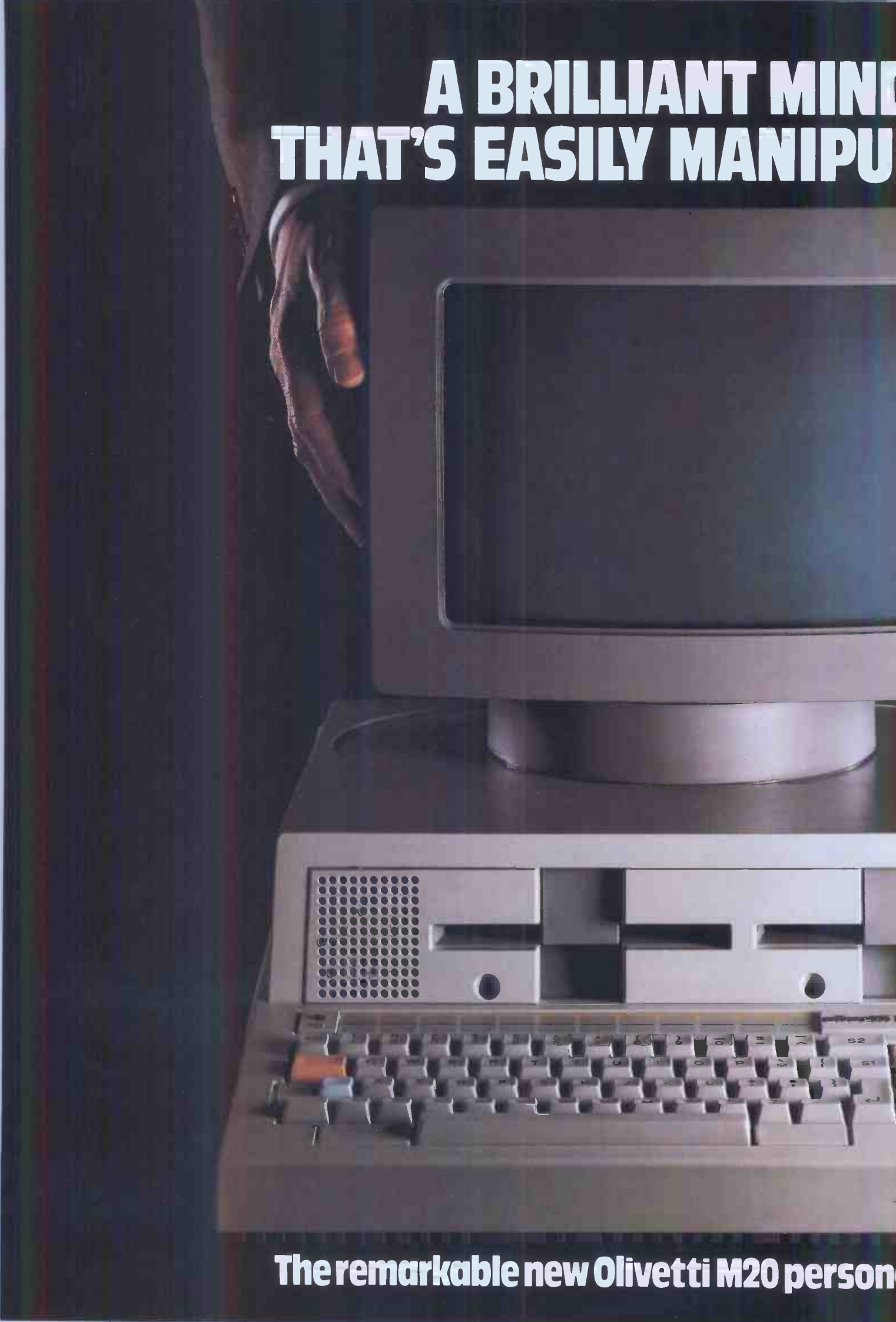
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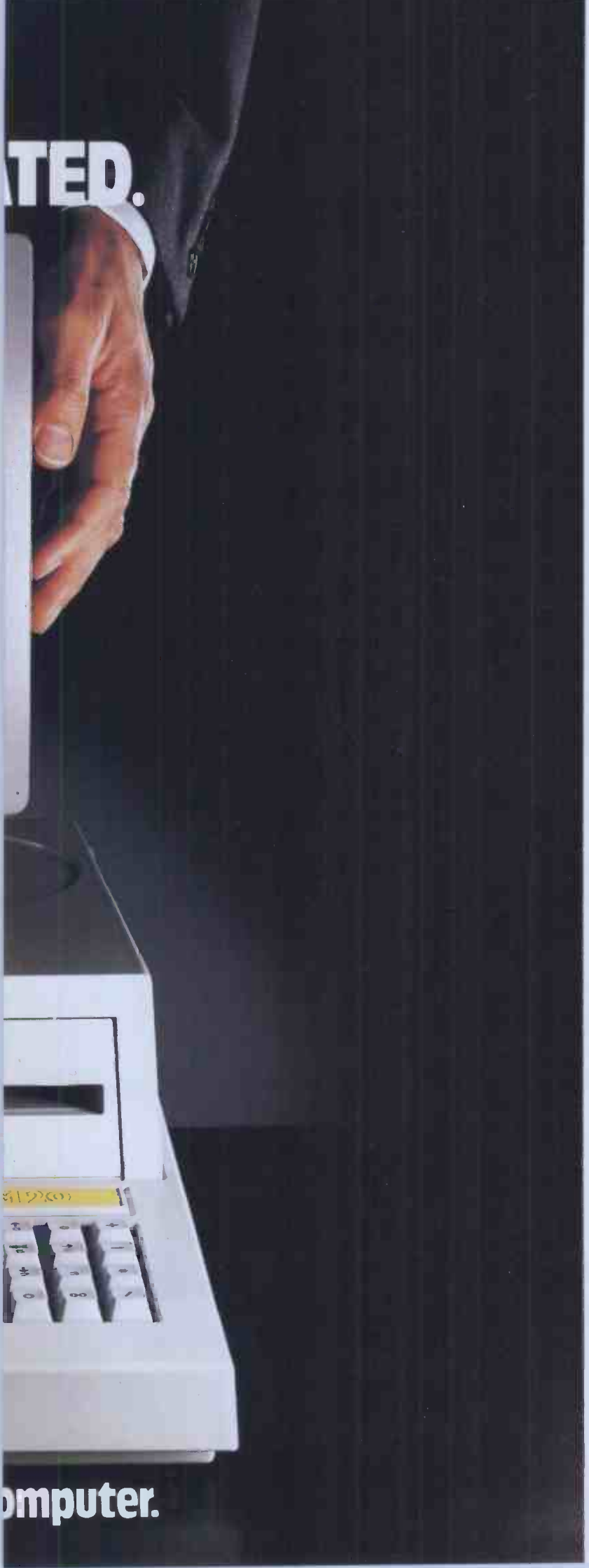
The remarkable new Olivetti M20 person



Please forgive our boasting but the new Olivetti M20 really does make the current crop of computers look like toys for adults.

It's simply the most advanced personal computer in Britain.

The 16-bit central processing unit and 'bus' allow larger more complex programs to be run on larger amounts of data and at far greater speed.

It has two 5¼" mini floppy disk units with a capacity of 320k bytes each that are integral to the system.

(These can be further extended with the addition of a hard disk.)

And it has a minimum internal capacity of 128K bytes.

The result is an extremely powerful computer with interfacing capabilities that allow it to communicate with a wide range of peripherals.

That's proof that it's brainy, but it's also beautiful.

The visual brilliance and clarity of the VDU can be controlled as its position can be swivelled and tilted to suit the operator.

And as well as handling up to two thousand characters, the screen can produce a variety of complex, high resolution graphics.

Naturally, lines, circles, ellipses, bar charts and pie charts are a cinch.

But the screen can actually split itself into sixteen independent windows.

It's all clever stuff but its language is simple.

It uses Microsoft®Basic which has been developed to a new level of professionalism.

In fact, the advanced PCOS*operating system combined with its programming language make the M20 easier to use than a typewriter.

But if you do manage to get lost there's a 'Help' function to guide you.

The M20 also has the reassuring ability to run through its circuits every morning and if any are faulty it'll tell you.

So Olivetti's national and international network of service engineers can work even faster.

Send off the coupon and find out why the M20 is simply brilliant.

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*CP/M available.

For more information on the M20 Personal Computer please send this coupon to Valerie Belfer.

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The North Star ADVANTAGE is a fully integrated microcomputer in an attractive, integrated enclosure. It provides high reliability and excellent operator comfort, plus straightforward servicing. For more information about the North Star ADVANTAGE, contact...

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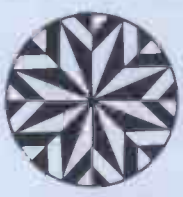

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from the professionals

GRAPHIT

Visicalc compatible

There are a number of programs which will portray graphs on a Microcomputer. Indeed, we stock two already, Graph Plotter and Plotter. Graphit, however, is the ultimate of such programs. It has been written solely for displaying graphs. It is compatible with Visicalc DIF files. Hence such a file constructed with Visicalc can be fed into Graphit and a graph display obtained. Users may also, however, insert data directly from the keyboard into Graphit. This data may then be fed into Visicalc for further processing.

Every function that we can think of that would be of use to a person requiring a graph has been included in Graphit. Labels may of course be used and these may be transposed from the side to the bottom or vice versa at any time. A great deal of work has been put into manipulation of the display in the sense of magnification, or changing the scale. The program will itself first of all calculate an appropriate scale but thereafter this may be altered in almost any way. Thus a small section of the graph may be made to occupy the whole of the screen. Alternatively a large proportion, or all, of the data may be displayed at once. In other words, the program has complete flexibility of display of the graph.

Scrolling is supported in either a latitudinal or longitudinal direction and by one column or by a complete page. If, for instance, the months for one year are set up along the bottom of the screen with sales figures up the side, the user can move along in either direction from month to month or jump six months at a time and show the whole page — the display facilities are almost endless. And display, when you come to think of it, is what a graph is all about.

The graph as shown on the screen may be printed out to a line printer or the raw data on its own can be printed out. The axis can be changed at any time so that if, as in the example mentioned above, we have the months along the bottom of the screen, by one simple keystroke they can be made to go up the side, and the sales figures along the bottom, with the graph changing accordingly of course.

At any time the zig-zag display can be changed for the step and of course vice versa.

Perhaps the most important feature, has been left until last. Graphit was specifically commissioned and the specification called for ease of use, as the prime requirement. Not only, therefore, is a comprehensive manual supplied, but also at almost any time while using the program the H key can be pressed for help, whereupon all of the available commands are displayed. Graph programs in the past have rather suffered from being included in other software. This one concentrates entirely on drawing graphs and gains a lot thereby. Available on disk only, compatible with the Genie I and II and the original Genie, together with the Tandy Models I and III.

(Visicalc is a Registered Trademark of the Visi Corp.)

Graphit on disk ..... £17.00 + VAT = **£19.55**
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- Complete technical information.
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- A liberal update policy.
- An enhanced **BASIC (LBASIC)** including:
  - > Upward compatible with Microsoft Basic.
  - > High speed **LOAD** and **SAVE.**
  - > Run multiple programs with common variables.
  - > **BLOCKED** (variable length) files are supported.
  - > **DOS** commands may be executed from **LBASIC.**
  - > Built in string array. **SORT.**
  - > Single stepper for debugging.
  - > Several new statements and file modes.
- A compiled **JOB CONTROL LANGUAGE (JCL).**
- **CONVert** utility to move files from Model III **TRSDOS.**
- An Extended Debugging and Monitor program (with disk access).
- **CMDFILE** for movement of disk and/or tape system **(/CMD)** files.
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- **RS-232 DRIVER** for serial support.
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* Specific hardware is required to use these features.

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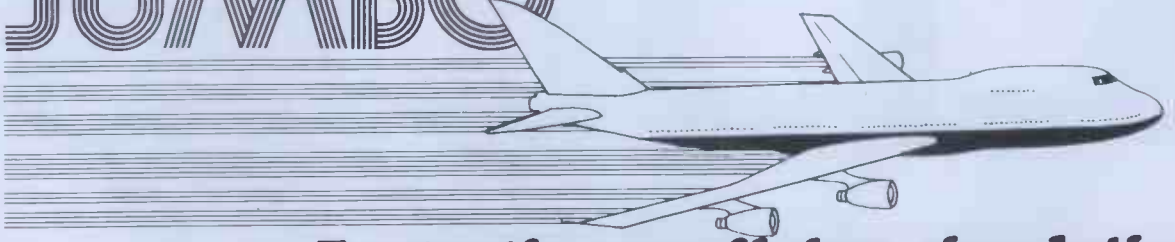
JUMBO



Fantastic new flying simulation

Occasionally a program comes along of such magnitude that it is hard to describe it, especially within the space allowable in an advertisement. Jumbo is such a program. There have, of course, been flying simulation programs before, but they have all rather fallen into the trap of trying to produce a graphic representation of the ground at some stage or other in the program, thus taking up space, and/or they have concentrated on the single act of flying. In other words, although one gets the feeling of flying a small aircraft, one is not going anywhere.

Jumbo is a fantastically accurate simulation of flying a Boeing 747. These planes are not small, and are not flown by eye. They are flown by eyes and instruments, and the instrument graphics in this simulation are really first class. As you may know, the primary instrument of an aircraft is the artificial horizon. This is simulated very well, and includes instrument landing approach indicators. Graphic maps of very high quality are produced and it is possible to fly in all of the British Isles including Southern Ireland, and to New York on the Eastern U.S. seaboard. The actual airports are at London, Birmingham, Manchester, Prestwick, Edinburgh, Belfast, Shannon and New York.

The program was written by two authors who combined their joint skills to produce a unique piece of software. The programmer got the last byte of performance out of the machine and the pilot the last drop of authenticity out of the simulation. Other simulation programs produce at best a similarity towards flying. With Jumbo you really feel that you are behind the controls.

The authors have used a number of gimmicks and programming techniques. For instance, it is possible to switch on an automatic pilot and to jump forward in time in increments of one minute or one hour — otherwise of course a flight from London to New York or vice versa would take some 8 hours to simulate. Whilst in this time skip the various controls are left as they are but fuel consumption and distance to go are taken forward at their correct rate.

A chart is supplied containing various items of data which you will need, including the take-off data for a 747 with various take-off weights, flap retractions, climb and cruise speeds and descent distances.

Realising that not everybody can fly a 747 and that there is even a large proportion of the population that cannot fly anything, two important items of assistance have been added. First of all is the documentation. This is split into two parts. The second is a "manual" on flying the 747. In other words, the instructions for running the program. The first part, however, is what amounts to an instruction manual for flying. It assumes that the user knows nothing about aircraft and although we do not purport that it gets anybody up to any sort of standard after it has been assimilated, the reader should have sufficient knowledge of flying and the theory of flight to fly in the program itself. The second feature of assistance to the novice pilot is a feature in the program which enables the user to practice landings. When the program is started, if one presses the P key, the aircraft is automatically put 11 miles out from London Airport approaching on an instrument landing.

The controls are pretty well complete, even to dive and wheel brakes. The flying track may be continuously monitored on the map display. Bearing and distance to your intended point of landing are available all the time. The instruments, incidentally, consist of:

- Artificial horizon
- Aileron indicators
- Indicated airspeed
- Power setting
- Elevators
- Attitude
- Compass
- Turn indicator
- Flap indicator
- Altimeter
- Fuel
- Elapsed time
- Distance to landing
- Rate of climb

Six maps may be chosen, as follows:

Scotland, Northern England, Southern England, Ireland, Eastern U.S.A., The whole of the U.K.

Route information and present position are shown on the map displayed. It is very difficult to think of any factor that the authors have overlooked. Even the quite meaningful thinning of the air with increasing height, which greatly affects the airspeed indicator in real life, is taken into consideration. Rather than having a fixed stalling speed, this continuously changes with the flight configuration, the weight, height and power setting, again as it does in real life.

We like to think that we publish good programs. Jumbo is outstanding. It is available on tape or disk for 16K or 32K memory machines. It is compatible with the Model I and Model III Tandy, Video Genie, Genie I and Genie II machines.

Tape ..... £15.00 + VAT = **£17.25**

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THE 16-BIT PERS

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Combine this faster and more powerful software with the advanced specifications of the Sirius 1 and you can see why more and more business users are choosing Sirius.

Because Sirius users have both the latest microcomputer technology and the powerful 16-bit software that takes full advantage of it.

Ergonomics plays a vital part in the design of ACT's Sirius 1. The screen tilts and swivels to suit the user and glare is eliminated.

The display is razor sharp, and the brilliance and contrast can be adjusted using keys on the low profile detachable keyboard.

UP TO 896 KBYTES RAM

128 Kbytes of RAM memory as standard easily upgraded to a massive 896 Kbytes ensures plenty of capacity for fully fledged business software and associated record files.

Within the basic system is 1.2 Mbytes of floppy disk storage, with 2.4 Mbytes double sided disks available as an option. More than any other comparable personal computer.

As a result, the Sirius is suitable from the start for large record processing applications. And with 5 and 10 Mbyte Winchester disk drives scheduled for early introduction, the Sirius can easily match your own organisation's growth.

SOFTWARE THAT TALKS BACK

And built into every Sirius is a revolutionary new concept: An audio decoder that can play back verbal messages and prompts under program instruction to assist the non-computer people to get acquainted with the software more quickly.

NEW 16-BIT SOFTWARE

All the big names in applications software are on the Sirius: ACT's Pulsar for accounting, WordStar for word processing, MicroModeller for financial modelling and SuperCalc the "spread sheet" program.

Plus the exciting SELECT, the only word processor that teaches you how to use it in less than 90 minutes.

And more than 100 top software companies are currently developing specialist software for every business and profession from the motor trade to solicitors.

The ACT octagon encapsulates our philosophy of providing users with a single source for their computing solutions.

ACT products include personal computers – network micro-computer systems – turnkey mini computers and a total range of services, including software development, computer field engineering, computer supplies, and a complete range of Bureau services.

The eight specialist ACT companies are each leaders in their field and are wholly owned by Applied Computer Techniques (Holdings) p.l.c., one of Britain's largest and most successful computer companies.

See us at the Personal Computer World Show The Barbican 9-12 Sept. 1982.

CT rius 1

NAL COMPUTER

Price £2,395

MORE LANGUAGES

The Sirius has more available programming languages than any newly-introduced personal computer. MicroSoft's BASIC 86, interpretative or compiled, CBASIC, a choice of several versions of COBOL, three different PASCAL's and a full scale FORTRAN.

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Unlike other personal computers, the ACT Sirius 1 is delivered with the two industry standard operating systems at 16-bit level — MS-DOS and CP/M-86. Once again a guarantee now of the widest choice of off-the-shelf 16-bit software.

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The Sirius is the ideal communications system, with two independent RS232 communications ports in addition to parallel and IEEE 488 ports. Available NOW are all the facilities required to communicate directly with large, mainframe computers.

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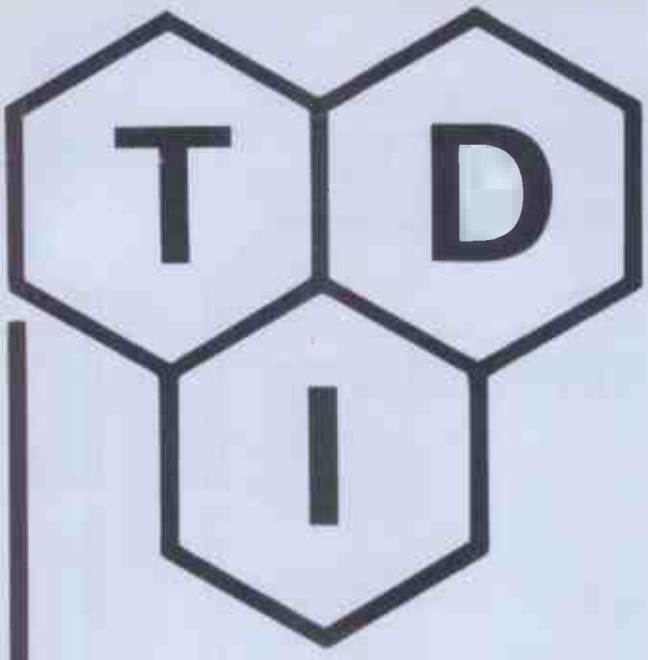

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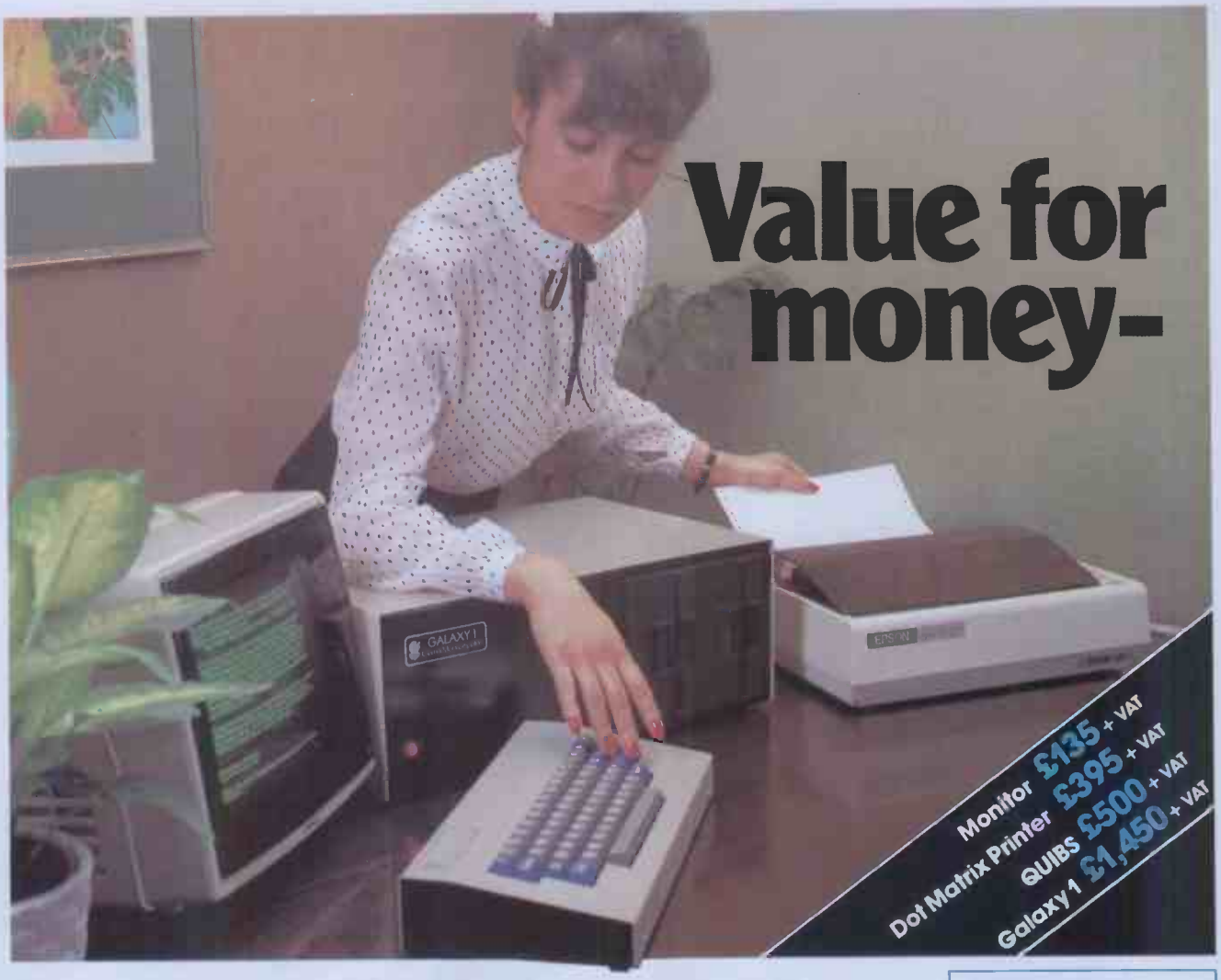

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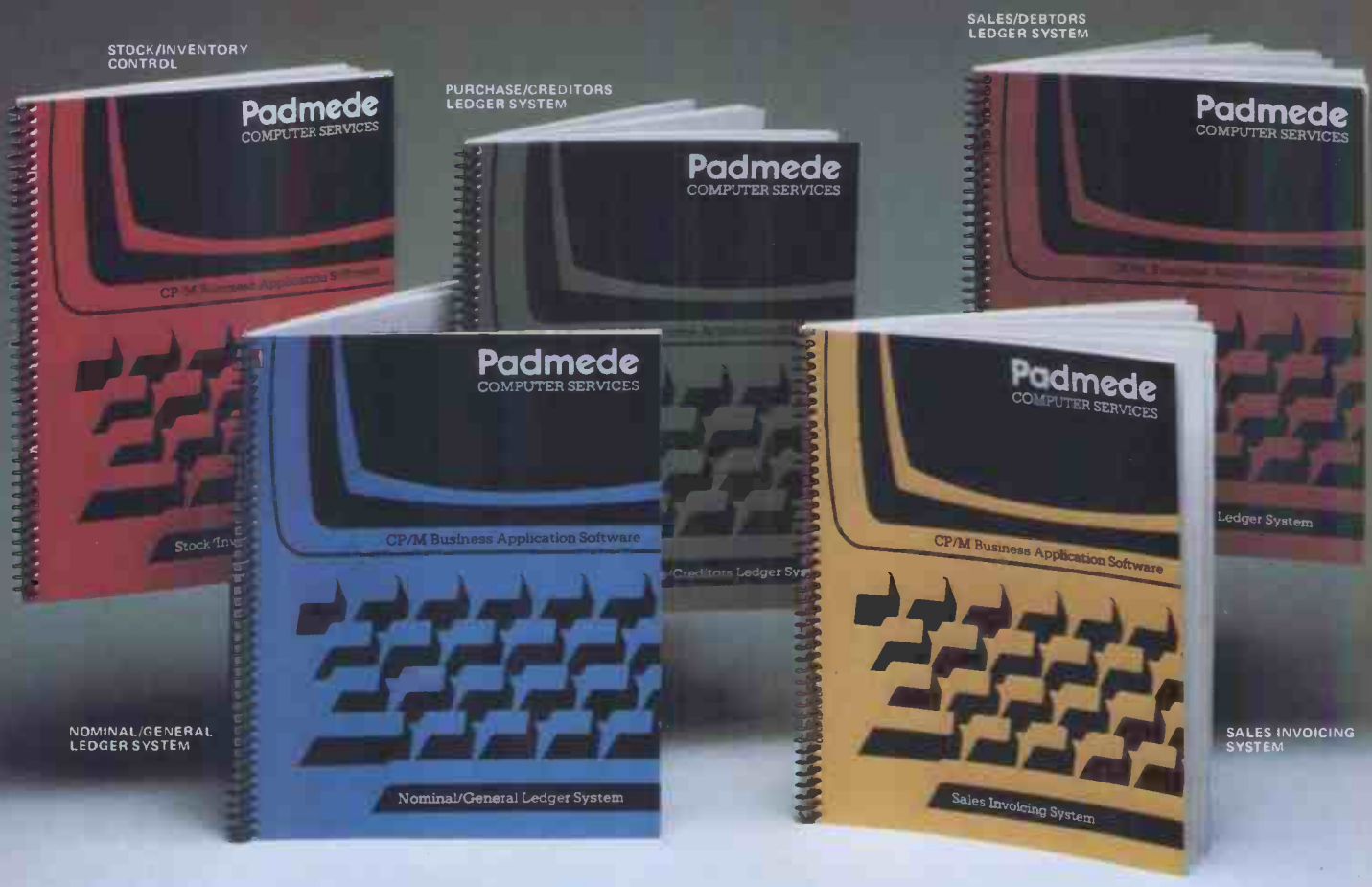

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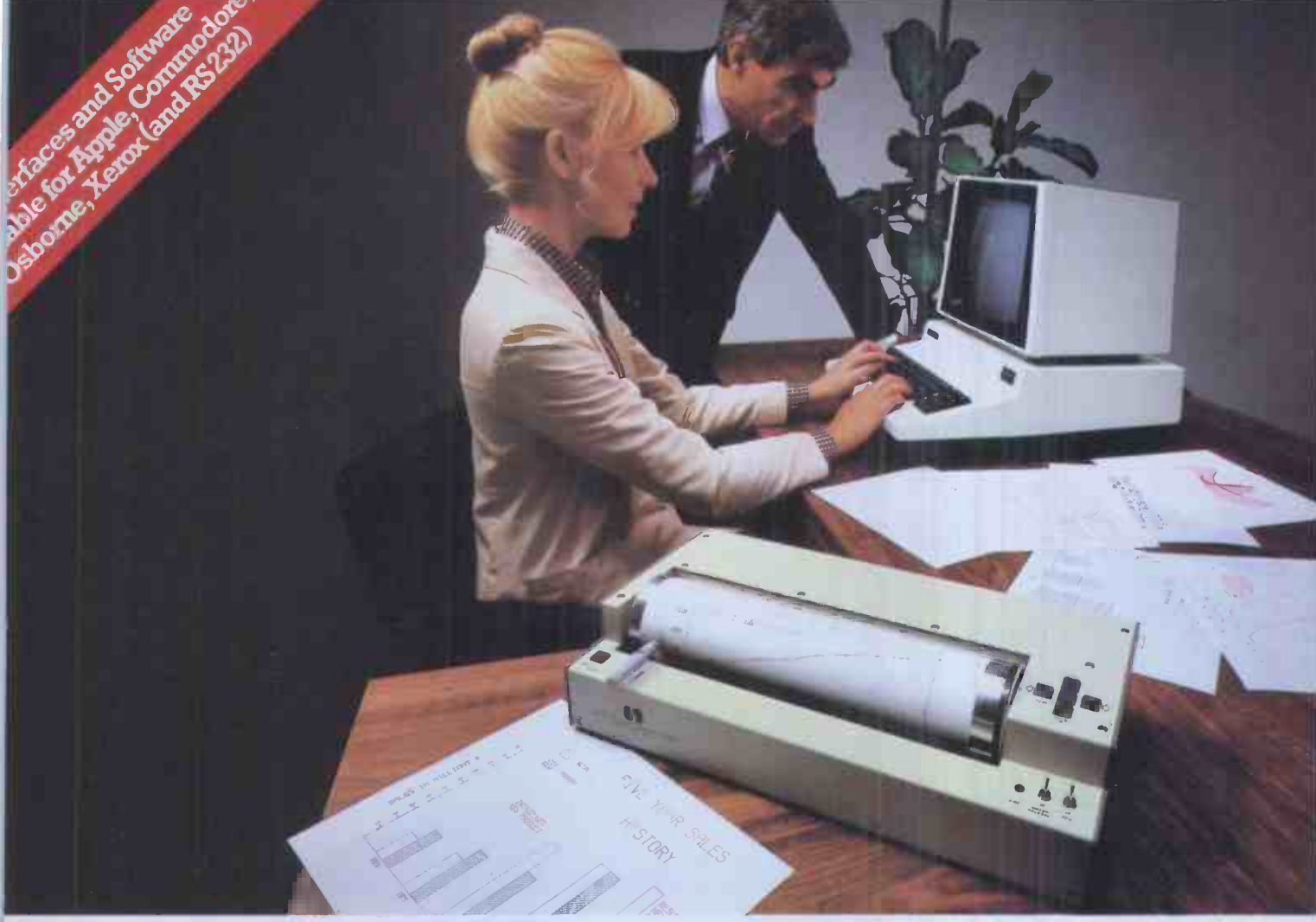

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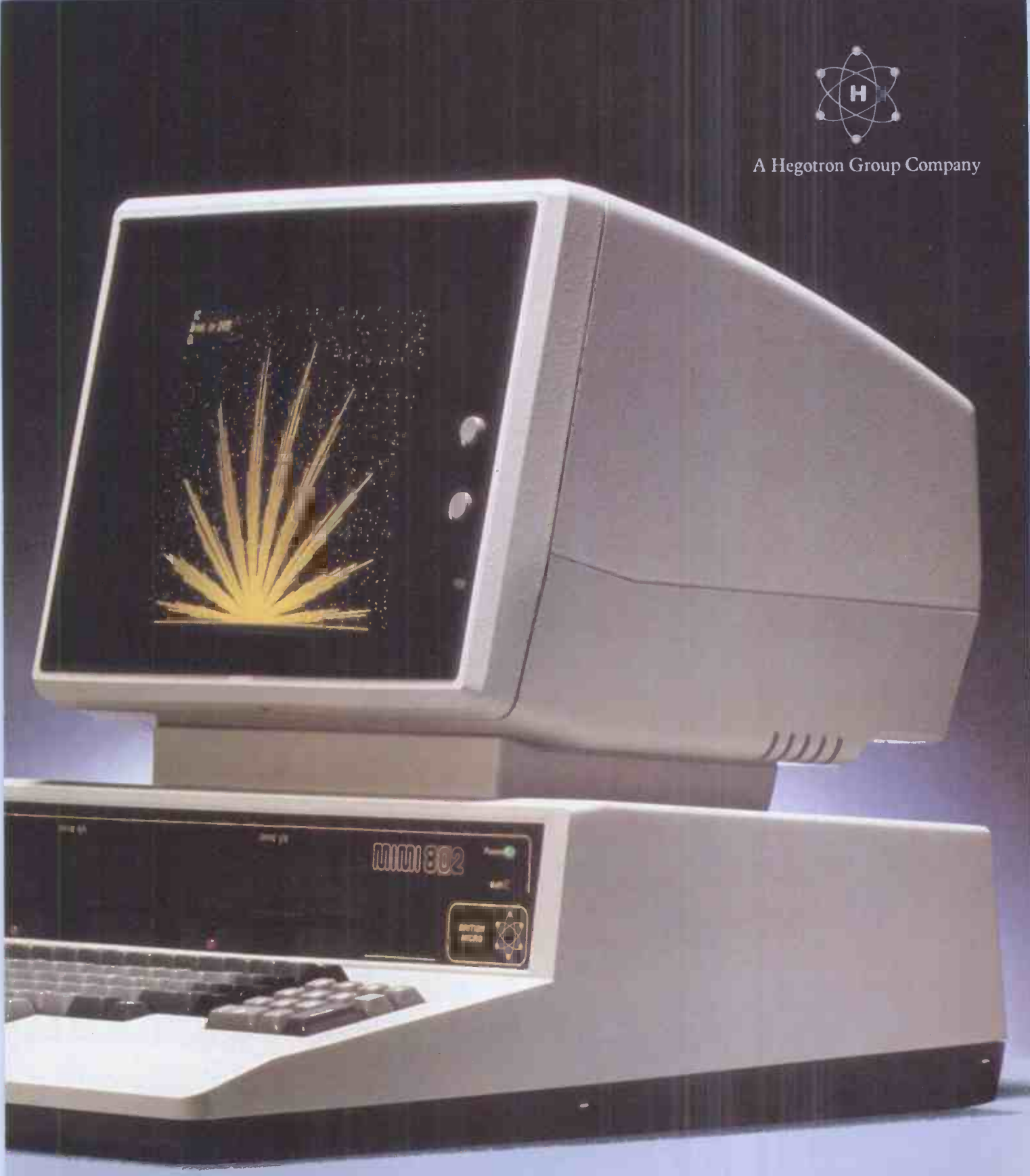

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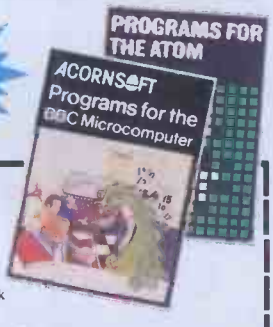

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SPECIFICATIONS PC 1500

Number of calculations	10 digits (mantissa) + 2 digits (exponent)
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Capacity	ROM: 16K bytes RAM: 3.5K bytes expandable to 11.5K byt
Memory protection	C-MOS battery back-up
Display	7 x 156 dots mini-graphic display (English upper- and lower-case letters, numbers, special signs, etc.)

CE 150 Colour Graphic Printer/Cassette interface (Optional)

Colour Graphic Printer	
Power source	Built-in rechargeable battery
Printing digits	Standard 18 digits (36, 18, 12, 9, 7, 6, 5, digits selectable)
Printing system	X-Y axis plotter system
Printing mode	Graph/Text switchables
Character sizes	9 different sizes from 1.2 x 0.8 mm to 10.8 x 7.2 mm (from 1/16" x 1/32" to 7/16" x 9/32")
Printing colours	Red, blue, green, black
Printing directions	Right, left, up, down
Minimum step width	0.2 mm (1/64")
Cassette Interface	Up to two cassette tape recorders can be connected

CE 151 Memory Module (Optional)

Capacity	4K-byte C-MOS RAM

CE 155 Memory Module (Optional)

Capacity	8K-byte C-MOS RAM

ASIC LANGUAGE SPECIFICATIONS
: 1500

mmands	RUN, NEW, LIST, CONT, TR ON, TR OFF, LOCK, UNLOCK, STATUS, MEM
tements	INPUT, PRINT, GPRINT, CURSOR, GCURSOR, PAUSE, USING, WAIT, CLS, IF . . . THEN, STOP, GOTO, ON . . . GOTO, GOSUB, ON . . . GOSUB, RETURN, ON ERROR GOTO, FOR . . . TO . . . STEP, NEXT, END, DIM, LET, REM, DATA, READ, RESTORE, BEEP, AREAD, ARUN, CLEAR, RANDOM, DEGREE, RADIAN, GRAD, BEEP ON, BEEP OFF
nctions	SIN, COS, TAN, ASN ACS, ATN, LN, LOG, EXP, DEG, DMS, RND, SQR (√), SGN, ABS, INT, PI (π), LEFT$, RIGHT$, MID$, ASC, VAL, LEN, CHR$, STR$; POINT
iables	A ~ Z, A$ ~ Z$, two-letter variables possible, two-dimensional arrays applicable
erations	+, —, *, /, (,), >, <, >=, <=, <>, =, ↑, AND, OR, NOT, &
hers	INKEY$, TIME, , ; : "

: 150 Printer

mmands	LLIST, TEST
tements	LPRINT, TAB, LF, ROTATE, COLOR, GLCURSOR, SORGN, LINE, RLINE, CSIZE, TEXT, GRAPH, LCURSOR

ssette Interface

mmands	CSAVE, CLOAD, CLOAD? MERGE
atements	INPUT#, PRINT#, CHAIN, RMT ON, RMT OFF

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Don't let its size fool you.

If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of under £200 excluding VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

Although NewBrain is as easy as ABC to use (and child's-play to learn to use this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to ge your teeth into.

And it'll also take CP/M® so it speak the same language as all the big busines micros, and feels perfectly at home with their software.

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So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9" 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and ¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

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Software that's hard to beat.

A lot of features you'd expect to find in software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

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To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

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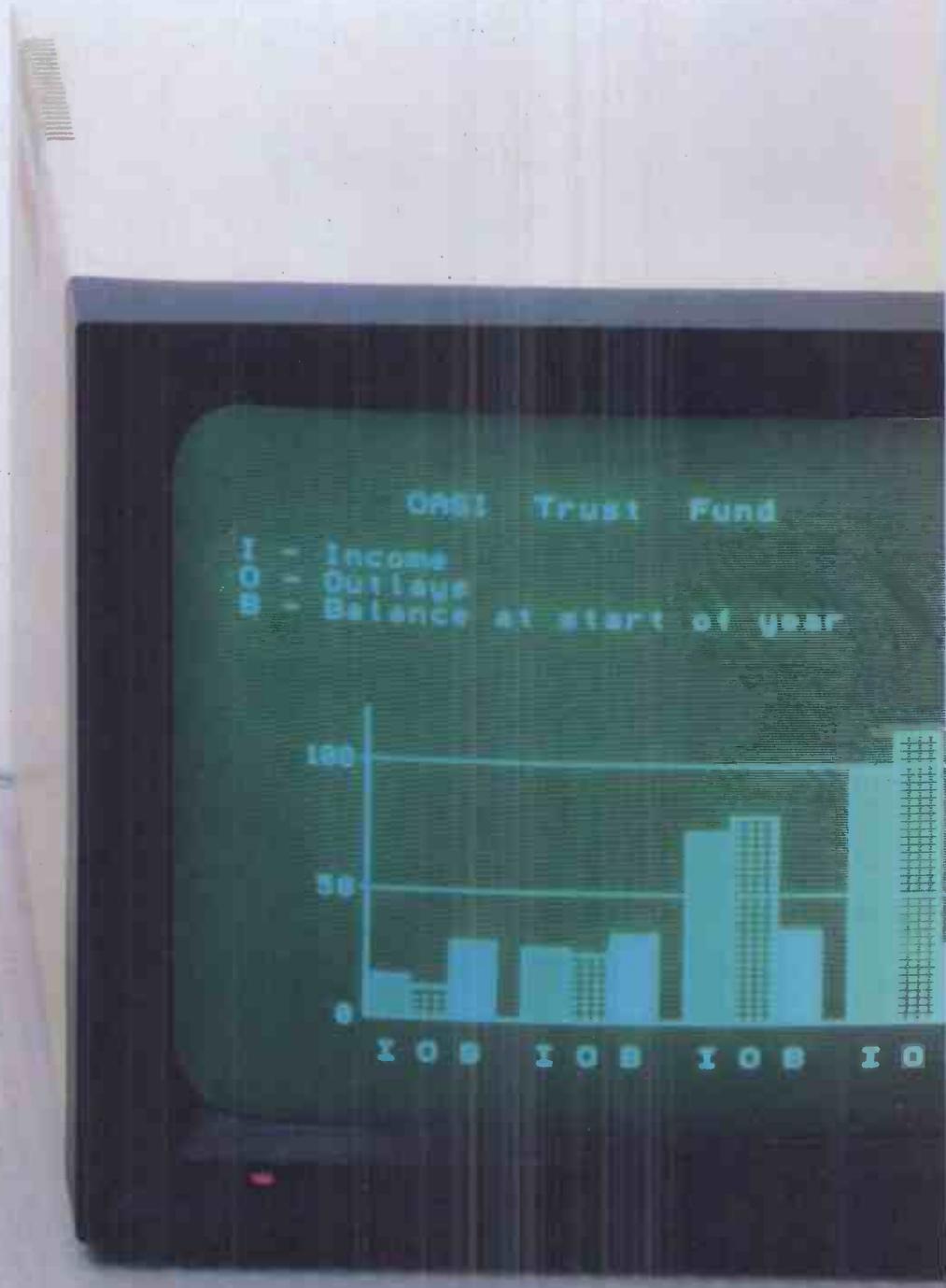

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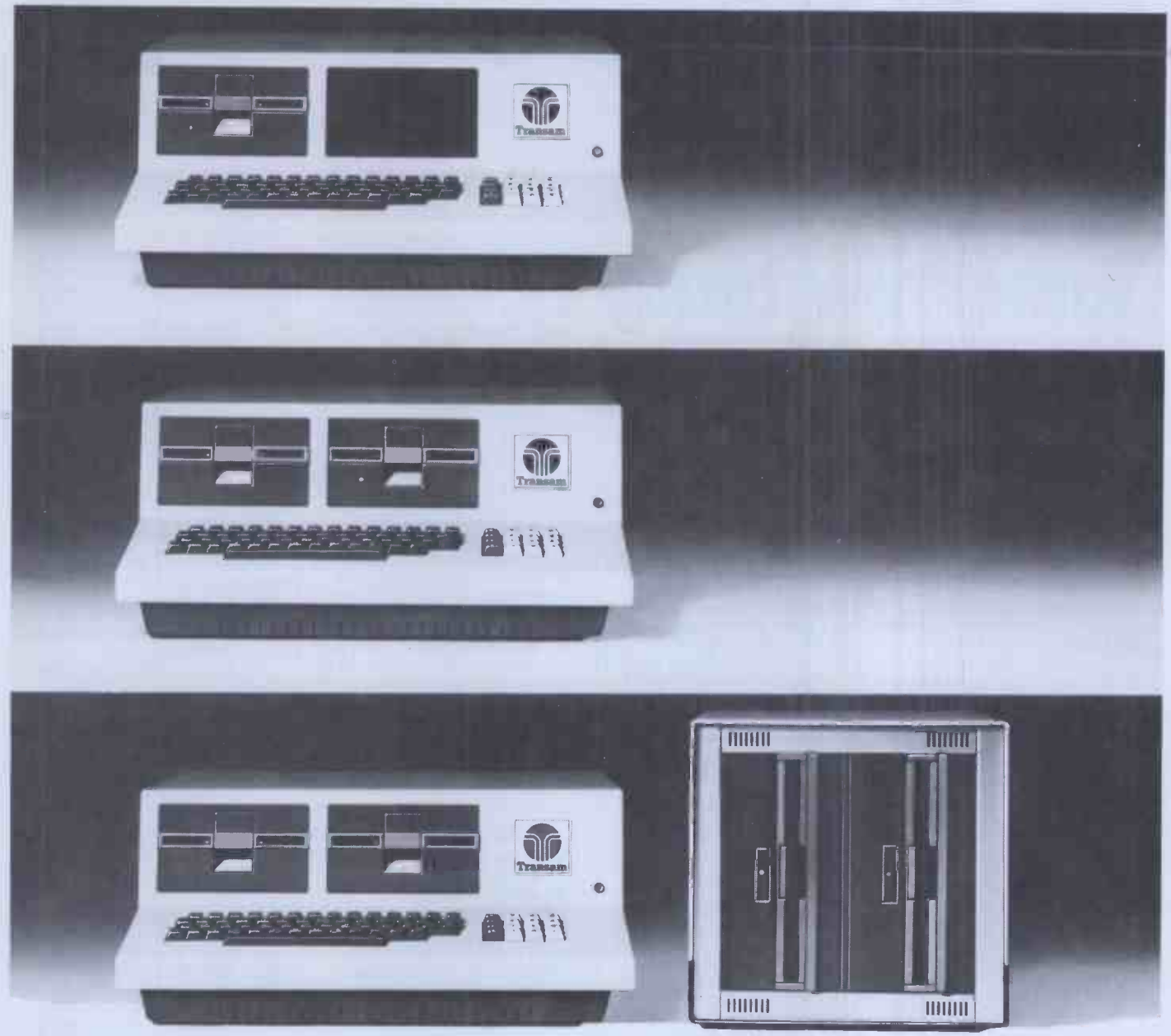

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Join the next decade now: use MicroProlog. Forget everything you thought you needed to know about programming and learn MicroProlog.

Expect to read a lot of this sort of thing. Prolog is a programming language. But it has been invested with a great deal of superstitious awe by the fact that Japanese computer scientists have chosen Prolog as 'the core language for their Fifth Generation Computers'.

Certainly, Prolog is a serious attempt to escape from the limitations of conventional computer programming. To quote the company which has unleashed a microcomputer version of the language on the world (LPA Ltd of London), 'Prolog unifies concepts from relational databases, with powerful list processing and pattern-directed rule-based programming, all in a single framework of logic programming.'

That jargon condenses three areas which could be a lifetime study in themselves.

Relational databases attempt to allow large heaps of amorphous data to be used as neatly filed information, even if the information went in in a very thoughtless way.

List processing is what the artificial intelligence community has been doing with a list processing language called Lisp (for LIST Processing, yet) for a couple of decades, so far without any serious results except an enormous number of proofs that artificial intelligence is not possible — or at least not with Lisp, and certainly not with anything else.

Pattern directed rule-based programming is derived from what used to be called expert systems.

By putting all these things in one packet, the inventors have taken the serious risk of confusing many, in the hope of providing the rest with a chance to start doing genuinely new things. In all honesty, I doubt that they expect any customers to actually start producing expert accounting systems at this stage.

Learn the future with MicroProlog, then — but one warning. Just because this is 'Micro' Prolog it doesn't mean that it is somehow a 'cut-down' version of the real thing. It is a full Prolog but, because it is on a micro, it can add several useful abilities, such as an interactive editor (like the one which lets you type in line 30 after line 50 in Basic but still sorts them out for you), modules, and random access files.

You need a CP/M machine such as the North Star, RML-380Z or Apple II with Z80 softcard, or a system that takes eight-inch floppies to IBM 3740 standard.

You also need £185. Alternatively you can pay £7 and get a primer, the price of which will be deducted from the full system when you buy.

Details from LPA at 36 Gorst Road, London SW11 6JE.

Mickie-taking

One of the most famous computer programs is the one which the late Chris Evans wrote, turning a 6800 system into a medical interviewer called Mickie.

This system is now available on the Apple, courtesy of the National Physical Laboratory and a company called Systemics (which is very anxious not to be confused with Systematics, by the way).

Systemics describes Mickie as 'a complete system for writing, editing and running interactive question and answer programs. Its first application was for medical history taking — hence the name Mickie, for Medical Interviewing Computer. But wherever questions and answers can be represented as a flow-chart, Mickie can be used to speed and simplify computerisation.'

Details from Joy Healey on 01-863 0079.

More Cobollers

When micros first appeared, it was always agreed that the one thing they would never be able to do was run proper programs written in a proper mainframe language like Cobol.

How foolish must the inventors of MicroCobol be feeling now, with Micro Focus announcing yet another implementation of CIS Cobol for yet another micro — this time the Apple III. And, like all other Micro Focus Cobols, this one is actually better, easier to use, and more powerful than most conventional mainframe Cobols.

This new version was announced by Apple, which will distribute the software through its normal dealers.

The deal comes shortly after an announcement from minicomputer maker Digital Equipment that it, too, would distribute Micro Focus software development tools for the Professional range of micros — the ones that are based not on CP/M but on DEC's own processor, the LSI-11.

And chip maker Intel has announced that it, like Apple and DEC, will be selling Level II Cobol for its special-purpose transaction processing chip, the iTPX 86/445 microsystem.

Micro Focus is also selling a great deal of software to Japan.

Now 16-bit DMS

Compsoft provides a popular data management system called DMS, which it has transferred to the Sirius 1 from the original Commodore machines.

The program is one of the stars in the Commodore user sky and last year was transferred to CP/M. On the Sirius it links to the Wordstar word processing program, so using DMS to select details from a mailing list when retyping a standard letter, or doing anything of that nature.

Cost is £400; details are available from Guildford (0483) 898545.

Zilog trainer

An 'interesting introduction to anyone who would like to learn something of microcomputer hardware' is the way Zilog describes its latest cheap system.

It is an 'application report' that is available. It shows 'in great detail, the design of a seven-chip microcomputer system with both a Basic and a debug facility in firmware'.

The system is based on the Z8671 single chip microcomputer, which is a member of Zilog's Z8 family. It provides 2 kbytes for the Basic and debug package (no, I can't see how it fits in either), 4 kbytes of user memory, a programmable full duplex serial port with RS232 interface, an 8-bit programmable timer, a total of 14 input and output lines, and three external interrupts. It can

The company that makes the almost-handheld Newbrain (Grundy) also owns Ceedata, which produces this giant CP/M system called the Grundy 8200 series.

Special feature (apart from a few extra utilities in the CP/M) of this machine is the fact that like the Rair Black Box (the ICL micro) it can manage to control more than the normal maximum of 64 kbytes of memory. This one can go up to 256k — 'a feature of value in word processing applications', says Micro Memory Systems, the company which distributes it.

Apart from price, the only caveat for the unwary about expanded CP/M memory is the fact that no two rival systems are like each other, so programs do have to be available for this particular micro, not just for CP/M — but that's true of most CP/M.

Details and prices from Newbury (0635) 40405.

There you are, looking at a video screen which your Prestel set has just filled with glorious colour — a map or complicated bar chart — and you want to hang it on the wall. You have a printer connected to the set but it only makes black marks on white paper. You know there is a colour printer available, but you can't connect it to the set. . . but wait! Yes, thanks to DNCS in Manchester, there is now a Prestel interface to the CX80 cheap colour printer. Details on 061-643 0016.

be expanded to a full 124 kbytes of memory if required.

By all means write away for the report, to Zilog at Moorbridge Road, Maidenhead, Berks, or phone on (0628) 39200 but unless you know your clock signals, stick to a Sinclair ZX81 (although the Spectrum seems to have killed that one right off).

Plenty of scope

Those readers who follow events in the publishing industry will be wondering what the ex-publishers of *PCW* are going to do with themselves now that the mag has moved on.

The answer is that they're about to launch a newspaper which is intended to do for the micro trade what *PCW* has done for the micro user. Called *MicroScope*, the new sheet will be launched on 23 September, and a scan of the masthead will reveal some names familiar to *PCW* readers.

News will be handled by Peter Jackson (ex-*Microdecision*), features by Ian White (ex-*Campaign*) and international news by Gareth Jefferson, recently returned from seven years in Japan. Columnists will include individuals named David Tebbutt and Martin Banks, while the Editor-At-Large is a certain G Kewney Esq.

The ad sales team consists of Steven England and Neil Fennell.

Publication will be fortnightly, by subscription only, and the modest claim is that *MicroScope* will become 'the eyes and ears of the industry'. An introductory half-price subscription is on offer to bona fide trade enquirers.

In case you're wondering how such a shameless puff could creep into *PCW* I should point out that the software editor will be one Dick Pountain, the author of this piece. . .

Any further information should be sought on the old *PCW* number — 01-631 1433.

For snobs only

For the managing director who has to have an Apple but can't bear to have anything like his juniors have, a friend of mine has devised a very posh desk made out of pitch pine a couple of centuries old, which takes computer, disks, and the wires, and makes it look suitably managing. It costs £500 or more.

For the rest of us, DN Computer Services has put together a collection of odd office bits and pieces, including a footstool for the continuous stationery. DNCS is in Manchester on 061-643 0016.

Telex standard

Anybody thinking of building a micro to run on the Telex network should take note of the small print in an otherwise encouraging announcement by the Minister for Posts and Telegraphs. Well, okay, the Minister of Information Technology.

Ken Baker has announced that outside people (that is, people who aren't British Telecom) will be able to make and sell Telex equipment as from next year, when a published standard will be available.

Quite by the way, and with no details added, he mentioned that this would be restricted to three people from July this year, until then. These three firms would be the ones who already make 80-volt teleprinters, 'because of the imminence of the conversion of the Telex network'. The change involves the end of the 80-volt Telex printers and the substitution of 'single-channel voice frequency' teleprinters.

No mention of the possibility that Telex could be changed in such a way as to cost rather less than the arm and a leg it costs to subscribe today, I notice.

Paper problem

If everybody has a computer and they are all linked together to send messages, then there is no need for paper. Any document you can think of can be held inside computer memory.

Yet it's a fair bet that some time will have to elapse before people are happy with paperless life — at a guess, as long as it took them to become happy with paper money. That is to say, forever: you will still find workers solemnly moving gold bars from one room to another inside bank vaults to represent international money movements that have taken place on paper.

And in the meantime, paper will actually be vastly increased by electronic mail, or so thinks the American research agency International Resource Development Inc.

According to a 205-page report which it has just produced on paper-based electronic mail, 'Many new types of electronic mail systems will stimulate rather than eliminate the use of paper in the office of the future.'

It even has a handle on the size of the paper problem: 'More than 21 billion messages,' says the report, 'will be sent via paper-based electronic-mail systems in 1992, compared with less than four million in 1982 (this year).'

Paper, says IRD, will be the 'medium of transition, enabling the growing minority of white-collar workers with electronic workstations to communicate with the majority of workers who are still without "office of the future" equipment'.

Those who (IRD hopes) will buy this report will be both the electronic mail people (suppliers of computers, networks and software) and also, naturally, the paper suppliers.

Telex, of course, is a good example of the sort of thing IRD is thinking of, where the message arrives over the wires, is printed out, and then lost in the internal mail system. In America, Western Union is described as 'well placed, if not well prepared, to take advantage of electronic mail growth'.

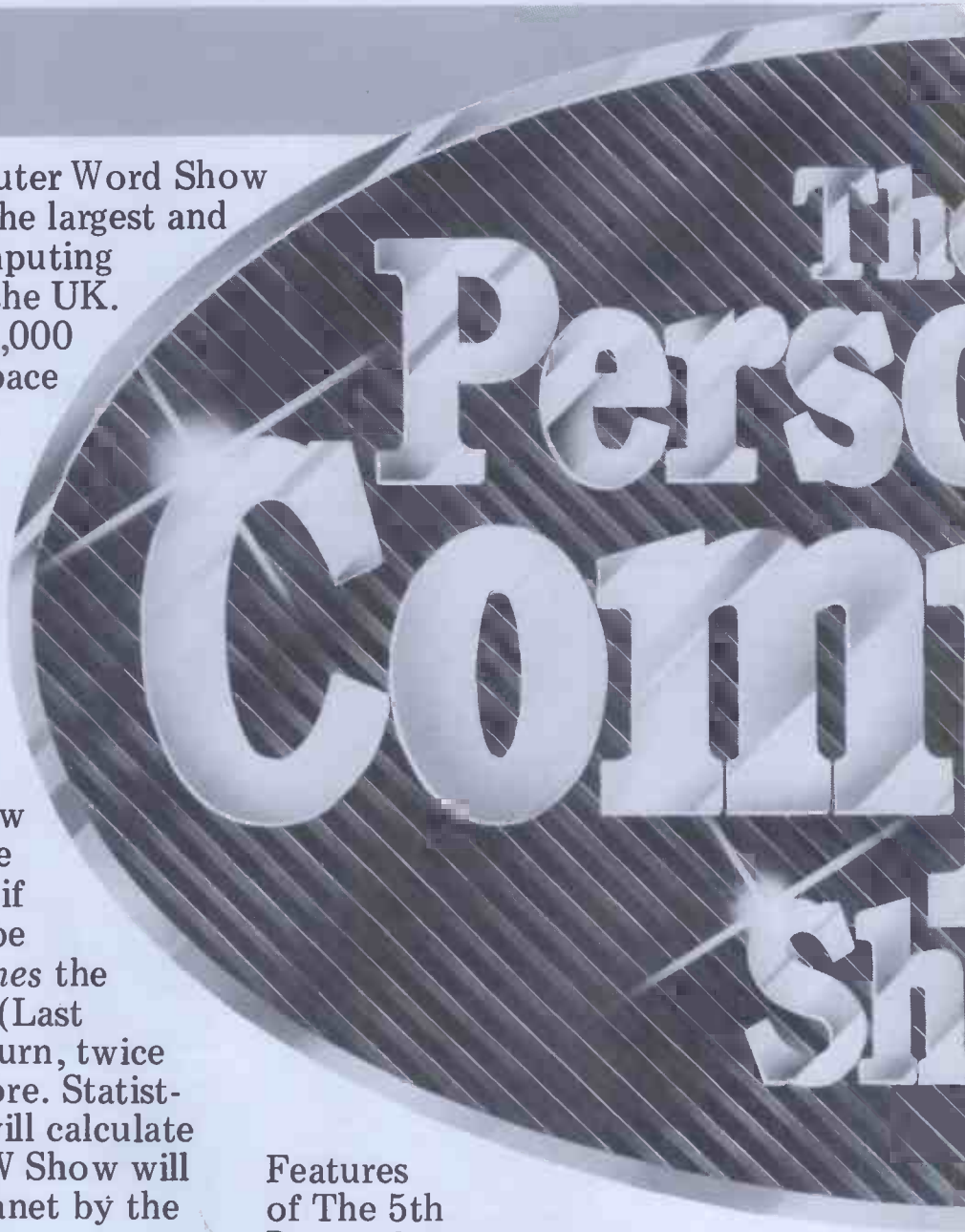
The report costs a mere $1200, from IRD in the US, tel (203) 866 6914.

RUN (if it's not too much trouble...)

Japanese people have trouble with computers because of an innate sense of politeness. Apparently (I have this from a Japanese gentleman but that doesn't make it true) people of this race 'customarily express themselves in imprecise words'.

The result, says Mr Taiyu Kobayashi, who is a big noise

TOMORROW



The 5th Personal Computer Word Show this September will be the largest and most exciting microcomputing exhibition ever held in the UK.

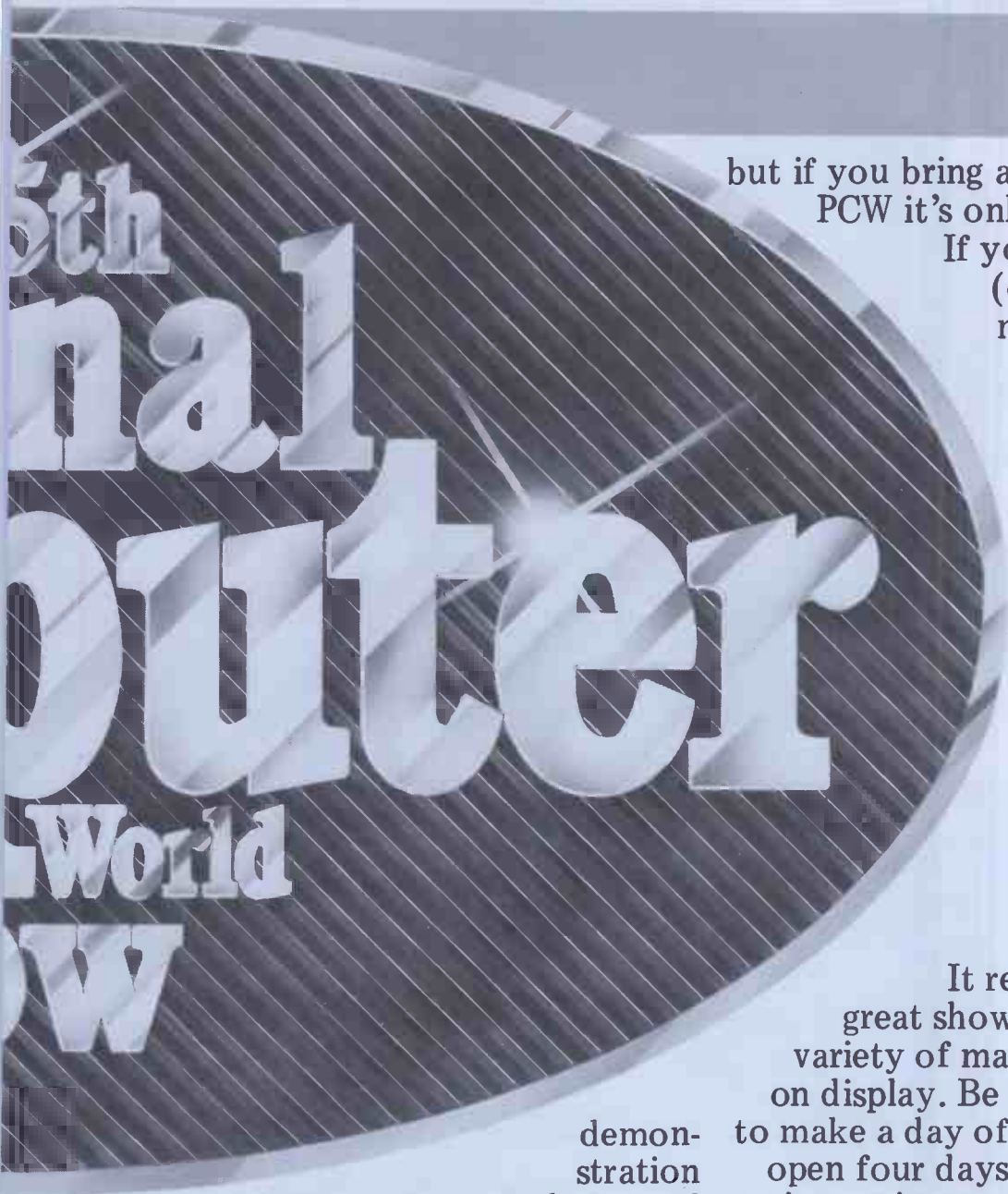
There will be over 25,000 square feet of display space in the newest and most prestigious exhibition venue in the country.

It's the only micro computing show to offer literally hundreds of stands covering micros for home, business and educational uses. Previous visitors to the PCW Show will get some idea of the size of this year's event if we tell you that it will be approximately *three times* the size of last year's bash! (Last year's show was, in its turn, twice the size of the year before. Statistically minded persons will calculate that at this rate the PCW Show will cover the face of the planet by the year 1995.)

Features of The 5th Personal Computer World Show will include a Sinclair City and Acorn/BBC Arcade offering the very latest software and add-ons for these popular machines, computer chess competitions as always, and an opportunity for you to challenge a micro to a game of Computer SCRABBLE ®.

From the business angle there's free consultancy with the National Computer Centre and more

THE WORLD!



demonstration machines and business software than you could get to see in a year at your own office. But you needn't risk divorce to evaluate them. . . your wife (or husband!) and the kids can be looking at the vast array of home and educational micros in one of the other halls. It's £2.50 to get in but if you bring along a coupon from PCW it's only £2.00 per person. If you're a business user (or potential user) of microcomputers just write with your cheque for £2.00 (payable to the Personal Computer World Show) to Tim Collins, PCW Show, 11 Manchester Square, London W1, enclosing your business card. We'll send you a special 'Fast Lane' ticket to save you the trouble of queuing.

It really is going to be a great show with a tremendous variety of machines and software on display. Be warned, you'll need to make a day of it (remember we're open four days this year, not three as in previous years) so give yourself plenty of time and wear comfortable shoes! See you there. . .

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Caxton

See 'Sirius system'

in the Japanese computer business (he's chairman of the board at Fujitsu, a company which is going to build a lot of British computers for ICL), is a conflict between the requirements of politeness and the needs of a computer.

'Being direct and exact may be considered impolite in Japan,' said Kobayashi. 'This creates difficulties with the computer, which must be told precisely what to do,' he added.

This fascinating revelation was delivered in a speech in London in June, which Kobayashi gave at a conference sponsored by the *Finanacial Times* on the subject of 'Is Japan a Pace-setter?'

Not astonishingly, the chairman of the board of Fujitsu thought Japan was indeed a pace-setter. No doubt this came as quite a surprise to the assembled delegates who'd paid good money to listen to him.

Sirius system

'Remember that old atmosphere that Apple dealers had three years ago — that they were doing something exciting, clever, new and rather wonderful?' a software producer asked recently.

'Well, today you get exactly that sort of fervour if you go to a Sirius dealers' meeting.'

Latest religious talisman for Sirius dealers is the release of the operating system which IBM commissioned for its own personal computer from Microsoft — MS-DOS.

In the rather neat phrase of ACT (Sirius agent in Britain), 'This means that many programs written for the IBM personal computer will now run on the Sirius 1 with little or no alteration. The Sirius uses the same Intel 8088 microprocessor chip as the IBM.'

And, it adds: 'The difference, however, is that while the IBM Personal Computer is not (officially) available in the UK yet — and will not be before the end of the year according to the latest reports — the Sirius is on sale at over 200 British computer dealers.'

Of course, matters aren't quite as simple as they seem. True, both IBM and Sirius can now run MS-DOS and, true, IBM hasn't yet released the IBM Personal Computer, which is therefore only available through dealers who have enterprisingly established direct import lines from America.

But a lot of software written for the Personal Computer, and written under MS-DOS particularly, has been commissioned, sponsored and marketed by IBM, on the very strict proviso that it remains exclusively IBM.

And a lot of software for the IBM machine will require very considerable alteration, both on CP/M-86 and on MS-DOS, because of the very different nature of the machinery.

Quite a lot of the Naval Task Force down in the South Atlantic was being driven around by the same turbines as Concorde uses for supersonic flight, but it would be foolish to expect too much performance similarity between a frigate and the aeroplane. The presence of an Intel 8088 inside each of the two computers is likely to prove similarly irrelevant, even with the same operating system.

This is not to say that programs for the IBM are guaranteed not to run on the Sirius. But it does mean that if you buy the Sirius to run a program you have seen demonstrated on the IBM, and the dealer cannot actually show you it in action on the Sirius, then you are sticking your neck out.

Details of MS-DOS from ACT, who will probably put you in touch with one of their fervent dealers. Phone 021-454 8585.

Lisp for BBC

A book called *Lisp on the BBC Microcomputer* is guaranteed to confuse the uninitiated so, before panic sets in, Lisp is a language in which artificial intelligence experimenters write list processing programs.

The book comes with a £17 software cassette for the BBC Computer or Acorn Atom which actually provides the Lisp language. The book itself costs £70-odd and is an introduction to the concepts of list processing.

The language Forth is available in a very similar fashion on both micros.

Full details and exact prices from Acornsoft in Cambridge, at 4a Market Hill, Cambridge CB2 3NJ, or contact dealers.

Xenophobic system

Pro-British snobs, asked to admire Unix (an operating system much favoured by American academics) and the C language which was used to write it, often say jingoistically that 'of course, C is based on BCPL, invented in Cambridge'.

So it probably is, though a fat lot of difference that makes now that C is the standard and BCPL is not. But if you wish to join the island enthusiasts and if you have a 6809-based system, then M6809 BCPL is available for about £150 or less. Details from Martin Saxon on 01-446 4648.

TLO teach-in

Bristol Apple users who have bought The Last One but find that (though it may indeed be fast and powerful) it isn't easy to use are to be offered training: a TLO Workshop on Saturday mornings. The provider is Datalink, a local store, which offers the software at a discount — £269 including VAT. Details on (0272) 213427.

But does it make house calls?

If it takes a really good engineer more than three minutes to find the fault in a microsystem, then it is going to cost more than £20 to fix. And even really good engineers are usually equipped with things like oscilloscopes and logic analysers, which were never designed to troubleshoot CP/M hardware.

Micro Doctor, says its inventor, is.

It can read out the contents of a Z80 program in ROM and disassemble it. It can find a bad bit in a RAM chip. It can print out the memory map of a micro. It can . . . here, why should I write a long list, get the details of this £300 system for yourself from Dataman Designs, Lombard House, Cornwall Road, Dorchester, Dorset DT1 1RX. Phone (0305) 68066.

Feel the width

Questions as to how 'wide' a memory chip is may sound esoteric silicon jargon. In fact, the previous absence of nibble-wide 64 kbit RAM chips has been a big handicap for microsystem builders.

The logic is simple enough once you know that eight 64 kbit RAMs make a 64 kbyte memory but that the first chip is not the first 8 kbytes. The first chip is the first bit

Playing blob-chaser games on any micro by pressing 'Z' and 'X' to move left and right is a tedious exercise. On the Sinclair ZX81, a machine without proper keys, it is downright frustrating as well.

Hence Thurnall Engineering's conviction that it will sell a lot of its add-ons, like games joysticks, with interfacing equipment.

Details and prices from 95a Liverpool Road, Cadishead, Manchester M30 5BG, or phone 061-775 4461.

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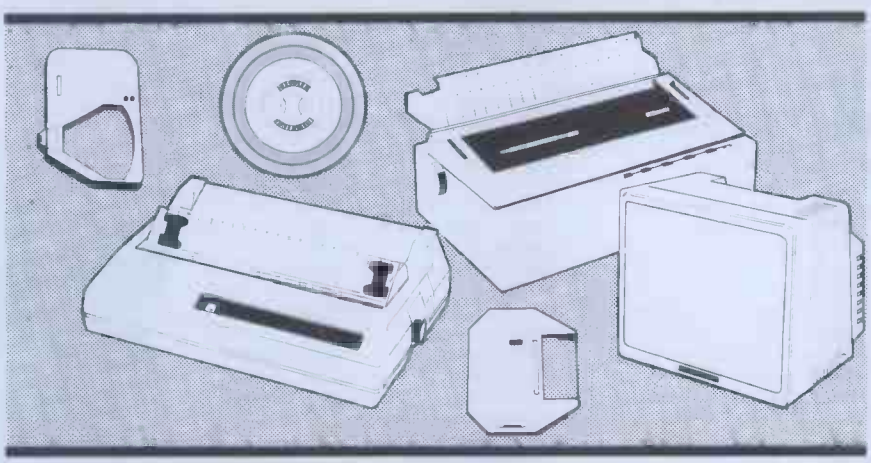

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See 'Stretching it out'

in all 64 kbits, the second chip is the second in all 64 Kbytes and so on.

This means that you can't have a 48 kbyte memory, which is a bit awkward when your micro needs to have a 16 kbyte in ROM. That's why Texas Instruments is so pleased about its new chip, which provides the first four bits of every byte in a 16 kbyte memory. Two of them provide a whole 16 kbytes, all on their own. Six of them will provide your 48 kbyte memory, and Clive's your uncle. (In case you're wondering, he had to use 32 kbyte RAMs on the Spectrum.)

Stretching it out

It is perfectly sensible to generalise and say that there is no sense in sharing one micro between two people — because the work involved in sharing outweighs the cost saving. Sometimes, however, it isn't true; and that is when a great many people want to use the same micro, but only occasionally.

An example is the Apbranch system which Saville Audio Visual has produced for Apple II users. This system is based on a special keyboard which can be as much as 1000 feet away from the Apple.

To quote Saville: 'A company wanting to put stock control on the Apple might want a terminal in the warehouse, one in goods input, one at an office desk and so on, so that they can enter data and retrieve it from various different points.'

Using the Apbranch terminal, says Saville, a standard four-terminal hook-up would cost an extra £1600 and would give access to any program running on the central Apple.

Details on York (0904) 37700.

Either/or (but not both)

Following the example set by giant computer maker Digital Equipment, a small British start-up micro company has launched a desk-top machine which uses both eight and 16-bit micros.

Setting itself apart from the example set by DEC, however, the company has produced this product, the Laser, as a multi-user, high price system and has designed it as an 'either eight or 16-bit' machine, rather than as both.

'A typical end-user configuration price,' says the company in a welter of syllabic prodigality, 'incorporating 64 kbytes of memory, eight bit processor, two disks giving 1.2 megabytes of storage, a ten-megabyte winchester disk, a serial printer and video display, would be £7900.'

Unfortunately, you can't run eight and 16-bit chips in the same box. The 16-bit Intel 8088 (as used by IBM, Sirius and DEC) is on a 'replacement board' which adds some £200 to the cost of the whole system. To run the one, you must have the other out of the box.

Anybody interested can contact Laser on Godalming (048 68) 5631.

M/C reference

For a mere 55p, a booklet on machine code for the Sinclair ZX81 has been released by Softest in Romsey.

The book is one of the rapid reference series which the firm produces. It's around the size of a tape cassette but only a few pages thick. It could actually get the keen ZX81 user started on assembler work for the first time.

Details from 10 Richmond Lane, Romsey, Hants SO5 8LA.

Cheaper Expert

Expert systems already existing on micros are quite possibly produced with something from Isis Systems, which released a software tool called Micro Expert in December 1980.

This system, says the company, has been used to produce expert systems that understand many subjects. The list goes: 'law, contracts, naval tactics, industrial planning, and fault diagnosis in chemical and industrial plants'.

Now it is cheaper. As of today, Micro Expert on a micro costs £380. On the Digital Equipment minicomputer range (PDP-11) it costs £800 and on that company's bigger VAX machine, £1200 — a good reason to use micros!

Details from Barry Parker on Redhill (0737) 71327.

Still waiting

A lot of people were planning to build business systems around the BBC Computer they may just have received from Acorn. Many of them will have been misled by me into thinking that by this time, they would be able to run CP/M software on the beast.

My apologies. The forecast was that a Z80 chip with a spare 64 kbytes of memory would be available, ready to plug into the BBC unit as a 'master processor' to run CP/M and the date forecast was March to May this year.

Fat chance!

My best information from Cambridge so far is that the add-on board with the 6502 chip in it will be out — perhaps — this month (September). Before that, business users wanting 'serious' programs will have to suck their thumbs and wait.

As for the CP/M add-on, the end of the year or later would be reasonable optimism, say my sources.

As far as the software goes, Acornsoft is (probably predictably) not aiming to license Visicalc, even on the add-on 6502 board but instead is working on its own spreadsheet program. Similarly with word processing. If I sound disappointed, that's because I am.

Towering RAM

It is called 'tower block' memory by its maker: 2 kbytes of memory which can be used either as ordinary read-and-write user memory, or as permanent memory, because it has a battery to ensure that the information never fades. It is called Memic, and you can get details of how to use it on boards which are too close together to take the tower block from Cambridge Microelectronics, 1 Milton Road, Cambridge, tel: (0223) 314814.

Bug Byte branches out

After ACT, now a big hardware dealer, software distributors are not two a penny in this country — so the news that Bug Byte of Liverpool now has 90 dealers to pass out its Acorn, PET and Sinclair programs to us must be significant.

Bug Byte isn't lacking in ambition, at least. 'Our target is to have 500 dealers within the next 12 months,' said Tony Baden, partner with Tony Milner in the business.

As an incentive to dealers, Bug Byte is offering discounts for cash, monthly prizes, point of sale display materials, promotional packs and a 12-month guarantee on its games.

Talking of 12-month guarantees, I admire ACT's nerve in announcing that the Sirius has had its warranty period 'quadrupled' because of its astonishing reliability.

This is what I call positive thinking with a vengeance. A less enthusiastic fan of the company than its publicity man might have been tempted to describe the operation as 'bringing the warranty period up to the bare excusable minimum of 12 months,' together with some suitable apology for having foisted a 90-day warranty off on the public for so long.

And before you write and complain, Mr Publicity old mate, yes I know other people offer 90 days and now they know what I think of them, too.

Bug Byte, anyway, is on 051-227 2642.

More micros for schools

Lovers of statistics who have noted that 'every secondary school in Britain now has at least one micro' (a quote by Ken Baker's Information Technology Ministry) and that there are well over 5000 secondary schools, will be encouraged by a move to put these machines into primary schools too.

By the end of 1984, says Baker, up to £9 million will have been spent (starting 1 October this year) in up to 27,000 schools, buying up to £18 million worth of computer hardware for children in the five-to-ten year bracket.

The scheme doesn't just cover any old micro. You

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have to want a Sinclair Spectrum (the big one with a 48 K byte user memory) or a big 'B' BBC micro with disk interface (but no disk) or the RML 480Z (cheaper, at //818, than the original 380Z).

The thing we are all supposed to get excited about, I suppose, is the fact that the Sinclair machine is now approved, and by the Department of Industry, too. And we'd all said how the mandarins of the DoI couldn't stand Uncle Clive!

Wyh, we must have been wrong after all (yawn). (Have I got the message right, DoI?)

I'd be a wee bit more impressed if the Spectrum wasn't priced at £346 — with a black-and-white monitor, you see — or £472 with a colour monitor. I'm sure the monitor sales are very valuable to Microvitec in Bradford but a colour monitor really is wasted on the Spectrum, which has its output bandwidth restricted to prevent PAL dot crawl.

Positive Positron

One of Britain's more interesting new microcomputer builders, Positron, has taken the important step of starting to look for a distribution chain without which (as even IBM will discover), serious micro marketing cannot be tackled.

The unusual machine, designed originally for video control as well as personal data processing, appeared for the first time at Compec North. Potential dealers who couldn't get to that show should contact Peter Loftus, the marketing director, on 061-228 3678.

British Micro is the company led by Manas Hegoyan (the man who so nearly bought Nascom after it went bust) which produces the best-value British CP/M machine.

Like Positron, BM is now pushing its Mimi design through retailers in this country; previous sales had largely been abroad and only a few hundred machines were built.

A big brother, with a 16-bit processor option, should be available very shortly.

The company has now announced a list of over 30 dealers all round the country (only seven in London) — for details or a local address, contact Gerald Roll, marketing manager on Watford 48222.

Beeb bug

There are a lot of theories about why the BBC Computer is less than perfect at saving and then loading programs on tape. There are also some hard facts — obtainable, of course, by joining the independent national user group.

To summarise, however, the BBC microcomputer wil will not reliably SAVE because it has a bug that corrupts the first block-header, one time in 16. There is a machine code fix for this and if that won't work for some reason (no room in memory, perhaps) it doesn't happen at the slow tape message speed, only the fast 1200 baud rate.

The machine will not reliably LOAD because many recorders have phase problems, only just audible, but crucially distorting to the timing mechanism of the machine. Unfortunately, some commercial duplicating firms are churning out BBC program tapes with this fault.

It may sometimes fail to both LOAD and SAVE because of earth loops — either one too many or one too few will do it — set up in the cables from computer to cassette recorder. This one is curable by unplugging or plugging in the 'record', 'mic' and 'remote' plugs until it works.

And it may fail to SAVE because some tape recorders are too sensitive and the BBC produces too loud a sound for the input circuits. Usually a 5k resistor, say users, needs to be put between recorder and computer to cure this.

Most of this information I got from Sheridan Williams' Beebug mag. I also discovered that BBC Basic gets very confused over the length of strings if they grow during the program, because it picks a new bit of memory to store them in each time they grow by eight bytes. And I found a way to avoid this, too.

Details of the user group and its invaluable magazine (£8.90 buys membership for a year, including the newsletter) from Beebug, Dept 1, 374 Wandsworth Road, London SW8 4TE.

The plug on the front of this box reveals that it fits onto a Sinclair ZX81; the loudspeaker holes reveal that it makes sounds. Like the BBC and VIC sound devices, this has three channels plus a noise channel. Like the BBC Computer, this one can control the 'envelope' of the sound. It costs a mere £30, including postage and VAT, and can be programmed in Basic 'to produce piano, organ, bells, helicopters, lasers, explosions, Space Invaders, etc,' says Bi-Pak Semiconductors of PO Box 6, Ware, Herts; tel Ware 3442/3182.

Setting standards

The micro manufacturers are working hard, trying to find a way of using disks so that they can all read each other's data off the magnetic surfaces.

And at the same time, the disk manufacturers are working hard, trying to devise standards to make the same thing possible.

The latest move, following several announcements (from Osborne and others) of operating systems that can read alien disks, comes from Dysan, Verbatim, Shugart and Tabor (who all make disks) who want to agree on a standard for the newest tiny disks, the microfloppy.

Maxell, through its UK distributor CPU Peripherals, has already launched one of these 'Compact Floppy Disks' (see pic) — only prototype and preproduction ones so far — for the computer designers to play with.

But the other four are worried by the Japanese lead in this market. And while they claim to be working for a standard just to make life easier for the rest of us, nobody need be too astonished if they eventually settle on a standard which is subtly different from the devices already available (in the US) from Japan.

CPU Peripherals is in Shepperton, Middlesex TW17 8AQ; tel Walton-on-Thames 46433. Verbatim is represented by BFI Electronics (01-941 4066) and Willis Computer Supplies (0279 506491).

Snap it up

Words like 'copy' are four-letter epithets in the program business, and there is a new phrase to use in polite society.

See 'Setting standards'

Programs like Snapshot, released as the latest weapon 'in the escalating arms race between Apple disk copiers and disk protectors', does not copy programs — it 'backs them up'.

Programs which Snapshot can 'back up' include difficult disks like Visidex, new releases of Visicalc, and even the well-known back-up maker, Locksmith.

Snapshot is not just a program but an electronic device. It works on the presumption that a program runs in perfectly normal machine code, no matter how cleverly it may be disguised on the disk.

So Snapshot circuitry interrupts the program while it is running and dumps the contents of memory to an unprotected back-up disk. The method will not work with programs that make repeated reference to their own source disks — things like Adventure, or accounting packages.

The trouble is that, if this method becomes commonly adopted, the only really safe method of making sure that a program will run only on one machine is to tamper with the machine itself. Apple users have suffered from a host of 'dongle' devices — scrambler circuits which plug into the games port. Apart from the obvious fact that they prevent the use of the games port for games, they are never the same from one program to the next.

So, to use a protected program, inevitably one ends up lifting the lid off and mucking about inside the Apple — sometimes dropping the video monitor, sometimes only the disks. I won't use the things.

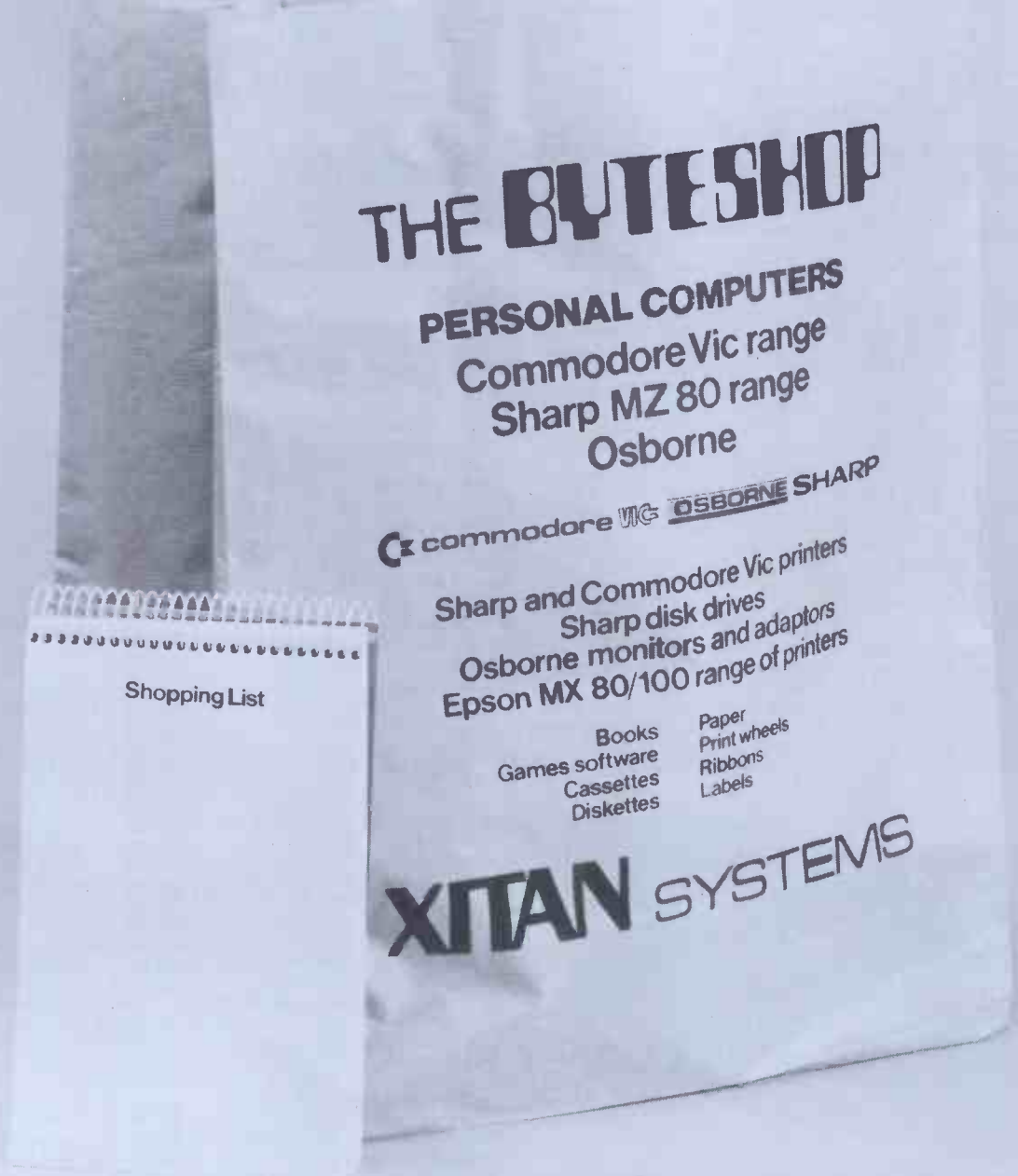
Snapshot is available from Dark Star Systems for £95 including VAT. Details from 54 Robin Hood Way, Greenford, Middlesex.

Up in arms

Both Apple and Atari are quite right, of course, to take the tough line they do about imitations, even if they take exactly the opposite viewpoint to each other.

Apple is getting very steamed up indeed about Far East imitation Apple IIs being

Bags of expertise



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sold for (I am told) under £200. Atari, on the other hand, couldn't give a soggy damn about imitation Ataris. It has steam under high pressure, however, to be released in an angry jet at anybody who copies the software which runs on its machines.

That, of course, is something that Apple doesn't mind too much — you can produce software to run on Apple till the cows come home, and Apple will help you all it can.

One software dealer I know has a good stock of Atari games and the like and, on the strength of this stock, got a customer for an Atari micro. The order was turned down flat by Atari because the dealer proposed to run non-Atari software on the machine.

On that note, I must report that I have wasted at least one week in the last three by playing a game called Snapper, produced by Acornsoft for the BBC Computer.

Pacman, Atari's game that is taking the US by storm, was originally available on an arcade machine before the current video game version appeared in the shops. Any difference between Pacman and Snapper is virtually undetectable by me. On track record, I would expect Atari to take up arms against Snapper. I'll let you know what happens.

Conservative figures

Trying their hand at market research, the retailers of Curry's (the Micro-C stores) have discovered that there are some 600 specialist retail outlets for micros in the UK, and some 217,000 systems sold.

These estimates are conservative, to say the least. I pass them on for historians to chuckle over: the Curry figures show that the £100 to £500 value market, with Atari, Vic and Texas Instruments quoted (no mention of Acorn, Tangerine, Ohio, Nascom, Transam, Tandy, Sharp, Video Genie and other minority single board systems) has 'over 50,000 micros installed' — in total, that is, not just over the last 12 months as some might imagine.

Business systems between £500 and £4000 account for 12,000 installations, says Micro-C. This is quite a trick, since Apple has averaged well over 1000 systems a month for well over two years, and Commodore does twice that (excluding the 30,000-odd VIC 20s) and has done so for at least three years, average. Only another 5000 systems, worth £4000 to £10,000, can be found in Britain they say.

Whatever might have happened to all the Superbrains, Princes, Sirii, Horizons, Cromemcos, Tuscans, RML 380Zs, Signets, Torches, Hewlett Packards, Casus, Osbornes, and the like, can only be guessed at. Probably there is some kind of misprint involved.

The misprint theory is substantially enhanced by the Curry's figure of 150,000 Sinclair machines sold, a figure easily exceeded just on the ZX81, ignoring its predecessors.

Easy bus

A great many Commodore computers were sold because the machines all included an output and control port called the General Purpose Bus (to IEEE-488 standard) which could be used to control scientific instruments.

A great many more would have been sold, however, if that wretched bus had been easy to use. It isn't really Commodore's fault that it was, instead, fiendishly complex.

Simplifying the job of driving remote devices through the bus, Rhombus has released an operating system which gives control of the bus to an extra 56 commands which look like Basic commands.

Rhombus supplies the software in chip form, a 4 kbyte ROM and a 125-page manual.

No apologies for the following string of jargon terms — those who don't understand the bus aren't going to learn it here — which will explain in outline what has been done. I quote:

'An on-screen bus monitor is implemented, and all commands can be called from a Basic program. BOS deals easily with binary, hex, BCD and ASCII data transfers. All the bus commands (GET, DCL, SPE and so on), together with SRQ, SERIAL and PARALLEL polls are available. There are no "time-outs". Character strings of up to the full length of 255 bytes can be input to Basic string variables (including the null byte — zero). Block data transfers, to or from PET memory locations, can be done at up to 6 kbyte per second rates, with decimal or hex addressing. A reliable GET½ routine is provided, and there are no "ILLEGAL DIRECTs".'

Price is £83. Specify which Commodore series machine you want to plug it in to. Contact Rhombus for its BOS data sheet (send self-addressed envelope) at 87 Bourne Way, Hayes, Kent BR2 7EX.

It may be only 24 characters wide, but it only costs £70. It may not be suitable for invoicing posh customers — but it does print on plain paper. It is the Amber 2400 printer, and builder Amber Controls says that it is capable of attachment to a great many home computers because a large range of serial and parallel interfaces are provided as standard.

Details from Amber at Walworth Industrial Estate, Andover, Hants; tel 65951.

Sirius hard disk

Sirius 1 is a computer that provides a fair bit of disk storage, but there is always a need for more — so the news that Corvus hard disks are available from Keen Computers will be welcomed by many users.

Their enthusiasm will not be based on the incredibly low price of the Corvus disks (because they aren't incredibly cheap) but on the fact that Corvus disks are networkable, so that two or more Sirius users can share the same hard disk.

The really clever thing about the Corvus net, however, is the fact that it is a Z80-based CP/M microsystem and you can use it to run all those useful CP/M programs which still aren't available on the 16-bit version, CP/M-86. Of course, you will probably have to convert your CP/M programs from your own system to this one, but that's another story — and maybe a shorter one.

Extra files called 80.CMD and 86.COM are supplied in CP/M-86, to let you switch from eight to 16 bits. And Keen Computers believes that all files generated under either CP/M are identical in structure, 'which means that any files created under one operating system may be used by the other, with no restrictions'.

See 'Sinclair slashed'

Sinclair slashed

An enormous price cut for te ZX81, down to £50, is expected to stop its drop in sales, says Clive Sinclair.

The price cut from 1 August was originally described as 'not necessary' when Sinclair launched the newer and better ZX Spectrum in April. But sales — Sinclair says he can't give details — have not held up as anticipated.

Reports from W H Smith that over-the-counter sales of the ZX81 had 'dried up' were denied by Sinclair. But he said that the drop in sales were not available 'because it isn't clear what seasonal factors are at work, and so on'. And he (rather reluctantly) refused to confirm one suggestion that sales had halved.

'We know that price cutting on this works — we had spectacular boosts in American sales by cutting the price from $150 to $100. I think sales trebled, actually,' he said.

The picture shows Clive practising for the half-marathon he helped sponsor in Cambridge in July. 'Of course I finished!' he expostulated contemptuously. 'It's only half a marathon, after all.' Having completed two New York Marathon runs, I suppose he's entitled to a little pride in his legs.

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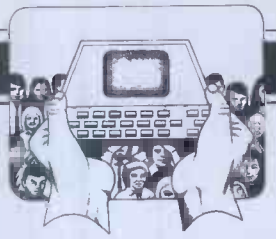
CTUK!NEWS

by David Tebbutt



It's been another good month for ComputerTowns — three more have started: Ashford in Kent, Church Stretton in Shropshire, and South Shields in, er, the north. Congratulations to all concerned. Readers can find the addresses of the first two organisers, Christopher Bates and Peter Earthy, in the ComputerTown Contacts at the back of the magazine. The organisers of the third, Dave Gallagher and Pam Collier, can be contacted via John Bone (also listed) for the moment.

Please forgive me for being a little terse this month. The reason is that I would like to hand the rest of the column over to Ron Dixon, Chairman of ComputerTown North-East, who tells the story of one ComputerTown's development:

"We thought a few notes about our history could be of help to those who worry that they could not organise a CTUK. Early in 1981, four members of the Newcastle Personal Computer Society (NPCS) read the original article in *PCW*. They were Steve Christian, Dave Thompson, John Bone and Richard Powell. This confirmed their own feelings about computer literacy. No organisation seemed to be interested in letting Joe Public in on the act so CTNE was born. It was as simple as that. Looking back, it seems that the most attractive feature of the proposed plan was that it would be a totally independent group, while still having national representation.

Its first meetings were at two community fairs or fetes and they went 'like a bomb'. The next problem was to find a venue for regular meetings. We had already agreed that they were to take place during the day. We didn't like the idea of a too-formal setting so a school or college was not for us. (You will probably have gathered by now that we're a rather informal crew. This is reflected in everything we do but of course this format may not suit other groups.) We found a small shop unit which was available for £3 on a Saturday and we thought this very good value.

Our first meeting in January had very little publicity but attracted all of 12 people as well as the four Grand Originals. We even got an extra computer, which lived in the flat above the shop. By March our regulars had expanded to 20 and we were getting too big for the shop — but where to next?

An old local church in central Gateshead was in the process of being converted into a community centre. We were lucky enough to move there two weeks before the official opening and have met there ever since on most Saturdays between 10am and 5pm. We now have over 60 regular members and about 20 regular microcomputers. Our members come from all walks of life: teachers, students, road sweepers, surveyors — you name them, we've got them.

Our formal organisation comprises a Chairperson, Secretary and Treasurer and we also have representatives of the three age groups. The most important is group A, our under-15 bracket, represented by Kevin Dixon. Dave Thompson leads group B (15-25) and is our representative on the management committee of Trinity Centre, Ian Simpson brings up the rear for the older generation in group C (over 25). Sylvia represents the interests of the Centre and keeps us out of trouble. Andy Stoneman is our treasurer and his age (16) shows again our view on his generation. John Bone is our secretary.

Two recent visitors to Geordieland were their Royal Highnesses the Prince and Princess of Wales. Andy and Kevin had the pleasure of meeting them. The Prince's Trust last year purchased a Video Genie for CHIPS, our sub-group, and it was the star exhibit, if you discount a local punk rock group.

Two of our members, Dave Gallagher and Pam Collier, are soon to start a ComputerTown in nearby South Shields. When they start, we will of course be there to support them.

At the time of writing, we have just had an incredible free offer of at least six terminals from the Trustee Savings Bank. It should be interesting to see just how many interfaces can be persuaded to operate with them.

How do you measure the success or lack of it with a group like ours? All I know is that we seem to enjoy ourselves and we keep coming back so there must be some attraction. Vandalism has only once raised its ugly head, when an Atom had a match struck on it. One such incident these days is not too bad, we think."

Now, if you'd like to follow CTNE's example, do write to me for a set of guidelines to help you on your way. I look forward to hearing from you.

For further details of CTUK! write to: CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL. Please enclose a large SAE for your reply.

Busy scenes at CTNE

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"JUST SKIMMED THE LAST THREE ISSUES AND FOUND THEM FASCINATING..."

Arthur C Clarke

It's amazing what goes on in the basement of *Personal Computer World*. Our erstwhile subscriptions manager, for example, engaging in correspondence with Arthur C Clarke! (For the uninitiated few, ACC is arguably one of the world's most visionary living individuals: a scientist, author of 2001: A SPACE ODYSSEY and 60 or so other works, originator of communications satellites, undersea explorer, etc, etc).

Mr Clarke tells us that he has an Apple II 'languishing in the lab... too busy to touch it for weeks'. Busy, apparently, completing SPACE ODYSSEY two ('my *latest*, last book!') on his Archie word processor (Archives III, 5 megabyte Winchester disk, Wordstar program) with which he is obviously deeply satisfied — 'I could no more imagine going back to a typewriter than to a slide rule...'.

We make no bones about our delight that Mr Clarke takes the trouble to write to us from his home in Sri Lanka and comment on *Personal Computer World* so favourably. As a subscriber to *PCW*, not only will you save a small fortune (see the rates below) but you can count yourself in august company. Remember that Clive Sinclair described *PCW* a short while ago as 'clearly one of the leading computer journals in the world'.

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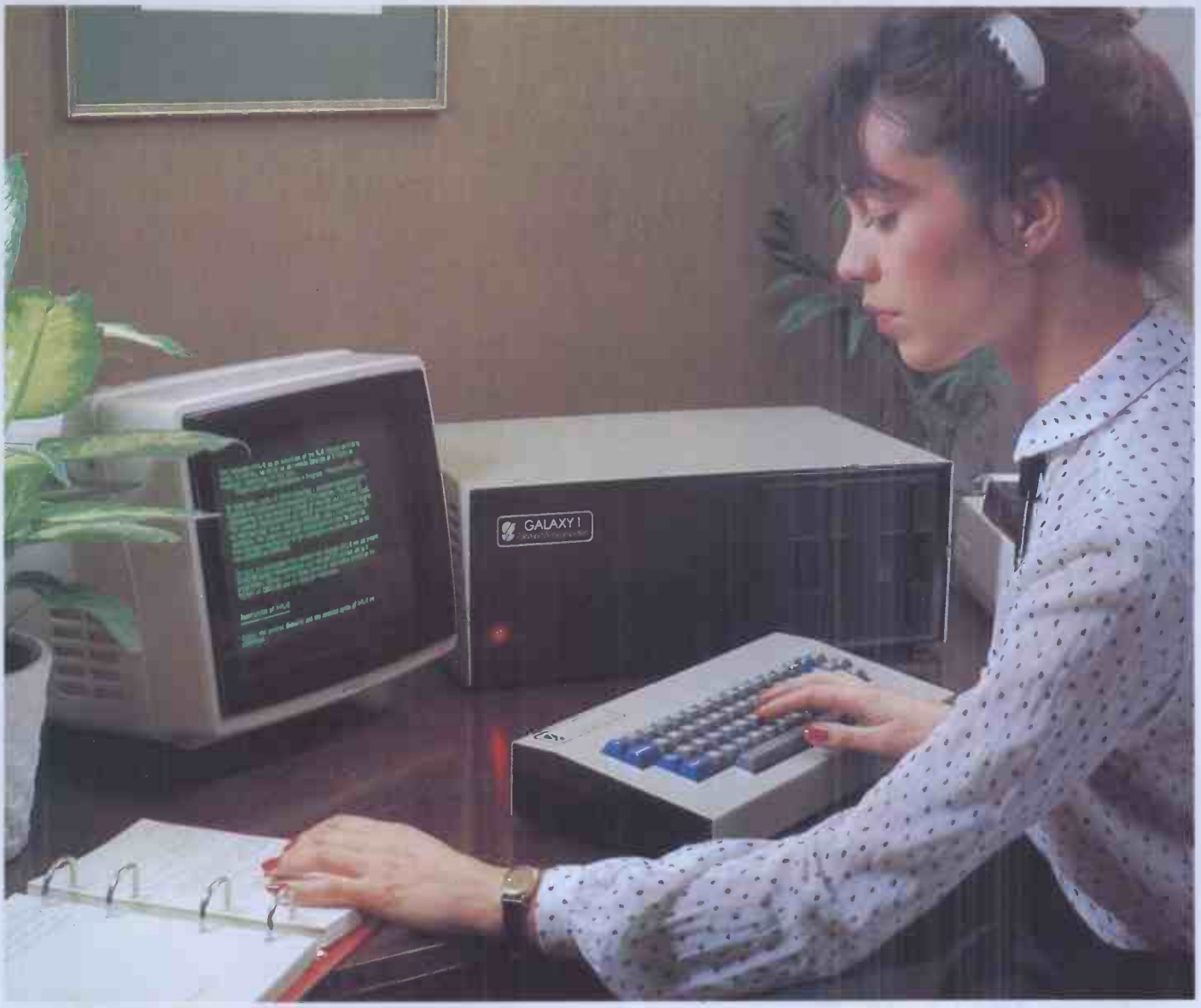

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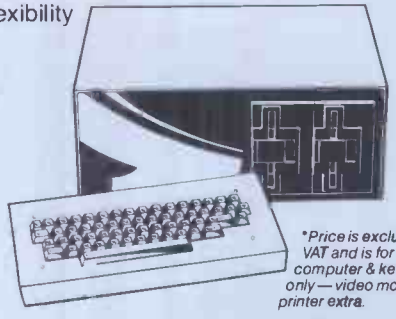

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MICROWRITER Revisited

Peter Rodwell re-assesses a unique text processing device.

Nearly two years have passed since I first reviewed the Microwriter, the device which enables you to 'type' single-handedly, to store your text either in the machine's own memory or onto tape and to print it out onto paper.

Since I first encountered it, the Microwriter has undergone considerable development, and the company which makes and markets it — Microwriter Ltd — has revised its marketing strategy and is now ready to hit the world with what is now not only a unique text-handling device but a very sophisticated one at that.

But first, for those of you who may never have heard of the Microwriter before, or who missed my original review, here's a brief outline of what the Microwriter is, what it does and how it is used.

The Microwriter was invented by expatriate American Cy Endfield. He hit on the idea when, after buying one of the early pocket calculators, he was trying to figure out a way of incorporating a word game into a hand – held electronic device.

The problem, he felt, was that using one key for each letter would require a very fiddly keyboard. The alternative, a chord keyboard with one key for each finger, had the drawback that learning the key combinations appeared impossible. Cy Endfield's big breakthrough was in devising a particularly clever and easy system for learning the key combinations by using the shapes of the letters themselves as mnemonics — each letter is formed by pressing the keys which correspond to the main features of its outline.

Exactly how this works can best be seen from Figure 1, taken from one of the handy reference cards supplied with the

Microwriter. When I first tried my hand at Microwriting, it took me about half an hour to learn the basic alphabet and about three weeks to learn all the other symbols and to build up speed to the point at which it was quicker and more convenient to Microwrite than to use a pen or a typewriter. This appears to be an average learning curve; the record for learning the key combinations is 1½ minutes!

Probably the most difficult part of learning to use the Microwriter is persuading yourself to try it in the first place, for the sight of a skilled user tapping away can be quite awe-inspiring: it just looks impossible. Once you get over that hurdle and actually try it out for a few minutes, it quickly becomes obvious that there's really nothing to it. The whole system is so well thought out that there's really no excuse for failing to learn!

Given that it's easy to learn, what do you do with it once you've mastered it? Well, the Microwriter is very nearly a portable word processor. 'Very nearly' because, although it allows you to enter, sort, retrieve and print out text it lacks facilities such as searching and replacing which are found on real word processors. But in its relaunched form, the Microwriter is an extremely powerful and versatile device; as you'll see, describing it as 'very nearly' a word processor hardly does it justice. Its great advantage over conventional word processors is, of course, its portability: I'm Microwriting this review while sitting outside in the sun, for example!

Hardware

The most immediately obvious physical change to the Microwriter is its case, which has changed from white to two-tone brown and cream and appears to have been flattened slightly and generally smartened up. The old LED display has been replaced with a 14-character LCD dot matrix unit which displays both upper and lower case characters and is much nicer.

On the front edge of the device is a massive socket which allows maintenance engineers access to the system's internal signals. Next to this is the socket for the battery charger. On the back edge are sockets for the RS232, TV and cassette interfaces and the on/off switch. There are in fact three ways of turning the Microwriter off: you can use the on/off switch, in which case when you turn on again you'll find yourself at the beginning of whatever's in memory; you can execute a series of key combinations; or you can simply leave the machine alone and it will turn itself off after eight minutes. In the last two cases, turning it on again puts you straight back to the point in memory where you were when you turned off — a handy feature.

Inside the machine some considerable development work seems to have taken place. There's still an RCA 1802 CMOS processor at the heart of things and there's still 8k of CMOS RAM to hold the text — enough for about 1200 words. The RAM is permanently powered by the rechargeable battery pack, incidentally, so its contents are retained even when the unit's switched off. The batteries power the unit for about 30 hours and it can be recharged overnight or while you're still using it.

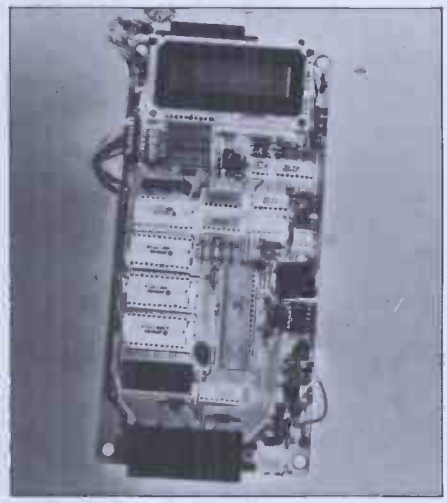
The original Microwriter had two PCBs inside; the new model has only one, yet the cassette and RS232 interfaces, previously separate units, have been fitted inside the main unit. This eliminates one of my earlier gripes — the untidy tangle of wires and the constant plug-swapping which resulting during a heavy editing, taping and printing session.

The TV interface remains a separate, external unit which you purchase as an optional extra. It has, however, become a little smaller and now uses the battery charger as its power supply instead of running from the mains.

New facilities

A whole host of new facilities has been added to the Microwriter, of which the two most exciting are on-screen writing for the video interface and the ability to communicate with other equipment such as word processors and computers.

On the earlier model it was only possible to dump text a screenful at a time to the video interface. The facility was useful for checking whether you had formatted the text correctly



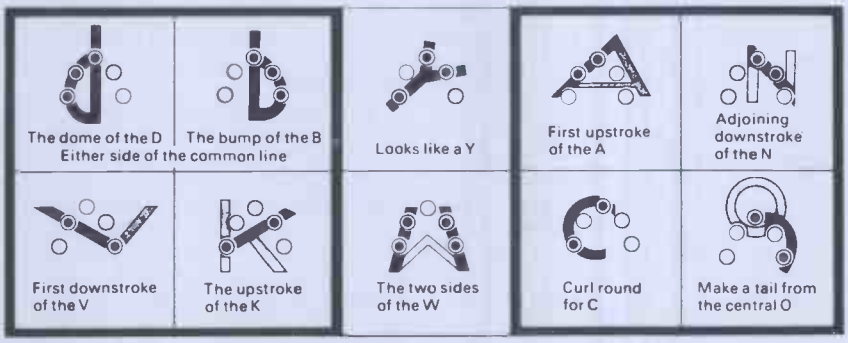


Fig 1 Part of the alphabet learning card (copyright Microwriter Ltd)

The video interface has outputs for TV and monitor.

Photography by David Leigh

MICROWRITER Revisited

for printing but, if you hadn't, changes had to be made within the Microwriter and the text re-dumped to the screen for rechecking. Now, though, the display is fully interactive and you not only see what you write as you write it but can make on-screen formatting changes as well as editing your text. If you were using the Microwriter mainly in one location , the video interface would be well worth getting. Good though the Microwriter's display is, I for one find it far easier to write when I can see a whole block of text in one go rather than just a 14-character window.

As before, the Microwriter has insert and delete commands and you can read through your text either forwards or backwards — the window has two scrolling speeds, the higher of which jumps along a word at a time fairly quickly but still readably. Text in memory can be split into separate documents and there are commands to jump to the start or end of each doument or to the start or end of memory. Likewise, the cassette handling works on documents rather than on total memory contents, so it's possible to do crude block moves by placing document markers around the block, taping it, erasing it, moving to the point in text to which you want to move the block, entering insert mode and playing in the tape. I found the tape interface easy to use and had absolutely no trouble at all with it. A very neat feature when reading tapes is an indicator on the display to show when the tape recorder's volume is at the optimum setting — with my Pearlcorder I found that tapes loaded perfectly over a very wide volume range, from full volume right down almost to the minimum setting.

Once you've written your text, you'll want to print it out somehow. The Microwriter has a standard RS232 interface with programmable baud rates from 110 to 4800 and adjustable framing (stop bits, parity, etc) so it will interface to any standard printer. Among the many new facilities added to the machine are what are called 'menu items' for setting and altering various system parameters, including all those for the RS232 interface. Once you've set the machine up to work with your printer, the settings are retained even when you switch off so you can then forget about them.

When the Microwriter prints text, it automatically prints a line feed and carriage return at the last space before the 60th character on each line; unfortunately it doesn't right-justify text. The line length can be altered with a menu setting or the facility can even be suppressed entirely. Other menu items allow you to preprogram certain key combinations to produce a string of up to three ASCII characters in a text stream — useful for sending instructions to a printer for turning bold printing or underlining on or off.

The menu settings allow you to configure the Microwriter as a terminal for use with a word processor or computer. I had no trouble at all in hooking up to my Cromemco for use with Cromemco's so-called 'word processing' package and in fact I now tend to use the Microwriter as a dumb input terminal in preference to the normal, typewriter-style VDU, although the latter is still used to display the computer's output, a 14-character display being pretty useless for this purpose.

There are two points worth noting when using the Microwriter as a terminal. Firstly, it's necessary to suppress the auto CR-LF facility as this plays havoc with a computer; and secondly, while you're using it as an input terminal, everything you type not only gets sent to the computer but is also put into the Microwriter's own memory so that, in a long session, you have to stop occasionally to clear it out. A memory full early warning is given on the display when there's only space left for 256 more characters.

Documentation

As well as upgrading the machine, Microwriter Ltd has revamped its documentation. Each Microwriter now comes with two booklets, a beginner's guide and a more advanced book, plus a series of very useful reference cards which you can keep in the machine's carrying case.

The beginner's guide firstly teaches you the alphabet key combinations and then takes you step by step through the remaining widely-used functions, including using the video interface, printing out text and using the cassette interface. Generally, the documentation is well-written, concise and clear and manages to teach without condescending — not always the case in the micro world. The beginner's book is enlivened with small cartoons featuring a cube-shaped entity reminiscent of the Tate and Lyle symbol.

Things are rather more serious in the second book, which provides full details of all the remaining facilities, including detailed descriptions of all the menu settings, what they do, their default values and how to change them, with plenty of information on interfacing the device to other machines. As the Microwriter can transmit the complete ASCII character set, including control codes, an ASCII table is thoughtfully provided.

The reference cards include the recommended learning sequence for alphanumerics plus a complete list of all the menu settings, with spaces for you to write down the values of any you change.

Prices

In my first review of the Microwriter, I incurred Cy Endfield's displeasure by stating that I thought the machine was overpriced. What I neglected to say in the review was that this was not solely my opinion but the result of showing the machine to some 30 or 40 people. All were very impressed until they heard that it cost £500, at which point they tended to wince or laugh and change the subject.

The basic Microwriter, including carrying case, cassette lead, charger and documentation, and with six months' warranty, is now £485 plus VAT. In fact the price has dropped in real terms, for not only has inflation taken its toll in the last two years but the RS232 and cassette interfaces are included both in the machine and in its price (they were optional extras before). And, of course, a very large number of extra features have been added to the machine. Still, though, I have to report winces from those to whom I have shown the device, a reasonable cross-section of potential Microwriter users.

Whether you would be prepared to pay this money for such a device is, obviously, a decision only you can make. Personally, I find it invaluable — not only because it allows me to write outside in the sun but because I find it quicker and easier to use than a conventional qwerty keyboard. And I suspect that this is the case with a great many Microwriter users: the qwerty keyboard can be an intimidating thing, especially for the businessman who has neither the time nor the inclination to learn touch-typing. The Microwriter has certainly gained favour not only in all sorts of business environments but in government departments, too: the Home Office has long used them, particularly for the preparation of documents too hush-hush to be given to a typist.

The Microwriter's six-month guarantee can be extended by a further 12 months for £28.75 and a similar scheme, costing £19.55, applies to the TV interface. Additionally, for £28.75 a year, Microwriter offers a loan scheme: if your Microwriter breaks down, you can take it to the nearest Microwriter centre (a network of which is being established across the country) and borrow another one while yours is being repaired.

Conclusion

The new Microwriter is a very attractive and versatile device which in a single package provides an easy-to-learn-and-use alternative to the qwerty keyboard plus a versatile text processor and a communicating terminal which can easily be interfaced to a computer or word processor.

I feel that the £485 + VAT purchase price may still act as a deterrent to many people — you've got to be able to justify that sort of expenditure in most businesses and the Microwriter isn't something which will immediately impress the accountant, even though I'm certain many people would find it a distinct productivity aid. Likewise, it would be expensive to equip a whole office with them, particularly if they were being used purely as input terminals; there's probably a market for a cheaper, 'cut-down' version which can act only as a dumb input device.

I must admit, though, that my main reason for wanting the device's price dropped is to encourage its wider use. I think it's a super device, embodying some really inspired thinking, which deserves to succeed.

END

COMMUNICATIONS

PCW welcomes correspondence 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,* 62, Oxford Street, London W1A 2HG.

Ode to Joy

I felt I simply had to write to you to share with your readers my delight at the wonders of the micro-computer! As a teacher, I can also share this pleasure with my pupils; or at least I will when our MEP computer arrives. One advantage of promising it more than a year before its delivery is that I should be ready for it when it comes. My BBC Basic should be quite good by then because I shall have my BBC ROM in my Atom; after two month's wait it must be due soon.

Perhaps I can improve my Machine Code programming from that book I ordered three months ago — the author must have finished writing it by now. Could it be that the delay is caused by the 6502 running at only 1Mhz? That is a little slow by today's standards.

In the meantime I suppose I shall have to continue bouncing away on the keys of my Atommmm.

Chris O'Donoghue, Enfield

Don't let it get to you Chris, take a Valium. . . Ed

Ooops! Part 27

It is all very well taking a sarcastic approach when writing ('Newsprint' July) about new equipment, but one should make sure that one has one's facts right first.

In the press release we sent to you on the NCR 9010, we made it very clear that it is a family of microprocessor systems. The personal computer is just one of the series. Other systems in the series we announced will include: small business system, satellite terminal network controller, factory terminal controller and a scientific workstation.

We also made it very clear that the personal computer was one of the systems which would not be released until later this year. Because of this we did not give any further details of the personal computer in the release. The price we quoted as an example was very clearly stated as being £5,700 for the satellite terminal, *not the personal computer.*

In fact it looks as though the price for the personal computer version of the NCR 9010 will be around £2,500. This will include a 64k processor, two integrated 5¼in minifloppy disks and a matrix printer. It will also handle colour and graphics. We feel this makes it competitively priced and good value for money, as is the whole of the 9010 family.

Perhaps *you* should 'go away and try again' and get your facts straight next time.

Michael Fenton Webster, Manager, Press and Public Relations, NCR Ltd

Appeal

We are a Cheshire Home for the physically handicapped, and have recently bought an Apple II microcomputer, now being adapted for use by severely handicapped operators, initially as an aid to solving some very basic problems and for recreation, viz:

1. Communication — between (a) residents and staff; (b) resident and resident.
2. Letter writing — through word processing etc.
3. Games — from chess through to Space Invaders.

We intend to set up a central library of programs, specifically for use by handicapped operators, and adapt programs to suit their physical capabilities. The library will be available to all interested parties, who wish to donate and borrow programs. At present we are looking for programs in three formats: 1. program listings; 2. Apple II floppy discs; 3. TRS-80 cassettes. Floppy disks and cassettes will be returned.

The idea is to provide a link between all organisations and individuals who are working in the field of computing for the physically handicapped. We would welcome enquiries from schools, colleges and residential homes, etc. If interested, please write, enclosing a SAE, to:

Seven Springs Cheshire Home, Pembury Road, Tunbridge Wells, Kent TN2 4NB.

Computer Literacy OK!

I had been thinking about computer literacy for some time, and reading several articles in your July issue made me clarify my own thoughts.

David Tebbutt's article on Computer Literacy was extremely interesting and, I feel, drew some very good conclusions along with one that was totally incorrect! I think that he is absolutely right in saying that most people have no need to know about bits and bytes, PEEKs and POKEs, Boolean algebra and flowcharts. Many of the introductory books and articles for the layman fall into this trap, and often leave the readers more confused about computing than before. Not only are they confused but, unless they are determined to succeed, they can be made to feel very inferior when talking to those already initiated into the 'brotherhood'. When I became a professional programmer, over ten years ago, I found that my language, Cobol, was despised by some of the longer-established programmers because it allowed upstarts like me to write programs without the dedicated training necessary to use assembly languages.

As with enthusiasts in other spheres, far too many of the computer fraternity are in love with their technical skills. It is often noticeable that many of the programs, proudly presented by their authors, don't actually *do* anything that would be recognised as useful by an outsider. We have many versions of very similar games, and there is much boasting about the economies of memory that have been achieved. There are numerous 'toolkit' programs and chips on the market, all of them claiming to make it easier to develop programs by providing special facilities for the input of Basic key words, but few of them make any difference to what programs can do for the end user. It seems to be implied by the advertising that the personal computer owner will spend all his (it always seems to be *his*) time developing programs, but very little time using the results!

So far I have seemed to agree with David Tebbutt all the way and you may wonder what I consider to be his serious error. This is the assumption that computer literacy is the things mentioned so far. We can pursue the analogy with ordinary literacy and realise that literacy is knowing how to *use* language properly, while knowledge of phonemes, morphemes and such things can be left to the professional student of linguistics. Similarly real computer literacy is knowing how computers can be used to help us in what we want to do, even if we have to ask someone else to write the program for us.

In the article by the teacher it is pointed out that the headmaster's request to store the names and addresses of his children is not much use because loading the file from tape would be much too slow. This is true, but it would be wrong to conclude that the computer cannot help. If the school could manage to obtain a cheap printer, such as the Seikosha, then an inexpensive word-processing program could be used to ensure that the printed list could be kept up to date, and so avoid the problems of using a much-corrected piece of paper. I use the program WORD4WORD to keep an index to my programs and am in the process of creating similar indices from my records and books. It would also be possible to create similar indices for magazine articles and pamphlets.

I feel that an understanding of these, and similar, possibilities is really computer literacy and should be encouraged as much as possible. Many of the programmers who at present write rather aimless programs could do worthwhile work if the potential users were sufficiently 'literate' to make sensible specifications of their requirements. I lecture at a management training centre and am regularly asked by students to explain 'what computers can do', and a good understanding of opportunities and limitations would probably lead to an improvement in the standing of computers, even though it would make it more difficult for the professionals to pull the wood over the users eyes!

Education in 'computer literacy' is certainly necessary, but we can leave out almost everything about the use of individual languages and computing devices. We must, however, talk about validation — what part of the input can be checked by a program — and the different types of file, depending on the way in which the user wants to access the data. It will also be necessary to talk about exception conditions — how do we know what possibilities there are, and what must be done with them if they arise? Even my own computer users group managed to fall into the old trap of one subscription for those under eighteen and another for those over, without saying what was to happen to those who were eighteen! Perhaps we ought

to talk about decision tables, and other methods of analysing problems. The solutions can be left to the programmer but the problem can be analysed properly only by the user.

Concern with programming as an Art Form leads to the current spate of articles in the various enthusiasts magazines showing how to convert one version of Basic to another. These are not as useful as they seem because it is difficult for the reader to remember all the details, especially the effect of PEEKs and POKEs, and because Murphy's Law ensures that the program you would like to convert is written in a dialect not yet covered. Your own wallchart, which is excellently printed, does not cover the RML 380Z used by my son's school, and some of the TRS-80 details are incorrect. TRS-80 Basic is much closer to the standard than implied by the chart, and I have never come across PRO mode which is mentioned in the LLIST column. If I can find these errors in the version I use how do I know if the other versions are correct?

Perhaps the real need is two complementary series of articles. The first would be useful algorithms for solving problems, presented on the assumption that I know all that is necessary about screen handling or printer controls. The second would be instructional materi material on programming a particular machine, and could be ignored by anyone not using that make. The present system of printing programs in specialised form can be very frustrating. On many occasions I have found a listing for a routine which would be very useful and hav have then had to abandon it because of PEEKs or POKEs which might or might not be significant. Instead of giving conversion notes perhaps the programmer could be persuaded to explain what each section of the program does, and give an outline of the underlying alogorithm. I have managed to make use of program listings containing all kinds of peculiar statements if I understood the basis for them.

David H Wild, Hemel Hempstead

REM explained

How glad I was to find a rare mention of CDOS in your article (Braindump — July). Since we acquired our Cromemco System 3 I have been looking for information on CDOS or even a detailed description of C/PM.

In your article you asked what REM is supposed to do. I discovered by chance that it is used to put REMarks into Batch files.

Your other point about the RUN mod may, I think, be a symptom of a more fundamental problem. If a program has been LINKed to run at a location other than 100H, it is loaded as normal but a header is inserted which moves the program and transfers control to the start location. Obviously if the area where the program is initially loaded and where it is run overlap, then a subsequent jump to 100H will produce a mixed up program.

On a different but similar topic, that of Fortran overlays. I have found an easy way of passing data between programs. If the variables in both programs are declared in the same order then they will have the same addresses in the data area. The programs can be linked with the data areas above the program areas and at a common location. Then load the second program, escape from it and SAVE only the program area. Using this method and the CDOS call to link programs produces a form of overlay for any LINKable programs.

John G B Burns, Edinburgh

Covering computers

I was particularly interested to read 'Banks' Statement' in the July issue of *PCW* on the subject of computer insurance.

For some time now, we have been negotiating with insurance companies to obtain comprehensive microcomputer insurance cover at reasonable rates. Such cover should, in our opinion, extend to all risks, transit, increased cost of working and breakdown/derangement.

All risks cover is now comparatively easy to obtain but the rates quoted in *PCW* are designed to include a host of electrical equipment rather than just microcomputers and, by virtue of the range of these items and the various uses to which they are put, the length of exclusions increases.

The article, I believe, confuses consequential loss and breakdown insurance. Consequential loss is essentially the additional costs incurred when, as a result of loss or destruction, alternative arrangements have to be made before the replacement machine arrives. An extension to that is the cost of reinstating lost data and programs. A businessman who relies heavily on his micro could suffer enormously if, as a result of fire, he loses a substantial proportion of his databank. In that event, much overtime and the employment of temporary staff may be necessary to get back to where he started before the accident.

Finally, breakdown insurance is an alternative to an expensive maintenance contract. Quite simply, if the computer breaks down, the insurance will pay the cost of repair (after the small initial excess). In this context, the word 'derangement' is important. It could be that the machine does not completely break down but plays up, in which case an adjustment is necessary rather than a repair. If derangement is not included in the breakdown cover, the cost of the latter would be excluded.

All these insurances are now available and, to give an example, insurance for a machine with a value of £2500 insured for all risks (including transit), with a further £3000 increased cost of working insurance, can be bought for £22.50. Breakdown and derangement cover is far more expensive but is still only about half the cost of a maintenance agreement.

We shall be at the *PCW* show in September but, if we can be of assistance to your readers in the interim, then please quote our Freepost address.

Geoffrey Hoodless & Associates, Freepost, Woking, Surey GU21 3BR.

Further Factor Facts

Permit me to continue the correspondence on factoring large integers. I have recently completed a study of efficiency of various factoring algorithms (for a first-degree course dissertation) and the following remarks are perhaps relevant.

A W Bain takes a rather simplistic view with his division algorithm. With his 1,000 primes he can expect to factor numbers up to about 10^6. If it takes him 15 minutes to calculate these and probably as long to use his factoring algorithm and bearing in mind that the cost of the algorithm is $O(N^{1/2})$ then I calculate that it would take him about 10^{55} years to factor 150-digit numbers. Certainly 'not in a million years', Mr Bain. Your algorithm is suitable for factoring numbers up to say 10^{10}. I used a 32-bit machine (an IBM 370/165) and it was found practical to use this algorithm to factor numbers less than the word-size of the machine ($2^{32} \sim 4 \times 10^{10}$).

For larger numbers we use other algorithms. Knuth's 'Semi-numeric Algorithms, The Art of Computer Programming volume 2' (second edition, Addison Wesley) has an excellent description of algorithms which beat the Exhaustive Search hands down. In particular I found the Monte Carlo algorithm most efficient in the range 10^8—10^{15} and the Continued Fraction method most efficient in the range 10^{15}—? However, not even these algorithms on our best computers would be capable of factoring 150-digit numbers if their factors are as large as 60 or 70 digits.

D A Faganchini is more cautious and closer to the truth. Sometime in the future we may be able to factor 150-digit numbers, just as today we can factor 40-digit numbers, and before electronic computers maybe 7 or 8 digit numbers. However we can still use encryption algorithms if we use say 500-digit numbers which presumably we will not be able to factor. It is only when somebody can demonstrate a programmable algorithm which factors numbers of *any* size in a practical time that encryption algorithms of this sort will become valueless. I for one doubt that such an algorithm exists.

Any readers requiring further information on this subject should read Knuth's book or can write to me at Emmanuel College, Cambridge.

R J MACMILLAN, Weymouth

That wall chart

I am writing with reference to the Master Program Converter Wallchart supplied with the July issue of *PCW*. I found that the TRS-80 graphics codes were incorrect — the blank graphic shape should be 128 not 129 and the full graphic shape should be 191 not 192.

As you can see the error is continued through the whole list. I decided to mention this to save future errors.

Trevor Lillington, Rickmansworth

Thanks Trevor, and everyone else who has written in pointing out errors in the multi-coloured monster. We will be publishing all the corrections soon! — Ed.

One Spectrum does not...

I saw my first Spectrum of summer on Friday 2 July 1982.

Is this a record?

I HIGTON, London E17

No — Ed

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BENCHTEST
PERSONAL COMPUTER

Chris Sadler and Roger Oliver take a close look at an elegantly styled 16-bit micro from Europe's largest office equipment supplier

OLIVETTI M20

One of the real advances that microcomputers have made over larger computers is their level of standardisation. Whereas big machines always have their in-house designed processors and software, microcomputers tend to be based around very few microprocessors and software products. Because of this, the appearance of so many packages that run in these environments means that new machines based on different processors have very little chance of catching up. Olivetti chose the Z8001 on which to base its M20 microcomputer. As it isn't a minicomputer in a micro box (like the Onyx), Olivetti decided to write its own operating system, although, as a concession to the rest of the micro world, it offers the mandatory Microsoft Basic. On an unusual machine the question must be whether it has sufficient features over a more standard system to make it worth having.

Hardware

The Olivetti M20 comes packaged in two detachable units, the main box and the monitor box. The main box houses the main board, a power supply and fan, the keyboard, and (on the review machine) a couple of disk drives. The monitor stands on a circular plinth, with respect to which the screen can be tilted. A shallow oval tray on top of the main box will accept the base of the plinth so that the monitor can be conveniently positioned in relation to the keyboard. The monitor draws its power from the main box — a single power cable drives the whole machine.

The keyboard has a numeric pad in addition to the qwerty layout. All 72 keys are grey (as is the plastic casing) except for a yellow one and a blue one on the left-hand side. The manual suggests that the blue and yellow keys are respectively control and command keys, although on the review machine both were labelled 'SHIFT', which makes it much harder to remember which is which.

There is a reset key above the coloured ones, and two mysterious keys labelled 'S1' and 'S2' above the Return key... more about these in the software section. All keys auto-repeat when held down for more than a short time. The keyboard is 'sculpted' and the keys make a positive click sound. Ten different character sets are available, as follows: USA ASCII, Italian, French, British, German, Spanish, Portuguese, Norwegian/Danish, Swedish/Finnish and the USA ASCII + Basic. The review machine was the last of these, with a Basic keyword etched on the front edge of each alphabetic character key.

Above the keyboard are two horizontal slots (unmarked) for the disks. Unusually, the rightmost drive is nominated drive zero. The disks are 5¼in soft-sectored double-density double-sided, 35 tracks/side, 320 kbytes unformatted. This drops to 286 kbytes formatted, which doesn't compare particularly well with other DDDS disks.

The main PC board has three edge-connectors which extrude from the rear of the cabinet. One of these is for the monitor; the others are a parallel (Centronics) and serial (RS232C) interface for the different printers. Two screws at the back secure the top and, once this is lifted off, everything else seems to slide apart very neatly. The keyboard mounting and disk drive mounting lift away to reveal the main board.

The processor chip is at the front of the board. It is a Z8001, Zilog's 16-bit, capable of addressing more than 64k. Along with a 16-bit data bus, this should offer a speed advantage over 8-bit systems in arithmetic operations and memory access, although with a 4 MHz clock it would not be expected to outperform a Z80A in, say, character manipulation.

To the left is the ROM area — on the review machine there were two chips in place, sockets for another two and space on the board for another four, giving 8k for ROM. Further back on the board are other devices like disk controller, etc. On the right-hand side there is 128k of RAM (the standard configuration), beyond which the board becomes a motherboard to three small expansion sockets and two larger ones. Each of the smaller sockets can accept an additional board with 32k of memory, so the maximum memory is 224k if the monochrome monitor is used. The colour monitor, however, uses one slot and so gives a maximum memory of 192k. The review machine had a black and white monitor and a single memory expansion card (ie, 160k).

The two larger sockets (50 connectors per side — the pinouts undocumented) are for an IEEE-488 interface socket and a pair of RS232 (or 20 mA loop) ports, and pop-out panels exist at the rear of the cabinet to allow for the necessary cabling. The board gives the appearance of a clean, uncluttered (and not particularly densely populated) design, although the review machine had a few 'fixes' snaking between the chips. On the extreme right at the back is a recessed, spring-loaded switch, allowing the system to be rebooted by sticking something sharp into the recess. The review machine showed evidence that people just don't carry sharp things around with them anymore as the area surrounding the reboot hole looked scratched and scribbled-on.

Olivetti offers a choice of four printers — a thermal one (which we had), a fast (140 cps) or slow (100 cps) matrix printer, or a daisywheel. The thermal printer and the slow matrix printer are capable of screen-dump graphics.

The screen can be configured for 16 lines of 64 characters or 25 lines of 80 characters (rather crammed together) with a corresponding alteration of character size. Likewise, graphics can be resolved to 512 x 256 pixels or 480 x 256 pixels. The colour monitor provides black, red, green, yellow, blue, magenta, cyan and white, while the black and white monitor supports reverse video. With its non-glare glare surface, the screen gives a crisp, steady image and the system runs very quietly. On power-up the system performs seven seconds' worth of diagnostic tests, sizing up the memory, testing which drives are on-line, etc. If, during the self-test, one of the keys B, D or L is pressed, the following events occur:

B: boots the Basic subsystem directly;

D: loops through the disk-testing portion of the diagnostic until some other key is pressed;

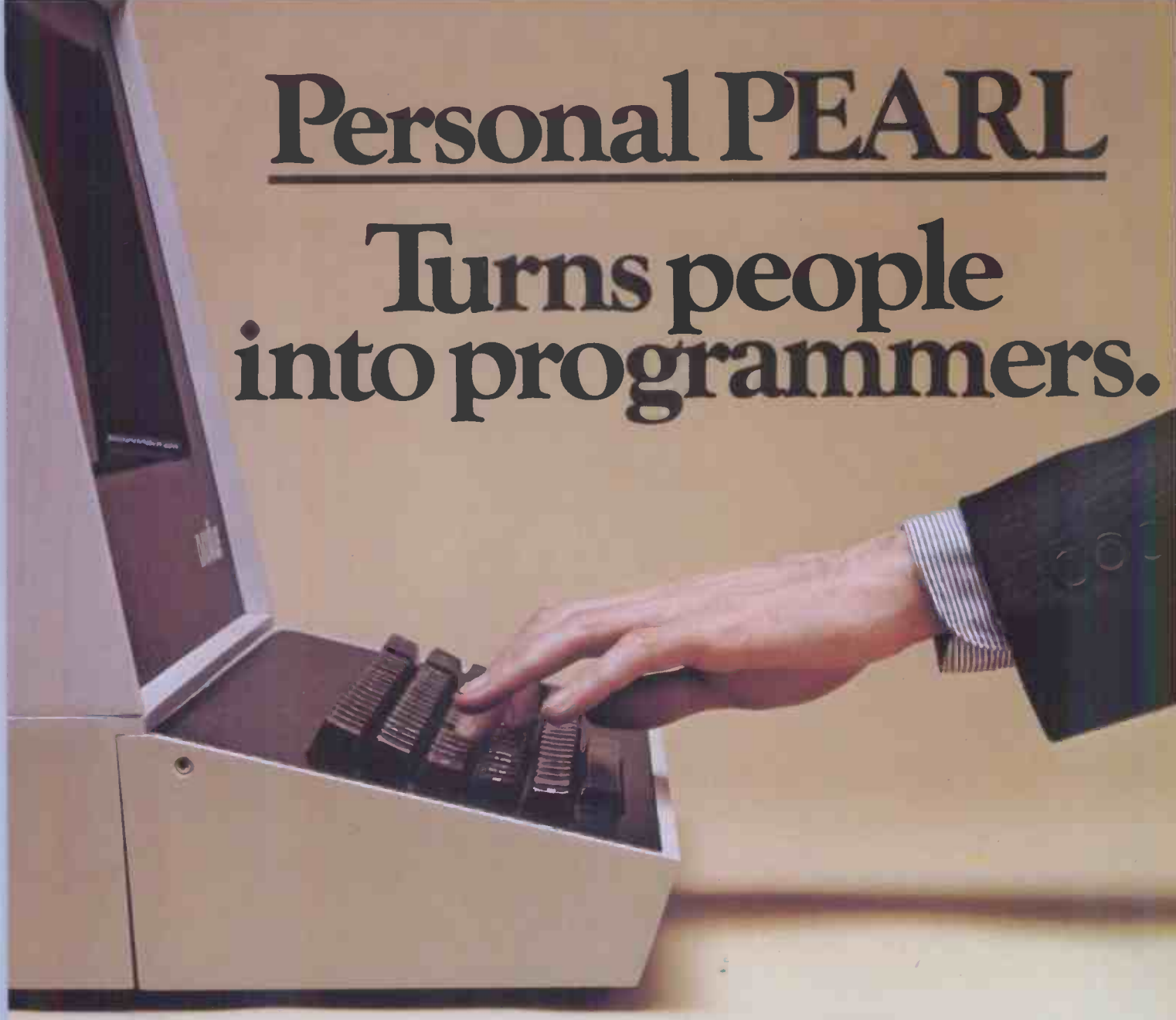
L: loops through the entire diagnostic until some other key is pressed.

When we tried the disk test, we discovered that drive 0 would not work and, although the disk test was run repeatedly thereafter, it never signalled this fact. On taking the system apart,

Photography by Kokon Chung

Personal PEARL

Turns people into programmers.



If you could program a computer by simply telling it the result you wanted, without using complex codes or languages, then anyone could become a programming professional. Sounds fantastic?

But now it's possible with Personal PEARL, and all for less than £200. It generates quality Business Programmes, Data Management, Costing, Mailing – in fact you create your own library of programmes that matches your operation today, and tomorrow.

After all, no-one understands your business better than you. So let Personal PEARL take the technology out of computer programming, and you'll find yourself writing professional business software – at the touch of a button.

pearl

Pearl Software International (UK) Limited, PO Box 34, Poole, Dorset, BH14 8AR.
Tel: Parkstone (0202) 741275

Please send more details of Personal PEARL.

Name:_____

Company:_____

Address:_____

_____ Tel:_____

Computer Make:_____

Disk Size:_____ VDU Make:_____

Pearl Software International (UK) Limited,
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OLIVETTI M20

we discovered that the drive had slipped its belt, and it worked perfectly once that was repaired.

Software

Software consists of the operating system PCOS (Professional Computer Operating System) and a large Microsoft Basic subsystem.

The first thing one can say about PCOS is that, by microcomputer standards, it is big. On the review machine, it left only 58k of user memory out of an original 160k. PCOS is composed of three parts: a nucleus, which contains system primitives, memory and device control code, etc; a set of memory-resident utilities (ie, commands); and a set of disk resident (transient) utilities. Memory is configured according to the Z8001 segmentation scheme as follows:

Segment	
0	PCOS kernel
1	Basic interpreter and PCOS utilities
2	PCOS variables, Basic stack and tables, user memory
3	Screen bitmap (and colour bitmap)
4	Diagnostics and Bootstrap

In PCOS, 'system' programming consists of:

i) controlling which of the utilities will be transient or resident;
ii) manipulating files and volumes;
iii) 'programming' the keyboard;
iv) setting certain operating parameters;
v) constructing a turnkey boot-up program.

The system disk is distributed with certain utilities compulsorily resident (marked as such in the table of PCOS commands which follows this section). Transient utilities are those which are loaded from disk when invoked and overwritten when they complete. Any utility which is going to be used more than once or twice in a session can be 'locked' into memory by means of the PLOAD command. It is possible to generate a new version of the operating system by PLOADing a set of utilities into the resident area and then PSAVEing the whole memory image onto a new system disk.

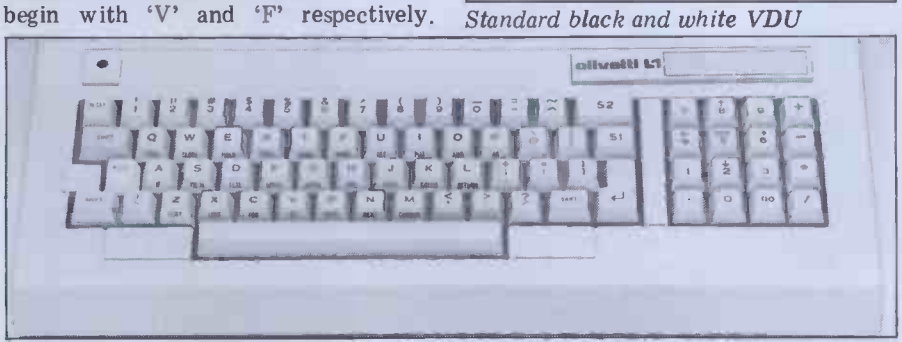
Volumes and the files which are stored on them can be manipulated by means of a series of commands which begin with 'V' and 'F' respectively. Thus, FCOPY transfers a single named file while VCOPY would back up a whole disk. Strangely there is apparently no command for deleting files! The Basic manual suggests using the Basic command KILL, which involves invoking the Basic interpreter, issuing the KILL command and then exiting from Basic — all just to delete a file! However, we discovered a utility (undocumented) on the system disk named FKILL.CMD which sounded like what we were looking for — anyway, it worked.

Security works on two levels — disk and file. As usual, a disk may be hardware write-protected (by physically blocking a 'write-permit' hole on the disk); it may also be password-protected against any unauthorised access. Files may also be software write-protected and password-protected. Basic programs may be SAVEd so that they can be executed but not LISTed or RUN.

Any key which generates a printable character can be reprogrammed, by means of the PKEY command, to produce any other character, or a string of characters. In particular, the substitution string can be a Basic or PCOS command, or a sequence of commands, separated by the ASCII codes for CR and LF. A series of PKEY commands can be saved on disk and downloaded at the start of each session, thus customising the keyboard — the Basic keywords printed on the keycaps are enabled in this way through a file on the system disk named SCIENTIFIC.BAS. (The key COMMAND is depressed in conjunction with the desired keyword key to obtain the Basic keyword.) A whole sequence of commands initiated by a single keystroke is as close as PCOS allows to the sort of command file processing obtainable in other operating systems (eg, SUBMIT in CP/M).

Three commands exist for configuring the environment for a particular session. SSYS takes five parameters which set the time and date, the number of (256 byte) blocks by which files are to be extended, the screen format (eg, 25 lines by 80 characters, etc) and a disk read/write verification switch. SBASIC allows the user to define the amount of open files and windows permissible and the size of the I/O buffers. Clearly, the more open files and windows allowed for and the larger the record buffer, the less memory there is for the user's code. As a rule of thumb, each window needs 90 bytes and each file needs 600 bytes in addition to its record buffer. By comparison, each memory-resident utility takes about 1800 bytes. The command SFORM sets up the printer. One of the parameters is the type of printer (eg, 'pr2400' for the thermal type) so it may not be too straightforward to interface a printer not supplied by Olivetti to the

Standard black and white VDU



The review machine came with an optional keyboard featuring Basic keywords.

I/O connectors are unlabelled but fully documented.

Basic reserved words

Commands

AUTO	LLIST	RUN
CONT	LOAD	SAVE
DELETE	MERGE	SYSTEM
EDIT	NAME	TRON
FILES	NEW	TROFF
KILL	NULL	WIDTH
LIST	RENUM	

Statements

CALL	LINE INPUT
CHAIN	LINE INPUT #
CIRCLE	LET
CLEAR	LPRINT
CLOSE	LPRINT # USING
CLOSE WINDOW	LSET
CLS	ON ERROR GOTO
COLOR	ON GOSUB
COLOR-	ON GOTO
CURSOR	OPEN
DATA	OPTION BASE
DEFDBL	PAINT
DEF FN	PRESET
DEF USR	PSET
DEFINT	PRINT
DEFSNG	PRINT #
DEFSTR	PRINT USING
DIM	PRINT # USING
DRAW	PUT
END	PUT£
ERASE	RANDOMIZE
ERROR	READ
EXEC	RSET
FIELD	RESTORE
FOR/NEXT	RESUME
GET	RETURN
GET #	SCALE
GOSUB	STOP
GOTO	SWAP
IF... GOTO... ELSE	WHILE/WEND
IF... THEN... ELSE	WINDOW
INPUT	WRITE
INPUT #	WRITE #
LINE	

Functions

ABS	HEX$	RND
ASC	INKEY$	SCALEX
ATN	INPUT$	SCALEY
CDBL	INSTR	SGN
CHR$	INT	SIN
CINT	LEFT$	SPACE$
COS	LEN	SPC
CSNG	LOC	SQR
CVD	LOG	STR$
CVI	LPOS	STRING$
CVS	MKI$	TAB
EXP	MKD$	TAN
EOF	MKS$	USR
ERL	MID$	VAL
ERR	OCT$	VARPTR
FIX	POINT	WINDOW
FRE	POS	

OLIVETTI M20

M20. One parameter is an optional string which, if supplied, will be printed as a title at the top of each page of printout.

Access to the printer is gained by appending '+PRT' onto the end of every command. Output is directed to the printer only as long as that command is operative — in the case of BASIC (the command which invokes the Basic subsystem) all screen I/O within the subsystem will be copied to the printer. The manual mentions '+CIN' (for Communications INput), which directs input from the serial port to the system (in place of keyboard input). '+CONS' resets both of the above, returning both input and output to the console.

On boot-up, once the memory-resident portion of PCOS is in place, the system searches for a file called INIT.BAS, first on drive 0 and then on drive 1. If it finds one it will begin executing the program, which can contain PKEY commands and S-type environment commands as well as an ordinary Basic program. Thus the system can be made completely turnkey and the whole machine customised every time it is switched on.

Other commands include SPRINT, which dumps a given window from the screen to the printer with an optional title or time/date entry, and LABEL, which enables one to write a title, vertically or horizontally, at a given point on the screen and up to 16 times the normal character size. A number of user aids discussed in the manual were not present on the review system. These included HELP, COMMANDS and ERRORS, which provide lists of commands and error numbers, together with facilities to obtain a description of individual commands and error numbers — but how satisfactorily they work we cannot tell.

Three facilities which are available within Basic require access to utilities within the operating system, and these should be resident if Basic is to make calls to them. They are the IEEE-488 extension package; MI, a utility which enables a Basic program to pass a Z8001 machine code instruction directly to the processor; and LTERM. The two keys S1 and S2 mentioned in 'Hardware' are actually the equivalent of the Return key, except that the utility LTERM keeps track of which of the three 'return' keys was actually depressed. This enables a programmer to provide users with a variety of input keys — useful for setting up menus, Y/N answers, and so on.

PCOS seems to be an irritating operating system to use — it doesn't react in a very consistent manner. Sometimes it is necessary to specify the disk from which one wishes to work, and at other times not. System reset is sometimes achieved with RESET+ CNTRL and sometimes with RESET+ SHIFT (the RESET key should be depressed fractionally after the other one). The PCOS file security system lays traps for the unwary. You need only mistype one key when resetting a disk password and fail to realise it and you are in trouble, as there's no way of breaking a forgotten password.

Even worse, since once the password has been correctly supplied access is granted, even if the password is changed, you will receive no indication for the rest of the session. Thus, at the end of the session you might (as you should) take a back-up copy onto (assuming a rolling sequence of disks) a previous copy! Incidentally, if the colon is left off the volume specifier when the VLIST command is used, PCOS announces that the disk is empty — this may give you a heart attack (where are my files?) or, even worse, persuade you that the disk in question is nice and empty and suitable for back-up!

Other criticisms are that there seems to be no way for users to create their own utilities for insertion into the system and that there is no opposite to the PLOAD command whereby resident commands can be made transient. Neither is there any way of finding out which commands are resident in any given PSAVEd system. Finally, although none of the 'help' files were supplied with the review system, some intriguing undocumented commands were found (FFREE, FKILL, FMOVE, FNEW, PRUN, RKILL, SCOMM, SDEVICE, VALPHA, VMOVE, VQUICK). Table 1 shows the documented commands.

The high level language provided with the M20 is Microsoft Basic Version 5.2, with special extensions covering the graphics capabilities and the IEEE-488 interface. All the basic commands, statements and functions are listed in Table 2.

The SAVE command has some interesting features. Unless an ',A' is appended to the command, the program is stored in packed binary format to save space. If ',P' is appended instead, the file is saved in 'protected' form, which allows it to be run but not listed or altered in the future. TRON and TROFF set the trace flag; if it is on, line numbers are displayed as the program executes. There are the usual control structures: FOR. . . NEXT, IF. . .THEN . . . ELSE, WHILE. . . WEND and GOSUB.

Arithmetic may be performed in 2-byte integers, 4-byte single precision and in 8-byte double precision. Functions for conversion between these are provided. Using DEFINT, DEFSNG, DEFDBL and DEFSTR, implicit variable typing by initial letter of variable name is possible. For example, the statement

10 DEFSTR S, U—W

will cause all variables beginning with the letters S, U, V and W to be of type STRING. Implicit typing may be overwritten by adding a character at the end of the name: ie, % for integers, ! for single precision, £ for double precision and $ for strings.

Data files may be either sequential or random. The former are set for input (ie, read), output (write) or append when they are opened; they are processed with the INPUT#, LINE INPUT# (ie, ignore delimiters), PRINT# and PRINT# USING statements. Random files are handled completely differently; the file is declared to be random when it is opened, and the maximum record length is also declared. Unfortunately, it is not possible to set the file to be read-only or write-only if it is a random access file. Communication between program and file is conducted via a buffer. GET# transfers a record from file to buffer and PUT# vice versa. To extract data from the buffer, the FIELD statement assigns specific buffer locations to field names. The field names must not appear on the LHS of an assignment if they are to be used later to address the buffer; hence the LSET/RSET statements are required to place data in the buffer. Since only string data can be placed in the buffer, the functions CVI, CVS, CVD and MKI$, MKD$, MKS$ are needed for interconversions.

BASIC	invoke Basic interpreter	Resident
COMMANDS	list all commands	
[COMMAND]?	display an explanation of the specified command	
ERRORS	list all error codes	
E n	display an explanation of error code number n	
FCOPY	copy named file	
FDEPASS	unset a file password	
FLIST	list a named file	Resident
FNEW	create a named file	
FPASS	set a file password	
FUNPROT	remove write-protection from a file	
FWPROT	write-protect a file	
HELP	display Help routines	
IEEE-488	invoke the IEEE-488 Basic control package	
LABEL	invoke the Labelling package	
LTERM	return number of Return key last pressed	Resident
MI	invoke machine instruction routine	
PKEY	program given key	
PLOAD	load and lock utility into memory	Resident
PSAVE	save current system on disk for subsequent reboot	Resident
SBASIC	set Basic environment	Resident
SFORM	set printer environment	
SPRINT	print screen	
SSYS	set system environment	Resident
VCOPY	copy volume	
VDEPASS	unset a volume password	
VFORMAT	format a disk	
VLIST	list a volume directory	Resident
VNEW	create a volume on a disk	
VPASS	set a volume password	
VRENAME	rename a volume	

Table 1

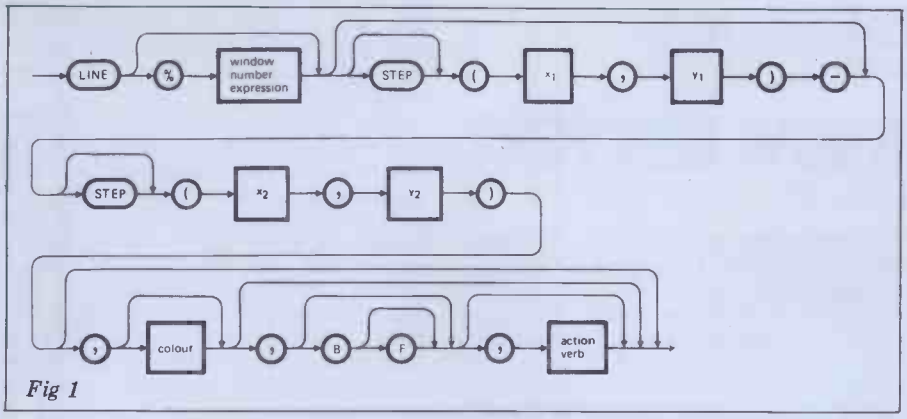


Fig 1

The most interesting features of the Basic's graphics facilities is that the screen can be divided into a maximum of 16 independent windows. (Strictly speaking, they are not real graphics windows since they cannot overlap non-destructively.) The WINDOW function subdivides the current window (either horizontally or vertically) and returns the new window number. The WINDOW% (expression) statement causes the user to 'move' to the window given by the expression. The usual DRAW and CIRCLE statements are available; the former is very complex since it also has to double for the MOVE command (ie, changing position without drawing a line). When drawing a line one can AND, OR, XOR and complement with the existing screen contents. The COLOR statement allows one to select four out of eight colours for use at any given time and to set foreground and background colours for each of the windows.

A nice feature of the graphics is that it is possible to store part of the screen display (text and graphics), pixel by pixel into an array, and to recreate the image at a later date. The PAINT statement allows any enclosed space to be filled in.

The IEEE-488 interface is apparently accessible to the user via a set of Basic keywords, but these are not documented in the Basic manual. There is an IEEE-488 Parallel Interface Reference Guide which comes with the actual interface, so perhaps they are described there. By means of these keywords it is possible to read or write data from compatible devices: assign talker/listener status to other devices; receive and respond to service requests from other devices; and act as a controller for other devices.

Generally speaking, the syntax of the Basic is rather complex (see Figure 1). There are examples of one keyword being made to perform too many functions. For example, WINDOW can be used as a function which takes on the number of a new window (which is created as a 'side effect') and which has a special case when it takes on the number of the current window (and no new window is created); WINDOW can also be a command causing another window to become the current window.

Fairly sophisticated program segmentation facilities are provided. It is possible to CHAIN programs together so that one 'calls' another. Communication between programs is via data files or COMMON variables. The latter seem to be like the Fortran facility in that a block of memory is set aside for access by various routines. According to the Basic manual, variables in COMMON statements in different programs are matched by position and type, and not by name. Thus, if one has

10 COMMON A$, N

in one program, and

10 COMMON B$, X

in another, and they were CHAINed, then A$ and B$ would access the same location, as would N and X. Unfortunately, this feature did not appear to work perfectly on our machine. One can also MERGE programs with the current program, allowing subroutines and blocks of code to overlay one another as they are needed.

Potential

The product literature explicitly directs the Olivetti M20 at the commercial and scientific user. This is backed by an apparently sound maintenance and guarantee policy and a list of software products. For the scientific user there is the option of the IEEE-488 interface, which grants access to a range of laboratory equipment, and a set of Basic graphics calls to assist with the display of information. In addition, the Basic BM8 ran exceptionally quickly so that the system, with the propriety Olinum (scientific subroutine library) and Olistat (statistical subroutine library), is probably a reasonable number-cruncher. On the engineering side, there are a few design and numerical control packages.

On the business side, there are Olispec, which provides the usual accounting suite; Oliword for word processing; Olientry for data preparation; and sales and production management packages and specialised packages for solicitors, independent schools, quantity surveyors, builders and electricians. Finally, there is Multiplan, the Microsoft forecasting and modelling package. Utilities include ISAM, Olisort and Olidoc — for 'documenting' a Basic program — together with Oliterm (a terminal emulator) and Olicom (a remote batch entry package).

There is also Olimaster, which purports to be an author language for 'development of interactive instruction' but we felt that the system was not really flexible enough to find widespread educational use. The system is not suitable for the hobbyist.

We have mentioned this software under 'Potential' rather than 'Software' because it was not available to us for review. Of the 10 or so independent software suppliers listed by Olivetti, we managed to contact about half; most of these said that work on the packages was near to completion, and most seemed to be established companies that had worked with Olivetti's minicomputer and accounting machine operations.

Expansion

Most of the hardware expansion features have been mentioned in the 'Hardware' section. In summary, a fully expanded system would offer twin floppy disks, 244 kbytes (with black and white monitor) or 192 kbytes (colour monitor) of main memory, an IEEE-488 parallel interface and a pair of RS232 or 20 mA current loop serial ports. A recent advertisement for the system in the computer press mentioned a hard disk but we could find no evidence for this, either in the documentation or on the board.

On the software side, the price list mentions an assembler (and, indeed, with CALL and EXEC the Basic interpreter is configured to interface with assembler routines) and again the advertisements spoke of Pascal, but we found no mention in the product literature. Presumably, Olivetti feels that offering access to IEEE-488 based peripherals will take its potential market as far as it wants to go.

Documentation

The manuals are masterpieces of slow, careful explanation and are probably ideal for an extended tutorial on fundamental microcomputer operations, with long sections on the use and abuse of floppy disks and a lot of trouble taken with the initial 'getting started'

GOTO page 213

Benchmark timings

BM1	1.3
BM2	4.0
BM3	8.1
BM4	8.5
BM5	9.6
BM6	17.4
BM7	26.7
BM8	1.6

All timings in seconds. For an explanation and listing of the Benchmark tests, see PCW *Vol 4 No 11, November 1981.*

Technical data

CPU :	Z8001, 4 MHz
Video:	16 x 64 or 25 x 80 character display; 512 x 256 or 480 x 256 pixel graphics, black and white or colour
RAM:	128k as standard + up to three 32k boards
ROM:	2k standard, expandable up to 8k
Comms:	Centronics parallel and RS232 serial, standard; IEEE-488 and two ports RS232 or 20 mA loop
Keyboard:	72 keys, programmable
Bus:	Olivetti's own — 16 data lines
Disks:	One or two, 320k (unformatted) 5¼in floppies
Printers:	Thermal, matrix or daisywheel

Banks' Statement

OLD ENOUGH TO KNOW BETTER?

Martin Banks explores the facts behind ICL's micro

I must admit that I am really quite glad that I've found out. I am pleased that it is official after all this time. I had suspected of course for a while that it might be the case, you know , for there have been signs around for the perceptive to see. But no: it is much better that it is official.

The personal computer has come of age. Yes, it's official. It is fair to say that it is not yet mature, for surely that will only come when the industry (or a product of it) receives the Royal Warrant. That hasn't happened yet, though it probably will, for it is a British company that has officially announced that the personal computer has got as far as coming of age.

It may surprise some of you to realise that it is a British company which has made this official announcement. I must admit that I was a little taken aback myself. I had considered that when the announcement came it would be perhaps from the likes of Apple, or maybe the dear Commodore. After all Apple has managed to grow in archetypal leaps and bounds to become one of the biggest manufacturers of computers in the world. It might be reasonable to assume that the honour of officially announcing that the personal computer has come of age might go to the big A.

Then again there has been the jolly blue giant, the computer balance sheet against which all other computer balance sheets are measured and found wanting. Yes, dear old IBM went and did it last year, didn't they. Out of the corporate thought popped the IBM Personal Computer, an event which prompted some observers at the time to even say that the personal computer had now come of age.

But of course it hadn't — at least, not officially. Even though the IBM machine had lots of clever bits designed into it, not least being Intel's 8088 microprocessor and lots of memory and the speed of 16-bit processing and things, the personal computer had not yet come of age. No.

But now it has, and it is a British company that has done it. What is more, that company is the oft-maligned 'flagship' of the UK computer industry, International Computers Ltd — ICL. Now our flagship has been through a hard time recently and has ranked amongst the sick and the lame. But daring surgery and the occasional transplant has seen what would appear at first light to be a miraculous recovery. It is hoped for all concerned that the patient's long term prognosis is indeed as good as it appears now.

In fact it is from one of these transplants that the company's ability to make its official announcement has become possible. You may have seen the announcement yourself. It appeared in June, in one of the colour supplements without which each Sunday newspaper becomes just a more verbose edition of its daily kin.

To be fair, the official announcement did not come directly from ICL itself. Rather, it came from the marketing Department of Baric Computing Services, a company jointly owned by ICL and Barclays Bank (no relation). There, spread across two pages of said colour supplement were the words 'The Personal Computer Comes Of Age'. The copy went on to enthuse: 'Sooner or later it was bound to happen. One system, from a world-famous computer company emerges from the crowd'.

Hands up to all those who, at this point, feel the urge to praise ICL for its magnanimity in pointing towards IBM, or perhaps DEC. But no, we would be wrong to make such misguided assumptions, for the advertisement Baric placed continued with the words: 'The Personal Computer from ICL'.

I must admit that my own thoughts on first seeing this advertisement, tucked up in bed on a Sunday morning as I was with equal portions of tea, toast and a hangover, tended towards half-hearted amusement. Further reading of the copy strengthened this view, for it finished with the classic 'negative' joke: 'We're not in the entertainment business.'

For that time on a Sunday morning I found it a joke that worked quite well. Others, I found out later, were not so well disposed towards the copy. Some, it must be admitted, patently refused to see the joke. One, who has struggled long and hard to establish a niche in the industry, told me quite plainly that he thought it '******* arrogant'. I could see some logic in that point of view.

I could also see some logic in the suggestion that maybe, just maybe, the advert was not entirely... how should I say... honourable. Now, it told no actual lies, but by the same token it implied one hell of a lot more than was actually there. For example, the phrases 'emerges from the crowd', 'The Personal Computer from ICL'.

The implication is that here is something significant from the company, something that 'comes into view from obscurity' (Oxford English Dictionary). Mark Potts take note.

Although our computer industry's flagship company does in fact manufacture the machine, it is neither new, nor ICL's, and for it to suddenly 'emerge from the crowd' after all this time does seem to be just a trifle presumptious.

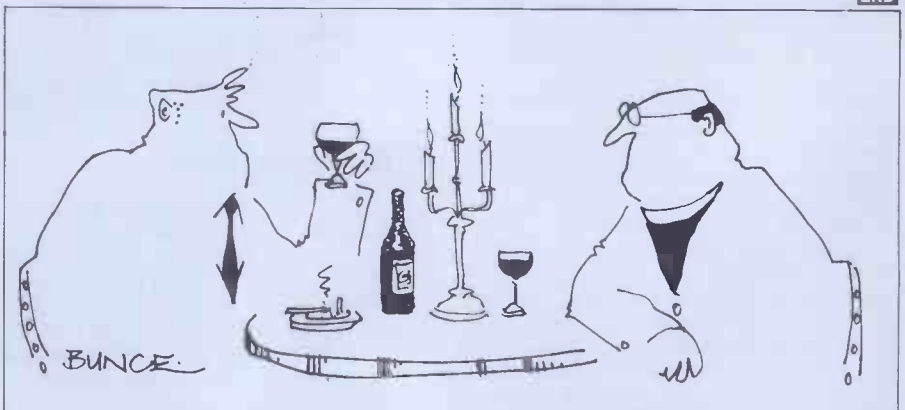
The machine of course, is actually the dear old Black Box from Rair. The deal for ICL to manufacture it under licence was struck between the two companies last year, and in the intervening period between then and its official launch, ICL has resprayed it. There is indeed a momentary tendency to speculate that the new colour might have been ICL's normal scheme for its hardware, but the company has chosen to avoid having the machine re-christened the 'Orange Box'.

The Black Box has been around now for several years and has been developed and enhanced by Rair over that period of time into a sound, if unspectacular, small business machine. It has been a consistent seller, though it has never reached the dizzy heights of the likes of Commodore, Apple or Uncle Clive. In practice, that level of volumetric pressure on sales would probably have been painful for the company.

Now it can certainly be argued that the financial and manufacturing clout of ICL could change that for the Box. The company has the resources to be able to turn on production quite significantly. But is such effort worth expending on this particular machine? With all due respect to Rair, it must be said that if the Black Box was ever going to be *that* significant, then maybe it would have happened back in 1978 when it first appeared. The sages nodded their collective heads appreciatively when the Box appeared; they did not jump about orgasmically like they did with some others.

ICL has got into the personal computer business, and many would say it's not before time. The way it has made its move, however, on the back of a modestly successful small business system, leaves something to be desired. At a time when the likes of IBM and Digital Equipment, respectively numbers one and two in the computer industry charts, have observed the trends in the computer industry and not just followed them, but predicted and anticipated future movements, ICL still seems to be dabbling one tiny little toe in the water.

Maybe when it finds that the water is okay, if occasionally a little choppy and rough, it will then produce a machine of its own that really justifies the hyperbole of 'one system, from a world-famous computer company emerges from the crowd'. END



'Well, here's to computer dating. Let's hope they iron out the bugs soon...'

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P FOR PERFECT?

Part 3
The Translators

Concluding Sue Eisenbach and Chris Sadler's appraisal of the UCSD p-System

The name 'p-System' is a carefully thought out attempt on the part of SofTech to dispel the widely-held idea that 'UCSD' stands for Pascal alone. We hope that the last two articles, describing the structure and philosophy of the operating system, its utilities and applications packages, have shown this not to be the case. This article, however, deals with the different translators provided by SofTech for program development.

The high-level languages offered by SofTech are UCSD Pascal Fortran 77 and Basic. All of these feature compilers which produce p-code object programs. In particular, there is no run-time environment in which Basic programs are directly interpreted. When one decides to develop programs in a particular language, the procedure is to name the relevant .COMPILER and .LIBRARY files as SYSTEM files on the system disc. Commands like R(un will then automatically deal with the source file in the correct language. However it is possible to mix modules written in different languages once they have reached the p-code stage.

SofTech is committed to providing native-code compilers so that the p-code interpretation phase can be by-passed for the sake of speed. To date, however, only the Z80 and 8088/8086 compilers offer this facility. There is also an Adaptable Assembler.

UCSD Pascal

The syntax of UCSD Pascal differs from standard Pascal, having numerous extensions and some omissions. Most users of UCSD Pascal (or the numerous 'look-alikes' — eg, Pascal M, Onyx Pascal, Corvus Pascal) would be loth to give up the extensions although most users look forward to SofTech bringing UCSD Pascal up to the new ISO standard. The manual says it will 'eventually comply with the standard' and it is to be hoped that 'eventually' will err on the side of sooner rather than later.

One glaring limitation is the restriction of the data type FILE to disk-resident files. In standard Pascal, a file is simply defined as a sequence of components, all of the same type, which may be associated with secondary storage and peripherals', but which may equally be entirely memory-resident where it provides an extremely useful structured data-type. Another shortcoming in relation to the standard is the absence of the facility whereby PROCEDUREs or FUNCTIONs can be declared as formal parameters in other procedure or function calls. This is a surprising omission, especially in view of the fact that this same feature is implemented in the underlying p-code. The major areas where UCSD offers extensions beyond the standard are in its string-handling capabilities, its memory management facilities, concurrency and I/O intrinsics.

UCSD Pascal has a pre-declared type STRING which caters for string variables from 0 to 255 characters in length. The length of any particular string can vary dynamically during the program's life, and there is a set of string-handling intrinsics by means of which strings can be manipulated within the program, although it is also possible to perform manipulations using standard Pascal and treating the strings as PACKED ARRAYs of CHARs.

The string-handling intrinsics are:
CONCAT, which accepts a variable number of strings and returns a single (concatenated) string;
DELETE, which removes a given number of characters from a given position in a string;
INSERT, which inserts a given string at a given position within another string;
and POS, which returns the starting position of a given sub-string within a string.
Finally, READ and READLN have been extended to cope with string input.

As a language, Pascal was designed for teaching good programming concepts. As such it is frequently somewhat deficient in the practical features needed to get a large, real application program developed and running quickly and without using up excessive amounts of memory — a common problem for programmers on microcomputers. UCSD Pascal tries to take these requirements into account by providing several tools for dealing with large programs. These include the idea of segmentation, whereby object modules within a program can be nominated to remain on the disk at run-time and brought into memory (where they replace other segments) only when required; and the idea of external units — collections of pre-compiled modules which are incorporated into a particular application program during linking.

The keyword SEGMENT is a reserved word in UCSD Pascal which, if placed before a PROCEDURE or FUNCTION, makes the loading of that segment independent of the loading of the main program segment. The segment therefore becomes a candidate for swapping in and out of memory. The run-time system, in general, copes with the interchange of segments but there are two intrinsic procedures, MEMLOCK (for locking a segment into memory), and MEMSWAP (for releasing a locked segment), which allow a programmer to intervene. In addition, it is possible to CHAIN disjointed program segments together.

The UNIT is divided into three sections: an INTERFACE section where all identifiers accessible from outside the unit are declared; an IMPLEMENTATION part where the actual code of the module appears; and a third section which can contain initialisation and termination code; The function of a unit is two-fold — firstly it can be used to store pre-compiled modules during program development, which saves having to compile error-free code over and over again during a particularly intensive debugging phrase. The second (and really more legitimate) application is to use the UNIT to offer users of a particular system a library of useful routines (eg, a graphics package or a statistics library) which they can call on in their own programs simply by including a USES statement in their code.

The 'initialisation and termination' section gives the designer of the unit an opportunity to ensure that the environment in which the modules will execute is the correct one (eg, on a graphics display, the screen is cleared and the cursor is set to a pre-defined position), and that the system is returned to 'normal' when the program completes. Facilities exist within the p-System to construct libraries from one or more units or even to incorporate a unit into the system libray.

Version IV of UCSD Pascal has been extended to allow for the initiation and control of concurrent processes — ie, modules which execute together, sharing the use of the processor. This facility is important, for instance, for the control of hardware devices, and hitherto programmers have had to resort to assembly-language programming to achieve this. Processes are declared like procedures except that the reserved word PROCESS is used; and are initiated from within a program by means of the intrinsic procedure START. A single process may be started more than once and the run-time system divides its attention between all the currently active processes. START takes additional (optional) parameters. one of which is a priority value to influence this division of attention; another is a 'stacksize' to control the amount of memory the process gets.

Interprocess communication is achieved by means of semaphores. A semaphore is initialised by the intrinsic procedure SEMINIT (identifier) where the identifier has already been declared as a SEMAPHORE. The intrinsic WAIT causes a process to pause until a given semaphore is available, while SIGNAL makes the semaphore available. Finally ATTACH is used to associate a semaphore with a hardware interrupt, thus making it possible to do real-time programming in Pascal (ie, via a hardware clock interrupt).

There are low-level I/O intrinsics which give the programmer control over all the peripherals, although they must be used carefully since the increased power increases the vunerability of, for instance, the filing system to programming errors. BLOCKREAD or BLOCKWRITE enable the direct access of logical blocks on disk files and allow rapid handling of arrays. UNITBUSY, UNITCLEAR, UNITREAD, UNIT-

STATUS, UNITWAIT and UNITWRITE offer the programmer total control of any I/O device on the system from within the program. Finally there is IORESULT which, after any standard I/O operation, returns a value between 0 and 18, reflecting the outcome of that operation. If the automatic I/O checking is disabled, the outcome of I/O faults is left in the hands of the programmer, and IORESULT is the diagnostic which provides a means for producing 'user proof' programs.

High-level I/O diverges from standard Pascal in the inclusion of a file type INTERACTIVE, which is similar to the type TEXT except that the automatic GET during the RESET operation is suspended. The standard files INPUT and OUTPUT are of type INTERACTIVE as is the UCSD 'standard' file KEYBOARD, which is a non-echoing version of INPUT. Most other implementers of Pascal compilers have solved this problem by a technique known as 'lazy I/O' whereby the automatic GET is queued until the first READ is encountered, and subsequent GETs are treated likewise. These different methods of solving the same problem mean that no interactive Pascal program can be moved from UCSD to a standard Pascal system without alteration of the code. Another extension is the provision of a second parameter, the file-name, for RESET and REWRITE. The intrinsic SEEK enables the programmer to reposition the file-pointer and thus allows random access file handling. Finally, the keyword CLOSE allows (through parameters) for the insertion or deletion of file-names from the disk directory.

Other extensions include: a CASE statement which 'falls through' if the selector is undefined; the ability to nest comments; the ability to compare arrays or records (by means of = or ◊; and EXIT, which when encountered causes the immediate termination of the block or program.

Long integers can hold numbers up to 36 digits long and the intrinsic STR serves to convert such numbers into strings for output purposes. PACK and UNPACK are not implemented, although PACKED is, and packed arrays of characters (these are implicit strings) can be manipulated by FILLCHAR, MOVELEFT and MOVERIGHT. The standard files INPUT, OUTPUT and KEYBOARD are always opened when a program begins execution and the program heading declaration is ignored. The implementation of SETs is rather impressive — they may have a maximum of 4080 elements. The intrinsic GOTOXY controls the cursor of the logical device CONSOLE, while REDIRECT and EXCEPTION can be used to enable or disable I/O redirection. Heap space is managed by NEW and DISPOSE, which deal in single records, VARNEW and VARDISPOSE which deal with a given number of words of memory, and MARK and RELEASE which together clear a predefined area in the heap.

Like many other Pascal compilers, UCSD Pascal supports the feature of compile-time options which appear as pseudo-comments somewhere within the text of a program. These include options for: switching I/O checking on and off; switching range checking on and off; conditional compilation of sections of code (useful for debugging); the inclusion of other source files during compilation; the production of listing files; the suppression of normal compiler message output (suitable for slow terminals); and the incorporation of user-defined libraries.

A useful option which has been omitted but which would not be too difficult to incorporate would be a switch which flagged all deviations from ISO Standard Pascal. Using this, a programmer who had developed a program under UCSD could obtain some help with converting the code to standard Pascal before transferring it to run under some other compiler. At a recent USUS(UK) conference, Tony Addyman, chairman of the ISO Pascal Standards committee, congratulated the p-System owners on selecting an operating system which made them independent of hardware manufacturers but pointed out that a standard Pascal compiler would make them independent of software manufacturers as well.

Standard Pascal was designed as a teaching language but UCSD Pascal seeks to go beyond this, providing a set of general-purpose problem-solving features and sufficient flexibility to allow most users to program a high-level solution to most problems, be they system, control or conventional applications. When it was originally developed many were sceptical as to whether a usable compiler could be implemented on a microcomputer at all, and UCSD Pascal was regarded as highly innovative. Today new machines and more demanding users make it important that all aspects of the p-System, not least its compilers, should be the subject of a continuous programme of improvement.

Fortran

The Fortran 77 compiler offers a sensible entry into the UCSD p-System for anyone with an established base of (Fortran) software, although the language is not quite as tightly bound to the operating system as is Pascal itself. According to the manual, SofTech Fortran is 'closely related' to the ANSI Fortran 77 standard subset. In fact, two features of the subset are not implemented: namely, the ability to pass function and subroutine names as parameters, and the allocation of equal amounts of storage space to INTEGER and REAL data elements. The compiler will compile standard Fortran IV programs. The compiler is credited to Silicon Valley Software Inc, both in the manual and on screen when the compiler is invoked.

On the other hand, several aspects of the 'full' Fortran 77 definition have been implemented, including the ability to reference array elements and to call functions from within a subscript expression; the ability to use integer expressions as limit specifications in DO loops and implied DO loops or as I/O unit numbers; and the ability to use an arithmetic expression within the I/O list of a WRITE statement or as the value of a computed GOTO. In addition, both random access and sequential files are permitted to be either formatted or unformatted, in line with the full standard.

The compiler supports four directives (a la Pascal), denoted by a $ in column one. $INCLUDE provides the conventional include facility (nesting up to five deep), useful for handling COMMON blocks and other declarations. $USES declares a library file, and $EXT declares an assembly language routine as callable from the code currently being compiled. $XREF produces a cross-reference listing. In addition to the code-file, the compiler will (optionally) produce a listing file consisting of a line-numbered listing which incorporates a procedure-relative instruction counter, and a symbol table. (In fact, the listing file is not as optional as it might be since typing 'n' in response to the question 'Listing file?' results in the production of a data file named 'n' on disk.) Compile-time errors are flagged immediately below the line in which they occur and are referenced by number. There are 186 compile-time errors ranging from 1 (fatal error reading source block) to 405 (read error on scratch file). Those up to 200 are syntax errors; the rest refer to compiler directives or peripheral problems.

The syntax of SofTech's Fortran 77 supports a single main program (optionally headed by a PROGRAM statement) together with an arbitrary number of subroutines and functions, headed by SUBROUTINE and FUNCTION statements respectively. Each of these is termed a 'program unit' and every program unit must be terminated by an END statement. There can be no trailing blanks after the final END statement — if there are any, the compiler tries to compile them! Statements within each program unit must be ordered so that, if they exist, specification statements precede DATA statements, which precede statement function statements, which precede executable statements.

Specification statements include IMPLICIT, DIMENSION, INTEGER, REAL, LOGICAL, CHARACTER, COMMON, EXTERNAL, INTRINSIC, SAVE and EQUIVALENCE. The data type CHARACTER allows for strings with lengths up to 127 bytes; the default length is one byte. These can be manipulated somewhat like other data types (eg, character 'constants' are allowed, assignments and (lexical) comparisons are possible) but no operators act on character variables, and variables of different lengths may not be associated together in EQUIVALENCE statements. INTRINSIC is used to declare all references to the subroutine library within the current program unit. SAVE is used to preserve a dynamically allocated common area when returning from a subroutine in which the COMMON blocks are defined. Since the p-System allocates common areas statically, its use is not necessary in SofTech's Fortran 77 and it was implemented only for sake of compatibility with the Fortran 77 standard.

Fortran 77 expressions are evaluated in the conventional way with normal operator precedence. The result of an integer division is truncated towards zero (ie, rounded down if positive and up if negative). Mixed INTEGER and REAL expressions are evaluated as REAL. Relational operators (.EQ. etc) with operands of like

type (INTEGER, REAL and CHARACTER, but not LOGICAL) may be employed. In the case of CHARACTER variables, operators like .GT. exploit the ASCII ordering. In addition to the usual '=' style computational assignment, there is a label assignment statement (ASSIGN — TO —) whereby the value of a variable can be set to an existing statement label number. (This includes FORMAT statement labels.)

Assignments to a REAL variable are, if necessary, converted (ie, if the expression is of type INTEGER) while, in the opposite instance, a REAL expression is truncated to 'fit' into an INTEGER variable. Likewise, CHARACTER variables are padded with trailing blanks or truncated when a length mismatch occurs on assignment.

Control statements include unconditional, computed and assigned GOTOs, arithmetic and logical IFs, the IF — THEN — ELSEIF — THEN... ELSE — ENDIF construct, together with DO, STOP, PAUSE, CALL and RETURN. The Fortran IV type constructs (ie, the GOTOs) may not jump into blocks of executable statements. The DO loop is tested at the top, in contrast with Fortran IV which tests at the bottom of the loop so you always get one pass through the block.

STOP and PAUSE can be used to halt execution and both can take an argument (INTEGER or CHARACTER) which will be printed on the console when the statement is executed. In the case of PAUSE, execution is recommenced when a key on the keyboard is pressed. In functions and subroutines RETURN transfers control back to the calling routine — however, the terminating END statement performs the same function, so anyone who believes that subroutines should have only one exit can dispense with the RETURN altogether.

SofTech Fortran 77 formatted records are constructed as character strings consistent with external p-System operations. This means, for instance, that a file of formatted records can be read by the system editor, and that formatted data files are portable from one p-System to another. No such guarantees exist for unformatted records which employ machine dependent internal representation. The symbol '*' can be used as a unit number number in READ and WRITE statements, denoting the device CONSOLE. I/O statements include OPEN, CLOSE, READ, WRITE, BACKSPACE, ENDFILE and REWIND. OPEN has four optional switches, as follows:
STATUS = NEW/OLD
ACCESS = SEQUENTIAL/DIRECT
FORM = FORMATTED/
UNFORMATTED
and RECL = record length; while CLOSE has STATUS = KEEP/DELETE.

Random access is handled by including a REC=⟨record number⟩ field into READ and WRITE statements. All the normal format specifiers are permitted and in addition the ' ' (backslash) symbol serves to suppress the automatic CRLF so that interactive screen I/O can do question and answer on the same line. Logical (L) format accepts (on input) and produces (on output) the abbreviations T and F for .TRUE and .FALSE. .

Table 1 shows the intrinsic functions

Basic

When we first thought of writing this series of articles we arranged for SofTech to send us one of the first Version IV p-System Basic disks. It was some considerable time before we actually got round to trying it out and we found that the compiler crashed on even the most trivial (ie, two line) Basic program. At the next USUS(UK) conference we buttonholed Jean Gianetta of the SofTech sales team, who confessed that early releases of the Basic had had problems, especially on the LSI-11 interpreter. She duly sent us a subsequent version which works. What surprised us, though, is that we had not heard a word about any such problems on the USUS grapevine, from which we are forced to conclude that p-System users, faced with Pascal, Fortran 77 or Basic tend to choose one of the first two.

The second surprise was that the p-System Basic dialect does not show any signs of being influenced by Pascal — as do, for example, Comal or even BBC Basic. The table of Basic reserved words implemented in SofTech Fortran shows what the syntax is like. There is a full range of string handling functions and special I/O features for handling functions and special I/O features for handling, for instance, money input data. Programs can be split up into libraries and subroutines with parameters and local variables. Like most compiled Basics, p-System Basic doesn't require line numbers to be in ascending numeric order, or even to exist at all. Each instruction is terminated by carriage return, which implies only one instruction per line, although it is possible to suppress this by enclosing the CR in Pascal-type comment delimiters. There are several compiler directives which, for example, turn I/O and range checking off, or switch to handling transcendentals in the library in 'a manner consistent with Texas Instruments machines'.

What with this cryptic remark and a few other odd things (eg, the command DISPLAY to write to the screen) we were curious as to where this dialect of

Type Conversion	INT, IFIX REAL, FLOAT ICHAR CHAR
Truncation and other Numeric Manipulation	AINT, ANINT, NINT IABS, ABS MOD, AMOD ISIGN, SIGN IDIM, DIM MAX0. MAX1, MIN0, MIN1 AMA0, AMAX1, AMIN0, AMIN1
Transcendentals	SQRT EXP ALOG, ALOG10 SIN, COS TAN ASIN, ACOS ATAN, ATAN2 SINH, COSH TANH
Lexicals	LGE, LGT LLE, LLT
End of File	EOF — returns TRUE or FALSE. (not standard Fortran 77)

Table 1 Fortran intrinsics

BENCHMARK TIMINGS

BM1	1.3	
BM2	1.5	
BM3	2.6	
BM4	4.0	UCSD Basic
BM5	4.2	
BM6	11.4	
BM7	15.7	
BM8	5.1	

All timings in seconds. For an explanation and listing of the Benchmark tests, see PCW *Vol 4 No 11, November 1981.*

BASIC RESERVED WORDS

CONTROL FLOW CONSTRUCTS
GOTO
ON—GOTO
IF—THEN—ELSE
FOR—TO—STEP NEXT
GOSUB
RETURN
ON—GOSUB
LET
STOP
END — must exist at the end of a program;

DEF [function type] function name [(parameter list)];
FNEND — necessary to end multi-line functions;
SUB subroutine name [(parameter list)] — starts a subroutine;
SUBEND — last statement in a subroutine;
SUBEXIT — terminates a subroutine call within a subroutine;
CALL subroutine name [(parameter list)] — calls a subroutine;
UNIT unit name — must exist at the start of a Basic program or subroutine that is to be compiled seperately and linked into a larger program.

I/O RESERVED WORDS

PRINT — sends output to printer;
DISPLAY — directs output to screen (like most Basics' PRINT);
ERASE ALL — clears the screen;
AT (line number, column number) — positions cursor at the specified place on the screen;
BELL — rings the bell;
USING — controls formatting in DISPLAY, PRINT and ASSIGN statements;
IMAGE — provides a format for a USING statement;
PUNCTUATION — allows the altering of monetary symbols for currency symbol digit separators and decimal points;
INPUT — can be used with AT, BELL, SIZE (max length acceptable for a given string) or a quoted string so that it can provide output as well as input);
ACCEPT — similar to INPUT except that it reads entire input into one string variable;
DATA
READ
RESTORE — repositions a file pointer and reinitialises a DATA statement;
INKEY — always returns 0;
INKEY$ — returns the next character frpm the keyboard buffer;
INTERNAL — binary format for a file;
REC — accesses an INTERNAL file record;
RELATIVE — random access file;
SEQUENTIAL — sequential access file;
OPEN — for files;
CLOSE — for files;
UPDATE — default mode for opening files, allows reading and writing;
APPEND — only allows writing to the end of the file.

ARRAY RESERVED WORDS

ASSIGN — associates a virtual array with a disk file;
DIM
OPTION BASE — used to set base index of an array, eg, to 1.

STANDARD FUNCTIONS
ABS
SIN
COS
TAN
ATN
EXP
LOG
INT
SGN
SQR
RND
RANDOMIZE
ASC — returns the decimal value of the first character in the string argument;
BREAK — finds the first character in a string that appears in a second string;
SPAN — compares characters in a string;
NUMERIC — returns —1 if string is a valid number and 0 otherwise;
VAL — returns numeric value of a string;
STR$ — returns a string given a numeric value;
POS — returns the position of one string in another;
RPT$ — returns a string which is a specified number of repetitions of the argument string;
UPRC$ — change all lower case letters to upper case;
CHR$
SEG$ — extracts a substring from a string;
DAT$ — returns month/day/year;
TIME$ — retuns hour/minutes/seconds;
FREESPEACE — returns number of free bytes;
EOF — returns 0 if not at end of file and a positive number otherwise;
FTYPE — returns 0;
TAB — loves to a tab position in a PRINT or DISPLAY statement;
ERR — returns an error number (0 if no error).

Table 2

P FOR PERFECT?

revealed that TI had commissioned SofTech to produce a version of its Business Basic.

Native code generation

Z80 and 8086 processor based p-Systems can take advantage of native code (n-code) generators. Since these accept p-code files as source, programs written in any high-level language can be rendered into n-code. In general, native code generation will be limited to specific procedures or functions within the high level source code which are bracketed by compile-time switches (ie, ($N+) and ($N—). Any assembly language routine referenced within such a procedure must be linked in before the code-file is submitted to the native code generator. Users looking for speed, therefore, have a fairly flexible regime — they can code in a high-level language for convenience, compile to native-code for the more crucial routines and finally hack out the assembler themselves for the bits which they absolutely cannot leave alone.

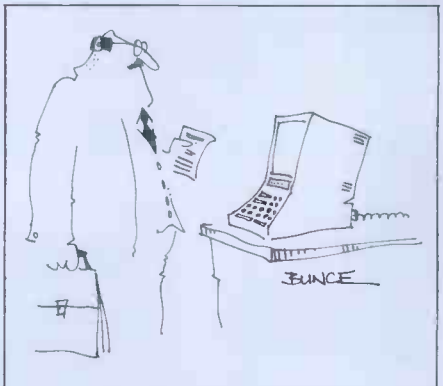
Conclusion

When it was first conceived as a university teaching project, the UCSD p-System was a realisation of some innovative ideas about Pascal on microcomputers, portability and the functionality of microcomputer operating systems. These features are not only available to all of us through SofTech's Version IV p-System, but are also being pursued by many software companies who have been influenced by the original San Diego project.

As users of micro computer systems who employ the p-System both at home and at work, equally for its power, its portability and its ease of use, and who have found information, enlightment and entertainment in its user community USUS, we can recommend the p-System for serious consideration by all microcomputer users. Finally, USUS (UK) may be contacted through

Mark Woodman
Mathematics Faculty
Open University
Walton Hall
Milton Keynes MK7 6AA

END



'Goodbye Harold, I've left you for good. For dinner see program one... clean shirts see program two...'

Test-drive your software!

Microplanner	**Rental £99 RRP £695**
Decision Modeller	**Rental £99 RRP £535**
VisiSchedule	**Rental £38 RRP £195**

Micromodeller	**Rental £99 RRP £595**
dBase II	**Rental £79 RRP £395**
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£29 Rental

	Retail
Supercalc	£175
Visitrend/plot	£165
Visifile	£161
Zardax	£160
Wordstar	£145
Datastar	£140
Easywriter (PRO)	£140
DBMaster	£135

£19 Rental

	Retail
Calcstar	£120
Visicalc	£113
Visiplot	£111
Word Plus (Speller)	£110
Time Manager	£105
ASCII Express II	£100
General Manager	£100
Complete Graphics Pack	£100

Our unrivalled list of business and technical software also includes accounting systems and expansion cards.

and if you decide to buy- the rental is free

The Software Rental Bank gives you the opportunity to evaluate software on your own machine, with your own data, before committing yourself to a purchase.

The Software Rental Bank offers a unique range of services.

- ★ Short-term rental of software packages and firmware products for 7, 14 or 28 days depending on your class of membership.
- ★ Free rental if you decide to purchase.
- ★ A really wide range of software and advice to help you make the right choice.
- ★ Access to the newest software available — a chance to simply 'taste' some of the latest and most controversial products.
- ★ Speedy service. Rent software by telephone or by mail — all the items on our *Software Asset Listing* are held in stock.
- ★ An advisory 'hot line' in case you have difficulty with a rented package.

The Bank is currently supporting the Apple II computer — including CP/M products for use with the Z80 card. Software for other microcomputers including Apple III, Sirius, IBM and other CP/M machines will be added to the Bank shortly.

Membership of the Bank

- ★ Full Membership costs £70 a year and allows you to rent up to £700 worth of software at any one time for 14 days.
- ★ Members periodically receive our *Software Asset Listing* which gives details of the packages available for rental. Members are encouraged to nominate new items for addition to our stock.
- ★ Larger organisations which may have microcomputers at a number of different locations can opt to join as Corporate Members.

To receive our brochure and software list phone Ruth Oliver on 0908-53491 *or* clip the coupon below.

I would like to receive the Software Rental Bank brochure.

Name _____

Organisation _____

Address _____

_____

_____

Telephone _____ Machine _____

Send to: The Software Rental Bank Ltd., 58 North Street, Leighton Buzzard, Beds LU7 7EN. **PCW** Sept. 82

SHOW PREVIEW

The 5th Personal Computer World Show

9–12 September 1982 Barbican Centre, City of London

The 5th *PCW* Show will be at least three times the size of last year's event at the Cunard Hotel in Hammersmith, and will also last for one extra day. The idea of dividing the exhibition into two sections was so effective last year that we've decided to do so again. Several companies have stands booked in both sections, and every aspect of computing is covered by one stand or another. Even the less publicised areas such as insurance, laboratory equipment and packaging are represented, so the Show is very much more than a collection of similar micros.

Several new products will be launched during the four days, including two or three new computers, several new peripherals and some new books and magazines. Indeed, the publishing industry seems to be almost as much in evidence as the microcomputer industry! Visitors will be able to buy or order most of the goods that take their fancy while they are there and many will be at special show prices. There will definitely be something for everyone: games for the

kids (young and old!), packages for education and business at all levels, clubs for enthusiast and beginner alike, and a multitude of peculiar devices for the expert. If you need advice on choosing a micro for your business, the National Computing Centre and the Association of Independent Computer Specialists will be on hand to help out. For the confused or just plain uninitiated, ComputerTown UK! and a varied collection of clubs (in Computer Club Corner) will answer your questions or put you in touch with clubs in your area.

Several special features have also been laid on. One of these is the chess competition, which has been a part of the Show ever since the first one. This year it will be the Third European Microcomputer Chess Championship. We've also got the added attraction of a Scrabble championship — computerised, of course, using Apple IIs. This will be open to any visitor who cares to fill in a registration form, and will use a package written by Peter Turcan and perfected by Little Genius. The package is exactly like the Spears game as far as rules are concerned, but players in the tournament will have a mere two minutes in which to make each move. Scrabble will be on sale from Apple dealers throughout the UK from 9 September. Little Genius will also take orders for it.

The winner of this contest will be the visitor who gets the highest score during the course of the competition, which will finish at about noon on the Sunday so there's time to present the prize. Little indication has yet been given as to what the winner will get for the struggle — but rumour has it that it will be a computer.

A viewdata system providing news, information and a Show guide has been set up by Electronic Insight. Monitors will be spread throughout the exhibition area. Acorn and Sinclair software villages have been organised, as well as a 'Sirius City'; providing the chance to browse through all the latest developments on these micros. (Acorn, incidentally, will be flaunting robot arms and lasers on its hobbyist stand, apparently.)

The Barbican Centre should serve as an ideal venue for the largest micro show in Britain. It has extensive facilities for the disabled, plenty of space in which to bash keyboards and lots of places in which to phone your friends or have a quick snack. Special hotel and travel packages have been arranged for visitors who have come a long way; these include transport, show tickets and accommodation. Priority tickets are available for hurried businessmen — anyone who writes to the Show organisers, Montbuild Ltd, either on headed notepaper or enclosing a business card, will have the opportunity to use a special 'fast lane' at the entrance to the Centre, which means they won't have to queue. Discount vouchers are being printed in several magazines offering a reduction of 50p on the entrance fee of £2.50, and reductions are given on advance bookings of 10 or more. Details of discount schemes can be obtained from Timothy Collins at Montbuild Ltd, 11 Manchester Square, London W1. Information on the hotel packages comes from Frank Gilbert of Pharaoh and Hughes on 01-995 8995.

Finally, if anyone is interested in entering the Chess Championship they are welcome to call our offices for an application form.

For details of opening hours etc, see the Show advertisement on page 84.

LOOK OUT! THERE'S A SNAPPER ABOUT

Flashing 'Power Pills' – after snapper has eaten them the ghosts turn blue.

Snapper makes eating noises as he snaps the ghosts, dots and fruit.

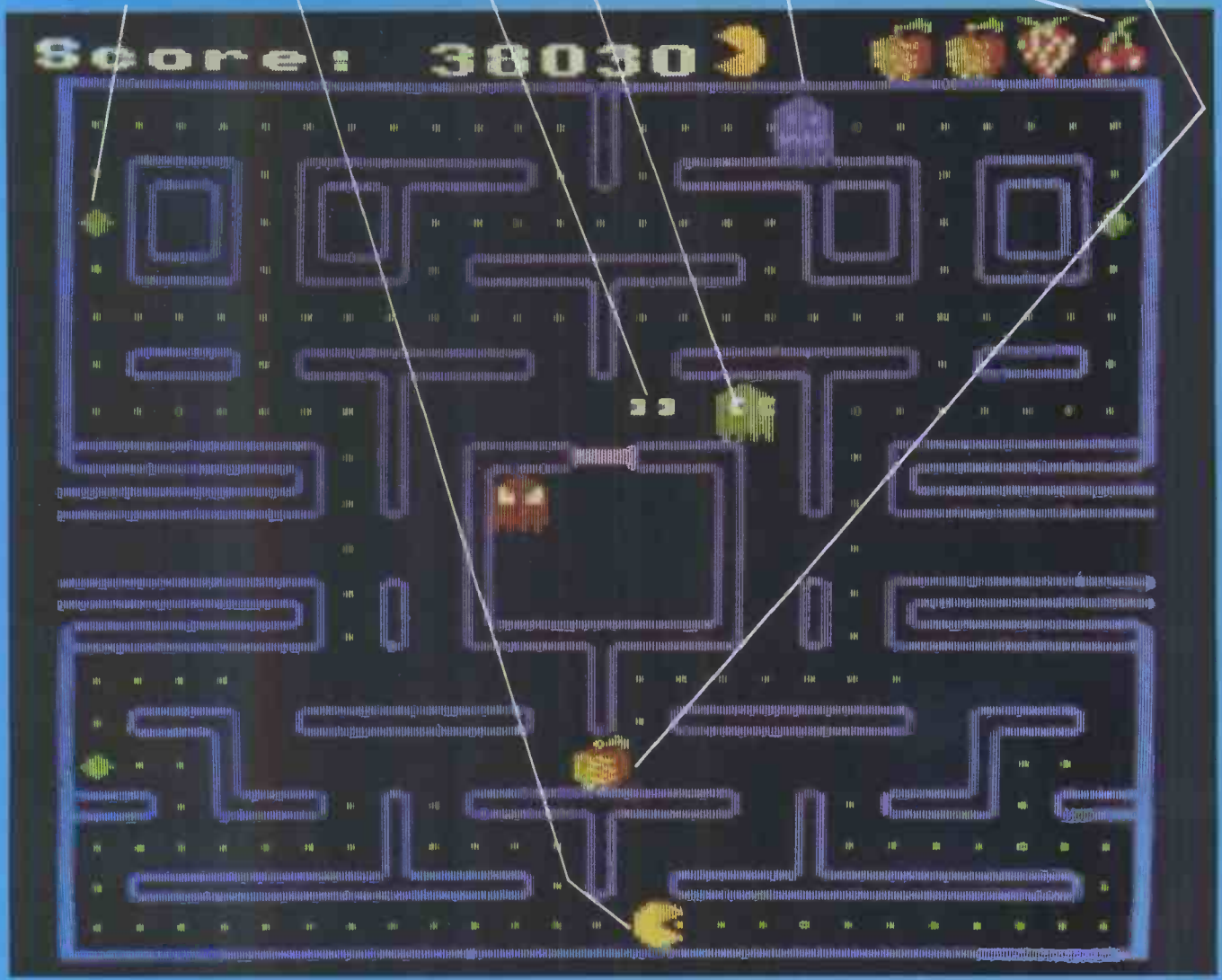
After the ghost has been 'snapped' their eyes return to the cave.

The ghosts eyes always look in the direction they are going.

Blue ghost ready for eating. If not eaten quickly they flash and revert back.

Fruits increase in value with higher scores.

Bonus points awarded for eating fruit.



Snapper - the new addictive arcade-style game for the BBC micro from Acornsoft.

Snapper's food is fruit and he must eat to stay alive. Ghoulish ghosts try to gobble him up and he can't fight back until he has found and eaten a power pill.

A total of 1,000 points is the minimum to rank among the top eight players on the high-score table – but the highest known score is 127,000!

For full details of this and other exciting games for the BBC Microcomputer System ring 01-930 1614 or write to:

ACORNSOFT

Acornsoft Ltd 4a Market Hill CAMBRIDGE CB2 3NJ.

The 5th Personal Computer World Show

STAND BY STAND

A breakdown of exhibitors at Britain's largest microcomputing show

Stand no: 317/322, 200
Acorn Computers Ltd, Fulbourn Road, Cherry Hinton, Cambridge.
Tel: 0223 245200

Acorn has stands planned in both hobbyist and business areas of the Show. Networks of Atoms and BBC Computers will be on the hobbyist stand; these will be complete with disk drives, file servers and printers. Robotic arms and lasers will also be a feature of this stand. Visitors will be able to gain 'hands-on' experience of Acorn hardware and the latest software from Acornsoft.

The business stand will also feature a network of BBC Computers providing demonstrations of many business, educational and industrial applications.

Stand no: 259, 160
Adda Computers Ltd, Mercury House, Hanger Green, Park Royal, Ealing, London W5 3BA. Tel: 01-997 6666

On Adda's home computing stand, the VIC-20 will take pride of place. There will be special offer prices on the complete VIC-20 starter pack, which includes the VIC-20, cassette deck, joystick, Introduction to Basic, ten blank cassettes and even a mains plug. A large selection of software will be on view.

Commodore business systems will be the order of the day on the business stand. Word processing, Silicon Office, database management, Visicalc and the multi-user MuPET will be demonstrated.

Special prices on all these products will be offered to any visitor who orders within seven days of visiting the Show — tickets are needed to qualify. Details of Adda's continuous Open Days programme are available from its offices in London, Reading and Slough.

Stand no: 444
Addison-Wesley Publishers, 53 Bedford Square, London WC1B 3DZ.
Tel: 01-631 1636

Addison-Wesley covers a large range of micro-related subjects in its titles and is also moving into the area of software publishing, particularly for education. Its latest venture is in magazine publishing in conjunction with Acorn Computers — Acorn User. The latest issue, aimed at the Atom, BBC and Econet user, will be sold from the stand along with a selection of books.

Stand no: 268
Adventure International, 736 Commerce Circle, Longdale Industrial Park, Longdale, Florida 32750, USA

Adventure International will be featuring a wide range of software for several of the most popular microcomputers, including TRS-80, Apple, Atari and CP/M. Several arcade-type games will be introduced, and 'playstations' for eager gamesters to try out the programs before buying them will also be an attraction.

A newly formed business division will exhibit its series of Maxi business application programs.

Stand no: Computer Club Corner
Amateur Computer Club, 142 Windermere Road, London SW16 5HE.
Tel: 01-764 4043

The ACC is the national organisation representing the interests of all the major user groups and small computer clubs in the UK. In this capacity it has again been asked to organise the amateur stands at the Show.
National clubs covering users of the following machines will be present: Apple, BBC, Commodore, Compucolor, Sharp, Sorcerer, Tandy and Tangerine, together with the Association of London Computer Clubs, Forth Interest Group, 68 Micro Group, etc.

The Club Database will again be a feature; this locates and prints out details of the nearest club to a specified locality.

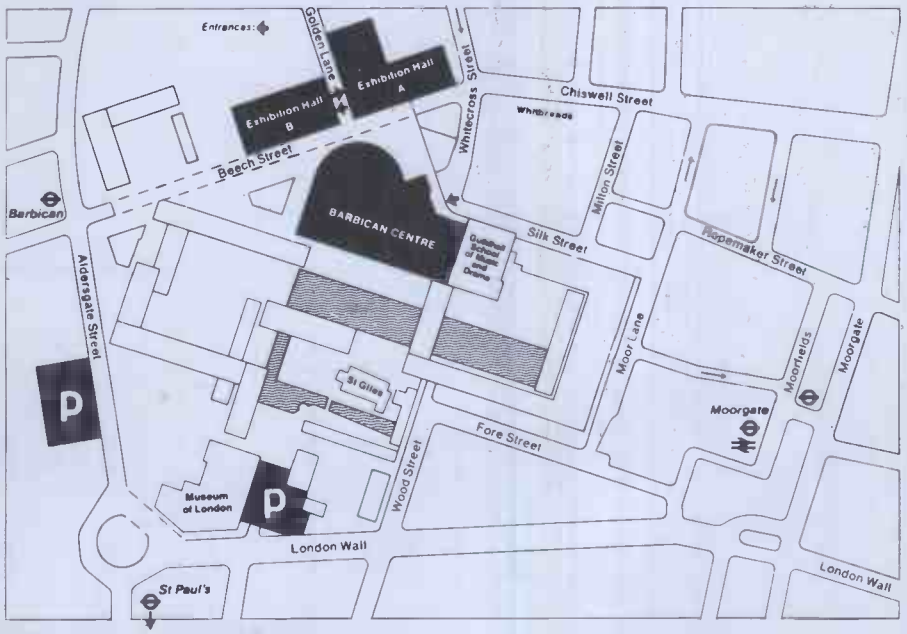
Stand no: 263
Applied Systems Knowledge Ltd, London House, 42 Upper Richmond Road West, London SW14 8DD.
Tel: 01-876 0102

Details unavailable at press time.

Stand no: 281
Artic Computing Ltd, 396 James Reckitt Ave, Hull, North Humberside.
Tel: 0482 75284

The latest products from this company will be at the Show. Among these is ZX Forth, a full implementation of Fig Forth for the ZX81. Another new product is a full editor, assembler and debugger for the ZX81. This has all the features of assemblers written for much larger machines and costs only £9.95.

A Pack-Man type game will be available, along with ZX Chess which will play in 1k. Artic also has a range of RAM expansions.



How to get there

By underground
Barbican, St Pauls, Bank, Liverpool St, or Moorgate
By train
Holborn Viaduct (SR), Cannon St (SR) or Broad St (ER).

Stand no: 102
Association of Independent Computer Specialists. Enquiries to John Baldachin (Secretary), 203 Kilburn High Road, London. Tel 01-624 9336.

The AICS is showing the services, software and equipment of some of its members. Its byword is 'the professional approach to computing' and all members are thoroughly vetted to ensure a high standard of technical experience and ability. If you have a consultancy problem involving any size of computer, an AICS member could help you solve it.

The 5th Personal Computer World Show

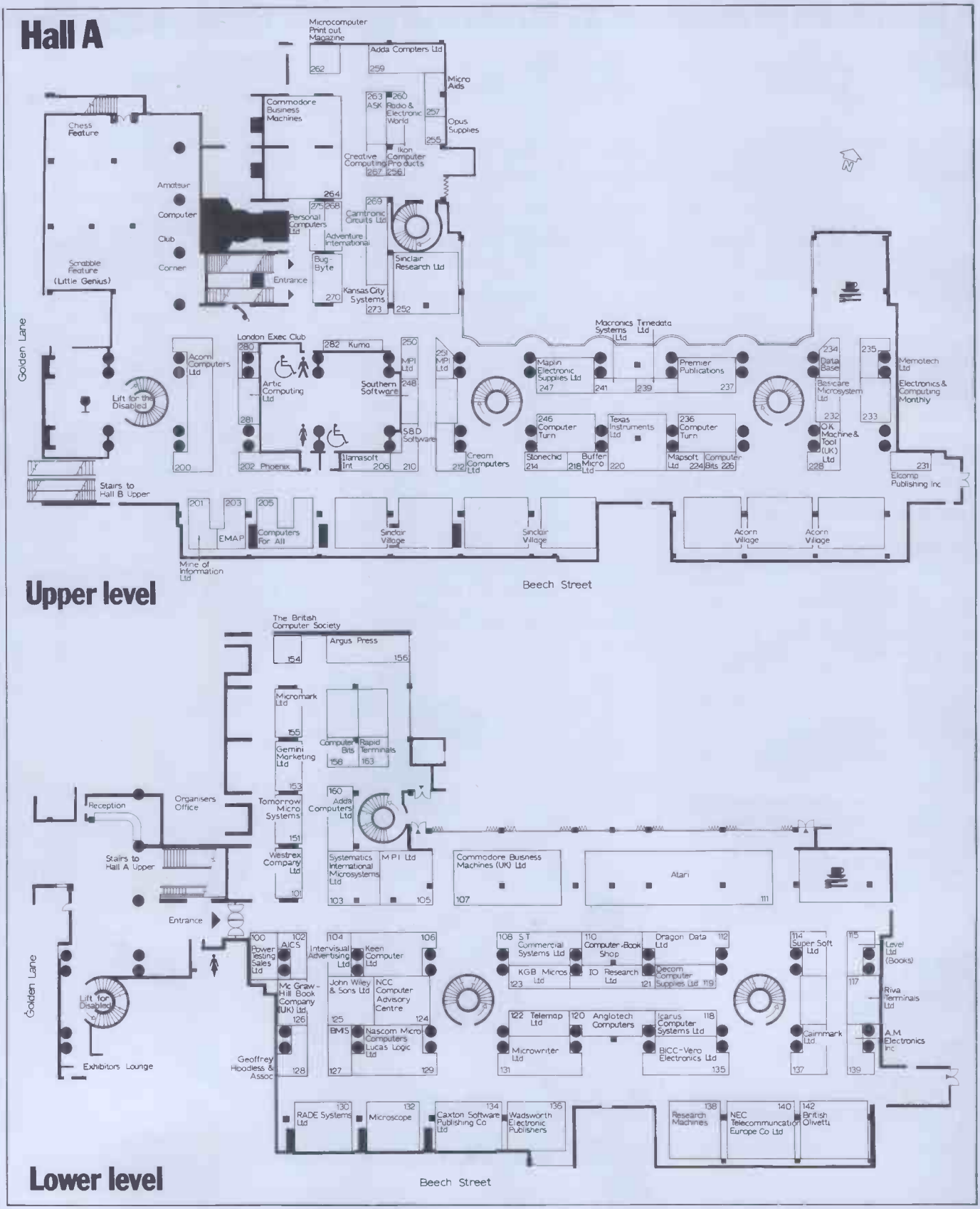
Stand no: 111
Atari International (UK) Ltd, 59 Alperton Lane, Wembley, Middlesex. Tel: 01-998 8844

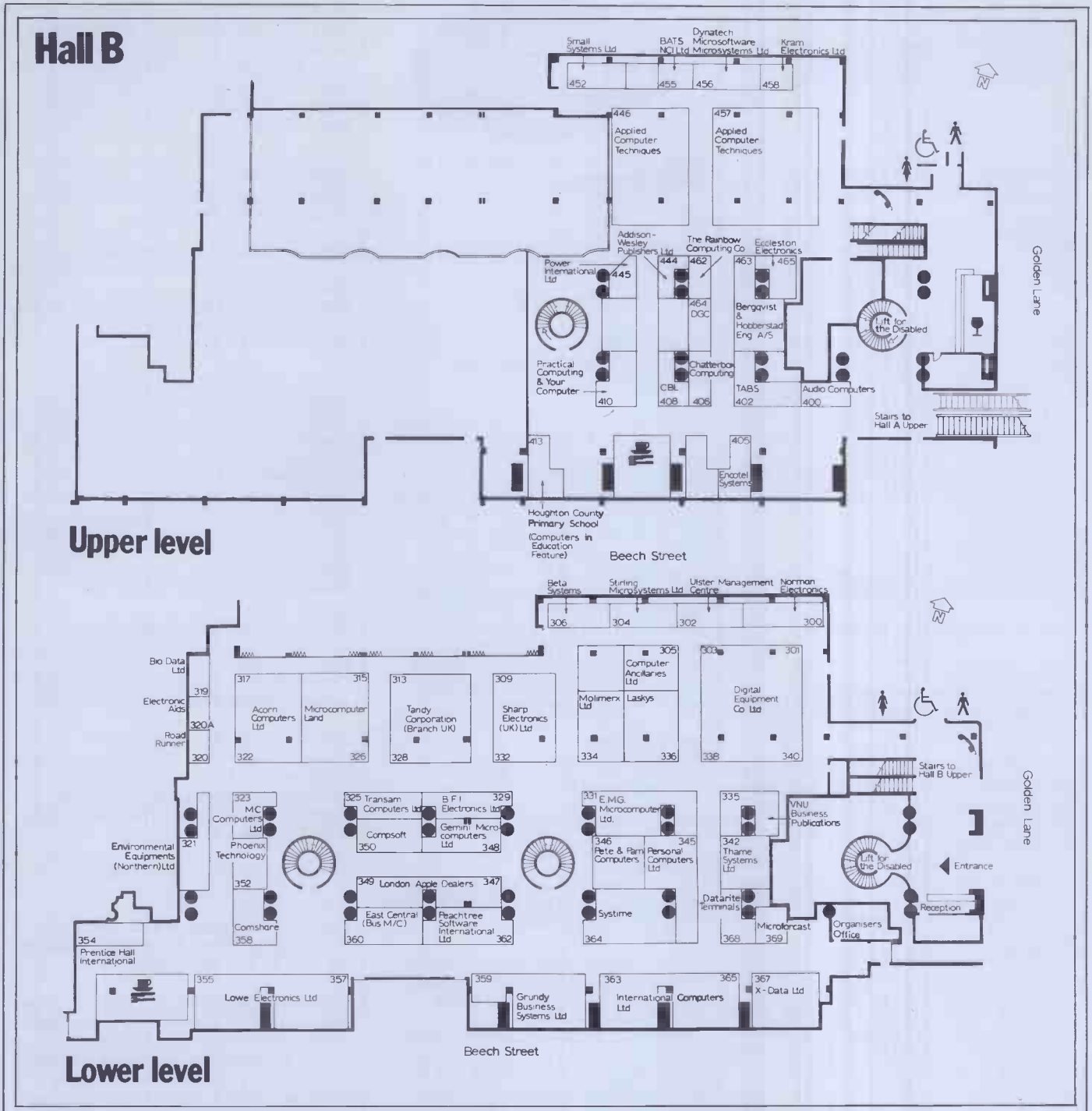
There will be ample opportunity to see and use Atari computers at this stand and a full range of software will be on display. Items from the Atari Program Exchange will be on the stand and several new products will be featured.

Stand no: Stand no: 139
AM Electronics Inc, 3446 Washington Avenue, Ann Arbor, MI 40104, USA

Details unavailable at press time.

Stand no: 120
Anglotech Computers, Old Crown, Windsor Road, Slough, Berks. Tel: Slough 74201





The Shelton Instruments 1000 series of business micros will be on this stand running packages from a range of applications software. The micros themselves are winchester-based and will be run as a multi-user system under Shelton's operating system, McNOS. The systems are low in price and cover a wide spectrum of sizes, capabilities and applications. Dealer enquiries are welcome.

Stand no: 446/447
Applied Computer Techniques (Holdings) PLC, ACT House, 111 Hagley Road, Birmingham B16 8LB. Tel: 021 454 8585

Details unavailable at press time.

Stand no: Stand no: 400
Audio Computers, 87 Bournemouth Park Road, Southend. Tel: 0702 613081

Details unavailable at press time.

Stand no: not known
Automation Facilities Ltd, Blakes Road, Wargrave, Berks. Tel: 0735 223012

Details unavailable at press time.

Stand no: 232
Basicare Microsystem Ltd, 5 Dryden Court, London SE11 4NH.
Tel: 01-735 6408

From Basicare Microsystem comes the Organic Micro, a range of units to add considerable power to your ZX81. Using products from this series, you can enable the ZX81 to retain programs when switched off, drive an 80-column printer or play high resolution games with sound and joysticks. Each unit costs under £30 on average.

Stand no: 455
BATS-NCI Ltd, 375 Regents Park Road, London N3 1DG

Details unavailable at press time.

Stand no: 463
Bergqvist & Hobberstad Engineering A/S, Herluf Trolles Gade 20/21, 1052 Copenhagen K, Denmark. Tel: 01-133 188

The Model 170Z is a monitor specially designed for use with the ZX81. It gives a better quality picture than a domestic TV, at the same time tidying up all the trailing cables connected to the machine. The ZX81 plugs into a slot at the front of the monitor and is then connected to power supply which will also drive the ZX printer. Any ZX81 peripherals can be connected. The monitor will also work as a conventional monitor with other micros and is equipped with a video output jack enabling output to two screens at once.

Stand no: 329
BFI Electronics Ltd, 516 Walton Road, West Molesley, Surrey KT8 0QF.
Tel: 01-941 4066

Details unavailable at press time.

Stand no: 135
BICC-Vero Electronics Ltd, Industrial Estate, Chandlers Ford, Eastleigh, Hants SO5 37R. Tel: 04215 66300.

Details unavailable at press time.

Stand no: 319
Biodata Ltd, 6 Lower Ormond Street, Manchester MI 5 QF. Tel: 061-236 1283

Biodata manufactures Microlink, a modular computer interface which links laboratory and monitoring equipment to microcomputers. The system allows the setting of an initial configuration and the potential for later expansion. It can be used with micros such as the CBM, Hewlett Packard and Sirius and comes with a detailed programming manual.

The system consists of a mainframe containing an IEEE interface and power supply, into which up to 18 modules are plugged. A selection of modules is available for applications in chemistry, engineering, electronics, physics and many others.

Stand no: 127
BMIS, Suites 101-110, 35 Piccadilly, London W1. Tel: 01-437 5505

Details unavailable at press time.

Stand no: 154
The British Computer Society, 13 Mansfield Street, London W1M 0BP. Tel: 01-637 0471

The British Computer Society is the major representative body of the computing profession in Britain. There are three grades of membership: Associate Member, Member and Fellow. Those who are interested in computing but not eligible for full membership can become Associate Members. This enables them to participate in the activities of the Society.

Members are entitled to the following benefits: regular copies of Computing (in which the society publishes a page of news) and the society's journals, price reductions on other publications and on the society's conferences and events, and the right to join up to nine specialist groups.

Stand no: 142
British Olivetti Ltd, 86/88 Upper Richmond Road, Putney, London SW15. Tel: 01-785 6666

Details unavailable at press time.

Stand no: 218
Buffer Micro Ltd, 374a Streatham High Road, London SW16

Details unavailable at press time.

Stand no: 270
Bug-Byte Microcomputer Software, 99-100 The Albany, Old Hall Street, Liverpool L3 9EP. Tel: 051-227 2299

Bug-Byte's speciality is entertainment. Spectral Invaders for the ZX Spectrum was the first program of its kind on the market for that computer and several others from the same company have been market firsts. A network of dealers has been set up, both nationwide and abroad (the USA and South Africa). All software comes with extensive documentation.

Stand no: 137
Cairnmark Ltd, 106 Church Road, London SE19 2UB. Tel: 01-771 3614

Details unavailable at press time.

Stand no: 269
Camputers Ltd, 36a Hills Road, Cambridge CB2 1LA.

The PCW Show will be the first public outing of the Lynx, the new home and small business computer from Cambridge-based Camputers. The Lynx incorporates a range of features normally associated with more expensive machines at a price of around £150 + VAT. With a 48k memory (expandable to 192k), proper typewriter keyboard and integral power supply, the Lynx has high resolution colour graphics and built-in speaker, making it ideal for games and educational use. Camputers will also be displaying a complete Lynx system with disk drives and printer.

Stand no: 408
CBL, 8 King Street Lane, Winnersh, Wokingham, Berks RG11 5AS.

Details unavailable at press time.

Stand no: 134
Caxton Software Ltd, Lading House, 10-14 Bedford Street, London WC2E 9HE. Tel: 01-379 6502

Caxton supplies an electronic card index with almost universal applications called Cardbox and a linear programming problem-solver (Optimiser) which will answer 'what if' questions using previously input data. Cardbox sells for £155 and will run on CP/M machines. Optimiser costs £295, running on Apple equipment.

Caxton is also on the look-out for experienced programmers with ideas for new packages. Caxton products are now sold worldwide through many different dealers and retailers.

Stand nos: 107, 266/278
Commodore Business Machines, 675 Ajax Avenue, Trading Estate, Slough, Berks. Tel: Slough 74111

Commodore will demonstrate a number of its new machines. The VIC will be on the stand with a range of software and accessories. On its business stand, software applications will be the order of the day, including Silicon Office, Prestel, accounting and word processing and many more.

Stand no: 305
Computer Ancillaries Ltd, 64 High Street, Egham, Surrey.

Details unavailable at press time.

Stand no: 110
Computer Bookshop, 30 Lincoln Road, Olton, Birmingham B27 6PA. Tel: 021-707 7544

Computer Bookshop is a wholesale supplier of microcomputer books, servicing the small computer industry via bookshops and microstores. Publishers represented include Sybex, Compusoft, Osborne/McGraw-Hill, Sams, Interface and Wiley and titles range from general programming to machine-specific books.

Stand no: 205
Computers For All, 72 North Street, Romford, Essex. Tel: 70 60725

Details unavailable at press time.

Stand no: 358
Comshare Ltd, 32/34 Great Peter Street, London SW1P 2AB. Tel: 01-222 5665

Details unavailable at press time.

Stand no: 267
Creative Computing, 39 E Hanover Avenue, Morris Plains, NJ07950, USA. Tel: 201-540 0445

Details unavailable at press time.

Stand no: 234
Database Publications Ltd, 68 Chester Road, Hazel Grove, Stockport, Cheshire SK7 5NY. Tel: 061-456 8383

Computer Dealer was launched in June this year as the first international trade newspaper for the micro industry. It covers all aspects of the micro marketplace and is produced to newspaper deadlines, which means it can take last-minute stories or advertisements right up to the day it goes to press. It is mailed first class to UK dealers and airmailed to dealers in the rest of the world.

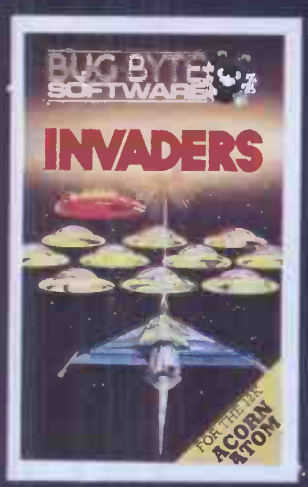
Windfall is Britain's only Apple magazine, with contributions from some of Britain's leading Apple experts. It aims to show the Apple user how to make his micro more powerful and his programs more exciting, with in-depth features on the Apple's music, speech and graphics capabilities. Back numbers will be available on the stand together with a variety of Apple logo T-shirts, ties and necklaces.

Stand no: 368
Datarite Terminals, 144/146 High Road, Chadwell Heath. Tel: 01-590 1155

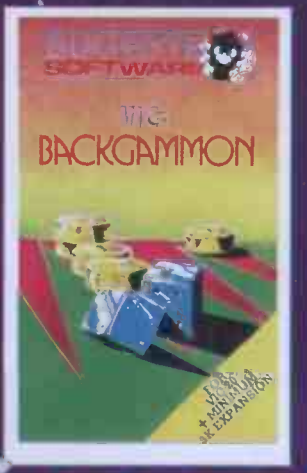
Details unavailable at press time.

Stand no: 119
Decom Computer Supplies Ltd, James House, Welford Road, Leicester LE2 7AE. Tel: 02403 7540

Decom supplies everything you need in



WHAT'S YOUR GAME?



FOR OWNERS OF ZX81, SPECTRUM, BBC MICRO, ATOM, COLOUR GENIE, VIC.

Bug-Byte games are best sellers. Tens of thousands of contented customers testify to that, so do consistently hot reviews in the popular micro-press. If your game isn't shown, don't worry, we probably have more quality games for more machines than any other software house – we just couldn't fit them all in. Bug-Byte games are available at good computer shops everywhere, or direct from our Liverpool office.

BUG-BYTE SOFTWARE

FREEPOST (NO STAMP REQUIRED) LIVERPOOL L3 3AB.

PLEASE SEND ME FULL DETAILS, MY COMPUTER IS _____

NAME _____

ADDRESS _____

_____

_____

PCW/82

ATTENTION DEALERS! For special introductory pack send coupon and business card to Mark Butler

ADVERTISEMENT

BERGQUIST & HOLDGSTAD ENG A/S

B+H

the way of supplies to run a computer system. Magnetic media, stationery, ribbons, labels and binders make up some of its product categories. Recently introduced is a surge corrector which will regulate the flow of mains electricity.

Stand no: 301
Digital Equipment Company Ltd, PO Box 110, Imperial Way, Reading, Berks. Tel: Reading 868711

Digital will display its new family of personal computers which comprise the professional 350 and 325 at the top of the range and the Rainbow 100 further down. The Rainbow is a twin-processor CP/M micro which will run both 8-bit and 16-bit software. All Digital's personal computers are equipped with the same full function keyboard, compact display monitor and system box containing disk drives and computer hardware. The Professional 350's extended system box can contain a 5¼in winchester type unit with 5 Mb of storage.

Stand no: 112
Dragon Data Ltd, The Mettoy Centre, Lodge Farm Industrial Estate, Northampton NN5 7DN. Tel: 0604 51075

This company has just launched its all-British home computer, the Dragon 32, designed with family learning in mind. It gives nine colours, a five-octave sound generator and 32k of user RAM for just £199.95. Arcade and adventure game software will be on display along with programming tutors which allow users to examine the structure of software.

Stand no: 456
Dynatech Microsoftware Ltd, Summerfield House, Vale, Guernsey. Tel: 0481 47377

If you are looking for a program to write your programs for you, Dynatech boasts a large range. This includes CORP and Codewriter. Dynatech also runs a holiday micro training school in Guernsey, using program generators with various micros. Some of these will be featured alongside the software on the stand.

Stand no: 360
East Central Business Machines Ltd, 139/147 Mile End Road, London E1. Tel: 01-790 9991.

Details unavailable at press time.

Stand no: 465
Eccleston Electronics Ltd, Legge Lane, Birmingham B1 3LG. Tel: 021-236 6220

Eccleston and Hart Ltd produces expanded polystyrene for packaging various components including computer parts. A business back-up system for providing an emergency power supply is also available.

Softcell Ltd produces and imports software and hardware from the USA for the Atari. It supplies RAM boards (guaranteed for four years) for upgrading both the 400 and 800. A perspex moulded case for Atari, VIC-20 and BBC computers can be bought to enhance the appearance and protect the machine.

Stand no: 231
Elcomp Publishing Inc, 53 Redrock Lane, Pomona, CA91766, USA

Elcomp will show its new products for the Atari, VIC-20, Apple II, Sinclair and OSI. These include a word processor, monitor and macro assembler for Atari, available on disk or cassette, plus many games, books and add-ons. The Elcomp Forth compiler will also be available for Atari and Apple II. Dealer enquiries are welcomed.

Stand no: 320
Electronic Aids (Tewkesbury) Ltd, Mythe Crest, The Mythe, Tewkesbury, Glos GL20 6EB. Tel: 0386 831020

Electronic Aids will be showing a range of sophisticated but competitively priced commercial software for the Commodore PET. The range includes accounting systems for companies with hundreds of employees and others specifically designed for the one-man business. All systems shown are in daily use and are supported with a thorough back-up service. Educational software and packages for school administration are also available.

Stand no: 233
Electronics & Computing Monthly, 67 High Street, Daventry, Northants. Tel: 03272 71702

Details unavailable at press time.

Stand no: 228
Electroware, Dutton Lane, Eastleigh, Hants SO5 4SL. Tel: 0703 610944

This company is a division of OK Machine & Tool (UK) Ltd, and will be exhibiting its range of connectors, cable, tools, PCBs, DIP sockets, enclosures and packaging accessories. Special offers will be made throughout the Show.

Stand no: 203
EMAP Business and Computer Publications Ltd, Petersham House, 57a Hatton Garden, London EC1N 8JD

Titles in the EMAP stable include Which Computer?, Computer & Video Games, What Computer?, Educational Computing and Which Micro? Specialist titles cover IBM, word processing and networking. All these magazines will be on sale on the stand, along with back issues, subscription details and special offers.

Stand no: 331
EMG National Microcentres, 2 Fleming Way Industrial Centre, Gatwick, Crawley, West Sussex. Tel: Crawley 519211

Offering more than just computers, EMG National Microcentres believes that the businessman is looking for a guaranteed solution rather than a 'do-it-yourself' micro. Its solution consists of in-depth training, a 12-month guarantee, on-site maintenance, system development services, long-term support and supplies.

In addition to all this EMG has a team of programmers who will write software tailored to exact requirements, as well as an extensive range of packaged software. It is backed by the British Rail Pension Fund and runs a national network of dealers.

Stand no: 405
Encotel Systems Ltd, 7 Imperial Way, Croydon Airport Industrial Estate, Croydon, Surrey. Tel: 01-686 9687

Details unavailable at press time.

Stand no: 321
Environmental Equipment (Northern) Ltd, Environ House, 64 Welsh Row, Nantwich, Cheshire CW5 5ES. Tel: 0270 625115

On display will be the complete range of A3 intelligent XY digital plotters and supporting software. The new WX4371 drum plotter will be featured. This has four pens, 43 intelligent functions and a pen speed of 200mm/second at a price of £1395. The WX4671 digi-plot will be on the stand along with the rest of the series and visitors will be able to test these plotters for themselves. All orders taken during the Show will be at a 10% discount.

Stand no: 153
Gemini Marketing Ltd, 9 Salterton Road, Exmouth, Devon EX8 2BR. Tel: 03952 5832

If you would rather not spend your cash on a disk drive and expensive disk-based software for a home computer, Gemini attempts to fill the software gap with cassette-based programs which will not make so much of a hole in your pocket. These run on such machines as the BBC Computer, VIC-20, MZ-80K, A & B, Atari and Spectrum, covering applications like accounts, stock control and database. Modules cost £19.95 and come with full documentation.

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Stand no: 348
Gemini Microcomputers Ltd, Oakfield Corner, Sycamore Road, Amersham, Bucks. Tel: 02403 28321

Details unavailable at press time.

Stand no: 359
Grundy Business Systems Ltd, Grundy House, Somerset Road, Teddington, London TW11 8TD.

On the Grundy stand will be the Newbrain personal computer, together with its associated peripherals. Developed in the UK, this micro is designed primarily for business users, but could prove to be useful to educational establishments and the enthusiast. All models offer 29k ROM and 32k RAM, the latter being expandable to 2Mb. The Newbrain will connect to a domestic TV.

Stand no: 128
Geoffrey Hoodless & Associates, 20 Leafield Close, St John's, Woking, Surrey GU21 3HW. Tel Woking 61082

'All-risk' computer insurance is this company's speciality. It also arranges maintenance cover for meeting the cost of hiring alternative equipment while existing equipment is repaired and has in its portfolio policies to cover the cost of maintenance itself. Requirements can be discussed on the stand.

Stand no: 118
Icarus Computer Systems Ltd, Deane House, 27 Greenwood Place, London NW5 1NN. Tel: 0202 295952

Icarus is the main UK distributor for the Superbrain and sole UK agent for the Columbia range of micros. Details on products for both of these will be part of its contribution to the Show. The Compustar hard disk system for the Superbrain will be exhibited. The Columbia range of CP/M and MP/M micros comes in a series of 320k to 80Mb, including a multi-user system for up to 16 users. There will also be details on products for these machines on the stand.

Stand no: 256
Ikon Computer Products, Kiln Lane, Laugherne, Carmarthen, Dyfed

This company manufactures a floppy tape system for the Nascom and will show this product along with others in its range. These will include a speech/sound synthesiser with a 15-bit user I/O port which can output either through a hi-fi system or through the system's own loudspeaker.

The 5th Personal Computer World Show

Stand no: 363
International Computers Ltd, ICL House, Putney, London SW15. Tel: 01-788 7272

Details unavailable at press time.

Stand no: 104
Intervisual Advertising Ltd, 22 Brook Street, London W1Y 1AE.
Tel: 01-499 2503

Details unavailable at press time.

Stand no: 121
IO Research Ltd, 6 Laleham Avenue, Mill Hill, London NW7 3HL.
Tel: 01-959 0106

This company will show its new range of colour graphic display controllers, the Pluto family. These will be demonstrated connected to a number of different micros. Also for the first time, the Pluto Palette will be displayed, giving the Pluto a wide range of colours. IO Research will also have details of its IONET local area network.

Stand no: 462
Jupiter Cantab Ltd, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP. Tel: 0954 80437

The two founders of this company (originally known as Rainbow Computing) played a major role in the design of the ZX Spectrum. Their latest venture is the Ace, the first micro designed specifically to run Forth. It sells at £90 (all-inclusive) and contains 3k of RAM, a full size moving-key keyboard, an internal loudspeaker and user-definable high-resolution graphics. The 8k ROM drives a full Forth interpreter with integer and floating point arithmetic and an editing system specifically designed for running Forth on a small computer.

Stand no: 273
Kansas City Systems, Unit 3, Sutton Springs Road, Chesterfield S44 5XE.
Tel: 0246 850357

Details unavailable at press time.

Stand no: 106
Keen Computers Ltd, 5 Giltspur Street, London EC1. Tel: 01-236 5682

Keen is sole UK distributor for Corvus and will feature the Concept 16-bit micro which will function either as a single micro or as a workstation in the Corvus Omninet network. The Concept has an A4 size bi-directional screen which adds something in the way of ergonomic versatility and CP/M compatibility ensures access to a good selection of software.

Stand no: 123
KGB Micros Ltd, 14 Windsor Road, Slough, Berks SL1 2EJ. Tel: Slough 38581

Details unavailable at press time.

Stand no: 458
Kram Electronics Ltd, Victoria House, 17 Highcross Street, Leicester LE1 4PF.
Tel: 0533 27556

The Andromeda, a Z80 dual disk CP/M machine, will be launched at this stand. Designed for business use, this will be priced at £1299. Also on display will be Kram's disk drives which have not been unpopular over the past few months, along with the Olivetti Praxis 35 daisy-wheel printer. A TRS-80/Video Genie expansion box giving 32k of extra RAM, printer interface and disk controller should prove to be an attraction. Other products will be shown but details are unavailable at press time.

Stand no: 336
Laskys, Hardman House, The Hyde, London NW9 6JJ. Tel: 01-200 0444

Details unavailable at press time.

Stand no: 115
Level Ltd (Books), PO Box 438, Hampstead, London NW3 1BH.

Details unavailable at press time.

Scrabble Feature
Little Genius Ltd, Suite 504, Albany House, 324 Regent Street, London W1.
Tel: 01-625 5693

The Scrabble contest will run from this stand. Little Genius will be distributing the Scrabble package among dealers shortly, and it will be available from the first day of the Show — through Apple dealers only. Little Genius can, however, accept dealer orders for it at the Show.

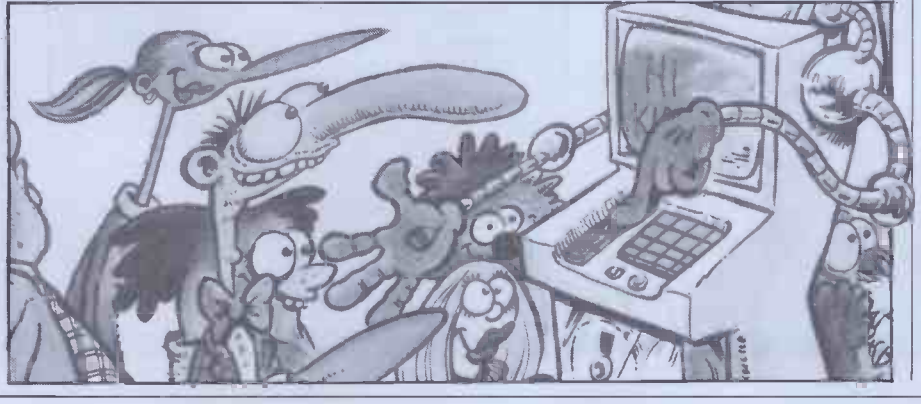
As a game it is modelled exactly on the original and has an extensive dictionary based on Chambers. It allows for all Scrabble-playing possibilities; it will give a list of letter values and square codes on request, as well as the option to see other players' racks. Projected retail price is £24.95.

Stand no: 347/349
London Apple Dealers, c/o Appletex, 7/8 Bedford Court, The Avenue, London W4. Tel: 01-995 5446

Details unavailable at press time.

Stand no: 355/357
Lowe Electronics Ltd, Chesterfield Road, Matlock, Derbyshire DE4 5LE.
Tel: 0629 4995

Details unavailable at press time.



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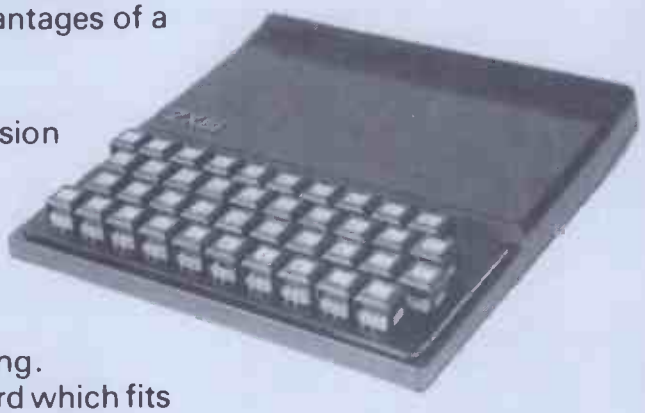

This is a genuine 40-key, push button keyboard which fits into the recess formed after peeling off the existing touch sensitive keypad.

The kit comes with a precision drilled P.C.B. finished in matt black, 40 keys, 2 colour legends, connecting tails, adhesive pads and a full set of instructions.

41 key version also available priced £23.00 (kit) £26.50 (built)

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Stand no: 241
Macronics Systems Ltd, 26 Spiers Close, Knowle, Solihull, West Midlands B93 9ES. Tel: Knowle 3693

Macronics not only supplies 'flicker-free' games for the ZX80 but was also the first company to develop a disk drive for the ZX81. The ZX81 will be on the stand supporting both 5¼in and 3½in drives as well as some add-on boards. Software for all the Sinclair micros will be on demonstration throughout the Show.

Stand no: 247
Maplin Electronic Supplies Ltd, PO Box 3, Rayleigh, Essex. Tel (mail order): 0702 552911

Maplin will have eight Atari computers on its stand for you to use. Each will have a different piece of software running on it which you can try out or just watch. Over 150 different Atari software titles will be available and you will be able to browse through the entire library. Both machines and software will be on sale, together with Maplin's own ZX81 keyboard. Details of the Maplin free credit scheme can also be obtained.

Stand no: 224
Mapsoft Ltd, Unit A, Oak Road South, Hadleigh, Benfleet, Essex. Tel: 0702 554002

Mapsoft is a wholesale software distributor and will be displaying its range of software and hardware for the Atari computers. Old and new trade customers will be able to sit down and browse through the large number of items available and take away Mapsoft's excellent colour catalogue. Titles include the latest arcade and adventure games with superb colour graphics and a wealth of languages, utilities and educational programs. All titles are stocked in depth and the company's fast service and excellent trade discounts make this stand well worth a visit.

Stand no: 323
MC Computers, 8 Park Street, Newbury, Berks. Tel: 0635 44967

A range of I/O cards for Apple computers, a family of interface modules for IEEE-based systems (including serial to IEEE converters) and Pi — a specially packaged Apple II for use under harsh conditions — will be on display.

Stand no: 126
McGraw-Hill Book Co (UK) Ltd, Shoppenhangers Road, Maidenhead, Berks SL6 2QL. Tel Maidenhead 23432.

Details unavailable at press time.

The 5th Personal Computer World Show

Stand no: 235
Memotech, 3 Collins Street, Oxford OX4 1X2. Tel: Oxford 722102

On display will be Memotech's series of memory expansions for the ZX81. Four new products will also be available: the Memopak HRG (high resolution graphics) a Centronics type parallel printer interface, an RS232 and a plug-in keyboard.

Room has also been made on the stand for parent company Orchid Ltd, which will unveil the Orchid SM1, a hi-res colour computer with video frame handling facilities.

Stand no: 257
Micro Aids, 2 Boston Close, Culcheth, Warrington, Cheshire WA3 4LW. Tel: 092 576 2804

Micro Aids has a good range of accessories for the cleaning, protection and maintenance of computers and related equipment. This includes transport cases, covers and other environmental enhancements.

Stand no: 315/326
Microcomputerland, 172/174 Tottenham Court Road, London W1. Tel: 01-388 5011

Details unavailable at press time.

Stand no: 262
Microcomputer Printout Magazine, PO Box 2, Goring, Reading RG8 9LR. Tel: 049162 789

Details unavailable at press time.

Stand no: 105, 250/251
Microcomputer Products International Ltd, 8/11 Cambridge House, Cambridge Road, Barking, Essex. Tel: 01-591 6511

A well-established mail order company offering CP/M software, hardware, books and magazines, MPI is able to provide software for over 80 different machines. Over 70 proven systems will be on display and books and magazines will be available at special exhibition prices. Dealers and retailers can join the MPI National Dealer Network through formal registration.

Stand no: 413
Micros and Primary School Education, c/o Don Walton, 40 Home Farm Road, Houghton, Huntingdon, Cambs.

MAPE is a national organisation supported by the government in its aims to promote and develop awareness and effective use of microelectronics as an integral part of the philosophy of primary education. It has 14 regions covering the country and membership is available to any school or person with an interest in the application of microtechnology to primary education. MAPE publishes a journal, Micro-Scope, and can provide information on software, insurance, classroom practice and in-service training.

Stand no: 369
Microforecast, 31/33 High Holborn, London WC1V 6BD. Tel: 01-404 0564

Details unavailable at press time.

Stand no: 155
Micromark Ltd, Ravenscroft Road, Henley-on-Thames, Oxon. Tel: 04912 77926

Stand no: 132
MicroScope, 14 Rathbone Place, London W1P 1DE. Tel: 01-631 1433

Launching on 23 September, Micro-Scope will be the first fortnightly newspaper for the microcomputing industry, and will be available on subscription only to bona fide members of the trade. not the general public. It is designed to provide a trustworthy and up-to-date source of news. Anyone in the trade wishing to know more about either subscribing or advertising should call by the stand for a drink and a chat.

Stand no:
MicroValue Group, Interface Components Ltd, Oakfield Corner, Sycamore Road, Amersham, Bucks. Tel: 02403 22307

Two all-British micros will be on this stand — the Galaxy 1 from Gemini Microcomputers and the Quantum 2000 from Quantum Computer Systems. Both are Z80 machines using the Gemini Multiboard system and both run CP/M. They have double and triple disk drives respectively, offering 800k and 2.4Mb of storage. Software available includes CP/M 2.2, Comal-80, a Z80 assembler/editor, a text editing package and a machine code debugging aid. A business system written specifically for these machines (QUIBS) will be demonstrated at the Show.

Stand no: 131
Microwriter Ltd, 31 Southampton Row, London WC1. Tel: 01-831 6801

Microwriter will be showing the recently launched Microwriter Mk IV, a much-enhanced version of the hand-held word processing device operated through a single hand chord keyboard. With its internal rechargeable batteries and 8k of memory, the Microwriter can be used as a portable word processor; text can

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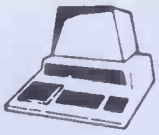

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8050 950K Dual Drive Floppy Disk	£895	£750
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The monitor ROM provided is a powerful advanced machine code monitor which debugs programs in preparation, displays memory, flags etc. in a versatile user friendly way *and in Hex.* Other programs will be available soon or, users can avail themselves of our ROM services — 12 hrs if you use a Prestel adaptor — for their own programs.

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01 373 5218

s.a.e. for further details please.

be printed out on any printer with an RS232 interface or can be up- or down-loaded to or from a word processing system or microcomputer. A video interface is available to allow on-screen editing and text can be saved onto cassette through the integral tape interface.

Stand no: 137
Mind Your Own Business, 106 Church Road, London SE19 2UB. Tel: 01-771 3614

Mind Your Own Business is the only UK business magazine with editorial consistently devoted to the understanding, selection and use of computer systems. Regular articles are carried on the PET and Apple, and a series is being published on CP/M and various compatible business packages.

Stand no: 201
Mine of Information Ltd, 1 Francis Avenue, St Albans, Herts AL3 6BL.
Tel: 0727 52801

Mine of Information is an established bookseller and consultancy specialising in personal computers. Their 'top 100' book list serves as a guide to the books which are up to date and good value for money. MoI also markets a game called 'MoI Othello' for ZX81. Versions of this game for ZX Spectrum and the BBC Computer will also be available.

Stand no: 334
Molimerx Ltd, 1 Buckhurst Road, Town Hall Square, Bexhill-on-Sea, East Sussex. Tel: 0424 220391

Among other packages for the TRS-80 and Video Genie, Molimerx will introduce SMAL-LDOS, a subset of its operating system LDOS. This will be available with a price reduction voucher against the purchase of LDOS itself. An update to its AJEDIT word processing system will be introduced.

Stand no: 129
Nascom Microcomputers, Lucas Logic Ltd, Welton Road, Wedgnock Industrial Estate, Warwick CV34 5P2.
Tel: 0926 497733

Details unavailable at press time.

Stand no: 124
The NCC Microsystems Centre, Oxford Road, Manchester M1 7ED.
Tel: 061-228 6333

The aims of the Microsystems Centre are to inform and educate businessmen on the applications and potential of microcomputing and to encourage its use in improving efficiency and competitiveness.

The Centre provides a number of one or two-day training courses, a consultancy service, a bookshop and a workshop where prospective buyers can examine software and computers free of charge. Annual subscription costs £50, including a starter pack comprising an hour-long advisory session and a cassette course on choosing a small business computer. Quarter-hour consultancy sessions are being offered to businessmen at the Show free of charge.

Stand no: 140
NEC Telecommunications Europe Ltd, NEC House, 164/166 Drummond Street, London W1P 3HP.
Tel: 01-274 7122

Personal computers, including the 8000 series, are NEC's main concern. One system on show will be the Benchmark word processing package which offers full word processing capability on a micro with full colour graphics and the NEC Spinwriter thrown in for less than £4000. A new, winchester-based, networking/mass storage system compatible with existing PC-8000 CP/M software will make its public debut.

Stand no: 410
Newnes Technical Books, Borough Green, Sevenoaks, Kent TN15 8PH.
Tel: 0732-884567

(see Practical Computing)

Stand no: 228
OK Machine & Tool (UK) Ltd, Dutton Lane, Eastleigh, Hants SO5 4AA.
Tel: 0703 610944

OK will be showing its wide range of electronics hardware, including bench tools, soldering irons, wire-wrapping kits and tools, IC tools, PCBs, cases, enclosures, connectors, sockets and test instruments. The full range of products is distributed throughout the UK by leading electronic and computer stores, and a free 48-page Electroware catalogue is available.

Stand no: 255
Opus Supplies Ltd, 10 Beckenham Grove, Shortlands, Kent BR2 0JU.
Tel: 01-464 5040

The Opus range includes Athana disks (which are provided with free library cases for safe storage), lockable filing boxes to hold 40 or 80 disks, disk mailers, head cleaning kits, ribbons and listing paper.

Computer desks are among the new products from Opus, and dynamic and static RAM and EPROM chips will be sold at competitive prices.

Stand no: 362
Peachtree Software International Ltd, 43/53 Moorbridge Road, Maidenhead, Berks SL6 8LT. Tel: 0628 32711

Peachtree is a part of MSA, the mainframe software company. It markets and supports accounting and office productivity systems. Two ranges of accounting systems are available. One is written in MBasic and the other in CIS Cobol. Products are available on most leading micros under CP/M, CP/M-86, MP/M, MSDOS and Unix operating systems.

Stand no: 345-366, 275
Personal Computers Ltd, 218 & 220/226 Bishopsgate, London EC2M 4JS.
Tel: 01-377 1200

Personal Computers is the oldest Apple dealer in the UK and will be showing Apple II and III. Plenty of application software will be demonstrated, with the emphasis on business. Personal's new tax package, Taxpayer*1, will be on the stand — this is designed for the professional accountant and for personal data analysis. Other applications will include financial modelling, graphics, banking and commodity analysis.

Stand no: 346
Pete & Pam Computers, Waingate Lodge, Waingate Close, Rossendale, Lancs BB4 7SQ. Tel: 0706 227011

600 lines of Apple related products is this company's boast. A distributor for over 50 software and hardware companies, including Epson, NEC, On-Line Systems, Micro Pro, Microsoft, Sirius Software and Zenith — to name a few — the company aims to provide prompt delivery, personal service and sound advice.

Stand no: 202
Phoenix Marketing Services, Oaklands House, Solartron Road, Farnborough, Hants GU12 9QL. Tel: 0252 514990

Details unavailable at press time.

Stand no: 352
Phoenix Technology, 158 Camberwell Road, London SE5 0EE.
Tel: 01-701 8668

A selection of European colour and monochrome monitors will be on show from Phoenix. These come in a range of sizes from 9in to 14in; there are also differing resolutions. Monochrome monitors can be bought with either a white or green phosphor and buyers can choose between a metal or plastic case.

Stand no: 445
Power International Ltd, 146a London Road, North End, Portsmouth, Hants PO2 9DJ. Tel: 0705 699031

This company will be introducing a new selection of power conditioning and distribution products for the electronic office. For the home user this includes a mains plug with built-in interference filter which replaces the conventional plug to give protection against interference present in the mains electrical supply.

Stand no: 100
Power Testing (Sales) Ltd, 137a High Street, Brentwood, Essex CM14 4RX.
Tel: 0277 220617

On show at this stand will be the Power Bank, a mains voltage regulator which will alleviate the possibility of damage to computers or software from mains irregularities. The unit requires no maintenance and micro and printer simply plug into it.

Stand no: 410
Practical Computing/Your Computer, IPC Electrical-Electronic Press, Quadrant House, The Quadrant, Sutton, Surrey. Tel: 01-661 3500

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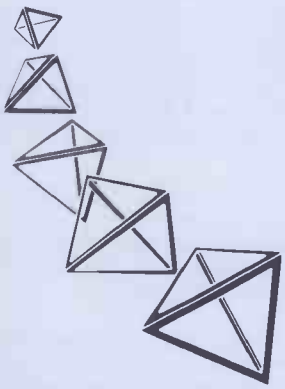

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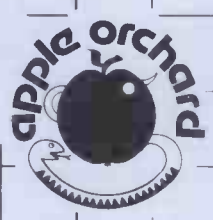

personal computing books for hobbyists, technicians and students. New books announced at the Show will include Computing Is Easy, a book for younger ZX81 users.

Sharing the stand with Newnes will be two of Britain's best-known personal computer magazines. Practical Computing offers programming advice, machine and software reviews and application articles for a professional and business audience. Your Computer is designed for those who are acquiring computers costing less than £300, such as the BBC Computer, ZX Spectrum, ZX81, VIC-20 and Acorn Atom. Both magazines will be selling current and back issues at the Show.

Stand no: 237
Premier Publications, 208 Croydon Road, London SE20 7YX.
Tel: 01-659 7131

Permier Publications will be displaying its current range of UK101/Ohio/TRS-80/Video Genie enhancements, including low-cost microdrives and disk controller cards, disk operating systems, screen enhancements and Basic enhancement firmware products. An important new range of UK101/Ohio hardware will be exhibited, including a 512x256 high resolution graphics card, a colour board giving 16 foreground and background colours, and a 256-character programmable character generator with software-selectable enhancements. New firmware products including a superb assembler/editor will be on show.

Premier's highly successful daisywheel word processing system based on WordPro4 Plus will be displayed, together with the Premier hardware and software range for the TRS-80 and Video Genie families including, hopefully, a colour Genie.

In association with Kram Electronics, Premier is developing a new disk-based system for the hobbyist, educational, scientific and business markets, based around the 6502 with other processor cards becoming available. All user software will be booted up from disk on startup. The system includes 512x512 graphics, modem, sound generator, facilities for colour and many other features. A pre-production unit will be displayed and Premier's staff will be on hand to answer your queries.

Stand no: 354
Prentice Hall International, 66 Wood Lane End, Hemel Hempstead, Herts HP2 4RG. Tel: 0442 58531

From a good selection of microcomputer books, several new titles will be displayed, dealing with many aspects of personal computing. Titles on the BBC Computer, Apple, PET, VIC, TRS-80 and Atari will be included. There will also be books available on programming languages, operating systems and other subjects.

Stand no: 130
Rade Systems Ltd, 53-55 Ballards Lane, London N3 1XP. Tel: 01-349 7411 (4 lines)

This company is a London-based manufacturer of advanced microcomputers. The Rade single board computer has proved to be suitable for several applications, including small to medium

business systems, games, industrial control and research and development. Each board is configured to run under CP/M 2.2. A range of add-on boards contributes to the overall flexibility of the system.

Stand no: 260
Radio & Electronics World, 200 North Service Road, Brentwood, Essex.
Tel: 0277 213819

Details unavailable at press time.

Stand no: 138
Research Machines Ltd, Mill Street, Botley Road, Oxford OX2 0BW.
Tel: 0865 49866

Details unavailable at press time.

Stand no: 117
Riva Terminals Ltd, Woking Business Park, Albert Drive, Woking, Surrey.
Tel: Woking 71001

Having previously specialised only in the distribution of printers and displays, Riva Terminals will be showing, for the first time, the Episode Type 1 microcomputer. This full-feature 8-bit computer with 64k RAM and two 5¼in disk drives is supplied in an attractive plastic case which takes up no more desk space than a sheet of A4 stationery. Weighing only 15lb, it will work with all types of printer or display and can be supplied with most industry standard CP/M software. Every Episode is supplied with CP/M 2.2 and Supervyz, a program which makes CP/M more user-friendly by changing its commands into a series of menus. Supervyz is available for any popular CP/M machine and the Episode will retail for less than £1000.

Stand no: 320
Roadrunner Electronic Products Ltd, 116 Blackdown Rural Industries, Haste Hill, Haslemere, Surrey GU27 3AY.

Roadrunner is a manufacturer and distributor of a wide range of electronic and computer-related products. Its large stock holdings enable it to give a 'same day' service on most items.

Its product catalogue will be available at the Show, featuring a good selection of circuit board and enclosure accessories. The main exhibit will be the Roadrunner wiring system and an introductory kit will be on sale from the stand. Roadrunner will also be introducing a group of branded word processing products.

Stand no: 210
SBD Software, 15 Jocelyn Road, Richmond, Surrey TW9 2TJ.
Tel: 01-948 0461

SBD imports and distributes Apple and Atari from the USA using many different suppliers. UK software can also be obtained through this company. Products cover applications such as word processing, database management and financial planning aids. Games and hardware add-ons are also on its stocklist.

At the Show SBD will run a games competition in which a prize goes to the highest scorer on the 'game of the day'.

Stand no: 309
Sharp Electronics (UK) Ltd, Sharp House, Thorp Road, Manchester M10.

Sharp will be exhibiting its well-known range of micros and pocket computers. The new MZ-80A personal computer, based on the Z80 processor chip, will be a feature as will be the more upmarket MZ-80B.

The PC1500, with an RS232 interface, incorporating 16k of ROM, a qwerty keyboard and 3.5k to 7.5k of RAM, retails at £179.95. An add-on four-colour printer/cassette interface is also available.

The PC3201 business computer is now available with CP/M 2.2. Implementation of this consists of a relocate board which relocates the PC3201 monitor ROM and replaces it with dynamic RAM. The computer comes with a financial modelling package and retails at £2,995.

Stand no: 252
Sinclair Research Ltd, 23 Motcomb Street, London SW1X 8LB.
Tel: 01-235 6949

Sinclair will be showing the recently launched ZX Spectrum personal computer and also giving one of the first public presentations of a new range of Spectrum cassette-based software. The Spectrum features full colour graphics, enhanced Sinclair Basic, sound generator and a moving-key keyboard. Sinclair will also be showing the ZX81 together with the RAM pack and ZX Printer.

Stand no: 452
Small Systems Engineering Ltd, 2/4 Canfield Place, London NW6 3BT.
Tel: 01-328 7145

This stand will feature a range of products for the Sirius 1. The Sirius 80 card plugs into one of the expansion slots, allowing all standard CP/M-80 programs to be run. The low-powered 256k RAM card gives extra RAM space and includes a utility which allows the card to be used as a disk drive.

A range of CP/M software is available for both the Sirius and the PET, together with a selection of PET peripherals which will include the Flowriter intelligent daisywheel printer.

Stand no: 248
Southern Software, PO Box 39, Eastleigh, Hants SO5 5WQ.

Launched at the Show will be Southern Software's database manager for TRS-80 and Video Genie, Electronic Notebook. Features of this system are retrieval on any field, menu-driven data entry and retrieval and a programmer interface to Basic. In addition, the ACCEL3 compiler and full screen editor will be demonstrated.

Stand no: 108
ST Commercial Systems Ltd, 26 New Broadway, Ealing, London W5 2XA.
Tel: 01-840 1926

Details unavailable at press time.

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Q. High Resolution Graphics?
A. The M20 has S12 x 256 bit-mapped graphics as standard, and they may be mixed with characters. The screen can also be split into up to 16 independent windows for multiple comparisons of data.

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Q. Finance?
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Q. Where can I get one?
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Stand no: 304
Stirling Microsystems Ltd, 241 Baker Street, London NW1. Tel: 01-486 7671

Details unavailable at press time.

Stand no: 114
Supersoft Ltd, 1st Floor, 10-14 Canning Road, Wealdstone, Harrow, Middlesex. Tel: 01-861 1166

Details unavailable at press time.

Stand no: 103
Systematics International Microsystems Ltd, Cleves House, Hamlet Haverhill, Suffolk CB9 8EE. Tel: 0440 61121

S I Microsystems will exhibit packages from its wide range of business software. These are written for many different micros and are in use all over the world. Packages can link together to form a suite or be used individually.

Stand no: 364
Systime Ltd, Concourse Computer House, 432 Dewsbury Road, Leeds LS11 7DF. Tel: 0532 702211

Details unavailable at press time.

Stand no: 402
TABS Ltd, Sopers House, Chantry Way, Andover, Hants. Tel: 0264 58933

Details unavailable at press time.

Stand no: 313
Tandy Corporation, 10-12 Floor, Thameway Tower, Bridge Street, Walsall, W. Midlands. Tel: 0922 648181

Tandy's new 16-bit micro, the Model 16, will be the star of the company's stand, but Tandy is unveiling a whole range of other new products: the DTI data terminal, a low-cost terminal; a double density disk drive kit for the Model I; a high resolution graphics board kit for the Model II plus an upgrade board to give the II 128k of RAM; a new range of printers including low-cost dot matrix, daisywheel and plotter printers; and a large range of new business, educational and home software.

Tandy will also have a whole classroom of networked Model IIIs with instructors on hand to answer education-oriented questions.

Stand no: 122
Telemap Ltd (Electronic Insight), Bushfield House, Orton Centre, Peterborough PE2 0UW.

Details unavailable at press time.

Stand no: 220/242
Texas Instruments Ltd, MS36 Manton Lane, Bedford. Tel: Bedford 3496

Texas will be at the Show for the first time this year, armed with the TI99/4A home computer. The new TI88 programmable calculator will also be on display (for the first time in the UK).

A new peripheral expansion system and speech synthesiser will be demonstrated for the TI99/4A. Visitors will be able to investigate different programming languages as well as other examples of the capabilities of home computers.

Stand no: 342
Thame Systems Ltd, Thame Park Road, Thame, Oxfordshire. Tel: Thame 4561

Details unavailable at press time.

Stand no: 239
Timedata Ltd, 57 Swallowdale, Basildon, Essex SS15 5BZ. Tel: 0268 411125

Timedata will be showing its latest selection of books and software for the ZX81 and Atom, including The Explorers' Guide to the ZX81 and a new publication, Exploring Spectrum Basic. The company's Eurocard RAM boards for Atom and other 6502/65XX based machines will be on display.

Add-ons for Apple are also available from this company and details of all products will be available on the stand.

Stand no: 151
Tomorrow Micro Systems, 2 Bridge Street, Hadleigh, Ipswich, Suffolk. Tel: 0473 823698

East Anglia-based Tomorro Micro Systems will demonstrate complete business systems, utilising M/A-COM OSI Keyfamily microcomputers. Networking and timesharing will be features of these machines.

Software to cover most major business requirements will be 'up and running', including software for security and environmental control. Staff will be on hand to answer questions and discuss problems.

Stand no: 325
Transam Computers Ltd, 59/61 Theobalds Road, London WC1. Tel: 01-405 5240

Details unavailable at press time.

Stand no: 125
John Wiley & Sons Ltd, Baffins Lane, Chichester, West Sussex PO19 1UD. Tel: 0243 784531

Now in its 175th year in publishing, John Wiley will display much of its large selection of computer books and software. Titles cover all levels and aspects of computing.

It is hoped that their first software products for IBM and Apple will be demonstrated and details of a new book by Tim Hartnell on the ZX Spectrum will be forthcoming. Wiley looks forward to meeting dealers, distributors and potential authors.

Stand no: 367
X-Data Ltd, 750/751 Deal Avenue, Slough Trading Estate, Slough, Berks. Tel: 0753 72331

Three new Oki printers will be on this stand for the first time. Two are the latest additions to the Microline series. Both offer high-resolution graphics and NLQ print. No details are yet available on the third printer.

Other recent products to be shown by X-Data are the Kitten and the Sphinx, two mini-winchester disk subsystems. These have host adaptors available for Apple, LSI, Multibus, S100, TRS-80, PET, IBM and others. The Microline 84 136-column printer and the Remex RFD960 mini disk drive which provides storage capacity of 1 Mb per disk will also be there.

Stand no: 302
Ulster Management Centre, Manor House, Rathlin Island, Ballycastle, Co Antrim. Tel: 02657 71220

A range of management and business training software will be on show at this stand, demonstrated on the Apple II. The software is well documented and varies from straightforward self-assessment programs for management evaluation to a sophisticated 'business game generator' and a management trainers' 'Micropak'.

Subjects covered range from finance to interpersonal skills, industrial relations to marketing methods and concepts. Over 20 new packages will be available for perusal with the added bonus that each purchaser during the Show will receive a free entry to the Centre's competition. Non-purchasers can buy a copy of the 'Software Riddle' for £10.

Stand no: 335
VNU Business Publications, 62 Oxford Street, London W1. Tel: 01-636 6890

VNU will feature its microcomputing titles at the Show (now including *Personal Computer World*). There will also be one forthcoming publication, Computer Answers, which will be launched in November and will have leading experts to answer your queries. What Micro?, launched in May, provides a useful Buyers Guide, drawn from a database system. The next issue will be in November. MicroDecision, now well-established in its market, will also be available.

Stand no: 136
Wadsworth Electronic Publishing Company, 10 Davis Drive, Belmont, CA 94002, USA.

WEPCO is a new publishing company which aims to provide up-to-date information for the computer world. Education will be a priority, mainly at a higher and secondary level initially, but expansion outside the classroom is planned, not only into the home but also into business and industry. Computer user publications will also be produced. Prospective authors will be welcome.

Stand no: 101
Westrex Company Ltd, Bilton Fairway Estate, Greenwood, Middlesex UB6 8PW. Tel: 01-578 0957

Westrex will be showing its Pasca 640 Z80 CP/M micro. This comprises a 12in VDU, twin 8in floppy disk drives and serial and parallel I/O ports. A 20 Mb winchester system will be demonstrated working with a Pasca. As a leading distributor for Epson products, the company will be exhibiting the complete range and offering special prices for orders taken at the Show. END

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BT-80	Record Retrieval for PLI-80	125.00
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SID	8080 Symbolic Debugger	47.00
ZSID	Z80 Symbolic Debugger	63.00
DESPOOL	File Print Spooler for CP/M	31.00
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All products are available in 8" SD, SS, Superbrain 5" SS, North Star Horizon QD format except those marked * which are not available in North Star format.

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CRAMMING IT IN

E40 is a new British package which enables you to compress text files on disk to as little as 40 per cent of their original size. Because it's an interesting subject, we asked E40's author, Dennis Andrews, to introduce the subject, while Dick Pountain puts E40 through its paces.

We tend to think of computers as machines for complicated calculations, and when computers were new and expensive their primary function was indeed to compute. Today, the great bulk of computer use is for storage of data or text and the two simplest operations — fetch and store — occupy most of a computer's active life.

To meet this demand, cheap removable media becomes essential: the quantity of data is just too large for fixed disk or memory to hold. Current removable disks are fairly slow, not because they must be but because it is economic. The new bulk requirements of the computer are to view, to print, to transfer, to edit — these are mostly slow operations, and really fast response is not worth paying for.

These two factors provide the soil for a new development to grow: compression codes. It has long been realised that the eight-bits-per-character of ASCII is wasteful and that the English language contains redundancy which would permit a more compact representation of characters. Procedures which do this are called compression codes.

The theory

The principal difficulties in making an effective compression code are the time and space requirements. In theory, compression to 15 per cent is possible (or at least claimed; maybe the limit is nearer 25 per cent with real data files). However, the drawbacks are prohibitive: the existing techniques would need enormous word dictionaries — and an enormous amount of time to scan them — or else they would need to do a statistical analysis of the data before starting to code at all, which is *much* slower but not quite so bulky. By contrast, E40 codes in about the same time as it takes to PIP a file from one place to another, and the coding procedure occupies just 11k. Compression is to around 3.2 bits per character.

This seemingly impossible speed is *because* the file is compressed: the extra processing time is offset by the reduced time for disk I/O. The decode process is actually faster than a straight transfer of the equivalent ASCII file.

There is no net space loss, either. This is obvious for the disk itself but, surprisingly, it is also true of memory space requirement. For example, Wordstar in a typical 60k system administers a 30k buffer. Set aside 11k for E40 and the remaining 19k holds the equivalent of around 47k of ASCII.

Both of these results are relative: if the available buffer space is small, then E40 may intrude; if the media transfer is fast, then processing time does exceed the saved I/O time. However, coding is still rapid: using a winchester, one can compress a typical 300-page novel in about three minutes — a small price for doubling the apparent size of the winchester!

While the basic idea of E40 came in the proverbial flash, the specification emerged only gradually and some significant user features were added after the code itself had been standard for months.

The original aim was a compression of around 3 to 1. This is possible using the techniques of Keele Codes but the process would run slowly and the program would be bulky. The figure of 40 per cent or 2.5 to 1 does not sound very different but its time and space requirements are in a different ball-park. In the other direction, one could have a faster process which compresses to, say, 50 per cent; but that would be a poor bargain, quite apart from its lesser attractiveness. At the present state of the art, disk I/O defines the limiting speed, not the processing. If compression were 50 per cent instead of 40 per cent, then the extra I/O would more than offset the reduced processing time, with a floppy disk system. It gradually became apparent that the optimum compromise lay around 40 per cent and, surprisingly, this was true for both mainframe and micro. The ratio of processing time to I/O time is about the same in each case when removable media are used.

In practice

Having defined compression, one still has to strike a balance between memory requirement and speed. This is a property of the implementation, not of the code itself. The target set — and reached — was that E40 coding should take in all about the same time as a simple transfer. In particular, we had winchester-to-floppy backup in mind in choosing speed. For an all-floppy system, therefore, E40 coding is usually faster than straight transfer.

Robustness was an essential feature of the specification from the start. The compression ratio must present no risk to the user: his data must be as safe in E40 code as in ASCII. The code was therefore made self-correcting, so that noise in the communication line, or damage on the disk, has a localised effect only. E40 recovers almost immediately if the compressed file is deliberately corrupted.

This recovery feature was judged very important; one could achieve better compression if the requirement was relaxed but then no one would risk using the code. This recovery feature is unique to E40. Some compression codes are very vulnerable to errors — for example, with Huffmann codes an error in any bit means that the remainder of the file is unreadable. One can prove mathematically that Huffmann codes offer the best possible compression — but at what a price!

Two other features are incorporated for security:

a) There is a Verify option. (CP/M has no automatic readback verification when writing to disk.) This slows archiving by about 20 per cent.

b) The user may introduce checksums into the codestream, and can select their spacing over wide limits.

The latter feature was designed for noisy communication channels but can be used if desired for extra security in any application. In reality, E40 is as safe or as unsafe as ordinary ASCII and one should take the same precautions with both. Whatever level of backup is selected, it costs half as much using E40.

The current implementations of E40 are not the fastest possible; instead they represent the best compromise between space and speed for current hardware. It seems likely that in the future memory will become cheaper and media will run faster. If so, we can speed E40 by a factor of two just by writing a greedier implementation — which means that E40 can keep up with hardware developments and the code can remain standard in the long term while retaining its costless character.

All files compressed by E40 have a 32-byte leader. This idea developed from the perception that compression would be as important in communications as for static storage of files. The leader contains all the vital statistics of the compressed file and allows it to be treated as a message, with no other protocol required. The leader defines the code, the filename, the size, the size when expanded, the checksum and other options which affect coding. (Options such as Verify, which do not affect the form of coding, do not appear in the leader.)

This idea developed gradually, though the bare notion of E40 as a message format came at an early stage.

Portability

An E40 message is universal and it is independent of hardware/instruction set/operating system. Any two machines equipped with E40 can communicate. The package offered for CP/M includes a communication utility called XKC, which transmits or receives files through a serial port. CP/M communication devices do not transmit 8-bit data words and will not receive nulls. Therefore, XKC converts the file to a 7-bit format without nulls. The net time saving is a little better than two-to-one over direct ASCII transmission.

Some operating systems will be able to transmit E40 compressed files direct without this conversion, achieving 40 per cent of transmission time instead of 46 per cent. These systems do not strictly need XKC but it will be offered anyway, as many operating systems lack

CRAMMING IT IN

a built-in computer/computer transfer utility.

Although XKC is profiled to CP/M, the E40 message which it carries is not. The code is guaranteed invariant, and is not shackled to any hardware, software or operating system. It is linked only to the English language and to ASCII (or an equivalent 8-bit character set). The code is also fully developed and is based on very extensive numerical research. We do not have plans for E38 or whatever, and are reasonably sure that no one else will better it by a fraction that is worth having. We know the drawbacks of each adjustment and have rejected far more than were finally incorporated.

This policy of invariance must be allied with a readiness to accommodate current practices; therefore E40 offers some tailored extensions, of which XKC is one example. Another variable is the end-of-file character — present in some operating systems but not in others. Therefore E40 excludes the end-of-file character from the message and the decode program EKC adds it back. Consequently, if a file is transmitted between systems it is correctly terminated in each host. (Nevertheless, the user does have an option to treat the end-of-file character as data. This is another tailored extension, largely to accommodate dBase II files; these sometimes include the CP/M end-of-file character CTRL-Z.)

E40 also has parameters which are geared to Wordstar. Most word processing systems use a 127-character set but Wordstar uses the eighth bit to distinguish fixed and reassignable formatting. We wondered whether to treat 'soft space' and 'soft return' as special characters but decided not to, because that would link E40 to one microcomputer product. Instead, the user has an option: code all 256 characters, or strip the eighth bit and fix the format. The latter gives much better compression. However, the second choice is not irreversible: there is a decoding option RESOFT which puts back the 'soft' spaces and returns.

This seems a long way round — but it achieves the intended aim: the compressed E40 file is completely standard and has optimal compression. One can pass it to another system which would baulk at Wordstar's character set; equally, one can receive a file written on another system and edit it using Wordstar, using all of Wordstar's formatting facilities. If one works exclusively with Wordstar, then both options can be preset in the program image. (All E40 options can be set as command parameters or in the program image, whichever the user prefers.)

Other extensions of E40 will be in the software interface, so that, for example, word processing software can read and write E40 files directly. Obviously, this can be achieved in short order by an overlay/chaining procedure, but it would be more efficient to build a software interface which is active throughout the word processing.

Compression utilities save money in the obvious way that disks take longer to fill up, or phone bills are halved. The less obvious savings are just as important.

Even experienced computer users find that disks can become very muddled and contain a mixture of finished and unfinished work, work of different kinds, and backup copies. This applies as much to winchesters as to floppy disks — perhaps even more so.

E40 offers a way to avoid this. The basic principle is to distinguish two roles for a disk: work-disks and completed work. Let us call these disks TEM and FIN. Work disks TEM are temporary and each relates to one enterprise or class of work. Completed work is copied onto FIN disks, using E40 instead of PIP. The completed work is thereby distinct in form as well as taking less space. FIN disks are classified, too, to form a compact library. Backup copies would be made anyway, so nothing is lost, but space is saved and the whole operation becomes methodical without any special effort.

Each TEM disk contains .TXT and .BAK copies of every file, which is the ideal arrangement when first editing a document. But FIN disks do not need to contain the last-version-but-one. In effect, then, FIN disks contain about five times as much material as the equivalent TEM disks; or the product of a working week rather than a working day.

Another saving occurs when the TEM disk becomes full. If one does not distinguish TEM and FIN, then DISK FULL usually results in the last file being copied to a new disk to continue work. There is considerable wastage on the first disk. Worse yet, the wasted space may be filled out of sequence because one can find no other disk handy. That work is as good as lost if it is set aside for any length of time.

These things do not happen when TEM and FIN are distinct. When TEM becomes full, the *earliest* work on it is transferred to its own FIN — if it is not already done — and is then deleted from TEM. Thus TEM is continually reassigned, and the current work is never taken out of it.

This work method requires two other classes of disk: system and archive. The latter is a straight copy of the FIN disk, made with suitable frequency; this provides far better security than two copies on one disk. Disks can be damaged, have corrupted directories, or just get lost. The system disk(s) contain editors, assemblers and the basic utilities.

In addition, TEM disks contain KC, and FIN disks contain EKC (and PIP for loading archive). That way, only one disk change is required at any stage of updating.

The four uses do not necessarily require four physical disks. With a winchester, all but archive can reside in it, and some floppy disks are large enough to contain both system and TEM files.

Are there any snags? Are the files less accessible? On the contrary, EKC can throw a file on the screen quicker than TYPE can do (though it takes 19.2 kbaud to demonstrate the benefit). Files can be transferred to new disks or via a line in less than half the time. E40 files peculiarities of British patent law may cause the application to be withdrawn. American patent law is different in two respects: (a) precedents exist for patenting computer programs; and (b) there is no publication of unsuccessful patents, ie, those judged 'obvious' in the legal sense. In British patent law, no one has yet established that the hurdle of 'not obvious' can be crossed at all by any computer program, however subtle. Further, all UK patents are published *before* they are examined. That means

```
stat huge.txt

 Recs  Bytes  Ext Acc
  128    16k    1 R/W A:HUGE.TXT
Bytes Remaining On A: 134k

A>kc

Encode KCE40
07-Jan-82  Copyright 1982 (C) Keele Codes Ltd. Licence No.SH001008

*=huge.txt

FILE COMPRESSED

*

stat huge.*

 Recs  Bytes  Ext Acc
   57     8k    1 R/W A:HUGE.E40
  128    16k    1 R/W A:HUGE.TXT
Bytes Remaining On A: 126k

A>ekc

Decode KCE40
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*=huge

KCE40   HUGE.TXT          8k        16k       0000

Filename exists: Overwrite ? y

FILE EXPANDED
```

Fig 1

CHECKOUT

Dick Pountain reports on E40 in use.

I checked out the E40 compression utility on the Sharp MZ80B under CP/M 2.2 without any communications hardware; I couldn't check the operation of XKC as a result. The version I tested was the original release which lacked the RESOFT option for expanding Wordstar files; this is included in all current releases of the software.

The package consisted of three CP/M COM files called KC, EKC and XKC. The first of these compresses files, the second expands them again; XKC is for serial communications with other machines.

Keele Codes has very cleverly designed the syntax of KC and EKC to be similar to that of PIP so that experienced CP/M users will have no trouble in adapting to its use. To compress a file HUGE.TXT you merely type 'KC', which loads the program and gives a sign-on message and the '*' prompt, as for PIP. Then 'B:SQUASH=A:HUGE.TXT' will compress the file into a file called SQUASH.E40 on drive B. The file type E40 is assigned automatically by the program. The shortest form allowed is '*=HUGE.TXT' which compresses into a file with the default name HUGE.E40 on the currently logged drive. A message FILE COMPRESSED signals successful completion.

To expand a file, type EKC, which loads the program and produces the '*' prompt. When you name the file for expansion a line of parameters is displayed which includes the original and final names and sizes and any options set. This line ends with the prompt GO? to which only the answer 'Y' will initiate expansion; any other answer returns the * prompt. FILE EXPANDED signifies success. Again the shortest form of the command is '*=SQUASH' which assumes the file extension E40 on the current drive and expands the file under its original name which is always saved in the header of the compressed file. Since this may involve overwriting the original version of HUGE.TXT, EKC asks you if you wish this to happen and gives you a chance to change the file name. Figure 1 shows the printout from one of the test sessions using KC followed by EKC.

Since KC and EKC are 10 and 12k long (ie, 22k total), it is feasible on a machine like the Sharp with 340k per drive to have them resident on all your work disks (I already do this with CP/M system, PIP, STAT and BACKUP).

The programs come with an 18-page manual which explains their use clearly and concisely for the experienced CP/M programmer. The less technical user will only require the one page summary of syntax in order to use KC and EKC.

So how well does it work? I tried it out on a 16k ASCII file generated with a text editor and achieved a reduction to 44.5 percent, a little short of the theoretical minimum. Transferring this file to another drive using PIP took 14 seconds. Using KC the transfer took 17 seconds and using EKC took 9 seconds. So decoding a compressed file onto another drive is significantly faster than using PIP while compressing is slightly slower.

I next tried E40 on a Lisp source file of 12k and here only achieved a reduction to 66 per cent, in line with what Keele Codes claims for program text (the reduction is less because program code is not plain English and contains a high percentage of unusual words).

Various other flavours of ASCII file produced compressions between 42 and 60 per cent, with the average being around 44 per cent for English text (most of it technical with a high unusual word count).

Using E40 on a Wordstar text file initially *increased* its size slightly; this is because I didn't use the [z] option which strips off the eighth bit for its 'soft' carriage returns which results in very inefficient coding by E40 as these constitute 'abnormal' characters. Running E40 again with [z] appended to the command produced a reduction to 45 per cent. Expanding this file restores the original text exactly but certain Wordstar options for re-editing, such as changing the margin width or reformatting, are lost. The current release of E40 has RESOFT, an optional parameter [r] to the EKC command, which restores the parity bit in appropriate places when expanding the file and so retains all of Wordstar's features.

I was unfortunately unable to get hold of a database file to try E40 on; with some DBM systems these contain much wasted spaced and so really large compressions to below 40 per cent are said to be achievable.

In summary, E40 did all it was claimed to do on the material I tried it on; it is no harder to use than PIP and can be used as a regular CP/M utility. It can provide a useful increase in disk space (Osborne and Apple owners would benefit substantially) as well as saving time when archiving large numbers of files. It is not really worth using it on program source but on text files it performed well and in line with its author's claims.

For further details contact Keele Codes on (0742) 686040.

that you may not only fail to protect your idea but it becomes public can also be decoded direct to the printer.

The only delayed access is when another program needs the original ASCII — eg, when a word processor is used to print a file which is no longer in TEM. Then one must run EKC first, at the cost of a few seconds. This event is rare in practice: most printing is done at an early stage in the file's life. Similarly, it is rare to re-open editing of a file that has left TEM.

The benefits are frequent, however: the operations which are speeded by E40 are the common ones, transfer and viewing. One must put in this pan too the savings made in general housekeeping. When E40 is used routinely, files are more easily located, there are fewer false moves and there are fewer transfers needed to keep the system up to date. Best of all, you do not have that drawer full of old disks saved in case they contain the only copy of something!

Database back-up

Compression can be as great as 5:1 with database files, mainly because they contain reserved but unfilled space. (Where this is not the case, compression of a database is much like any other text.)

The use of E40 doubles the maximum size of the database which can be backed up from winchester to floppy. It postpones the day — which comes all too soon — when segmentation becomes necessary for backup. When a database has reached this size, there is a temptation to risk fewer backups because it has become tedious. One may even have no room on the source disk for the segments.

Secrecy and patents

I must disappoint your curiosity as to how E40 works. Keele Codes Ltd has maybe a nine-month lead in which to establish E40 as a standard. By all means compare input and output and try to figure it out — but we won't help you!

The basic ideas of E40 are the subject of a patent application — but the peculiarities of British patent law may cause the application to be withdrawn. American patent law is different in two respects: a) precedents exist for patenting computer programs; and b) there is no publication of unsuccessful patents, ie, those judged 'obvious' in the legal sense. Under British patent law, no one has yet established that the hurdle of 'not obvious' can be crossed at all by any computer program, however subtle. Further, all UK patents are published *before* they are examined. That means you may not only fail to protect your idea but it becomes public property instead, which seems unfair. Copyright remains, of course, and the code E40 is protected by copyright — not just the particular way of executing it.

The company Keele Codes Ltd is legally quite independent of the university. However, there are close links: all the members of the company are also members of the university and the company pays the university for the goods and services it uses. This symbiosis works very well. The university gains money at an opportune time, and can sell offpeak computer time to a convenient customer. (All really heavy computing is reserved for the summer.)

It is an interesting thought that 10 years ago E40 would almost certainly have become a scientific paper rather than a commercial product. . .

END

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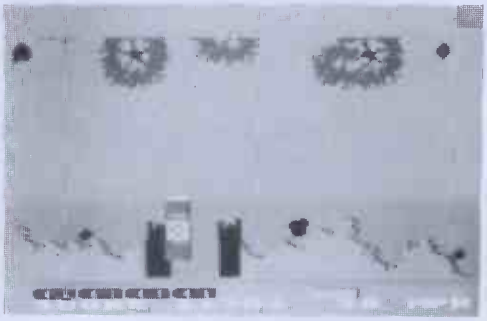

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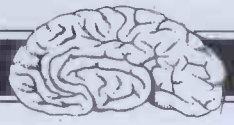

BRAIN DUMP

Peter Rodwell reports from somewhere in the centre of a jumble of computers, cables, disks, printers. . .

COMPUTER CORNUCOPIA

Yes, it's arrived! I'm talking, of course, about my Sinclair Spectrum, which, regular 'Dump readers may recall, had yet to be delivered when I last filled this column with my ramblings.

Well, I'm now the possessor of a 48k Spectrum -- and jolly good fun it is, too, although lack of time has prevented me from spending the obligatory long nights 'exploring the system envelope'. Two things struck me immediately on trying the machine out for the first time: it makes a funny and slightly irritating buzzing sound, and it's necessary to tune the TV set very carefully to get a good colour picture. This latter problem may be due to the fact that (without wishing to boast) I have a remote control TV with tiny pre-set tuning knobs which take a lot of adjustment even with TV stations.

Lack of time has also prevented my building a port through which to transfer my WP program from the Cromemco. What has been taking up my time has been a Sirius 1, one of which has also infiltrated the Rodwell flat which, with these and the occasional Benchtest machine, now has the look of a crazed terminal junkie's hideaway. I've wanted a Sirius ever since I Benchtested it at the end of last year.

Fascinating though the Sirius is, though, it has to earn its keep and I have been pounding away to transfer a suite of programs I wrote for the Cromemco to handle payments for the magazine's contributors. The change of ownership of *PCW* means the old program needs large alterations anyway and I'm now struggling to convert both program and self from Cromemco's nice but idiosyncratic Basic to standard Microsoft Basic under MS-DOS.

The Cromemco looks a little forlorn next to Chuck Peddle's technowonder, but there's plenty of life left in it. For a start it's going to become a rather expensive but reasonably intelligent printer buffer, taking output from the Sirius and printing it or storing it on disk for later printing if it's in the middle of a job when I send more stuff to it.

At this point I'd like to thank the small group of people who contacted me about my RUN command for the Cromemco. This involved a patch to the operating system to restart a program in memory without reloading it from disk. The REM command, several of you pointed out, is used as a remark in batch command files, so my patch would have caused havoc were I in the habit of using such things, which I'm not. This, apparently, is documented in later CDOS manuals which I don't have. Okay, CDOS freaks, try this: the intrinsic commands lookup table contains two entries for the Attributes command, one spelt ATRIB, the other ATTRIB. Is there any reason why I shouldn't use one of these for RUN instead of REM?

Having both an 8-bit and a 16-bit machine at my fingertips also gives me a chance to play with XLT-86, the Digital Research utility which translates 8080 source code into 8086 source code. From a preliminary look at it, it seems quite interesting, although there's still quite a bit of manual work to be done to the resulting code before you have a working CP/M-86 CMD file. Of particular importance, naturally, is the question of how efficient the resulting translation is compared to a program written directly in 8086 code, taking full advantage of the '86's power. I'll keep you posted.

END

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BENCHTEST SOFTWARE

AQUILA

Kathy Lang continues her database evaluation series

Aquila is an information retrieval system intended primarily for applications which involve a mixture of keyword information and running text,such as bibliographic records. It uses a clear menu-driven approach which takes the user through the various options available at each stage of processing. The system, which is distributed in this country by the originators, Kent Barlow Associates, was prompted by the need to provide the ability to process on micros the kind of bibliographic database often found on large computers and hence has the ability to import subsets of some of these, such as BIOSIS, the data base of books and papers on biological subjects.

Aquila uses one file for each set of data, and no connection is possible between files. The overall structure of each record within a file is fixed and must be defined in advance, but lengths of fields within records need not be specified, as records are packed to take exactly the amount of storage the actual data requires. Retrieval is on the basis of searches which can request matching of predefined keyword fields or of words within running test. Searches can be saved for subsequent re-use.

Aquila has two types of field — predefined fields, which are of the conventional keyword type, named and consisting of a single item, and undefined fields, which are simply free text. A record may contain up to 20 predefined fields, in addition to a field which every record must have — the 'accession number', which is used to ease the retrieval of particular records for amendment. Predefined fields may be up to 38 characters long, undefined fields up to 255 characters, and the total size of the record must not exceed 472 characters. Total file size carries the usual CP/M restrictions — one disk for floppy disk systems, eight megabytes on hard disk systems.

All data is assumed to be textual — there is no provision for calculation or for testing data against a range of values, nor for special treatment of dates, though there is a limited 'wild card' facility.

Once the structure of a file is specified it cannot be changed, and there are no facilities for reading from external files other than those in the special formats for which a preprocessor is available.

Input and updating

Data input and updating in Aquila is entirely screen-based. Display of records is in a standard format which the user cannot change, and simply displays in order the names of the fields specified by the user when the record structure is set up. This set-up process is carried out when the database is created. It involves giving, for each predefined keyword field, a full name and an abbreviated name of two letters; no length need be specified, as Aquila stores in each field the exact information it needs to hold with no padding characters.

Once the number and names of the predefined keyword fields have been defined you can then put data into the files. Each record is given a record number (sequentially allocated) by Aquila, and must also be given an 'accession number' by the user. Aquila then displays on the screen the name of each keyword name in turn; when all have been input, you then get the opportunity to put in free field text. Finally, the record is displayed to give you the chance to make any necessary changes.

For record amendment, the individual record is accessed by record number. To save you keeping a separate list or printing out the whole data file, Aquila allows you to print out a list showing the correspondence between the record number and the accession number. Once retrieved, you must go through the record in order, either accepting the current value of each field or replacing it completely — you can't edit a field, nor can you jump directly to the field you want to change, though you can finish the amendment as soon as you've completed your changes. Aquila then displays the amended record; you can either accept it or else have the record restored to its original state and start the amendment again.

Once you have finished putting data in or amending, you must instruct Aquila to create a search file (an inverted form of the file to permit searching on selected criteria — rather like creating a set of indexes). This is a lengthy process for a file of any size, and the manual recommends doing this in a slack period or overnight.

Displaying data

Records are always displayed completely, with one record on the screen at a time — you can't choose to display only certain fields. Access is either by record number (as in the amendment process) or by position in the retrieval sequence. For instance, if a search (see below) finds ten records, you can display them all, the first five, or just one of them.

Printing data

Records are printed in the same format as the screen display, and there are no facilities within the main part of Aquila for user-defined print formats. There is, however, an optional text processor which can be accessed from the main menu, which will format data written out as part of the selection process onto a disk file.

Selection

The selection facilities in Aquila are extremely powerful, and form the main core of the package. When a file of data is formed, Aquila is then asked to create a search file. During this process, the data is stored in such a way that every predefined keyword field is indexed, and also every word in underfined fields apart from those included in the STOP file. A standard STOP file, containing words like 'in', 'on' and 'to', is provided with the package, but you can create STOP files of your own for particular applications. Once this search file has been created, you can then select records according to desired criteria.

There are two elements in the search process. Any predefined field, or word in an undefined field, may be part of a term set. For instance, you can use the command FIND to search for all records in which the 'supplier' field is 'British Rail', and this selection then becomes the first Term Set. If you then require further selection, say to extract all the records referring to 'engines' sold by British Rail, you would then FIND a second set of records with 'engine' as the product and produce a search set by using FIND to combine the two Terms Sets with AND, to give all those records which had British Rail in the Supplier field and engines in the Product field.

The set of commands to do this, and Aquila's responses, are shown in Figure 1, where the /? is a prompt; the material

```
/? FIND SU=BRITISH RAIL
T1    15 KW=SV=BRITISH RAIL
S1    15 T1 — T1/OR/
/? FIND PR=ENGINE
T2    35 KW=PR=BRITISH RAIL
S2    35 T2 — T2/OR/
/? FIND S1/AND/S2
S3    12 S1/AND/S2
```

Fig 1 — Search sequence

Kent Barlow Information Associates
(AQUILA)

Create/Update?Amend Database Which function? N

Enter N to create a new data base
Enter O to update/amend an existing database

Create new database

Enter database name? INMAIL

How many predefined keywords do you want? 4

Enter prompt for keyword 1? DATE OF RECEIPT

Enter code for this keyword? DR

Fig 2 Menu

remaining on those lines is typed by the user and the other lines by Aquila.

Term sets can be produced either by matching keywords (or words in an undefined field) exactly, or by a limited form of 'wild card' used at the end of the item to be matched. For instance, PART* will match PARTY, PARTITION, PARTNER, etc. When the 'wild card' asterisk is used, Aquila gives a separate term set number to each exact match, so it's easy to rule out the ones you don't need. Search sets combine term sets with AND, OR and NOT. Up to 2000 Term and Search sets could be used together in a single search in my version of Aquila. Once you have the desired selection (and Aquila will tell you how many records your search has revealed), you can display the records on the screen, print them or write them to a disk file. You can also save the search itself, for subsequent re-use.

Tailoring and adaption

Aquila has limited services for adapting the software to particular requirements. The package can be adapted quite easily to a variety of terminals. When creating a search file, Aquila uses a stop file of words which are not to be indexed, and this file can be edited by the user. But there are no facilities for optional indexing interactively — you have to decide in advance which words you don't want indexing.

Data for Aquila searches can be written out to subfiles, for subsequent processing by other programs. But Aquila can only read files created by itself or by preprocessors written specially to pack the data into its internal format. These preprocessors permit interfacing with several standard databases, and this is one of the main inspirations for Aquila, enabling libraries, educational institutions and researchers to acquire subsets of these sets of data for processing on their own micros.

User image

The software is another example of the curate's egg syndrome. The menu system is straightforward and comprehensive: the menu for creating a new file of data is shown in Figure 2 as an example.

Thereafter the program leads the user through the options available at each stage, in a way which should permit a novice to use the package without much trouble and largely without help from the manual. The only exception is in the search terminology, which I found rather confusing, but which one could easily get used to. The less desirable aspects of the user image include the restriction of using only the record number for access to individual records, and the use of two-character abbreviations for variable names in searches. The use of symbols, rather than a name or prompt, to request input of free text fields is also rather confusing.

The documentation is straightforward and easy to use, though for most purposes, other than the formation of searches, you wouldn't really need it. I did find one real howler, though — the user is advised, if he gets in a real muddle, to press the reset button (at the cost, on most systems, of losing all his current work at best) and this is in the opening section when being given advice on how to use the backspace key, and without any warning of the dangers. However, this was an exception in an otherwise well-written manual.

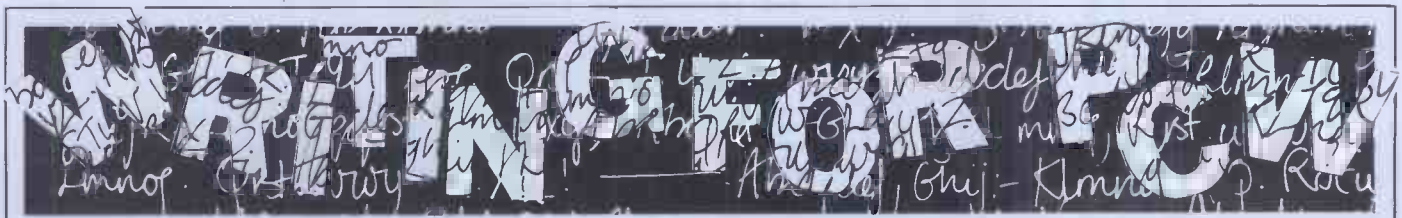
Costs

Aquila costs £310 for the software, with extra charges for interfaces to other databases. Some telephone support is available from Kent Barlow, included in the price, and I found them very helpful with my queries.

Conclusions

Aquila is clearly aimed at a particular section of the market for data management systems — those which have a mixture of fixed fields and free text, and in particular the bibliographic area, in which there are a number of very large databases which are used by many people in schools, higher education and research, as well as in some commercial areas. The facilities for creating, updating and searching should be quite adequate for such applications, and in particular the ability to create a complete word index to free text with the use of a 'stop' list is as far as I know provided only by Aquila. It is a pity, though, that this is done by creating a complete new search file every time the data is changed on a batch basis, which could be too inflexible and time-wasting in some applications.

More serious drawbacks for bibliographic applications could be the limitation to 472 characters per record and the absence of sorting facilities. If these limitations don't affect your application, then in this rather specialist area Aquila would be well worth considering.



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 lookout 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.

BENCHTEST SOFTWARE

SELECTED WORDS

Jane Bird casts an eagle eye over an easy-to-use CP/M word processing package

There is much talk in the computer fraternity about the next generation, the so-called 'fifth generation'. These machines will have pre-programmed intelligence so that they can give the end user the illusion that he is interacting with a thinking being.

Fifth-generation computers will eliminate such mundane tasks as writing programs for anyone but systems designers who will be cloistered away somewhere out of view. Instead, the end user will be able to talk to the machine, explain his problem in an elementary version of his native language and get an intelligible response. The first machines providing natural language interaction will come on micros for specialist subjects like engineering field maintenance and these are expected to arrive within the next two years.

Apart from engineering, an obvious use for such systems is in the office, where people are accustomed to dealing with text all the time. And in office automation so far we have seen systems which are only a fraction along the way to being user-friendly to the extent of understanding natural language. We can and should expect far more intelligible systems because they are perfectly within the realms of current software capability.

However, the Select word-processing package from Bonsai is notable for its user-friendliness and does go some way towards apparently understanding what the user is doing. This is probably unnecessary for the dedicated personal computer user but it will be very comforting to the non-initiated who want to use a word-processor. In fact, Select is characterised by up-front user-friendliness rather than by exciting and powerful text manipulation. But it certainly provides the fundamentals. While easy to use, it is likely to be slow. Certainly when it is used on the NEC PC8000 provided for this Benchtest I found myself waiting 20 seconds for the next frame. If you have not used a personal computer before, you may not mind the wait too much — but if you're an old hand it's very frustrating.

So Select concentrates on being user-friendly, and the first example of this is in the special Teach package. Teach takes the user step by step through the process of editing with Select and includes lots of little exercises and tests. Select certainly does make claims to be exactly the kind of 'intelligent' system described above. 'Welcome to word-processing. Now a computer has finally learned to think the way you do,' says Teach.

In theory you can do the whole thing in 90 minutes — but unless you're feeling really on the ball, I wouldn't recommend it. Spread over two sessions, the 26 lessons are manageable, although I felt the need to go back to the beginning again to check how to start.

Starting to use Select

This can be tricky, because Select is designed to run on any CP/M machine. The widespread support for this operating system means that you may be using one of an enormous number of different micros. So the first thing to do is to check that you know how to make the best use of your particular hardware. For example, the PC8000 has only two keys for controlling the direction of the cursor. This means you have to use the shift key for two of the four required directions, and of course there is no diagonal to go straight to the top or the bottom of the screen. However, the PC8000 has five function keys at top of the keyboard which Select uses for moving the cursor left, right and down, as well as for tabbing and setting the shift lock. In normal lower case you can use one of the original cursor directions for cursing up.

While still on the subject of hardware, I should mention that this can be the root of a lot of the problems with speed. Other micros can presumably perform faster, although a Select salesman told me that it really doesn't make much difference if you use a 16-bit as opposed to an 8-bit (the PC8000) machine. So if you're actually buying a machine specifically to run Select for word-processing, then take a good look at response times first.

When loading Select, other minor machine-dependent problems can arise. On the PC8000 disk drives are identified by numbers whereas Select gives them letters, but if you're doing word-processing you probably know your alphabet well enough to solve that problem! Select also asks you to do your immediate erasing by using the backspace key but my keyboard had no such key; it required you to cursor left instead.

So the major hurdle you first have to to clear is that of customising Select. The Select manual gives simple instructions on how to do this, assuming that you have used a hardware manual to fit your system together and format your disks.

Select is organised in two parts: the system funtions and the editing facility. The same command keys perform either system or editing functions, according to which mode you are in. This can cause some confusion at first. Whereas Q is for Quit in both modes, E is for Edit in the systems commands but stands for erase when editing. This latter function is performed by D for Delete in the system commands, but D stands for Display in the editing commands.

Whenever you call up Select, the main menu appears on the screen. This lists all the different things you can do with Select. 'The best way to learn Select is to *put the manual down now!* Type "T for Teach", suggest the manual. So here's what happens when you do.

Learning with Teach

The whole idea of Teach is to enable an absolute moron to use Select. The trouble is that you do feel rather conscious of being treated like a moron. What happens is that Teach sets up a series of exercises and tells you if you got them right or wrong. It openly acknowledges its own limitations. ('I'm afraid I'm not clever enough to tell you what you got wrong'), but it does see fit to offer (facile) comments of congratulations or sympathy according to how brilliantly or appallingly you're performing.

Your first hint of this come after the very first lesson, which tells you how to use the cursor. It can't actually work out whether you experimented with the cursor or not, but it still bounces back with the message 'CONGRATULATIONS, YOU'RE MOVING THE CURSOR AND RARING TO GO'.

Assuming you keep going, you are treated throughout to such warm encouragements as 'YOU'RE HOT', and 'WOW! AM I IMPRESSED', and 'MY! MY! YOU DO SEEM TO BE GETTING THE HANG OF IT. NOW TRY ON YOUR OWN.'

There was only one point at which I really did get angry and that was when male chauvinism started creeping in. During the lesson on GO TO, the package invites you to try it out with 'BET YOU CAN'T WAIT TO GIVE 'ER A GO!"

Teach certainly is very helpful in familiarising you with Select and how it works. Of course, it depends whether you're the type who likes reading manuals or whether you don't start learning until you get your hands on the machine. You can get hands on straight away with Teach and even though this is bound to lead to mistakes, the same system seems resilient enough to cope with most errors and get you back where you started from.

However, we did have some bugs in our Teach package, and the most irritating one appeared on the Move lesson. Every time I followed the instructions on this lesson, I invoked the message JFILE ERROR, PRESS ANY KEY and, upon pressing the key, I lost Teach completely and found myself back at the Select main menu. So I never got to practise Move interactively. Other bugs were less spectacular. One which lists all the functions you can perfom with Select kept coming up with garbage across the top line.

Teach screens are well set out, so that, although it is rather irksome to spend a long time reading the green phosphorescence, that task is made as easy as possible. You first get a screen defining the task for that particular lesson, then you get an exercise screen which gives instructions in the top section and the text to work on in the bottom half. If that goes okay, then you are invited to do the test again, this time without the instructions visible on the screen. At the end of any lesson you can either go back over what you just did, continue with the next lesson (it doesn't have the gall to stop you continuing if you got the last lesson wrong), or quit the session. But you cannot exit in the middle of a lesson — which is tedious if all you want to do is quickly refer back.

And that brings me on to what is probably the most frustrating aspect of Teach: the slowness of getting from one screen to the next. Several that I timed took over 20 seconds, and no matter how exciting you may find your new computer it doesn't take you long to get impatient with that kind of response time.

Before I leave the subject of Teach, I must mention that it is by no means a comprehensive explanation of the system; it is for instruction in editing, not system facilities such as Merge and Spell.

Editing facilities

To enter text, you have to be in Insert mode but in order to make any changes you have to exit from Insert and call up the appropriate editing function for what you want to do.

Without doubt the single most frustrating thing in the whole of Select is the fact that every time you press backspace in normal insert mode you delete what you go back over. To change 'debate' to 'rebate' you either have to backspace all the way and retype the whole thing, or you have to change from Insert mode to Xchange mode, go back and change the character, and then move back into Insert mode before continuing to enter text. This seems an extraordinarily and unnecessary procedure for the most minor of alterations.

Similarly, should you wish to do something as basic as changing a five letter word for a six letter word then you must first go into Xchange mode for the first five characters and then you have to finish Xchange and move into Erase mode to get rid of the last one. Finally, you have to get back into Insert mode in order to carry on entering text.

A small problem with continually entering and deleting text occurs if you are habitual enough to always put two spaces after a full stop. The package is not clever enough to get rid of these spaces if they are wrapped around to the beginning of the next line so you can get lines curiously indented a mysterious one or two spaces.

Another minor irritation is that you cannot open a document to edit it straight at a specified page; you have to go through the interim stage of getting to the first page and making use of the editing command GO TO to select the desired page number. However, one very useful facility if you're not quite sure what page you want is Display, which throws up the next screen immediately.

A problem I encountered in getting to know the system concerned when to use the Escape, and when the Return key. The manual defines the difference between them as being that Return is to tell the system that you have finished adding information to a command. Escape, on the other hand, is to end a command, allowing you to select the next command from the menu which is permanently displayed on the top line of the screen. You can also press Escape when you want to abort a command. So Escape both enters and

The NEC (courtesy of Bonsai Computers) has a full typewriter-style keyboard.

Photography by Kokon Chung

SELECT

aborts. Feeling confused? If you are switching between different functions, such as creating a document, editing it, and then continuing to insert new text, you have to use the Escape key a surprising number of times. Escape also executes the Erase function and Return is used for making a forced end of line while in Insert mode.

The design principle behind it is apparently that it gets rid of the need for special format and control keys, but I find it makes life at least as confusing as using the traditional control keys. All the WP user needs is to be able to see his text on the screen and have it updated as he goes along, and he doesn't need or want to be bothered with special entry modes.

It becomes apparent as you continue to use Teach that the letters of the alphabet do not perfectly align themselves to correspond to possible functions of word-processing. It is all very well to call setting up a new document Create and give it the mnemonic C, as with D for Display or E for Erase. But when it gets to Print you realise that you've already used up P for Pointer. So the command for printing (unformatted) text from the screen is O for Output. (The Select main menu command for printing formatted text is Print, however, as one would expect.)

X for Exchange is the convenient function you invoke for overtyping. V for Verify is a handy feature which brings back a screen you have inadvertently caused to go blank. It redisplays your current screen so that you can check all the changes have been made as you intended.

Locate is a search command and will find any character, word or phrase in your document. L also has the anomaly that if the string you are looking for contains a forced end of line then you have to put it in quotation marks.

Move is the highly useful facility — the keystone is WP in fact — which enables you to transport a whole block of text from one part of your document to another.

Then there seems to be an unnecessary number of commands to do really quite similar things. For deletion there are both Erase and Zap commands. Erase works differently from most editing commands in that you move the cursor to the relevant position in the text, press E, then move the cursor to one space after the bit you want scrapped. Once the area is properly defined you press Escape. This has the strong disadvantage that you can't press Escape to abort the command if you decide you don't want to erase that portion of text after all, because this is how you actually perform the deletion. Instead, you have to 'curse' all the way back until there is no longer any area of text marked out for erasure. Erase has two further properties. E followed by a space kills a word, and E followed by a full stop kills a sentence.

Zapping, on the other hand, deletes a block of text which has been identified by setting pointers at beginning and end. I fail to see why this facility has to have a separate name as it could just as well be carried out by using Erase plus Pointers. It seems to be the result of a desire to fill out the Select ABC and indulge the juvenile thrill of using this piece of comic-strip lingo.

Another unnecessary duplication is that there are three different commands for copying text that you have already created: Copy, Write, and Append. The first two involve the use of pointers. These are set to the beginning and end of the section you wish to copy. The new location for the section of text is identified by positioning the cursor. The copy facility doesn't destroy the text in its original location and it could be useful if you are compiling a document which quotes the same piece of text several times. (On the other hand, if you simply had a rather long, unwieldy name you had to keep using then it would be easier to mark it with a unique string such as XYZ and then use the global search and replace string facility, Replace.)

Write is designed to create a new document which consists of a block of text taken from your current document.

Append simply replicates a complete document. Somehow, I always end up thinking of legal secretaries and turgid conveyancing documents when I come across these facilities, and I really do think one copying function should provide all that most users will want. Considering Select's lack of facilities, such as the creation of special characters, or simple adddition of columns of figures, or even the lack of ability to draw a vertical line on the screen for forms, the plethora of copying facilities seems excessive.

Formatting

To start designing your document formats, you must turn to the manuals, as Teach explains only editing procedures. The easiest to remember are those which are displayed constantly at the top of the screen when you are in Insert mode. They relate to producing characters in bold face, underlined, subscripted or superscripted. Again, these commands are keyboard-dependent and if you have an Apple, for instance, you may have to set up special control characters to do them. But with the PC8000 it is simple — just a case of remembering to put the appropriate character at the end of the section as well as the beginning so that you don't end up underlining pages of your document. The characters are '—' for underline, ' ' for bold, '[' for subscript and ']' for superscript.

Once you have chosen a suitable format for your characters, you will want to determine print formats to decide page layout. Select is quite versatile in this respect; the chief drawback being that the justification facility is rather limited. You cannot opt for justification by spaces between characters or punctuation marks, but only by the spaces between words. This can yield overlarge spaces when particularly long words are used.

There is no special facility for altering the pitch to give gradations of text of different density. But you can choose either six or eight vertical lines to the inch.

One great help when designing page layouts is a section in the manual which gives examples. It is a quick and easy reference to what you can do, and it was the way I found out that you can only have enforced spaces between the left hand margin and the first character if you use left, and not right, justification. (You need to know this in setting up headers.)

There are two ways you deal with formatting — either on the special format page that goes with every document, or actually on the text as you enter it, in which case you use the left hand margin. The latter is used mainly for altering formats as you go along so that a quotation, for instance, can be indented, single spaced and right justified where the bulk of the text is blocked, double-spaced and has a ragged right edge.

You can set up 'headers' for recurrent text at the top of your pages, and 'footers' at the bottom for, say, pagination. The system will do the actual numbering for you and you can leave introductory pages free at the beginning of a document.

Pagination, however, does become rather labour-intensive with Select because there is no clear line across the screen showing where the ends of your pages come. This means that you will constantly find paragraphs spreading themselves over page boundaries, and the only way to fix this is to go through the document and define forced ends manually. An if you want to insert pages or other large amounts of text then you will have to review all your subsequent page boundaries again.

Merge and Spell

Select includes two valuable document preparation facilities, Merge and Spell. Spell is a proofreading tool and picks up spelling mistakes for 'multiple thousands of words'. It can also be customised so that is you use a lot of jargon it can pick up spelling mistakes in that. It highlights misspelt words for your attention as it reads through.

Merge is an essential facility if you are using WP for business and are sending lots of standard letters to people on a mailing list. It will insert individual information in each letter and then print the appropriate address on an envelope.

Conclusion

In conclusion, Select is an easy to use WP system which provides most of the basics. It would suit somebody who had not used a micro before, but it quickly becomes frustratingly slow. The software seems resilient; indeed Bonsai claims 100 man-years of testing has been applied. Select makes a noble effort to demystify computers — but there's still lots of scope for improvement.

END

Benchmark timings

BM1	24.0
BM2	44.0
BM3	19.0
BM4	31.0
BM5	31.0
BM6	41.0

All timings in seconds. For an explanation of the word processor Benchmarks, see PCW, *April 1981.*

'There's a hole in my Apple...'

M J Parrott describes a crafty way to fit an Apple program around the hi-res graphics area

From time to time it can be useful to leave a space within a Basic program to incorporate perhaps a machine code program or data space. This is also true for a special reason on the Apple II when one wishes to protect the hi-res pages from program text. The usual way round this particular problem is to load the Basic text above the hi-res pages either by changing the beginning of program pointer ($67,68) before loading it (usually in an EXEC file) or by letting the program relocate itself to above the hi-res page when it RUNs by using a utility such as the &LOMEM: developed by Neil Konzen (*Apple Orchard*, March 1980).

The drawback with loading a program above the hi-res pages is that approximately 6k of memory is left fallow; it can only be used for machine code routines or shape tables. Also, the &LOMEM: utility does not work for very long programs because of the way in which it calculates the new link addresses of the relocated text.

It is desirable therefore to be able to load a program at the normal starting location ($801), to continue up to the area of memory to be protected (this is $2000 to $4000 for hi-res page 1 and $2000 to $6000 for hi-res pages 1 and 2 together), to jump over this area of memory and to continue up to the end of program text.

This is actually quite easy to do and the program listed will allow you to do it without problem. In essence the only work required is to move the latter part of the program and to change the link addresses where required. There are, however, a couple of provisos, but before pointing these out it is probably best to indicate the general construction of an Applesoft Basic program.

When you type in a Basic program it is constructed from memory location $801 (2049) upwards. Memory location $800 will contain a zero value. The actual line of Basic you type in is not stored exactly as you type it. If you call the monitor (CALL-155) and type 800L you can examine the start of any programs you have previously typed in or LOADed. The first two bytes of the line are the link address. In reverse order, these point to the start of the next line of Basic. Perhaps the best way of demonstrating this is via an example such as the short program:

```
10 PRINT "HELLO"
20 GO TO 10
```

If you type this in, call the monitor and type 800.817 and press ⟨return⟩ you will see the following:

```
0800— 00 0E 08 0A 00 BA 22 48
0808— 45 4C 4C 4F 22 00 16 08
0810— 14 00 AB 31 30 00 00 00
```

The values 0E,08 are the link addresses for line 10 and point to location $80E where the next line, 20, starts. At this location appear the link addresses for this line — they point to $816 where you will find the value 00,00. This is how Applesoft knows it has reached the end of a program.

Going back to the first line, the next two locations contain the line number expressed as a hexadecimal number stored in two bytes in reverse order, ie, 0A 00 for the decimal value 10. Next follows the text of the line. The PRINT command appears as a single byte in the 'tokenised' form BA. There then follow seven bytes which spell out "HELLO" in standard ASCII (with the high bit set low). Next is the end of line token, a zero byte. The next line has its link addresses, its line number and the tokenised form of 'GOTO', which is AB, followed by the number of the object line stored as ASCII values. Then come the end of line token (0) and the two zero value link addresses which signify the end of the program.

In general, then, any line of Basic is sandwiched between two zero bytes and this is the first proviso on relocating part of a program; the second part must start with a zero byte so that it looks like a normal line of Basic to Applesoft. The second proviso is that the last line of the first part of a split program must be one that does not simply move on to the next line (because it isn't there). In other words this last line must be either a GOTO or a RETURN.

If these two conditions are met and the link addresses are adjusted after splitting then a program will run quite

GOTO page 211

```
9  REM

'CLEARSPLIT' IS ASSEMBLED BY
THIS APPLESOFT PROGRAM

10  TEXT : HOME
20  PRINT "THE MACHINE CODE PROGRAM 'CLEARSPLIT'"
30  PRINT "IS NOW BEING ASSEMBLED UNDER HIMEM:"
39  REM

LOOK AT MACHINE'S HIMEM AND
CALCULATE STARTING LOCATION FOR 'CLEARSPLIT'
(I.E. $200 BELOW HIMEM)

40 P =  PEEK (116) - 2
50 HI =  PEEK (115) + 256 * P
60  FOR I = HI TO HI + 332
70  READ V: POKE I,V: NEXT
79  REM

NOW DATA HAS BEEN ASSEMBLED FOR
A 48K MACHINE.  IF YOURS IS
ALSO 48K LINES 80 TO 190
INCLUSIVELY MAY BE DELETED

80  IF P = 148 THEN  GOTO 200
90  POKE HI + 11,P: POKE HI + 35,P
100  POKE HI + 40,P: POKE HI + 56,P
110  POKE HI + 61,P: POKE HI + 75,P
120  POKE HI + 80,P: POKE HI + 85,P
130  POKE HI + 106,P: POKE HI + 133,P
140  POKE HI + 173,P: POKE HI + 182,P
150  POKE HI + 186,P: POKE HI + 189,P
160  POKE HI + 191,P: POKE HI + 197,P
170  POKE HI + 200,P: POKE HI + 287,P
180  POKE HI + 294,P: POKE HI + 300,P
190  POKE HI + 303,P
200  PRINT : PRINT : PRINT "INSERT YOUR DESTINATION DISC"
210  PRINT "AND PRESS RETURN TO SAVE IT"
220  GET T$: IF  ASC (T$) <  > 13 THEN 220
230  PRINT  CHR$ (13) +  CHR$ (4)"BSAVE CLEARSPLIT ,A"HI",L333"
239  REM

THE DATA FOLLOWS

240  DATA  169,76,141,245,3,169,20,141,246,3,169,148,141,247,3,96,0,0,0,0,
     169,189,32,192,222,32,103,221,32,82,231,165,80,141,16,148,165,81,141,
     17,148,169,193,32,192,222,32,103,221,32,82
250  DATA 231,165,80,141,18,148,165,81,141,19,148,216,160,1,177,103,208,3,
     76,18,212,56,173,16,148,233,11,141,16,148,176,3,206,17,148,165,103,13
     3,80,133,94,165,104,133,81,133,95,160,1,177
```

```
260  DATA 80,240,221,205,17,148,240,17,176,33,133,95,136,177,80,133,80,133
     ,94,165,95,133,81,144,228,133,155,136,177,80,205,16,148,176,8,170,165
     ,155,133,95,138,144,228,56,165,94,233,1,133,155
270  DATA 165,95,233,0,133,156,24,165,175,105,1,133,150,144,2,230,176,56,2
     29,155,141,16,148,165,176,133,151,229,156,141,17,148,24,173,16,148,10
     9,18,148,133,148,133,175,170,173,17,148,109,19,148
280  DATA 133,149,133,176,168,138,32,147,211,165,117,72,165,118,72,160,3,1
     77,155,133,117,200,177,155,133,118,32,32,237,104,133,118,104,133,117,
     160,3,177,155,56,233,1,145,155,200,177,155,233,0,145
290  DATA 155,160,5,169,171,145,155,162,255,232,189,0,1,200,145,155,201,0,
     208,245,24,165,155,105,1,133,155,144,2,230,156,24,169,1,109,18,148,16
     0,0,145,155,141,18,148,72,144,3,238,19,148
300  DATA 173,19,148,200,145,155,133,156,104,133,155,177,155,240,14,160,4,
     200,177,155,201,0,208,249,200,152,24,144,211,76,108,214
```

```
9  REM

DATA FOR THE MACHINE CODE PROGRAM 'CLOSESPLIT'

10  DATA 32,88,252,165,103,133,94,165,104,133,95,56,160,1,177,94,240,22,13
     3,81,229,95,201,1,240,2,176,15,136,177,94,133,94,165,81,133,95,56,176
     ,228,76,18,212,165,94,133,0,165,95,133,1
20  DATA 177,94,133,156,136,177,94,133,155,56,165,175,241,94,133,80,165,17
     6,200,241,94,170,160,0,177,155,145,94,136,208,249,230,95,230,156,202,
     48,6,208,240,164,80,208,236,200,177,0,240,34,200
30  DATA 200,200,177,0,208,251,200,24,152,101,0,160,0,145,0,133,80,165,1,1
     05,0,200,145,0,133,1,165,80,133,0,56,176,217,24,165,0,105,3,133,175,1
     65,1,105,0,133,176,32,108,214,76
39  REM

THE PROGRAM BEGINS HERE
BY BEING POKED IN

40  DATA 208,3
50  TEXT : HOME
60  PRINT "THE MACHINE CODE PROGRAM 'CLOSESPLIT'"
70  PRINT "IS NOW BEING ASSEMBLED AT $300 (768)"
80  FOR I = 768 TO 768 + 152: READ J: POKE I,J: NEXT
90  VTAB 10: PRINT "INSERT YOUR DESTINATION DISC"
99  REM

NOW SAVE IT TO DISC

100  PRINT "WHEN READY PRESS ⟨RETURN⟩"
110  GET T$: IF  ASC (T$) <  > 13 THEN 110
120  PRINT  CHR$ (13) +  CHR$ (4)"BSAVE CLOSESPLIT,A768,L153"
```

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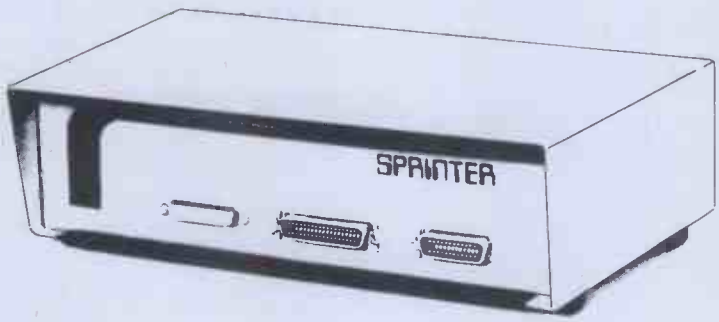

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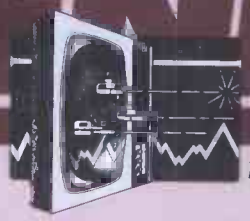
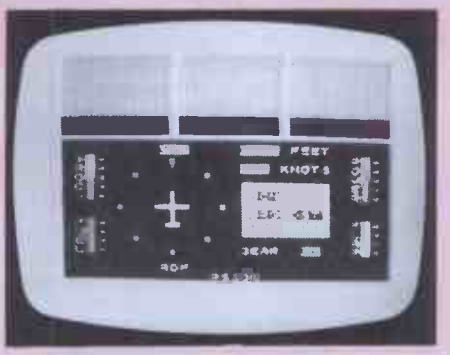


Dick Olney takes a further look at ZX81 games

I was going to cover the Acorn Atom this month, but because of the number of games I've been sent for the ZX81 recently — including the new Sinclair/Psion offerings — I decided to have a second look. (Atom owners may rest assured, however, that a full review is on its way!) As you'll know if you read last month's 'Screenplay', I don't rate the ZX81 very highly as far as arcade-type games are concerned but, nevertheless, its cost has given it predominance in the British home market, and games software for this machine is thus likely to reach the widest audience of all.

By the time you read this, many ZX81 enthusiasts will have already placed their orders for the Spectrum, which promises to change the face of home computing in this country. Meanwhile Sinclair has entered the games arena (its initial efforts were trivial, to say the least) with an impressive set of software produced by Psion Ltd in association with Micro Gen. The latter can supply joysticks for use with some of these games for £29.95 each (including extension board), though unfortunately I was unable to review these.

One of the most interesting Psion tapes was the Adventure set (see Fantasy Games review). Although this is the only such game I have reviewed on the ZX81 there are several others available, and I would recommend them to anyone who is disinterested or disappointed with the arcade type games. I have met many people who spurned Space Invaders, yet became almost obsessed when confronted with a good adventure. Anyway, here's another selection of games for Uncle Clive's classic. I have indicated in the reviews whether or not they require the 16k RAM.



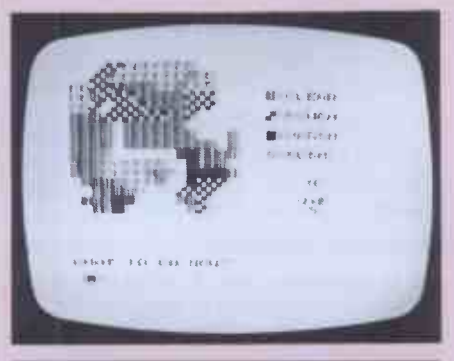
Game: Flight Simulation
Supplier: Sinclair/Psion
Price: £5.95

The leaflet which comes with this game suggests it simulates the flight of 'a small, high-performance, two-engined, propellor-driven aeroplane'. Not being a pilot I don't know whether this is completely accurate — but certainly all the fundamental features of flying are included. The cursor keys represent the aeroplane's joystick, which is confusing at first since the ↑ key in fact sends you into a dive (joystick forward). The 'P' and 'O' keys increase or decrease throttle, 'F' and 'D' do the same for flap extent, and 'G' lowers or raises the undercarriage.

There are three screen formats which you can move between at will. The cockpit display shows a full instrument panel with power, flap and fuel gauges, altimeter, speedometer, rate of climb and heading indicators and a selection of navigational aids. The latter give your position relative to any one of six beacons. A map of the area with the positions of the airport and beacons can be obtained by pressing the 'M' key. The third display is used for landing and shows a view out of the cockpit window, together with your speed and altitude.

There is no set task involved in this simulator — you just take off, fly the aircraft between the various beacons, and land (there is in fact an option just to practise the landing). It is very well done, however, and good use is made of the ZX81. As you might expect it does need the 16k RAM pack!

Presentation: ▰▰▰▰▰▰▱▱▱
Addictive quality: ▰▰▰▱▱▱▱▱▱
Value for money: ▰▰▰▰▰▰▱▱▱



Game: Fantasy Games
Supplier: Sinclair/Psion
Price: £4.95

Many people are still under the impression that all computer games involve frantically pressing buttons amidst what is to them visual and often auditory chaos. For any readers who may be guilty of this, adventure games — as they have come to be called — are 'role playing' games in which you are presented (sometimes with the aid of a map) with a scenario and a task or tasks. You must direct your actions, again usually through verbal commands, in order to explore and solve the various problems you are confronted with.

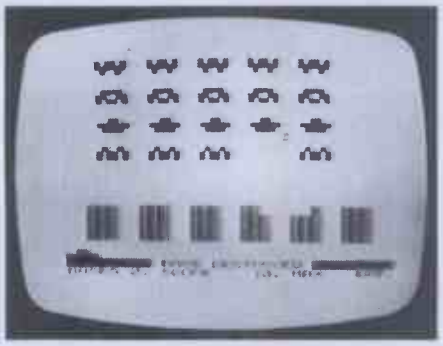
Although I have reviewed adventure games in the past, it is difficult to give them the coverage they deserve, partly because of the time it takes to really acquaint myself with them; and anyway it's often difficult to know what to say without giving too much away. This pair of adventures is particularly noteworthy because they provide a sort of introduction to games of this genre. The first, 'Perilous Swamp', is extremely simple but should help you get the hang of things. You are given a small square map showing areas of impassable swamp and dry(ish) land with your position marked (you start at the edge), as well as that of a princess whom it is hoped you will save from an evil wizard. At each move you encounter some beast, invariably guarding a valuable item of treasure, and are given the option to fight, run or bribe. You begin with a limited number of combat points, and any running or fighting will use up a certain amount of these (in the latter case depending on the combat strength of the beast itself), while you can only bribe if you have already ripped off some treasure elsewhere. Your success at fighting depends on how many combat points you decide to use, and on running or bribing on the potential or whim of your adversary. If you're lucky you'll rescue the princess and carry her back to the edge of the swamp — otherwise you get killed.

On the other side of the tape is an adventure called 'Sorcerer's Island' with a similar format, but a much more extensive map and greater flexibility of commands. Your task is simply (?) to escape from the island. This is considerably more interesting and challenging enough for the most avid adventurer. I must admit I didn't even get close to finishing it, but there seemed to be plenty of surprises.

These games from Psion are certainly not as sophisticated as many adventures I've seen, but they offer a valuable oportunity for the beginner to become acquainted with one of the most promising areas of computer leisure. I firmly believe that adventure games will one day be almost as widespread and popular as crosswords, and may well prove to have a more lasting appeal than their arcade-type counterparts. Anyway the limitations that the ZX81 places on the latter definitely make this and its fellows the better value for money.

Value for money: ▰▰▰▰▰▰▱▱▱
Presentation: ▰▰▰▰▰▰▱▱▱
Complexity: ▰▰▰▱▱▱▱▱▱

SCREENPLAY



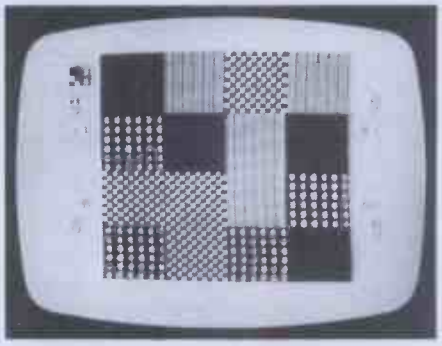
Game: Space Raiders and Bomber
Supplier: Sinclair/Psion
Price: £3.95

The first of this pair is a standard version of Space Invaders, with very chunky rather oversized graphics. You fire 'I's at the aliens using the space key ('Z' and SHIFT are used for movement) and they drop asterisks on you. There are no flying saucers and the raiders do not speed up as their numbers lessen. They need only reach the top of your shields to capture your base, not the bottom of the screen — which is somewhat disturbing to start with. Three speeds of play are possible; dubbed normal, fast and superfast, but these do not vary as much as one might think.

Bomber is the familiar game where you have to destroy skyscrapers before your plane crashes into them. The plane moves across the screen dropping one line on each cycle. The various-sized skyscrapers are destroyed by bombs or forward-firing missiles, of which only one may appear on the screen at any time. The game can be played at nine different speeds.

Both of these need 16k of RAM. Neither of them is original or particularly inspiring. I must have played dozens of versions of Space Invaders and, although I assume that many people are still playing this grandfather of games, I can't help feeling that it is about time the games publishers gave it a decent burial.

Presentation: ▰▰▰▱▱▱▱▱
Use of graphics: ▰▰▰▰▱▱▱▱
Addictive quality: ▰▰▱▱▱▱▱▱
Value for money: ▰▰▰▱▱▱▱▱



Game: The Nowotnik Puzzle & other diversions
Supplier: Phipps Associates
Price: £5.00

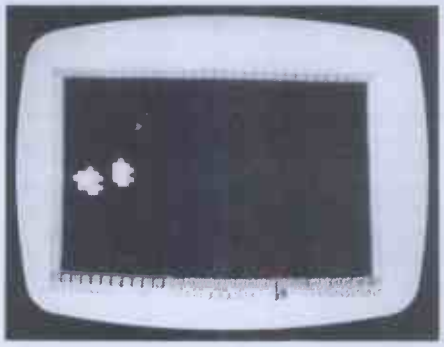
Here is a trio of programs written by one Dr David Nowotnik to run on a 16k ZX. The puzzle to which this gentleman lends his name is a cross between one side of a Rubik's cube and those flat plastic novelties where, given a single space, you have to rearrange the pieces into some prescribed pattern. The screen starts out divided into four squares, each with a markedly different shading, and the program proceeds to shuffle these into an unrecognisable form. Your task, of course, is to get the puzzle back to its original configuration. For purposes of movement, the puzzle is divided into four overlapping bands (top and bottom, and left and right halves) each of which can be moved in either direction, as if the outer edges were joined up. The original squares are well dispersed throughout the screen, and it is exceedingly difficult to bring together their constituent parts. The puzzle has five skill levels, varying from hard to almost impossible, and contains full instructions with examples. I've never really had the patience for this sort of thing, but as puzzles go the Nowotnik is certainly a good one.

The second program is called 'Demolition' and is, as the name suggests, along the lines of Breakout. Here the wall moves slowly *upward* and the bricks are knocked out by an asterisk which is dropped from the top. In fact the asterisk shoots across the screen and is hurled down at the wall in the desired position by pressing any key. When the first wall (or what remains of it!) gets about halfway up another appears at the bottom, and so on until any brick reaches the top. Despite the simplicity of this game, I enjoyed it, though it was definitely relaxing rather than exciting.

The final program, called 'Tenpins', is exactly that. You are shown an aerial view of the alley with the ball on one side and the pins set up on the other. The ball moves steadily up and down across the top of the alley (if you see what I mean!) and when it is in the desired position you press any of the keys 1-9 to bowl it. The actual key you press will determine the strength of your bowl and the trick is — more speed less accuracy. When the ball reaches its goal the pins which it has knocked down gradually disappear. One or two players can take part and a full scoreboard is displayed at the bottom of the screen.

This package is nicely presented — all the programs carry full 'integral' instructions — and is good value for money. None of the games are immensely impressive in themselves, but they complement each other well.

Presentation: ▰▰▰▰▰▰▱▱
Use of graphics: ▰▰▰▱▱▱▱▱
Addictive quality: ▰▰▰▱▱▱▱▱
Value for money: ▰▰▰▰▱▱▱▱

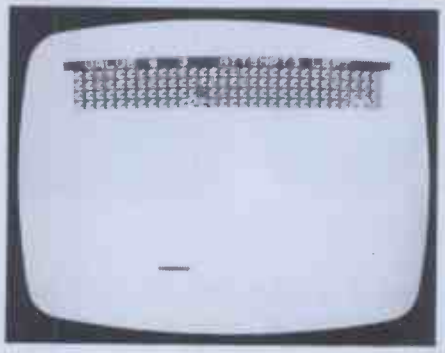


Game: Asteroids & Invaders
Supplier: Silversoft
Price: £5.95 and £4.95

These are Silversoft's versions of the old originals to run with 16K. The Asteroids (called 'Meteor' in the program but 'Asteroids' on the pack) uses different characters to represent the direction the ship is facing (eg, 'A' for up, 'V' for down, " for left and the graphics characters such as L for diagonals) which, though partly effective, do make it difficult to take the game seriously. There are no special features such as hyperspace, so apart from movement and firing the only other control is thrust. This will move the ship whilst you are pressing the key, but does not give actual acceleration as in the original, so that motion ceases when you remove your finger. There are ten speed options and movement is fluent so the game, as far as it goes, plays quite well. Despite its limitations this is just the thing for Asteroid addicts.

Much the same can be said for the Invaders. It too has ten speed options and is implemented exactly as the original. The graphics are very well done and movement and controls work well, resulting in probably the best version of Space Invaders, you'll get for the ZX81. Despite any reservations about the insistence of games publishers to maintain such strong links with their pre-history through endless versions of this game (see the Space Raiders review), this is possible the best game of its type played on this machine. There's a message there somewhere!

Presentation: ▰▰▰▱▱▱▱▱
Use of graphics: ▰▰▰▰▱▱▱▱
Addictive quality: ▰▰▰▱▱▱▱▱
Value for money: ▰▱▱▱▱▱▱▱

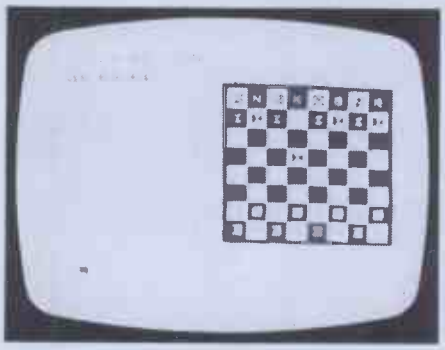


Game: 1k Breakout
Supplier: J K Greye Software
Price: £4.95

Despite the unoriginality of this game it's probably the best investment you can make for the 1k machine. The 'wall' is made up of reverse image '£'s which change into normal '$'s when hit and thus your score is given in dollars. Each game consists of ten balls, which are served from the top of the screen, and the bat is moved using the '5' and '8' keys. There are options for three different speeds and two bat sizes, and these are changed by BREAKing the program and performing various POKE functions.

One annoying aspect of this game was that instead of having an overriding direction the bat doesn't move at all if the two keys were pressed simultaneously. Since I tend to keep one finger on the 'recessive' key in these games, using the other to reverse direction and hence never being stationary, I found my bat halting at the most inconvenient times! Nevertheless a good game and, as I've said, one of the best you'll get in 1k.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



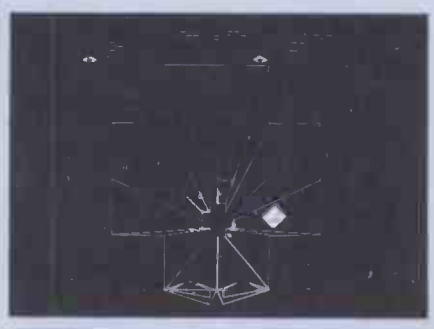
Game: Chess
Supplier: Sinclair/Psion
Price: £6.95

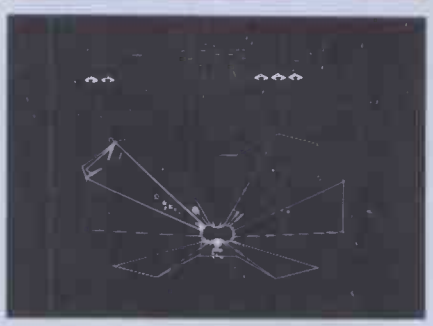
A fully fledged chess package with six playing levels, this offering from Sinclair/Psion runs on a 16k machine. The board is displayed over half the screen and is quite clear, except that it's a bit difficult to see which colour each of the pieces is. The leaflet suggests you use a normal chessboard alongside this game just to be sure, which sounds like good advice. All moves are possible including castling and en-passant, and you can choose which colour to play. Moves are input using the usual alpha-numeric cartesian coordinates (1-8 and A-H), and the only major criticism I have is that these codes are not displayed beside the board for quick reference.

There is a facility to set up the board to solve problems or simply create interesting situations, which can be used at any time in the game. It is also possible to change sides at any point. The standard of play is very high as the blurb on the package proudly announces; even skill level two can beat the average player. One side of the cassette contains a 'Chess clock' simulator for timing games, though of course this can't be used alongside the chess program itself.

Presentation:
Special features:
Playing skill:
Value for money:

ARCADE ACE





Tempest first appeared last summer and must be the fastest machine I've ever seen. The battle scenarios consist of magnificent line graphic structures whose perspective gives the impression of looking down a long tube. Using a rotary control, you guide a yellow pincerlike object around the near edge. Your weaponry consists of a fire button which projects missiles along the walls of the tube, and a 'superzapper' which eliminates everything in view.

A number of objects are thrown against you. The most valuable, fireballs, look like badly drawn Xs and fly up and down the tube at the same speed. These can be hard to get rid of, but they only appear when the game is quite well advanced. Pulsars move between adjacent lines, making the lines themselves intermittently lethal. They must be destroyed between pulses. Flippers literally flip-flop up the tube and look very like your pincers except that they are red. If they reach the top of the tube they move menacingly around the edge. Since the 'superzapper' can only be used once in each frame, it is often most useful when several flippers are closing in on you and preventing movement.

Purple diamond-shaped objects are called 'tankers' and, though quite easy to destroy, they split into two flippers if hit or if they reach the top — so watch out! Finally 'spikers' are small green spirals which move up and down the tube on the end of spikes. When one tube has been cleared these spikes remain and must be avoided when you 'zoom down the tube'. If you are successful you find yourself at the edge of another tube of a somewhat different shape. I don't know how many shapes there are — plenty to keep me going, at least! You are given three pincers to start with and get an extra at 20,000.

I must assume that the name of this game refers to the noises which accompany it. The rapid action leads to a remarkable cacophony of whizzes and bangs. Undoubtedly the most impressive feature of Tempest, however, is the colour graphics which can only be described as spectacular. There may not be as much in the way of controls as something like Defender, and certainly the stategy is not as complex, but the very speed of Tempest makes it a real challenge.

This game was one of the last of its type to appear, coming as it did at the beginning of the rise in popularity of 'cute' games such as Pac Man and Frogger and has consequently attracted less attention than it might have. In some respects it's a bit too overwhelming and would thus quickly deter any but the most enthusiastic and quick-witted novice. It's definitely worth a try, however, if only for the unusual graphics. END

DIY LOGO

Mike Parr presents 'Pogo' — a 16k implementation of Logo in Microsoft Basic

In the April 1982 *PCW*, Harvey Mellar looked at the Logo language in general terms, and indicated the educational possibilities of an easy-to-use procedure-defining facility coupled with turtle graphics.

Logo is now becoming available on some micros (Apple, TI) but is not yet widespread. No problem! In Figure 3 there's a listing of a Logo system written in Microsoft Basic which runs in 16k. Some 'uncommon' features of Basic have been avoided (eg, the ELSE), thus the program, though written on a TRS-80 Model I, will run on most systems without major alterations. Later, I'll describe how to carry out any modifications.

Pogo?

Though Logo is not rigidly defined, the version in this article has one major omission — list processing — hence I call it 'Pico Logo', or 'Pogo'. What it does have, however, is simple procedure defining with local variables (which allow recursion) plus turtle graphics and IF, REPEAT, WHILE and assignment statements. In short, most 'standard' Logo turtle graphics programs will work in Pogo.

To any Logo distributors who are concerned that my free system will put them out of business, don't worry! Pogo is slow, being an interpreter written in an interpreted language. Typically, a ten line procedure definition takes at least 30 seconds to be translated into an internal machine code, which is then interpreted. Editing and input of procedures is reasonably fast, though.

The language

In this section I'll describe in detail the Logo subset features, referring to Pogo where a major difference exists.

When you load and run the Pogo system, it prompts you with C?, meaning that a command is required. You may choose to do a calculation — PRINT SUM 3 7 will display the result '10'. SUM is a built-in procedure which needs two 'arguments', and which produces a result. PRINT is a procedure which takes one value and displays it on the screen. Note that an argument can be a procedure call, as in PRINT SUM 3 PROD 4 6. Here, Logo first evaluates 4 times 6, then adds 3, then finally prints 27. For subtraction, multiplication and division we have DIFF, PROD and QUOT respectively.

To 'teach' Logo the meaning of a new word, use the TO command, as in

```
TO SHOWTWICE 'NUMBER
10 PRINT ; NUMBER
20 PRINT ; NUMBER
END
```

When you embark on typing a definition, you will be prompted by NE?, which means 'type a numbered line or END'. The rules for inserting and deleting lines are the same as in Basic. This definition also introduces two new symbols — the quote and the semicolon — which Pogo uses to distinguish variables from procedure names. More precisely, a semicolon indicates the value of a variable, and the quote indicates the name of a variable. (Logo uses a colon, but this confounds most Basic INPUT statements.)

Anyway, back to SHOWTWICE. The purpose is to print a number twice, but we require that it works for any number. In Logo, this is simple — we make the procedure accept a value to work on, and (arbitrarily) we have called this value NUMBER. In Pogo all variables are local to the procedure in which they occur, thus the programmer has an unrestricted choice of names. To test the procedure, we may type

```
SHOWTWICE 6
```

causing

```
6
6
```

to be printed. This procedure has a printing effect, but no result. To return a value we use the RESULT statement, as in

```
TO DOUBLE 'N
10 RESULT SUM ; N ; N
END
```

and might test it with

```
DOUBLE 8
DOUBLE DOUBLE 3
```

which print 16 and 12 respectively.

As well as TO, we have EDIT, which allows one to alter an existing procedure; LIST, to display a definition; and ERASE, to remove a definition from memory.

To compare values, we have the six procedures EQ, NE, GT, LT, GE, LE. 'True' and 'false' are represented in Pogo as 1 and 0, thus

```
PRINT EQ 10 PROD 2 5
```

causes 1 to be displayed, as 10 is equal to 2 times 5.

To illustrate the IF...THEN...ELSE statement, here are two simple procedures:

```
TO MAX 'A 'B
10 IF GE ; A ; B
20     THEN RESULT ; A
30     ELSE RESULT ; B
END
```

which could be tested by

```
PRINT MAX 6 9  (9 is printed)
```

and

```
TO SHOWPOSITIVE 'N
10 IF GE ; N 0 THEN
20                PRINT ; N
END
```

which displays a value only if it is positive. In Logo the layout of a program is up to you, except that spaces are used to separate items.

When one of the options of an IF is composed of more than one statement, we can either define them as a new procedure, or 'connect' them using AND, as in

```
IF EQ 'A 'B
      THEN PRINT ; A
      AND PRINT ; B
```

Repetition

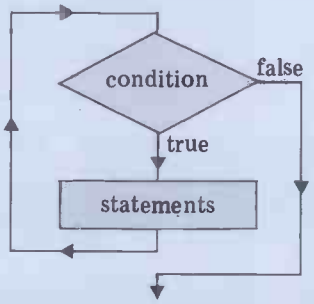
We have two choices — REPEAT and WHILE; eg,

```
REPEAT 3 PRINT ; A
      AND PRINT ; B
```

which causes six items to be printed. Note that where '3' was used, we could have used any item that produces a value. When the number of repetitions is unpredictable, WHILE is used, as in —

```
WHILE GE ; A ; B  DO
                  statement
AND               statement
AND               statement    etc.
```

The logic of a WHILE as a flowchart is



Presumably, the repeated statements will affect the terminating condition otherwise the program will loop for ever. Note that, to maintain compatibility with Logo, a WHILE may use either DO or THEN.

The problem is that, where an IF is contained within a WHILE, an AND could be linked to either statement. Full Logo allows us to use square brackets to overcome ambiguities, but the Pogo rule is that an AND is connected with the nearest IF or WHILE. Where this rule is unsuitable for your program logic, consider using an extra procedure definition to get round the problem.

Assignment

Whereas in Basic we write A=B + C, in Logo we write

```
MAKE 'A SUM ; B ; C
```

Again, any new variables that we invent are automatically made local to the current procedure, and will be re-created every time the procedure is entered — this allows recursion.

Graphics

Turtle graphics are a major feature of Logo, and enable procedures to be

defined which draw shapes. We have FORWARD, RIGHT, PENUP, PENDOWN. To draw an 'L' shape on the screen we could enter

```
FORWARD 6 AND RIGHT 90 AND
   FORWARD 6
```

Here are three useful procedures:

```
TO LEFT 'DEGREES (turn left)
10 RIGHT DIFF 360 ; DEGREES
END
TO FD 'N (allow FD as short for
FORWARD)
10 FORWARD ; N
END
```

Finally, to backtrack N steps without drawing a line:

```
TO BACK 'N
10 RIGHT 180
20 PENUP
30 FORWARD ; N
40 PENDOWN
50 RIGHT 180
END
```

We can now define a procedure to draw a shape with N equal sides of length L (called a polygon in geometry).

```
TO POLYGON 'N 'L
10 REPEAT ; N
20    FD ; L
30    AND RIGHT QUOT 360 ; N
END
```

If your program frequently draws squares, it might be worth having a special definition:

```
TO SQUARE 'N
10 POLYGON 4 ; N
END
```

Other built-in procedures

These are peculiar to Pogo. Firstly, to read in a number while the program is running, use INPUT:

```
PRINT SUM INPUT INPUT
```

which asks you for two numbers, then prints their sum.

To produce random numbers in range 0 to 9, use RND, eg,

```
REPEAT 100 PRINT RND
```

Finally, a 'quick and dirty' patch. In full Logo, we may use global variables and lists. In Pogo, PEEK and POKE can be used to provide global variables and arrays, while still keeping the overall size of the system small. Unlike similar Basic statements, full-length integers can be stored and recalled from an area of memory, as in

```
POKE 1234 6 (put 1234 in 6th
location)
PRINT PEEK 8 (print contents of 8th
location)
```

By suitable choice of procedure names, the effect of global arrays and variables can be obtained. Note that you cannot 'crash' your underlying Basic interpreter with Pogo PEEK/POKE.

Other statements

The two remaining statements — STOP and QUIT — are simple, but might be confused with similarly named Basic statements. STOP causes a return from the current procedure to the calling procedure, whereas QUIT stops the program completely, allowing the user to type fresh commands.

Setting up Logo

Firstly, a brief guide to the overall operation of the system. Typed-in procedure definitions are stored in a linked list. When a procedure call is typed, the appropriate procedures (because the call may itself involve other calls) are translated into an internal machine code, similar in nature to the stack-based p-code of many Pascal translators. Finally, this code (held in an integer array) is interpreted.

I adopted this approach mainly because I had a suitable interpreter subroutine, and didn't want to re-invent wheels — especially my own. A further benefit arises from the splitting of a relatively complicated program into two simpler separate routines which can be written and tested independently.

Now to details. The system is portable but not intelligible, due to Basic's primitive control structures, short variable names, and lack of named subroutines. It is a tight fit in 16k, so there are few comments, and those that do exist employ a shortand:

a. 'C' means 'subroutine to compile and check an item'. Each language item has its own compilation subroutine, which may need to call other similar subroutines (or even itself) if nested items exist. This method of compilation is known as 'recursive descent'.

b. The 'WH' comment indicates the start of a 'WHILE' loop. The program was planned (on paper) using Pascal-style loops, and then converted to Basic. Thus

```
WHILE condition DO
   BEGIN
      statements
   END
```

becomes in Basic —

```
1999 IF NOT condition THEN 3000'WH
      statements
2999 GOTO 1999
3000 etc.
```

The listing

As listed, the program runs on a TRS-80 Model I Level II machine in 16k, but alteration to other Microsoft Basic systems is no problem. Refer to these lines:

Line 20 — if your Basic doesn't need a CLEAR, remove it.

Lines 10050 and 10060 — if you have more than 16k, you can usefully increase some of the K variables, as indicated in figure 1.

Line 20005 — clear the screen.

Lines 23400 to 23460 -- their purpose is to draw a line (usually an approximation in characters or pixels) from an initial position X,Y that is A units long at an angle of AN degrees. Afterwards, X and Y are updated to the new position. If you need to resort to POKE, alter line 23440 to plot a suitable character (eg,*) at the closest position to X and Y — ie, at INT (X+0.5) and INT (Y+0.5). To be on the safe side, include a check that X and Y do in fact correspond to a legal screen position. Finally, if you have the luxury of high-definition graphics (meaning that lines will be shorter), you may choose to multiply X and Y by a scale factor.

Line 29115 — read a line from cassette to L9$.

Line 29420 — transmit L9$ (including its trailing space) to cassette.

Filing procedures

The listed program has two filing commands. FETCH will load the next procedure from cassette, and FILE, followed by a procedure name, will write a procedure onto cassette. To run the system with named files (either on

Vital Variables

K9	number of Logo lines in total (16k, 100. 24k, 200)
K8	number of reserved words
K7	size of c() code array (16k, 200. 24k, 300).
K6	size of compiler stack (16k, 20. 24k, 40)
NU()	number of line
TE$()	text of line
LK()	link (ie, pointer) to next line
CS()	compiler stack
C()	holds internal machine code, and also interpreter run-time stack
SY$	current symbol being compiled
TY$	— and its type.
L9$	I/O line
ID$	input device — K M F — keyboard, memory, or file.
EL$	end-of-line flag
0D$	output device — S F — screen or file.
E0	error occurred
PU	Penup/pendown
P	interpreter program counter (also misc. compiler pointer)
PK()	PEEK/POKE array (16k, 10. 24k, 100)

Error codes

Number	Meaning
1	missing ; before variable
2	illegal item after ;
3	missing THEN in IF statement
4	missing THEN or DO in WHILE statement
5	missing ' after MAKE
6	illegal item after ' in MAKE
7	procedure name after '
8	reserved word after '
11	not enough room to hold the internal machine code.
20	attempt to define a procedure twice
21	illegal item after TO
22	missing ' in TO
23	missing variable in TO
24	procedure does not exist

tape or disk) would require the addition of OPEN and CLOSE statements using (for example) the procedure name as a file name.

DIY LOGO

Recent developments

In that essential book *Turtle Geometry*, forms of 'pursuit' games are described — to program these, it is useful to be able to run a 'hunter' and 'evader' procedure simultaneously. Though details are not included in the current listing, I have extended the language to allow this 'concurrent' or 'parallel' running, and also to allow procedures to interact using the technique of semaphores.

Reference

'Logo Learning', Mellar. *PCW* April 1982.

Turtle Geometry. Abelson and diSessa. MIT Press 1981.


```
10 PRINT"LOGO MK1"'MIKE PARR
20 CLEAR 1000:GOSUB 10000:GOSUB 40100:ID$="K"
100 'FOREVER,DO:
205 EO=0:PRINT"C";:GOSUB 29100:C$=" ":GOSUB 28000
210 IF SY$="TO" THEN GOSUB 800:GOTO 350
220 IF SY$="EDIT"THEN GOSUB 700:GOTO 350
230 IF SY$="LIST" THEN GOSUB 1200:GOTO 350
240 IF SY$="FILE" THEN GOSUB 1300:GOTO 350
250 IF SY$="ERASE"THEN GOSUB 1500:GOTO 350
260 IF SY$="FETCH"THEN ID$="F":GOTO 350
290 S3=0:S4=0:S1=0:EO=0:GOSUB 5100:I=0:GOSUB 9010
294 GOSUB 7000:ID$="K":IF EO=1 THEN 350
296 PRINT"ABOUT TO RUN:-":GOSUB 20000
350 GOTO 100'END LOOP
700 'EDIT SY$
720 GOSUB 28000:GOSUB 1000:IF P1=0 THEN E=24:GOSUB 9990:RETURN
725 XP=OP:X1=P1:X2=P2:XN=LK(P2)'TEMP
730 PRINT"NE";:GOSUB 29100:GOSUB 28000:GOSUB 900
740 IF(P1=X1)AND(P2=X2)THEN RETURN
750 IF X1=P5 THEN P5=P1:GOTO 770'ELSE
760 LK(XP)=P1
770 IF X2=P6 THEN P6=P1:RETURN
780 LK(P2)=XN:RETURN
800 'TO
810 GOSUB 9400:IF EO=1 THEN RETURN
820 GOSUB 40400:TE$(X)=L9$:NU(X)=-1:P1=X
825 GOSUB 40400:LK(P1)=X:TE$(X)="END ":NU(X)=-1:P2=X:PRINT"NE";:
    GOSUB 2910C
830 GOSUB 28000:GOSUB 900
850 IF P5=0 THEN P5=P1:P6=P2:ID$="K":RETURN
860 LK(P6)=P1:P6=P2:ID$="K":RETURN
900 'EDIT A DEF
910 IF NOT(SY$<>"END") THEN 960'WH
920 IF TY$<>"NUM" THEN PRINT"NUMBERED LINE OR END PLEASE!":
    GOTO 950
925 NL=VAL(SY$)
930 IF EL$="Y" THEN GOSUB 40500:GOTO 950'DEL
940 TL$=RIGHT$(L9$,LEN(L9$)-P9+1):GOSUB 40500
950 PRINT"NE";:GOSUB 29100:GOSUB 28000:GOTO 910
960 RETURN
1000 'SEARCH FOR DEF
1010 F=0:P=P5:OP=0
1020 IF NOT((P<>P6)AND(F=0)) THEN 1070'WH
1030 IF NU(P)<>-1 THEN OP=P:P=LK(P):GOTO 1060
1040 IF TE$(P)="END " THEN OP=P:P=LK(P):GOTO 1060
1050 N$=RIGHT$(TE$(P),LEN(TE$(P))-3):N2=1:X$=""
1052 IF NOT(MID$(N$,N2,1)<>" ") THEN 1054'WH
1053 X$=X$+MID$(N$,N2,1):N2=N2+1:GOTO 1052
1054 IF X$=SY$ THEN F=1
1055 IF F=0 THEN OP=P:P=LK(P)
1060 GOTO 1020
1070 IF F=0 THEN P1=0:P2=0:RETURN'NOT THERE
1080 P1=P:P=LK(P)
1090 IF NOT(NU(P)<>-1) THEN 1110 'WH
1100 P=LK(P):GOTO 1090
1110 P2=P:RETURN
1200 'LIST
1210 OD$="S":GOSUB 1400:RETURN
1300 'FILE
1310 OD$="F":GOSUB 1400:OD$="S":RETURN
1400 'PROC OUT TO OD$
1410 GOSUB 28000:GOSUB 1000:IF P1=0 THEN E=24:GOSUB 9990:RETURN
1430 L9$=TE$(P1):GOSUB 29400:P=LK(P1)
1440 IFNOT(NU(P)<>-1)THEN 1490'W
1450 L9$=STR$(NU(P))+"  "+TE$(P)
1480 GOSUB 29400:P=LK(P):GOTO 1440
1490 L9$="END ":GOSUB 29400:RETURN
1500 'ERASE
1510 GOSUB 28000:GOSUB 1000:IF P1=0 THEN E=24:GOSUB 9990:RETURN
1517 P=P1
1520 IF(P1=P5)AND(P2=P6)THEN P5=0:P6=0:GOTO 1535'ONLY1
1523 IF OP=0 THEN P5=LK(P2):GOTO 1535'FIRST
1527 IF P2=P6 THEN P6=OP:GOTO 1535'LAST
1530 LK(OP)=LK(P2)'MIDL
1535 X=LK(P):GOSUB 40450:P=X
1540 IFNOT(NU(P)<>-1)THEN 1560'W
1550 X=LK(P):GOSUB 40450:P=X:GOTO 1540
1560 GOSUB 40450:RETURN
2000 'EVAL 1 PROC CALL
2010 GOSUB 4300:IF W<>0 THEN GOSUB 4000:
    GOTO 2300'WAS BUILT IN ONE
2020 T1=P1:T2=P2:GOSUB 1000:IF P1=0 THEN E=24:GOSUB 9990:GOTO 2300
2025 PRINT SY$;" ";
2030 GOSUB 9700:IF W=0 THEN GOSUB 9300:GOSUB 9100:W=S1
2035 P1=T1:P2=T2
2040 S3=S3+2:NA(S3-1)=W:NA(S3)=N:GOSUB 28000
2050 IF NOT(NA(S3)>0) THEN 2080'W
2060  GOSUB 3000:NA(S3)=NA(S3)-1'EVAL ARGS,RECURSE
2070 GOTO 2050
2080 S3=S3-2:I=4:A=-NA(S3+1):GOSUB 9020:GOTO 2300
2300 RETURN'EVAL PROC END
3000 'EVAL 1 ARG
3010 IF TY$="NUM" THEN I=18:A=VAL(SY$):GOSUB 9020:GOSUB 28000:
     GOTO 3300
3020 IF TY$="WORD" THEN GOSUB 2000:GOTO 3300'IS A FUN CALL
3030 ' IT MUST BE A ;VAR
3040 IF SY$<>";" THEN E=1:GOSUB 9990:RETURN
3042 GOSUB 28000:IF TY$<>"WORD"THEN E=2:GOSUB 9990:RETURN
3044 GOSUB 9500
3050 I=5:A=W:GOSUB 9020:GOSUB 28000:GOTO 3300
3300 RETURN'EVAL ARG END
4000 'C. 1 BUILT-IN PROC
4010 IF SY$="PRINT" THEN GOSUB 4500:GOTO 4200
4020 IF SY$="IF"THEN GOSUB 4600:GOTO 4200
4030 IF SY$="WHILE"THEN GOSUB 4800:GOTO 4200
4040 IF SY$="MAKE"THEN GOSUB 4900:GOTO 4200
4050 IF SY$="RESULT"THEN GOSUB 28000:GOSUB 3000:I=19:
     GOSUB 9010:GOTO 4200
4055 IF SY$="FORWARD" THEN GOSUB 28000:GOSUB 3000:I=24:
     GOSUB 9010:GOTO 4200
4060 IF SY$="RIGHT" THEN GOSUB 28000:GOSUB 3000:
     I=25:GOSUB 9010:GOTO 4200
4065 IF SY$="REPEAT"THEN GOSUB 5000:GOTO 4200
4070 IF SY$="STOP"THEN I=3:GOSUB 9010:GOSUB 28000:GOTO 4200
4075 IF SY$="PENUP"THEN I=16:GOSUB 9010:GOSUB 28000:GOTO 4200
4080 IF SY$="PENDOWN"THEN I=17:GOSUB 9010:GOSUB 28000:GOTO 4200
4081 IF SY$="RND"THEN I=32:GOSUB 9010:GOSUB 28000:GOTO 4200
4083 IF SY$="INPUT" THEN I=29:GOSUB 9010:GOSUB 28000:GOTO 4200
4085 IF SY$="PEEK" THEN I=30:GOSUB 9010:GOSUB 28000:GOTO 4200
4087 IF SY$="POKE"THEN GOSUB 28000:GOSUB 3000:GOSUB 3000:I=31:
     GOSUB 9010:GOTO 4200
4100 IF(W<6)OR(W>15) THEN 4120
4110 X=W:GOSUB 10600:GOSUB 28000:GOSUB 3000:GOSUB 3000:
     GOSUB 10700: I=X:GOSUB 9010:GOTO 42C
4120 REM
4200 RETURN'C. BUILT-IN END
4300 'SEARCH RES WORDS
4310 W=K8
4320 IF W=0 THEN RETURN
4330 IF SY$=R$(W) THEN RETURN
4340 W=W-1:GOTO 4320
4500 'C.PRINT
4510 GOSUB 28000:GOSUB 3000:I=1:GOSUB 9010:RETURN
4600 'C.IF
4610 GOSUB 28000:GOSUB 2000:I=20:A=0:GOSUB 9020:X=S4:GOSUB 10600
4620 IF SY$<>"THEN"THEN E=3:GOSUB 9990:RETURN
4630 GOSUB 28000:GOSUB 5100:IF SY$="ELSE" THEN GOSUB 28000:
     GOTO 4650
4640 GOSUB 10700:C(X)=S4+1:RETURN'NO ELSE
4650 I=22:A=0:GOSUB 9020:GOSUB 10700:C(X)=S4+1
4660 X=S4:GOSUB 10600:GOSUB 5100:GOSUB 10700:C(X)=S4+1:RETURN
4800 'C.WHILE
4810 X=S4+1:GOSUB 10600:GOSUB 28000:GOSUB 2000
4820 IF(SY$<>"THEN")AND(SY$<>"DO")THEN E=4:GOSUB 9990:RETURN
4830 I=20:A=0:GOSUB 9020:X=S4:GOSUB 10600:GOSUB 28000:GOSUB 5100
4840 I=22:A=0:GOSUB 9020:GOSUB 10700:C(X)=S4+1
4850 GOSUB 10700:C(S4)=X:RETURN
4900 'C.MAKE
4910 GOSUB 28000:IF SY$<>"'" THEN E=5:GOSUB 9990:RETURN
4920 GOSUB 28000:IF TY$<>"WORD"THEN E=6:GOSUB 9990:RETURN
4930 T1=P1:T2=P2:GOSUB 1000:IF P1<>0 THEN E=7:GOSUB 9990:RETURN
4940 P1=T1:P2=T2:GOSUB 4300:IF W<>0 THEN E=8:GOSUB 9990:RETURN
4950 GOSUB 9500:X=W:GOSUB 10600:GOSUB 28000:GOSUB 3000
4960 GOSUB 10700:A=X:I=23:GOSUB 9020:RETURN
5000 'C.REPEAT
5010 GOSUB 28000:GOSUB 3000:X=S4+1:GOSUB 10600
5020 I=21:A=0:GOSUB 9020:GOSUB 5100:I=22:A=0:GOSUB 9020
5030 GOSUB 10700:C(S4)=X:C(X+1)=S4+1:RETURN
5100 'C.BLOCK
5110 GOSUB 2000
5120 IF NOT(SY$="AND") THEN 5140'WH
5130 GOSUB 28000:GOSUB 2000:GOTO 5120
5140 RETURN
6000 'C. 1 DEF
6005 ID$="M":SY$="":GOSUB 29100
6010 PA(N1)=S4+1
6020 GOSUB 28000:GOSUB 28000:GOSUB 28000:S2=-1
6030 IF NOT(SY$="'") THEN 6050'WH
6040 GOSUB 28000:GOSUB 9500:GOSUB 28000:GOTO 6030
6050 I=2:A=S2+1:GOSUB 9020
6060 S2=S2+2:VN$(S2)="":VN$(S2-1)=""
6070 IF NOT((SY$<>"END")AND(EO=0))THEN 6090'WH
6080 GOSUB 2000:GOTO 6070
6090 I=3:GOSUB 9010:RETURN
7000 'C. ALL NEEDED FUNC DEFS
7010 CA$="N"
7020 IF NOT(CA$="N") THEN 7100'WH
7030 CA$="Y":N1=1
7040 IF NOT(N1<=S1) THEN 7090'WH
7050 IF PA(N1)<>0 THEN 7080
7060 SY$=PN$(N1):GOSUB 1000
```

```
7070 GOSUB 6000:CA$="N"
7080 N1=N1+1:GOTO 7040'EW
7090 GOTO 7020
7100 GOSUB 7200:RETURN
7200 'FIX UP CALL ADDRS
7210 FOR N=1 TO S4-1
7220  IF(C(N)=4)AND(C(N+1)<0)THEN C(N+1)=PA(-C(N+1))
7230 NEXT N:RETURN
9010 'GEN CODE I
9012 IF S4+1=K7 THEN E=11:GOSUB 9990:RETURN
9014 S4=S4+1:C(S4)=I:RETURN
9020 'GEN CODE I,A
9022 IF S4+3>K7 THEN E=11:GOSUB 9990:RETURN
9024 C(S4+1)=I:C(S4+2)=A:S4=S4+2:RETURN
9100 'NOTE CALLED PROC NAME,AND N ARGS
9110 S1=S1+1:PN$(S1)=SY$:CP(S1)=N:PA(S1)=0:RETURN
9300 'COUNT N ARGS OF A PROC
9305 N=0
9310 FOR X=1 TO LEN(TE$(P1))
9320 IF MID$(TE$(P1),X,1)="'" THEN N=N+1
9330 NEXT X
9340 RETURN
9400 'CHECK 'TO' LINE
9410 GOSUB 28000:IF TY$<>"WORD" THEN E=21:GOSUB 9990:RETURN
9415 GOSUB 1000:IF P1<>0 THEN E=20:GOSUB 9990:RETURN
9416 GOSUB 4300:IF W<>0 THEN E=20:GOSUB 9990:RETURN
9418 PRINT SY$
9420 IF NOT(EL$="N") THEN 9460'WH
9430 GOSUB 28000:IF SY$<>"'" THEN E=22:GOSUB 9990:RETURN
9440 GOSUB 28000:IF TY$<>"WORD"THEN E=23:GOSUB 9990:RETURN
9450 GOTO 9420
9460 RETURN
9500 'GET/MAKE VAR NUMB
9510 GOSUB 9800:IF W>=0 THEN RETURN
9520 S2=S2+1:VN$(S2)=SY$:W=S2:RETURN
9700 'SEARCH PROC TABLE
9710 W=S1
9720 IF W=0 THEN RETURN
9730 IF SY$=PN$(W) THEN RETURN
9740 W=W-1:GOTO 9720
9800 'SEARCH FOR A VAR
9810 W=S2
9820 IF W=-1 THEN RETURN
9830 IF SY$=VN$(W) THEN RETURN
9840 W=W-1:GOTO 9820
9990 'ERROR
9991 IF E0=1 THEN GOSUB 28000:RETURN
9992 E0=1:PRINT"ERROR NUMBER ";E;" NEAR ITEM ";SY$
9993 PRINT"IN LINE:":PRINT L9$:GOSUB 28000:RETURN
10000 'INIT
10010 S2=-1:S5=1
10040 P1=0:P2=0:P5=0:P6=0
10050 K8=33:DIM R$(K8):K9=100:DIM NU(K9),TE$(K9),LK(K9)
10060 K7=200:DIM C(K7):K6=20:DIM CS(K6),PK(10)
10090 R$(1)="PRINT":R$(2)="IF":R$(3)="THEN":R$(4)="ELSE"
10100 R$(5)="WHILE":R$(6)="SUM":R$(7)="DIFF":R$(8)="PROD"
10110 R$(9)="QUOT":R$(10)="GE":R$(11)="LE":R$(12)="GT"
10120 R$(13)="LT":R$(14)="EQ":R$(15)="NE"
10130 R$(16)="RESULT":R$(17)="AND":R$(17)="REPEAT":R$(18)="END"
10140 R$(19)="MAKE":R$(20)="FORWARD":R$(21)="RIGHT":R$(22)="STOP"
10150 R$(23)="PENUP":R$(24)="PENDOWN":R$(25)="INPUT":
      R$(26)="PEEK":R$(27)="POKE"
10160 R$(28)="TO":R$(29)="LIST":R$(30)="ERASE":R$(31)="FILE":
      R$(32)="FETCH"
10165 R$(33)="RND"
10200 RETURN
10600 'PUSH X
10610 IF S5>K6 THEN STOP
10620 CS(S5)=X:S5=S5+1:RETURN
10700 'POP X
10710 IF S5<=1 THEN STOP
10720 S5=S5-1:X=CS(S5):RETURN
20000 '*** INTERPRET ***
20005 CLS
20010 P=-1:S=S4+1:A=0:B=0:L=0:AN=0:X=30:Y=30:DR=3.142/180:PU=0
20020 P=P+1
20030 P=P+1
20040 I=C(P):A=C(P+1):IF I=0 THEN RETURN
20045 IF S+2>K7 THEN PRINT"TOO MANY PROC. CALLS!":RETURN
20050 IF I>6 THEN 20070
20060 ON I GOTO 21100,21200,21300,21400,21500,21600
20070 IF I>12 THEN 20090
20080 ON I-6 GOTO 21700,21800,21900,22000,22100,22200
20090 IF I>18 GOTO 20110
20100 ON I-12 GOTO 22300,22400,22500,22600,22700,22800
20110 IF I>24 THEN 20130
20120 ON I-18 GOTO 22900,23000,23100,23200,23300,23400
20130 ON I-24 GOTO 23500,23600,23700,23800,23900,24000,24100,24200
21099 '** INTERPRET INSTRUCS **
21100 PRINT C(S):S=S-1:GOTO 20030'PRN
21200 S=S+1:C(S)=L:L=S-1:S=S+1:C(S)=B:
      B=S-A-2:GOTO 20020'FUN HEADER
21300 S=B-1:B=C(L+2):P=C(L):L=C(L+1):GOTO 20040'RET
21400 S=S+1:C(S)=P+2:P=A:GOTO 20040'CALL
21500 S=S+1:C(S)=C(A+B):GOTO 20020'LLV
21600 S=S-1:C(S)=C(S)+C(S+1):GOTO 20030'SUM
21700 S=S-1:C(S)=C(S)-C(S+1):GOTO 20030'SUB
21800 S=S-1:C(S)=C(S)*C(S+1):GOTO 20030'MUL
21900 IF C(S)=0 THEN PRINT"ZERO DIVIDE !":RETURN
21910 S=S-1:C(S)=INT(C(S)/C(S+1)):GOTO 20030'DIV
22000 S=S-1:IF C(S)>=C(S+1) THEN C(S)=1:GOTO 20030'LE
22010 C(S)=0:GOTO 20030
22100 S=S-1:IF C(S)<=C(S+1) THEN C(S)=1:GOTO 20030'LE
22110 C(S)=0:GOTO 20030
22200 S=S-1:IF C(S)>C(S+1) THEN C(S)=1:GOTO 20030'GT
22210 C(S)=0:GOTO 20030
22300 S=S-1:IF C(S)<C(S+1) THEN C(S)=1:GOTO 20030'LT
22310 C(S)=0:GOTO 20030
22400 S=S-1:IF C(S)=C(S+1) THEN C(S)=1:GOTO 20030'EQ
22410 C(S)=0:GOTO 20030
22500 S=S-1:IF C(S)<>C(S+1) THEN C(S)=1:GOTO 20030'NE
22510 C(S)=0:GOTO 20030
22600 PU=1:GOTO 20030'PUP
22700 PU=0:GOTO 20030'PDOWN
22800 S=S+1:C(S)=A:GOTO 20020'LCN
22900 C(B)=C(S):S=B:B=C(L+2):P=C(L):L=C(L+1):GOTO 20040'RES
23000 S=S-1:IF C(S+1)=0 THEN P=A:GOTO 20040'JIF
23010 GOTO 20020
23100 C(S)=C(S)-1:IF C(S)<0 THEN S=S-1:P=A:GOTO 20040'TESTREP
23110 GOTO 20020
23200 P=A:GOTO 20040'JUN
23300 C(A+B)=C(S):S=S-1:GOTO 20020'STORE
23400 A=C(S):S=S-1:T1=COS(DR*AN):T2=SIN(DR*AN):N=1'FWARD
23410 IF NOT(N<=A)THEN 23460'W
23420 X=X+T1:Y=Y+T2
23430 IF PU=1 THEN 23450
23440 SET(INT(X+0.5),INT(Y+0.5))
23450 N=N+1:GOTO 23410
23460 X=INT(X+0.5):Y=INT(Y+0.5):GOTO 20030
23500 AN=AN-C(S):S=S-1'RIGHT
23510 IF NOT(AN<0) THEN 23530'WH
23520 AN=AN+360:GOTO 23510
23530 GOTO 20030
23900 INPUT"NUMBER ";N:S=S+1:C(S)=N:GOTO 20030
24000 C(S)=PK(C(S)):GOTO 20030'PEEK
24100 S=S-2:PK(C(S+2))=C(S+1):GOTO 20030'POKE
24200 S=S+1:C(S)=INT(10*RND(0)):GOTO 20030
28000 'GET SYM,TYPE
28005 IF(EL$="Y")AND(ID$="K")THEN SY$="":TY$="X":RETURN
28007 IF(SY$="END")AND(ID$="M")THEN RETURN
28010 SY$="":GOSUB 29300
28020 IF CC$<>"D" THEN 28060
28030 SY$=SY$+C$:GOSUB 29200
28040 IF CC$="D" THEN 28030
28050 TY$="NUM":RETURN
28060 IF CC$<>"L" THEN 28100
28070 SY$=SY$+C$:GOSUB 29200
28080 IF(CC$="L")OR(CC$="D")THEN 28070
28081 TY$="WORD":RETURN
28100 SY$=C$:TY$="X":GOSUB 29200:RETURN
29000 'READCHAR
29005 EL$="N"
29035 IF P9>LEN(L9$)THEN GOSUB 29100
29037 IF P9=LEN(L9$) THEN EL$="Y"
29040 C$=MID$(L9$,P9,1):P9=P9+1:RETURN
29100 'READLINE
29105 P9=1:EL$="N"
29110 IF ID$="K" THEN INPUT L9$:L9$=L9$+" ":RETURN
29115 IF ID$="F" THEN INPUT#-1,L9$:RETURN
29120 IF ID$="M" THEN L9$=TE$(P1):P1=LK(P1):RETURN
29130 RETURN
29200 'GETCHAR
29210 GOSUB 29000
29220 IF(C$>="0")AND(C$<="9")THEN CC$="D":RETURN
29230 IF(C$>="A")AND(C$<="Z")THEN CC$="L":RETURN
29240 CC$="X":RETURN
29300 'GET NON-SPACE
29310 IF C$<>" " THEN RETURN
29320 GOSUB 29200:GOTO 29310
29400 ' OUT L9$
29410 IF OD$="S"THEN PRINT L9$:RETURN
29420 IF OD$="F"THEN PRINT#-1,L9$:RETURN
40000 'LINE EDITOR
40100 'INIT FREE LIST
40120 FOR X=1 TO K9-1
40130  TE$(X)="":NU(X)=0:LK(X)=X+1
40140 NEXT X
40150 P3F=1:LK(K9)=0:RETURN
40200 'SEARCH FOR NL IN NU(),RESULT P
40210 OP=0
40235 P=P1H
40240 IF NOT(NL>NU(P)) THEN 40280'WH
40245 IF P=P2 THEN 40280
40250  OP=P:P=LK(P)
40270 GOTO 40240
40280 RETURN
40400 'GETFREE X
40410 IF P3F=0 THEN PRINT"OUT OF SPACE !!":STOP
40420 X=P3F:P3F=LK(P3F):LK(X)=0:RETURN
40450 'RETURN P TO FREE.
40460 TE$(P)="":NU(P)=0:LK(P)=P3F:P3F=P:RETURN
40500 'DO EDIT
40510 GOSUB 40200
40520 IF EL$="Y" THEN GOSUB 40800:RETURN 'DEL
40530 IF P=0 THEN GOSUB 41000:RETURN'MUST BE INSERT
40540 IF NU(P)=NL THEN GOSUB 40700:RETURN'REPL
40550 GOSUB 41000:RETURN'INSERT
40700 'REPL
40710 TE$(P)=TL$:RETURN
40800 'DEL
40810 IF P=0 THEN RETURN
40820 IF NU(P)<>NL THEN RETURN
40840 'FIRST,LAST,MIDDLE?
40850 IF P=P1H THEN P1H=LK(P1H):X=P:GOSUB 40450:RETURN
40860 IF P=P2T THEN P2T=OP:X=P:GOSUB 40450:RETURN
40870 LK(OP)=LK(P):GOSUB 40450:RETURN
41000 'INSERT
41030 GOSUB 40400:NU(X)=NL:TE$(X)=TL$:LK(X)=LK(OP):LK(OP)=X:RETURN
60000 CSAVE"1":CSAVE"2":CSAVE"3"
```

END

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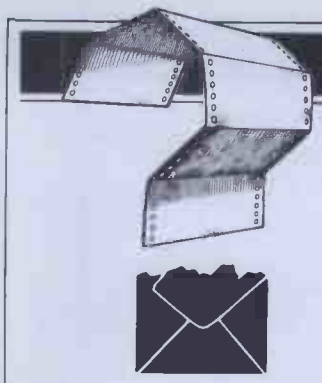


COMPUTER ANSWERS

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.

Give me your answer, do...

Would you be willing to forecast whether the price of the least expensive daisywheel printers will go down much? I am sure that there is a mass market for 'letter quality' printers. Will developments in printer technology meet this need? How do I choose a printer? I await your august opinion with bated breath.
R P Phillips, Milton Keynes

As you may have noticed I am not usually very outspoken, and also find it hard to make reliable predictions. However I would say, yes, printers will come down in price markedly as the demand increases. But choosing a printer is a very difficult task — there are so many that a shortlist needs to be drawn up. In order to compile a shortlist you must first ascertain answers or ranges of answers in the following areas: price, speed, print quality, reliability, paper size/type, graphics capability, paper feed mechanism.

For everything except 'print quality' a matrix printer is best, but the familiar 'dotty' looking characters tend to put people off. There are several matrix printers around now that have an 'enhanced' print option. This reduces the dottiness by printing every column of dots twice, the second time with the dots shifted slightly to fill the gaps. The result is a far more acceptable print quality but at half the printing speed. I would say that the quality is adequate for most letters. For the best in quality for letter-writing purposes, the daisywheel printer is hard to beat, though.

There are a couple of daisywheel printers on the market for around £500 and one of them even has a keyboard so it can be used as a typewriter, too. However they are incredibly slow (around 10 cps) and would take about 6 minutes to print this answer. However you can obtain for £1400 a 50 cps daisywheel that is maybe 10 times faster. It can manage that factor faster because the speed a printer operates is not determined just by how many characters per second it can print, but also by whether it prints bi-directionally, and has a logic seeking head. For example, try printing the alphabet down the centre of a page and see whether printers that all lay claim to being the same speed actually are. Bear in mind that matrix printers offer other advantages, such as enlarged and compressed print, or dot graphics, where a picture may be drawn using the individual pins of the matrix. Resolutions of over 1000 dots across the page can be obtained. Most matrix printers tend to slow down a lot when printing graphics because the matrix head gets extremely hot, and a delay is built in at the end of a certain amount of printing. The better daisywheels can also do limited dot graphics with 1/120th inch between dots.

Also coming on the market again (they have been around before) are the 'ink-jet' printers. These work on a similar principle to the matrix printer except that ink is sprayed out of a matrix of nozzles. The advantage here is twofold — the ink spreads slightly and thus fills the gap betweenthe dots, and secondly the heads do not get hot and thus wear out as quickly as impact matrix printers. Siemens make an ink jet printer but at the time of writing I haven't seen it on sale in Britain. Acorn is also bringing out such a printer for the Atom/BBC micro range.

Another favourite request from people is that the printer supports 'proportional spacing'.

This means that letters like 'i' and 'l' take up less space than 'm' or 'w'. Remember that this probably needs a word processor that can use this feature, and that several word processing packages do not support proportional spacing.

Consider also the mechanism for feeding the paper into the printer. You may require single sheets to be fed in automatically. Does the printer have single sheet (friction) feed. Does it have tractor feed for continuous stationery? Will it allow a variety of paper sizes?

Two printers that I would recommend are the Epson MX100 impact matrix printer for around £500, which has most of the features listed above; and the Commodore 8300P for around £1400, which is really the Diablo 630 daisywheel in Commodore clothing. The latter printer is really exceptional value for money in the Commodore guise. It supports all of the previously mentioned features and is the printer I use for the majority of my work now. You should also consider reliability and ruggedness, and it is in this area that money can be saved if you don't want a printer that can take being hammered for six hours a day, for example.
There are certainly cheaper printers but they tend to be quite frail. So, all in all, printers are tending to hold their price at present, but are gaining in facilities and sophistication. I suspect that they will start to drop in price over the next few years, but remember that a £500 printer that holds its price for a year is actually about £50 cheaper due to inflation! So don't expect too great a drop in price.
SW

Squashed

I have a dilemma and I am hoping that you can help. I have recently started a squash club. My membership lists are full. Several of my friends say that I should computerise my membership lists. There are several reasons why I think this would be a good idea: first and foremost because it is so time-consuming (and hence expensive) to do the mailing of renewals/circulars manually. However if I were to buy a computer it could be quite a large outlay, which is something that I can ill afford in the first year of the club's existence. Your advice would be most welcome.
J James, Birmingham

You are wise to be wary — many companies have bought computers and found out the expensive way that they are not always cost-effective. You could well find with further research that it is best to stick to the manual approach, perhaps using part-time labour to cope with the peak periods.

An alternative which should be investigated is to approach a computer 'Bureau'. Yellow Pages should list dozens, and your library should be able to help you locate some from their business index. Computer Bureaux exist to provide a wide variety of services, and can prove to be particularly cheap for some operations. From what I can gather from talking to people, few think of the 'Bureau' solution, although if you went to a proper computer consultant then a bureau should be offered as an alternative to buying or leasing a computer. Some of the reasons why companies should consider a bureau are: to gain data processing experience; to evaluate hardware and software; cost -- you only pay for the service required; non-involvement; peak loads; advice; stand-by computer system.

The bureau could even install a terminal, so you could access the files yourself; this could prove rather expensive, though. Your application could almost certainly be processed in the 'batch' mode so a terminal is an unnecessary luxury.

I would consider the options that you have very carefully, as you would probably need to spend at least £3000 on the computer system. It would be possible to spend less, but you must take reliability, versatility and expandability into account.
SW

More dates

The answer headed 'Dates' in the June edition is one solution to the problem of simplifying entry into a particular Basic program. I wonder if you can supply the ultimate solution to run a Basic program under CP/M from cold boot without any operator intervention.
David Eno, Winchester

Many thanks for publishing my 'DATES.COM' program, however I should have stated that in the line labelled FCB: there must be *exactly* 5 spaces between the last $ sign and the next quote or it will not work.
J S Linfoot, Oxford

Thank you for pointing that out. I was aware of it but failed to make it clear in the answer.

The ultimate solution can be obtained in several ways (so I have been told). I have only discovered one and that is to fool the system into thinking that it is in the middle of a 'SUBMIT' sequence. To do this trickery you will need the utility SUBMIT.COM that is supplied on the CP/M system disk. Put this onto your working disk. Suppose that you want to run a Basic program called 'DATES.BAS'

under the MBasic interpreter. You must create a file called 'FRED.SUB' whose contents are:
MBASIC DATES
SUBMIT FRED
Having created this file (by using an editor or via Basic) you type whilst still in CP/M:
SUBMIT FRED

Now you have succeeded, because if you remove the disk, when you put it back, even from a cold start the system will start up by itself.

It all works because the 'SUBMIT' program creates a file called FRED.$$$ which contains the commands in FRED.SUB yet to be executed, and whenever the file FRED.SUB is just about to finish executing it re-creates itself because it has a 'SUBMIT.FRED' within the file 'SUBMIT.FRED'. Very confusing isn't it? There are a number of CP/M books on the market — the best one that I have found is by Osborne, and is available from 'Mine of Information' (St Albans 52801, mail order only). This book explains the SUBMIT program quite well, so start by reading that. If you want to break the chain and restore the disk to normality you will have to put the disk in drive B and an ordinary disk in drive A and type ERA B:FRED.$$$ or you can do this within Basic using KILL"FRED.$$$".
SW

Quicker printer

I have an Anadex DP8000 printer connected to my computer. I am very pleased with it but find it rather annoying that I have to wait for it to finish printing before I can get on with more data entry. I would have thought that the computer could make both the printer work *and* allow me to enter more data at the same time, as the computer is so much faster than my typing and the printer's printing. I have tried setting the baud rate to 9600 baud but it only seems to work at the the same speed at 1200 baud. Is it possible?
L Hill, Braintree.

I am afraid that you need a slightly different operating system to achieve what you want directly. However, I suggest that you extend the Anadex's buffer to its maximum of 4k. You should be able to buy the chips from the dealer who supplied you with the Anadex for not too much money. If you now work at 9600 baud and your output to the printer is not too rapid or too long, then there should not be too much of a hold-up. There will still be a noticeable delay, but it should not be prohibitive. Put it this way, you can be typing while the printer still has about one page (A4) of printing left to do. Expanding the printer's buffer is a solution that many people overlook in order to achieve faster throughput.
SW

Snap decision

We have seven photographic shops and a warehouse, and we are looking for a computer system which will tell us the stock position of an item in each of these places. There are approximately 5000 items and the changing of the data will only occur in the warehouse. We are searching for the software, floppy disk and computer. Please help as we have had no success as yet.
N Kramer, Wembley

You need a proper professional approach to solving your problem; there is no point in my even starting to help through these pages. Contact the Association of Professional Computer Consultants at 109 Baker Street, London (01-235 7292). They will charge for their services, but proper professional advice is extremely valuable. Let me know the outcome if you wish.
SW

Queue jumper

Where can I get a BBC micro without having to wait for untold weeks like I would if I ordered through the usual Kettering address?
R Dickson, London

Both the 'Comp Shop' and 'Microage Electronics' claim to be able to get you one in two to three weeks. I am testing out this claim and can tell you next month. Both these companies advertise in *PCW*, and both are in London.
SW

PET printer

I own a 3032 PET with dual disk drives, and now I wish to add a printer. After seeing the output from the CBM 4022 printer and noting the price I looked further afield. The output from the Epson MX80 F/T was a distinct improvement, but I was warned that the features which give a good typeface are lost when it is interfaced to the PET. Is this true? The Centronics 737 also has good output, but can the vertical line spacing be programmed as with the Epson, as this is vital for printed forms? Can you give your recommendations for under £500?
D V Ferrand, Bristol

The extra features of the MX80 are not lost when connected to the PET. This is purely dependent on software, so the extra facilities may not be available with many standard packages.

Remember that most printers also require an interface at extra cost to connect to the PET.

Most printers can be set to 8 or 6 lines per inch, which is suitable for most forms. It is normally possible to design the layout of pre-printed stationery for computer printers.

I personally like the Oki range of matrix printers.
Mark Wratten

PET upgrade

I am a PET 2001 'old ROM' owner and I would like to update my machine to either a 4000 series PET or a 'new ROM' PET. Which firm will do the update?
Richard Payton, Derby

It is certainly possible to upgrade your computer to version 2 Basic. However, only certain machines can be upgraded to Basic v4. The Basic language is contained in ROMs which can be removed and replaced with new ones. Usually the ROMs are not soldered in so it is a simple task to do this yourself.

You must determine which type of ROMs you have, as there are two kinds. The difference is the number of pins that the ROMs have. This can be either 40 or 24. If your machine has the latter, and dynamic RAMs (16 pin type 4018), then it can be upgraded to Basic v4. Any reputable Commodore dealer will be able to supply replacement chips, and advise on which to use.
Mark Wratten

Sharp talk

I wonder if you could give me some answers on the subject of interfaces. I have recently purchased a Sharp PC 1500 and CE 150 plotter. Sharp say that they will be soon bringing out an RS232 communications interface. But what does RS232 mean?
M Sargaison, Berkhamsted, Herts.

Communications interfaces are used by computers to enable them to talk or listen to external devices. RS232 is one particular type of communication. Many printers, VDUs, etc, have an RS232 interface, which will enable your computer to send/receive information to/from them. Therefore in theory your machine will be able to 'talk' to any device which has an RS232 interface.

Described briefly, RS232 is a definition of a standard of communication. Information is passed along a single pair of wires, as a series of positive and negative pulses. Each pulse is known as a bit. Each byte is sent as a sequence of eight bits, preceded by one or two stop bits. The data is transmitted at a predefined rate (bits per second) to which both devices must be set.
Mark Wratten

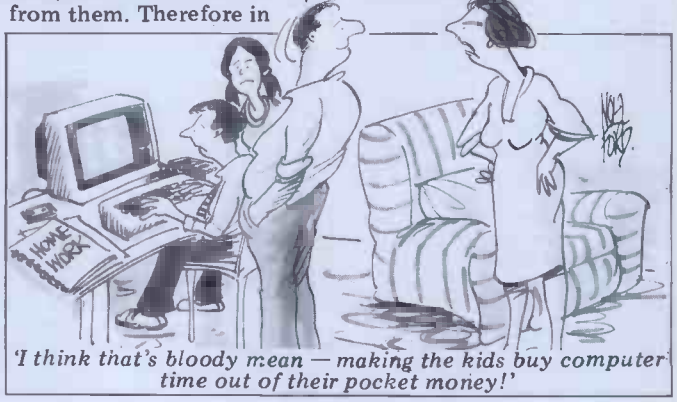
KWIC query

I have seen a book index produced by a Keyword-In-Context ('KWIC') program. Each main word was listed as part of the line of text in which it occurred and the whole index was ordered alphabetically according to the letters of the keyword. Each entry was numbered with the appropriate line number from the text.

Do you know of a KWIC program for a micro, or can you offer any hints on writing one in Basic or Pascal?
B Kat, Newcastle upon Tyne

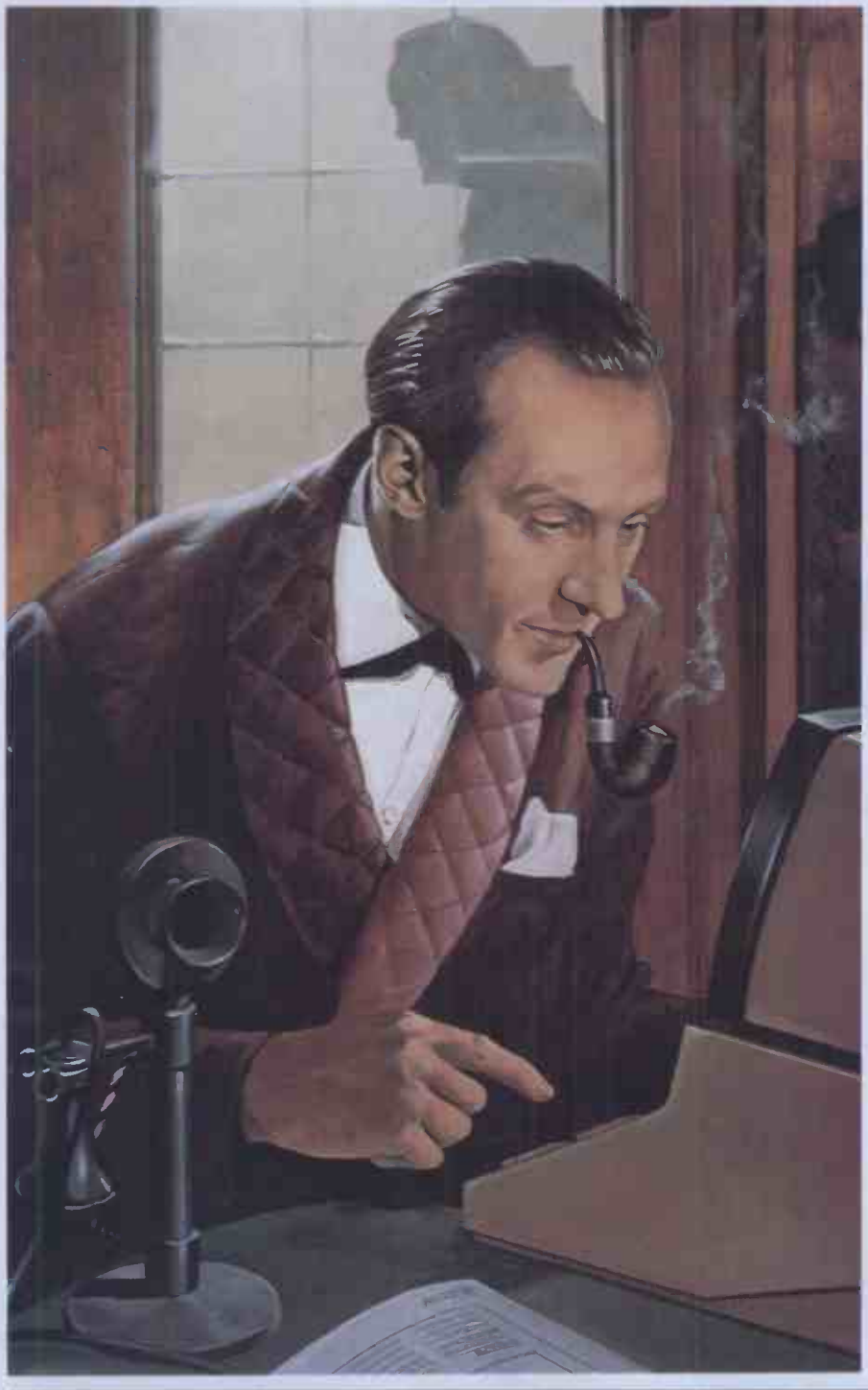
I had not personally come across such a program for a micro, but the National Computer Centre have suggested 'The Index' from TCL Software Ltd, of Theobalds Road, London WC1. Alternatively they suggest that if your documents are not too long you could consider 'Cardbox' from Caxton Software Publishing Company of 10-14 Bedford Street, Convent Garden, London WC2.

My own approach would be to make use of two word-processing programs. The first of these, 'The Word'. available from AIM Research of 20 Montague Road, Cambridge CB4 1BX, will compile an index from your source document. Microsoft's 'Microspell' will display (or print if the screen is directed to printer (Control P in CP/M)) misspelt words in context. So, if you removed all the words of interest for your index from Microspell's dictionary, it would generate your keywords in context!
P L McIlmoyle



'I think that's bloody mean — making the kids buy computer time out of their pocket money!'

THE PCW £5000 MANHUNT



Welcome to the Big One! This is the *PCW* competition to beat them all. For starters, the prize money is the biggest we've ever given away. The competition runs for four months and you have to get every part right to stand a chance of winning. And the object of the competition is to find a person, by telephone, and leave the answer as a message!

It's a sort of treasure hunt for the information age; let your fingers do the walking.

Don't expect it to be easy; £5,000 is near enough a year's salary so you're going to have to work for it.

Each month we will present a puzzle for you to solve, starting in this issue. In the December issue you'll get the final instalment and by combining the answers to all the puzzles in the right way you will be led to the name, rank and phone number of a person resident in the UK.

You will then phone this number and an answering machine will tell you if it's the right one. Then you leave a message consisting of one of the puzzle answers. The first person to get onto the answering machine tape with the right answer gets the loot. We'll give you more detailed instructions as we go along; right now let's get down to the first puzzle.

All you have to do this month is find the smallest palindromic integer whose square, when reduced by a million, gives a result which contains each of the digits **0** to **9** at least once.

For the uninitiated, a palindromic integer is a whole number which reads the same from left-to-right as it does from right-to-left, eg, 121, 3443, 12421.

When you have the number take its digital root — you'll need both for the final — by adding all the digits together repeatedly until you have a single digit. For instance the digital root of 987654 is three:—

9+8+7+6+5+4=39

3+9=12

1+2=3

Don't send in the answer as usual please; we're not interested until after the last puzzle. Just keep these two numbers safe and look out for the next puzzle next month. Best of luck.

JJ Clessa

ONE BIT AT A TIME

M Gonzales and D A Sinclair conclude their examination of the RS232 interface.

PART 2: SIMPLE INTERFACING WITH RS232

One possible reason for buying a microcomputer system is for use as a terminal to another computer such as a mainframe. The simplest requirement is for use as a cheap alternative to a VDU or teletype without any extra local intelligence — ie, a dumb terminal. A dumb terminal program (DTP) is quite simple to write. Figure 1 gives a flowchart for a DTP which operates in the full duplex mode. For half-duplex operation the flowchart should be modified to display the keyboard character on the screen after it is output to the UART.

This looks straightforward enough, but there are some pitfalls. For example, the mainframe which runs the British Library on-line literature searching service sends two control characters which turn the teletype motor off and on between lines of print. One of us had the job of writing a program to enable a Sorcerer micro to be used as a terminal to this computer. These control characters meant 'cursor home' and 'clear screen' to the Sorcerer, so it was impossible to read the mainframe's output on the screen. However, the problem was easily solved by a subroutine to filter out any awkward control codes from the received data.

A more sophisticated solution is to have a conversion table to convert received control codes to their local equivalent. So, if the mainframe thinks that 'clear screen' is 0H (ie, ASCII VT) whereas on the micro it is 13H (ASCII DC3), the table should have an entry saying that received 0BH should be echoed to the VDU as 13H. Of course the inverse process should not be carried out — ie, 13H should not be transmitted as 0BH.

Ideally no conversion or other processing should be done on characters typed at the keyboard, since in full duplex mode they can have no unpleasant local effect (such as accidentally clearing the screen). Problems may occur, however, if you use the routines provided in the monitor to read the keyboard, since these routines often look for and act upon certain control characters. For example, on the Research Machines 380Z, depressing Control-F on the keyboard causes the machine to enter the software front panel mode. This can be avoided only by writing an alternative keyboard input routine.

The flowchart in Figure 1 assumes that output to the VDU is much faster than I/O to the RS232 port. Surprisingly enough, this is not always the case. The Research Machines 380Z has a flicker-free display, achieved by scrolling only during the TV frame blanking, which occurs just 50 times a second. So writing a line feed to the VDU can take up to 20ms! Therefore characters will be lost at the beginning of each line for data rates over 50cps (550 baud). To solve this, a flickering display routine must be written — a difficult task on the 380Z as the screen memory is not one contiguous block. In our application (described below) we took the easy way out: we connected a spare VDU to the second serial output port. The main RS232 port was being

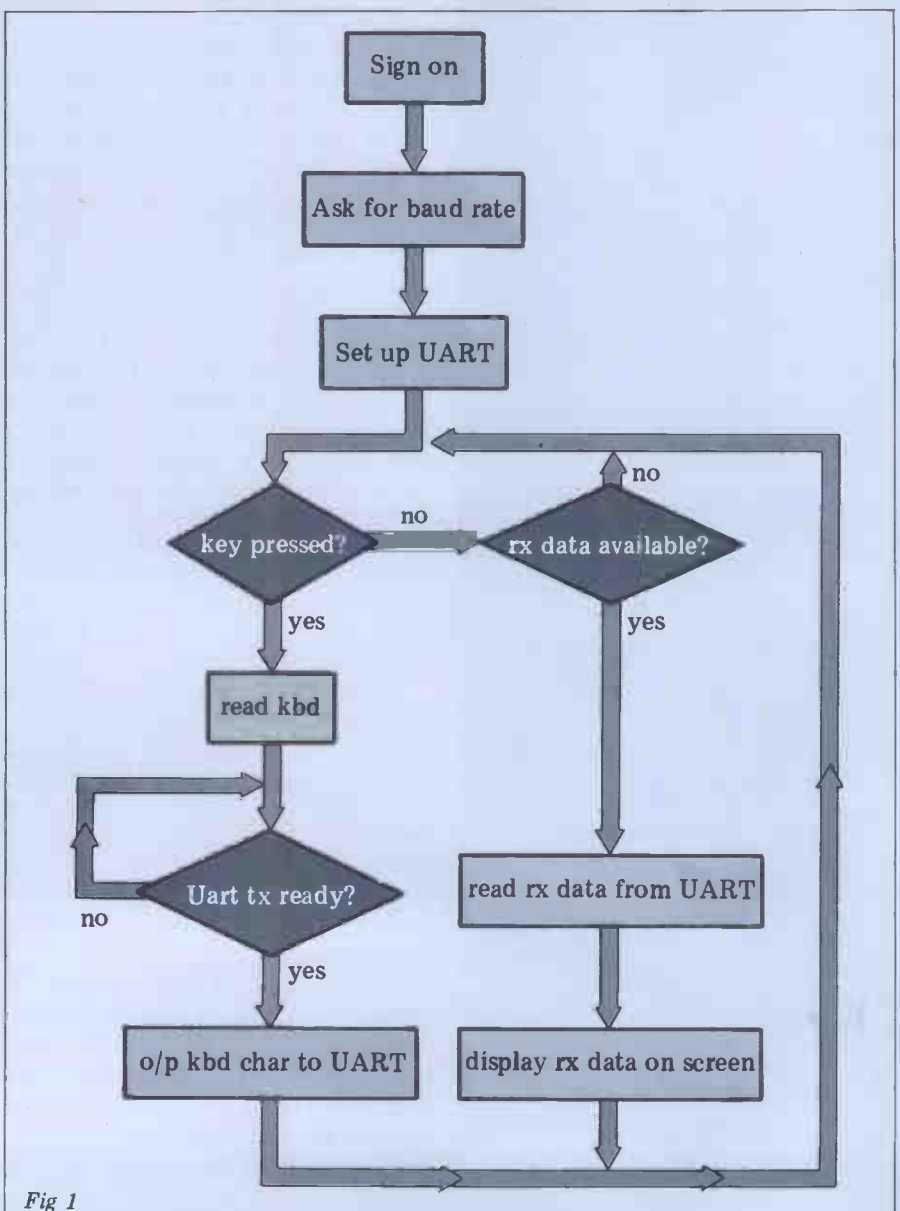


Fig 1

Signal name		Pin number
Protective ground		1
Signal ground		7
Transmitted data	TXD	2
Received data	RXD	3
Request to send	RTS	4
Clear to send	CTS	5
Data set ready	DSR	6
Data terminal ready	DTR	27
Carrier detect		8
Ring indicator		22

Table 2a Main RS232 signals

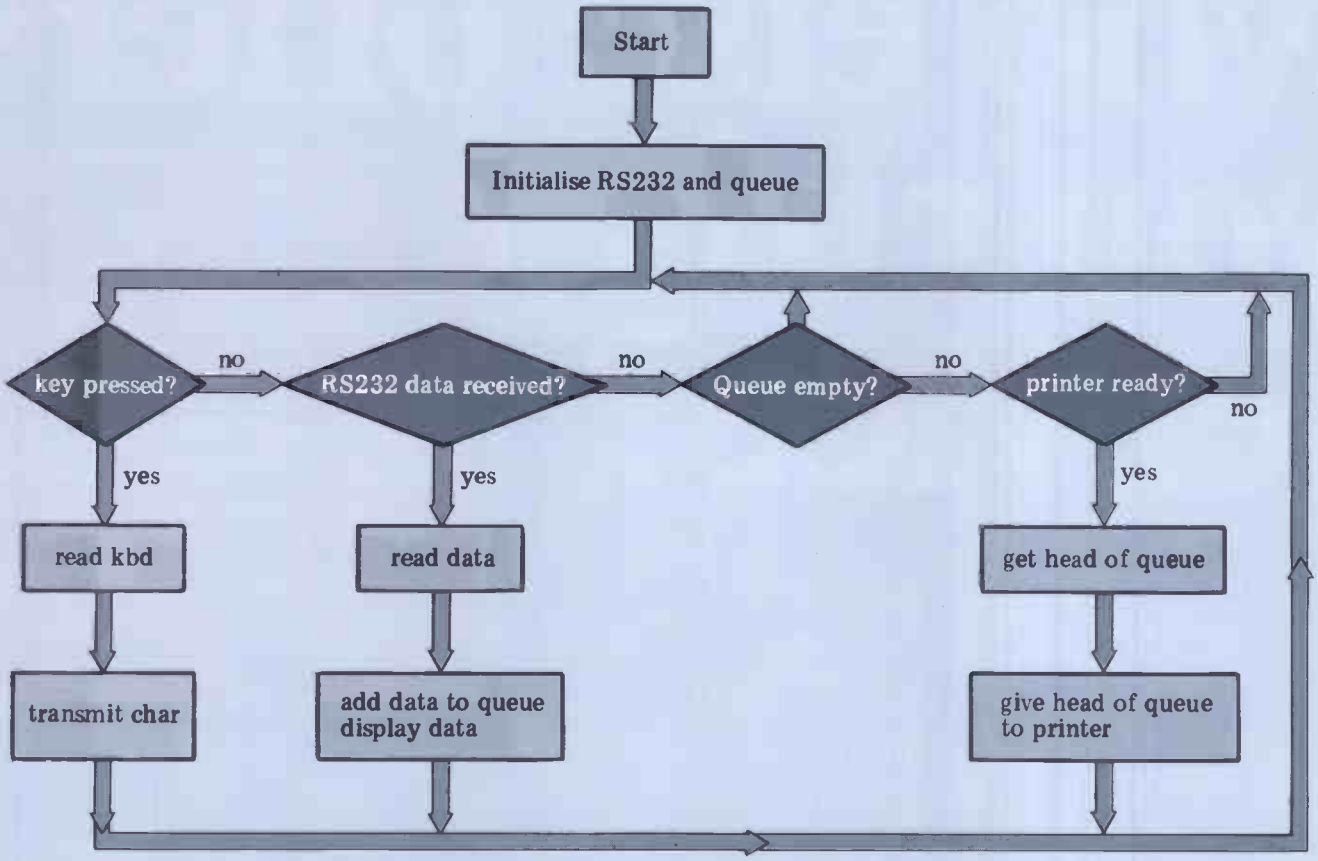


Fig 2

used at 1200 baud so we set the VDU port to 2400 baud; we found that output to the VDU was then sufficiently fast for us not to miss any incoming characters on the main RS232 port. This arrangement worked perfectly as long as one remembered to type on the 380Z keyboard while watching the VDU screen (the second serial port is not bidirectional).

It is possible to copy the dialogue between a mainframe and a microprocessor system to a printer even if the printer is much slower than the RS232 data rate between the microprocessor and the mainframe, always assuming that the printer status ('ready to print' or not) can be tested. To do this the full duplex system in Figure 1 is modified as in Figure 2. All characters received from the RS232 port are queued, and whenever the keyboard, RS232 and printer are not busy a character is taken from the front of the queue and printed. As characters are added and removed the queue will move up the memory buffer allocated to it. If the buffer length is a power of two then the buffer can very easily be made circular (by logically ANDing the 'position in the queue pointer' with 2^{n-1} for a buffer of length 2^n). This prevents the queue growing without limit and perhaps overwriting the program.

Information Transfer	Computer Industry	Telecommunications Industry
Both ways at the same time	Duplex	Duplex
Both ways but not at the same time	Half Duplex	Simplex
One way only	Simplex	Channel

Table 1. Nomenclature for various types of information exchange

Protective ground	is tied to the instrument power grounds and if connected to both the DTE and the DCE they should both have the same power line ground reference.
Signal ground	is the ground reference for interface signals.
Transmitted Data	is used to send serial data from the DTE to the DCE.
Received Data	is used to send serial data from the DCE to the DTE.
Clear to send	is a control signal that indicates that the DCE is ready to receive data on the TXD line.
Data Set Ready	is a control signal that indicates the DCE is connected and prepared to receive/transmit data.
Data Terminal Ready	is a control signal that indicates the DTE is connected and prepared to receive/transmit data.
Request to send	is a control signal sent from the DTE to the DCE that indicates the DTE wishes to send something to the DEC.
Carrier Detect	is a control signal in a modem system that indicates to the DTE that a data carrier is being received from the distant modem.
Ring Indicator	is a control signal in a modem system that indicates to the DTE that a ringing signal has been received by the modem.

Table 2b Major RS232 signals — signal definition

Intelligent terminals

We can now make a cheap VDU-cum-teletype from a micro, but we are still far from realising the full power of the micro as an intelligent terminal. In our application we wished to use the micro as an intelligent terminal that gathered data from various experimental sensors, buffered the results on disk, and at convenient intervals sent the data to a number-crunching mainframe for subsequent processing. We also needed to retrieve the results of the processing from the mainframe and store then on the intelligent terminal's disk for examination, plotting and analysis. This meant we wanted to be able to transmit and receive ASCII files over an RS232 line without making any changes in the software in the mainframe at the far end of

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the line. Such a system has the additional advantages that source programs and data can then be readily exchanged with other similarly equipped microprocessor systems, and that local pre- and post-processing of the results could significantly reduce the amount of mainframe computing time required.

Transmitting a file from the microprocessor system to the mainframe is straightforward. The file is read off the disk a block at a time and sent down the line and, provided the mainframe can buffer up characters as fast as they are received, no problems are encountered. If the mainframe buffer tends to fill up too soon (or it is non-existent) then the intelligent terminal program (ITP) should, after transmitting the carriage return at the end of each line, wait for receipt of the corresponding line feed (supplied by the mainframe). After the arrival of the line feed the ITP can safely assume the mainframe is ready and able to receive the next line.

Receiving a file is much more complicated because writing a block of data (say, 128 characters) to the microprocessor disk takes much more time (2-3 seconds approx) than is needed to transmit a single character from the mainframe. So, unless the mainframe can be persuaded to stop talking at the right moments, data will be lost every time a block is written to disk. To get a mainframe to pause after exactly 128 characters requires non-trivial software to be written for it; this precludes file reception on an ad hoc basis by non-programmers. Also, if a character in a block is transmitted but not received the micro will wait for ever for the 128th character of the block.

The average end user wants to be able to say 'that looks interesting — I'll take a copy of that' and then do so without needing to write fancy programs for his mainframe. Therefore the ITP must be able to buffer up more than a 128-character disk block and must be able to write to the disk only when the mainframe is not transmitting.

It is obviously asking too much for a program to decide when a mainframe is going to pause for enough time to write several kbytes of buffered dialogue to disk and to be able to make this decision independent of which mainframe it is connected to. The ITP could transmit a character meaning 'pause terminal output' to the mainframe whenever the receiving buffer is almost full and then restart the printout when the buffer is written to disk. Unfortunately the 'pause' and 'restart terminal output' control characters are likely to be different for different mainframes. Also 'pause terminal output' may not be noticed immediately, so some characters will be received after it has been transmitted; this again leaves us with the problem of deciding when the mainframe has finally finished transmitting.

To avoid these problems we decided to let the mainframe send a variable number of characters. The user examines the output from the mainframe as it is displayed on the microscreen and decides when the mainframe has finished transmitting. The user then tells the ITP (by pressing a control key unused by the mainframe) that it is safe to write the buffer to the disk. The ITP then does so and replies with a message to the user that it is now safe to restart mainframe output. There will be an upper limit to the number of characters that the mainframe can transmit in one block, since there will only be a finite amount of space for buffer storage in the microprocessor memory.

Ideally we should give an error message when the ITP buffer is almost full. It is difficult to give a decent message such as 'The buffer is almost full' without either data loss or intermingling of received data and error message. A simpler solution is to carry on storing data in the buffer but to echo all received characters as 'bells' or '?'s.

To reduce development time we loosely based our program on a program in volume 25 of the CP/M user group library. Called '88-MODEM', this was written by Tim Pugh. It is intended for sophisticated American modems that include facilities such as auto-dialling, but it can be adapted to British conditions without too much rewriting. Communications programs such as those described above are not recommended for the novice programmer! It is often tricky to debug such programs, since if the program fails to work it may be difficult to decide what caused the fault — this is due to the complex interaction between the communications equipment and the computers at each end of the line. For this sort of program development it is often best to use a terminal or another microprocessor system in the same room to simulate the modem connection to the mainframe. This enables both sides of the dialogue to be seen simultaneously — so, for example, you can verify that characters transmitted at one end of the line are actually being received at the other end.

RS232 for fun and profit

After reading this far you should have enough information to write a user-friendly dumb or intelligent terminal program, based on the RS232 standard, for your microcomputer. In this section we suggest some answers to the questions of whether the RS232 is a good standard for inter-computer communications, and how useful an intelligent terminal program can be.

The standard has some drawbacks — chiefly because it is not being used for its intended purpose, so it cannot be followed to the letter. The use of DTR/DSR for handshaking is a good example of a necessary breach of the standard. More control lines are provided than are needed for computer serial I/O; this has the effect that manufacturers tend to select any six lines from 25.

However, RS232 is very widely used so it shouldn't take much more than a specially wired cable to connect two devices from different sources. Problems start to occur if handshaking is attempted — eg, DTR or DSR may be held permanently high even when the device is not ready to receive.

Another advantage of the RS232 interface is that it is cheap to implement, using widely available special purpose ICs such as the 8251 UART for the Z80, and it is usual for microprocessor systems to come ready equipped with one or two RS232 ports.

With an RS232 port and an inexpensive modem, programs and data can be very cheaply transferred from a micro to other micros or mainframes. In a three-minute phone call costing 5-10p, at a speed of 1200 baud, almost 20,000 characters (about 3500 words of English) can be transferred. To send 3500 words by mail would cost at least 15½p and the GPO will do its best to deliver within a day or so!

One possible concern of a user of a terminal-modem-computer link might be related to the security of the transmission system. He would be worried not only about the possibility of criminal interception and modification of his data, but also about possible corruption of his data by a noisy or faulty line. For instance, say, if data terminals between various branches of a bank and the head office computer were connected using RS232 modem-like links over the public telephone network there would be at least some potential doubt about the security of the data thus transferred. A solution to this problem might involve the use of secure, dedicated land lines. In addition, sophisticated error-checking and correction codes would (hopefully) be used to ensure that only valid transactions were performed.

In this article we have tried to describe the basic elements of the serial RS232 interface. In the computer world ideas and equipment often change radically in a few years. The RS232 interface and the concept of a serial interface are embedded in the basic techniques of the computer designer. Transplanted from its original role of modem-terminal interconnection the RS232 interface now appears on almost every computer and microprocessor back panel. It is frequently the method of communication between processors and printers, plotters and other slow and medium-speed peripherals. Its popularity is based on the availability of cheap custom chips like the UART that provide most of the hardware necessary for the interface, the simple nature of the software needed to drive the interface and the small number of wires (and hence the small expenditure on cabling) needed to interconnnect interfaces.

In the future we can expect to see many more interconnection standards appear (like the Cambridge ring and Ethernet and the RS432 standards, to mention a few). It is difficult to see how the basic effectiveness and simplicity of the RS232 interface can be improved upon for most routine applications. We expect to be typing our programs in via an RS232 port for quite a few years to come.

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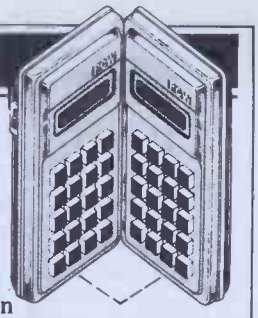


By Dick Pountain

HP'S DEDICATED DUO

In the Dec 81 edition of this corner I reviewed the new Hewlett Packard 11C programmable calculator which, along with its sister the 120 financial calculator, I saw as HP's answer to Casio in terms of features and packaging, if not in price. It now transpires that these two machines were the advance guard of a whole new range of HP calculators designed for specific tasks. The two machines reviewed this month, the 15C and 16C, are the latest additions (don't ask me what happened to the 13 and 14; did I miss them?) and they are both far more exciting than the 11 in their different ways.

The 15C is mathematically oriented and has a range of operations never before offered on a programmable — nor for that matter on many micros that I know of. These include complex number arithmetic, matrix manipulation, numerical integration and equation solving/root finding, in addition to the normal maths and statistical functions.

The 16C is called the Computer Scientist and will be of interest to all terminal junkies rather than the regular readers of this column. It is aimed straight at that slot which the Texas Programmer has had to itself for some years now — machine code programmer's assistant. It has features that go well beyond what's offered by the ageing TI machine and will I suspect find its way into a lot of computer labs as well as the homes of well-equipped hobbyists.

Hardware

The 'TeenC' machines form a coherent range in that the physical packaging is identical; only the model numbers and the legends on the identically laid out keyboards differ. I will therefore refer you to the 11C review for the exact details and, to save space, will concentrate here on the internal differences. To recap briefly, though, both machines have constant memory and 10-digit LCD displays and are powered by three 'button' cells with a life of 60 hours' continuous use or 18 months' memory preservation. Both have built-in hardware diagnostic routines as well as the logic circuitry. It goes without saying that both use Reverse Polish arithmetic.

The 15C has 469 bytes of continuous memory and the 16C has 203; the way this memory is used and managed on the two machines, is very different however.

The 15C has manual memory management similar to that of the 41C — you decide what the highest numbered storage register is to be. There are two fixed storage registers so that only 448 bytes maximum can be allocated to program space. When the partition has been set any registers above the top one named are uncommitted; they are still available for data storage but are automatically converted to program steps when required. Some of this space is used by the 'advanced functions' — ie, matrix, complex, solve and integrate — when they are in use.

The 16C uses automatic memory management similar to that on the 11C; as you enter more program steps data storage space is converted, seven bytes at a time from the top down, into program space. Program space is protected once filled; ie, you can't overwrite program steps by accessing a nonexistent data register, but the reverse obviously cannot be true (ie, data is lost if its register is converted). I can't tell you how many data registers are available because one of the features of the 16C is variable word size. A data register is one word long and that could be anything from four to 64 bits! With a 16-bit (two-byte) word size you could have a maximum of 101 registers (203/2=101.5; the half is not usable for data but will be available for program steps).

On both machines one program line is usually one byte, sometimes two. Both use the same editing functions and numeric op-codes as the 11C.

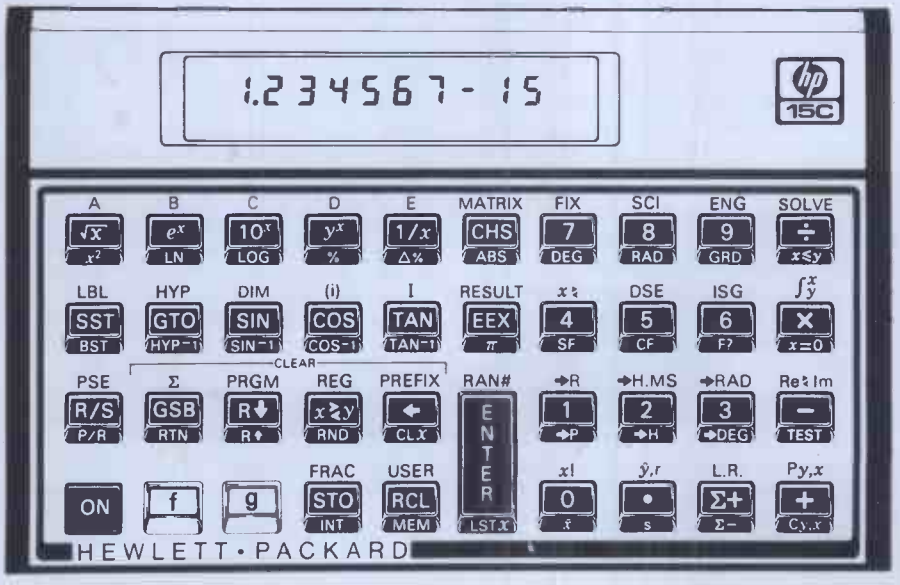
15C firmware

True to the new HP formula the 15C supports three numeric formats, FIX, SCI and ENG, while working internally with 10-digit mantissas. A nice touch, aimed at international markets, is that the digit separators for thousands and decimal point can be swapped to conform with usage in various countries — eg, 23.567.200,12 instead of 23,567,200.12. A very full range of functions is provided, including all the normal trig and logs, hyperbolics plus factorials and gamma functions, permutations, combinations, linear regression and full statistics routines. A random number generator is built in which can be seeded using the X-register contents.

The really interesting operations, however, are the four 'advanced functions'. Of these, solve and integrate have already been reviewed in my review of the HP-34C (*PCW* March 1981) so I shall concentrate here on the complex arithmetic and matrix-manipulation features which are completely new

The complex mode allows all those maths operations which are meaningful to be performed on imaginary and complex numbers as well as reals. This is achieved by creating a second stack, similar to the normal one, which holds the imaginary part of the numbers (critics of Reverse Polish should note the simplicity of this solution). The imaginary stack is actually formed from four uncommitted data registers and is created only when complex mode is entered.

To enter a complex number into the machine one merely types the real part followed by ENTER and the imaginary part followed by the 'I' key. This creates the complex stack and enters complex mode which is flagged by a C annunciator in the display; it also automatically transfers the imaginary part of your number into the imaginary stack. Arithmetic is then carried out as normal: since the display holds only one number it is necessary to exchange the X-registers of the two stacks to view the imaginary part using the 'Re⇋Im' key or to press the '(i)' key which displays the imaginary X-register only while held down. Complex mode remains set once selected and is cancelled only by clearing system flag 8. Real arithmetic is not affected at all by complex mode, as those operations which do not work on complex numbers simply ignore the imaginary stack. The only exception is the rectangular to polar coordinate conversion which operates somewhat differently in complex mode to allow the user of phasor notation. Operations which ignore imaginary numbers include some of the conditional branch tests and functions like factorial and INT. The memory operations STO and RCL work only on the real stack so that a complex number must be stored in two registers using Re⇋Im between the STOs.



It takes a while to become comfortable with the use of these two parallel stacks, only one of which is visible, but once you have the knack complex arithmetic is no harder than real. Certain operations like forming the complex conjugate require thought since the CHS key changes the sign of the real X-register only. Complex mode can be combined with both the solve and integrate routines to find complex roots and integrals; manipulation of complex matrices is rather different and will be discussed below.

Matrix operations

Though of necessity limited by the relatively small memory available, the matrix operations of the 15C are very comprehensive and ingeniously implemented.

A maximum of five matrices may be stored at one time and their combined number of elements is restricted to 64, so the largest possible is a single 8x8. Each matrix is named with a 'descriptor' consisting of one of the letters A-E and two numbers representing the dimensions. The letters are provided on five keys which also serve as branching labels and, in USER mode, to execute labelled programs. These descriptors behave like numbers in that they may be stored on the stack or in a single data-register and they are used to represent the matrix in arithmetic operations.

To create a matrix you must first allocate sufficient memory in the uncommitted area; each element needs one register. Then the matrix is dimensioned using the DIM and MATRIX keys.

A major obstacle to matrix manipulation on a calculator is that only one element can be displayed at a time. This problem has been solved by reserving a special function for the two registers R0 and R1; if the row and column numbers of a matrix element are stored in these registers then they are automatically incremented after any operation has been performed to give the next position to the left, wrapping round the end of rows and returning to 1,1 after the last element is reached. To store or recall elements it is sufficient to press STO or RCL and the matrix's name, eg, B. While B is held down the element's position is displayed, eg, B 2,5. As soon as B is released the operation is performed and the display shows the result. Storage arithmetic functions can be used on matrix elements, eg, STO+. To perform operations on the whole matrix RCL MATRIX is used to bring its descriptor into the display. n STO MATRIX will fill the whole matrix with the number n.

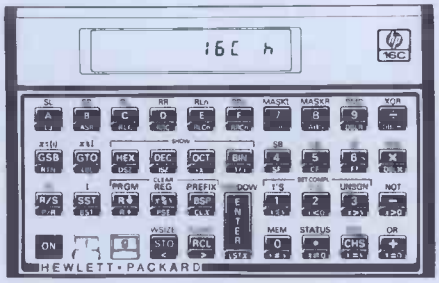
Permitted operations on matrices are: copy, invert, transpose, form the row norm or the Euclidean norm, extract the determinant, scalar addition, multiplication, subtraction and division and matrix addition, subtraction and three matrix products (XY, $Y^T X$, $X^{-1} Y$).

Some of these operations require a separate result matrix to be defined to hold the answer while others allow the original matrix to hold the result; the difference can be crucial with so little memory to play with. The operations are quite fast by calculator standards:

Invert 8x8 matrix	60 secs
Transpose 8x8 matrix	4 secs
Extract determinant 8x8 matrix	28 secs

Complex numbers may be stored in a matrix taking two elements each but complex mode will not support matrix calculations. Instead complex matrices are handled using a real representation which requires only one stack; several transformation routines are provided to allow entry of such matrices in an obvious form and then to turn them into a machine usable form.

Although limited by memory size, these matrix facilities are well designed and are highly suitable for applications such as the solution of simultaneous equations.



HP16C: The Computer Scientist

The 16C is a far more narrowly dedicated machine than the 15C; for instance, its arithmetic functions are limited to +, −, x, ÷ and square root.

It is, however, fully programmable with all the usual conditional tests and flags and an indirect register. Its intended use is as a 'toolkit' for the machine code programmer and it has some very sophisticated facilities for this purpose: it is much more than a hex-to-decimal calculator.

Numeric base conversion is nevertheless an important part of its job and to this end it has keys marked HEX, DEC, OCT and BIN whose functions should be clear. A nice touch is that when these keys are in use an alpha prompt at the right of the display tells you which base you're in. The normal operating mode is integer and it is in this mode that conversions are done. A floating point mode is provided which is decimal only, and pressing the HEX, OCT and BIN keys in this mode forces a return to integer mode. If you merely want to see the, say, octal representation of a number a key called SHOW will display it in this base for as long as the OCT key is held down.

Three sign conventions are supported in integer mode, namely 1s complement, 2s complement and unsigned. These are selected by the COMPL keys and affect the operation of the CHS (change sign) key in the appropriate fashion; in unsigned the CHS key takes the 2s complement and sets flag 5 and a G in the display to show the result is out of range.

The most powerful feature of the 16C is its variable word size. This can be set to anything between one and 64 bits with the WSIZE key. Once set all operations including input and output are performed in this word size; setting a 1-bit size renders the machine rather inarticulate! The smart kids at Corvallis fortunately made WSIZE 0 the same as 64 — without this you might never get out again. Since the displays holds only eight characters it's necessary to scroll it when showing binary in word sizes beyond eight. This can be done either character by character with the ⟨ and ⟩ keys or in eight character chunks with the WINDOW key. A displayed '.' at the right or left side tells you that there are undisplayed digits present at that side.

As well as the five function arithmetic (with carry and out-of-range flags) a full set of bitwise shifts, rotates and logical operators including XOR are provided. There are even MASKL and MASKR, which create left or right justified strings of one bits of chosen size for masking. Three double length operators, double multiply, double divide and double remainder return exact results of twice the current word size.

The #B key returns the sum of the bits in the display register and is handy for checksum calculations.

Given all these features it is possible to emulate virtually any processor ever devised, since even instructions such as complicated indirect jumps could be programmed as a subroutine and assigned to one of the A-E keys. It's quite nice to think that you might have a Cray 1 in your pocket even if its megaflop rate is rather disappointing! More seriously though I suspect that this machine will become almost indispensable to those poor wretches who will have to write for the 68000 or the new 32-bit chips which are threatened. Since it uses Reverse Polish it would be a nice toy for a Forth programmer to find in a Christmas stocking too (hint, hint).

Conclusions

These two machines are produced, packaged and documented up to the standard one has come to expect from Hewlett Packard. The prices are hardly bargain basement at £95.70 for the 15C and £106.34 for the 16C but if you need to do what they do it would be hard to do it any cheaper with such convenience. More interesting is the indication they give of the thinking at HP. For several years the trend was to ever more powerful general-purpose programmable calculators, culminating in the HP-41CV. You can do virtually everything these two machines do on a 41C given the time and ingenuity to write the programs and the patience to load them every time you need to use them. The point being that not everyone has all those requisites and so the dedicated programmable appears on the scene. Aimed at a specific profession with 90 percent of what you need hardwired in and sufficient programming flexibility for you to write the other 10 percent, this seems to me a shrewd choice of direction — and one which will sell a lot of calculators.

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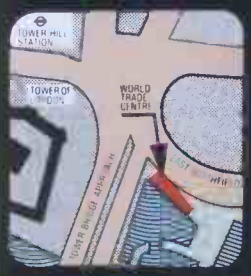

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PCW SUBSET

Alan Tootill presents more useful assembler-language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to: Sub Set, PCW, 62, Oxford Street, London W1A 2HG.

6502 arithmetic

The original 6502 arithmetic routines were printed in February and April and I am pleased to see that some of you have been using them. All the routines work as specified but, as Len Parsons of Enfield was first to point out, they don't fit together as a complete package as well as they might.

Consider the use of SADB46 to convert an ASCII decimal string into a 32-bit signed binary number in M1 - M4, which will be moved to M6 - M9 as the dividend of the SDIV46 routine. If SADB46 is used again to convert a divisor, it will overwrite the dividend in M6 - M9. If the divisor is taken first and moved into MA - MD, it would have to be saved before a second use of SADB46 for the dividend, as it needs MA - MB to hold the address of the ASCII string.

This awkwardness can be eliminated by reallocating the zero page memory throughout all the routines, with the accumulator in M0 - M3, the secondary accumulator in M4 - M7, the tertiary accumulator in M8 - MB, MC - MD pointing to ASCII strings, ME holding the sign of the product of the secondary and tertiary accumulators and MF available as a temporary store.

Vincent Fojut of Altrincham has put in some impressive work on improving all the 6502 arithmetic routines. This very much enhances the value of the original contribution and the process needn't necessarily stop here. I am applying the zero page reallocation to Vincent's improvements, going back to the improved SNEG46 printed in July. This must now be altered to negate (2's complement) four bytes in zero page locations M0 - M3 (instead of M1 - M4) with the most significant byte now in M3.

Vincent's next improvement, which I give here before he changes it again, is to the SADB46 routine we have been considering. He gives two versions, one the fastest and the other the shortest he has achieved to date. The fastest is nine bytes longer but said to be six to seven times faster than the original, while the shortest is 16 bytes shorter and said to be still three to four times faster than the original routine.

The faster version is coded all in line, without lower level loops within the main loop. In both versions speed is gained over the original routine:
1) in multiplying by 10 by shifting as well as adding;
2) rippling carries through the higher bytes of the accumulator by the ADC = 0 instruction, and
3) adding and moving in one block of code, instead of moving the accumulator to the secondary accumulator in one block of code and adding the new digit in a second block of code.

In the short version, Vincent is now duly contrite about the unstructured handling of overflow but it saved two bytes and brevity was all.

Datasheet

```
;=SADB46 - ASCII-decimal to 32-bit binary conversion
;/CLASS: 2
;/TIME CRITICAL? No
;/DESCRIPTION: Converts an ASCII-decimal string to a
;/             signed 32-bit integer
;/ACTION: Clear 32-bit accumulator
;/        If there's a sign, get it & increment
;/        character pointer
;/        Fetch digit & convert to binary
;/        Multiply accumulator by 10 & add digit
;/        Repeat until non-numeric character found
;/        Negate accumulator if sign was '-'
;/SUBr DEPENDENCE: SNEG46 &, for short code, local
;/                 TIMZ2
;/INTERFACES: An area of RAM, pointed to by MC - MD, holds
;/            the ASCII-decimal string
;/INPUT: MC - MD (with the most significant byte in MD)
;/       point to the first byte of the string to be
;/       converted, which may start with a plus or a
;/       minus and is terminated by the first character
;/       that is not an ASCII-decimal digit
;/OUTPUT: For a valid string: M0 - M3 contain the signed
;/        binary equivalent, with the least significant
;/        at M3.  MC-MD point to the start of the string.
;/        The carry is reset.  For overflow: carry is set,
;/        MC - MD point to start of string
;/REGs USED: A,X,Y,P,M0-M7, MC-MD
;/STACK USE: 2
;/LENGTH: 124 for fast conversion, 99 for short version
;/T-STATES: Min 203, max 1650 fast; min 351, max 2878
;/          short
;/PROCESSOR: 6502
;
; fast version
;
SADB64:   LDY £0       ; Zeroise                    A0 00
          STY M0       ;  accumulator               84 zz
          STY M1       ;                            84 zz
          STY M2       ;                            84 zz
          STY M3       ;                            84 zz
          LDA (MC),Y   ; Get first char             B1 zz
          TAX          ; Save it                    AA
          CMP £$2D     ; Minus sign?                C9 2D
          BEQ SDB2     ; Branch if so               F0 56
          CMP £$2B     ; Plus sign?                 C9 2B
          BNE SDB3     ; No, check if valid digit   D0 55
          BEQ SDB2     ; Yes, get next char         F0 50
SDB1:     ASL M0       ; Multiply                   06 zz
          ROL M1       ;  accumulator               26 zz
          ROL M2       ;  by 2                      26 zz
          ROL M3       ;                            26 zz
          BMI OVFW1    ; Check for overflow         30 59
          ADC M0       ; Add                        65 zz
          STA M4       ;  new                       85 zz
          LDA M1       ;  digit                     A5 zz
          ADC £0       ;  to                        69 00
          STA M5       ;  "*2" value                85 zz
          LDA M2       ;  and                       A5 zz
          ADC £0       ;  store                     69 00
          STA M6       ;  in                        85 zz
          LDA M3       ;  secondary                 A5 zz
          ADC £0       ;  accumulator               69 00
          BMI OVFW1    ; Check for overflow         30 43
          STA M7       ;                            85 zz
          ASL M0       ; Multiply                   06 zz
          ROL M1       ;  accumulator               26 zz
          ROL M2       ;  by 2 again                26 zz
          ROL M3       ;  (= *4)                    26 zz
          BMI OVFW1    ; Check for overflow         30 37
          ASL M0       ; Multiply                   06 zz
          ROL M1       ;  accumulator               26 zz
          ROL M2       ;  by 2 again                26 zz
          ROL M3       ;  (= *8)                    26 zz
          BMI OVFW1    ; Check for overflow         30 2D
          LDA M0       ; Get                        A5 zz
          ADC M4       ;  (accumulator              65 zz
          STA M0       ;  *10) +                    85 zz
          LDA M1       ;  new digit                 A5 zz
          ADC M5       ;  by adding                 65 zz
          STA M1       ;  (acc *8)+                 85 zz
          LDA M2       ;  (acc *2 + new             A5 zz
          ADC M6       ;  digit)                    65 zz
          STA M2       ; Store back                 85 zz
          LDA M3       ;  in                        A5 zz
          ADC M7       ;  accumulator               65 zz
          BVS OVFW1    ; Check for overflow         70 15
          STA M3       ;                            85 zz
SDB2:     INY          ; Get next                   C8
          LDA (MC),Y   ;  character                 B1 zz
SDB3:     SEC          ; Is it                      38
          SBC £$30     ;  an ASCII                  E9 30
```

```
            CMP £$10     ;  digit?                  C9 0A
            BCC SDB1     ; Continue if so           90 A6
            CPX £$2D     ; Was 1st char "-"?        E0 2D
            BNE SDB4     ; Skip if not -ve          D0 03
            JSR SNEG46   ;  else negate             20 XX XX
SDB4:       CLC          ; Clear carry to show OK   18
            RTS          ;                          60
OVFW1:      SEC          ; Set carry to show error  38
            RTS          ;                          60
;
; short version
;
SADB46:     LDY £0       ; Zeroise                  A0 00
            LDX £4       ;  accumulator             A2 04
SDB1:       STY M0-1,X   ;                          94 ZZ
            DEX          ;                          CA
            BNE SDB1     ;                          D0 FB
            LDA (MC),Y   ; Get first char           B1 ZZ
            CMP £$2D     ; Minus sign?              C9 2D
            PHP          ; Save test result         08
            BEQ SDB5     ; Branch if true           F0 31
            CMP £$2B     ; Plus sign?               C9 2B
            BNE SDB6     ; No, check valid digit    D0 30
            BEQ SDB5     ; Yes, get next char       F0 2B
SDB2:       STA M4       ; Save new digit           85 ZZ
            STX M5       ; Zeroise rest             86 ZZ
            STX M6       ;  of secondary            86 ZZ
            STX M7       ;  accumulator             86 ZZ
            JSR TIMZ2    ;  multiply acc by 2       20 XX XX
            LDX £-4      ; Add acc *2               A2 FC
SDB3:       LDA M4+4,X   ;  to new digit            B5 ZZ
            ADC M0+4,X   ; Store in                 75 ZZ
            STA M4+4,X   ;  secondary               95 ZZ
            INX          ;  accumulator             E8
            BNE SDB3     ;                          D0 F7
            BVS OVFW2    ; Check for overflow       70 27
            JSR TIMZ2    ; Mult acc by 2 again      20 XX XX
                         ;  (= *4)
            JSR TIMZ2    ; Mult acc by 2 again      20 XX XX
                         ;  (= *8)
            LDX £-4      ; Get acc *10 +            A2 FC
SDB4:       LDA M0+4,X   ;  new digit               B5 ZZ
            ADC M4+4,X   ;  by adding               75 ZZ
            STA M0+4,X   ;  (acc *8) to             95 ZZ
            INX          ;  (acc *2 +               E8
            BNE SDB4     ;  new digit)              D0 F7
            BVS OVFW2    ; Check for overflow       70 14
SDB5:       INY          ; Get next                 C8
            LDA (MC),Y   ;  character               B1 ZZ
SDB6:       SEC          ; Is it                    38
            SBC £$30     ;  an ASCII                E9 30
            CMP £$10     ;  digit?                  C9 0A
            BCC SDB2     ; Branch if so             90 CB
            PLP          ; Was 1st char "-"?        28
            BNE SDB7     ; Skip if not -ve          D0 03
            JSR SNEG46   ;  else negate             20 XX XX
SDB7:       CLC          ; Clear carry to show OK   18
            RTS          ;                          60
OVFW1:      PLA          ; TIMZ2 overflow           68
            PLA          ; Discard return address   68
OVFW2:      PLP          ; Discard saved flags      28
            SEC          ; Set carry to show error  38
            RTS          ;                          60
TIMZ2:      ASL M0       ; Multiply                 06 ZZ
            ROL M1       ;  accumulator             26 ZZ
            ROL M2       ;  by 2                    26 ZZ
            ROL M3       ;                          26 ZZ
            BMI OVFW1    ; Check for overflow       30 F1
            RTS          ;                          60
```

Random numbers for Z80

Readers who have been following the saga of pseudo-random number generation through the 'Sub Sets' for April, July, September. October and December 1981 and February and June 1982 will know what lead to the conclusion that 16-bit routines are not good enough for serious work and to the call for a 32-bit routine with a 2^{32} modulus.

As we saw, Ettrick Thomson of Aldeburgh has serious reservations about routines using a modulus which is a power of two, because of the non-random nature of the numbers they produce. He has therefore given us in our next Datasheet, RD31, a 31-bit routine, using the series $r_{i+1} (2^9 + 1)r_i \pmod{2^{31} - 1}$. It will repeat after $2^{31} - 2$ numbers, giving all possible combinations of 31 bits, except the all-zero and the all-one combinations. The primitive root comes from Werner Linger, 'on a method by D H Lehmer for the generation of pseudo-random numbers', *Numerische Mathematik*, Vol 3 pp265-270 (Oct 1961).

Ettrick does not have the facilities to check that $2^9 + 1$ is a primitive root of $2^3 - 1$, so we will be glad to hear from anyone who has been able to do this.

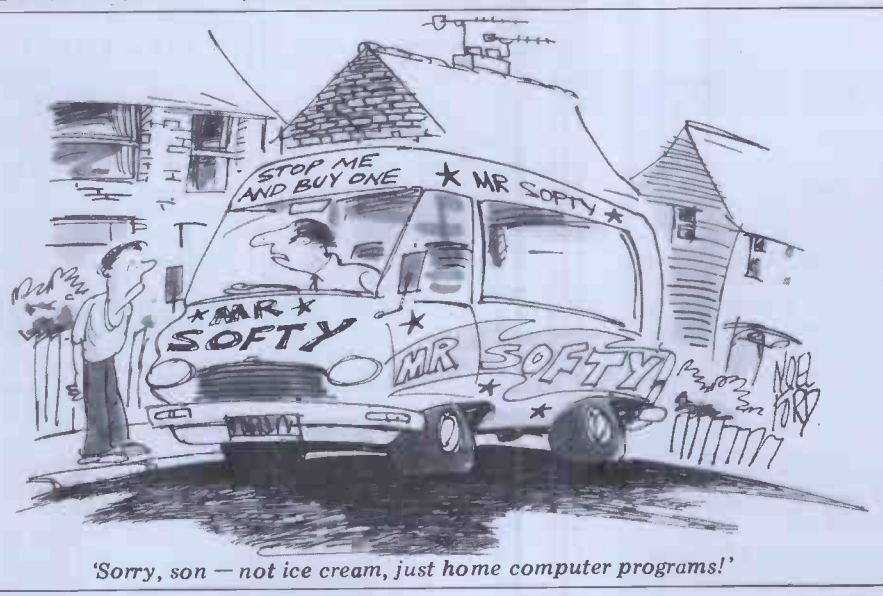
Of the various r_is Ettrick used in testing the routine, the two interesting ones are in Figure 1.

	RN	RN+1	RN+2	RN+3
r_i = 1389794485	181(B5H)	148(94H)	214(D6H)	82(52H)
r_{i+1} = 1	1(01H)	0(00H)	0(00H)	0(00H)
r_i = 2021376542	30(1EH)	194(C2H)	123(7BH)	120(78H)
r_{i+1} =1879048192	0(00H)	0(00H)	0(00H)	112(70H)

Fig 1

Datasheet

```
;= RD31 - 31-bit pseudo-random number generator
;/CLASS: 2 (not position independent)
;/TIME CRITICAL? No
;/DESCRIPTION: Generates a 31-bit pseudo-random
;/             number from the series r(i+1) = ur(i) (mod M)
;/             where M=2^31-1 (a Mersenne prime) and u=2^9+1,
;/             one of M's primitive roots
;/ACTION: Let r(i)=X+2^22Y where X is the 22-bit number
;/        consisting of bits 0-21 of r(i) and Y is the 9-bit
;/        number consisting of bits 22-30.  Form P, the 31-bit
;/        number Y+2^9X and Q, the 32-bit number P+r(i).  Then
;/        Q=ur(i)-YM so that r(i+1) = Q(mod M).  But, since
;/        (as can be shown) 0<Q<2M, r(i+1)=(if Q<M) then Q
;/        else Q-M; note also that if bit 31 of Q is zero,
;/        then Q<M but (since Q=M does not occur) if bit 31
;/        of Q is 1 then Q>M.
;/SUBr DEPENDENCE: None
;/INTERFACES: Four bytes of directly-addressable RAM, RN,
;/             RN+1, RN+2, RN+3 are used to store the
;/             previous number r(i)=(RN)+2^8(RN+1)+2^16(RN+2)
;/             +2^24(RN+3) or a selected seed, for which the
;/             most significant bit of RN+3 must be zero and
;/             the remaining 31 bits are arbitrary, except
;/             that they must not be all zeros or all ones.
;/INPUT: A seed or the previous random number
;/OUTPUT: The new random number r(i+1) is built up in RN,
;/        RN+1, RN+2, RN+3
;/REGs USED: AF,BC,DE,HL
;/STACK USE: None
;/LENGTH: 53
;/TIME STATES: 242 (average)
;/PROCESSOR: Z80
;
RD31: LD   HL,(RN+2)   ; Begin to form P=          2A XX XX
      RL   L           ;  BC+2^16DE                CB 15
      RL   H           ;                           CB 14
      RL   L           ;                           CB 15
      RL   H           ;                           CB 14
      LD   C,H         ; C=bits 22-29 of r(i)      4C
      LD   A,(RN)      ; Carry flag = bit 30       3A XX XX
      RLA              ; A=bits 30,0-6; carry=     17
      LD   B,A         ; bit 7;BC=bits 22-30,0-6   47
      LD   DE,(RN+1)   ;                           ED 5B XX XX
      RL   E           ;                           CB 13
      RL   D           ;                           CB 12
      RES  7,D         ;DE=bits 7-21;P now formed  CB BA
      LD   HL,(RN)     ; Begin to form Q in (RN)   2A XX XX
      ADD  HL,BC       ;  (RN+3)                   09
      LD   (RN),HL     ;                           22 XX XX
      LD   HL,(RN+2)   ;                           2A XX XX
      ADC  HL,DE       ;                           ED 5A
      RES  7,H         ; Reset bit 31 of Q (but    CB BC
      LD   (RN+2),HL   ;  its value is preserved   22 XX XX
                       ;  in the sign flag
      RET  P           ; Return if                 F0
      LD   HL,RN       ;  Q<M with r(i+1)=Q        21 XX XX
INC:  INC  HL          ;                           34
      RET  NZ          ; Return if Q>M with        C0
      INC  HL          ;  r(i+1)=Q-2^31+1          23
      JR   INC         ;                           18 FB
```



'Sorry, son — not ice cream, just home computer programs!'

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*, 62, Oxford Street, London W1A 2HG. *Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish.*

ZX81 REVERSE VIDEO

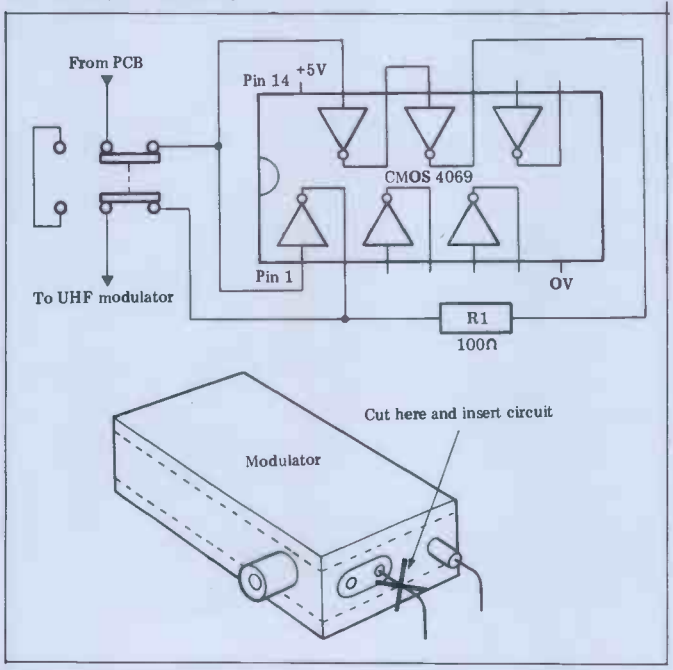
This is an idea to help all those ZX81 owners who are fed up with their black letters on a white background.

The circuit shown inverts the video signal, but, since it also inverts the TV sync signals, it is necessary to reconstitute them using the other two inverters and R1.

The UHF video input terminal (the one nearest the jack socket) has to be cut and the circuit inserted in the cut wire.

The +5V and OV power supplies can be obtained from the back plane.

Richard Wood



ATOM DEBOUNCE

This short routine combines a couple of subroutines in the Atom operating system ROM to overcome the machine's infamous keybounce problem. The subroutines used are the standard keyboard input routine and a delay routine which counts the 60Hz flyback pulses from the video display chip. The assembler source is shown below. Since the code is only nine bytes long it can be entered into some of the spare zero page RAM directly from the command line as:

```
!#A0=#A2FE9420;!#A4=
  #FB832005;?#A8=#60.
```

The patch is installed by loading the start address of the code into the read character vector as follows:

```
!#A0=#A0;?#20B=0
```

This vector will have to be re-installed if the break key has to be used at some point. The length of the debounce period is set by the contents of location #A4 currently five.

```
JSR #FE94 ;Read character.
LDX @ 5 ;Load flyback count.
JSR #FB83 ;Count the flyback pulses.
RTS ;Exit with character in A.
```

John Mackinnon

FASTER PET SCREEN

If you POKE to screen memory on an old PET, you'll notice a lot of flickering. To overcome this during screen display, the print character routine in ROM contains code which waits until the electron beam of the screen is returning from the bottom right hand corner of the screen to the top left hand corner. During this time the screen is inactive and so no flicker occurs. This is all very well, but this waiting slows down the screen handling a great deal.

Later on, Commodore improved the PET's hardware, so that unless the screen was accessed *very* rapidly, no flicker would ever occur. Unfortunately, these improvements came after Basic 3.0 was released, and so the wait routine is still there, even though it isn't needed. In Basic 4.0, however, the wait routine has gone, and the screen printing is much faster. If you have Basic 3.0 and you want the display speed of Basic 4.0, you could change a few bytes in the ROM, but there is a way of getting extra speed by using just two POKEs.

Bit 5 of I/O port B on the VIA is set to act as input, and it is this bit that is set to zero during the flyback period. What the two POKEs do is to set the bit to act as output, and then to set the bit itself to zero. When the wait routine is accessed, it sees that bit 5 is zero, thinks the beam is returning, and so waits no more.

Scrolling, however, is not speeded up and, if a lot of scrolling is involved, the increased speed will not be noticeable if only a few lines are involved. Under optimum conditions — that is, with no scrolling at all — printing is speeded up by about three and three-quarter times.

The two POKEs are:

```
POKE 59458,62:POKE
59456,223
```

It is important to do these two POKEs on one line, as the first defines bit 5 as output, and this bit may be set so that when the PET comes to print out READY, the computer will wait for this bit to go zero, which will never happen. The second poke ensures that this bit is set to zero before any more printing is done.

Finally, a word about monitors. I bought my PET new in January last year. It has the small keyboard and built-in cassette deck. It has only 8K (dynamic not static) but still has a monitor. Whether or not you have a monitor depends on which ROM you have and not, as many people think, on how much RAM you have. The rule is: if you switch on and see '***COMMODORE BASIC***', then you do not have a monitor as you have Basic 2.0, otherwise you *do* have a monitor.

J.D. Slodzik

RAMTOP REVISITED

Having read two issues of *PCW* with tips for resetting RAMTOP on the ZX81, I enclose the 'follow-up' to Geoff Wilkins's idea. RAMTOP can be reset from a program, without stopping it, clearing memory or clearing variables; it simply involves CLS, as follows:

To set RAMTOP to 30000;

```
10 POKE 16388,48
20 POKE 16389,117
30 CLS.
```

As from line 30, RAMTOP will be at 30000 (7530H). This routine does not have to be at the beginning of the program.

Tudor Costigan

TJ's WORKSHOP

NUMBER FORMATTING

I was interested in D Gayler's program in the June TJ's workshop to print numbers, including values less than 0.01, to three places of decimals. If you input some numbers greater than 1, the decimal points no longer fall in line. If you input numbers between 0.0095 and less than 0.01 the system fails altogether and prints .00:

The effect sought by D Gayler, with the additional benefits of showing a leading zero for quantities less than 1 and keeping the decimal points in line when some values are greater than 1, can be achieved using PRINT USING as shown in Program 1.

In some circumstances it could be desirable for the actual number entered to be printed without rounding. Program 2 prints out all the entered figures without rounding and with all trailing zeros supressed to avoid giving a false idea of accuracy.

These programs were run on a TRS80 Level II.

Peter Davy

```
10 LPRINT"NORMAL";TAB(15)"IMPROVED"
20 INPUT N
30 LPRINT N;
40 LPRINT TAB(15) USING"##.###";N
50 GOTO 20

NORMAL          IMPROVED
 12             12.000
 12.2375        12.238
 9.5E-03         0.010
 9.2E-03         0.009
 .543            0.543
 4.67            4.670
 5.786           5.786
 .2039           0.204
 9.87654         9.877
 8.87654         8.877
```

```
10 LPRINT"NORMAL";TAB(15)"IMPROVED"
20 INPUT N
30 IF N=INT(N) THEN A$="##":GOTO 60
40 IF INT(N)=0 THEN M=N+1 ELSE M=N
50 A$="##."+STRING$(LEN(STR$(M))
     -LEN(STR$(INT(M)))-1,"
60 LPRINT N;
70 LPRINT TAB(15) USING A$;N
80 GOTO 20

NORMAL          IMPROVED
 12             12
 12.2375        12.2375
 9.5E-03         0.0095
 9.2E-03         0.0092
 .543            0.543
 4.67            4.67
 5.786           5.786
 .2039           0.2039
 9.87654         9.87654
 8.87654         8.87654
```

ROUNDING

With reference to D Gayler's note about printing floating point numbers to three decimal places (*PCW* June) perhaps some of your readers do not know that B=INT (A*10 ↑ D+0.5)/10 ↑D gives B the value of A rounded to D decimal places.

Peter Howard

TRS-80 EXIT

Here's a routine to deal with situations where your main program calls subroutine A, which then calls subroutine B, then subroutine B wishes to return straight back to the main program without going through subroutine A.

Some Extended Basics allow this, using a POP or EXIT command which deletes from the stack all information concerning the last GOSUB statement executed. So in our example a POP followed by a RETURN in subroutine B would go straight back to the main program.

Program listing 1 contains a short 12-line program to implement such a command on a 16k LII TRS-80.

If the program is typed in and executed it will reserve memory at the top of memory for a short machine code routine; it will also POKE the routine into memory and link the routine to the LINE command, which is only used if you have disks.

The routine poked into memory is only 10 bytes long, and all that it does it to clear all information concerning the last GOSUB from the stack before returning to the program.

Program listing 2 illustrates how the statement is used. If the LINE command in line 50 were not present then the RETURN in line 60 would return execution of the program to line 30, but the LINE command in line 50 clears all information about the GOSUB 50 in line 30 from the stack.

Once program listing 1 has been run the machine code routine will stay in memory until the computer is switched off or crashes — a NEW command will not delete the routine.

The program is short enough to load every time you have a session with your computer and you do not need to set the memory size as the program does it itself. It was written on a Model I, but it should work on a Model III or a Video Genie without any alterations.

Tim Pile

```
10 PRINT"LINE 10":GOSUB 30
20 PRINT"LINE 20":END
30 PRINT"LINE 30":GOSUB 50
40 PRINT"LINE 40":RETURN
50 PRINT"LINE 50":LINE
60 PRINT"LINE 60":RETURN

RUN
LINE 10
LINE 30
LINE 50
LINE 60
LINE 20
```

Listing 2

```
0  POKE 16562, 127: POKE 16561, 245  'SET TOP OF MEMORY
1  POKE 16545, 127: POKE 16544, 195  'SET STRING SPACE
2  CLEAR                             'REINITIALISE
3  FOR I = 32758 TO 32764            'THIS LOOP POKES
4  POKE I,51                         'SEVEN "INC SP"'S
5  NEXT I                            'INTO HIGH MEMORY
6  POKE 32765, 195                   'THIS POKES THE
7  POKE 32766, 30                    'CODE FOR
8  POKE 32767, 29                    ' JP 1D1EH
9  POKE 16803, 195                   'THIS LINKS THE
10 POKE 16804, 246                   'LINE STATEMENT
11 POKE 16805, 127                   'TO BASIC
```

Listing 1

MICROTAN IMPROVED USR

This routine greatly extends the USR(I) instruction of Microtan Basic, whilst using only six bytes of user RAM. It enables more than one machine-code subroutine to be called from Basic without repeatedly POKEing zero page.

To use, enter the following code using Tanbug's M command:

IFFA 20 F5 DF JSR$D5F5
1FFD 6C 33 00 JMP ($33)

Enter Basic, answering 8186 to the memory size prompt. To initialise the subroutine, POKE 34,31: POKE 35,250. This can be done as part of a program or directly. Convert the start address of the machine code into decimal, and use it as the argument of the USR instruction. For example, to call the keyboard scan routine of Tanbug, use J=USR(65018).

If this routine is to be incorporated into a home brew toolkit, then the only modification necessary is the start address poked into memory locations 34 and 35.

Clive Jones

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TJ's WorkshoP

BLINKING CURSOR FOR ATOM

When editing text that includes several inverse characters, it is sometimes easy to 'mislay' the cursor on the Atom. This short program uses interrupts from the VIA to generate a blinking cursor. Never again will your cursor be lost!

The program operation is as follows:
Lines 5-10 set up the assembly of the two machine code routines contained in lines 80-240 and 250-280. Line 20 sets the zero page vectors such that an interrupt is handled by the routine at line 80. Lines 30-40 configure the VIA to generate interrupts (note that LK2 must have been fitted to the Atom board). Line 45 changes the vector for the RDCVEC routine, so that the modified version in lines 250-280 is used. Line 60 determines where in memory the machine code is assembled. This can be changed to any convenient address. Lines 80-80-90 count the interrupts, only blinking the cursor every 9 counts (set in line 100). Lines 110-120 save the X and Y registers. Lines 140-200 use an operating system routine to invert the cursor, pause briefly, and then invert the cursor once more. Lines 210-240 restore all registers, and return from the interrupt. Lines 250-280 are the modified 'read-character' routine. Interrupts are enabled, the standard Atom read character routine is called, and interrupts are disabled. This enables that the cursor blinks only while waiting for input — normal processing speed is not affected.

When the program is run, the cursor will commence to blink! It will continue to do so (irritating, isn't it?) until BREAK is pressed.

Russell Whitworth

```
  1 REM ****************************
  2 REM *** BLINKING CURSOR ***
  3 REM ***   R.S.WHITWORTH   ***
  4 REM ****************************
  5 DIM LL4
 10 FOR N=1 TO 2;GOSUB a;NEXT N
 20 ?#204=LL4%256;?#205=LL4/256
 30 B=#B800
 40 B?11=#40;B?6=#FF;B?7=#FF;B?5=#FF;B?14=#C0
 45 ?#20A=LL3%256;?#20B=LL3/256
 50 END
 60aP=#2800
 70[
 80:LL4 LDA #B804
 90 DEC #A8;BNE LL2
100 LDA @9;STA #A8
110 STY #AA
120 STX #A9
125 LDY #E0
130 JSR #FD44
140 LDX @#20
150:LL0 LDY @#FF
160:LL1 DEY
170 BNE LL1
180 DEX
190 BNE LL0
195 LDY #E0
200 JSR #FD44
210 LDY #AA
220 LDX #A9
230:LL2 PLA
240 RTI
250:LL3 CLI
260 JSR #FE94
270 SEI
280 RTS
290]
300 RETURN
```

BEEB LOAD

I have just been trying out the append routine in the June 82 TJ's Workshop. The routine works fine, but I would like to point out for the benefit of other readers that there is a misleading statement in the article text. It states that a LOAD statement cannot be put on one of the function keys. This is not so; try this:
*KEY9 "LOAD " " " "¦M"

In common with most other compilers, interpreters, and assemblers, BBC Basic allows you to indicate a quotation mark within quotation marks by the use of double quotation marks. I hope you can follow that.

Kam Ho

APPENDECTOMY

I was amazed to see that you dedicated a whole page to BBC APPEND in June's *PCW* when I can do it in two lines.

All you have to do is
1) Load first program
2) PRINT TOP -2
3) Then type *LOAD "SECONDPROGRAMNAME"

This has appended the second program to the first. Even if the line numbers of the second program are the same as the first program you can still RENUMBER it. But any GOTOs or GOSUBs in the second program will be mis-directed and an error will be created. If the line numbers of the second program had already been made larger than the first program's, there would be no problem.

R. Jewsbury

SHORT SHARP BACK-UP

In your June 82 issue Clinton Evans described a method for making a back-up copy of SP5025 Basic. This method can be shortened considerably thus:
1) Load Basic SP5025.
2) Type POKE 10167,1 (CR) — to knock off the PEEK protection in Sharp Basic.
3) Insert a blank cassette.
4) Type USR(33): USR (36) (CR).
5. Press RECORD & PLAY as prompted.

A copy will now be made that can be loaded from the monitor as usual.

The monitor calls USR(33):USR(36) may be used to make a back-up copy of any previously loaded program as long as the monitor pointers FILESIZE and FILESTART remain intact.

Peter Lawrence

UK101 EASY MUSIC

Here is an easy way to make your 101 make music. It could be adapted for use on another micro.

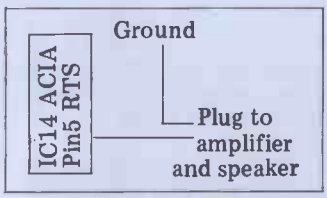
On the ACIA there is a line called the RTS which can be POKEd up or down. If this is done fast enough and it is connected to an amplifier and speaker, music is produced. If the speed of the POKEing up and down is changed the note is changed.

The connection on the ACIA is pin 5, the other is ground. The address to POKE is 61440, up is 64, down is 0. Here is an example program. As speed is important, the values are defined beforehand. To create lower notes the delay of making the computer convert the number into hex is used.

```
1  A=61440:B=64:C=0
2  FOR X=C TO B:POKE A,B:POKE A,C:NEXT
3  FOR X=C TO B: POKE A,B:POKE A,0:NEXT
4  FOR X=C TO B: POKE A,64:POKE A,C:NEXT
5  REM CONTINUE AS ABOVE
10 GOTO 1
```

The RGS line could be used to operate a relay, though the signal may have to be increased.

David Eastlake



TJ's WORKSHOP

BEEB INKEY TWEAK

The BBC still holds a lot of surprises. Here is one. At first glance the INKEY statement seems quite adequate for games and so on. However, it must be followed by a number, eg, INKEY (50). This number is the time in centi-seconds the BBC waits for, whilst checking to see if the key has been pressed.

Most games up to now have used INKEY (0) as an instantaneous check for a key, but there are complications. If you keep your finger on a key for a short while, the keyboard buffer soaks up the extra and so INKEY (0) may still return the value after you stop pressing the key. To get around this most people use *FX 11,1 and *FX12,1 at the beginning of a program to change auto-repeat delay and rate and return to normal with *FX 12,0. Fine, unless you ESCAPE in the middle of a program and try typing with a super-fast repeat and very small delay! Tricky.

Also the arrow keys (which are ideal for games) cannot be used. Again this can be got around by using *FX4,1 which sets the arrow keys to values &88 - &8B; *FX4,0 will restore them to normal use. Again, if you ESCAPE, the cursor keys won't work till you type *FX4,0. Even if you do all this, the INKEY (0) results aren't really satisfactory.

Of course there is a way. The number in INKEY statements need not be positive. For instance INKEY (-1) will return 0 until the SHIFT key is pressed, whereupon it will return -1. INKEY (-2) tests for CTRL key, 0 normally, -1 if pressed. All keys, including the cursor keys, can be tested, each one has its own INKEY number. This acts as a true INKEY statement — PEEK (151) to all PET people and PEEK (197) to VIC owners!

For example, ifyou wanted the F key to fire a laser, use

```
100 IF INKEY (-68) = -1
    THEN PROCLASER
```

Here is the complete list.

Simon Birrell

KEY	INKEY VALUE (all values in decimal)	KEY	INKEY VALUE	KEY	INKEY VALUE
A	-66	2	-50	<,	-103
B	-101	3	-18	>.	-104
C	-83	4	-19	?/	-105
D	-51	5	-20	SHIFT	-1
E	-35	6	-53	DELETE	-90
F	-68	7	-37	COPY	-106
G	-84	8	-22	CTRL	-2
H	-85	9	-39	TAB	-97
I	-38	0	-40	f0	-33
J	-70	=	-24	f1	-114
K	-71	^ ~	-25	f2	-115
L	-87	; +	-121	f3	-116
M	-102	←	-26	f4	-21
N	-86	→	-122	f5	-117
O	-55	@	-72	f6	-118
P	-56	[{	-57	f7	-23
Q	-17	£	-41	f8	-119
R	-52	↑	-58	f9	-120
S	-82	↓	-42	CAPS LOCK	-65
T	-36	+ ;	-88	SHIFT LOCK	-81
U	-54	* :	-73	SPACE BAR	-99
V	-100	] }	-89		
W	-34		-74		
X	-67				
Y	-69				
Z	-98				
1	-49				

SPECTRUM SCROLLING

Anyone who tries POKEing the screen of a Spectrum will soon find out that, although the columns are in a sensible order, the rows are not. This has several side effects: for instance, a scrolling program to move the screen to one side is far easier than one to move it up or down.

Another feature of the Spectrum is that the colour table is laid out conventionally but separately. A scroll program to move text or graphics will not move its colours with it!

Here is my solution to the problem. The program shown will load four separate machine code routines into REMs in lines 1-4. These can then be called in any combination you want.

USR 23760 calls the colour scrolling to the left routine,
USR 23798 calls the right colour scroll.
USR 23836 calls the 'Text left' routine.
USR 23874 calls the 'text right' one.

Please note: all four REM statements should be followed by 32 characters: do *not* enter any colour control codes in them, these count as two characters.

After entering and running the program, lines 5-8 and 100-420 can be deleted, although I would recommend leaving lines 10-13. The new routines can be MERGEd into existing programs, or used to write new ones. How about writing a 'Defender' type program?

For an example of the scrolling, enter these lines with the routines present:

```
20 CIRCLE PAPER6;128,87,80
30 FOR g=1 TO 10:
   RANDOMIZE USR 23760:
   NEXT g
40 FOR g=1 TO 10:
   RANDOMIZE USR 23798:
   NEXT g
50 FOR g=1 TO 10:
   RANDOMIZE USR 23836:
   NEXT g
60 FOR g=1 TO 10:
   RANDOMIZE USR 23874:
   NEXT g
```

I hope this will be of use to someone; I can't be the only one to have a ZX Spectrum, can I?

Bill Longley

```
    1 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XX
    2 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XX
    3 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XX
    4 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XX
    5 FOR g=0 TO 27: READ h: POKE 23760+g,h: NEXT g
    6 FOR g=0 TO 27: READ h: POKE 23798+g,h: NEXT g
    7 FOR g=0 TO 28: READ h: POKE 23798+38+g,h:
NEXT g
    8 FOR g=0 TO 28: READ h: POKE 23798+2*38+g,h:
NEXT g
   10 REM USR 23760 — LEFT COLOUR
   11 REM USR 23798 — RIGHT COLOUR
   12 REM USR 23836 — LEFT TEXT
   13 REM USR 23874 — RIGHT TEXT
  100 DATA 17,0,88,33,1,88,1,255,2
  110 DATA 237,176,33,31,88,14,24
  120 DATA 58,141,92,17,32,0,119,25
  130 DATA 13,200,24,250
  200 DATA 17,255,90,33,254,90,1,255,2
  210 DATA 237,184,33,0,88,14,24
  220 DATA 58,141,92,17,32,0,119,25
  230 DATA 13,200,24,250
  300 DATA 17,0,64,33,1,64,1,0,24
  310 DATA 237,176,33,31,64,17,32,0
  320 DATA 1,192,0,54,0,11,121,190,200,25,24,247
  400 DATA 17,255,87,33,254,87,1,0,24
  410 DATA 237,184,33,0,64,17,32,0
  420 DATA 1,192,0,54,0,11,121,190,200,25,24,247
```

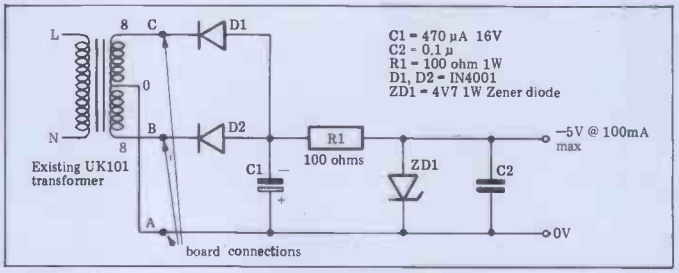
SIMPLER UK101 NEGATIVE SUPPLY

While the circuit shown in June's TJ's Workshop, to derive a negative supply for the UK101, works well and is suitable for many micros (using, say, the CPU clock as a drive signal), a simpler solution is shown in the circuit below.

The existing PSU on the UK101 uses half a full wave centre-tapped configuration, so with the addition of the extra diodes and capacitor the bridge circuit is completed and approximately —10V is supplied.

The resistor and Zener provide stabilisation for currents up to 100mA.

C R Faulkner



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BEEB COLOUR HI-RES

The BBC Computer is a goldmine for micro explorers, with many of its features still undocumented or undiscovered. Jeff Aughton reports on a way to create multicoloured user defined graphics in Mode 2

The comprehensive graphics facilities of the BBC micro are currently the subject of much discussion. In particular, the use of the VDU23 command which enables the user to create her (or his) own graphics characters has been thoroughly documented. This command is simple to use, requiring only an elementary understanding of binary numbers, but unfortunately the character so defined is a *text* character and as such may be displayed in two colours only — background and foreground. To create more exotic graphics shapes requires some knowledge of the screen format. Most programmers will use Mode 2 for video games since it allows the maximum of 16 colours to be displayed. In this mode, each memory location allocated to the screen is responsible for lighting up two dots (the screen is arranged as 160x256 dots) as shown in Figure 1.

We see that the top left-hand corner of the screen is HIMEM and that the following seven locations are allocated to the seven dot-pairs below that on the screen. HIMEM+8 is the top dot-pair of the second character cell, and so on. This process is repeated across the screen.

The first dot-pair on the second text line will be HIMEM+640... and the final dot-pair, at the bottom right hand corner, will be (if my maths is correct) HIMEM+20479.

Writing numbers into these locations will light up one or both dots, although the relationship between the numbers and the colours is rather strange.

Suppose we wish to light up the two dots at memory location LOC with magenta and yellow (in that order). We proceed as in Table 1.

Thus ?(LOC)=39 will produce the desired effect.

This merging process is very laborious and error-prone and so the utility program listed in Figure 2 has been written to assist with the calculations. It will generate the numbers required to

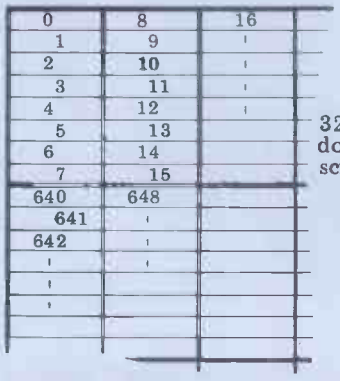
Colour number of magenta = 5 = 0101_2 → 0 1 0 1

Colour number of yellow = 3 = 0011_2 → 0 0 1 1

combining: $0\ 0\ 1\ 0\ 0\ 1\ 1\ 1_2 = 39_{10}$

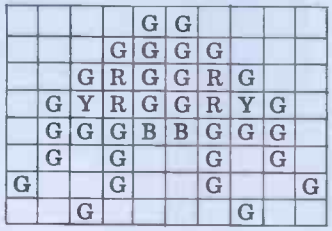
Table 1

80 cells across the screen



locations are shown as displacements from HIMEM

Fig 1 Screen organisation in Mode 2



Key

G= Green B= Blue

R= Red Y= Yellow

Fig 3 Typical pattern

```
.ALIEN   LDX#40          ;NO OF BYTES TO MOVE
.LOOP    LDA BASE,X      ;GET A BYTE
         DEX
         STA LOC,X       ;STORE IT
         BNE LOOP        ;GET NEXT
         RTS             ;ALL DONE
```

Fig 4 Machine code program to draw alien on screen

```
 10 REM UTILITY FOR MODE 2 GRAPHICS
 20 MODE6:DIM A%(10,8),S%(20,8):W%=10
 30 PROCinfo
 40 PROCmenu
 50 ON M% GOSUB 70,90,140,340,410
 60 MODE6:GOTO40
 70 REM QUIT
 80 MODE7:END
 90 REM SET UP NEW PATTERN
100 FORI%=1TOW%:FORJ%=1TO8
110 S%(I%,J%)=0:NEXTJ%,I%
120 INPUT'"WIDTH (EVEN,2-20) "W%
130 IF(W%AND1)OR(W%<2)OR(W%>20)THEN120
140 REM EDIT OLD PATTERN
150 MODE3:PROCboard
160 ON ERROR GOTO 310
170 Y%=1:X%=1:*FX 4,1
180 @%=0:PRINTTAB(AC%+2*X%,8+Y%);"";
190 M%=GET:N%=M%+7*(M%>57)-48
200 IF M%>135 AND M%< 140 THEN 250
210 IFN%<0ORN%>15 THEN190
220 PRINTTAB(AC%+2*X%,8+Y%);CHR$(M%)
230 S%(X%,Y%)=N%
240 GOTO 180
250 M%=M%-135
260 IF M%>2 THEN 290 ELSE M%=M%*2-3
270 X%=X%+M%:IF X%<1 OR X%>W% THEN X%=X%-M%
280 GOTO 300
290 M%=M%*2-7:Y%=Y%-M%:IF Y%<1 OR Y%>8 THEN Y%=Y%+M%
300 GOTO 180
310 IF ERR<>17 THEN MODE7:PRINT"ERROR @ ";ERL:STOP
320 ON ERROR OFF:*FX4,0
330 GOTO60
340 REM VIEW SHAPE
350 MODE2:PROCmerge
360 PRINT"Here is your pattern"
370 FORI%=1TOW%/2:FORJ%=1TO8
380 ?(HIMEM+3479+8*I%+J%)=A%(I%,J%)
390 NEXTJ%,I%
400 PRINTTAB(0,10);:GOTO470
410 REM LIST DATA
420 MODE6:PRINT''"THE SEQUENCE OF NUMBERS YOU NEED IS:"''
430 @%=3:PROCmerge
440 FORI%=1TOW%/2:FORJ%=1TO8
450 PRINTA%(I%,J%);" ";:NEXTJ%
460 PRINT:NEXTI%
470 PRINT'"Press C to continue"
480 REPEATUNTILGET$="C"
490 RETURN
500 DEFPROCboard
510 PRINTTAB(22,4)"***  Press ESCAPE to recall menu ***"
520 AC%=(78-2*W%)DIV2
```

```
530 PRINTTAB(AC%,8)" ";
540 FORI%=1TOW%:PRINT" ";CHR$(96+I%);:NEXT
550 FORJ%=1TO8:PRINT'TAB(AC%)CHR$(48+J%);
560 FORI%=1TOW%:M%=S%(I%,J%)
570 IFM%=0THENA$=" " ELSE A$=CHR$(48+M%-7*(M%>9))
580 PRINT" ";A$;
590 NEXTI%,J%
600 PRINTTAB(0,20)" 0=BLACK              4=BLUE";
610 PRINT"              8=BLACK/WHITE          C=BLUE/YELLOW"
620 PRINT" 1=RED                5=MAGENTA            ";
630 PRINT"9=RED/CYAN             D=MAGENTA/GREEN"
640 PRINT" 2=GREEN              6=CYAN               ";
650 PRINT"A=GREEN/MAGENTA        E=CYAN/RED"
660 PRINT" 3=YELLOW             7=WHITE              ";
670 PRINT"B=YELLOW/BLUE          F=WHITE/BLACK"
680 ENDPROC
690 DEFPROCmerge
700 FORI%=1TOW%-1STEP2:FORJ%=1TO8
710 M%=0:FORK%=0TO3
720 IFS%(I%,J%)AND2^K% THEN M%=M%+2^(2*K%+1)
730 IFS%(I%+1,J%)AND2^K% THEN M%=M%+2^(2*K%)
740 NEXTK%:A%((I%+1)DIV2,J%)=M%:NEXTJ%,I%
750 ENDPROC
760 DEFPROCinfo
770 PRINTTAB(14)"UTILITY 1.0"
780 PRINT'"This utility enables the creation of"
790 PRINT"high resolution colour graphics in MODE2"
800 PRINT"Facilities are available to set up,view"
810 PRINT"and edit the pattern which is formed in"
820 PRINT"an 8 x N matrix (where 2<=N<=20).Use the";
830 PRINT"selection menu to choose the required"'"facility."
840 ENDPROC
850 DEFPROCmenu
860 PRINT''" Options: 1) Quit program"
870 PRINT"           2) Set up new pattern"
880 PRINT"           3) Edit existing pattern"
890 PRINT"           4) View shape"
900 PRINT"           5) List numeric data"
910 INPUT'"Your choice "M%
920 IFM%<1ORM%>5THEN910
930 ENDPROC
```

create colour graphics patterns eight dots deep by up to 20 dots wide (the 20 limit is arbitrary and could be increased).

Obviously one major use of this program is to create SLABs (Sinister Looking Alien Beings) for space games and an example is given below.

To create the SLAB shown in Figure 3, run the program selecting width=10 and feed in the colour information shown in the figure. The program will generate the sequence of numbers:
0,0,0,4,4,4,8,0,0,4,9,11,12,4,4,8,12,
12,12,12,48,0,0,0,0,8,6,7,12,8,8,4,0,
0,0,0,8,8,8,4,0.

Writing these successively into HIMEM+8x,HIMEM+8x+1... HIMEM+8x+39 will draw the SLAB on the screen. For speed, this should be done in machine code and a simple program to do this is shown in Figure 4. Before calling the routine, the 40 numbers should be deposited in 40 safe consecutive memory locations, the first one being at BASE+1 and the last at BASE+40. LOC is assumed to contain a screen location which is divisible by eight. Notice that this program is not complete — it has to be assembled and both BASE and LOC need to be defined.

Obviously, this is a very simple example but it illustrates one possible approach to some sophisticated graphics effects.

Any shapes more than eight dots high would have to be produced by combining two or more such patterns but since they are being written to the screen in machine code speed problems are unlikely to arise. END

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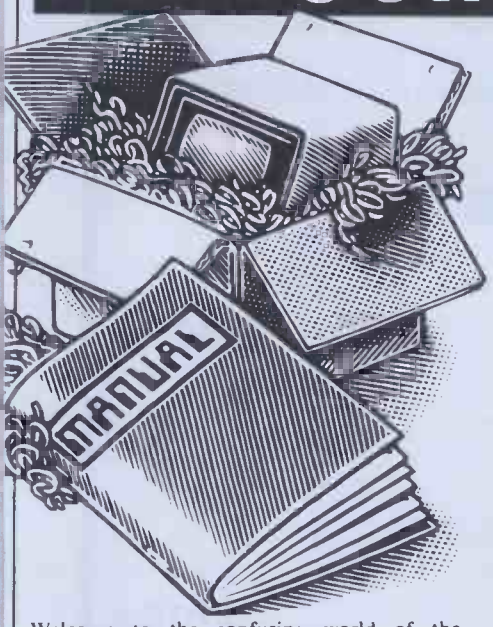

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

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.

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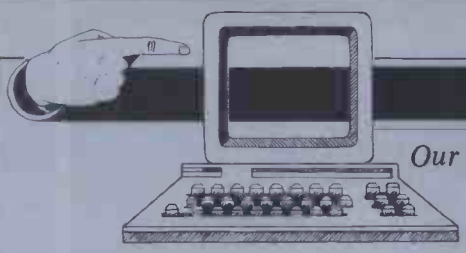

IN STORE

Our bi-monthly guide to microcomputer systems. Updates should be sent to: Dick Olney, PCW, 62 Oxford Street, London W1A 2HG

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 24 (£3195)	AI 09237-70578(19)	64k RAM: Z80A: dual 5¼" F/D (600k): 12", 24 x 80 VDU: 2 x RS232 ports: 3 x P/P	CP/M: *MP/M Basic: Cobol: Fortran: Pascal.*	ABC 26 with dual 8" F/D (2.3Mb) £4500. Options: 10Mb H/D £4000. BT 4/81 (S).
ABC 80 (£738)	Datormark Ltd: 07 44896	16-40k RAM: Z80A: C: 12", 16 x 40 b&w VDU: 4680 bus: IEE 488: RS232 port.	DOS Basic (16k ROM: *Fortran: Pascal: A: Multi user Basic.*	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5¼" F/D (320k) £895: dual 8" F/D (2 Mb). BT 1/80. (I)
ACT Sirius 1 (£2349)	ACT 021 454 8585 (50)	128-512k RAM: 8088: dual 5¼" F/D (1.2M): 12", 25 x 80 VDU: 2 x RS232 ports: 2 x P/P	CP/M 86: U: *Basic: Cobol: Fortran: Pascal*	High res graphics. Options: 10 Mb H/D: dual 5¼" F/D (2.4 M) BT 2/82.(S)
Adler Alphatronic (£1895)	Adler 01-250 1717	48-64k RAM: 8085A: dual 5¼" F/D (320k): 12", 24 x 80 VDU: S/P: P/P	CP/M: *Basic: CBasic: Fortran: Cobol*	With 80 cps printer and dual F/D £2345 (inc CP/M). (S)
Alpha Micro (£5650)	Alpha Micro (UK) Ltd: 01-250 1616 (TBA)	64k — 1 Mb RAM: 16 bit: dual 8" F/D 2.4 Mb): 6 S/P.	Multi-user OS: Basic: M/A: Pascal: U. *Fortran: Cobol*	Modular. Expands to 1200 Mb, 24 terminals or multiprocessor system. (E)
Altos ACS 800-2 £2995)	logitek: 02572 66803 (33)	64k RAM; Z80A; dual 8" F/D (1 Mb): 2 x RS232 ports: 2 P/P.	CP/M: *Basic: CBasic: Cobol.*	Single user. Options: DMA. Floating point processor. Phototyping board.
Altos ACS 8000-10 (£6675)	As above.	280k RAM: Z80A: single 8" F/D (500k): 10 Mb H/D: 6 x RS232 ports: P/P: network RS422 port: DMA	CP/M: *MP/M: Basic: Cobal: Fortran: APL: Pascal.*	Multi-user/multitasking. Up to 4 users. Options: 10 Mb: mag tape backup (S + H).
APL Signet (£1750 or £130pm)	Micro APL 01-834 2687	64k RAM: Z80A: dual 5¼" F/D (380k): 2 x RS232 ports.	CP/M: APL: *Basic: U: Fortran: Cobol: Algol: Forth*	Desktop APL computer with self teaching course. (S)
Apple II (£695)	Apple (UK) 0442 48151 (200+)	16-48k, RAM: 6502: 8 I/O slots.	OS: Basic: *Pascal: Fortran: Cobol: Pilot*	280 x 192 high resolution graphics: Option: single 5¼" F/D (116k) £349.
Apple II (£2496)	As above	128-256k RAM: 6502B: dual 5¼" F/D (286k): 12", 24x80 VDU: RS232 port: P/P.	SOS: *Basic: Pascal:*	Options: single 5¼" F/D (143k) £384: 5Mb H/D £2256. (E) BT 5/82
Atari 400 (£345-16k)	Ingersoll: 01-226 1200 (40)	16k RAM: 6502: C int: cartridge slot: 12 x 20 TV int: RS232C port: touchpad k/b: Opt: C £40	OS (10k ROM): Basic (8k ROM). *Pilot: Forth.*	High resolution colour graphics. 4-channel sound. Four games controller/light pen sockets. BT 10/80. (I/B).
Atari 800 (£645-16k)	As above.	16-48k RAM: 6502: C int: 4 x cartridge slots: 12 x 20 TV int: RS232C port. Opt: single 5¼" F/D (90k) £345: 16k RAM £65.	As above.	As above. Software & RAM on cartridge modules. Up to 4 disk drives. BT 10/80. (I/B).
Athena 8285 (£5694)	Butel-Comco Ltd: 0703 39890 or 01-202 0262 (TBA)	64k RAM: 8085A: dual 5¼" F/D (644k): 12" 25 x 80 VDU: 150 cps printer: RS232 port.	AMOS: T/E: Basic: *Cobol: Fortran: Pascal: APL: M/A.*	Extended ASCII K/B with numeric pad: graphics. Options: dual 8" F/D (2 Mb): up to 1200 Mb H/D.
Atom (£120)	Acorn: 0223 312772 (35)	2-12k RAM: 8-16k ROM 6502: Full K/B: C int: TV int: 20 I/O lines: 1 P/P. Options: 80 col printer £199, Prestel adaptor £120.	Basic in 8k ROM: A Cass O/S.	High resolution graphics on bigger model: colour monitor O/P. Loudspeaker. Note also, systems based on Acorn SBC. BT 7/80(B).
Attache 201 (£8000)	COLT 01-572 3784 (10)	64k RAM: Z80: dual 8" F/D (2.4 Mb): 12" 24 x 80 VDU: 180 cps printer.	Basic: *Fortran: Cobol.*	Upgradable to multiuser system with 18 Mb H/D. Full range of business packages included software dealers TBA. (S)
BASF 7120 (£4400)	BASF: 01-388 4200 (12)	88k RAM: 2xZ80A: 3 x 5¼" F/D (480k): 12", 24 x 80 VDU: RS232 port: P/P	DOS: (OASIS) *Ex Basic: Cobol U. A. CP/M*	H/D available soon. Also 7125 with *960k* F/D £4900 and 7130 with single F/D (430k) & 5Mb H/D £6300. Disk controller has own Z80A. BT 9/80
BBC Micro (£205)	BBC Micro Systems 14 Station Road Kettering Northants (no tel)	16-32k RAM: 6502: C int: TV int: RS423 port: P/P: Option: single 5¼" F/D (100k) £230	MOS: Basic A	Video text & second processor int. 32k model with Econet and disk interface £3.95. BT 1/82 (I)
Billings BC-12 FD: (£3995)	Mitech: 04862 23131 (TBA)	64k RAM: Z80A: dual 5¼" F/D (640k): 12", 24 x 80 b&w (or b&g) VDU.	DOS: Basic: *Fortran: Cobol: A*	With dual 8" F/D (2 Mb) £5995. Additional dual 8" F/D £300 option: 50Mb H/D. (S).
Bonsai SM3000 (£2750)	Bonsai 01-580 0902	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Pascal: Fortran*	Many floppy and hard disk options. Applications software avail. from Bonsai.

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
C/09(£3500)	SWTP Ltd: 01-491 7507 7507 (16)	64k RAM: 6809: dual 5¼" F/D (700k) 9", 24 x 80 VDU: 2 S/P: 1 P/P.	TSC FLEX: *Basic: Fortran Pascal: A: Dis A: T/E: U.*	Expandable to S/09 UniFLEX *32 user system. (H)*
Canon BX-3 (£3000)	Canon 01-680-7700.	32k RAM: 6809: dual 5¼" F/D (640k): 28 char display: 80 cps printer: 3 x RS232 port: P/P.	OS: Basic: A. *Cobol: Pascal*	Fully integral unit. Extensive applications support offered on all Cannon Machines. Options: dual dual 5¼" F/D (640k) £1500.
Canon CX-1 (£2850)	As above.	32k RAM: 6809: dual 5¼" F/D (640k): 12", 24 x 80 VDU: 3 x V24 ports: P/P: light pen.	OS: Basic: A:	Price includes installation & training. Extensive application support offered. Options: dual 8" F/D (1Mb) £3300.(S)
Canon TX-25 (£1450)	As above.	16-32k RAM: 6809: C: 20 char display: 26 col, 2.4 ips printer. Option: 2 x RS232 port.	Basic: A	Fully integral unit. Cassette is Cannon's own design (8k). Can be used with communications. (S).
Challenger IP & C4P (£220 & £395)	CTS: 0706 79332 Millbank Computing: 01-549 7262. Mutek: 0225 743289. Watford Elec Watford 4058 (18)	4.32k RAM: 6502: C int: RS232 port. Options: dual 5¼" F/D (160k) £550: for C4P dual 8" F/D (1.15 Mb) and 20MB H/D	O/S: Basic (8k ROM) *Ex Basic:* A.	D/A conv: colour capability. Runs OSI business software on 8" F/D Plato educational software a ail soon. BT 4/80. (S).
Challenger 2 (£150)	As above	48k RAM: 6502: dual 8" F/D (0.5 Mb): RS232 port.	OS65U: Ex Basic: A.	Designed as low cost business system (S).
Challenger C3 (£2334)	As above	32-56k RAM: 6502: 6800: Z80: dual 8" F/D (1.15 Mb): 2-16 S/P.	OS65U: Basic: *CP/M: Fortran: Cobol*	Expandable to multi-user (8) system. Options: C3B & C3C H/D units, 74 Mb for about £8500. (S&H).
Clenlo Conqueror (£2475)	Clenlo Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM: Z80: dual 8" F/D (1 Mb): 3 S/P: 2 P/P.	CP/M: CBasic-2: Pearl 1: *U Fortran: Cobol: Pascal*	With 2.4Mb F/D £2950. Also H/D systems with 10 Mb H/D & tape drive £543
Comart Communicat (£1995)	Comart 0480 215005 (25)	64k RAM: Z80A: dual 5¼" F/D (780k): 2 S/P: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal*	With 1.5 Mb F/D £2295. With 4.8 Mb H/D & 790k F/D £379 Option: 18 Mb H/D. £ 395 (S)
CommodorePET 16k, & 32k (£550, £69	Commodore: 0753 79292 (150)	16-32k RAM: 6502: C: 9" 25x40 VDU: IEEE-488/port: Options: dual 5¼" F/D (353k) £695: same but (950k) £895	O/S: Basic (in 8k ROM): *Forth: Pilot: Pascal: Comal: Lisp: A*	CBM 8032 with 80-col screen (32-96k) BT 12/80. £895 Field service avail.
Commodore Vic 20 (£200)	Commodore: 0753 79292 (150)	5-32k RAM: 6502: Cint: 22 x 23 TV int: S/P: P/P: Games int.	Basic	Graphics 3 tone sound generator. Will interface to PET. Option: single 5¼" F/D (170k). BT 9/81(S).
Compucolor II (£1175)	Dyad Developments: 08446 729 (TBA)	16-32k RAM: 8080: 13" 32x64 8-colour VDU: single 5¼" F/D (5lk): RS232 port.	DOS (ROM): Ex-Basic (ROM): A. *M/A: T/E: Fortran: U*	32k version £1295. High resolution graphics. 6-month subscription to user magazine inclusive BT 9/79. (S).
Compucorp 625 (£6000)	Compucorp: 01-952 7860 (17)	48-60k RAM: Z80: dual 5¼" F/D (630k): 9". 16x80 VDU: 40 col printer: RS232 port, P/P.	Basic: A: *Fortran: Pascal:* U	IEEE-488 Controller and S100 int. Many applications packages avail. (E).
Compucorp 655/ 665/675/685 (from £5050)	As above	60k RAM:. Z80: Up to 4x5¼" F/D(160k-2.4 Mb): 9", 20x80 or 12" 20x80 or 20" 60x80 VDU: 40-col printer: RS232 port.	As above	Prices incl installation and training. Opt: 10-20 Mb H/D
Computermart 2000 DS (£1500)	Computermart: 0603 615089	32-256k RAM: 8085: dual 8" F/D (1-2 Mb): S/P: P/P.	CP/M: *Cis Cobol: Basic: Fortran*	Expandable to multi-user, multi-tasking,, multi-processor 96 Mb H/D system (around £15000).
Cromemco System Zero/DDF, System 2, System 3, System Z2H. (£2627/£2873/ £4893/£6118).	Datron: 0742 585490. Comart: 0480 215005 MicroCentre: 031-556 7354 (18)	64k RAM: Z80: dual 5¼" F/D (346k) on System Zero, System 2 & Z2H: dual 8" F/D (1.2 Mb) on Sys 3: 10 Mb H/D on Z2H: S/P: P/P.	CDOS: *Basic: Cobol: Fortran: RPG II: Lisp: A: W/P: Multi-user Basic. Cromix.*	System 2 & 3 expandable to Multi-user (max 7) £8373 System 2: £10252 Sytem 3. Options: dual 8" F/D (996k): 11.2Mb H/D. BT 10/79 (E).
DAI (£595)	Data Applications (UK): 0285 2588 (7)	48k RAM: 8080: C int: 24x60 VDU int: RS232 port: over 20 industrial ints. option: dual 5¼" F/D £595	Basic (ROM): U	Colour graphics up to 255 x 335: 3 notes & noise generator: PAL O/P to TV: Paddle int: H maths option. (I). BT 10/80.
Diablo 3000 (£6250)	Business Computers Ltd: 01-207 3344	32k RAM: 8085: dual 8" F/D (1.3 Mb): 12", 24x80 b&w VDU: 45 cps printer.	DOS: Basic: DACL: A: U.	Selection of business packages included (S).
Digital Micro-systems DSC-3 (£3530)	Modata: 0892 41555 (14)	64k RAM: Z80A: dual 8" F/D (1.14Mb): 4xRS232 ports: EIA port.	CP/M: CBasic: *Cobol: Fortran: Pascal: PL/I*	Expandable to multi-user system with 10-28 Mb H/D. Extensive software avail. (S).
Digital Micro-systems DSC-4 (£4395)	As above	128k RAM: Z80A: single 8" F/D (500k): 11 Mb H/D: 4x RS232 ports: 2 P/P.	CP/M: Basic-E: CBasic: *Cobol: Fortran: Pascal.*	Also DSC-3 with 64k RAM. Options: 128k RAM £1295: up to 4 Mb F/D and 20 Mb. H/D. (H).
Durango F-85 (£4995)	Comp Ancillaries: 0784 36455 (12)	64k RAM: 8085: dual 5¼" F/D (1 Mb): 9", 16x64 green VDU: 132 col 165 cps printer: N/P.	O/S: D Basic: *CP/M: CBasic: Micro Cobol.*	Up to 5 work stations: fully integrated system. Options: additional dual 5¼" F/D (1 Mb): 12-24 Mb H/D.(S).

List of Abbreviations

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E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

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MEMO

To: Steven

From: CFJ

Date: 21 August 1982

This sounds more like the type of product and approach we're looking for – will you follow up at Stand 362 PCW Exhibition and we'll discuss on Monday 13 Sept.

Charles

First things first.

First things first. Small business computer hardware or software - which comes first? At Peachtree we know that software has to come first.

It's all a very confusing business at the moment. The microcomputer is growing up, making computer power accessible to thousands of smaller businesses and to departments of larger organisations who couldn't justify it before. The trouble is, you are forced to choose a computer first (the hardware, like the tape recorder) and then find the programs (the software, like the music) to make it do what you want.

Peachtree has changed all that. There is no question now which comes first. It must be the software.

For the first time ever, the small computer user (like the large computer user) has the option of choosing a coheren complete and comprehensive set of *busine software products*, all from the same compa all designed to work together.

Peachtree Financial Management Tools Nominal Ledger and Budgeting, Financial Forecasting, Purchase Ledger, Sales Ledger, Inventory Management.

Peachtree Business Management Tools Sales Order Processing, Payroll Accounting, Name and Address Management.

Peachtree Office Management Tools Word Processing, Automatic Spelling Dictionary, Communications to other computers.

Until now either you, the user, or your computer supplier have had to cobble together a collection of products from different sources to meet some or all of these requirements.

Now - for the first time - your computer supplier can offer you the full set, (or the parts you need to start with) plus all the service you need, from one source.

This means that your software systems are easier to install and you get a quicker return on the investment you make in your computer.

It means that the systems all work

the new IBM P

Now you can go and buy your computer. Ask for Peachtree business software products in the confidence that you will receive skilled and professional advice in their use from your computer supplier, backed up by Peachtree We work through local computer service companies because they are close to your office and your needs.

So, first things first: Send us the coupon or your business card or letterhead. We'll send you the name of your nearest supplier, along with a detailed description of Peachtree business software products and a full explanation of the importance of software. Or telephone Miss Susan Jane at Maidenhead (0628) 71011. Peachtree Software International, MSA House, 99 King Street, Maidenhead, Berkshire SL6 1YF.

I'd like to know more about PEACHTREE business software products.

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

PCW/6/82

.....TELEPHONE NUMBER.....

Please return to Susan Jane, Peachtree Software International, MSA House, 99 King Street, Maidenhead, Berkshire SL6 1YF. Telephone Maidenhead (0628) 71011 Telex: 847400 MSAUK G
MSA (Management Science America) Ltd is a subsidiary of Management Science America Inc.

PEACHTREE SOFTWARE

AN MSA COMPANY

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Dynabyte 5000 Series (£1780)	Metrotech 0895 58111(35)	64k RAM:. Z80: S100 bus: 2 ser ports: 1 par port: any com of 5¼" F/D (630k), dual 8" F/D (1Mb), 9/27/45 Mb H/D, 32/64/96 Mb Cart Module Disk.	CP/M: MP/M: CP/Net, CBasic, MBasic Cobol, Fortran, Pascal, PL/1-80	All systems expandable to multi-user and net working: CP/M inc in base price for F/D system, MP/M for H/D systems.
Equinox 200 (£7500)	Equinox: 01-739 2387 (N/A)	64-512k RAM: Z80: 10 Mb-1200 Mb H/D: 6xS/P: 1 P/P.	CP/M: CBasic: *Cobol: Fortran.*	Multi-user MVT/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&H).
Exidy Sorcerer (£695)	Liveport Data Products: 0736 798157 (27)	48k RAM: Z80: RS232 port: 1 P/P: S100 connector: 30x64 VDU int. N/P.	O/S: Basic (ROM): *T/E: A: CP/M: Algol: Fortran: Basic: 80. Pascal: W/P.*	High-resolution graphics capability: user programmable character set, Option: single 5¼" F/D (316k) £600
Gemini Multiboard (£500)	Micro Value 02403 28321(7)	64k RAM: Z80: 25 x 80 VDU int (with Z80): Option: dual 5¼" F/D £690.	CP/M: *Basic Cobol: Pascal Fortran AP/L: Comal*	Modular system. Other options inc ROM board & EPROM programmer. BT 2/82 (H&S).
Gemini Galaxy 1 (£1450)	As above	64k RAM: Z80A: dual 5¼" F/D (800k): 12", 25x80 VDU: RS232 port: P/P: C int	CPM: *Basic: Comal: Pascal: AP/L: A*	Options: dual 5¼" FD (800k): dual 8" F/D (2.4Mb)
Gimix System 68 (£2000)	SEED: 05433 78151: Windrush 0692 505189	16-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2xRS232 ports.	OS-9: Flex *Basic: Pascal: A: Dis A: T/E:U*	With dual 8" F/D (2 Mb) £2900. Designed as development system for industrial control. (H).
Haywood 3000 (£2121)	Haywood: 01-428 0111. (TBA)	64k RAM: Z80A: dual 5¼" F/D (800k): RS232 port: P/P. Opt: 15" 28x80 VDU £799.	CP/M: *Basic: Cobol: Fortran: Pascal: W/P.*	Also system 7000 with 8" F/D (2.5 Mb) £3100. (S)
Haywood Hinet (£8000)	Haywood 01 428 0111	64k RAM: Z80A: dual 8" F/D (1Mb): 11Mb H/D: RS232 port: RS422 port: P/P.	CP/M: HiNet: *Basic: Cobol: Fortran: Pascal*	Local area network, up to 32 users. Range of H/D avail.
HP 85 (£1830)	Hewlett Packard Ltd: 0734 784774 (16)	16-32k RAM: C.P.U.: 5", 16x32 VDU: C(200k): 64 cps printer: 4 P/P. Options: dual 5¼" F/D (540k) £1408: fusl 8" F/D (2.4 Mb) £3744.	Basic (ROM)	Full dot matrix graphics. Complete range of interfaces, peripherals and application packages avail. 16k RAM £222. (S).
IMS 5000 (£1500)	Equinox: 01-739 2387 (20)	16-56k RAM: Z80: dual 5¼" F/D (320k): 2xS/P: 1 P/P:	CP/M: C/Basic: *Cobol, Fortran.*	3 drives option: (S&H).
IMS 8000 (£2500)	As above	64-256k RAM: Z80: dual 8" F/D (1 Mb): 2xS/P: 1 P/P	CP/M: CBasic: *Cobol: Fortran: MicroCobol.*	Multi-user MVT/FAMOS available in place of CP/M. (S&H).
Intecolor 8000 (£2999)	Dyad Developments: 08446 729 (TBA)	8-32k RAM: 8080: 19", 80x48 colour VDU: single 5¼" F/D (90k): Option: up to 26 Mb H/D.	DOS(ROM): Ex-Basic. *A:M/A:T/E: Fortran: U*	High res graphics avail: Many options including size of F/D and VDU. (S).
ITT 2020 (£867)	ITT: 0268 3040 (15)	16-48k RAM: 6502	Monitor: A: ExBasic: Dis A.	360x192 high res graphics. Ex-Basic in 6k ROM: Options: single 5¼" F/D (116k): £425: 16k RAM, £110: RS232 port, £96: 32k system, £931: 48k system £995: (B).
Ithaca DPSI (£3995)	Ithaca: 01-341 2447 (10).	64k RAM: Z80: dual 8" F/D (1 Mb): 2xRS232 ports: 4xP/P. Opt: H/D.	CP/M: *Basic: Cobol: Fortran: Pascal: A: U.*	Z8000 16-bit processor board avail. IEEE/S100 (8 or 16 bit) compatible. (E).
Kemitron K2000 E (£2300)	Kemitron 0244 21817 (3)	64k RAM: Z80A: single 5¼" F/D (150k): 12", 24x80 VDU: 2xS/P: P/P	CP/M: *Basic: Cobol: Fortran Pascal: A*	Extensive range of support cards and industrial interfaces.
Kemitron K3000 E (£3300)	As above	64k RAM: Z80A: dual 8" F/D (2Mb): 2xS/P: P/P	CP/M: MP/M: *Basic: Cobol: Fortran: Pascal: A*	Up to four screens and four printers can be attached. Options: 10Mb H/D.
LX-500 (£3500)	Logabax Ltd: 01-965 0061 (13)	32k RAM: Z80: dual 5¼" F/D (180k): 12" 25x80 b&w VDU: 100 cps printer.	DOS: Basic: A.	Other printers available. (S).
LSI M-One (£4200)	LSI Computers: 04862 23411 (20)	8-16k RAM: 8080: dual 8" F/D (1.2 Mb): 12", 24x80 b&w VDU	FMOS: A	Choice of standard business packages included in price. (S).
LSI M-Two (£6000)	As above	64-128k RAM: 8085A: dual 8" F/D (1.2 Mb): 12", 24x80 VDU: 60 cps printer	Elsie: *CP/M: Basic: Cobol Fortran: Pascal: A: U*	Max 8 VDUs and 4 printers. Many applications packages available. Option: 10 Mb H/D £2600. (S).
LSI M-Three (£2400)	As above	64k RAM: Z80A: dual 5¼" F/D (350k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A*	Option: 10Mb H/D.
Macro 1 (£3950 or £294 pm).	Micro APL Ltd. 01-834 2687 (TBA)	64k RAM: Z80A: dual 8" F/D (1 Mb): 4xRS232 ports.	CP/M: APL: U: *Basic: Fortain: Cobol: Word-2star Algo: Pascal: Forth.*	Designed as timesharing replacement. Macro 2 with 2 Mb F/D £4750 or £334 pm.
Marinchip M9900 (£4990)	Microprocessor Eng. 0703 775482	128k RAM: 9900: dual 8" F/D (2Mb): 4xRS232 ports.	NOS: Basic: Pascal: W/P: *SPL: Forth: Meta*	Multi-user/multi-tasking OS. Options: H/D up to 120 Mb.
Megamicro (£6080)	Bytronix: 0252 726814(5)	56k RAM: Z80: dual 8" F/D (500k): 12", 20x80 green VDU: 180 cps printer: 2 S/P: 2 P/P.	CP/M: U: *Basic: A: M/A.*	Range of bus. packages now avail. from Ludhouse of Streatham. (H&B).
Micro Trainer 1 (£650)	Hewart: 0625 22030 (N/A)	16-32k RAM: 6800/6809: 10" 16x24 VDU: 2xC int: Opt: dual 5¼" F/D (160k) £595: 8k RAM £17.	Basic: A: *Pascal: PL/M: W/P*	SS50-based system. Graphics avail. Int card with real time clock £17. (1).
Microtan 65 (£69)	Tangerine: 0223 60488(6)	1k RAM: 6502: 32x16 TV int: Exp up to 328k RAM.	2k TANBUG monitor: 2k A, disassembler, cassette firm ware: *10k Microsoft Ex. Basic.*	Options: bulk I/O modules, hi-def graphics, CP/M, system racking, ASCII keyboard. Prestel adaptor (S&H).

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Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Millbank Sys 10 (£2995)	Millbank: 01-788 1083(6).	65k RAM: Z80: dual 5¼" F/D (700k): 12", 24x80 VDU: 2x RS232 ports: RS4449 port: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal: PLI: W/P.*	One high level lang. included. 12-month warranty. Mainframe comm. package. H/D avail. soon. (S&H)
MS5001 (£7450)	BMG Ltd: 0793 37813 (N/A)	64k RAM: 8085: dual 8" F/D (1 Mb): 12", 80x24 VDU: 80 cps printer: RS232.	CP/M: *Basic: Cobol: Fortran: MP/M.*	Price includes desk mounting and one computer. Hardware & software support. Leasing arrangements available. (E).
MSI 6816 (£1200)	Strumech: 05433 4321 (5)	16-56k RAM: 6800: dual 9" 16x64 b&w VDU: C int: 1 S/P: 1 P/P.	Basic: A.	Graphics & PROM programmer available. (S&H).
MSI System 12 (£8000)	As above	56-184k RAM: 6800: 10 Mb H/D: single 8" F/D (500k) 24x80 VDU: 1 S/P: 1 P/P.	SDOS: Basic: CBasic: U.	As above. Business packages avail. Up to four terminals. (H&S).
Munroe EC8800 (£2150)	Fi-Cord Int. 061 445 7716	128k RAM: Z80A: single 5¼" F/D (320k): 3xRS232 ports: P/P	Munroe Multitasking System: *CP/M: Basic: Cobol: Fortran: Pascal*	High res colour graphics. Option: single 5 ÷ " F/D. (320k). £495
Munroe OC8820 (£2990)	As above	128k RAM: Z80A: dual 5¼" F/D (640k): 9", 24x80 VDU: 3xRS232 ports: P/P	As above	5MB H/D avail soon. BT 4/82.
Nascom 3 (£416)	Lucas Logic 0926 497733	8-60k RAM: Z80: dual 5¼" F/D (700k): RS232 port: P/P.	Basic: *Pascal: A: CP/M: Cobol Fortran*	Options dual 5¼" F/D (700k) £685: 48k RAM £130.
NEC PC 8001 (£599)	IBR 0734 664111	32k RAM: Z80A: P/P Option: dual 5¼" F/D (326k) £699	Basic N: (24k ROM) *CP/M: Fortran: Cobol: Pascal.*	Colour monitor £359 (low res) or £579 (high res) both 12", 25x80 many expansion units avail. (E) BT 6/81
Newbrain MB (£199)	Grundy: 0223 350355 (TBA)	32k-2 Mb RAM: Z80A: Nat 420: 2xC int: V int: 2xV24 ports.	CBasic (16k ROM): A.	Graphics. Battery or mains. Options: ½ Mb RAM £450 16 char display £30.(E).
North Star Horizon (£1975)	Comart: (25) 0480 215005. Interam 01 675 5325 (30)x Trader Comp 01-328 3484 (21)	56-63k RAM: Z80A: dual 5¼" F/D (360k): 15", 24x80 VDU: 150 cps printer: 2 S/P: 1 P/P.	DOS: Basic: CP/M: *Cobol: Fortran: Pascal.*	Options: 3-26 Mb H/D, multi-user.
North Star Advantage (£2195)	As above	64k RAM: Z80A: dual 5¼" F/D (720k): 12", 24 x VDU: S/P.	GDOS: CP/M: *CBasic: MBasic: Fortran: Cobol: Pascal*	Price includes business graphics & demo software. 6 slot expansion.
Oki if 800 (£3000)	Encotel. 01 686 9687	64k RAM: Z80A: 2k ROM: dual 5¼" F/D (768k): 12", 24x80 VDU: 80 col printer: loudspeaker: RS232 port: 20k ROM cartridge	Basic: A: *CP/M Cobol: Fortran:*	Fully integral unit. Graphics. Options: dual 5¼" F/D (560k): RS232 port: PP. (I). BT 10/81
Onyx C8000 (£6875)	Onyx Dist Ltd: 0734 664343 Colt 01-577 2150. (TBA)	64k RAM: Z80: 12 Mb Cartridge: 10 Mb H/D: 4 S/P: P/P	CP/M: *MP/M Oasis: Unix: Fortran: Pascal: W/P*	C8001 with 128k RAM £8220. Multi-user version avail. using Oasis.(E) BT 3/81.
Osborne 1 (£1250)	Osborne 0908 615274(30)	64k RAM: Z80A: dual 5¼" F/D (200k): 5", 24x52 VDU: RS232 port. P/P	CP/M: Basic: W/P: *Cobol Fortran: Pascal*	Integral system in weatherproof carrying case. Will run on battery pack. Option: dual 5¼" F/D (400k). BT11/81.
Oscar (£2560)	IDS Ltd: 0908 313997(30)	64k RAM: Z80: dual 5¼ F/D (800k): 12", 25x80 VDU: RS232 port: 1 P/P	CP/M: *Basic: Pascal Fortran: Cobol: W/P:A*	Also avail. with dual 5" F/D(1.6Mb) £2905 and 8" F/D(2 Mb) £3380. Advanced video board. S&H).
Panasonic JD 800M, JD850M (£3300, £4350)	Panasonic Business Equipment: 0753 75841 (10 regional dist)	56k RAM: 8085A: 4k PROM dual 8" F/D JD800M (500k): JD850M (2.4 Mb): 2xRS323 ports. P/P	CP/M: Basic: A *Micro-Cobol.*	Option: 8.4 Mb H/D £2725 (up two). BT3/80(S).
Pascal Microengine (£2295)	Pronto Electronic Systems Ltd: 01-554 6222	64k RAM: MCP 1600: 2x RS232 ports: 2 P/P.	Pascal.	CPU instruction set is P-code: no interpreter needed. Available with dual 8" F/D (2 Mb) £3900.
Pasca 640 (£2500)	Westrex Ltd: 01-578 0957 (TBA)	64k RAM: Z80A: dual 8" F/D (512k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A: W/P: U*	Maintenance contracts avail. Option: 5-20 Mb H/D. (S) BT 5/18
Periflex 630z564 (from £2250)	Sintrom: 0734 85464(5)	64k RAM: Z80: dual 5¼" F/D(1.2 Mb): 2xRS232 ports. 1 P/P.	CP/M: *Basic: Fortran: Cobol:A*	One-day installation training on site included in price. Option: dual 5¼" F/D(630k) £464, dual 8¼" F/D(1 Mb) £1025. 35 Mb H/D. BT 6/80 (S&H).
Periflex 1024/64 (from £2750)	As above	64k RAM: Z80: dual 8" F/D (1.2 Mb): 2xRS232 ports: 1 P/P.	As above	As above
Philips P2000 (£2444)	Philips Data	16-48k RAM: Z80: dual 5¼" F/D (140k): 12", 24x80 VDU: RS232 port.	PDOS: UCSD p-system: *Pascal: Basic Fortran:A.*	With 48k RAM, Pascal and Basic £3300: BT 12/81.(S).
Powerhouse 2 (£1125)	Powerhouse Micros: 0422 48422 (TBA)	32-64k RAM: Z80A: 5" 29x96 VDU: RS232 port: external bus.	4k Monitor: *FDOS: Basic: ExBasic (14k EPROM)*	VDU has flexible screen logic. Options: FDOS & Basic £210: graphics card £200. (H).
Powerhouse 3 (£2600)	As above	32-64k RAM: Z80A: dual 5¼" F/D (350k): 5", 29x96 VDU: RS232 port: external bus.	As above	VDU as above. With 1.2 Mb F/D £3500. ExBasic & FDOS in 14k EPOMs £300. (H).
Prince (£3045)	Digico: 04626 78172 (50)	48-64k RAM: 2xZ80: dual 5¼" F/D (800k): 2xRS232 port: 12", 24x80 VDU	CP/M: *Basic: Pascal: Fortran: Cobol: W/P:A:* T/E:U	High res graphics. Options: single 5¼" F/D (400k) £600: dual 8" F/D(2 Mb) £2000 5-10Mb H/D. Rentals avail. (S).

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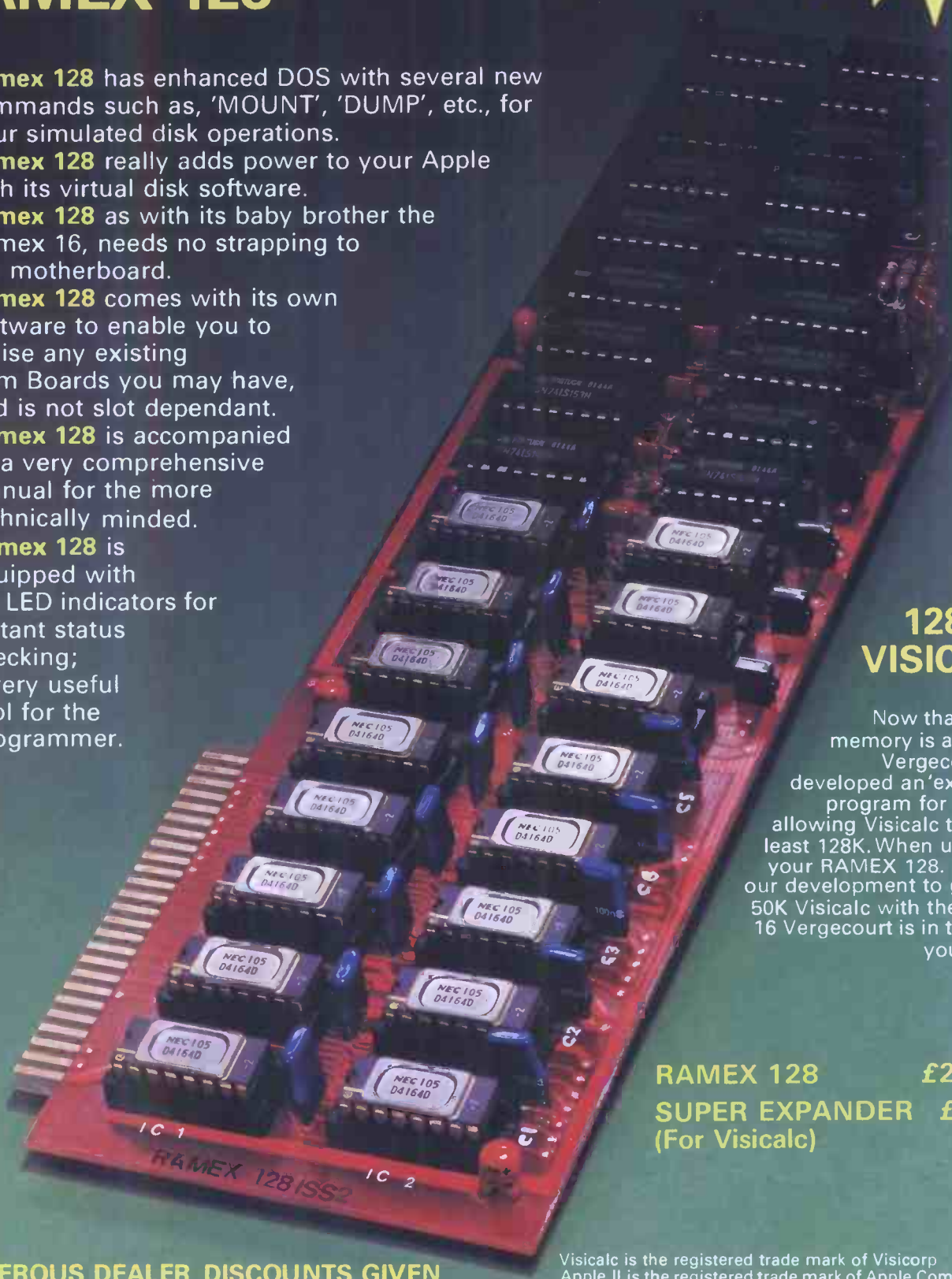
The ultimate in expansion for your Apple II from the people that gave you the RAMEX 16. The first Ram Expansion Card to go strapless.

NEW

RAMEX 128©

- ★ **Ramex 128** has enhanced DOS with several new commands such as, 'MOUNT', 'DUMP', etc., for your simulated disk operations.
- ★ **Ramex 128** really adds power to your Apple with its virtual disk software.
- ★ **Ramex 128** as with its baby brother the Ramex 16, needs no strapping to the motherboard.
- ★ **Ramex 128** comes with its own software to enable you to utilise any existing Ram Boards you may have, and is not slot dependant.
- ★ **Ramex 128** is accompanied by a very comprehensive manual for the more technically minded.
- ★ **Ramex 128** is equipped with six LED indicators for instant status checking; a very useful tool for the programmer.



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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Quantum 2000 (£2250)	Quantum Comp Sys 0532 458877	64k RAM: Z80A: dual 8" F/D (2.4Mb): 12", 24x80 VDU: C int: P/P	CP/M *Basic: Cobol: Fortran: Pascal: A*	Many expansion boards avail inc high res colour graphics. Option: 5-10Mb H/D.
Raannd SPI (£4500)	Raannd: 0506 33372 (TBA)	64k RAM: MCP 1600: dual 8" F/D (2 Mb): 12", 24x80 VDU: RS232 port: P/P	Pascal *ADA: Basic*	Based on Microengine (with integrated P-code). Up to 4 F/D drives. 64k RAM expansion avail. BT 12/80. (S).
Rair Black Box 3/30 (£3750)	Rair: 01-836 6921 (N/A)	64-512k RAM: 8085: dual 5¼" F/D (500k): 6 Mb H/D: 2xRS232 ports.	CP/M: Basic: Cobol: Fortran: M/A	64k RAM expansion £500. 256k RAM £1250. Up to 16 RS232 ports.
Research Machines 380Z (£1867)	Research Machines: 0865 49866 (N/A)	16-56k RAM: Z80A: dual 5¼" F/D (300k) RS232 port. P/P.	ExBasic: A: T/E: U: *CP/M: Fortran: Cobol: Algol: Pascal.*	High res colour graphics. Many possible systems. With 56k RAM & dual 8" 'FD (1 Mb) £3347.
Research Machines Link 480Z (£550)	As above	32-64k RAM: Z80A: C: 2xS/P: P/P	Basic: A: T/E	High res colour graphics. Network station.
S/09 (£7000)	SWTP Ltd: 01-491 7507(16)	128k RAM: 6809: dual 8" F/D (2 Mb): 12", 24x80 VDU: 2xS/P: 1 P/P.	UniFLEX: *Basic: Pascal: Fortran: A: Dis A: TIE: U.*	Expands to 32 users, 768k RAM, 90 Mb H/D, UNIX 'look alike'. (S&H).
Saracen (£1925)	Bytronix 0252 726814 (TBA)	32-64k RAM: Z80: dual 5¼" F/D (800k): 2xRS232 ports.	CP/M: *Basic: Cobol: Fortran: Pascal: A:*	Applicatjons packages & maint contracts avail. With dual 8" F/D (2 Mb) and 64k RAM, £2676. (E).
SBS 8000 (£1449)	Manhattan Skyline Ltd: 0801 3442: C.Itoh 01-353 6090 (TBAz7	64k, RAM: Z80A: 12", 16 x 64 VDU: 1 P/P: RS232 port (extra £133)	ExBasic (24k ROM): *DOS*	Options disk control card £237: dual 5¼" F/D (368k) £795: dual 8" F/D (2 Mb) £1400. BT 11/80. (S)
SEED System 1 (£2000)	Strumech: 05433 78151 (5)	32-56k RAM: 6800: various disk options: 12 ', 24 x 80 VDU: RS232 port: P/P	DOS: Basic U: *Fortran: A: Pilot: Strubal: T/E*	Graphics. PROM programmer Also system 19 multi-user (£3000). (E)
Sharp MZ-80K (£460-34k)	Sharp Electronics (UK) Ltd: 061-205 2333 (22)	6-48k RAM: Z80: C: 10" 24 x 40 VDU: Option: dual 5¼" F/D (289k) £695	Basic, A. *CP/M: Pascal: Fortran: Forth*	Graphics: loudspeaker. BT 10/79 (B)
Sharp MZ-80B (£1045)	As above	64k RAM: Z80A: C: 9", 25 x 80 VDU: RS232 port: P/P.	Basic: *A: Pascal: FDOS*	High res graphics. Options: dual 5¼" F/D (560k) £800: 80 cps printer £415. (S)
Sharp PC3201 (£2995)	As above *CP/M: Cobol*	64k RAM: Z80A: dual 5¼" F/D (500k): C int: 12", 25 x 80 VDU: 70 1pm printer.	DOS: U: Basic: *CP/M: Cobol.*	Various expansion cards avail. BT 7/81 (I&B)
Sinclair ZX81 (£50-kit, £70-built-prices inc VAT).	Sinclair: 0276 66104 (100+)	1-16k RAM: Z80A: C int: TV inb: full K/B: 44-pin expansion port	Basic (8k ROM).	Advanced 4-chip design. Printer now avail. soon BT 6/81
Sinclair ZX Spectrum (£125)	As above	16-48k RAM: Z80A: 16k ROM: T.V. int.	Basic	Options: 32k RAM £60. RS232 port and microdrive disks avail soon. BT 6/82
Signet 202 (£2295)	Interram 01-675-5325 (30)	64k RAM: Z80A: dual 5¼" F/D (400k): 12", 24 x 80 VDU: 2 x RS232 ports: 80 col printer.	CP/M: *Basic: Fortran*	Options: dual 5¼" F/D (800k): 3-12 Mb H/D, Multi user.
Smoke Signal Chieftan (£1800)	Windrush 0692 405189: Seed 05433 78151 (TBA)	32-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2 x RS232 port.	DOS: *68/FLEX: Basic. Fortran: Cobol: A. Disc A: Pascal: U.*	With daul 8" F/D (2 Mb) £2600. Designed as development system for industrial control. (H).
Solitiare WP & BS200 (£6750 & £8200)	Solitaire KPG: 01 995 3573 (TBA)	64k RAM: 8085: 14" VDU (with own CPU): 45 cps printer: CPU port: dual 5¼" F/D (700k) 8" F/D (1.02 Mb) with BS200.	DOS: Basic	All solitaire systems are compatible: anmd can be upgraded to multi-user H/D system. (S)
Sord M100 ACE (£2339)	Midas Computer Services Ltd: 0903 814523 Exleigh Bus. Mach. 0735-66577.(10)	48k RAM: Z80: 8k ROM dual 5¼" F/D (245k): 24 x 64 green VDU: RS232 port: N/P	O/S: Basic: *A: Fortran: Pascal.*	Up to 3 drives possible. Colour graphics avail. Option S100 bus. (I)
Sord M223 Mk II-VI (£4078)	As above	64k RAM: Z80: 8k ROM: dual 5" F/D (700k): 12", 24 x 80 green VDU: RS232 ports: S100 bus: N/P	*O/S:* Ex Basic: *CBasic: Multi-User Basic: Fortran: Cobol*	Expandable to 4 Mb F/D. 32 Mb, H/D, 5 screens, 2 printers. M243 with 192k RAM & 1.4 Mb F/D £5087.
SPC/1 (£3770) (TBA)	Digital Data: 01-573 8854	64-1024k RAM: 8085 A-2: dual 5¼" F/D (90k): 12", 24 x 80 VDU: 2 x RS232 ports: Option: single 8" F/D (1 Mb) £1090:	Mikados, Comal: Pascal: A.	With 32k RAM and single F/D (Comal only) £1995. Expandable to multi-user system (8 users). BT 7/80 (S).
Superbrain (£1750)	Icarus: 01-485 5574 (45)	64k RAM: 2 x Z80: dual 5¼" F/D (320k): 12" 25 x 80 VDU: 2 x RS232 port.	CP/M: A: *Basic: Cobol: Fortran: APL: Pascal*	Limited graphis, Mainframe int avail. Full range of appliation packages avail. Also avail with 700k & 1.5 Mb F/D. BT 8/80. (S&H)
System 10 (£2995)	Millbank 01-788 1083 (TBA)	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24 x 80 VDU: 2 x RS232 port: P/P	CP/M: *Basic: Fortran: Pascal: Cobol: PL/1: W/P*	12 month warranty. Maint. contracts. Applications packages avail. Choice of high level language in price. (E)
System 20 (£3500)	Extel: 01-739 2041 (TBA)	64-512k RAM: Z80A: dual 8" F/D (1 Mb): 12", 24 x 80 VDU: 3 x V2	CP/M:E Basic: *M Basic: Pascal: Cobol: Fortran*	Maintenance contracts avail (132 field service engineers). Expands to multi-user system. Options 13.7 Mb H/D £5799: 27.4 Mb H/D £6674. (S)
Tandberg EC10 (£3250)	Tandberg: 0532 774844 (N/A)	64k RAM: 8080 A: single 8" F/D (250k): 12" 25 x 80 VDU: 7 x RS232 ports: printer int.	CP/M: Ex Basic (24k) *Multi-user Basic: Pascal: Cobol:* A: U:	Up to 7 terminals. Includes V28 comms port. (S&H)

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

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A COMPACT STAND ALONE COMPUTER - JUST ADD TERMINALS

from **£995**
(inc. CP/M & SUPERVYZ)

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EPISODE™

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The EPISODE comes complete with a unique software system called SUPERVYZ, **"the computer users best friend".** SUPERVYZ allows a non technical user to easily operate the computer and utilise the full capabilities of CP/M. A secretary can work the system and simply command the computer through a series of menus.

SPECIFICATION

Op.System: CP/M 2.2 with SUPERVYZ
RAM: 64K
Processor: Z80A, 4MHz
Floppy Disc: up to 1.6 M byte
Hard Disc: up to 10 M byte of Winchester
Interfaces: 2 Serial RS232 channels, 1 parallel centronics
Facility: Battery powered calendar clock

AND TERMINALS...

VDU's	ADDS DEC Lear Siegler
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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Tandy TRS-80 Model 1 (£252)	Tandy: 0922 648181 (200)	4-48k RAM: Z80: C: 12", 16 x 64 VDU: RS232: P/P	Basic (4k ROM): A.	Fully expandable. Option: single 5¼" F/D (175k) £320 (up to 4). Many extras available. 32k RAM £304. (I)
Tandy TRS-80 Model II (£2347)	As above	64k RAM: Z80: single 8" F/D (500k) 12" 24 x 80 VDU: 2 x RS232 port: P/P	Basic *M/A Fortran: Cobol*	Option: single 8" F/D (500k) £782 (subsequent £391, up to 4).
Tandy TRS 80 Model 3 (£500-£1700)	As above	See Model I Levels I and II		Fully integral unit. Up to 2 integral and 2 external 5¼" F/D. BT 8/81
Tandy TRS-80 Colour (£304)	As above	4-16k RAM: 6809: 8-16k ROM: C: 16 x 32 TV int: RS232 port.	Colour Basic.	With 16k RAM, 16k ROM & Extended Colour Basic £390 (I). BT 9/81.
TECS (£1200)	Technalogics Computing Ltd: 061-793 5293 B&B Computers Ltd: 0204 26644 (TBA)	4-56k RAM: 8k PROM: 6800/ 6809: 2xC: TV int: 2xRS232 ports: internal viewdata modem & printer port.	FLEX: Basci: *Pascal: TDOS: A: T/E: Pilot: Fortran: Cobol.*	Fully viewdata compatible. Options — dual 5¼" F/D (320k) £850: dual 8" F/D £120 £1200. (S&H).
Terodec PBM-1000 (£4020)	Terodec: 0734 664343 (40)	80k RAM: Z80A: single 5¼" F/D (819k): 6Mb H/D:2xS/P: P/P	CP/M CP/Net CBasic: *Fortran: Pascal: Cobol*	System with Okidata 80 printer: TV1 910 VDU: W/P and various application packages £5995 (S&H)
Terodec Delta (£3770)	As above	64k RAM: Z80A: dual 8" F/D (2 Mb): 2 S/P: 3 P/P. Options: 10 Mb H/D: Tape.	CP/M: *MP/M: CP/Net: CBasic: Fortran: Pascal: Cobol: Basic.*	2 user system with 10 Mb H/D £7750 4 user system with 40 Mb H/D & tape back up £12050. (S&H)
TI 99/4A (£299)	TI: 0234 67466 (TBA)	16-48k RAM: 26k ROM: 9900: 2 x C int: 24 x 32, 16 colour TV int: 3 tones & noise: P/P.	OS: Basic.	12 month guarantee. Options 32k RAM: 2 x RS232: 3 x 5¼" F/D (92k each): Speech Synthesiser.
Tuscan CP/M Starter (£999)	Transam: 01-405 5240 (N/A)	24k RAM: Z80: single 5¼" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: *Basic: Fortran: Pascal: Cobol:*	Options: single 5¼" F/D (190k) £155: single 5¼" F/D (370k) £285: 16k RAM £162: 3 Mb H/D £1450: 20 Mb H/D £2970 (S&H)
Tuscan Starter Kit (£299)	As above	8k RAM: Z80: Cint: 56-key K/B Options: Case £110: 5 x S100 socket £20: TV int £3.50	8k Basic	Fully assembled version £499 BT 1/81 (H&S)
Vector MZ (£2650)	Almarc: 0602 52657 (3)	56k RAM: Z80A: dual 5¼" F/D (630k): 3 S/P: 2 P/P.	CP/M: Basic: *Algol: Cobol: Pascal: Fortran Coral: CBasic: A.*	High resolution graphics. Also system B with video board & terminal £3450. (E)
Vector System 2800 (£4600)	As above	56k RAM: Z80A: dual 8" F/D (2.4 Mb): 3 S/P: 2 P/P	As above	High-res graphics. Many Options. Fully expandable to 5005 multi-user system (max 5) £5400.
VIP (£2650)	Almarc 0602 52657 (3)	64k RAM: 3k ROM: Z80B: single 5¼" F/D (630k): 12", 24 x 80 VDU: RS232 port, 3 x P/P	CP/M: *Basic: fortran: Cobol: Pascal: A.*	Up to 3 additional F/D drives. Options: dual 8" F/D (2 Mb) £1063, 32 Mb H/D (TBA). (H&S). BT 2/81
Genie I (£299)	Lowe Electronics: 0629 2430 (N/A)	16k RAM: Z80: 500bps C: 16 x 64 TV int: extra C int: 1 P/P	Basic (12k ROM): *Pascal: A M/A: Fortran*	Options: single 5¼" F/D (184k) £220; dual 5¼" F/D (368k) £375 (I)
WH8 (£352)	Heath 0452 29451 (N/A).	16-64k RAM: 808A (or Z80): 4 S/P. Option: single 5¼" F/D (102k) £241	OS: HDOS: CP/M: *Fortran: Pascal: Basic*	Kit. 3 drives max. Colour graphics avail. (S&H) BT 2/80.
Xerox 820 (£1845)	Business Comp Sys 01 207 3344	64k RAM: Z80: single 5¼" F/D (162k): 12", 24 x 80 VDU: 2 x RS232 ports: P/P	Monitor: *CP/M: Basic: Cobol: Fortran: Pascal*	With 8" F/D (500k) £2250. CP/M £95. BT 1/82 (S + H)
Zentec (£4838)	Zygal Dynamics: 02405 75681 (TBA)	32-64k RAM: 2 x 8080: dual 5¼" F/D (256k): 15", 25 x 80 VDU: RS232 port.	OS/: A: U: *Basic:* Cis Cobol	User programmable character set. Option: dual 8" F/D (1 Mb). (S)
Zenith WH-11A (£2673)	Heath Ltd: 0452 29451 & 01-636 7349 (N/A)	LSI 11: 16-32k RAM: 25 x 80 VDU: S/P: P/P.	*O/S: Basic, Fortran:* A: U	PDP 11-compat. Option: 2 x 8" F/D (1 Mb). £171. (S&H).
Zenith Z89 £1570-£1710	As above	16-48k RAM: Z80: single 5¼" F/D (102k): 12 ' 24 x 80 b&g vdu: RS232.	*Basic: A: HDOS:* CP/M: *MBasic: CBasic: Fortran.*	3 x 5¼" F/D possible. Options: dual 8" F/D (1 Mb) £1717, 20 Mb H/D.
Zilog MCZ 1/05 (portable): MCZ 1/20A (£3250)	Thames Systems: 084421 5471 (N/A)	64k RAM: Z80: dual 8" F/D (600k): RS232 port: MCZ1/20A only 1 P/P: Option: 10 Mb H/D £7100	RIO: O/S: *Cobol: Basic: Fortran: Pascal M/A: U.*	Available desk top or rack mounted. Debug in 3k PROM. 1/20A runs multi-user Cobol, up to 5 terminals with 40 Mb H/D. (S&H).
Z-Plus (from £400)	Rostronics Ltd: 01-870 4805 (16)	64k RAM: Z80A: dual 8" F/D (0.5/1Mb): 12" 24 x 80 VDU: 4 S/P: 1 P/P	CP/M: MP/M: A: U: *Basic: Cobol: Fortran: Pascal: APL: PL/I: Algol.*	Complete with furniture. Various business packages avail. Option: 20 Mb H/D £4000. BT 12/79 (S&H)

SINGLE BOARDS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Acorn System 1-5 (£65-£1600)	Acorn: 0223 312772 (35)	11/8k RAM: 6502: EPROM socket: Hex K/B: C int: 8-digit LED display: up to 16 ports. Options: Eurocard 64-way connector: VDU card: full K/B card.	½k monitor: *Basic. Pascal: Forth: DOS.*	Kit. Programmable address linking. On-board 5 V regulator. linking. On-board 5 V regulator. Can be expanded to disk-based system. (S&H)
AEX-09 (£750)	Micro Design 0908 663655	8k RAM: 32k PROM: 6809: 16 I/O lines: RS232 port: RS422 port.	OS-9: *(Basic: Pascal: Fortran avail soon)*	Full A/D & D/A conversion facilities. 4 x 8 but outputs. (H)
Aim 65C (£259)	Pelco: 0273 722155(7)	1-4k RAM: Full K/B 2 x C: 20 char LED: 20 char thermal printer: RS232 port.	A. Disc A: T/E: 8k monitor: *Basic (8k ROM): PL65. Forth*	Expandable using RM65 models to full disk systems. (E)

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
BEX-09 (£850)	Micro Design 0908-663655	64k RAM: 6809: 64k PROM: 2xRS232 ports: P/P	1k Monitor	Multi-processor interfaces on board.
Bigboard (£450)	Maclin-Zand 01-837 1165 (N/A)	64k RAM: Z80, F/D controller: 24 x 80 VDU controller	2k monitor: *CP/M: Basic: Fortran: Cobol: Pascal: A.*	Many options. Will support up to four 8" F/D drives. BT 3/81. (E)
Biproc (£119)	B L Micros: 0494 44307. (TBA)	1k RAM: Z80: TV int: RS232 port. Opt: 4k RAM £8: K/B £30.	2k Monitor: A.	With 9980 instead of Z80 £155 as well as Z80 £180. Kit. (H)
Cromeco SC (£355)	Comart: 0480 215005 (25) Datron. 0742 585490.	1k RAM: Z80A: 8k EPROM sockets: RS232 port: 3 P/P. Option: S100 bus.	Monitor: *Basic.*	5 program interval timers. Can put own Basic program in EPROM. (E)
Elf II (£50)	Newtronics: 01-348 3325 (N/A)	¼-64k RAM: RCA 1802: Hex K/B: 2-digit LED: TV int: C int: RS232. Options: Full K/B: VDU card.	1k monitor: A: Dis A: T/E: Elf-bug *Tiny Basic: Basic,*	TTY N-line decoders. Low resolution graphics (high res avail). Kits or built. Full range of peripherals. (H).
Explorer (£82)	As above	4-64k RAM: 8085: Full K/B. RS232 port: 6 x S100 bus: C int: 1k video RAM.	2k monitor: *Basic (8k) CP/M: Basic Fortran: Cobol.*	Supplied in kit or built. Full range of peripherals including F/D. (H)
Hewart 6800S (£299)	Hewart: 0625 22030 (N/A)	16k RAM: 6800: full K/B VDU int: 2 x C int: 1 S/P: 2 P/P: Option: 16k RAM £90	1k monitor: A: T/E.	Can be upgraded with 6809. (H)
Hewart 6800 Mk 111 (£152)	As above	1k RAM: 6800: VDU board	1k monitor.	Options: single 5¼" F/D (75k) £350: PROM programmer £32. (H)
Kemitron Z80 Starter (£240)	Kemitron 0244 21817 (3)	Z80A: 16k PROM: 2xS/P: 24 channel parallel I/O	ZEMON monitor: Basic	Expandable to 64k RAM and disk.
Microaxis 1 (£250)	Micro Design 0908 663655 (N/A)	1k RAM: 1-8k PROM: 6809: 8 channel A-D system: 12 optically isolated I/O lines.	1k monitor	Designed for industrial control. Can be expanded to F/D system. (H)
MPC 09 (£750)	As above	64k RAM: 48k PROM: 6089: RS232 port: 50 I/O lines: 4 timers: 1 W audio amplifier.	1k monitor: *Multi tasking OS*	As above.
MPE 9900 (£385)	Microprocessor Eng 0703 775482	2-8k RAM: 9900: 4-32k EPROM: 2xRS232 ports: P/P	Basic: *Forth*	Designed as industrial controller.
MPE 6809 Graphics-A (£450)	Microprocessor Eng. 0703 775482	24k RAM: 8-16k EPROM: 6809: 2xRS232 ports: 2xP/P	GForth	320x256 Pixel graphics (8 colour). Applications packages may be placed in EPROM.
Microtan 65 (£69)	Tangerine: 0353 3633 (6)	2k RAM: 6502: 16 x 32 TV int: Options: 64 Pixel graphics £6.50	2k monitor, *Basic*	TANEX expansion kit with 7k RAM: 4k EPROM sockets: 14k Basic: 4 S/P: 32 P/P £145 (E)
Nascom 1 (£125)	Lucas Logic 0926 497733	4k RAM: Z80: Full K/B: TV int: 2 P/P: 1 S/P. Options: 16k RAM £140: single 5¼" F/D (250k) £240 (4 disk controller £127).	2k monitor: *B Basic. Tiny Basic: A: T/E: U.*	Kit. Built version £140. Also Nascom 2 with 8k Microsoft Basic in ROM £225 (no RAM). (S&H)
77/68 (£90)	Newbear: 0635 30505 (N/A)	4k RAM: 6800: LED: C int: VDU int.	1k monitor: *Basic*	Expandable to 64k RAM with F/D. (B)
79/09 (£65)	As above	1k RAM: 6809. P/P: S/P	2k Monitor.	Designed to upgrade 77/68. (H).
SBC 100 (£135)	Airamco: 0294 57755 (TBA)	1k RAM: Z80: 8k ROM: S100: 1 S/P: 1 P/P.	*1k monitor: DOS in ROM*	Kit. Available assembled £196. (E)
Superboard (£188)	(as Challenger)	4-8k RAM: 6502: 10k ROM: full K/B: VDU int: C int.	Basic (8k ROM)	Options: RS232 port: single 5¼" F/D (100k) £316: 8k RAM £18 (S&H)
Smoke Signal SCB 68 (£181)	Windrush 0692 405189 (TBA)	1k RAM: 6800/6809: 8k EPROM: 1 S/P.	2k monitor	Fully expandable to 64k RAM with F/D. (H)
SYM-1 (£160)	Newbear: 0635 30505 (N/A)	1-4k RAM: 6502: C int: VDU int: 2 x 6522 ports. Option: TV int.	4k monitor: *Basic A.*	Expandable to 64k RAM with F/D. (B).
Tuscan (£299)	Transam 01-405 5240 (N/A)	8k RAM: 8k ROM: Z80A: 5 x S100 slots: RS232 port: TV int: C int: 1 P/P.	*2k monitor: 8k CP/M: Pascal*	High res graphics available. Can be expanded to F/D system. BT 1.81. (S&H)
UK101 (£149)	Comp Shop: 01-441 2922 (4)	4k RAM: 6502: full K/B: 16 x 48 VDU or TV int: C int: RS232 port, Options: 4k RAM £16	2k monitor: 8k Basic: *Dis A: U.*	Graphics. Expansion & colour avail. Kit or fully assembled. (S&H)
Windrush 6801 (£175)	Windrush: 0692 405189	2k RAM: 6801/3/5: 12k EPROM: S/P: 3 P/P	2k Monitor	Designed for industrial control & dedicated small systems. (H)
ZCB (£260)	Almarc: 0602 625035 (3)	1k RAM: Z80A: 3 PROM sockets: RS232 port: 3 P/P	*Will take any 2708/ 16 = 32 software.*	S100 bus compatible. Expandable to full system. (E)

ACC NEWS

Rupert Steele presents his monthly round-up of news from the Amateur Computer Club

Congratulations, Uncle Clive! Sinclair has, with a single product, done to the computer market just what he did to the calculator market; he has turned the whole thing upside down. The Spectrum is not only a rather nice personal computer, but the price is such as to put personal computing (of a decent, rather than ZX81, variety) within the price range of the man/woman in the street.

Peter Whittle, the ACC Chairman, has now received his Spectrum and has been hard at work doing things with it; these are to be reported in *ACCumulator*. In the current issue, he gives details of a Spectrum expansion RAM, and the pin connections for the add-on RAM sockets. He remains chained to his desk and I hope to mention more goodies as soon as they are invented. . .

Of course, the ACC is not the only group of people interested in the Spectrum. Various competitors have been most interested and are now involved in a mad scramble to bring out similar machines within a few months, before the Sinclair becomes the *de facto* standard. We already have the Acorn Electron announced (presumably its successor will be the Quark, or possibly the Neutral K-meson) and Commodore is promising new products.

Also vying with the Spectrum in this market, and also proving that computer hobbyists are really just big children wanting better toys, is one of Britain's leading toy manufacturers, Mettoy, with the 'Dragon', a 6809 based 32k machine. It has 16 lines of 32 characters in its ASCII display, and 256x192 colour graphics. Software is the Microsoft

ACC NEWS

extended colour Basic, so we shouldn't have to learn Sinclairese to use this machine.

Since the Dragon is a 6809 beast, it should be of particular interest to those involved in the national 68XX group that I mentioned last month. If you are interested in 6800, 6809, 68000 and their systems, then write, describing your interest and/or hardware, to Jim Turner at 63 Millais Road, London E11 4HB or tel 01-558 3681. The 68XX group says that the majority of the interest is in 6809 (as in Dragon) at the moment, but Roger Bird, another of its members, asks what on earth has happened to all those 7768 users.

It's coming up to the *PCW* Show again. Montbuild, the organiser, has asked the ACC to organise the Club area, and Dr David Annal, our exhibition man, has been beavering away sorting out the stands. So if your club hasn't yet spoken to David about a stand at *PCW* this year, then it's probably tough luck and too late (but it might be worth dropping him a line to see). David is also organising another meeting of the national user group chairmen with the ACC committee, which will be held at the show. If your national user group wasn't represented at the last meeting, then get in touch with David and he'll tell you all the info. We can also deal with large scale regional user groups at this meeting, although we don't expect to be saying anything that would be of interest to local clubs. David Annal is the ACC Secretary and his address is 142 Windermere Road, London SW16 5HE.

Also at *PCW* will be the ACC stand, on which we expect to have a host of features. Firstly, we will have the customary ACC database (hopefully updated according to the information that comes flooding (??) in to Peter Whittle at 49 Bartlemas Road, Cowley Road, Oxford), which enables those attending the exhibition to be put in touch with the local clubs near them. Among other exhibits, we expect to have Prestel, Mailbox/Bulletin Board, general Data Communications and interfaces, along with the Spectrum and the Dragon. So there's going to be plenty to see, apart from the great joy of holding a conversation with Peter on the stand.

As far as other shows go, the ACC was at the Capital Radio adventure day at Battersea Park, where there was a computer club area in the usual way. Lots and lots and lots of people came and had a look, found that computers don't bite and that they could have quite a bit of fun playing with them. Peter Whittle tells me that Prince Charles was within 30 yards of approaching the ACC stand, but that the sign had disloyally fallen down so that the Royal Attention was not attracted. Never mind, Peter; you'll have to wait another year for that OBE.

I thought that I'd also point out that the ALCC (Association of London Computer Clubs) Computerfair is going up in the world. It will be moving from the North London Poly (which really got somewhat overloaded) to Central Hall Westminster, where it will be part of the GLC's IT82 programme. I am slightly mystified by how IT82 can stretch into 1983, even for the GLC; perhaps this air of unreality has descended on Uncle Ken ever since the Tories did in his Fares Fair scheme.

Do you have anything to do with running a computer club? If so why not write to me with some information for a mention in 'ACC News' — leave a good two clear months before any topical event. The only people who have requested a plug this month are OPeCC, and they had one last month, so they're not getting another — mind you their meeting on Prestel packed a punch. . .

Tony Sweet of BT Prestel came to OPeCC to discuss the future of Prestel and telesoftware, and gave a most convincing set of demonstrations. He loaded a video game into an Apple via the Aladdin's Cave telesoftware pages and successfully ran it (well, not that successfully — he didn't win). The telesoftware is in a compressed format designed by CET (the Council for Educational Technology) and requires an unpacking and checksum verifying program. He also went through an assortment of gateways onto other systems and explained how this could dramatically increase the power of Prestel, with possible use of gateways for telephone directories and the like. Some new gateways were on the way, but the details were still hush-hush What must have slightly upset Tony (apart from the 'Drop Dead' greetings card sent to him by Peter Whittle) was that, when demonstrating the ALCC pages, he came across a page written by Len Stuart, claiming that Prestel was inferior to another system, 'Scrapbook'. I don't think Tony will be putting that page up again in a talk.

While we are on OPeCC, Maj-Gen Len Phelps has threatened to send a Task Force after me if I don't point out that he is now the general contact (sorry!). The fact that he is the fourth different OPeCC contact in ACC news this year is nothing to do with the chairman. Honest. Len's address is Southport Cottage, Sutton Courtenay, Nr Abingdon, Oxon OX14 4AN.

Finally, I should report that Peter Whittle came staggering into my office a few days ago, with some lumps of conrete still stuck to his legs, saying something about computer communications with an Apple in Rome. Apparently a data transmission error had caused the most awful Italian insult to be displayed at the other end (a bit like 'I seem to be having this tremendous difficulty with my lifestyle'), and the 'boys' had been round. Apart from that, the international computer communication experiment seems to have been a success, and I'll have full details next month, including some discussion of the technicalities.

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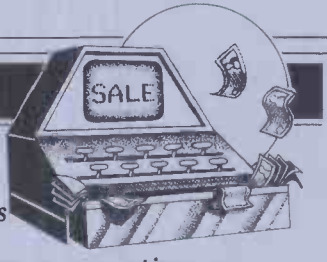

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✱VIC20 — boxed, unwanted gift. 7 months old, mint cond, hardly used. Accessories include TV, splitter, s/ware magazines, reasonable offers, buyer collects. Ring Adam after 5pm. Tel: Northwood 27733 (London).

✱DAI — personal computer, 48k, RAM, 24k, ROM are you interested in buying a computer, ring now for a free demonstration tel: 01-570 3844.

✱ZX81 — 16k RAM + I/O port, full size, qwerty kboard, smart wooden box, manual etc, 3 books, £50 s/ware, inc: 2 adventures, Mazogs, 3D defender, galaxians, worth £200. Asking £150 ono. Write: D Jewitt, 100B Townmead Rd, London SW6 2SG.

✱Acorn Atom — Games Asteroids, 747, Adventure space fighter, Polecat, Minefield, Earth warning, Lunar Lander, Astro, Birds, worth over £70 will accept £30. Tel: Middlesbrough (0642) 211573.

✱Acetronic — TV game, Hobby module, hardly used £35. Tel: 0553 671077, eve, B Peak.

✱ZX81 — as new, Sinc built, 1k, manual, leads, transformer, selection of progs, under guarantee. All for £55 ono. Phone Ivybridge, 2428 after 4.

✱ZX81 — +16k, RAM Sinc built, complete with all leads, only 3 months old. 2 Sinc cassettes + Quicksilva, Defender, etc. Still under guarantee, E87 book: PEEK, POKE, Byte + RAM. Tel: 061 624 1827, Kenneth.

✱UK101 — 8k RAM, new monitor, cased, inc leads and manual. As new. £165 ono. Tel: 021 350 4748.

✱Sharp MZ-80K — 48k, 6 months old, manual, books, 40 tapes, over £400 worth of s/ware. £360. Tel: Duddington (078-083) 284, between 10/11.30pm near Peterborough.

✱ZX81 — 16k RAM, Fuller MkII keyboard, complete with accessories + s/ware inc. Asteroids, Defender, invaders, centipede, catacombs, breakout + many more, costs only £105. Phone: Gerrards Cross (Bucks) 84764 w/ends and after 4.

✱Video genie — + Tandy green screen monitor, tiny Pascal, assembler, books on same. £300 or near offer, phone 01-575 5863 eve.

✱TRS80 — 48k LII, keyboard, expansion interface, single teac drive, operating system & misc disk s/ware. Offers! Genuine reason for sale. May split. Tel: Ware (0920) 821701 after 6.

✱ZX81 — +16k RAM, Sinc built, new kboard. All accessories, lots of good games, quick sale needed. £80. Can deliver immediately in London. Tel: Jason 01-328 6988 any reasonable time of day.

✱Tangerine Micron fully expanded — 8k RAM Tanbug V2.3 Basic (10k) Pixel graphics exc display on an ordinary domestic TV. All leads and manual supplied. Tel: (Brighton) 696285. Eve only: £300.

✱Sharp MZ-80K — 20k RAM, Basic tape + manual + applications tape + several games progs, 9 months old, per cond. original packing. £325 ono. Tel: Biggin Hill, 74185 after 6.

✱Acorn Atom — 12k RAM, 8k ROM, high-res graphics and assembler, some s/ware and books, pile of magazines, all leads and manuals, only £99, ring Kevin, Horsham 62635 (Sussex).

✱ZX81 Sinc built, hardly used, under guarantee, £55. Tel: 0642 723996.

✱Acorn Atom — 12k RAM, 48k ROM. All leads, manuals, some books and s/ware and pile of computer magazines, only £99. Phone Kevin Smith, Horsham 62635 (Sussex).

✱Complete PET system — for £995. 4022 printer, 2031 single disk — both hardly used. Plus 3016, new ROM, large keyboard PET and cassette unit. Phone 0484 718311, office hours.

✱Wanted Pet computer, new Rom, interested; disk drive/printer. (With manuals). Exchange for Yamaha organ (B-35N). Bought in error. 6 months old, vgc. Will deliver/collect within South-East. Tel: Hastings 430236

✱Wanted: TRS-80 48k with vdu & recorder (but might consider floppy tape). Must be as new. Detail & price to: R. Nubley, 66 Alderside Crescent, Lanchester, Co. Durham.

✱Wanted computer pen — friend. Commodore Pet 3016 requests corresponding with other addicts. Ideas inc software exchange hints & tips for programming games/business. Write J.W.D., 5 Harding Close, Kettering, Northants

✱Wanted: Sinclair ZX81 (Sinc. built) with accessories. Tele: Bolton (0204) 51973, after 6 pm.

✱Apple, Video-Genie, Pet, Vic, ZX81. Tired of that programme? Not what you wanted? Cash to 50% of current list for cassette, disc, Rampack, immaculate condition with full documentation Tel: 0424 220188.

✱Wanted: ZX81, home built or factory built + games. Svein Utne Kringsjaav. 51, N-7000 Trondheim, Norway.

✱Wanted — secondhand computer min 64k RAM twin disk drives or Winchester CPM compatible. Tel: Weymouth 03057 79881 day, 786562 eve.

✱Acorn Atom — 12k ROM, 13k RAM 5V supply + GP80A printer. All perfect bundle of s/ware and books bargain package £325 the lot. Tel: 01-552 1467 eve.

✱Superboard — 8k RAM, metal case and psu 48x32 display, Cegmon, Basic 1,3 and 4. 300/600/1200 baud, manuals, user group newsletters, £200. Tel: Bolton, 0204 34886 after 7.30.

✱ZX81 — 16k built, manual, leads, mains adaptor plus expanded keyboard and s/ware inc. chess, cassette one and two, QS defender & invaders, Adventure C, Monster maze, centipede and Galaine, £89. Tel: 01-455 5743.

✱TRS80 — LII, 16k, vdu, tape recorder, 6 months old, still boxed, manuals, lots of s/ware all

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Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

for £250. Tel: Shorne, Kent (0474) 82 2539.

✱ TRS80 — LII, 16k vdu cassette manuals, number of program games etc, worth over £600. £200 ono. Tel Worksop 483547.

✱ ZX81 — 16k, Sinc built, exc cond, psu and manual, two books, ZXAS and Taurus monitor for machine-code. Best offer over £100, phone 01-207 1223 5-9.

✱ Acorn Atom — fully expanded. Word pack ROM. 5v psu. s/ware, books. £195. Currah digital cassette recorder for Atom 6000 baud. Full s/ware control. Tapes, documentation. £200 ono. Tel: 0223 355957.

✱ ZX81 — 16k RAM, printer, Fuller FD extended keyboard+case (plenty of room inside), telesound 82 unit, new psu, all manuals + leads, 2 books, exc cond. only 4 months old. Bargain £145, ring W Peacock (01)591 6526.

✱ Atari Video Computer — + joysticks, paddles, steerers, keyboards. Cartridges inc Backgammon, basketball, bowling maze, asteroids, casino, dodgem, indy, checkers, invaders, many others cost £560 accept £350. Tel: 0924-277346 after 7.

✱ TI59 + PC100B — 96 step prog. cal, with printer. Complete with master module, leads, charger, wallets, manuals, coding sheets, over 60 prog cards, progs inc with boxes and instructions. Would cost £300+ quick sale a must for £195. Mr King 01-769 7255.

✱ UK101 — with 17k RAM, metal cased room for another 7k RAM on board, Mono2 Cegmon 300/600 baud 5V 5Amp supply s/ware and books £240, ovno, Harlow (0279) 26383 eve.

✱ TRS-80 — 16k LII, + numeric keypad, as new inc manuals and £150+ of s/ware (arcade games, assembler) £340, also Aculab, 9k baud, floppy tape: £125. Both: £450. Tel: Waterlooville, Hants, 61563 eve.

✱ Northstar Advantage — Epson, MX82 F/T with graphics option and serial interface, graphics Basic and all cables. Brand new, bargain at £1599. Contact Dave on Slough 74201 ext 55 during office hours.

✱ PET 8k — old ROM. integral cassette, recently overhauled, manuals and s/ware inc £220. Tel: 01-997 4193 eve and w/ends.

✱ UK101 — absolute basic machine, fully working and professionally tested. Hardly used; built for practice. All reasonable offers con (£90 ono). Tel: 01-670 0547.

✱ Aculab — floppy tape plus s/ware £150. Epson printer interface (connects to TRS80 kboard) £50. Tel: 01-427 1098 anytime.

✱ ZX81 — Sinc built + byg byte 16k RAM, all leads, manual, some programs, book (PEEK, POKE, Byte and RAM), psu, good cond. boxed £90. Tel: Clacton 422060 eve/w.ends.

✱ Acorn Atom — 8k ROM and 12k RAM, instruction manual, leads, magic book and brand new psu, exc cond. Phone Abergavenny 4534 with reasonable offers. Will sell to highest bidder.

✱ ZX81 — 16k RAM, Sinc built, manual psu, leads 3 games £80, Vic 20 cassette recorder, leads joystick, two games, three manuals, four months old, £200 ono. Thetford 2875 eve.

✱ Tangerine Rack System — Microtan 65, full-exp, Tanex — (8k RAM, extended microsoft Basic, X-Bug). System, psu, full ASCII keyboard, many progs. Would cost £350+. Bargain @ £100. Tel: Helsby (Cheshire) 0928 2 3044 eve.

✱ Apple II+ — 48k, twin disks, parallel card, paper tiger printer, language card, Pascal, 12inch Hitachi monitor, Tasc compiler, 3.2.1 visicalc, DOS toolkit, apple-writer, Dakins Aids, ple, etc. £1450. ono. Slough 41092.

✱ Softy Mk1 — Eprom programer and emulator for triple rail devices (can be upgraded for single rail as well). £70, power supply, if required, £18. Slough 41092.

✱ Hewlett Packard — 2100A computer 2600A terminal, 2748A tape reader 7900A disk drive system to swap for Sharp system MZ80K disks printer, accessories or offers, 8 Blackdown Avenue, Waterthorp, Sheffield S19 6NG Yorkshire.

✱ VIC20 — + cassette player. Two months old. £170 cash only. No offers. Brian 01-866 4515.

✱ Video Genie — 16k, LI with sound cover + many tapes inc. ZChess, Galaxian, Invaders, Star Trex III, etc. Total value £370. vgc. hardly used. £240 ono. Tel: Basildon 553325 after 6pm.

✱ ZX81 — 16k Sinc, RAM + 4k ROM, ZX80 + psu, manuals, ZX81 companion. All in good cond. £100 ono. Tel: Andy on 0272 683195 anytime.

✱ Casio fx702p — 1.68k RAM, flexible memory. Only one month old, comes with ten progs already in store. Need money for ZX Spectrum. Great value at £85. Tel: St Austell 0726 64345.

✱ 48k Sorcerer — all manuals, two Hitachi cassette recorders with moto-control cables, one Hitachi 9in monitor complete with cables various s ware as new £499 ono. Tel: Cheltenham (0242) 37954.

✱ Video Genie — 16k, joysti s, games, manuals, books etc, perfect, upgrade forces sale. £260 ono. Also 2 synths £100 ono each. Tel: Ian, Great Leighs (Essex) 8138 after 7.

✱ Video Genie EG3003 — as new, box leads and manuals complete, also s/ware inc games etc. £250 ono. Tel: Ilkley (0943) 600851.

✱ TRS80 — L II, 16k, b/w, tv, manuals, books, magazines, 40 programs, cassette recorder, joystick, printer, interface, £450. GP80 Seikosha printer hardly used, £150. Tel: 0303 56266 eve.

✱ Teletype KSR33 — printer plus keyboard, RS232 interface, plus stand. Exc cond. £120. 01-950 0416.

✱ TRS80 32k — fitted with resolution graphics, flashing cursor, system load/save, lower case, single key entries, cassette VDU £500, line printer £150 plenty of s/ware inc Scripsit Chandlers Ford 2002.

✱ ZX81 — little used Sinc built, with mains adaptor, leads, manual and user book £50. Tel: Witnesham (near Ipswich) 047 [illegible]5 680.

✱ Sharp MZ-80K — 48k RAM 2.4 Meg board, assembler, toolkit, cristal Basic, space invaders, chess, forty other games, one year old, £500, phone after 4 Bursledon 4843.

✱ Texas TI99/4A — 6 months old, still in guarantee costs over £300 plus £150 accessories, inc joysticks, games, cassette lead, manuals etc. Genuine reason for sale. Only £350. Tel: 061 437 4530.

✱ PET 2001 — 8k old ROM, integral cassette deck + Pet/CBM computer book by Osborne and Donahue. Will deliver within 200 miles of Hull £240. Tel: 0482 645221.

✱ ZX81 — 16k, Sinc built, inc. all leads and adaptor, original packing, manual and ZX81 companion, Sinc. games cassettes, exc cond, £90 ono. Phone Crawley (0293) 882927.

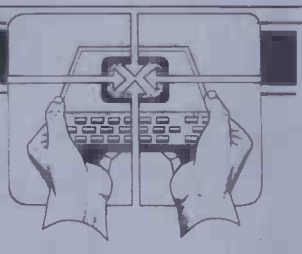
✱ Apple Videx — 80 col card, very little use £120. PET 3040 disk drive per cond. offers ? Phone Mike Days 01-387 0505.

✱ ZX81 — 16k RAM pack with books and tapes worth £150, nearly new, will accept £100. Contact Mark Sylvester, 30 Chatsworth Drive, Louth, Lincs LN11 0JA.

✱ ZX81 — +16k RAM, Sinc built, manual, leads, 2 games cassettes, 1 game & 2 m/c books all for £85. vgc. Contact Mark, 173 Mayfield Gardens, Brentwood, Essex. Tel: (0277) 232439.

CTUK! CONTACTS

For further information on ComputerTown UK! see 'CTUK News' or Prestel page 3574831



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SO1 7JH

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Burton-on-Trent,
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Ron Wright or Bill Phillips
Mountview Youth Centre,
Mountview School,
Fisher Road,
Harrow Weald,
Middlesex

Susan Kelly,
Head of Reference Services,
PO Box 4,
Civic Centre,
Harrow,
Middlesex.

Pete Shaw,
15 St Vincent Road,
Clacton-on-Sea,
Essex C015 1NA

Philip Joy,
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Essex.

Alan S Waring,
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Bradford BD3 8HG

Derek Moody,
2 Victoria Terrace,
Dorchester,
Dorset DT1 1LS

Derek Knight or Bob Carter,
Rayners Lane Library,
Imperial Drive,
Rayners Lane,
Middlesex.

Peter Earthy,
46 High Street,
Church Stretton,
Shropshire,
SY6 6BX.

Christopher Bates,
Ashford Main Library,
Church Road,
Ashford, Kent

USER GROUPS INDEX

These are alterations and additions to the complete listing published in the August issue. The next full listing will appear in the February 1983 edition

LOCAL

Blackburn Computer Group. Meetings first Monday monthly. Newsletter planned. For details of venues, etc contact membership secretary Dave Walsh, 19 St Margaret's Way, Blackburn, Lancs. Tel: 0254 661518. Contributors welcome for newsletter.

Coastal Computer Club. Meets every Monday eve in the Physics laboratory of Wyndgate Upper School, Park Farm Rd, Folkestone at 7pm in term time. Contact: Dave Leath-Butler, Tel Hythe 60726. Membership fee £2. and weekly subscription 20p. Guest fee 30p. Seminars etc arranged.

Croydon Apple User Group, for serious users. Now meeting at 7pm on the 2nd Monday of every month. Venue: 60 Hawkhurst Way, West Wickham. Tel: Hon Sec Paul Vernon on 01-777 5478 for details.

Harlow Computer Club. Meetings 3rd Tuesday monthly at Harlow Advice Centre from 8pm until 10.30. Details from Bob Robson, Harlow 20730 (eve & w/ends).

OPeCC— Oxford Personal Computer Users Club. For information phone Len Phelps, Sutton Courenay 438 or Tim Fowler, Oxford 45172 (w) or Oxford 725313 (h).

Perth & District Amateur Computer Society. Meetings 3rd Tuesday monthly at Hunters Lodge Motel, Bankfoot. Meetings start at 7.30 and include a talk and demonstration. Contact: Alastair MacPherson, 154 Oakbank Rd, Perth PH1 1HA. Tel: 0738 29633.

West London TRS-80/Video Genie User Group. Meets first Sunday monthly at the central common room, The Residences, Northwick Park Hospital, Watford Rd, Harrow. Affiliated to National TRS80/Video Genie Users Group.

Yeovil MZ-80K User Group now publish a four monthly newsletter full of listings, ideas and projects. MZ-80A also supported. Software library now includes source code of most well-known programming languages. Address Sharp MZ-80K User Club, Yeovil College, Yeovil, Somerset BA21 4AE.

NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull. . . (Forum-80 H,Q) Tel: 0482 859169, System operator Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm Sat/Sun 1.00pm to 10.00pm.

Forum-80 London. . . Tel: 01-747 3191. System operator Leon Jay. Electric mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00 pm.

Forum-80 Milton. . . (TRS-80 Users Group 80-Net) Tel: 0908 566660. System Operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter. TRS-80 information system hours: 7 days a week 7.00pm to 10.00 pm.

Forum-80 Holland. . . Operator: Nico Karssemeyer, tel 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

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.

Mailbox-80 Liverpool. . . 051-220 9733, System Operator: Peter Tootill, Electronic mail, downloading TRS-80 information.

ACC. . . members bulletin board, Peter Whittle (0908 44262)

ABC-80. . . Stockholm, Sweden) Tel: 010 468 190522.

University Research Computer. . . Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

Elfa. . . Sweden 010 468 7300 706

Tree Tradet. . . Sweden 010-468 190522.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Manchester	(The University) Eurographics Exbn & Conf. Contact: Interbuild Exbns Ltd, 01-496 1951	8-10 Sept
London	(Barbican Centre) PCW Show. Contact: Interbuild Exbns Ltd, 01-486 1951	9-12 Sept
London	Computer Choice '82. Contact: James Brewster Assoc, 01-486 8686	20-22 Sept
USA	(Atlanta, Georgia) Computerised Office Equip Exbn. Contact: Cahners Exbn Group, 0483 38085	21-23 Sept
London	(Barbican Centre) London Business Show. Contact: BED Exbns Ltd, 01-647 1001	28 Sept-1 Oct
Wembley	(Conference Centre) Viewdata Exbn. Contact: Online Conferences Ltd, 09274 28211	12-14 Oct
Finland	(Helsinki) Business Machines & Equipment Exbn. Contact: ECL (Exbn Agencies) Ltd, 01-485 1951	12-16 Oct
London	(Bloomsbury Crest Hotel) Computer Graphics Exbn. Contact: Online Conferences Ltd, 0924 28211	19-21 Oct

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LEISURE LINES

by J J Clessa

Almost 400 entries to the June Prize Puzzle highlighted an easy problem. Several people said that the quickie (the four times fives) was more difficult. Be that as it may, the winner of this month's prize, selected from many, was Michie (no indication of initials or sex) from Ashford in Middlesex. He (she, it) gave the answer we wanted of 78 tadpoles, 13 terrapins, 5 tortoises and 4 turtles. Actually there were also two other possible solutions which were also accepted for the prize draw. These were 77,13,10 and 0 or 79, 13,0 and 8 although they only involved purchase of three of the four creatures.

No quickie

In the maelstrom of moving from one office to another, Leisure Lines has suffered the sad loss of the only copy of September's Quickie. As we're all up in arms at the time of writing (far too late, we fear) a humble apology for this dreadful omission is all we could think of to fill up the space.

Prize puzzle

This month's Prize Puzzle is based on an old chestnut — or should I say coconut?

Six men are shipwrecked on a desert island. The only food on the island is coconuts. They therefore decide to collect all the coconuts and divide them equally among themselves.

They spend one complete day gathering all the coconuts into a single pile, and by the time sunset arrives they are so tired that they decide to postpone the share-out until the following day. They therefore all go to sleep.

During the night one man awakes and decides to take his share and hide it before the others awake. He divides the pile into six equal shares and finds that there is one coconut remaining which he throws to a nearby monkey. He hides his share, puts the rest back into a single pile and goes back to sleep.

A little later, a second man awakes and repeats the process, again finding one coconut remaining which he gives to the monkey. He takes and hides his share and goes back to sleep.

This performance is repeated by each man in turn during the night. Each time the coconuts are divided into six and each time there is one left which the monkey gets.

Next morning all six men awake and decide to share out the remaining coconuts. Again they divide them into six equal shares and again there is one left over which is given to the monkey. What is the least number of coconuts that there could have been in the beginning?

Answers, *on postcards please*, to: September Prize Puzzle, Personal Computer World, 62 Oxford Street, London W1, to arrive not later than 30 September 1982.

PROGRAMS

PCW is interested in Basic or Pascal programs for any popular micro — please tell us which one you wrote your program on and how much memory it uses. Make sure your programs are fully debugged before you send them in on cassette (although we will accept disks) with a clear listing on plain paper. Documentation would be welcome, and if you want it returned please label everything with your name and address and include an SAE. Send contributions to Maggie Burton, PCW Programs, 62 Oxford Street, London W1A 2HG

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PROGRAMS

Video Genie Extended Basic

by W Burgar

This program will add nine useful commands to Genie Basic, using the DOS commands to call routines from high memory. Because it works in this way, the top of memory needs to be set before the program can be loaded. When the machine has just been switched on, type 32680, return and then load the program.

The reserved words added by this program are: GET — waits for any key (excluding shift) to be pressed; NAME — works in the same way as GET except that the character pressed is printed in the cursor position; KILL — disables the break key; PUT — turns break key back on; CLOSE — turns off the video driver so that all print statements are suppressed; OPEN — turns video driver back on; LOAD — loads a program from tape straight after the current program so that the current program is not lost; MERGE — combines two programs after a LOAD. It is best here to renumber the second program with higher line numbers than the first program; FIELD — this is a graphics command which literally reverses the whole of the screen, turning black characters white and vice versa.

These additions use 88 bytes at the top of RAM. After typing the program in, save it before running as other wise it will be lost by NEWing itself out of memory.

```
  5 REM AFTER TYPING THIS PROGRAM IN, SAVE IT
  6 REM BEFORE RUNNING IT!
 10 CLS:PRINT"EXTENDED BASIC BY W J BURGAR* "
 20 PRINT"COMMANDS ARE: GET* NAME* KILL* PUT*
    CLOSE* OPEN* LOAD* MERGE* FIELD*"
 30 REM READ IN JUMP ADDRESSES TO DOS MEMORY
 40 FOR I=16761 TO 16788: READ C: POKE I,C:
    NEXT I
 50 REM READ IN MACHINE CODE TO TOP OF MEMORY
 60 FOR I=32680 TO 32751: READ C: POKE I,C:
    NEXT I
 70 NEW: REM FINISHED
 80 REM DATA FOR JUMP ADDRESSES IN ORDER
 81 REM OPEN, FIELD, GET, PUT, CLOSE, LOAD, MERGE,
    NAME, KILL
 90 DATA 195,168,127,195,174,127,195,73,0,195,192,
    127,195,198,127
100 DATA195,203,127,195,221,127,127,195,228,127,195,
    234,127,201
110 REM DATA FOR MACHINE CODE
120 DATA 62,7,50,29,64,201,1,0,4,17,0,60,26,47,203,
    255,18,19,11,120
130 DATA 177,32,245,201,62,201,50,12,64,201,175,50,29,
    64,201,58,249
140 DATA 64,214,2,50,164,64,58,250,64,50,165,64,205,31,
    44,201,33
150 DATA 233,66,34,164,64,201,205,73,0,195,51,0,62,7,50,
    12,64,201
160 REM DON'T WORRY ABOUT SN ERROR AFTER MERGE
 65 PRINT*"PRESS ANY KEY":GET
 66 REM THESE ARE 65&66; NOT 165&166!
```

(signifies '↓')*

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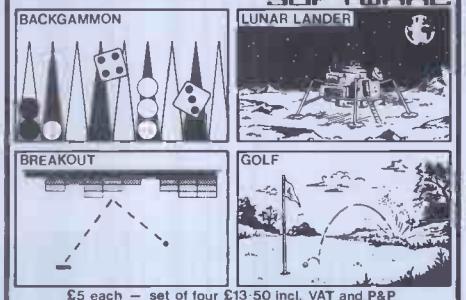

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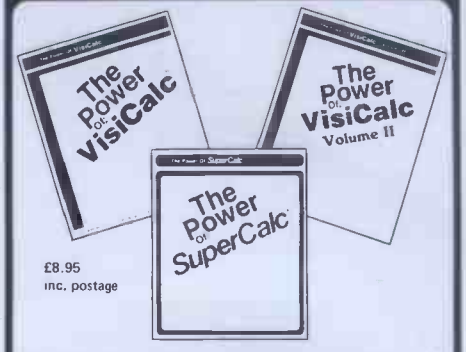

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Written in plain English, each of these texts contain seven easy-to-follow exercises, especially designed to show users of these popular computer software programs how to expand their applications usage. Specific examples are used to illustrate the logic of each step in designing an applications program.

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PROGRAMS

ZX81 Alphabetising

by Ian Kingston

For any form of indexing this program should come in useful. It allows the user to compile an alphabetical index of up to 800 words of 15 characters maximum. The lengths of words accepted by the program can be altered by changing the values in lines 50, 105, 150, 155, 160, 230, 250 and 285 although this will affect capacity and running time. If a paper printout is required, line 285 should read LPRINT Q$(F,1 TO 15). The graphics symbol used in line 100 is a shifted graphics 'H' and the program needs 16k to run.

```
  10 REM "ALPHABETIZING"
  15 REM (C) 1982, I.KINGSTON
  20 PRINT TAB 5;"GIVE A GENEROU
S ESTIMATE"
  25 PRINT
  30 PRINT TAB6 ;"OF THE NUMBER
OF WORDS"
  35 PRINT
  40 PRINT TAB 8;"TO BE ALPHABET
IZED"
  45 INPUT Q
  50 DIM Q$(Q,15)
  55 CLS
  60 LET X$="----------------"
  65 LET Z$="                "
  70 LET N=1
  75 PRINT TAB 2;"TYPE IN EACH W
ORD SEPERATELY",,,
  80 PRINT "FOR A SPACE ENTER SH
IFTED EIGHT",,,
  85 PRINT " ENTER "" "" AT END
OF WORD LIST"
  90 LET NN=0
  95 PRINT AT 10,0;"WORD  ";N;TA
B 22;"MAX = ";Q
 100 PRINT AT 15,0;"
     "
 105 PRINT AT 16,15;"MAX 15 LETT
ERS"
 110 IF INKEY$ "" THEN GOTO 110
 115 LET C=CODE INKEY$
 120 IF C=118 THEN GOTO 165
 125 IF C=23 THEN GOTO 180
 130 LET NN=NN+1
 135 IF C=119 THEN LET NN=NN-2
 140 IF C=115 THEN LET Q$(N,NN)=
CHR$ 0
 145 IF C>28 AND C<64 THEN LET Q
$(N,NN)=CHR$ C
 150 IF N>=1 THEN PRINT AT 15,0;
Q$(N,1 TO NN);Z$(1 TO 15-NN)
 155 PRINT X$(1 TO NN);Z$(1 TO 1
5-NN)
 160 IF NN<15 THEN GOTO 110
 165 PRINT AT 15,0;Z$,,Z$
 170 LET N=N+1
 175 IF N<=Q THEN GOTO 90
 180 FAST
 185 CLS
 190 FOR F=1 TO N-1
 195 FOR M=1 TO N-1
 200 IF F=M THEN GOTO 215
 205 IF CODE Q$(F,1)>CODE Q$(M,1
) THEN GOTO 230
 210 IF CODE Q$(F,1)=CODE Q$(M,1
)THEN GOTO 250
 215 NEXT M
 220 NEXT F
 225 GOTO 275
 230 LET Z$=Q$(F, 1 TO 15)
 235 LET Q$(F,1 TO 15)=Q$(M,1 TO
 15)
 240 LET Q$(M,1 TO 15)=Z$
 245 GOTO 205
 250 FOR G=2 TO 15
 255 IF CODE Q$(F,G)>CODE Q$(M,G
) THEN GOTO 230
 260 IF CODE Q$(F,G)<CODE Q$(M,G
) THEN GOTO 215
 265 NEXT G
 270 GOTO 215
 275 SLOW
 280 FOR F=N-1 TO 1 STEP -1
 285 PRINT Q$(F,1 TO 15)
 290 NEXT F
 295 STOP
 300 SAVE "ALPHABETIZING"
 305 RUN
```

PET File Comparison

by Lionel Kremer

For those PET users who keep several versions of program under development at once, this program will be of help in keeping track of changes made. It will compare sequential program files line by line, prepare two output files which consist of the unmatched lines (or blank ones) and then list them on screen and printer if required. The listing feature of this program can also be used on its own to list and print out any sequential file, whether numbered or not.

Before loading and running the program, the files to be compared must be prepared. This is done using the follong sequence of commands: DOPEN#1, 'filename', W/CHD1/ LIST PRINT#1/CLOSE#1 'Compare' can then be loaded and run. Output files are assumed to be on drive 0 and can be specified for re-use by the @ prefix.

Absent-minded readers should be reminded that all programs to be compared must first be copied.

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PROGRAMS

'Compare' was tested on a 32k PET with Basic 4 and DOS2. It was, in fact written for the 8032 PET. 40 column users will find that pairs of lines appear truncated. This will not affect the usefulness of the program as the lines of interest (only) can be read in full from the files @TEMP1 and @TEMP2. Another 40 column complication is that the bottom of the display gets overwritten. This, again, can be solved by accessing the comparison files.

```
0 REM"S=DSAVE"@COMPARE
100 REM***** COMPARE SEQUENTIAL PROGRAM FILES ******************************
110 SY=PEEK(52)+PEEK(53)*256:MC=SY+255:REM SY$ AND M.C. ABOVE TOP OF MEMORY
120 IFPEEK(MC)+PEEK(MC+77)=287THEN150:REM M.C. INSTALLED
130 SY=SY-333:MC=SY+255:POKE53,INT(SY/256):POKE52,SY-PEEK(53)*256
140 GOSUB7000:CLR:GOTO110:REM LOWER TOP OF MEMORY AND INSTALL M.C.
150 SYSMC,0:REM INITIALISE SY$ AT TOP OF MEMORY
160 REM***** END OF M.C. AND SY$ INSTALLATION ******************************
1000 DIMF$(2):CR$=CHR$(13):OPEN15,8,15
1010 PRINT"□R■OMPARE OR L■IST ?";
1020 GETA$:IFA$<>"C"ANDA$<>"L"THEN1020
1030 PRINT"■"A$:IFA$="L"THEN3000
1040 INPUT"FIRST READ FILENAME";F$:INPUT"DRIVE▶▶▶0■■■■";D:D$=STR$(D):LF=1
1050 GOSUB4000:IFVAL(DE$)>0THEN1040
1060 INPUT"SECOND READ FILENAME";F$:INPUT"DRIVE▶▶▶0■■■■";D:D$=STR$(D):LF=2
1070 GOSUB4000:IFVAL(DE$)>0THEN1060
1080 INPUT"FIRST WRITE FILENAME▶▶▶@TEMP1■■■■■■■■";F$:D$="0":LF=11
1090 GOSUB4000:IFVAL(DE$)>0THEN1080
1100 INPUT"SECOND WRITE FILENAME▶▶▶@TEMP2■■■■■■■■";F$:D$="0":LF=12
1110 GOSUB4000:IFVAL(DE$)>0THEN1100
2000 REM***** START COMPARISON *********************************************
2010 M%=-1:PRINT"■■■FILE 1          FILE 2          LINES■"
2020 IFE1%THEN2040:REM END OF FILE 1
2030 LF=1:GOSUB5000:L1$=SY$:N1=N:E1%=EF%:IFNOTM%THEN2060
2040 IFE2%THEN2300:REM END OF FILE 2
2050 LF=2:GOSUB5000:L2$=SY$:N2=N:E2%=EF%
2060 IFN1<>N2THEN2200:REM UNMATCHED LINE
2100 REM***** LINE NUMBERS MATCH **********
2110 M%=-1:IFL1$<>L2$THENGOSUB6000:PRINT#11,L1$:PRINT#12,L2$
2120 IFE1%ORE2%THEN2300
2130 GOTO2020:REM GET 2 MORE LINES
2200 REM***** UNMATCHED NUMBERS **********
2210 M%=0:GOSUB6000:IFN1>N2THEN2230
2220 PRINT#11,L1$:PRINT#12,STR$(N1):GOTO2020:REM GET 1 MORE
2230 PRINT#12,L2$:PRINT#11,STR$(N2):GOTO2040:REM    DO.
2300 REM***** END OF A FILE **************
2310 EF%=0:LF=1:IFE1%THENLF=2:GOTO2340
2320 IFEF%THEN2340
2330 GOSUB5000:GOSUB6000:PRINT#11,SY$:PRINT#12,STR$(N):GOTO2320
2340 IFE2%OREF%THENICLOSE:OPEN15,8,15:GOTO3000
2350 GOSUB5000:GOSUB6000:PRINT#12,SY$:PRINT#11,STR$(N):GOTO2340
3000 REM***** LIST NEW FILES ***********************************************
3010 F$=F$(1):REM 1ST O/P FILE
3020 PRINT"▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶"F$:INPUT"□LOOK AT FILE";F$:D$="0":LF=3
3030 GOSUB4000:IFVAL(DE$)>0THEN3020
3040 PRINT"WITH PRINTOUT - Y/N ?"
3050 GETA$:IFA$<>"Y"ANDA$<>"N"THEN3050
3060 P%=A$="Y":IFP%THENOPEN4,4
3070 GOSUB5000:IFP%THENPRINT#4,SY$
3080 IFNOTEF%THEN3070:REM REPEAT UNLESS EOF
3090 CLOSE3:PRINT:IFP%THENCLOSE4
3100 IFF$=F$(1)THENF$=F$(2):GOTO3020
3110 F$="":GOTO3020:REM ANY MORE FILES?
4000 REM***** OPEN SEQ FILE - BASIC3 TRAPS MISMATCH *************************
4010 IFF$=""THENPRINT"■INVALID":DE$="1":RETURN
4020 IFLEFT$(F$,1)="@"THENF$=MID$(F$,2):D$="@"+D$
4030 FF$=D$+":"+F$+",SEQ":IFLF>3THENFF$=FF$+",WRITE":F$(LF-10)=F$
4040 OPENLF,8,LF+1,(FF$):INPUT#15,DE$,A$
4050 IFVAL(DE$)>0THENPRINT"■"F$" - "A$:CLOSELF
4060 RETURN
5000 REM***** ASSEMBLE LINE FROM INPUT FILE *********************************
5010 POKE158,0:IFPEEK(151)<>255THENFORI=1TO800:NEXTI:REM DELAY IF KEY DOWN
5020 IFLF<3THENPRINT"□□■"TAB((LF-1)*15+3)"*":PRINT"□□□";
5030 SYSMC,LF:REM READ LINE FROM FILE LF INTO SY$
5040 EF%=ST=64:PRINT"■"SY$:IFLF=3THENRETURN
5050 N=VAL(SY$):IFN=0THEN5070:REM NON-NUMERIC
5060 PRINTTAB((LF-1)*15)"■■■"RIGHT$("    "+STR$(N),5):RETURN
5070 PRINTTAB((LF-1)*15)"■■■ ****":IFNOTEF%THEN5020:REM IGNORE UNLESS FINAL
5080 N=65535:RETURN:REM DUMMY FINAL LINE IF NON-NUMERIC
6000 REM***** COUNT LINES FOR NEW FILES *************************************
6010 C=C+1:PRINTTAB(30)"□"RIGHT$(C)    "+STR$(C),5):RETURN
7000 REM***** MACHINE CODE *************************************************
7010 FOR I=0 TO 77 :READ D:POKE MC+I,D:NEXT I:RETURN
7020 DATA 32,160,189,32,135,183,32,234,194,169,83,133,66,24,169,89
7030 DATA 105,128,133,67,32,135,193,166,98,208,11,160,2,185,51,0
7040 DATA 145,68,136,208,248,96,32,198,255,160,0,32,207,255,201,13
7050 DATA 240,20,145,52,200,208,244,32,204,255,169,15,133,210,32,224
```


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PROGRAMS

```
7060 DATA 242,162,176,76,207,179,152,160,0,145,68,76,204,255
8000 REM***** ALTERNATIVE LINES IF M.C. NOT REQUIRED **********************
8010 REM OMIT LINES 110-160, 7000-7060
8020 REM 5025 SY$="":REM NOT TO BE USED IN M.C.VERSION
8030 REM 5030 GET#LF,X$:IFX$<>CHR$(13)THENSY$=SY$+X$:GOTO5030
READY.
```

BBC Music Player

by K Hussey

For those BBC users who are musically minded, this program will bring a little home-made melody into computing activities. It makes good use of Beebon's sound facilities although it doesn't use the 'ENVELOPE' command.

The program remembers and repeats a sequence of notes which the user enters in a notation which is almost conventional. Only single note sequences can be played (there are no chords) from a range of three octaves. A small sequence of notes can be automatically repeated which saves time when it needs to be used several times in succession.

A menu makes it easy to use and spurious notes such as Z or M are treated as pauses. It is only possible to change one note at a time and, unfortunately, no delete facility is included to deal with several notes at a time. Also lacking is the ability to store tunes on tape — perhaps some ideas could be offered on that one for future programs.

Finally, there is one small bug which should be borne in mind. Notes are entered as note and duration. If the duration is missed out or return is hit the program will reply with a continuous and rather gloomy bottom 'A' note. This is easily remedied by pressing 'escape' and using the 'change note' facility to replace the invalid input.

2k in mode 7 is the amount of memory used so Music Player would therefore run on either a model A or B.

```
   10 DIM a%(120),f%(120),m%(120),entry$(120)
   20 ON ERROR GOTO 390
   30 C$="AA$BCC$DD$EFF$GG$"
   40 D$="aa$bcc$dd$eff$gg$"
   50 E$="a'a'$b'c'c'$d'd'$e'f'f'$g'g'$"
   60 GOTO 390
   70 CLS
   80 PRINT'''TAB(4);"Press escape to return to menu."'"Enter r1-20 or R1-20 to
repeat notes"'"1 to 20 and add them to the tune."
   90 K=1:temp%=K:flag%=0
  100 PRINT,K;:INPUT N$
  110 entry$(K)=N$
  120 IF ASC(N$)=&52 OR ASC(N$)=&72 THEN PROCrpt:GOTO 100
  130 test%=ASC(MID$(N$,2,1)):IF test%<&39 THEN k%=2 ELSE k%=1
  140 m%(K)=VAL(MID$(N$,1,k%))
  150 M$=MID$(N$,1+k%,LEN(N$)-k%)
  160 l%=INSTR(C$,M$):IF l%<>0 THEN N=36:GOTO 210
  170 l%=INSTR(D$,M$):IF l%<>0 THEN N=84:GOTO 210
  180 l%=INSTR(E$,M$):IF l%<>0 THEN N=134:GOTO 240
  190 a%(K)=0:f%(K)=0:PROCtone
  200 K=K+1:temp%=K:GOTO 100
  210 a%(K)=-15:f%(K)=N+4*(l%+(l%>3)+(l%>5)+(l%>10)+(l%>14))
  220 PROCtone:IF flag%=0 THEN K=K+1:temp%=K ELSE K=temp%:flag%=0
  230 GOTO 100
  240 a%(K)=-15:f1%=l%+(l%>5)+(l%>12)+(l%>17)+(l%>24)
  250 f%(K)=N+4*(f1%/2)
  260 GOTO 220
  270 PROCplay:GOTO 390
  280 DEF PROCtone
  290 SOUND 1,a%(K),f%(K),m%(K)
  300 ENDPROC
  310 DEF PROCplay
  320 FOR q%=1 TO temp%-1
  330 SOUND 1,a%(q%),f%(q%),2*m%(q%)-1
  340 SOUND 1,0,0,1
  350 NEXT q%
  360 ENDPROC
  370 CLS:PRINT''''''''"Enter the note number of the change":INPUT K:CLS
  380 flag%=1:GOTO 100
  390 CLS:d$=CHR$(&8D):T$="MUSIC PLAYER"
  400 PRINT''TAB(8);d$;T$'TAB(8);d$;T$
  410 PRINT''"1)....Enter notes:16-Semibreve"'TAB(18);"8-Minim"'TAB(18);"4-Crotc
het"'TAB(18);"2-Quaver"'TAB(18);"1-Semiquaver"
  420 PRINT TAB(5);"For instance:4c# or 16A or 6d'$"'TAB(5);"Enter rests as 8r o
r 8R or 2r etc."
  430 PRINT'"2)....Play the phrase"'"3)....Change an entry"'"4)....Continue entr
ies"'"5)....List entries to specified point"'"6)....Leave the program"
  440 PRINT'STRING$(13,"@x@")
```

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PROGRAMS

```
450 PRINT'"Enter your choice and then RETURN"
460 INPUT choice:ON choice GOTO 70,270,370,580,630,470
470 END
480 DEFPROCrpt
490 pos%=INSTR(N$,"-")
500 r1%=VAL(MID$(N$,2,pos%-2))
510 r2%=VAL(MID$(N$,pos%+1,LEN(N$)-pos%))
520 REPEAT
530 entry$(K)=entry$(r1%)
540 m%(K)=m%(r1%):a%(K)=a%(r1%):f%(K)=f%(r1%)
550 PROCtone:K=K+1:temp%=temp%+1:r1%=r1%+1
560 UNTIL r1%=r2%+1
570 ENDPROC
580 K=temp%:CLS
590 FOR list%=K-5 TO K-1
600 PRINT list%;"?";entry$(list%)
610 NEXT list%
620 GOTO 100
630 CLS:INPUT''''''''"Listing required from note:"n1%
640 INPUT"to note:"n2%
650 FOR list%=n1% TO n2%
660 PRINT list%;"?";entry$(list%)
670 NEXT list%
680 K=n2%+1:GOTO 100
```

PET Virus

By Allan and Sue Vining

To carry on the tradition of finding and publishing programs with dubious themes and/or titles, here is a game called 'Virus', which will run on any PET in roughly 2k of RAM. I don't think readers will catch anything playing it, but it will certainly provide much in the way of entertainment. The idea is to control an antibody and trap viruses with it. Full instructions are in the program.

```
1 PRINT" CLS "
2 PRINT"                VIRUS"
3 PRINT"                ‾‾‾‾‾"
4 PRINT:PRINT"YOU CONTOL AN ANTIBODY (O) THAT MUST"
5 PRINT"TRAP A VIRUS.YOU START OFF WITH ONE AND"
6 PRINT"AS YOU ELIMINATE THEM THE STRAIN GROWS.
7 PRINT"CONTROLS ARE 8 UP  2DOWN  4LEFT  6RIGHT"
8 PRINT"       RVS PRESS SPACE TO START"
9 GETA$:IFA$=""THEN9
13 POKE59467,16:POKE59466,80:POKE59464,0:M=59464
14 M(4)=190:M(3)=205:M(2)=230:M(1)=255
15 N=N+1:IFN=5THEN720
16 PRINT"CLS":POKEM,0
17 Z=33268:Y(1)=32975:Y(2)=33404:Y(3)=32948:Y(4)=33330
18 FORI=1TO4:B(I)=INT(RND(1)*4+1):NEXT
19 B=40:C=1:D=32:X=INT(RND(1)*4+1)
20 IFX=1THENX=B
21 IFX=2THENX=-B
22 IFX=3THENX=C
23 IFX=4THENX=-C
24 PRINT"XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
30 FORI=1TO20:PRINT"X                                    X":NEXT
50 PRINT"XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
100 GETA:POKEM,178:IFA=0THEN200
120 ONAGOTO200,130,200,140,200,150,200,160
130 X=B:GOTO200
140 X=-C:GOTO200
150 X=C:GOTO200
160 X=-B
200 Z=Z+X
210 IFPEEK(Z)<>32THENGOTO700
220 POKEZ,81
225 FORT=1TON:IFB(T)=0THENU=U+1:NEXT
226 IFU=NTHENU=0:GOTO15
227 U=0
230 FORT=1TON:IFB(T)<>0THENGOSUB300
240 NEXT
250 GOTO100
300 POKEM,M(T)
305 IFPEEK(Y(T))=DTHEN500
310 ONTGOTO320,330,350,380
320 ONB(T)GOTO385,390,395,400
330 ONB(T)GOTO385,400,395,390
350 ONB(T)GOTO390,400,385,395
380 ONB(T)GOTO400,385,390,395
385 B=B:GOTO500
390 G=-C:GOTO500
395 G=-B:GOTO500
```


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PROGRAMS

```
400 G=C
500 Y(T)=Y(T)+G
510 IFPEEK(Y(T))<>D THENY(T)=Y(T)-G:B(T)=B(T)+1:IFB(T)=5THENB(T)=1:GOTO310
515 W=Y(T)
516 IFPEEK(W-B)<>DANDPEEK(W+B)<>DANDPEEK(W-C)<>DANDPEEK(W+C)<>DTHENGOSUB600
520 POKEM,0:POKEY(T),87:RETURN
600 B(T)=0:RETURN
700 FORI=1TO3:FORJ=80TO120:POKEM,J:NEXT:NEXT:FORI=50TO255:POKEM,I:NEXT
705 POKEM,0:PRINT"CLS 12CDOWN 11CRIGHTYOU CRASHED":FORQ=1TO1000:NEXT:RUN13
720 POKEM,0:PRINT"CLS 12CDOWN 14CRIGHTYOU WIN"
READY.
```

BBC Radar

by Stephen Smith and Matthew Jones

This games is laid out as a two-part program, the instructions being effectively a separate routine. This is necessary because of the memory used by BBC hi-res graphics. Level of play is passed from part one to part two.

Radar makes good use of 'ENVELOPE' and of colour and graphics. It will run on model A or B.

Multiple line statements are used to save RAM and the listing looks, therefore, rather untidy. Radar is a game of quick thinking rather than reaction (which makes a change from the 'zap the zombies' type of real-time game). Rules for play can be read from the listing of part one.

Part 1

```
 5 TIME=0
 10REM          'RADAR'
 20REM
 30REM         written by
 40REM    MATTHEW 'BLACK' JONES
 50REM          and
 60REM STEPHEN 'I LOVE TRACY' SMITH
 90MODE7
 100PRINTTAB(15,2)"RADAR"
 105PRINT
 110PRINT"The game is played by displaying a radarscreen with a sweeping arm,
which, whenit passes a ship tells you the bearingof that ship and indicates
it on thescreen.";
 120PRINT" A ping also indicates this."
 130PRINT"There are ten ships, only six of which appear at any one time. As y
ou hit the first four ships they are thus replaced."
 140PROCKEY:CLS:PRINT:PRINT
 150PRINT"To shoot at a ship press the 'S' key. You cannot fire at a ship be
fore the radar has made one complete sweep.";
 160PRINT"The computer will then ask you for the bearing of the ship you
wish to fire at,which was originally displayed on the screen.";
 170PRINT" The computer will then tell you how far away the ship is, Either:-"
 180PRINT"     Very close,"
 190PRINT"     Near,"
 200PRINT"     Midrange,"
 210PRINT"     Far away,"
 220PRINT"     Very far away."
 230PROCKEY:CLS:PRINT:PRINT
 240PRINT"   You the have four goes at that ship. Each time you enter the angle
of eleva- tion you want to fire at.";
 250PRINT"After each shotyour on board computer tells you how close your sh
ot was to the enemy ship, using the same scale as for the ranges."
 260PRINT" The game finishes when all ten ships have been sunk, or, until you
have been sunk yourself."
 270PROCKEY:CLS:PRINT:PRINT
 280PRINT"The chances of you being hit are relatedto time, the greater the tim
e taken, the greater the chance of you being hit;until eventually you run out
of time. This time is related to the level of play."
 290PRINT" The level of play also affects the accuracy required for your sh
ots."
 300PROCKEY:CLS:PRINT:PRINT
 310PRINT" What level of play do you wish to play at"
 320PRINT:PRINT"(Input a number between 1 & 5,level 1 is the hardest,5 is easie
st)"
 330A$=CHR$(11):PRINTA$;A$;A$;A$;
 340PRINTCHR$(9);CHR$(9);:INPUTL%:IFL%<1 OR L%>5 THENPRINTCHR$(30);CHR$(10);CHR
$(10);CHR$(10);:GOTO340
 350ENVELOPE1,1,0,0,0,0,0,0,126,-15,-1,60,126,100
 360ENVELOPE2,10,0,0,0,0,0,0,34,10,-20,-26,100,126
 370ENVELOPE3,3,1,1,1,1,10,10,10,126,0,0,-128,126,126:FORN=1 TO (TIME/100):AA=RND
(178):NEXT
 380ENVELOPE4,4,0,0,0,0,0,0,0,126,-5,-3,-1,126,110
 390CLS:PRINT:PRINT:PRINT"Now press the play button on your cassette":PROCKEY:C
HAIN""
 1000DEFPROCKEY:LOCALA$:PRINT:PRINT" PRESS ANY KEY WHEN READY.":REPEAT:UNTILINKE
Y$(0)="":A$=GET$:ENDPROC
```

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* REVERSE – turns any character to its opposite video
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This allows a total of eight options.
SUPERSCROLL allows you to scroll, up or down, ONLY the text within your defined window and can set the print position at the start of the blank line.
FLEXISCREEN and **SUPERSCROLL** are mutually compatible i.e. work within the same window or may be used independently. Absolute simplicity in use and a MUST for any ZX81 user (> 3½ RAM). Think of the possibilities – flash words/areas of screen, prompts highlights, games, scroll columns, underscroll headings etc. etc.
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PROGRAMS

Part 2

```
   10TIME=0:T=0:AR=10:DIMAR(10,2):FORI=1TO10:AR(I,1)=100+RND(900):AR(I,2)=RND(178
)*2:NEXT
   20FORII=1TO4:AR(II,2)=AR(II,2)+400:NEXT:X1=550:Y1=625:VDU23,228,129,12,60,255
,126,60.0,129:MODE5:IFL%=0THENL=1ELSEL=L%
   30COLOUR130:VDU19,130,2,0,0,0:CLS:COLOUR3:PRINTTAB(1,31)"PRESS 'S' TO SHOOT":
PLOT4,X1,Y1
   40FORI=0TO359STEP2:REPEAT:UNTIL INKEY$(0)="":X=FNsin(I):Y=FNcos(I):PLOT1,X,Y:
MOVEX1,Y1:X=FNsin(I-1):Y=FNcos(I-1):IF I<180 PLOT83,X,Y+5:PLOT4,X1,Y1 ELSE PLOT8
3.X,Y-5:PLOT4,X1,Y1
   50FORD=1TO10:IFI=AR(D,2)THENGOSUB220
   60NEXT:IFINKEY$(10)="S" THEN90
   70IF TIME>12000*L+6000THENX=-1:GOTO230
   80AA=RND(TIME):IF AA>24000 AND AA<(24000+(TIME/500))THENX=-1:GOTO230ELSE NEXT
:GOTO40
   90IFTIME<6390THENPRINTTAB(1,26)"NOT READY YET SIR.":SOUND0,-15,66,70:GOTO80
  100SOUND1,3,105,108:G=0:VDU28,0,31,19,26:VDU19,3,0,0,0,0:COLOUR3:CLS:PRINT" SE
LECT BEARING OF   TARGET (1-360')";:INPUTA:U=1:A=A-1:IFA<0ORA>359THEN90
  110Z=FNshipdist(A):IFZ=-1THENCLS:PRINT"THERE IS NO SHIP AT THAT ANGLE.":PROCpa
use:GOTO210
  120PROChint(U,A):PROCpause:A1=(ACS(Z/1500))*180/PI
  130CLS:PRINT" WHAT ELEVATION DO  YOU WISH TO FIRE AT (1-89)";
  140INPUTE:IF E<1ORE>89THEN130ELSEIFE<45THENE=90-E
  150SOUND0,1,5,18:T=1500*COS(E/180*PI):IF(Z+(10*L))>T AND(Z-(10*L))<T THENCLS:S
OUND0,2,5,50:PRINT"YOUV'E HIT THE ENEMY SHIP!!":VDU26:COLOUR0:PROCship(A,230):GO
TO170
  160U=2:Q=20*ABS(A1-E):PROChint(U,Q):PROCpause:G=G+1:IFG>3THEN210ELSE130
  170FORN=1TO10:IFAR(N,2)=A OR AR(N,2)=A+1OR AR(N,2)=A-1THEN AR(N,2)=-9:N=11
  180NEXT:AR=AR-1:IFAR=0THENX=1:GOTO230
  190FORII=1TO10:IFAR(II,2)>360THENAR(II,2)=AR(II,2)-400:II=11
  200NEXT
  210VDU26:VDU19,3,7,0,0,0:COLOUR3:PLOT4,X1,Y1:GOTO80
  220VDU19,1,15,0,0,0:COLOUR1:PROCship(I,228):VDU19,130,2,0,0,0:COLOUR130:SOUND2
,4,150,25:PRINTTAB(0,26)"   SHIP AT ";I+1;"'                    ":D=11:RETURN
  230CLS:IFX=1THENPRINTTAB(5,8)"YOU WON!":L%=L%-1ELSE PRINTTAB(5,8)"YOU LOST!"L%
=L%+1
  240PRINT" ANY KEY TO REPLAY":A$=GET$:RUN
  250DEFPROCship(F,B):LOCALI,T,H:I=F/180*PI:IFF>20THENT=-SGN(COS(I))ELSET=0
  260IFF>179AND F<285 H=-2:T=2ELSEH=0
  270PRINTTAB(T+8+(3*SIN(I)),12-H-(3*COS(I)));CHR$(B):ENDPROC
  280DEFFNshipdist(A):LOCALI,Z:FORI=1TO10:IF AR(I,2)=A OR AR(I,2)=A+1OR AR(I,2)=
A-1 Z=AR(I,1):I=11ELSEZ=-1
  290NEXT:=Z
  300DEFPROChint(U,Q):CLS:IFU=1THENPRINT"THE SHIP IS ";:Q=Z ELSEPRINT"YOUR SHOT
IS ";
  310Q=INT(Q/200):ONQ+1GOTO360,330,340,350,320
  320PRINT"VERY FAR AWAY":ENDPROC
  330PRINT"NEAR":ENDPROC
  340PRINT"MIDRANGE":ENDPROC
  350PRINT"FAR AWAY":ENDPROC
  360PRINT"VERY CLOSE":ENDPROC
  370DEFPROCpause:LOCALI:FORI=1TO5000:NEXT:ENDPROC
  380DEFFNsin(I):LOCALX:X=300*SIN(I/180*PI):=X
  390DEFFNcos(I):LOCALY:Y=270*COS(I/180*PI):=Y
```

PET German Game

by Jeff Aughton

This is a board game for the 8k 'new ROM' PET. It's called 'the German Game' because it was discovered in a toy shop in Germany and the real name (which was probably very long) has subsequently been forgotten. It's a computer-player rather than a two-player game and the object is to surround your opponent's piece. The program includes full instructions.

```
100 REM ** THE GERMAN GAME **
110 REM * BY J.AUGHTON 4/82 *
120 REM
130 POKE53,31:B=826:P=7937
140 READX:IFX<0THEN160
150 POKEP,X:P=P+1:GOTO140
160 REM
500 REM SET UP STRINGS ETC.
510 REM
520 B$="                              "
530 C$="[graphics]"
540 D$="SQQQQQQQQQQQQQQQQQQQ"
550 H$="[graphics]"
560 N$="[graphics]"
570 V$="|    |    |    |    |    |    |"
```


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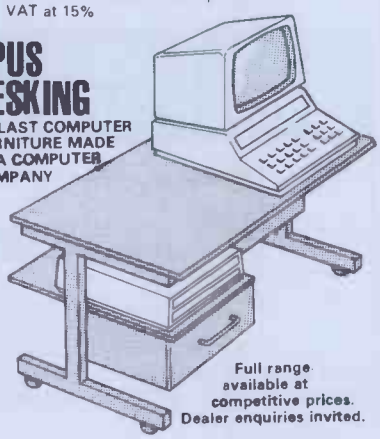

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PROGRAMS

```
580 Z$="  ■■■  "
600 FORP=BTOB+175
610 POKEP,9:NEXT
620 P=-1:GOSUB8000
1000 REM
1010 REM MAIN LOOP
1020 REM
1030 PRINT"■■DO YOU WANT TO START (Y/N)";
1040 INPUT"■■■■■";A$
1050 IFA$<>"Y"ANDA$<>"N"THEN1030
1060 C=-(A$="N")
1140 GOSUB5000
1150 FORI=2TO7:FORJ=2TO8
1160 POKEB+I+16*J,0
1170 NEXTJ,I
1200 X1=5:Y1=2:X=X1:Y=Y1
1210 P=1:A$=C$
1220 GOSUB7700
1230 X2=4:Y2=8:X=X2:Y=Y2
1240 P=2:A$=H$
1250 GOSUB7700
1260 IFCTHEN3000
1270 REM
2000 REM HUMAN MOVE
2010 REM
2020 GOSUB7200
2030 PRINT"■IT'S YOUR MOVE"
2040 GOSUB7300
2100 IFABS(X-X2)<=1ANDABS(Y-Y2)<=1THEN2170
2110 GOSUB7500
2120 PRINT"■YOU ARE TRYING"
2130 PRINT"■■■TO MOVE TOO FAR"
2140 PRINT"■■■■■■TRY AGAIN!"
2150 GOSUB7600:GOTO2000
2170 IFPEEK(B+X+16*Y)=0THEN2240
2180 GOSUB7500
2190 PRINT"■THAT SQUARE IS"
2200 PRINT"■■ALREADY OCCUPIED"
2210 PRINT"■■■■■TRY ANOTHER!"
2220 GOSUB7600:GOTO2000
2240 REM IT'S O.K.-HI TRISHA!!
2250 X3=X:Y3=Y:X=X2:Y=Y2
2260 P=0:A$=Z$
2270 GOSUB7700
2280 X2=X3:Y2=Y3:X=X2:Y=Y2
2290 P=2:A$=H$
2300 GOSUB7700
2310 GOSUB7200
2320 PRINT"■NOW PLACE A"
2330 PRINT"■■■NEUTRAL PIECE-"
2340 GOSUB7300
2350 IFPEEK(B+X+16*Y)=0THEN2420
2360 GOSUB7500
2370 PRINT"■YOU CAN'T MOVE"
2380 PRINT"■■■■THERE - IT'S"
2390 PRINT"■■■■ALREADY TAKEN"
2400 GOSUB7600:GOTO2310
2420 REM IT'S O.K.
2430 P=9:A$=N$
2440 GOSUB7700
2450 C=C+1
```

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PROGRAMS

```
2460 REM
3000 REM COMPUTER MOVE
3010 REM
3020 GOSUB7200:MA=0:K=0
3030 PRINT"■IT'S MY TURN -"
3040 PRINT"■■■ LET ME SEE..."
3045 IFC<2THENGOSUB7100:GOTO3150
3050 FORI=X1-1TOX1+1:FORJ=Y1-1TOY1+1
3060 IFPEEK(B+I+16*J)=0THENGOSUB6000
3080 NEXTJ,I
3085 IFMATHEN3150
3090 IFKTHENGOSUB7000:GOTO3150
3100 GOSUB7600:GOSUB7200
3110 PRINT"■I CAN'T MOVE"
3120 PRINT"■■■■■■YOU WIN"
3125 PRINT"■■■■IN";C;"MOVES"
3130 GOSUB7600:GOSUB7600
3140 GOTO4500
3150 REM I CAN MOVE
3160 GOSUB7200
3170 PRINT"■I WILL MOVE TO"
3180 PRINT"■■■■■■■■■■";CHR$(X3+63);Y3-1
3190 X=X1:Y=Y1
3200 P=0:A$=Z$
3210 GOSUB7700
3220 X1=X3:Y1=Y3:X=X1:Y=Y1
3230 P=1:A$=C$
3240 GOSUB7700:GOSUB7600
3250 GOSUB7200
3260 PRINT"■I WILL PLACE A"
3270 PRINT"■■■■PIECE AT :"
3280 X=X4:Y=Y4
3290 PRINT"■■■■■■■■■■";CHR$(X+63);Y-1
3300 P=9:A$=N$
3310 GOSUB7700:GOSUB7600
3320 FORI=X2-1TOX2+1:FORJ=Y2-1TOY2+1
3330 IFPEEK(B+I+16*J)=0THENC=C+1:GOTO2000
3340 NEXTJ,I
3350 REM YOU LOSE
3360 GOSUB7200
3370 PRINT"■YOU CAN'T MOVE"
3380 PRINT"■■■■■■■I WIN!!"
3385 PRINT"■■■■IN";C;"MOVES"
3390 REM
4000 REM GAME OVER
4010 GOSUB7600:GOSUB7600
4020 PRINT"■■■I WAS OBVIOUSLY TOO GOOD FOR YOU!!"
4030 PRINT"■■DO YOU WANT YOUR REVENGE(Y/N)?";
4040 GOTO4530
4500 REM YOU WIN (FLUKE!)
4510 PRINT"■■■AMAZINGLY,YOU WON-BUT I WASN'T TRYING!"
4520 PRINT"■CAN I HAVE ANOTHER CHANCE(Y/N)?";
4530 GETA$:IFA$="Y"THEN1000
4550 IFA$<>"N"THEN4530
4600 PRINT"■■":END
4700 REM THAT'S ALL FOLKS!!
4780 REM
5000 REM DRAW BOARD
5010 REM
5020 PRINT"■"SPC(21)"A  B  C  D  E  F"
5030 PRINT"■ THE GERMAN GAME     ┌──┬──┬──┬──┬──┬──┐"
5040 FORI=1TO6
```


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ZX81 16K

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PROGRAMS

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5060 PRINTSPC(17)I;V$
5070 PRINTSPC(20)"├──┼──┼──┼──┼──┼──┤"
5080 NEXT
5090 PRINTSPC(20)V$
5100 PRINTSPC(17)I;V$
5110 PRINTSPC(20)"└──┴──┴──┴──┴──┴──┘"
5120 PRINTLEFT$(D$,17);"  MY  PIECE:"
5130 PRINTD$;" YOUR PIECE:"
5140 A$=C$:A=14:D=16:GOSUB7800
5150 A$=H$:D=22:GOSUB7800
5160 RETURN
5990 REM
6000 REM WISE MOVES
6010 REM
6020 POKEB+I+16*J,1
6025 POKEB+X1+16*Y1,0
6030 FORK=X2-2TOX2+2:FORL=Y2-2TOY2+2
6040 IFPEEK(B+K+16*L)THEN6300
6050 POKEB+K+16*L,9
6060 X=I:Y=J:GOSUB7920
6070 E=M+1
6075 X=X2:Y=Y2:GOSUB7920
6080 E=E/(M+1)
6090 IFE<MATHEN6200
6100 MA=E:X3=I:Y3=J:X4=K:Y4=L
6200 POKEB+K+16*L,0
6300 NEXTL,K
6310 POKEB+I+16*J,0
6315 POKEB+X1+16*Y1,1
6320 RETURN
6330 REM
6500 REM ASSORTED SUBROUTINES
6510 REM
7000 REM RANDOM MOVE(1)
7010 REM
7020 FORX3=X1-1TOX1+1:FORY3=Y1-1TOY1+1
7030 IFPEEK(B+X3+16*Y3)=0THEN7050
7040 NEXTY3,X3
7050 FORX4=2TO7:FORY4=2TO8
7060 IFPEEK(B+X4+16*Y4)=0THEN7080
7070 NEXTY4,X4
7080 RETURN
7090 REM
7100 REM RANDOM MOVE(2)
7110 REM
7120 X3=X1-2+INT(3*RND(1)+1):Y3=Y1+1
7130 IFPEEK(B+X3+16*Y3)THEN7120
7140 X4=INT(4*RND(1)+3)
7150 Y4=INT(2*RND(1)+5)
7160 IFPEEK(B+X4+16*Y4)THEN7140
7170 GOSUB7600
7180 RETURN
7190 REM
7200 REM CLEAR MESSAGE & PLACE CURSOR
7210 REM
7220 PRINT"
7230 FORI=1TO9
7240 PRINT" ";B$
7250 NEXT
7260 PRINT"
```


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PROGRAMS

```
7270 RETURN
7290 REM
7300 REM INPUT MOVE
7310 REM
7320 PRINT"■■■■■■■LETTER ";
7330 MI=65:MA=70:GOSUB7400
7340 X=T-63
7350 PRINT"■■■■■■■NUMBER ";
7360 MI=49:MA=55:GOSUB7400
7370 Y=T-47
7380 RETURN
7390 REM
7400 FORI=0TO9:GETA$:NEXT
7410 PRINT"■■■";
7420 FORI=0TO220:NEXT
7430 GETA$:IFA$=""THEN7450
7435 T=ASC(A$)
7440 IFT>=MIANDT<=MATHEN7480
7450 PRINT"■ ■";
7460 FORI=0TO220:NEXT
7470 T=RND(1):GOTO7410
7480 PRINT"■";A$
7490 RETURN
7495 REM
7500 REM NAUGHTY MOVE
7510 REM
7520 PRINT"■■■**ILLEGAL MOVE**"
7530 GOSUB7600:GOSUB7200
7540 RETURN
7590 REM
7600 REM 2 SECOND DELAY
7610 REM
7620 FORI=0TO2000:NEXT
7630 RETURN
7690 REM
7700 REM CONVERT X,Y TO A,D
7710 REM
7720 A=3*X+16:D=3*Y-3
7730 REM
7800 REM PRINT A$ AT (A,D)
7810 REM
7820 PRINTLEFT$(D$,D+1);SPC(A-1)A$
7830 IFP<0THENRETURN
7840 POKEB+X+16*Y,P
7850 RETURN
7890 REM
7900 REM COUNT 'MOVES' FROM (X,Y)
7910 REM
7920 POKE35,X:POKE36,Y:POKE37,0
7930 SYS7937
7940 M=PEEK(37)
7950 RETURN
7995 REM
8000 REM RULES
8010 REM
8020 PRINT"■          THE GERMAN GAME■"
8030 PRINT"THIS IS A NEW BOARD GAME FOR TWO PLAYERS"
8040 PRINT"EACH PLAYER (YOU AND I) HAS ONE PIECE■"
8050 PRINT"AND THE OBJECT OF THE GAME IS TO PREVENT"
8060 PRINT"THE OPPONENT FROM MOVING. THE PLAY■"
8070 PRINT"CONSISTS OF ALTERNATE TURNS AND YOU MAY■"
```


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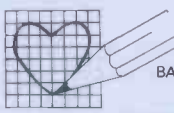

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PROGRAMS

```
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 8090 PRINT"YOUR PIECE     ON ANY ADJACENT EMPTY CELL."
 8100 PRINT"AND THEN PLAY A NEUTRAL PIECE     ANY-■"
 8110 PRINT"WHERE ON THE BOARD.I WILL PLAY LIKEWISE■"
 8120 PRINT"AND THE WINNER IS THE LAST TO MOVE."
 8130 A=12:D=13:A$=H$:GOSUB7800
 8140 A=31:D=15:A$=N$:GOSUB7800
 8150 PRINT"■■■":GOSUB8700
 8160 PRINT"■REMEMBER THAT THE OBJECT IS TO TRAP MY■"
 8170 PRINT"PIECE     (AND THAT I WILL TRY TO DO THE■"
 8180 PRINT"SAME TO YOU).■"
 8190 PRINT"NOTE THAT I DO NOT INSIST ON YOU PRESS-■"
 8200 PRINT"ING ■ RETURN ■ WHEN YOU ENTER YOUR MOVE■"
 8210 PRINT"OF COURSE YOU MAY DO SO IF YOU WISH BUT■"
 8220 PRINT"I WILL PROBABLY IGNORE YOU.LET'S GO...."
 8230 A=7:D=1:A$=C$:GOSUB7800
 8240 PRINT"■■■■■■■■■■■■":GOSUB8700
 8600 RETURN
 8700 PRINT"■       PRESS ■ SPACE ■ TO CONTINUE"
 8710 GETA$:IFA$<>" "THEN8710
 8720 RETURN
 9000 REM
 9010 DATA 169,42,141,30,31,162,48,165,36,10,10,10,10,24,101,35,125,70,31
 9020 DATA 168,185,58,3,208,22,230,37,202,224,42,240,21,152,24,125,70,31
 9030 DATA 168,185,58,3,208,240,230,37,208,234,202,202,202,202,202,202,232
 9040 DATA 202,208,1,96,173,30,31,56,233,6,141,30,31,76,8,31
 9050 DATA 1,1,240,240,15,239,0,31,1,1,239,240,16,16,1,1,239,241,0,242
 9060 DATA 16,16,239,255,0,238,16,16,241,1,1,1,16,16,239,15,0,223,1,1
 9070 DATA 15,16,255,255,16,16,241,17,-1
READY.
```

TRS-80 Card shuffler

By Russell Hutson

Here's a routine to add to your card playing programs which will act as something of a croupier. It takes up 3.93k but can be compressed to 2.95k by removing REMs and other trimmings.

It is designed to set up a pack of 52 cards, set up a copy of this pack and shuffle the deck. This process takes 14 seconds on average and an area is marked in the listing where the rest of a card game can be inserted, using the arrays set up by the routine. Output is in the form 'AS BLK 1 11' – A being rank, S suit, BLK colour and 1 11 being values (in this case either one or 11 for an ace). The program will run on its own, but it is not meant to do so. A list of variables at the end should serve as a useful guide when writing a full program using the shuffler.

It needs a TRS-80 Level II or Video Genie to run, but should be quite easy to convert for use on other micros.

```
 0 REM////////////////////////////////////////////////////////
 1 REM//////// PACK OF CARDS SUBROUTINE-DEC1981RHUTSON ////////
 2 REM////////////////////////////////////////////////////////
10 CLS:CLEAR2048:S=1
20 DIM CL$(2),S$(4),N$(13),C$(4,13),V$(2,13),CP$(4,13),SP$(52),
   PC$(52),CC$(79)
30 PRINT" PLEASE WAIT WHILE I LOOK FOR THE PACK OF CARDS."
40 FORX=1TO2:READCL$(X):NEXT
50 FORX=1TO4:READS$(X):NEXT
60 FORX=1TO13:READN$(X):NEXT
70 FORX=1TO13:READV$(1,X):NEXT
80 FORX=1TO13:READV$(2,X):NEXT
90 PRINT"
I THOUGHT I PUT THEM IN THAT 1K NEXT TO THE CPU."
100 FORC=1TO4:FORX=1TO13
110 IFS$(S)="H"ORS$(S)="D"THENCL=1ELSECL=2
120 C$(C,X)=N$(X)+S$(S)+" "+CL$(CL)+" "+V$(1,X)+" "+V$(2,X)
130 NEXT:S=S+1:NEXT
140 PRINT"
```


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PROGRAMS

```
 AH.... THERE THEY ARE! WHO PUT THEM IN THAT MEMORY LOCATION ?"
150 GOSUB170
160 PRINT"
 I'M GOING TO SHUFFLE NOW
 (I'M ALL FINGERS & RESISTORS AT THIS)":GOTO200
170 FORC=1TO4:FORX=1TO13
180 CP$(C,X)=C$(C,X):NEXT
190 RETURN
200 REM ////// SHUFFLE ROUTINE //////
210 FORX=1TO52
220 C=RND(13):S=RND(4)
230 IFC$(S,C)=""THEN220
240 SP$(X)=C$(S,C):C$(S,C)=""
250 IFC=1ANDS=3THENPRINT"
 OOPS! DROPPED THAT ONE... DIDN'T SEE IT, DID YOU?"
260 NEXT
270 PRINT"
THEY'RE SHUFFLED ENOUGH. NOW COMES THE GAME"
300 REM
310 REM
320 REM ########################################################
330 REM ############## INSERT CARD PROGRAM HERE ###############
340 REM ########################################################
350 REM
360 REM
940 END
950 DATA RED,BLK
960 DATA H,D,S,C
970 DATA A,2,3,4,5,6,7,8,9,10,J,Q,K
980 DATA 1,2,3,4,5,6,7,8,9,10,10,10,10
990 DATA 11,2,3,4,5,6,7,8,9,10,10,10,10:REMALTERNATIVE VALUES
65519 REM========= VARIABLES USED ===========
65520 CL$ - ARRAY HOLDING COLOURS (RED/BLK)
65521 S$  - ARRAY HOLDING SUIT (H/D/S/C)
65522 N$  - ARRAY HOLDING CARD NAME VALUE (ACE OF HEARTS ETC.)
65523 C$  - ARRAY HOLDING WHOLE PACK OF CARDS (C$(SUIT,VALUE))
65524 V$  -ARRAY HOLDING 2 CARD VALUES (1=NORM:2=PONTOON)
65525 CP$ - ARRAY HOLDING COPY OF PACK
65526 X/C - LOOP VARIABLES
65527 S   - SUIT
65528 CL  - COLOUR NUMBER (1=RED:2=BLACK)
```

'There's a hole in my Apple...'

Continued from page 151

normally as long as the end of program pointer ($AF,B0) is adjusted and from it the pointers to variables, arrays and strings are also reset. If the program is SAVEd, however, in its split form everything will be there on a subsequent LOADing but the program will only LIST up to the end of the first part and it will not run correctly. The reason is not hard to find: all the link addresses are correct except for those in this last line. Therefore a split program must POKE in the two 'wrong' link addresses when it begins to execute. There is another annoying thing about a split program saved to disk; it wastes disk space. In the case of a program split around on hi-res page 34 sectors are lost and a massive 68 are lost for two hi-res pages. It is true that this space can be used to keep a hi-res picture for either introducing the program or starting it off but generally I would rather save the disk space. Clearly it would be better to let the Basic program be split after LOADing and RUNning and also it should all be as automatic as possible. Hence was born the '&CLEAR... TO... utility.

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code program for you in memory and then save it to disk; when used, the machine code program is merely BRUNned from within the Basic program. The second is to incorporate the listed Applesoft program within your own program and then CALL the machine code routine after it has been POKEd in.

After the routine is BRUNned or CALLed, the area of memory wished to be kept clear is merely passed to it as two decimal values. These need not be simple numbers; they can be expressions. For example, to clear the area of memory required for two hi-res pages a line of Basic such as:

```
1 PRINT CHR$(13)+CHR$(4)"BRUN
  CLEARSPLIT":&CLEAR
  2*16*256 TO 6*16*256
```

will accomplish the split as long as the binary file 'CLEARSPLIT' is on the disk.

As long as the lower area is cleared first a second or third area can also be cleared merely by invoking the appropriate &CLEAR. . .TO. . .line. The utility can also be used in the immediate mode as long as it BRUNned first. Thus a program can be split and saved in the split form if wished as long as a line of Basic is incorporated which will POKE in the two link addresses as explained above. (You will have to determine the exact values after incorporating the line by either going through the memory following the link addresses yourself or by using a small program as described above.)

The utility can also be used to completely relocate a program above the hi-res page as in Neil Konzen's &LOMEN: utility but without the worry of losing part of a long program. This is accomplished by using the lines:

```
1 PRINT CHR$(13)+CHR$(4)"BRUN
  CLEARSPLIT":&CLEAR 1024 TO
  16384
2 POKE 104,64 :REM for page one
```

Five points are worth noting when using the &CLEAR. . .TO. . .utility. The first is it must be used early in a program before any of your variables or strings are defined since it does a CLEAR before returning to the Basic; the second is that it does not protect itself by resetting HIMEM: so it will be overwritten by any STRING activity; the third is that the line number corresponding to the first line in the latter part will be displayed on the screen; the fourth is that an attempt to set an initial value not within the program will result in an error message as will the wrong syntax in the line, and the fifth is that after splitting, a program cannot be edited.

There are three ways round this problem. In the first you must develop the program exclusively above the hi-res pages by changing the start of program pointers and using smaller arrays, etc, until you are convinced it is perfect then add the &CLEAR. . .TO. . . line. In the second you must keep on disk a version of the program which incorporates any changes you make but which is SAVEd before RUNning and it is this version which is edited. In the third you must use another program which will close up a split program. This is also listed and is called 'CLOSESPLIT'. Its use is very simple. To edit a split program either BRUN 'CLOSESPLIT' or, if it is already in memory, just CALL 768. If after splitting a program you LIST it you will notice that 'CLEARSPLIT' has introduced a line of Basic which is a GOTO. 'CLOSESPLIT' will remove this, recombine the program, reset the end of program pointer, and do a CLEAR before returning you to Basic.

To save space, I have presented both programs only as Applesoft programs. Both of these will assemble the appropriate machine code programs in RAM and will then save them to the required destination disk. 'CLOSESPLIT' resides at $300 and so the relevant Applesoft program will merely form it and SAVE it. 'CLEARSPLIT' however, was originally assembled at $9400 for a 48k machine with DOS. So the relevant Applesoft program has been written so that it will determine the size of memory available (from the HIMEM: pointer at $73,74) for any machine and then assemble the program as appropriate. Tape users can easily modify these two to their advantage and use 'CLEARSPLIT' in the immediate mode, or by incorporating the program within their own program can use it in the deferred mode.

If anyone would like a source listing of the two assembly programs I will be happy to try to supply them if possible. Also, if anyone has difficulties with them I would very much like details of the problem to try to improve the both of them. I can be reached at The Department of Chemistry, University of Machnester Institute of Science and Technology, PO Box 88, Sackville Street, Manchester M60 1QD.

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OLIVETTI M20

Continued from page 109

phase. Troubleshooting is dealt with in the same style, using large flowcharts which end up in boxes with messages like 'contact Olivetti dealer/distributor'. PCOS commands and Basic keywords are dealt with exhaustively, with explanations of each of the field values and syntax diagrams (although not very many examples).

However, manuals have a dual function to perform. They have to get the user started on the system and then have to serve as reference material for filling in all the details, and the Olivetti manuals fall down somewhat here. Instead of an index, there is an exhaustive table of contents (five pages long in the PCOS manual). This references everything one could want to look up — but in page order rather than alphabetically, so it's quite hard to use. As we had only the PCOS and Basic manuals, hardware information was rather hard to come by and information about (say) the IEEE-488 interface was virtually nonexistent. Although there are 'pocket' reference manuals for PCOS, Basic and the interface (not supplied), there seems to be no hardware manual at all.

The manuals are very glossy and one gets the impression that considerable care has been taken in their production and translation into English. In the two volumes, only one sentence appeared to have wriggled through the translator's comprehension.

Prices

Olivetti has decided that its micro is going to be competitively priced with the current 8-bit systems. The review machine's configuration (standard system with 160k RAM, dual minifloppy disk drives and a monochrome display) costs £2395. To this must be added the printer (£738), the manuals (£50) and PCOS (£30). As there was no price for Basic, it must be included in the standard price.

Olivetti sells three configurations (all of which carry a one-year guarantee). The basic configuration comes with one disk only and 128k of RAM and sells for £1895. The review machine was the middle configuration, whereas the upmarket version comes with a colour display and costs £3262.

Upgrades and peripherals are not particularly inexpensive and as there are no technical specs for the hardware it is unlikely that second sources will appear. The dot matrix printers cost £550 for 100 cps and £1475 for 140 cps. A 32k memory upgrade costs £139, the IEEE interface £227 and the serial ports £225. Most of the Olivetti applications cost between £150 and £300, while the third-party software seems to be priced from £300 to £1000.

Conclusion

The Olivetti M20 represents a brave attempt by a large firm to make its way independently in the microcomputer market. (By way of comparison, Texas Instruments and Hewlett Packard tried it; IBM and DEC did not.) This independence reflects itself by the decision to base the hardware on an unpopular processor; this cuts Olivetti off from the mainstream of microcomputer software development, both at operating system and application levels. Olivetti seems to be fully aware of this step as it is making efforts to provide the requisite software, both in-house and by recruiting external software houses.

The system could appeal to scientific/commercial users who derive confidence from dealing with a big firm which offers some sensitivity in meeting software needs and which is willing to provide extensive and sound maintenance and support. **END**

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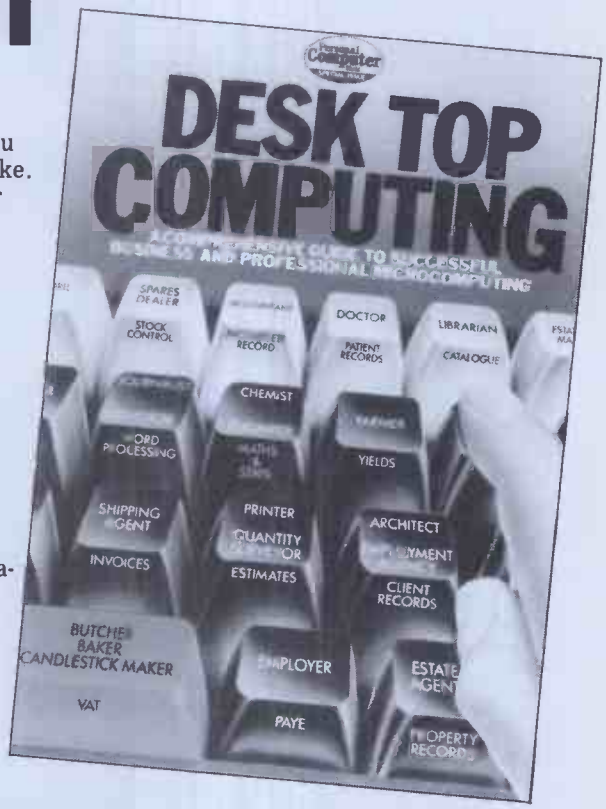

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December 1980
Benchtest: Microwriter/Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs:TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligatow Swamp, PET Connect, UK101 Minefield, PET Simon
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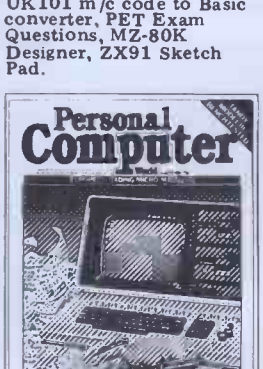
Volume 4 No 1
January 1981
Benchtest: Transam Tuscan/Real-time control using trains — part 1/Recover from a data tape disaster/PET Music
Multi-user systems — part 1/Programs:TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram

Volume 4 No 3
March 1981
Benchtest: Onyx C8002/Benchtest: Bigboard/Micro music software package/ALC circuit/Commons report/HP 43C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing' PET Bouncy.

Volume 4 No 5
May 1981
Benchtest: Pascal 640/WP Benchtest: Magic Wand/PET colour/Low-cost digital tape system/Using calculator printers on micros/Apple music-making/Multi-user Benchtest: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.

Volume 4 No 6
June 1981
Benchtest: NEC PC-8001/Multi-user Benchtest: MP/M/Benchtest: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchtest: Wordpro 4 plus/Budget tape interface/Further Casio quirks/Programs: UK101 Zor, PET Chords.

Volume 4 No 7
July 1981
Benchtest: Sharp PC-3201/Multi-user Benchtest: Acorn Econet/Case study: Accident investigation on TRS-80/Zilog Z8 family/WP Benchtest: Format-80/Pascal Benchmarks: readers' letters/Quicker Casio computations/Programs: ZX80 Sliding Letters, UK101 Car Rally, TRS-80 Calendar, UK101 m/c code to Basic converter, PET Exam Questions, MZ-80K Designer, ZX91 Sketch Pad.



Volume 4 No 8
August 1981
Benchtest: Tandy Model III/Viewdata update/WP Benchtest: Spellbinder/Printer survey/Microholism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.

Volume 4 No 9
September 1981
Benchtests: Tandy Color Computer, Commodore VIC/Checkouts: Hi-Tech Speakeasy, Tantel/Multi-user Benchtest: HMSOS/WP Benchtest: Memorite III/Word proc program for PET/Apple dealership run by spastics/Printer facing extra/Calc Corner: Casio fx602p review/Programs: PET Arithmetic test, ZX80 Eldorado, 380Z Memory test.

Volume 4 No 10
October 1981
Benchtest: OKI if-800/Checkouts: Heuristics speech link, Softy 2/Calc Corner: Texas TI51-111/Jeff Taylor on computer literacy projects/Introducing TJ's Workshop/Control your own Substation pt 1/Programs: TRS-80 Sailing.

Volume 4 No 11
November 1981
Benchtests: Osborne 01, IBM Personal Computer. Checkout: Sharp IQ3100 Microtranslator. Calc Corner: Casio fx702p. PCW Show report, Benchmark Summary, Euro Micro Chess Championship report. Programs: TRS-80 Sheepdog trial, ZX81 Sun and Planets.

BENCHTEST GUIDE

Here's a list of all the Benchtests and reviews (and the issues in which they were published) available from the Back Issues Centre

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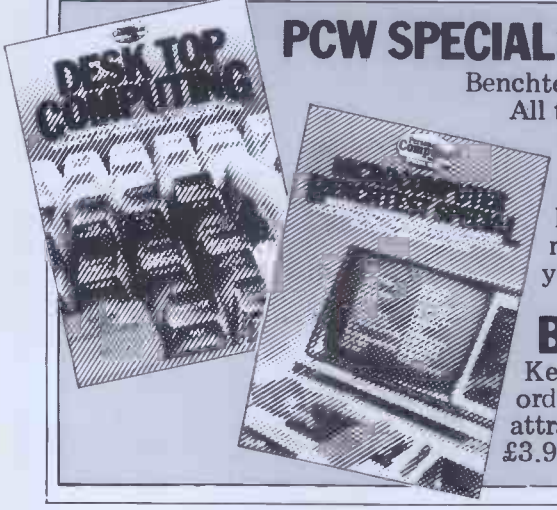

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Vol 4 No 12
December 1981
Benchtests: Sharp MZ-80B Philips P2000/School network/ BBC Micro inside story/ 'Turtle' Graphics for Apple/ Forth language/ Curve fitting/ Calc corner: HP14C review/ Programs: PET Fantasy, ZX81 Battleships and cruisers.

Vol 5 No 1 January 1982
Benchtests: BBC Micro, Xerox 820/Frames of Reference (new series)/ ZX81 Printer Checkout/ Digital Drummer for PET/ Calc Corner: Benchmarks/ Programs: MZ-80K Fortune, TRS-80 Reaction Timing, ZX80 Laybrinth, Apple Letters.

Vol 5 No 2 February 1982
Benchtests: Sirius-I, Casio fx-9000p, Gemini Multiboard/Word Processor Benchtest: Scripsit 2.0/ Plotter Checkout: Watanabe/Hardware feature: High Density VDU card project/Music system: FREQOUT/Calc Corner: Aerial Navigation/Programs: Pet Haemophilia, Pet Cheese, TRS-80 Extra, Sharp PC1211 Exam, Personality test.

Vol 5 No 3 March 1982
Benchtests: Texas Instruments 99/4A, Hewlett-Packard 125/Choosing a Database/Compsoft DMS reviewed/Screenplay (new series)/Calc Corner: Hewlett-Packard Interface Loop/Programs: TRS-80 Solitaire, TRS-80 Ducks, Nascom Business Documents, MZ-80K Race Chase, ZX81 Graphplot.

Volume 5 No 4
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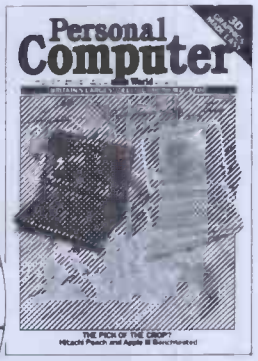
Benchtest: Monroe OC8820/DB Benchtest: FMS-80/Checkout: Sid 1/ Generating screen forms/ Comal/Logo/Brain Dump-New series/Calc Corner: Casio FP-10 printer/ Programs: TRS-80 Maths & Trig, PET Boot the Cat, ZX81 Resistor & Res code.



Vol 5 no 5 — May 1982
Benchtests: Apple III, Hitachi Peach/Database Benchtest: dBase II/3D Graphics Made Easy/ Equation Solving/Calc Corner: fx 602 quirks/ Programs: PET Mini-Animate, MZ-80K Catch, Apple Maze, Atari Sums For Kids, ZX81 Book Index, PET Stockmarket, Microtan 3D Rotation, Extra for MZ-80K, UK101 Crossword Notepad.
With free Word Processing Supplement containing a summary of all *PCW*'s WP Benchtests.

Vol 5 No 6.
June 1982
Benchtests: Sharp MZ-80A/ ZX Spectrum/Database Benchtest: DBMS2/West Coast Faire Report/Lisp/ VIC 20 games/Calc Corner: Sharp PC1500/ Programs: RML Altered Basic/VIC-20 Large Characters/BBC Breakout/ VIC-20 Trailblazer/MZ-80K Next-to-Last-One/MZ-80K Tarot.

Vol 5 No 7
July 1982
Benchtests: Mimi 801/ Newbrain/Database Benchtest: Silicon Office/UCSD p-System/BBC Computer In-Depth/Apple II games/ Calc Corner: TI88/ Programs: ZX81 Hypocycloids/BBC Character Generator/TRS-80 Truth/ PET Doc/TRS-80 Screen Dump/UK101 Screen Converter/PET boxes/Atari Earth.

Vol 5 No 8
August 1982
Benchtests: Sord M23/ Dragon 32/Database Benchtest: Cardbox/ Preview: Sony SMC-70/ UCSD p-System/RS232 Interface/Sirius graphics/ NCC Show report/ZX81 Speech Checkout/Calc Corner: Casio fx602p/ Programs: TRS-80 Quadrangle/UK101 Conversion of units/PET Mopup/Apple Lifespan/Apple Trees/ Nascom Snail Racing/ UK101 Long Multiplication & addition.

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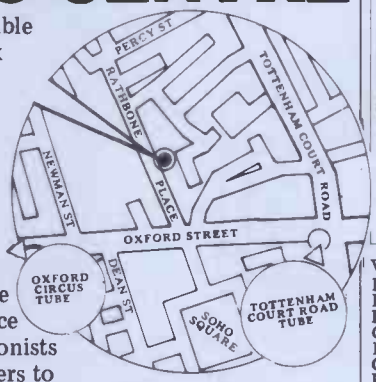

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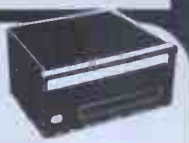

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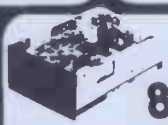

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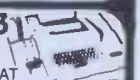

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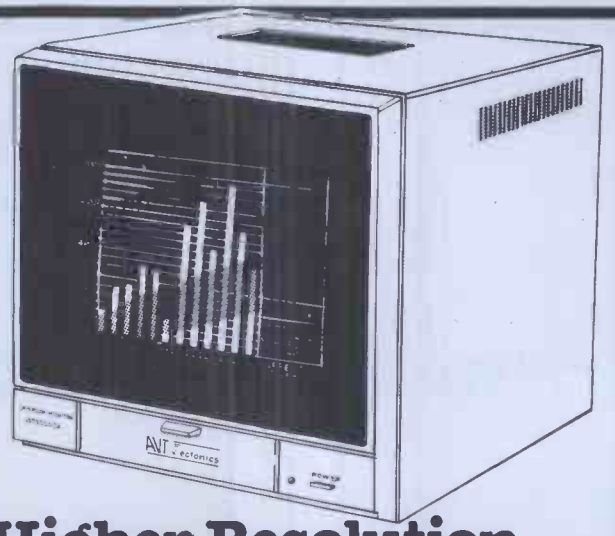

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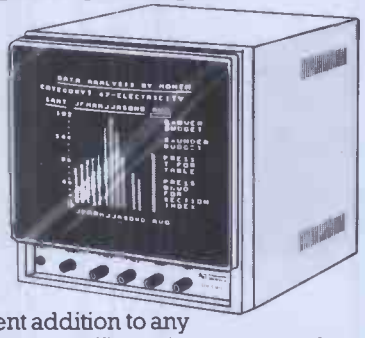

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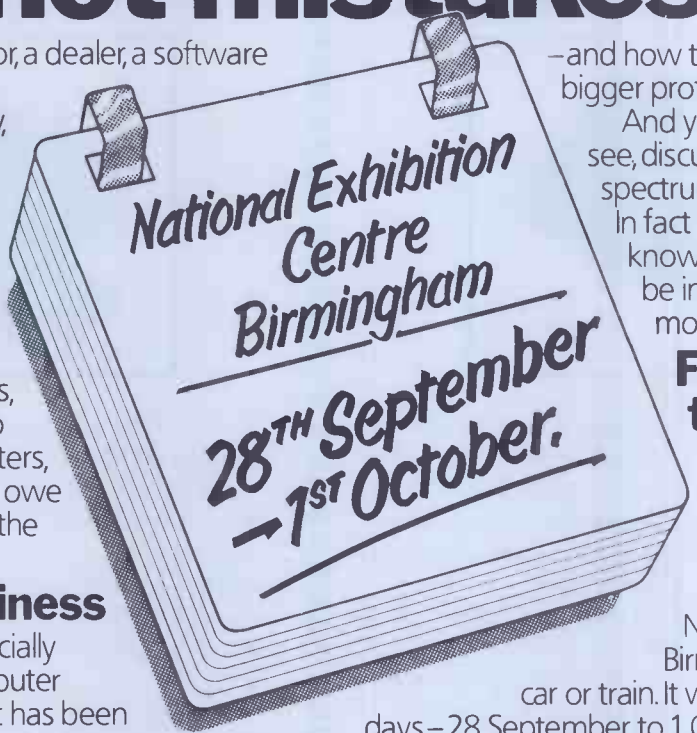

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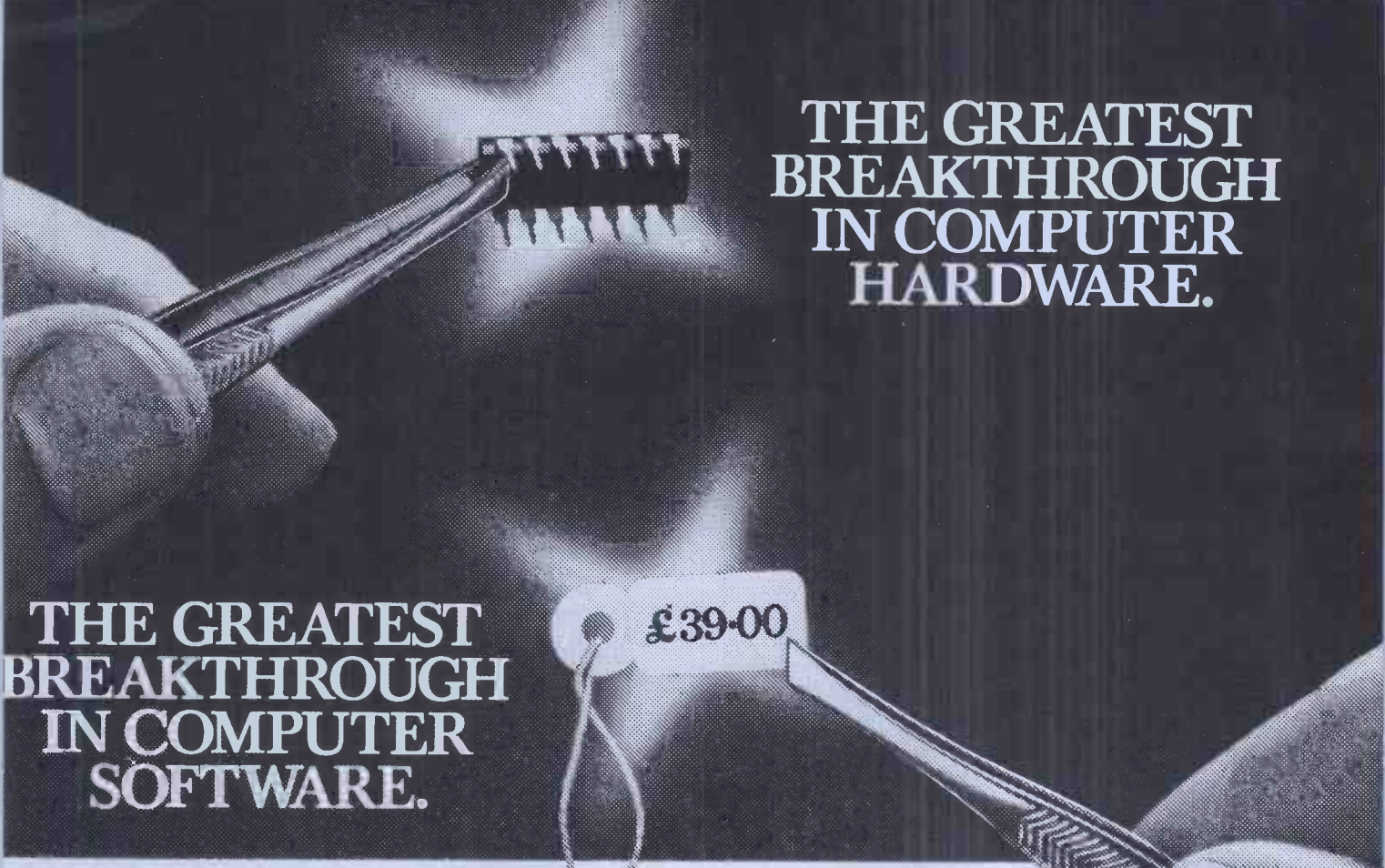

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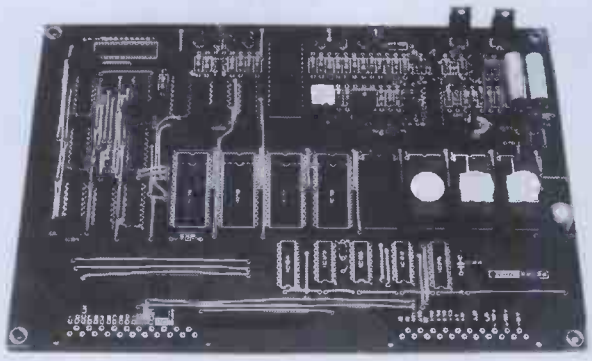

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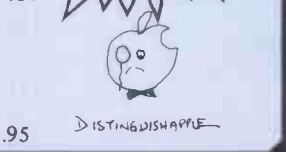

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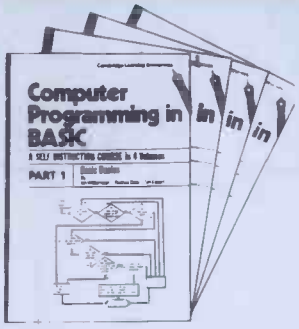

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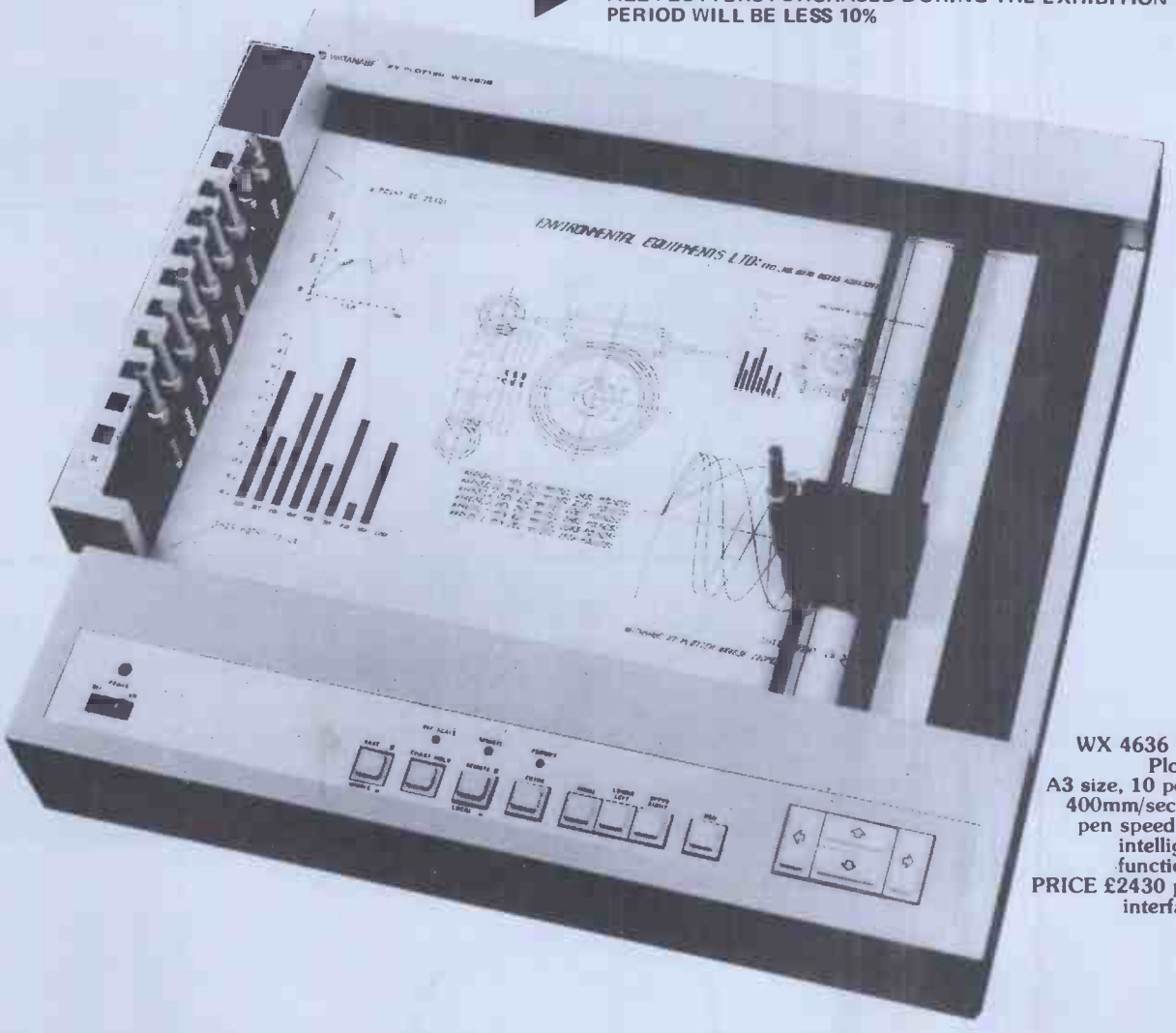

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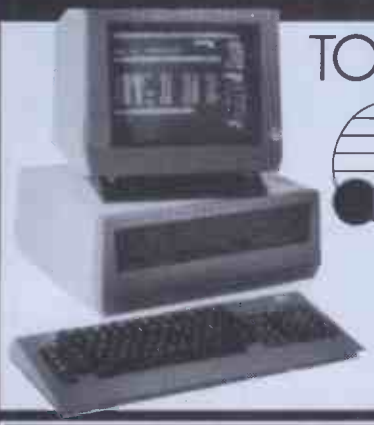

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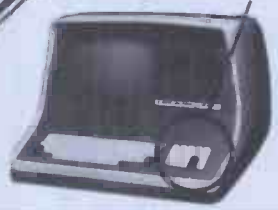

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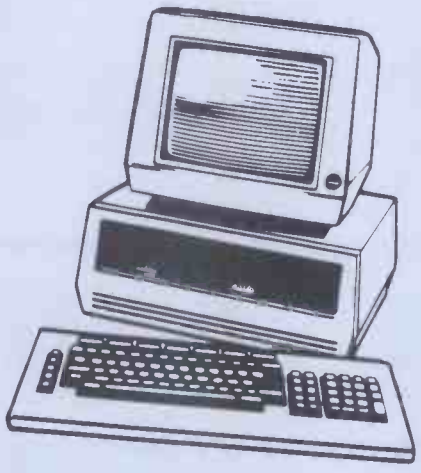

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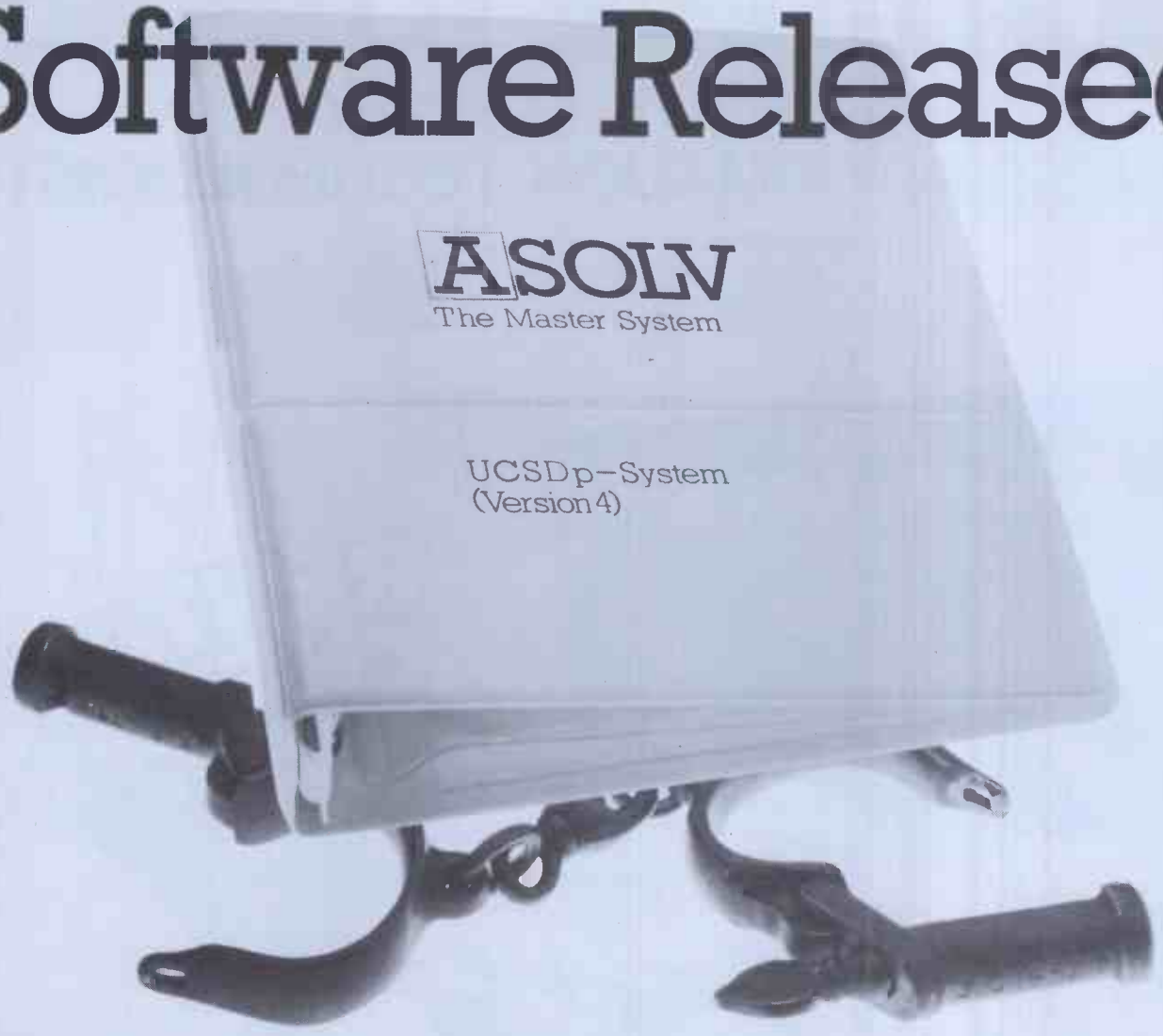

The Hardware Barrier

Whatever microcomputer you own or use its capability has been limited by the availability of software as this is generally designed to run on a specific type of machine. And all too often that important software package has been unavailable on your machine. This restriction has necessitated the benefits of hardware being traded off against software availability with consequent loss in efficiency. Now there's the Master System.

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Different computer languages offer different benefits to the user. Such is the Master System's versatility that even a program having modules written in different languages can be run and executed. This allows you to capitalise on the advantages of particular languages avoiding their weaknesses.

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With advances in microcomputer technology happening so fast, your major concern is whether your investment in today's technology will be protected in the future. The Master System is designed to give your needs that protection. Software and Hardware houses such as IBM, Apple and ACT Sirius 1 have already adopted the Master System and it is gaining rapid worldwide acceptance. More than 30,000 users have chosen it. Increasingly the Master System will enable you to take advantage of the latest software releases. As your computing needs grow you may outgrow the capacity of your microcomputer, the Master system ensures that your investment in software programs and important data is protected without restricting your future hardware options.

Complete Documentation

The Master System is currently available as a software package comprising a diskette and comprehensive documentation. The Master System is also being built to accommodate Winchester based systems.

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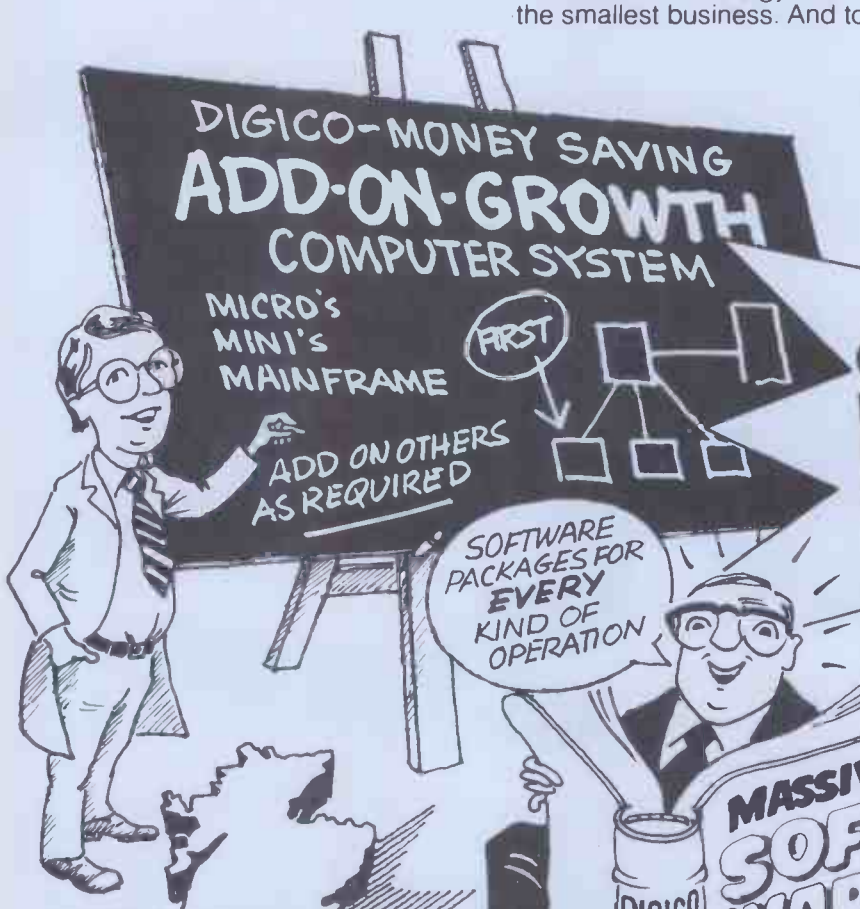

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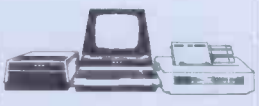

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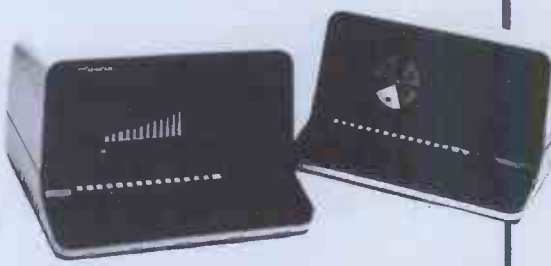

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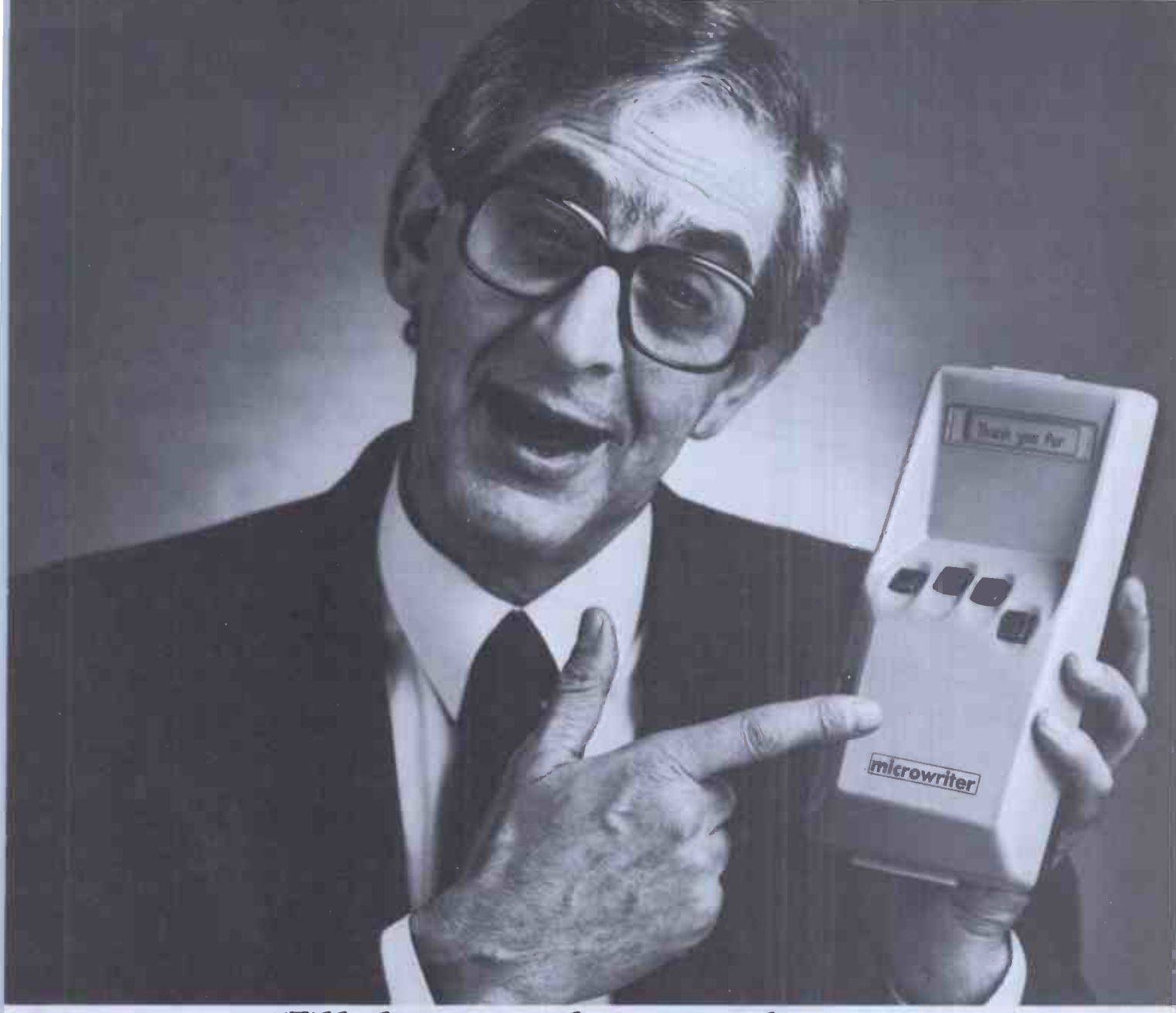

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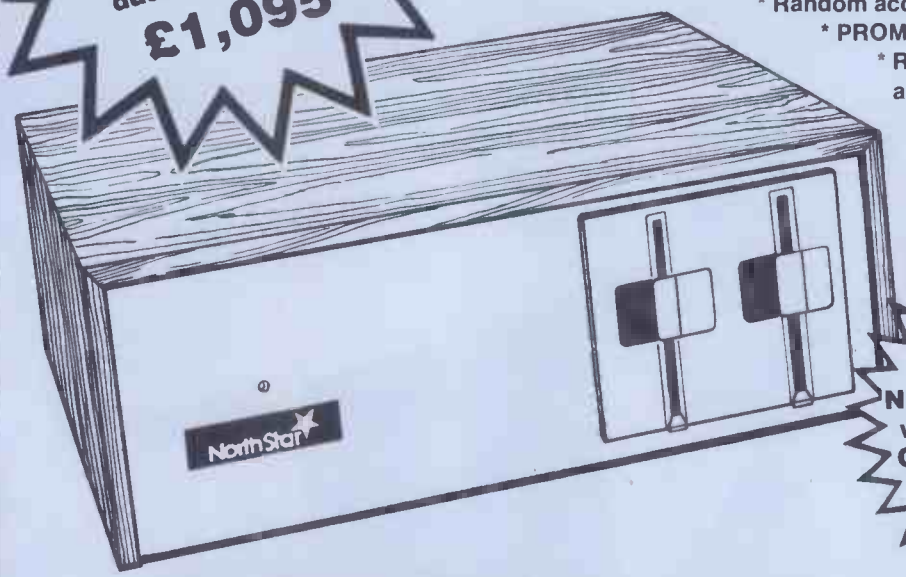

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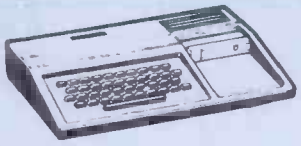

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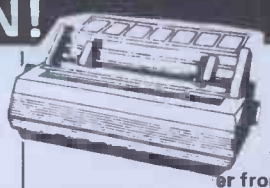

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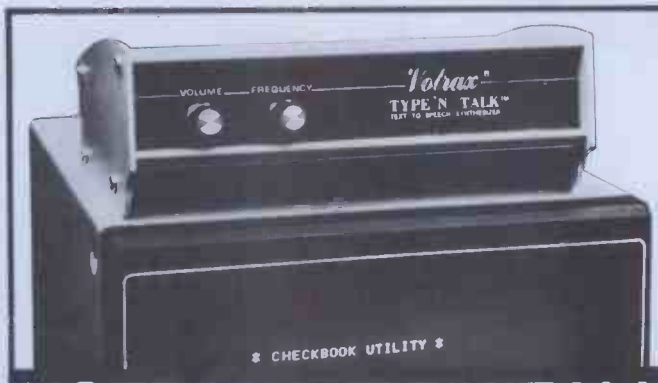

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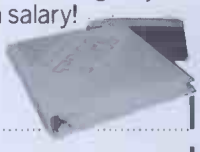

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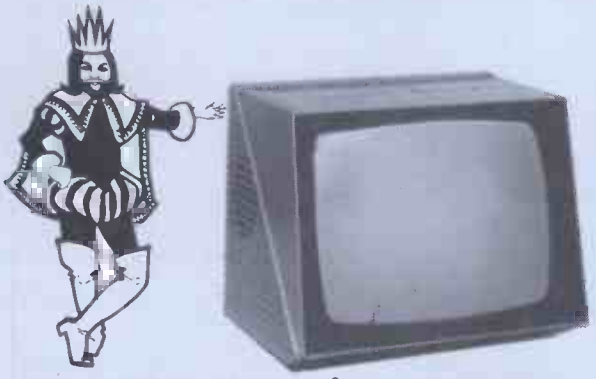

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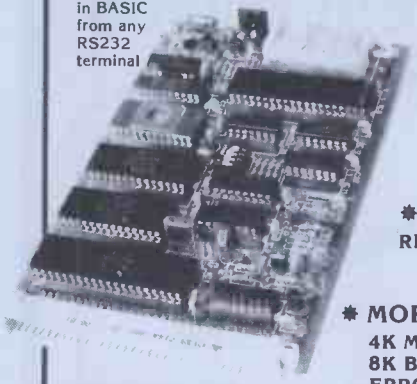

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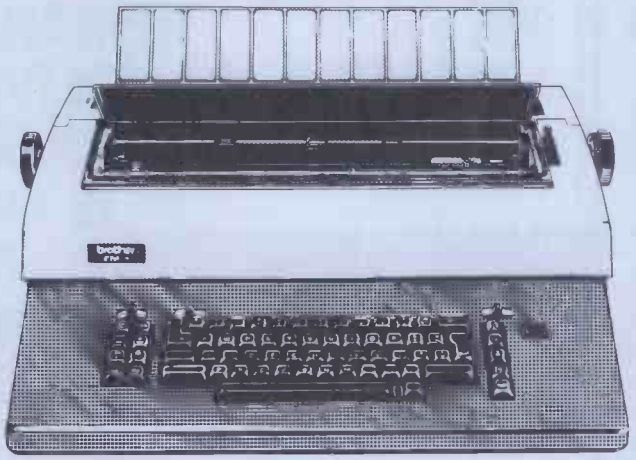

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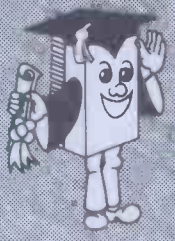

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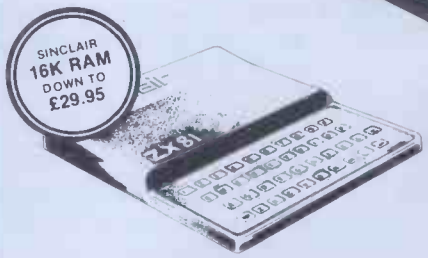

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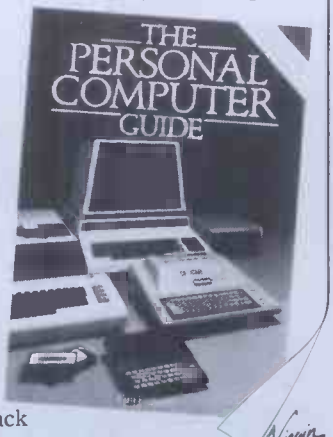

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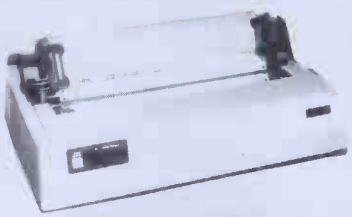

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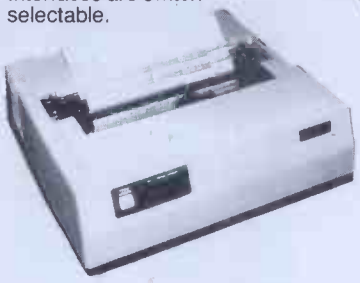

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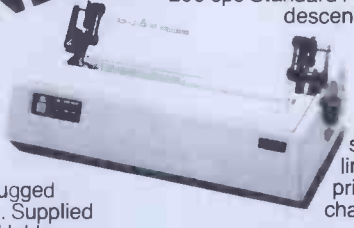

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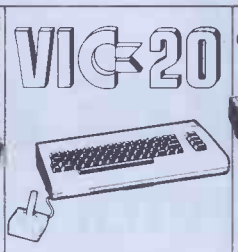

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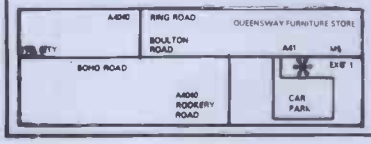

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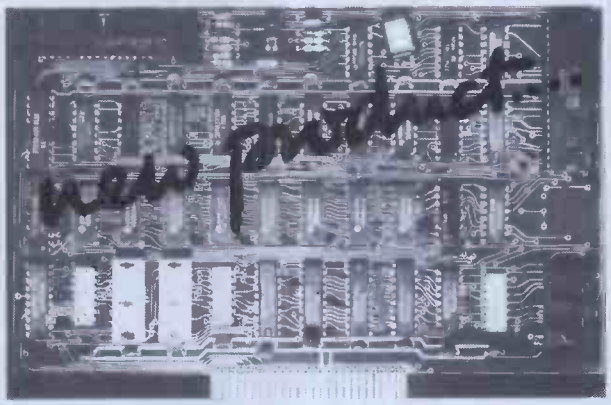

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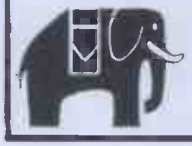

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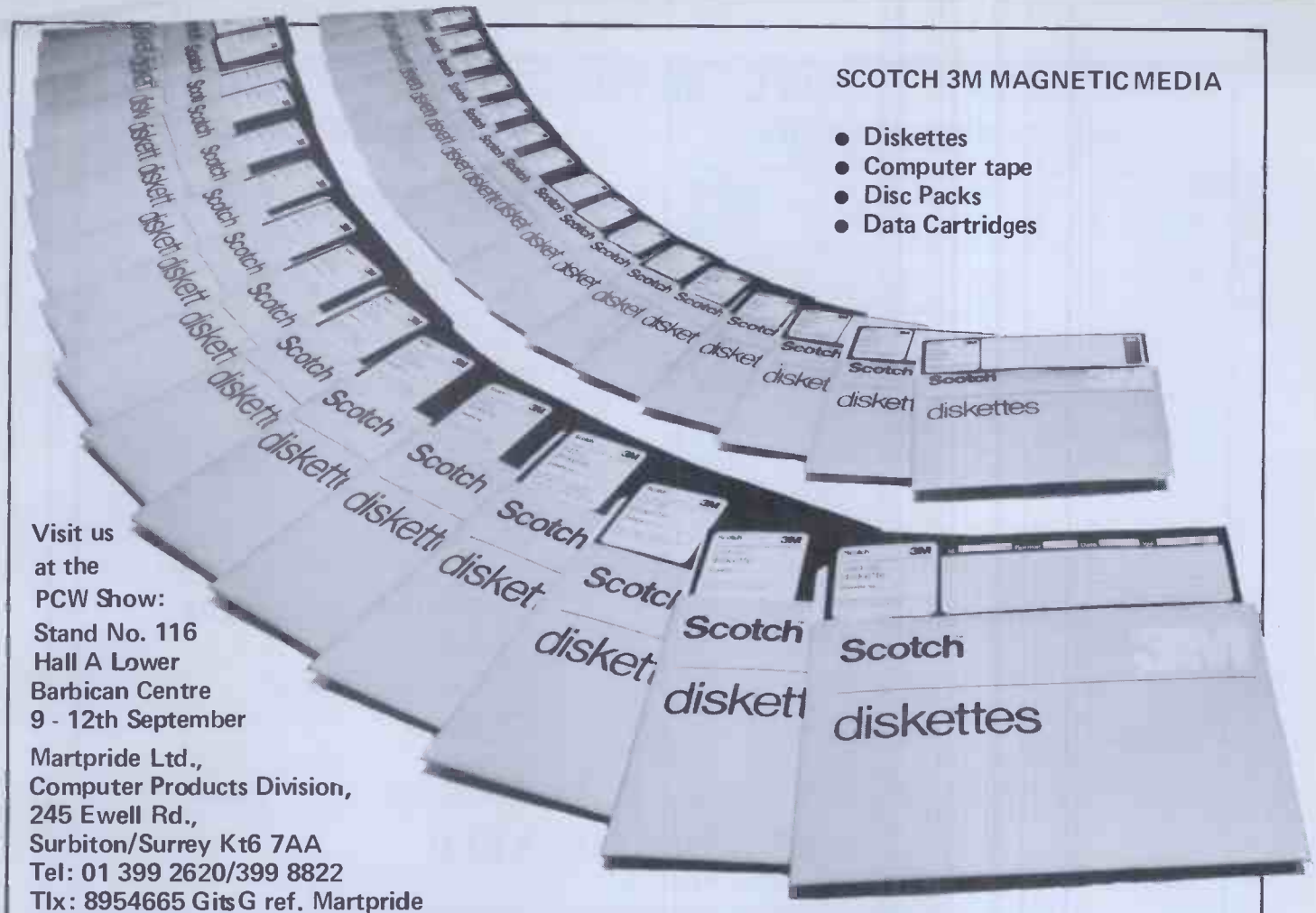

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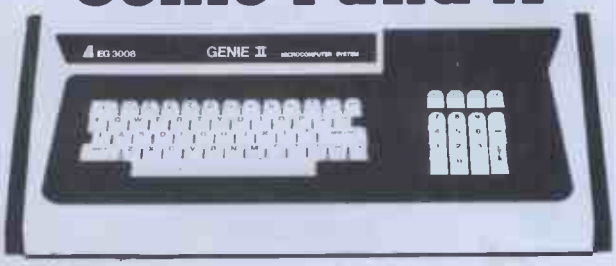

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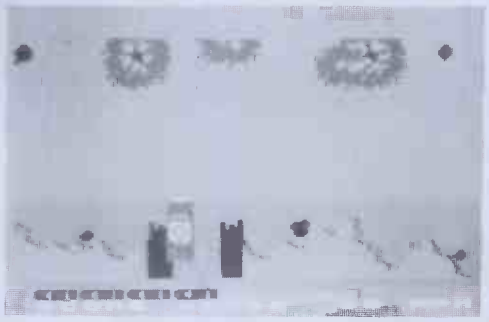

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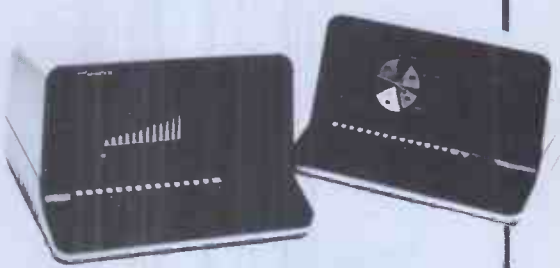

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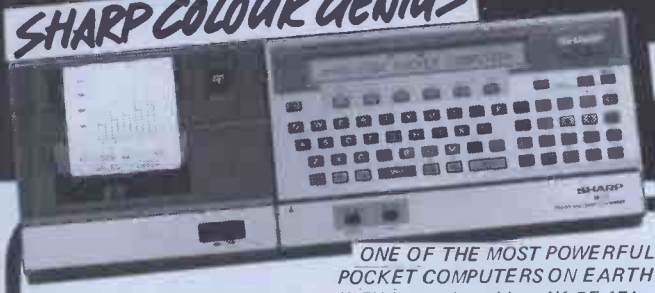

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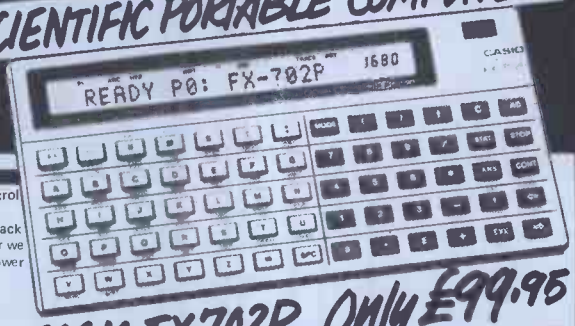

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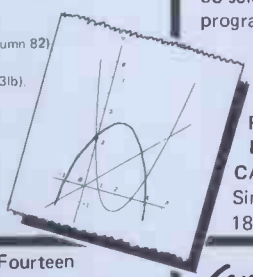

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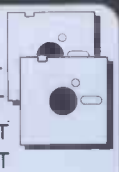

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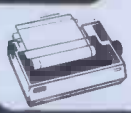

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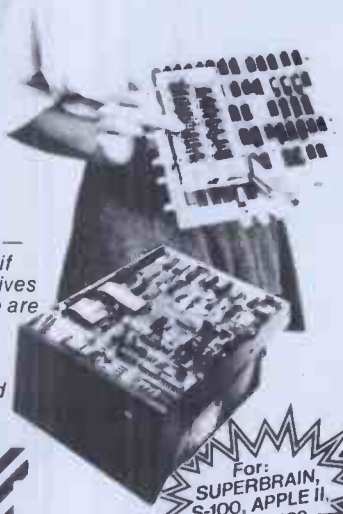

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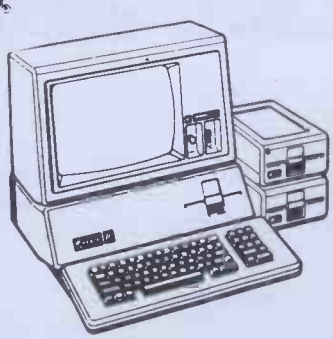

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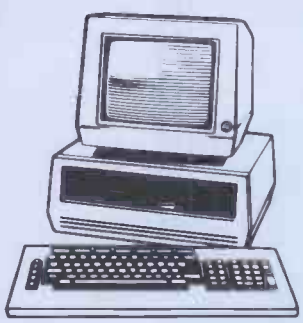

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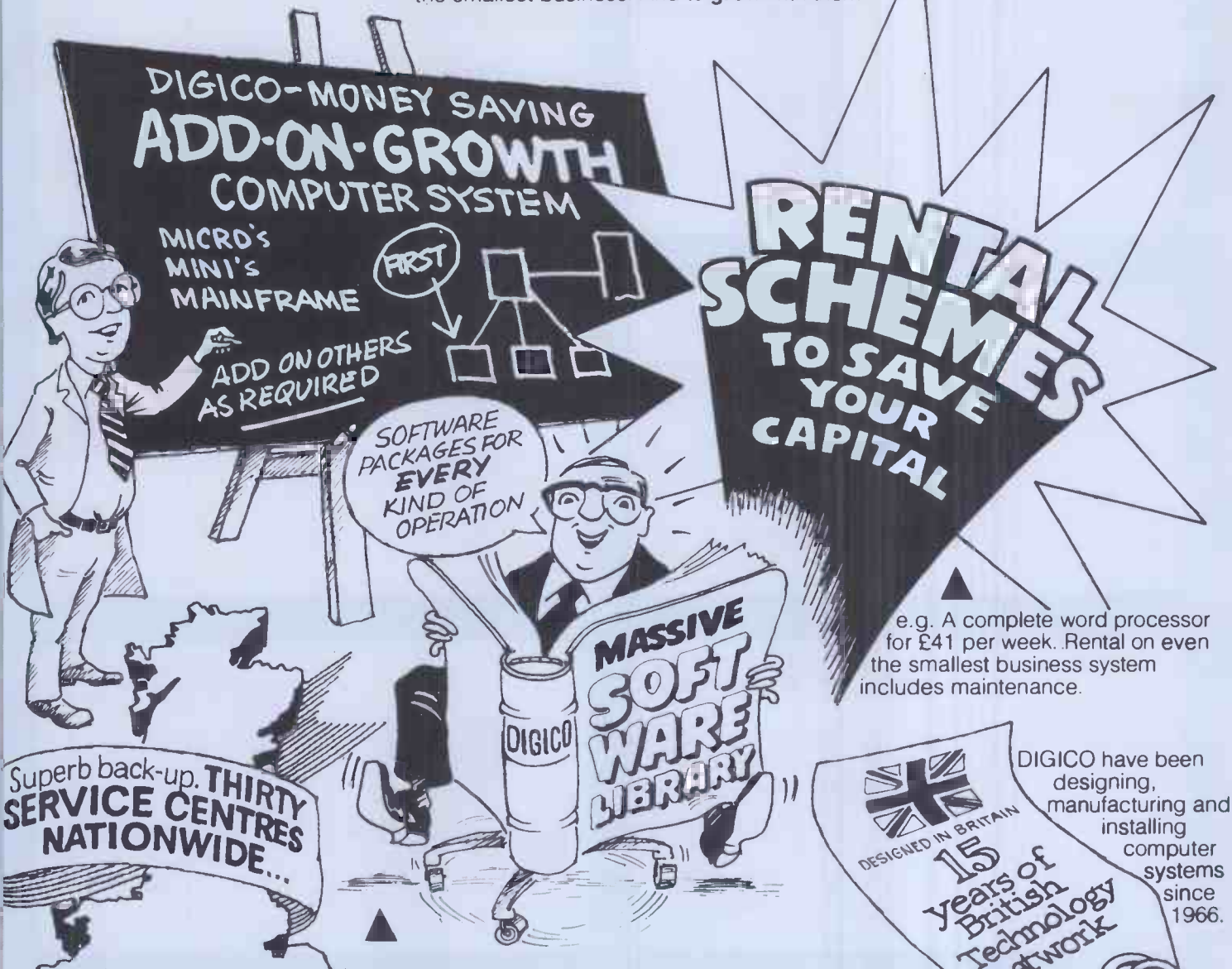

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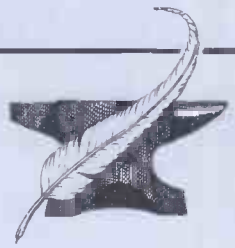

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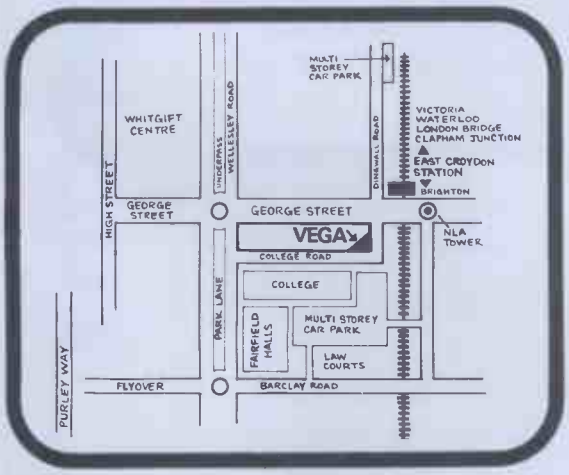

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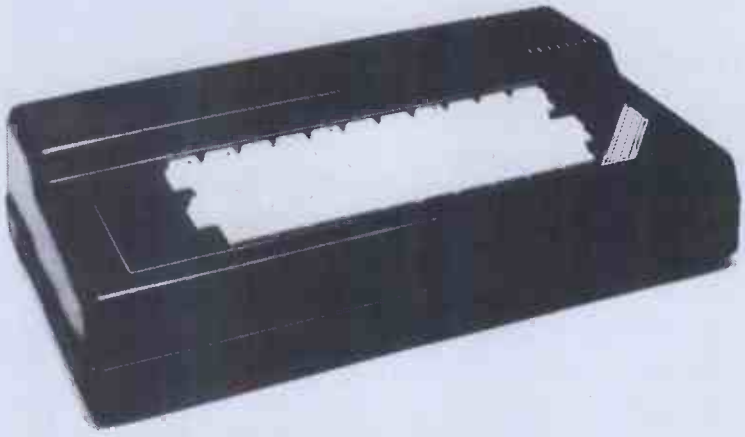

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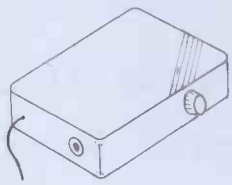

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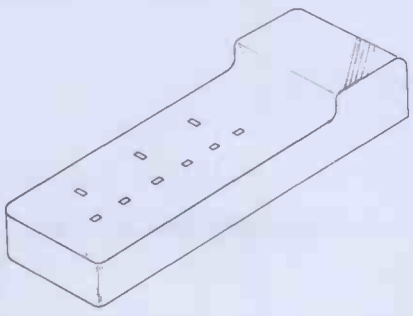

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Auxiliary memory: 2 optional internal diskette drives 5¼", 160K/320K bytes per diskette
Keyboard: 83 keys, 6ft cord attaches to main cabinet*, 10 function keys* 10-key numeric pad*, tactile feedback
Monochrome display: High-resolution (720h x 350v)*, 80 characters x 25 lines, upper and lower case, green phosphor screen*.
Colour/Graphic: *Text mode* – 16 colours*, 256 characters and symbols in ROM*
Graphics mode – 4-colour 320h x 200v resolution*, black-and-white 640h x 200v resolution*
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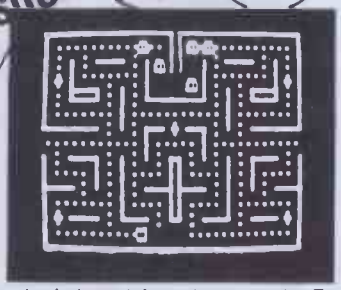

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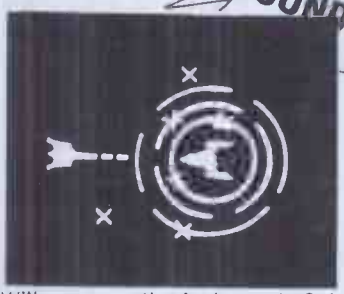

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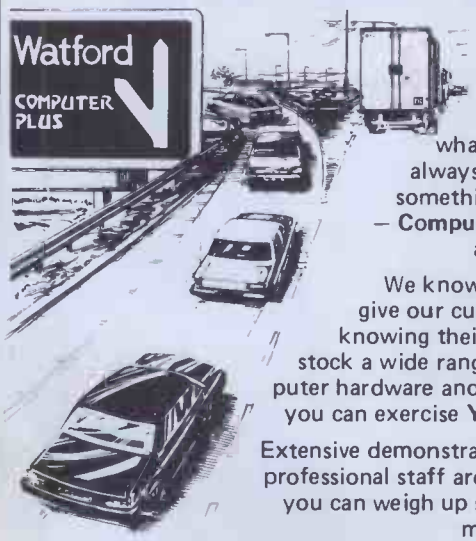

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CHIP CHAT

CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT

Heard about the ACT dealers who received packs of Sirius software from ACT itself? Nobody could read the disks — all they got were operating system error messages. When queried, ACT replied that the Post Office in Birmingham was using some machinery which demagnetised the disks. 'Not possible!' said some of the dealers. 'We called in and picked up ours personally.' 'Ah,' said ACT, 'you must have left them lying next to a telephone and let it ring for more than 12 rings — that would corrupt them.' It was then that a red-faced minion at ACT reported the real reason: somebody had sent out blank disks by mistake. . . How's this for a little co-incidence: Bonsai uses a media buying agency to fix up all its advertising space; the chap in charge of the Bonsai account is — Clive Sinclaire. Bet that causes some confusion. . . As most of you will by now have heard, *PCW* has been sold for the second time in its history. After turning down over two dozen offers in the last two years or so, publisher Felix Dennis finally made a deal with VNU (publishers of *Computing*, *Datalink* and *MicroIndecision*) and we've now all moved into vast and (comparatively) luxurious offices in Oxford Street, just around the corner from our old place. Meanwhile, the whole publishing industry is bursting with curiosity to find out just how much VNU paid for us — it's been kept a closely guarded secret. Now we hear that someone is offering an Osborne computer to the first person to name the exact price. Guesses in excess of £300 million are thought to stand little chance of winning. . . While the disgraceful situation over the BBC Model B computer continues (people still waiting after eight months, apparent lack of interest in providing customers with real information on the part of Acorn, BL Marketing and the BBC), another order backlog situation is rapidly developing with the Sinclair Spectrim. First the original batch had to be returned to the Timex factory for a small fault to be corrected, then the factory had a short strike, now (late July) the factory has closed down for its annual holidays. From all accounts the Spectrum launch was brought forward from its originally planned date, which wouldn't have helped the situation, but we would have thought that Sinclair would have learnt by now from past backlog horrors — both his and those of other companies. Another backlog is reportedly building up with the Sirius, demand for which is said to be phenomenal, to the extent that ACT is having to ration supplies to dealers until the rate at which the machines are shipped from the factory can be stepped up. . . For our photo treat this month we thought we'd destroy any fond illusions you may have concerning the appearance of our very own newshound Guy Kewney. The picture of him which appears at the top of 'Newsprint' is, in fact, of 'Bumper' Harris and the person you see here is the real GK, snapped at a Downing Street 'Think Tank' session at which he was asked to advise on whether or not 'Uncle' Clive should receive a life peerage in the last New Year's Honours List.

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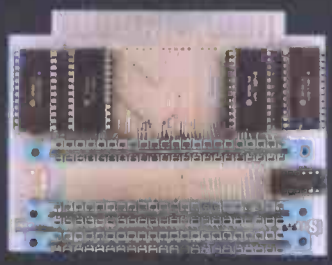

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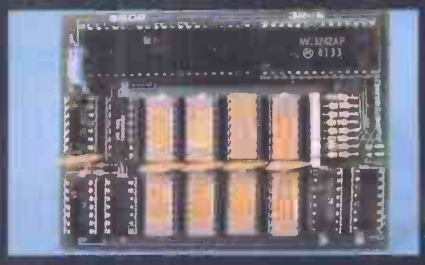

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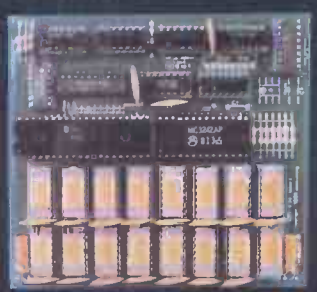

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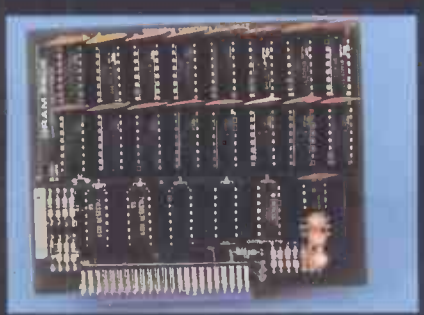

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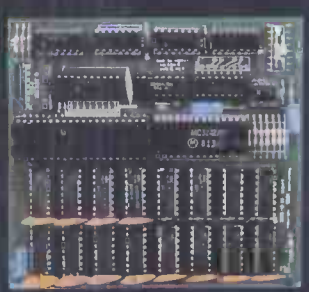

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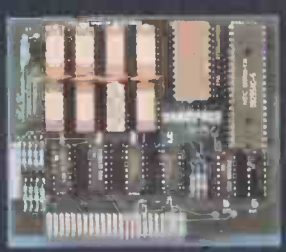

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