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New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumeric graphics. A feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)
Hardware required – ZX81.
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 – Five games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)
Hardware required – ZX81.
Price – £4.95.
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: Biohythms (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £8.95.
Programs – What are Biorhythms, Your Biohythms, 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 – Novelist, 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 Wales. Countries and Capitals of Europe.
Description – The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series – History 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Events in British History. British Monarchs.
Description – From 1066 to 1981, find out when important events occurred. You can recognise monarchs in an identity game.

Cassette E5: Fun to Learn series – Mathematics 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Addition/Subtraction. Multiplication/Division.
Description – Questions and answers to basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series – Music 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Composers. Musicians.
Description – Which instrument does Peter Grimes play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series – Geography 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Inventions before 1850. Inventions since 1850.
Description – Who invented television? What were the 'dangerous Lucifer'?

Cassette E8: Spelling 1
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Description – Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable 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 or 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.

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Simply use the FREEPOST order form below and either enclose a cheque or give us your credit card number. Credit card holders can order by phone – simply call Camberley (0276) 66104 or 21282 during office hours. Either way, please allow up to 28 days for delivery, and there’s a 14-day money-back option, of course.

Cassette B3: VU-CALC (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Programs – VU-CALC. Examples.
Description – A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, keep records of club memberships, or as a telephone directory.

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

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PCW/9/82
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<tr>
<th><strong>Apple 48K Europlus</strong></th>
<th><strong>C/ WP PRICE</strong></th>
<th><strong>EX- VAT PRICE</strong></th>
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**2670**

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### SOFTWARE FOR CP/M

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<tr>
<th><strong>Wordstar 3.0</strong></th>
<th><strong>C/ WP PRICE</strong></th>
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PCW 37
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<th>Game</th>
<th>Price excl VAT</th>
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<tr>
<td>Any 3 VIC Centre cassette games for just £17.50 excl VAT</td>
<td>Any 3</td>
<td>£43.50</td>
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<td>Choose from:</td>
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<tr>
<td>Blitz</td>
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<td>Canyon Fighter</td>
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<td>PR Software</td>
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<td>Orbitello</td>
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<td>Super Moon Lander</td>
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Total price £20.12 inc VAT + f2 post & packing

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Total price £50.02 inc VAT + f4 post & packing

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<td>RS22DC fully implemented</td>
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Total price £207.00 and VAT

**GETTING BIGGER**

A 16K Ram expansion cartridge
A choice of either Programmers Reference Guide or VIC Revealed and a choice of Super Expander or Programmers Aid or Machine Code Monitor cartridges

- £180 excl VAT

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Total price £207.00 and VAT

- £217 excl VAT

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Total price £276.59 excl VAT + f5 per order, postage & packing.

**HAVE FUN AT OUR EXPENSE**

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Any three VIC cartridge games from the VIC Centre for just £43.50 excl VAT

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Total price £249.55 incl VAT + f4 post & packing

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ADD Home Computers Ltd, FREEPOST, London W3 61313 - you do not need a stamp enclosing details of your order + cheque to include VAT + postage & packing

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DRAGON 32

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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.)

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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
- Indicated airspeed
- Turn indicator
- Distance to landing
- Rate of climb

Six maps may be chosen, as follows:


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.

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<td>POWER SOURCE: AC220V-240V/50Hz</td>
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<td>POWER CONSUMPTION: 60W</td>
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The PC1500 has the capacity and BASIC language usage that is very nearly that of the desk-size Personal Computer. When fitted with the optional 4-colour graphic printer, it is one of the most powerful pocket computers on earth.

Chores can be handled swiftly and accurately any time of day, wherever you happen to be. Estimates, records and charts of sales, billings and other important data can be re-programmed, calculated and summoned at the touch of a button. It can even play blackjack, analyse your biorhythms or give you a beeped reminder of a scheduled meeting.

Large memory capacity, up to 11.5K bytes. 4-colour print-out. Six user-programmable keys.

The incredible new PC1500. A revolution in pocket computers.

From Sharp. Where great ideas come to life.

---

SPECIFICATIONS PC 1500

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of calculations</td>
<td>10 digits (mantissa) + 2 digits (exponent)</td>
</tr>
<tr>
<td>Program language</td>
<td>BASIC</td>
</tr>
<tr>
<td>CPU</td>
<td>C-MOS 8-bit CPU</td>
</tr>
<tr>
<td>Capacity</td>
<td>ROM: 16K bytes</td>
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<tr>
<td></td>
<td>RAM: 3.5K bytes expandable to 11.5K bytes</td>
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<tr>
<td>Memory protection</td>
<td>C-MOS battery back-up</td>
</tr>
<tr>
<td>Display</td>
<td>7 x 156 dots mini- graphic display</td>
</tr>
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CE 150 Colour Graphic Printer/Cassette interface (Optional)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Power source</td>
<td>Standard 18 digits (36, 18, 12, 9, 7, 6, 5, 4 digits selectable)</td>
</tr>
<tr>
<td>Printing system</td>
<td>X-Y axis plotter system</td>
</tr>
<tr>
<td>Printing mode</td>
<td>Graph/Text switchables</td>
</tr>
<tr>
<td>Character sizes</td>
<td>9 different sizes from 1.2 x 0.8 mm to 10.8 x 7.2 mm (from 1/16&quot; x 1/32&quot; to 7/16&quot; x 9/32&quot;)</td>
</tr>
<tr>
<td>Printing colours</td>
<td>Red, blue, green, black</td>
</tr>
<tr>
<td>Printing directions</td>
<td>Right, left, up, down</td>
</tr>
<tr>
<td>Minimum step width</td>
<td>0.2 mm (1/64&quot;)</td>
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CE 151 Memory Module (Optional)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
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<tbody>
<tr>
<td>Capacity</td>
<td>4K-byte C-MOS RAM</td>
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CE 155 Memory Module (Optional)

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<thead>
<tr>
<th>Specification</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>8K-byte C-MOS RAM</td>
</tr>
</tbody>
</table>
**SIC LANGUAGE SPECIFICATIONS**

**: 1500**

### Commands
- RUN, NEW, LIST, CONT, TR ON, TR OFF
- LOCK, UNLOCK, STATUS, MEM
- 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, ARUN, CLEAR
- RANDOM, DEGREE, RADIAN, GRAD
- BEEP ON, BEEP OFF
- SIN, COS, TAN, ASIN, ACSC, ATN, LOG
- EXP, DEG, DMS, RND, SQR (v)
- SGN, ABS, INT, PI (π), LEFTS, RIGHTS, MIDS
- ASC, VAL, LEN, CHR$, STR$, POINT

### Statements
- A ~ Z, A$ ~ Z$, two-letter variables possible
- two-dimensional arrays applicable
- AND, OR, NOT, &
- INKEYS, TIME, . . . .

### 150 Printer

### Cassettes Interface
- CSAVE, CLOAD, CLOAD? MERGE
- INPUT#, PRINT#, CHAIN, RMT ON, RMT OFF

---

To: Sharp Electronics (UK) Ltd, Computer Division,
Sharp House, Thorp Road, Newton Heath,
Manchester M10 9BE. Tel: 061-205 2333.

Please send me details of the Sharp PC 1500

Type of application: __________________________

Name: __________________________

Address: __________________________________

PCW: 1

---

The world of Sharp

where great ideas come to life.

Design and specifications subject to change without notice.
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 get your teeth into.

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

NO OTHER MICRO HAS THIS MUCH POWER IN THIS MUCH SIZE FOR THIS MUCH MONEY.
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 will come as a surprise are the 128K 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, 12" and 24" monitors, plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and ½" 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.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics. However, if you're feeling practical you can always tackle household management, statistics and educational packages.

And because NewBrain isn't all work and no play, there's the usual range of mind-ending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go further than the coupon at the bottom of this page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you know where to go next.

Each NewBrain order will include a FREE comprehensive user manual, a catalogue of expansion modules and peripherals, and a detailed list of available software.

Please send me the following:-

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Price per item (Inc. VAT &amp; p&amp;p)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NewBrain A</td>
<td>£233.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NewBrain AD with onboard single line display</td>
<td>£267.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Printer</td>
<td>£465.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitor 12&quot;</td>
<td>£142.50</td>
<td></td>
</tr>
</tbody>
</table>

I enclose a cheque/Postal Order for £________payable to Grundy Business Systems Reader Account.

NewBrain, Grundy Business Systems Ltd., Grundy House, Somerset Road, Teddington TW11 8TD.

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The entire PC-8000 system is now available through better computer dealers across the country. And that means more than hardware. It means effective software, the finest documentation and extensive training to help you get the most from your personal computer. So why not turn our system to your personal advantage now.
In fact it leads to many others! Joining the amazing success of our PAL Encoder Card, these four new expander cards all featuring the unique 'Digitek Safety Tab' are ready to plug straight into your Apple Computer.

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**16k Ramcard £91** Insert the card straight into slot 0, and increase the memory capability of your Apple without having to remove any memory chips.

**Z80 Expansion Card £110** Installing the Z80 into your Apple gives you two systems in one, which enables you to run the popular CP/M operating system.

**RS232 High Speed Serial Interface £72** The RS232 Interface Card incorporates 13 selectable Baud rates from 75 to 19,200.

**Print-master Interface £79** The ultimate parallel interface for Apple to all popular dot matrix printers.

The PRINT-MASTER accepts Apple protocols, 15+ software commands and has on-board graphics dump capability to all popular graphics printers. No need to load clumsy software routines — it's all at your fingertips on the PRINT-MASTER — choice of inverse printing, double size picture, 90° picture rotation, many word processor type text commands, plus many more.

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- Ramcard £91
- Z232 £72
- Print-master £79

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Please ask your sales staff to contact me

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Company

Address

Telephone

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Company

Address

Telephone

Offered subject to availability
Designed for expanding minds

The Tuscan S100 can read and write in 18 different disc formats including IBM, RML 380Z, and Superbrain, plus many more CP/M based machines. Now with optional IEEE interface and high definition colour graphics. The versatility of the S100 Bus and CP/M make an investment in Tuscan S100 an investment in the future.

Communication with minis and mainframes? - no problem! With four different communication options, Tuscan S100 looks and feels like an intelligent terminal.

Plotters and colour printers? - no problem! Tuscan S100 is just about the most versatile cost effective micro around. 5 or 8" hard or flexible, disc drives mean power at your fingertips. We go for capacity at low cost plus professional expertise. Send for our prices now - and a list of references. (Just in case you want to check our track record.)

Transam Microsystems Ltd.,
59/61 Theobalds Road,
London W.C.1.

Telephone 01-405 5240/2113

Transam MICROSYSTEMS LIMITED
Join the next decade now: use Prolog. This 'Micro' Prolog differs from the full Prolog in several useful ways. 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 Computer.

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 something useful with the 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, this 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 be used to some extent 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-3502 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 Gorse 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 fused 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.

**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 company that makes the almost-handheld Neurbarn (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 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.

**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.

Now 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.

**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
Jefferson, recently returned
readers. The ad sales team consists
of Steven England and Neil
Fennell. 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 in-
dustry will be wondering
what the ex-publishers of PCW
are going to do with them-
selves 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-Micro-
decision), features by Ian
White (ex-Campaign) and
international news by Gareth
Jefferson, recently returned
from seven years in Japan. Columnists will include individ-
uals 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 forth-
nightly, by subscription only,
and the modest claim is that
MicroScope will become 'the
eyes and ears of the industry'.

An introductory advertisement
will be printed on the front cover of the
first issue, which is in Manchester on 061-
643 0016.

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).

Paper problem
If everybody has a computer
and they are all linked
together to send messages,
then there is no need for
teleprinters. 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
disposable life - at a guess, as
long as it took them to
become happy with paperless life. 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).

Pap er,says IRD, will be the
'medium of transition,
helping workers to communicate
in 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 compu-
ters, networks and software)
and also, naturally, the paper
suppliers.

Telex, of course, is a good
e xample 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 elec-
tronic 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 them-
selves in imprecise words.

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

MicroScope will become the
"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.

Telex standard
Anybody thinking of building
a micro to run on the Telex
network should take note of
the small print in an other-
wise encouraging announce-
ment by the Minister for
Posts and Telegraphs, Well,
more correctly, the Minister
for Electronic and
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 equip-
ment as from next year, when

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).
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
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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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**NEWSPRINT**

in the Japanese computer business (he's chairman of the board at Fujitsu, a company which is trying 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 Financial Times on the subject of 'Is Japan a Post-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 the Sirius system.'

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 super-sonic 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 8586.

**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 experi-

menters 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 Manchester, at 4a Market Hill, Manchester M30 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 lot of software for micros for ICL), is a company which is going to 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 . . .

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

Details and prices from 95a Liverpool Road, Cadishead, Manchester M30 6BG, or phone 061-775 4461.

**But does it make house calls?**

store, which offers the software at a discount — £289 including VAT. Details on (0572) 213427.
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Sadly you may well find it difficult to detect any £100 bugs. But at least you can take some consolation from having acquired some very good software indeed.

Software systems for most 8 bit and 16 bit microcomputers including IBM Personal, Sirius and Xerox using CP/M and MS-DOS operating systems.

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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 4800Z (cheaper, at £718, 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 manda-rins of the Dol couldn't stand Uncle Clive!

Wry, we must have been wrong after all (yawn). (Have I got the message right, Dol?) I'd be a wee bit more im-pressed 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 micro-computer 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 Compe North, Potential dealers who couldn't get to that show should probably contact Positron, the marketing director, on 061-223 3678.

British Micro is the company led by Manas Hegoyan (the man who so nearly bought Nascom after it went bust) who produces the best - or £472 with a black-and-white monitor, sometimes only 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 Genni Bell, 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 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' Beeb mug. I also discovered that BBC Basics gets very confused over the hell 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 Beeb Bug, Dept 1, 374 Wendsworth Road, London SW8 4TE.

**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 smallest 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, and CPU Peripherals is in Shepperton, Middlesex TW11 8AQ; tel Walton-on-Thames 46439, Verbatim is represented by BPI Electronics (01-941 4066) and Verbatim 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.

The plug on the front of this box reveals that it fits onto a Sinclair Z80 machine. Other holes reveal that it makes three 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 344293182.

**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 II's being
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sold for (I am told) under £300. 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 Acorsoft 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 home 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) in Tangerine, Ohio, Nascrom, 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 Super brains, Prince, Sirri, 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 substantiated by the Currys 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 128-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 I explain in outline below, which I have wasted at least one week in the last three by playing a game called Snapper, produced by Acorsoft 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 home 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.

**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 Corruss 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 Corruss disks (because they aren't incredibly cheap) but on the fact that Corruss disks are networkable, so that two or more Sirius users can share the same hard disk.

The really clever thing about the Corruss net, however, is 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 home system to this one, but that's another story — and maybe a shorter one.

Extra files called 80.COM 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 file created under one operating system may be used by the other, with no restrictions.

**Sinclair slashed**

An enormous price cut for the 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 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 exulted cagily. '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.
Those are difficult questions for anyone looking at microcomputers for their business — particularly for the first-time user. On stand 124 at The 5th Personal Computer World Show you'll find some straight answers.

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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 something like this. 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.

It 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, surpluses — you name them, we've got them.

Our formal organisation comprises a Chairperson, Secretary and Treasurer. 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 heads 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 youdiscount 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.
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'.

Well, that's always been our aim. And if it's true that a person is known by the company he keeps, you could do a great deal worse than fill in the coupon on the right hand side of this page. You won't even need to put a stamp on your envelope... unless you live in Sri Lanka, that is!

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BRITISH MADE
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.

Probabbly 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.
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 fixed beforehand 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 manually, 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 refill 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 document or to the start or end of memory. Like with a filing machine, the block sliding window is used to display documents rather than on total memory contents, so it's possible to do crude block moves by placing document markers round the block, tapping it, moving it, the point to which you want to move the block, entering insert mode and playing in the tape. I found the tape interface easy to handle and 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, so compatible baud rates range from 110 to 4800 and adjustable frame lengths (stop bits, parity, etc) so it will interface to any standard printer. Among the 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 have set up your printer, the settings are retained even when you switch off so you can then forget about them.

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 RS232 characters as you type, or a text stream — useful for sending instructions to a printer for turning bold print- ing 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 a Microwriter to 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 type, 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, if you are using the Microwriter 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, which 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 confusing — 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 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, changeover, 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 but also the machine has been updated (as RS232 and cassette interfaces are included both in the machine and in its price (they were optional extras before). As well, of course, a number of extra features have been added to the machine. Still, though, I have to report wincses 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 to type very well. 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 five-year hush-hush repair 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 as an interface to terminals; there's probably a market for a cheaper, 'cut-down' version which can act only as a dumb input device.

In any case, though, that main reason for wanting one is that the device's price dropped is to encourage its wider use. I think it's a superb device, embodying some really inspired thinking, which deserves to succeed.
Ode to Joy

I felt I simply had to write to you to share with your readers the delights of the wonders of the micro-computer! As a teacher, I can also share my 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 personal computer version of the NCR 9010 family. I hope that we won’t be too long in getting the price we quoted as an appeal to those of our AMP computer users who are looking for programs in special facilities for the hand- capped operators, and adapt programs to suit the 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 available in two densities, 80 tracks per inch and 66 tracks per inch. 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, Fernbury Road, Bridge Wells, Kent TN2 4NB.

Computer Literacy OK!

I had been thinking about computer literacy for some time and one of my 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 machine language, PEKs 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 in 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 us to keep up with the developments of assembly languages.

As with enthusiasts in other spheres, far too many of the computer fraternity are too close with their technical skills. It is often noticeable that many of the programmers, 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 'trendy' programs available 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 reference 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 thing that is 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 phonetics, morphemes and such things can be left to the professional student of linguistics. Similarly, 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’s school friends is not a good 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 Seikoha, 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 do not recommend WORD4WORD to keep an index to my programs and am in the process of creating similar indices from my records and books.

I feel that an understanding of these, and similar, programs could be encouraged as much as possible. It could be that grammars 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 those who are initiated in the ‘brotherhood’ how computers can do’, and a good understanding of opportunities and limitations would probably lead to an improvement in the standing of computer users. It would make it more difficult for the professionals to pull the wool over our 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 programs, 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 those of us who are users group managed to fall into the old trap of one subscription for two houses 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 analyzing problems. The solutions can be left to the programmer but the problem can be analyzed properly only by the user.

Concern with programming and Academic Computer Magazine to the current state of articles in the various enthusiastic magazines showing how to complement one dialect 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, is written in a dialect not yet covered properly only by the user. I have never come across PRO mode which is mentioned in the LLIST column. If I can find the error, I would like to know if the other versions are correct?

Perhaps you have missed 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 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 machines you have to find a listing for a routine which would be very useful and have been looking for it because of PEEKs or POKEs which might or might not be satisfactory. 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 algorithm. 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 Jun). Since we acquired our Cromemco System 3 I have been looking for information on CDOS and you have given 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 assumed 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, there is a subsequent jump to 100H will produce a mixed up program.

On a different but similar topic, that of Fortran over- lays, 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 area as a single area and at a common location. Then load the second program, escape from it and SAVE only the program area. Using this method and the C/PM calls to link programs reduces the confusion I use how do I know if the other versions are correct?

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David H Wild, Hemel Hempstead

**Covering computers**

I was particularly interested to read 'Bankers' 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 micro-computer insurance cover at reasonable rates. Such cover should, in our opinion, extend to all risks, transit, increased cost of repair 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 micro-computers and, by virtue of the range of these items and the variations to which they are put, the length of exclusions increases.

In 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 example is the cost of reinstating lost data and programs. A businessman who relies heavily on his micro could suffer enor- mously if, as a result of fire, he loses a substantial proportion of his data bank. In that event, much over-time 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, (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, there is 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 area as a single area and at a common location. Then load the second program, escape from it and SAVE only the program area. Using this method and the C/PM calls to link programs reduces the confusion I use how do I know if the other versions are correct?

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David H Wild, Hemel Hempstead

**Further Factor Facts**

**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 black/ white/ multi-colour 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.

**Spectrum does not...**

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

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No — Ed
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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 most 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... mysterious 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 5¼ soft-sectored double-density double-sided, 35 tracks/side, 220 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 socket 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.

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

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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) initiating 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 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 depresed 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 printer.

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

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

I/O connectors are unlabelled but fully documented.
M20. One parameter is an optional string which, if supplied, will be printed as a title at the top of each page of printout.

Commands 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 system) an all screen I/O within the sub-system will be copied to the printer. The manual mentions *CIN* (for Command), which will 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 will begin executing the program, which can contain PKEY commands and 8-type environment commands as well as an ordinary Basic program. Thus the system can be completely turned off and the whole machine customised every time it is switched on.

Other commands include SPRINT, which dithers 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 — i.e., 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 S 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 key usefull 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+ SHIF. 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 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 notice 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 one. 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, there is an imbalance between documented and undocumented commands were found (FFREE, FKILL, FMOVE, FNEW, PRUN, R Kill, 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 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 read but not listed.

Table 1

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC</td>
<td>Basic interpreter</td>
</tr>
<tr>
<td>COMMANDS</td>
<td>list all commands</td>
</tr>
<tr>
<td>[COMMAND] ?</td>
<td>display an explanation of the specified command</td>
</tr>
<tr>
<td>ERRORS</td>
<td>list all error codes</td>
</tr>
<tr>
<td>E n</td>
<td>display an explanation of error code number n</td>
</tr>
<tr>
<td>FOPENy</td>
<td>create named file</td>
</tr>
<tr>
<td>FDELETE</td>
<td>list a named file</td>
</tr>
<tr>
<td>FLIST</td>
<td>create a named file</td>
</tr>
<tr>
<td>FNEW</td>
<td>remove write-protection from a file</td>
</tr>
<tr>
<td>FPASS</td>
<td>write-protect a file</td>
</tr>
<tr>
<td>FUNPORT</td>
<td>display Help routines</td>
</tr>
<tr>
<td>HELP</td>
<td>invoke the IEEE-488 Basic control package</td>
</tr>
<tr>
<td>IEEE-488</td>
<td>invoke the Labeling package</td>
</tr>
<tr>
<td>LABM</td>
<td>return number of Return key last pressed</td>
</tr>
<tr>
<td>LTERM</td>
<td>invoke machine instruction routine</td>
</tr>
<tr>
<td>MI</td>
<td>program given key</td>
</tr>
<tr>
<td>PKEY</td>
<td>load and lock utility into memory</td>
</tr>
<tr>
<td>PLOAD</td>
<td>save current system on disk for subsequent reboot</td>
</tr>
<tr>
<td>PSE</td>
<td>set Basic environment</td>
</tr>
<tr>
<td>SDEVICE</td>
<td>set printer environment</td>
</tr>
<tr>
<td>SFORM</td>
<td>print screen</td>
</tr>
<tr>
<td>SPRINT</td>
<td>set system environment</td>
</tr>
<tr>
<td>SSSYS</td>
<td>copy volume</td>
</tr>
<tr>
<td>VOOPY</td>
<td>use volume password</td>
</tr>
<tr>
<td>VDEDESS</td>
<td>format a disk</td>
</tr>
<tr>
<td>VFORMAT</td>
<td>create a volume directory</td>
</tr>
<tr>
<td>VLIST</td>
<td>set a volume password</td>
</tr>
<tr>
<td>VNEW</td>
<td>set a volume password</td>
</tr>
<tr>
<td>VPRINT</td>
<td>rename a volume</td>
</tr>
</tbody>
</table>
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 the capability 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.

One 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 by using 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 Olimum (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 OIlespec, which provides the usual accounting suite; Olilaword for word processing; Olintery 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 Oliotec — for 'documenting' a Basic program, together with Ollterm (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 mini-computer 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 the open 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'.

**Benchmark timings**

<table>
<thead>
<tr>
<th>Model</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM1</td>
<td>1.3</td>
</tr>
<tr>
<td>BM2</td>
<td>4.0</td>
</tr>
<tr>
<td>BM3</td>
<td>8.1</td>
</tr>
<tr>
<td>BM4</td>
<td>8.5</td>
</tr>
<tr>
<td>BM5</td>
<td>9.6</td>
</tr>
<tr>
<td>BM6</td>
<td>17.4</td>
</tr>
<tr>
<td>BM7</td>
<td>26.7</td>
</tr>
<tr>
<td>BM8</td>
<td>1.6</td>
</tr>
</tbody>
</table>

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 floppy
- **Printers**: Thermal, matrix or daisy wheel
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, for I am pleased that it is official, patently so to say, at 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 to. 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 which can never grow old. But the industry (or for 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 officially announced this event. I must admit that I was a little taken aback myself. I had considered that when the announcement came it would be 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 USA.

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 lame and the lamest. But daring surgery and the occasional transplant has seen what would appear at first light to be a miraculous recovery. It is to be hoped 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 itself. It appeared in June, in one of the colour supplements without which each Sunday newspaper becomes just a more verbose edition of its dally 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, patronly 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... honest. 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 presumptuous.

The machine of course, is actually the dear old Black Box from Rair. The deal, it is thought, was to name it the Box. The 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 certain hint of irony 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 pours 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. 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 the Black Box was ever going to be that significant, then maybe it would have happened back in 1978 when it first hit the mass market. The sages nodded their collective heads appreciatively when the Box appeared; they did not jump about organically 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’.

Well, here’s to computer dating. Let’s hope they iron out the bugs soon...
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THE BEST WILL ALWAYS STAND OUT FROM THE CROWD.
Lynx sighted at Barbican.

Sorry chaps, this is not an excuse to don the safari suit, more the announcement of the new Lynx computer. Like its namesake, it's a real mean machine. Micro size, micro price (under £200) with a macro memory of 48K expandable to 192K. Plus its own external power supply.

And a typewriter keyboard. The Lynx computer will be on show at the Barbic Personal Computer World Exhibition, on Stand 269 in Hall A on the upper level. So drop in and put it through its paces. But beware... it bytes.

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TELEPHONE: TRING (0442 82) 6841/2/3.
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 strong 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 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 these programs are directly interpreted. When one decides to develop programs in a particular language, the programmer is to name the relevant .COMPILER and .LIBRARY files as SYSTEM files on the system disc. Commands like RUN will then cause the p-code to be dealt with the correct 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 6808/6806 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' e.g., 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 object modules, often referred to as 'function calls'. This is a surprising omission, especially in view of the fact that this same feature is implemented in the undeclared procedure of the assembler, which is an important programming aid. The major addition where UCSD offers extensions beyond the standard are in its string-handling capabilities, its memory management facilities, concurrency and I/O intrinsics.

When UCSD Pascal has a pre-declared type STRING which casts 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 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 inter-change 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: a COMPILER section where all identifiers acceptable from outside the unit are declared; an IMPLEMENTATION part where the actual code of the module appears; and a third section which can contain initialization 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 phase. The second (and really more legitimate) application is for the UNIT to form a particular system a library of useful routines (e.g., 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 'initialization and termination' section gives the designer of the unit an opportunity to ensure that the environment is correct for the UNIT to execute. The UNIT facilities exist within the p-System to construct libraries from one or more units or even to incorporate a unit into the system library.

Version IV of UCSD Pascal has been extended to allow for the initialization and control of concurrent processes — i.e., modules which execute together, sharing the use of the intrinsic facilities. It 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 processes get.

Interprocess communication is achieved by means of semaphores. A semaphore is initialized 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 (i.e., 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 demand for power increases the vulnerability of, for instance, the filing system to programming errors. BLOCKREAD or BLOCKWRITE operate on the device of logical blocks on disk files and allow rapid handling of array entries. UNITBUSY, UNITCLEAR, UNITREAD, UNIT-
High-level I/O diverges from standard Pascal in the form of a file 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 USCD 'standard' file KEYBOARD, which is a non-echoing version of INPUT. Most other implementers of Pascal 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 like withdrawals from a bank account. The problem is mean that no interactive Pascal program can be moved from USCD 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 logical device, and thus allows random access file handling. Finally, the keyword CLOSE allows (through the operating system) the immediate termination of the block or program.

Pascal

The Forth compiler offers a sensible entry into the USCD p-System for anyone with an established base of (Forth) software, although the language is not quite as tightly bound to the operating system as Pascal itself is. According to the manual, SoftTech Forth 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 for 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.

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that formatted data files are portable between p-System operations. This means, for records in formatted files, such as (see, e.g., character) fields or columns, in contrast to Fortran IV which tests at the top in a loop. The DO loop is tested at the top, in contrast to Fortran IV which tests at the bottom of the loop so you always get one pass through the block.

Control statements include unconditional, computed and assigned goto, arithmetic and logical IPs, the IF - THEN - ELSE - THEN - ELSE - ENDIF construct, together with DO, STOP, PAUSE, CALL and RETURN. The Fortran IV type construct was not a feature of the R2/2s but may 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 length specifier in READ and WRITE statements, denoting the device CONSOLE. I/O statements include OPEN, CLOSE, READ, WRITE, BACKSPACE, ENDFILE andREWIND. OPEN has four optional switches, as follows:

- STATUS - NEW/OLD
- ACCESS - SEQUENTIAL/DIRECT
- FORM - FORMATTED/

**Table 1 Fortran intrinsics**

<table>
<thead>
<tr>
<th>Type Conversion</th>
<th>INT, IFIX</th>
<th>REAL, FLOAT</th>
<th>ICHAR</th>
<th>CHAR</th>
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</thead>
<tbody>
<tr>
<td>Truncation and other</td>
<td>AINT, ANINT, NINT</td>
<td>IABS, ABS</td>
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<tr>
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<td>MAXO, MAX1, MINO, MIN1</td>
<td>AMAXO, AMAX1, AMINO, AMIN1</td>
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<td>Lexicals</td>
<td>LGE, LGT</td>
<td>LLE, LLT</td>
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</tbody>
</table>

**END of File**

EOF - returns TRUE or FALSE. (not standard Fortran 77)

**BENCHMARK TIMINGS**

<table>
<thead>
<tr>
<th>BENCHMARK TIMINGS</th>
<th>BM1</th>
<th>BM2</th>
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<th>BM4</th>
<th>BM5</th>
<th>BM6</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1.3</td>
<td>1.5</td>
<td>2.6</td>
<td>4.0</td>
<td>2</td>
<td>11.4</td>
<td>15.7</td>
<td>5.1</td>
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</tbody>
</table>

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
- IF
- STOP
- END - must exist at the end of a program;

**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 CR/LF 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 transcoders 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 to see where this dialect of BASIC RESERVED WORDS

- GOTO
- ON-GOTO
- IF-THEN-ELSE
- FOR-TO-STEP NEXT
- GOSUB
- RETURN
- ON-GOSUB
- IF
- STOP
- END - must exist at the end of a program;
Table 2

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;
FUNCTIONS — 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 from 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
RN
RAND
O
NUMERIC — compares characters in a string;
VAL — returns numeric value of a string;
STRS — 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;
DATE$ — returns month/day/year;
TIME$ — returns hour/minutes/seconds;
FREESPACE — returns number of free bytes;
EOF — returns 0 if not at end of file and a positive number otherwise;
FTYPE — returns 0;
DISPL$ — moves to a tab position in a PRINT or DISPLAY statement;
ERR — returns an error number (0 if no error).

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, enlightenment 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

‘Goodbye Harold, I’ve left you for good. For dinner see program one... clean shirts see program two...’
Test-drive your software!

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<td>microFinesse</td>
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£29 Rental

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

£19 Rental

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- Visicalc: £113
- Visiplot: £111
- Word Plus (Speller): £110
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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.

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- Full Membership costs £70 a year and allows you to rent up to £700 worth of software at any one time for 14 days.
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Send to: The Software Rental Bank Ltd., PCW Sept. 82
58 North Street, Leighton Buzzard, Beds LU7 7EN.
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 IIIs. 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. 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 ad-

vance 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.
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!
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, Visiscalc 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. 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: 01-784 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, Compu-color, 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 0192

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 ZXS11. 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.

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: 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: 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 9QF.
Tel: 01-941 4066
Details unavailable at press time.

Details unavailable at press time.

Details unavailable at press time.

Details unavailable at press time.

Details unavailable at press time.

Details unavailable at press time.
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
Computers 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 Computas. 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 graphics and a built-in speaker, making it ideal for games and educational use. Computas 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.

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, Otford, 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, Compudis, 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 60/75
Details unavailable at press time.

Stand no: 358
Comshare Ltd, 32/34 Great Peter Street, London S1P 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 has programs making 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
Datartite 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
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.

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ADDRESS

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ZX81

1 2 3 4 5 6 7 8 9 0
Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M
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 310, Imperial Way, Reading, Berks. Tel: Reading 568711

Digital will display its new family of personal computers which comprise the professional 380 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 380'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, Logge 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.

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, 66 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 digit-plotter 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 5822

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. Forth compiler will also be available 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, GL20 6EB. Tel: 0386 631020

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: 02372 711702

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.
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100 yards from Archway Station and 9 Bus Routes

130 PCW
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 Comapstar 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 80Mh, 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.

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: 01-559 0160

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 8k 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 38881
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.
PRESENTING
THE NEW...

ZX KLIK - KEYBOARD

IF YOU ARE like many ZX81 users and are fed up with the
dead 'touch sensitive' key pad then consider the advan-
tages of the new KEMPSTON KLIK-KEYBOARD. This is
a genuine push button keyboard which has been
designed as an exact replacement, being no larger than
the existing key pad, but offering all the advantages of a
full size keyboard. Consider these facts:
• Fits on to the ZX81.
• No soldering needed on the assembled version
  (just plug in)
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• Positive feedback from keys.
• Full two colour legends supplied.
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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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ZX Spectrum Hard Ware.
We are proud to announce that we have developed a
24 line Input/Output port built EXCLUSIVELY for
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developed.
Note that this is DEFINITELY NOT a ZX81
MODIFICATION but a purpose built unit which is
built and fully tested before despatch.
Please send a SAE for further details.

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60 Adamson Court, Hillgrounds Road, Kempston, Beds MK 42 8KZ
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: 235
Memotech, 3 Collins Street, Oxford
Tel: 092 576 2804

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 5M1, a hi-res colour computer with video frame handling facilities.

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: 04916 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
Microm 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.
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ZX81 ROM EXPANSION BOARD

FREE POWERFUL MACHINE CODE MONITOR IN 2K ROM

Lion Viewdata TV, announce a ROM expansion board for the Sinclair ZX 81. As an introductory offer a powerful advanced machine code monitor in 2K ROM is provided free for a limited period, with every board purchased.

The use of the ROM expansion board provides a simpler and inexpensive way of running programs using additional ROM's instead of time consuming and difficult cassette loading. Expansion ports are also provided for memory expansion and our Lion MXV07 Prestel adaptor which gives the additional facilities to the ZX81 of Prestel, unlimited Telesoftware and Autodial Memory Push-button dialing facilities for under £50.

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.

The ROM expansion is very easy to use it simply plugs into the rear edge connector and takes 2K or 4K ROM's 2716, or 2732. Additional memory can be added if required.

LION VIEWDATA TV
18 Harcourt Terrace London SW10
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 downloaded to or from a word processing system of 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. Mol also markets a game called 'Mol Othello' for ZX81. Versions of this game for ZX Spectrum and the BBC Computer will also be available.

Stand no: 334
Molmerx 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, Molmerx will introduce SMALL-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
Nasecom Microcomputers, Lucas Logic Ltd, Welton Road, Wedgwood Industrial Estate, Warwick CV34 5P2. Tel: 0926 497733
Details unavailable at press time.

Stand no: 124
The NCC Microsystems Centre, Oxford Road, London SE19 2UB. Tel: 01-771 3614
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 main-frame software company. It markets and supports accounting and office productivity systems. Two ranges of accounting systems are available. One is written in MBS and the other in CICS 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, Rosedale, 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 — name a few — the company aims to provide prompt delivery, personal service and sound advice.

Stand no: 202
Phoenix Marketing Services, Oaklands House, Salarion 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 it into.

Stand no: 410
Practical Computing/Your Computer, IPC Electrical-Electronic Press, Quadrant House, The Quadrant, Sutton, Surrey. Tel: 01-661 3500
Newnes Technical Books will be selling
Outstanding Software from Apple Orchard
Six quality products to help you make the most of your Apple

PROTECT YOUR SOFTWARE INVESTMENT
With Copy II Plus

Copy II Plus gives you the power to make back-up copies of most of the "protected" software packages currently available.

INSURANCE
With Copy II Plus you can protect your valuable software investment. Make back-up copies of VisiCalc, DB Master, the Apple Special Delivery range, and many more; keep your originals safely locked away from the wear and tear of everyday use.

EASILY PAYS FOR ITSELF
While some software companies offer replacement of expensive damaged diskettes, many do not. With Copy II Plus you eliminate the time, expense, and worry of costly accidental damage to your valuable software. 

£50

THE FILER
a new Apple Disk Utility

SAVE TIME
Fed up wasting valuable time waiting for disks to copy? With the FILER's fast and accurate copy program you can make completely reliable back-up copies of your disks in 35 seconds. The FILER is ideal for backing up your data disks, and for copying all unprotected disks.

OTHER FEATURES
The FILER package also contains a disk drive speed check, a disk drive test, and a sophisticated file manager. Options include:
- Catalog with space on disk, Copy Files, Copy DOS, Delete, Lock and Unlock Files, and Change Booting Program (name and filetype).

£16

THE HOME ACCOUNTANT
A comprehensive and powerful Personal Financial system.
Runs up to 5 cheque books, cash, and credit cards • Up to 100 budget categories • Flag taxable items • Graph actuals v. budget • Easy-to-use – less than an hour a month to maintain • Demo available for £4.

£55

THE GENERAL MANAGER
The latest quality product from On-Line Systems. The General Manager is a true hierarchical database – not just a file manager. Use it for anything from a simple names and addresses file to a complex customer accounts system.

The General Manager offers all the features you expect from a database program, and more:
- Hierarchical structure gives greater efficiency in data storage and retrieval.
- Retrieve information on several sort criteria, industry and/or searches.
- Full range of calculation abilities, including logical operators.
- The powerful data access commands provided by the Applesoft interface enable you to input or output data to and from Applesoft Files. Information can also be selected and written to text files.
- Data can be spread over 100 disks on 1-4 disk drives.
- Expand or change your database with no loss of data.

A demo disk costing £4 is available, describing these features in more detail.

£79

GraFORTH
The Apple Graphics Language

The Apple Graphics language from insoft – specially created to get the most out of the graphics capabilities of your Apple.
- Draws 3D images in colour, at rates that make animation easy.
- User defined character sets (any size, colour or typeface).
- Text and graphics can be mixed on any part of the screen.
- Music can be included in programs.
- Excellent manual shows how to use the full capabilities of the system.

Ideal for entertainment software development, scientific and educational uses, and any application where sophisticated graphics are required.

Demo available for £4 (refunded if you buy)

£50

All products require Apple II 48K, DOS 3.3

Prices exclude VAT – please add 15%. We accept Access and Diners Club. Dealer enquiries welcome.

Please send cash with order, or phone or write for more details to:

Apple Orchard Ltd (Dept S)
17 Wigmore Street
London W1
Tel: 01-580 5816
personal computing books for hobbyists, technicians and students. New books are 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 manufacturers. 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, Z8 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
Premier 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 enhancements 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 super assembler/translator will be on show.

Premier’s highly successful daisywheel word processing system based on WordPro4 Plus will be displayed, together with the Premier daisywheel controller 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 bootable from disk on startup. The system includes 512x256 graphics, modem, sound generator, facilities for colour and many other features. A 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 Ballard 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 been 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 Episco Type 1 microcomputer. This full-feature 8-bit computer with 64k RAM and two 5¼ disk drives is supplied in an attractive plastic case which takes up no more desk space than a sheet of A4 stationery. Weighting only 15lb, it will work with all types of printer or display and can be supplied with most industry standard CP/M software. Every Episco 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 disk operating system and the Episco will retail for less than £1000.

Stand no: 320
Roadrunner Electronic Products Ltd, 116 Blackdown Rural Industries, Hasle 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 micro 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 MZ88.

The PC1500, with an RS232 interface, incorporating 16k of ROM, a qwerty keyboard and 3.5k 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 Motcombe 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: 01-329 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 program 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 5W.
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.
TRUE 16 bit!

OLIVETTI M20 — a classic 16 bit microcomputer from the small business computer experts for no more than the price of a Sirius.

M20D: 160K RAM, Dual disks, monochrome £2395
M20C: 192K RAM, Dual disks, colour £3762
M20S: 128K RAM, single disk, monochrome £1895

Q. When is a 16 bit computer not a 16 bit computer?
A. When it only has an 8 bit data bus, eg 8088 cpu.

Q. Why buy a 16 bit computer that is not true 16 bit?
A. You tell us! It appears many people are doing just that. But now they have a real choice at a sensible price with the introduction of the new Olivetti M20.

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.

The colour model provides even more effective graphics.

Q. Speed?
A. Substantially faster than the "half" 16 bit micros, inevitably it is also a lot quieter, Z-8001 cpu.

Q. Software?
A. A wide range of business, scientific and engineering programs will be available in a matter of weeks for the official launch. M-Basic 5.2 is supplied as standard.

Q. Servicing?
A. Nationwide through Olivetti Engineering.

Q. Finance?
A. Leasing and rental through Olivetti Finance.

Q. Where can I get one?
A. From us, we can demonstrate right now.
Texas Instruments Ltd, MS36 Manton
Examples of the capabilities of home programming languages as well as other and speech synthesiser will be demonstrated for the first time in the UK.

Stand no: 114
Supersoft Ltd, 1st Floor, 10-14 Canning Road, Waldestone, Harrow, Middlesex.
Tel: 01-861 1166
Details unavailable at press time.

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

S1 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
Sysme Ltd, Concours 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

East Anglia-based Tomorro Micro Systems will demonstrate complete business systems, utilising M/A-COM OSI Key family microcomputers. Networking and timesharing will be features of these machines.

Stand no: 313
Tandy Corporation, 10-12 Floor, Thame 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 boards 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 III's with instructors on hand to answer education-oriented questions.

Stand no: 122
Telemat Ltd (Electronic Insight), Stafford House, Rathlin Island, Ballycastle, Co Antrim. Tel: 0265 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 £1.

Stand no: 335
VNU Business Publications, 62 Oxford Street, London W1. Tel: 01-636 8890

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
Westrex Company Ltd, Bilton Fairway Estate, Greenwood, Middlesex UB6 8PW. Tel: 01-578 0957

Westrex will be showing its Pasca 640 280 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.

Stand no: 367
X-Data Ltd, 750/751 Deal Avenue, Slough Trading Estate, Slough, Berks. Tel: 0753 723231

Three new Oki printers will be on this stand for the first time. Two the latest additions for both 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 Spinax, 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 RDPS600 mini disk drive which provides storage capacity of 1 Mbyte per disk will also be there.
<table>
<thead>
<tr>
<th>Software</th>
<th>Price</th>
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<tr>
<td>MICROSOFT</td>
<td>£</td>
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<tr>
<td>BASIC-80</td>
<td>MICROSOFT’s popular and powerful BASIC Interpreter (MBASIC)</td>
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<tr>
<td>BASIC Compiler</td>
<td>Compile your BASIC-80 programs for speed and protection</td>
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<tr>
<td>FORTRAN-80</td>
<td>Fortran compiler to ANSI X3.9 1966 except COMPLEX data</td>
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<tr>
<td>COBOL-80</td>
<td>The COBOL compiler for microcomputers. (BASIC, FORTRAN and COBOL compilers include MACRO-80, LINK loader, Library manager and CREF utilities.)</td>
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<tr>
<td>MISC</td>
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<td>CB-80</td>
<td>CBASIC compatible compiler</td>
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<td>PASCAL/M</td>
<td>SORCM’s PASCAL</td>
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<td>SUPERCALC</td>
<td>SORCM’s spread sheet and modelling system</td>
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<td>MILESTONE</td>
<td>Project Management and Scheduling from Organic Software</td>
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<td>dBASE II</td>
<td>Relational Database Management from Ashton Tate</td>
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<td>dUTIL</td>
<td>Programming aid for dBASE II</td>
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<td>QUICKSCREEN</td>
<td>Statistical program library from ECOSOFT for (and needs) BASIC-80</td>
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<td>MICROSTAT</td>
<td>Digital Research PL/I Compiler</td>
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<td>BT-80</td>
<td>Digital Research 8080 Macro Assembler</td>
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<td>8080 Symbolic Debugger</td>
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<td>SID</td>
<td>280 Symbolic Debugger</td>
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<td>ZSID</td>
<td>File Print Spooler for CP/M</td>
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<td>DESPOOL</td>
<td>Tex editor</td>
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<tr>
<td>SPELLBINDER</td>
<td>Lexisoft’s Wordprocessing and Office Management System</td>
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<tr>
<td>PRO PASCAL</td>
<td>280 True Pascal Compiler</td>
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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.

**THIS ISSUE’S SPECIAL OFFER**

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PO BOX 11 CRANBROOK KENT TN17 2DF Tel. (058 080) 310
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 users were surprised when new 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 transfer 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 costs 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 codes can achieve 15 per cent (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 administered 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 on disk is small, 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 E40 recovers 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 limit: 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 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 its form, in 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 local effect only. E40 recovers almost immediately if the compressed file is deliberately corrupted.

This recovery feature was judged very important and would 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 Huffman codes an error in any bit means that the remainder of the file is unreadable. One can prove mathematically that Huffman 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 automatic readback verification when writing to disk.) This slows archiving by about 20 per cent.

b) The user may introduce checksums into the file stream, 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 speed and space for current hardware. It is expected that if this system becomes 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 file name, 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 do not strictly need XKC but it will be offered anyway, as many operating systems lack
a built-in computer/computer transfer utility.

Although XKC is profiled to CP/M, this is a feature 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 any other 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 will do 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 the 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 than the former but 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 build 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 a 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 muddied and contain a mixture of finished and unfinished work, work of different kinds, and backup copies. This applies as much to wordprocessors 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 KEC 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 k baud 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
I checked out the E40 compression utility on the Sharp MZ280 under CP/M 2.2 without any communications hardware; I couldn't check the options on a LOGIK 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 command for PIP. Then 'B: SQUASH AHUGE.

TEXT' will compress the file into a file called SQUASH.E40 on drive B. The file is then automatically and automatically expanded by the program. The shortest form allowed is '4E: HUGE.TXT' which compresses into a file with the default name HUGE.E40 on the currently logged-on 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 such as the drives with the possible GO? to which only the answer 'Y' will initiate expansion; any other answer returns the prompt. FILE EXPENDED signifies success. Again the shortest form of the command is '4E: 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 inexperienced CP/M programmer. The less technical user will only require the one page summaries 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 Wordstar. The situation was a reduction from about 40k 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 percent, 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).

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) 658040.

Dick Pountain

CHECKOUT

Dick Pountain reports on E40 in use.

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 law, the company Keele Codes Ltd 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 is no doubt that 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 off computer time to a convenient customer. (All really heavy computing is sold on a pay-as-you-go basis.)

It is an interesting thought that 10 years ago E40 would almost certainly have become a scientific paper rather than a commercial product.

Database back-up

Compression can be as great as 5:1 with database files, mainly because they contain reserve but unfilled space. (Where this is not the case, the 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 made a major compromise 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,
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Lack of time has also prevented my building a port through which to transfer my WP program from the Cromemco. This latter problem may be due to the fact that (without wishing to boast) I have a remote control TV with tiny pre-set knobs which take a lot of adjustment even with TV stations.

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END
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 data, 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 text. 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 for 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 software. 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 underdefined 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 Term 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

```plaintext
/? FIND SU=BRITISH RAIL
T1 15 KW=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
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 sets 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 terminologies. 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 ideas 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 make it easy to use the package. But it can take a lot of 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 for a price, 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 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 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 limitations to 1122 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.
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 acting with a thinking being. 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 should arrive within 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.

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.

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 out 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.
So the major hurdle you first have 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 functions 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").

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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 perform with Select kept coming up with garbage across the top line.

Teach screens are well set out, so that, although it is rather tiresome to spend a long time reading the green phosphorescence, the 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 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, this 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...
executes the Erase function and Return is used for a forced end of line while in Insert mode.

The design principle behind it is apparent that it gets rid of the need for mind control. It seems to me that one can 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 does Erase and Copy commands. You 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 Command A and the memory as with D for Display or E for Erase. But when it gets to Print you realize that you've already used up F for Pointer. So the command for printing (unformatted) text on 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 displays 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 put it in quotation marks. W for Windows is the key useful facility of the keystroke 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 Gap 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 scraped. Once the area is properly defined you press Escape. This has the strong disadvantage that you cannot use 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 that 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 place, and it could prove 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 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 section and inserts it into your document. Consider Select's lack of facilities, such as the creation of special characters, or simple addition of columns or rows. 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, usually settings of the Justify facility. The commands 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 and claim 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 lots of large 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 enforce 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 active on the text as you enter it, in which case you are using 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, and the spacing adjusted right 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 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 it is 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.

---

**Benchmark timings**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Time (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM1</td>
<td>24.6</td>
</tr>
<tr>
<td>BM2</td>
<td>44.0</td>
</tr>
<tr>
<td>BM3</td>
<td>19.0</td>
</tr>
<tr>
<td>BM4</td>
<td>31.0</td>
</tr>
<tr>
<td>BM5</td>
<td>31.0</td>
</tr>
<tr>
<td>BM6</td>
<td>41.0</td>
</tr>
</tbody>
</table>

All timings in seconds. For an explanation of the word processor Benchmarks, see PCW, April 1981.
From time to time it can be useful to leave a space within a Basic program to incorporate 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 &LOMEN: developed by Neil Konzen (Apple Orchard, March 1980).

The drawback with loading a program above the hi-res pages is that approximately 5120 lines of memory is left fallow; it can only be used for machine code routines or shape tables. Also, the &LOMEN: 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 pages 1 and 2 together), to jump over this area of memory to be protected (this is approximately 6k of memory is left fallow; it can only be used for machine code above the hi-res pages). 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 (CALL-156) 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 expressing 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 OE 08 0A 00 BA 22 48
0808- 45 4C 4C 4F 22 00 16 08
0810- 14 00 AB 31 30 00 00
```

The values OE,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 and the second byte in reverse order, i.e., OA 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 address, 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 a 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
```
Your computer is capable of sending data at many thousands of characters per second but the fastest Epson can only print 100 characters per second and most daisywheel printers are even slower. This means your computer is forced to wait for the printer to finish one line before it can send the next. A costly waste of time.

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Answer: SPINTER

Problem: Attach a letter quality serial printer to a parallel output computer for Word Processing.
Answer: SPINTER

Problem: Save money by attaching a low cost matrix printer to a serial output computer.
Answer: SPINTER

Problem: (Insert your interfacing problem here)
Answer: SPINTER

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SPINTER IS A TRADEMARK OF MUTEK.
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 'Screnplay', I don't rate the ZX81 very highly as far as its on its way!) As you'll know if you second Psion offerings - I decided to have a recent selection of games for Uncle Clive's classic. I have indicated in the reviews whether or not they require the 16k RAM.

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 choice: you can 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 something somewhere. Your score 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 less 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 opportunity for the beginner to become acquainted with one of the most promising areas of computing there is. 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 of the ZX81 places on the latter definitely make this and its fellows the better value for money.

**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, propeller-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 F 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 O 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 called up whenever you need it. 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!

**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.
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 particu-
larly 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.

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**SCREENPLAY**

**Game: Space Raiders and Bomber**
Supplier: Sinclair/Psion
Price: £3.95

The first of this pair is a standard ver-
sion 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 some-
what 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 particu-
larly inspiring. I must have played
dozens of versions of Space Invaders
and, although I assume that many
people are still playing this grandfa-
ther of games, I can't help feeling that it is
about time the games publishers gave
it a decent burial.

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**Game: The Nowotnik Puzzle & other
diversions**
Supplier: Phipps Associates
Price: £3.00

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 prescri-
bred 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
impressively impressive in themselves
but they complement each other well.

---

**Game: Asteroids & Invaders**
Supplier: Silversoft
Price: £3.95 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, 'L' 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 accelera-
tion as in the original, so that motion
ceases when you remove your finger.
There are ten speed options and move-
ment is fluent so the game, as far as it
goes, plays quite well. Despite its limita-
tions 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 publish-
ers 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!
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 '6' 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 over-riding 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.

---

Game: 1k Breakout
Supplier: J K Greye Software
Price: £4.95

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 alphanumeric 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.

---

Game: Chess
Supplier: Sinclair/Psion
Price: £6.95

A number of objects are thrown against you. The most valuable, fire-balls, 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 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.

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 pincer-like 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, fire-balls, 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's 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 colourful 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 strategy 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.
In the April 1982 PCW, Harvey Meilard 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, runs 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 CT, 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 NEW, 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 PRINT 6
TO SHOWTWICE NEW 6
TO SHOWTWICE END

Pogo will display '66'. To test for SIX, we may type PRINT 6
TO SHOWSIX NEW 6
TO SHOWSIX END

This definition also introduces two new possibilities of an easy-to-use procedure-defining facility coupled with turtle graphics. Graphics are a major feature of Logo, and enable procedures to be 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 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, PENDUP, PENUP, PENDOWN. To draw an 'L' shape on
the screen we could enter
FORWARD 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),
20 PENUP
30 FORWARD ; N
40 PENDOWN
50 RIGHT 180
END
Finally, to backtrack N steps without
drawing a line:
TO BACK 'N
10 RIGHT DIFF 360 ; N
20 PENUP
30 FORWARD ; N
40 PENDOWN ; 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 6 (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 inter-
nal 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 port-
table but not intelligible, due to Basic's
primitive control structures, short
variable names, and lack of named sub-
routines. It is a tight fit in 16k, so there
are few comments, and those that do
exist employ a short style.
a. 'C' means 'suboutine 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 compila-
tion 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
statement.
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 sys-
tems 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 approxima-
tion 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 posi-
tion. 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/A) and
INT (Y/A). 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 IFS.
Line 29420 — transmit IFS (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
In that essential book *Turtle Geometry*, forms of 'pursuit' games are described—

"...developments of OPEN and CLOSE statements using tape or disk would require the addition of semaphores. 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

1000 "LINE EDITOR"
1010 "FIRST,LAST,MIDDLE?"
1020 "FIRST,LAST,MIDDLE?"
1030 "FIRST,LAST,MIDDLE?"
1040 "FIRST,LAST,MIDDLE?"
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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 augur opinion with bated breath.  

R P Phillips, Milton Keynes

As you may have noticed I am not usually very outspoken, and indeed it is 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 gap. 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 word processor so it can be used as a typewriter, too. However the speed is slow (around 10cps) and would take about 6 minutes to print this answer. However you can obtain for £1400 a 50cps daisywheel that is maybe 10 times faster. It can mean the difference between life and death because the speed a printer operates is not determined just by how many characters per minute 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 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 between the 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 mechanical feeding of the paper into the printer. You may require single sheets to be fed in automatically. Do 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 I mention above; and the Commodore 8300P for around £1400, which is really the Diablo 630 duplicated in the 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 to inflate! So don't expect too great a drop in price.

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 becoming expensive) to keep 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: high demand for 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.

Squashed

The answer headed 'Dates' in the June edition is one solution to the problem of simplifying entry into a particular line of work. You 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 'DATA BASE' answer, 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 LinBoT, 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 and then put it back, even from a cold start the system will start up by itself.

A word of caution: The ‘SUBMIT’ program creates a file called FRED.SSB which contains the commands in FRED.SUB yet to be executed, and whenever the file FRED.SUB is just about to finish executing it recreates 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 that state that I have found is by Osborne, and is available from Mine of Information (SOLD 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 SSB or you can do this within Basic using KILL ‘FRED.SSB’. 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 trying to get a basic computer 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 weeks. I am testing out this claim and can tell you next month. Both companies advertise in SW, 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 4032 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 Commodore 737 also has good output, but can the vertical line spacing be programmed as well as the Epson, as this is vital for printed forms? Can you give me your recommendations for under £2000?

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 upgrade 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 in any easy state. Basic language is contained in ROMs which can be removed and replaced. Oh and dynamic ROMs. 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 4. 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 soon bring out an RS232 communications interface. But what does RS232 mean?

M Sargison, 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. Any printer, VDU, etc can be 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 (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 Pascall?

B Kett, North Yorks

I had not previously come across such a program for a micro, but the National Computer Centre have suggested that an index from TCL Software Ltd, of Theobalds Road, London W1C. 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, Covent 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 ‘Micspell’ 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 source document from ‘Micspell’s dictionary, it would generate your keywords in context!”

L McNiven

‘I think that’s bloody mean — making the kids buy computer time out of their pocket money!’
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 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 — i.e., 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 on and off 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 OH (i.e., 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 — i.e., 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 used.

### Signal name

<table>
<thead>
<tr>
<th>Signal name</th>
<th>Pin number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protective ground</td>
<td>1</td>
</tr>
<tr>
<td>Signal ground</td>
<td>7</td>
</tr>
<tr>
<td>Transmitted data</td>
<td>2</td>
</tr>
<tr>
<td>Received data</td>
<td>3</td>
</tr>
<tr>
<td>Request to send</td>
<td>4</td>
</tr>
<tr>
<td>Clear to send</td>
<td>5</td>
</tr>
<tr>
<td>Data set ready</td>
<td>6</td>
</tr>
<tr>
<td>Data terminal ready</td>
<td>27</td>
</tr>
<tr>
<td>Carrier detect</td>
<td>8</td>
</tr>
<tr>
<td>Ring indicator</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 2a Main RS232 signals
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.

### 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 them 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

---

**Table 1. Nomenclature for various types of information exchange**

<table>
<thead>
<tr>
<th>Information Transfer</th>
<th>Computer Industry</th>
<th>Telecommunications Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both ways at the same time</td>
<td>Duplex</td>
<td>Duplex</td>
</tr>
<tr>
<td>Both ways but not at the same time</td>
<td>Half Duplex</td>
<td>Simplex</td>
</tr>
<tr>
<td>One way only</td>
<td>Simplex</td>
<td>Channel</td>
</tr>
</tbody>
</table>
who else offers you this service?

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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 logging 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) may not be noticed immediately, so that the ITP must be able to buffer up more characters for his mainframe. Therefore without being able to say 'that looks interesting - I'll finally be able to copy that along with a copy of that' and then do so when the mainframe is not transmitting. However, RS232 port and an inexpensive terminal modem, programs could 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, if data terminals between thousands of small companies and 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 serial interface are embedded in the basic techniques of the computer designer. Transplanted from its original role of mainframe-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 input and output 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 components (and hence the small amount on cabling) needed to interconnect interfaces.

In the future we can expect to see many more interconnection standards appear (like the Cambridge ring and Ethernet and the RS4232 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 trying our programs in via an RS232 port for quite a few years to come.

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 micro-screen 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 sends 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 'p's.

To reduce development time we loosely based our program on a program solution for a user group library. Called '88-MODEM', this was written by Tim Pugh. It is intended for sophisticated American modems that tend 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, 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 it is going to need time to write several kbytes of buffered dialogue to disk and to be able to make this decision independent of which mainframe it is operating on. The ITP could transmit a character meaning 'pause terminal output' to the mainframe whenever the receiving buffer is almost full and then restart the printing out of 'pause characters'. Unfortunately the 'pause' and 'restart terminal output' control characters are likely to be different for different mainframes and so '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.

One Bit At A Time

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 idea, what is the need for intercomputer communication, and how useful an intelligent terminal program can be.

The standard has some drawbacks - chiefly because it is not being used for intercomputer communication and 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. The 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 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 less than £250, and that the microcomputer systems to come ready equipped with one or two RS232 ports.

With an RS232 port and an inexpensive terminal modem, programs could 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.

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In the Dec 81 edition of this corner I reviewed the 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 pricing. As you can see my enthusiasm was such that I transpired 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/roof finding, in addition to the normal trig 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 at international markets, is that the physical packaging is different in complex mode to allow those operations which do not work on complex numbers simply ignore the imaginary stack. The only exception is those operations which do not work on imaginary X-register only while held to press the 'i' key which displays the imaginary X-registers of the two stacks to view the imaginary part of your number into the imaginary stack. 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 ReIm between the STOs.
It takes a while to become comfortable with the use of these two parallel stacks, one only one of which is visible, but once you have the feel of it complex arithmetic is no harder than real. Certain operations like forming the complex conjugate require thought since the CHS key is taken as sign of the imaginary 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 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, after the last element has been displayed. To store matrix 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 numeric operations.

Permitted operations on matrices are: copy, invert, transpose, form the row norm or the Euclidean norm, extract the determinant, scalar addition, matrix addition and subtraction and matrix multiplication, addition, subtraction and three matrix products (XY, YT X, X⁻¹) and matrix addition, subtraction and matrix multiplication, addition, subtraction and three matrix products (XY, YT X, X⁻¹).

Some of these operations require a special 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 10 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 DEC, OCT and BIN whose functions should be clear. A nice touch is that when these keys are in use an alpha prompt in 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 selected using 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 called 64H you would display it in base八 for as long as the OCT key is held down.

Three sign conventions are supported in integer mode, namely 1's complement, 2's 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 2's 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 probably have the already unused 7th bit reserved for something interesting.

**Conclusions**

These two machines are produced, packaged and documented in a way that 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 and do it much more cheaply. The 15C has a full set of bitwise shifts, rotates and logical 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 this is 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).
For most businesses, purchasing a microcomputer accounting system can be a costly exercise especially if it isn’t practicable.

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- Hotline telephone support.
Alan Toothill 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 SABD46 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 M8 - M4, the secondary accumulator in M4 - M7, the tertiary accumulator in M8 - M7, 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 Altinchanham 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 note (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 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
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;FILE PLAN: Get 2 character pointer
;FETCH DIGIT & CONVERT TO BINARY

PCW SUBSET

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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 that we arrived at the conclusion that 16-bit routines are not good enough for serious work and to the call for a Z80 31-bit routine with a 2^31 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 - 31-bit pseudo-random number generator.

"Sorry, son - not ice cream, just home computer programs!"
**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.

![Diagram of circuit](Image)

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 0V power supplies can be obtained from the back plane.

Richard Wood

---

**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:

10 POKE 16388,48
30 CLS.

This routine does not have to be at the beginning of the program. Without stopping it, clearing memory or clearing variables; it simply involves CLS, as follows:

174 PCW
### 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 0.00:

These programs were run on a TRS80 Level II.

**Peter Daisy**

<table>
<thead>
<tr>
<th>10 LPRINT &quot;NORMAL&quot;;TAB(15)&quot;IMPROVED&quot;</th>
<th>20 INPUT N</th>
<th>30 LPRINT N;</th>
<th>40 LPRINT TAB(15) USING&quot;###.###&quot;;N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NORMAL</strong></td>
<td><strong>IMPROVED</strong></td>
<td></td>
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<tr>
<td>12</td>
<td>12.000</td>
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<td>12.2375</td>
<td>12.238</td>
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<tr>
<td>9.5E-03</td>
<td>0.010</td>
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<td>9.2E-03</td>
<td>0.009</td>
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### 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.

The effect sought by D Gayler gives B the value of A rounded to D decimal places.

**Tim Pile**

<table>
<thead>
<tr>
<th>10 LPRINT &quot;NORMAL&quot;;TAB(15)&quot;IMPROVED&quot;</th>
<th>20 INPUT N</th>
<th>30 IF N=INT(N) THEN A$=&quot;###&quot;;GOTO 60</th>
<th>40 IF INT(N)&gt;0 THEN M=N+1 ELSE M=N</th>
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### ROUNDNING

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**

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### MICROTRAN IMPROVED USR

This routine greatly extends the USR(I) instruction of Microtan Basic, whilst using only six bytes of RAM. RAM enables more than one machine-code subroutine to be called from Basic without repeatedly POKEling zero page.

To use, enter the following code using Tanbug's M command:

IF PA 20 F5 DF JSR D5F5 1FPD 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. For Reference, use the following subroutine.

**Clive Jones**

| 10 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 = 32759 TO 32764: THIS LOOP POKE "SEVEN INC SP"S |
| 5 NEXT I: INTO HIGH MEMORY |
| 6 POKE 32765, 193: THIS POSES THE CODE FOR JP IDIEH |
| 9 POKE 32767, 23: THIS LINKS THE LINE STATEMENT |
| 10 POKE 16580, 246: TO BASIC |

**Listing 2**

| 10 PRINT "LINE 10"; GOSUB 30 |
| 20 PRINT "LINE 20" END |
| 30 PRINT "LINE 30"; GO to 50 |
| 40 PRINT "LINE 40"; RETURN |
| 50 PRINT "LINE 50"; LINE |
| 60 PRINT "LINE 60" RETURN |

**Listing 1**

| 0 POKE 16562, 127: POKE 16561, 245: SET TOP OF MEMORY |
| 10 POKE 16545, 127: POKE 16544, 195: SET STRING SPACE |
| 20 CLEAR: REINITIALISE |
| 30 FOR I = 32759 TO 32764: THIS LOOP POKE "SEVEN INC SP"S |
| 50 NEXT I: INTO HIGH MEMORY |
| 60 POKE 32765, 193: THIS POSES THE CODE FOR JP IDIEH |
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| 100 POKE 16580, 246: TO BASIC |

**Clive Jones**
FOR FREE BROCHURES - TEL: 01-301 1111

I am interested in purchasing an Atari 400/800 computer and would like to receive copies of your brochures and test reports as well as your price list covering all of the available Hardware and Software:

Name

Address

Postcode
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

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:

*KEYS "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. Jewabury

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)
3) Insert a blank cassette.
4) Type USR(33):USR(36)
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 Laurence

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 delay the making of the computer convert the number into hex is used.

David Eastlake
**BEEB INKEY TWEAK**

The BBC still holds a lot of surprises, there is one. At first glance the INKEY statement seems quite adequate for games and so on. However, it must be followed by a number, e.g. 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 *FX11,1 and *FX12,1 at the beginning of a program to change auto-repeat delay and rate and return to normal with *FX10. Fine, unless you ESCAPE the value after you stop using, say, the CPU clock as 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 scroll, enter these lines with the routines present:

20CIRCLE PAPER6;128,87,80
30 FOR g=1 TO 10:
40 RANDOMIZE USR 23760:
50 NEXT g
60 FOR g=1 TO 10:
70 RANDOMIZE USR 23836:
80 NEXT g
90 FOR g=1 TO 10:
100 RANDOMIZE USR 23874:
110 NEXT g
120 I hope this will be of use to someone; I can’t be the only one to have a ZX Spectrum, can I?

**SIMPLER UK101 NEGATIVE SUPPLY**

While the circuit shown in June’s T’J’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 time 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.

**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!

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**C R Faulkner**

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PCW 179
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 particular, 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.

| Colour number of magenta = 5 = 01012 | 0 | 1 | 0 | 1 |
| Colour number of yellow = 3 = 00112 | 0 | 0 | 0 | 1 | 1 |

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

```
10 REM UTILITY FOR MODE 2 GRAPHICS
20 MODE6:DIM AX(10, 8),AX(20,8);W%=10
30 PROCinfo
40 PROCmenu
50 ON M%$GOSUB 70,90,140,340,410
60 MODE6:GOTO40
70 REM QUIT
80 MODE7:END
90 REM SET UP NEW PATTERN
100 FORW%=1TOW%:FORJ%=1TO8
110 PRINT"THE SEQUENCE OF NUMBERS YOU NEED IS:";";
120 NEXTJ%,I%
130 IF (W%AND1)OR(W%<2)OR(W%>20)THEN120
140 REM EDIT OLD PATTERN
150 MODE3;PROCboard
160 ON ERROR GOTO 310
170 IF M%=1 THEN 1X%=1;FX%=4,1
180 IF M%=1 THEN PRINTTAB(A%+2*XX%,B%+YY%);";
190 NEXTJ%,I%
200 ON ERROR GOTO 300
210 IF W%<0 OR W%>15 THEN190
220 PRINTTAB(AX%+2%+XX%,BY%+YY%);CHR$(M%)
230 NEXTJ%,I%
240 GOTO 180
250 M%=M%-135
260 IF M%>2 THEN 290 ELSE M%=M%-2-3
270 IF X%>W% OR Y%>W% THEN X%=X%-W%
280 GOTO 300
290 IF Y%>W% THEN Y%=Y%-W%
300 GOTO 180
310 IF ERR<>17 THEN MODE7:PRINT"ERROR &":ERL:STOP
320 ON ERROR OFF:FX4,0
330 GOTO 60
340 REM VIEW SHAPE
350 MODE2:PROCmerge
360 PRINT"Here is your pattern"
370 FORI%=1TOW%:FORJ%=1TO8
380 IF M%=1 THEN PRINTTAB(AX%+2%+XX%,BY%+YY%);";
390 NEXTJ%,I%
400 PRINTTAB(0,0);1:GOTO40
410 REM LIST DATA
420 MODE6:PRINT"THE SEQUENCE OF NUMBERS YOU NEED IS:";
430 IF M%=1 THEN PRINTTAB(AX%+2%+XX%,BY%+YY%);";
440 FORI%=1TOW%:FORJ%=1TO8
450 PRINTTAB(AX%+2%+XX%,BY%+YY%);";
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%=7B-2#W%:DIV2
```

will light up one or both dots, although the relationship between the numbers and the colours is rather strange.

Thus ?(LOC)=39 will produce the desired effect.

```
Fig 1 Screen organisation in Mode 2
Fig 2 Typical pattern
```

Fig 1 Screen organisation in Mode 2

<table>
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Fig 3 Typical pattern
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:

```
0,0,0,4,4,8,8,0,0,4,9,11,12,4,4,8,12,12,12,12,0,0,0,0,8,7,12,8,8,4,0,0,0,8,8,8,4,0.
```

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 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.

---

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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 fifteen’ 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 has to be given a set of rules in order to perform arithmetic on, or by comparing it.

The computer processes data by reshuffling, recording them; later the computer can listen to and move 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 what information is on the disk and it can get to any item of data by moving the head to the appropriate track and then locating the correct 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 cassette and disk drives are floppy disks — 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 which is like a TV screen with a typewriter-style keyboard. 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 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 obvious is RS232 (RS for recommended standard, 232 for serial interfaces to printers, the Centronics standard is popular). A modem connects a computer, via a serial interface, to the telephone system 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 oblong rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn’t so up to it about the use of these.

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.

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<table>
<thead>
<tr>
<th>Machine</th>
<th>Price from</th>
<th>Main Distributor/ (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
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<tbody>
<tr>
<td><strong>Alpha Micro</strong> (£5850)</td>
<td>Alpha Micro (UK) Ltd: 01-251 1618 (TBA)</td>
<td>64K - 1 MB RAM: 16-bit: 8&quot; F/D (2.4 Mb) 6.5 f.</td>
<td>Multi-user OS: Basic: M/A: Pascal: U: Fortran: Cobol.</td>
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<td>Modular. Expands to 1200 MB, 32 terminals or multiprocessor system. (E)</td>
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<td><strong>Arati 800</strong> (£654-16k)</td>
<td>As above.</td>
<td>16-48K RAM: Z80: Cint: 4 x cartridge slots: 12 x 20 TV int: RS232 port, joypad k/b: Opt: single 5¼&quot; F/D (E803) £480. 32K RAM 48K: 663.</td>
<td>As above.</td>
<td></td>
<td>As above. Software &amp; RAM on cartridge modules. Up to 64 disk drives. BT 10/80. (E/B)</td>
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<td><strong>Attache 201</strong> (£8800)</td>
<td>COLT 01-572 3784 (10)</td>
<td>64K RAM: Z80: dual 8&quot; F/D (2.4 Mb): 12&quot;, 24 x 80 VDU: 160 cps printer.</td>
<td>Basic: Fortran: Cobol.</td>
<td></td>
<td>Upgradable to multitimer system with 18 Mb H/D. Full range of business packages included software dealers. TBA. (S)</td>
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<tr>
<td><strong>BASF 7120</strong> (£4400)</td>
<td>BASF 01-388 4200 (12)</td>
<td>88K RAM: 2xZ80A: 3 x 5¼&quot; F/D (480k): 12&quot;, 24 x 80 VDU: RS232 port: P/P</td>
<td>DOS: (OASIS) Ex Basic: Cobol U: A: CP/M</td>
<td></td>
<td>H/D available soon. Also 7125 with 9060 F/D (100k) and 7130 with single F/D (4038) &amp; 6K. BT 2/80. (S).</td>
</tr>
<tr>
<td><strong>BBC Micro</strong> (£205)</td>
<td>BBC Micro Systems 14 Station Road Ketton, Northants (no tel)</td>
<td>16-32K RAM: 6520: Cint: TV int: RS422 port: P/P: Option: single 5¼&quot; F/D (E803) £230.</td>
<td>MOS: Basic A</td>
<td></td>
<td>Video test &amp; Second processor int. 32k model with Econsi and disk interface £3.95. BT 1/82 (I)</td>
</tr>
<tr>
<td><strong>Billings BC-12 FD:</strong> (£395)</td>
<td>Mitech: 04862 23131 (TBA)</td>
<td>64K RAM: Z80A: dual 5¼&quot; F/D (640k): 12&quot;, 24 x 80 b/w or bs/dk VDU.</td>
<td>DOS: Basic: Fortran: Cobol: A</td>
<td></td>
<td>With dual 8&quot; F/D (2 Mb) £5995. Additional dual 8&quot; F/D £300 option. 50Mb F/D. (B)</td>
</tr>
</tbody>
</table>

### List of Abbreviations
- **A** Assembler
- **BT** Bench Tested
- **C** Cassette
- **E** Enhanced
- **F/D** Floppy disk
- **G/C** Graphics card
- **H** Hardware
- **I** Introductory
- **M/A** Macro assembler
- **N/A** Not available
- **O/S** Operating system
- **P/P** Parallel port
- **S** Software
- **T/E** Text editor

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are exclusive of VAT.
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 coherent complete and comprehensive set of business software products, all from the same company 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.

---

**MEMO**

**To:** Steven  
**From:** C.F.  
**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 September.

Charles

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.

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
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<tbody>
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<table>
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<tr>
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<td></td>
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</tbody>
</table>

PCW/6/82

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.
<table>
<thead>
<tr>
<th>Machine (Price from)</th>
<th>Main Distributor/s (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynabook 5000 Series (£1780)</td>
<td>Metrotech 0805 58111(33)</td>
<td>64k RAM: Z80: $1000 bus: 2 ser ports: 1 par port; any com of 5/4&quot; F/D (630k), dual 8&quot; F/D (1Mb), 9/24/45 Mb H/D, 32/64/96 Mb Cart: Monitor H/D.</td>
<td>CP/M: MP/M: CP/Net, CBasis, MicroBasic, Fortran, Pascal, PL/1-80</td>
<td>All systems expandable to multi-user and multi tasking. CP/M in inc base price for F/D system, MP/M for H/D system.</td>
</tr>
<tr>
<td>Equinox 200 (£7500)</td>
<td>Equinox: 01-739 2387 (N/A)</td>
<td>64-512k RAM: Z80: 10 Mb 1200 Mb H/D: 6xS/P: 1 P/P.</td>
<td>CP/M: Classic Cobol, Fortran.</td>
<td>Multi-user MV/VM/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&amp;H).</td>
</tr>
<tr>
<td>LSI M-One (£4200)</td>
<td>LSI Computers: 04862 23411 (20)</td>
<td>8-16k RAM: 8080: dual 8&quot; F/D (1Mb): 12&quot;: 24x80 b/w VDU:</td>
<td>FMS: A</td>
<td>£995: (B).</td>
</tr>
<tr>
<td>Microntan 65 (£699)</td>
<td>Tangerine: 0223 60488(6)</td>
<td>1Rk RAM: £605: 32x16 TV int: Exp up to 32k.</td>
<td>£995: (B).</td>
<td>£995: (B).</td>
</tr>
</tbody>
</table>

List of Abbreviations:
- A: Assembler
- BT: Bench Tested
- C: Cassette
- E: Extensive
- F/D: Floppy disk
- G/C: Graphics card
- M: Macro assembler
- S: Software
- N: Not available
- P: Parallel port
- T: Text editor
- U: Utility
- V: Video

Please note: Software items listed in italic are not included in the basic price of the equipment. All prices are exclusive of VAT.
<table>
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<tr>
<th>Machine (Price from)</th>
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<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micron EC8820 (£2990)</td>
<td>As above</td>
<td>128k RAM: dual 51/4&quot; F/D (6400k): 2x, 24x80 VDU: 3xRS232 ports: P/P</td>
<td>As above</td>
<td>5MB H/D available soon. BT 4/82.</td>
</tr>
<tr>
<td>NEC PC 8001 (£599)</td>
<td>1BR 0734 664111</td>
<td>32k RAM: Z80A: P/P Option: dual 5 1/4&quot; F/D (320k) £699</td>
<td>Basic N: (24K ROM) CP/M: Farrent: Cobol: Pascal</td>
<td>Colour monitor £359 (low res) or £579 (high res) both 12&quot;, 25x80</td>
</tr>
<tr>
<td>Oscar (£2560)</td>
<td>IDS Ltd 0908 313997 (30)</td>
<td>64k RAM: Z80A: dual 5 1/4&quot;: F/D (800k): 12&quot;: 24x40 VDU: RS232 port: 1 P/P</td>
<td>CP/M: Basic: Pascal: Farrent: W/P: A</td>
<td>Also available with dual 5 1/4&quot;: F/D (60k): £290 and 8&quot; F/D (2Mb) £3380. Advanced video board. SHK.</td>
</tr>
<tr>
<td>Perifex 1024/64 (from £2250)</td>
<td>As above</td>
<td>64k RAM: Z80: dual 8&quot;: F/D (1.2Mb): 2x: 2xRS232 ports: 1 P/P.</td>
<td>As above</td>
<td>As above</td>
</tr>
</tbody>
</table>

List of Abbreviations

- A Assenmer
- B Bench Tested
- C Cassette
- D Daisy
- E Floppy disk
- F/F floppy disk
- G/C Graphics card
- H Hardware
- I Interface
- M/A Macro assember
- N/A Not available
- N/P Numeric pad
- O/S Operating system
- P/P Parallel port
- S/S Serial port
- T/E Test editor
- TBA To be announced
- 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.
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.

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.

128K VISICALC

Now that all this memory is available, Vergecourt has developed an 'expander' program for Visicalc, allowing Visicalc to use at least 128K. When used with your RAMEX 128. Just like our development to give you 50K Visicalc with the Ramex 16 Vergecourt is in tune with your needs.

RAMEX 128 £295.00
SUPER EXPANDER £40.00
(For Visicalc)

Vergecourt is the registered trade mark of Visicorp
Apple II is the registered trade mark of Apple Computers Inc.

DDP RESEARCH & MARKETING
Reg Office: 17 Nobel Square, Basildon, Essex SS13 1LP
Telephone: 0268 728484.
Telex: 995323

Vergecourt LTD
<table>
<thead>
<tr>
<th>Machine/Processor</th>
<th>Main Distributor/s (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link 4802</td>
<td>As above</td>
<td>32-64k RAM: Z80A: C: 2x5/4&quot; P/P: P/P</td>
<td>Basic: A: T/E</td>
<td>Expand to 32 users. 768k, RAM, 90 Mb H/D, UNIX 'look alike'. (S&amp;H).</td>
</tr>
<tr>
<td>Sinclair ZX81</td>
<td>Sinclair: 0761 66104 (100+)</td>
<td>1-16k RAM: Z80A: Cint: 31/2 Mb: full K/B: 64-pin expansion port.</td>
<td>Basic (8k ROM).</td>
<td>Advanced 4-chip design. Printer now available. soon BT 6/81</td>
</tr>
<tr>
<td>Sinclair ZX Spectrum</td>
<td>Sinclair: 0761 66104 (100+)</td>
<td>16-48k RAM: Z80A: 16k ROM: T/ V int.</td>
<td>Basic</td>
<td>Options: 32k RAM £60. RS222 port and introsdive disks avail soon. BT 6/82</td>
</tr>
<tr>
<td>Solitaire WP &amp;</td>
<td>Solitaire KPG: 01 37373 (TBA)</td>
<td>64k: RAM: 8085: 14&quot; VDU (with own CP): 45 cps printer: CPU with expansion card (800k): 8&quot; F/D (1.02 Mb) &amp; RS200.</td>
<td>DOS: Basic:</td>
<td>All solitaire systems are compatible: most can be upgraded to multi-user H/D system. (S).</td>
</tr>
</tbody>
</table>

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**List of Abbreviations**

- A: Assembler
- B: Bench Tested
- C: Cassette
- C: Cassette
- D: Disk
- E: Extensive
- F/D: Floppy disk
- G/C: Graphics card
- H: Hardware
- Int: Interface
- M/A: Macro assembler
- N/P: Not available
- N/P: Numeric pad
- O/S: Operating system
- P/P: Parallel port
- S: Software
- S/P: Serial port
- TBA: To be announced
- U: Utility

---

Please note: Software items listed in *italics* are not included in the basic price of the equipment. All prices are exclusive of VAT.
EPISODE™

A new personal workstation computer. The EPISODE is a stand alone computer that gives you flexibility. Just use or add the visual display and printer of your choice. Small and compact the EPISODE takes up less space than a business letter and is available alone or with combination of floppies and Winchester drives. Through the inclusive standard CP/M operating system a wide variety of application packages can be used. The EPISODE can also communicate via networks & share data bases.

APPLICATION SOFTWARE

Both MicroPro & Lifeboat Associates software are available in EPISODE format.

SUPERVYZ™

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: 280A, 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...

<table>
<thead>
<tr>
<th>VDU's</th>
<th>ADDS</th>
<th>DEC</th>
<th>Lear Siegler</th>
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<tr>
<td>GRAPHIC</td>
<td>ADDS</td>
<td>DEC</td>
<td>Digital Engineering</td>
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<td>COLOUR</td>
<td>Datamedia</td>
<td>KEYBOARD</td>
<td>GE</td>
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<td>Sundex</td>
<td>A-J</td>
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<td>CDE</td>
<td>Epson</td>
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<td>DEC</td>
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<td>Lear Siegler</td>
<td>Okidata</td>
<td>Seikosha</td>
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<td>Televideo</td>
<td>Star</td>
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<tr>
<td>FROM</td>
<td>Datamedia</td>
<td>Sundex</td>
<td>Sundex</td>
</tr>
</tbody>
</table>

RIVA TERMINALS LTD. Head Office: 9, Woking Business Park, Albert Drive, Woking, Surrey GU21 5JY

PSA Member

Head Office: Tel Woking (04862) 71001 Telex 859952

Northern Office: Tel Harrogate (0423) 509577
Scottish Office: Tel Strathaven (0357) 22678

PSA Member

Head Office: Tel Dublin 952316

FROM Riva
### IN STORE

**Machine**

<table>
<thead>
<tr>
<th>Price from</th>
<th>Main Distributors (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
</table>
| **Tandy TRS-80 Model I (E2252)**
| Tandy: 0922 648181 (200) | 4-48 RAM: Z80: 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 £310. (1) |
| **Tandy TRS-80 Model II (E2347)**
| 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 (E500-1500)**
| As above | See Model I Levels 1 and II | Colour Basic. | Fully integral unit. Up to 2 integral and 2 external 5¼" F/D. BT 8/81 |
| **Tandy TRS-80 Colour (C504)**
| As above | 4-16 RAM: 6809: 8-16 ROM: C: 16 x 32 TV int. RS232 port. | | With 16k RAM, 16k ROM & Extended Colour Basic £360 (1). BT 9/81 |
| **TECS (£1200)**
| **Terotec PBM-1000**
| (E4020) | 80k RAM: Z80A: single 5¼" F/D (18k): 64k/2D:2S/2S: P/P: P/P | CP/M: CP/Net: Classic: Fortran: Pascal: Cobol: | System with Okidata 80 printer: TV1 910 VDU: W/P and various application packages £3955 (S&H) |
| **Terotec Delta**
| (£3970) | As above | CMOS: IBM compatible | Fully assembled version £499 BT 7/81 (H65) |
| **TI-99-4A ( £1299)**
| TL: 0234 67466 (TBA) | 16-48 RAM: 26k ROM: 9900: 2 x C int: 16 x 32 16 colour TV int: 3 tones & noise: P/P. | OS: Basic. | High-resolution graphics. Also system TV with multi-user & terminal £3450. (E) |
| **Zilucian CP/M Starter ( £999)**
| **Tuscan Starter Kit (£299)**
| As above | 8k RAM: Z80: Cint: 56-key K/B | 8k Basic | Fully assembled version £285 BT 7/81 (H65) |
| **Vector MZ**
| **Vector System**
| 2600 (£4600) | As above | CMOS: IBM compatible | User programmable character sets. Options: single 8" F/D (100k) £15. |
| **VIP (£2650)**
| **Zenix I**
| (£299) | 16k RAM: Z80: 500k B: C: 16 x 64 TV int: extra C int: 1 P/P: | Z80: Basic: | Options: single 5¼" F/D (184k) £205: dual 5¼" F/D (£368k) £375 (I) |
| **WHS (£352)**
| Heath 0452 29451 (N/A) | 16-64k RAM: 808A (or 808): 4 S/P: | OS: HDSOS: CP/M: Pascal: Basic | Kit: 3 drives max colours. | |
| **Xerox 820 (£1645)**
| Business Computer Systems: 01 207 3146 | 64k RAM: Z80: single 2 ¼": 512k; 16k PROM: 8k EPROM | CP/M: Pascal: Basic: Cobol: Fortran: | With 8" F/D (£500k) £2250. CP/M £95. BT 1/81 (E & H) |
| **Zenetic**
| **Zensib WH-11A**
| (E2673) | Heath NHS 0452 29451 & 01-636 7349 (N/A) | O/S: Basic: Fortran: | User programmable character sets. Options: dual 8" F/D (1 Mb) £5. |
| **Zensib Z89**
| **Zilog MCZ/105 (pachable) MCZ/120A (£2350)**
| Thames Systems: 034421 (5471) (N/A) | 64k RAM: Z80: dual 8" F/D (600k): Z80A: RS232A: only 1 P/P: Option: 10 Mb H/D | RIO: O/S: Cobol: | Available desk top or rack mounted. (B) MCZ/120A runs multi-user Cobol, up to 5 terminals with 10 Mb H/D. (S&H) | |
| **Z-Plus from £400**

### SINGLE BOARDS

**Machine**

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<th>Price from</th>
<th>Main Distributors (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
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</tr>
</thead>
</table>
| **Acorn System 1-5**
| **AEX-9**
| **Aim 65C (£259)**

### List of Abbreviations

- **A** Asssembler
- **B** BENCH TESTED
- **C** CASSETTE
- **E** EXTENSIVE
- **F/D** Floppy disk
- **G/C** Graphics card
- **H/D** Hard disk
- **I** Introductory
- **Int** Interface
- **N/A** Not available
- **O/S** Operating system
- **P/P** Parallel port

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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</thead>
<tbody>
<tr>
<td>BEX-09 (£850)</td>
<td>Micro Design 0906-626665</td>
<td>64k RAM: 6809; 64k PROM: 2xRS232 ports/P</td>
<td>1k Monitor</td>
<td>Multi-processor interfaces on board.</td>
</tr>
<tr>
<td>Bigboard (£450)</td>
<td>Maclin-Zand 01-837 1165 (N/A)</td>
<td>64k RAM: Z80; F/D controller: 24 x 80 VDU controller</td>
<td>2k monitor: CP/M: Basic: Fortran: Cobol: Pascal: A.</td>
<td>Many options. Will support up to four 8&quot; F/D drives. BT 3/81. (E)</td>
</tr>
<tr>
<td>Cromeco SC (£355)</td>
<td>Comart: 0480 215003 (20) Datron, 071 52 S5450.</td>
<td>1k RAM: Z80A; 8k EPROM sockets: RS232 port: 3 P/P.</td>
<td>Monitor: Basic.</td>
<td>5 program interval timers. Can put own Basic program in EPROM. (E)</td>
</tr>
<tr>
<td>Explorer (£82)</td>
<td>As above</td>
<td>64k RAM: RO85: Full K/B: RS232 port: 6 x 5100 bus: Cint: 1k video RAM.</td>
<td>2k monitor: Basic (8k): CP/M: Basic: Fortran: Cobol:</td>
<td>Supplied in kit or built. Full range of peripherals including F/D. (H)</td>
</tr>
<tr>
<td>Hewat 68005 (£299)</td>
<td>Hewart: 0625 22030 (N/A)</td>
<td>16k RAM: 6800: full K/B VDU int: 2 x Cint: 1 S/P: 2 P/P.</td>
<td>Basic upgrade with 6800.</td>
<td></td>
</tr>
<tr>
<td>Hewat 6800 Mk. 111 (£152)</td>
<td>As above</td>
<td>1k RAM: 6800: VDU board</td>
<td>1k monitor.</td>
<td>Options: single 5¼&quot; F/D (154) £350 programmer £32. (H)</td>
</tr>
<tr>
<td>Kemtron Z80 Starter (£240)</td>
<td>Kemtron 0244 21817 (3)</td>
<td>Z80A: 16k PROM: 2x5P: 24 channel parallel I/O</td>
<td>ZEMON monitor: Basic</td>
<td>Expandable to 64K RAM and disk.</td>
</tr>
<tr>
<td>Microaxis 1 (£250)</td>
<td>Micro Design 0906-663665 (N/A)</td>
<td>1k RAM: 1-8k PROM: 6809: B channel A: Davestem: 12 optically isolated I/O lines.</td>
<td>1k monitor</td>
<td>Designed for industrial control. Can be expanded to F/D system. (H)</td>
</tr>
<tr>
<td>MPE 9900 (£385)</td>
<td>Microprocessor Eng. 0703 775432</td>
<td>32k-9900: 4-32k EPROM: 2x8232 ports/P</td>
<td>Basic: Fortran</td>
<td>Designed as industrial controller.</td>
</tr>
<tr>
<td>MPE 8809 Graphics-A (£450)</td>
<td>Microprocessor Eng. 0703 775432</td>
<td>24k RAM: 186 EPROM: 6809: 2x8232 ports: P/P</td>
<td></td>
<td>320x256 Pixel graphics (8 colour). Applications packages may be placed in EPROM.</td>
</tr>
<tr>
<td>Micronet 65 (£69)</td>
<td>Tangerine: 0333 3633 (6)</td>
<td>2k RAM: 6502: 16 x 32 TV int. Options: 64 Pixel graphics £6.50.</td>
<td>2k monitor, Basic</td>
<td>TANEX expansion kit with 7k RAM: 4k EPROM sockets: 4k Basic: 4 S/P: 32 P/P: £145 (E)</td>
</tr>
<tr>
<td>77/68 (£90)</td>
<td>Newbear: 0635 30505 (N/A)</td>
<td>4k RAM: 6800: LED: C int: VDU int.</td>
<td>1k monitor: Basic</td>
<td>Expandable to 64K RAM with S/D. (B)</td>
</tr>
<tr>
<td>79/90 (£85)</td>
<td>As above</td>
<td>1k RAM: 6809: P/P: S/P</td>
<td>Monitor.</td>
<td>Designed to upgrade 77/68, (H).</td>
</tr>
<tr>
<td>SBC 100 (£135)</td>
<td>Airacmos: 0294 57755 (TBA)</td>
<td>1k RAM: 8k: ROM: 5100: 1 S/P: 1 P/P.</td>
<td>1k monitor: DOS in ROM</td>
<td>Kit. Available assembled £196. (E)</td>
</tr>
<tr>
<td>Superboard (£188)</td>
<td>(as Challenger)</td>
<td>4-8k RAM: 6502: 10k ROM: full K/B: VDU int: Cint.</td>
<td>Basic (1k ROM)</td>
<td>Options: RS232 port: single 5¼&quot; F/D (104) £316: 8k RAM £188 (S&amp;H)</td>
</tr>
<tr>
<td>Smoke Signal SCB 68 (£181)</td>
<td>Windrush 0692 405189 (TBA)</td>
<td>1k RAM: 6800/6809: 8k EPROM: 1 S/P.</td>
<td>2k monitor</td>
<td>Fully expandable to 64K RAM with F/D. (H)</td>
</tr>
<tr>
<td>Sylm (£160)</td>
<td>Newbear: 0635 30505 (N/A)</td>
<td>1-4k RAM: 6502: C int: VDU int: 2 x 6222 ports. Option: TV int.</td>
<td>4k monitor: Basic B.</td>
<td>Expandable to 64K RAM with S/D (B)</td>
</tr>
<tr>
<td>Tuscan (£290)</td>
<td>Transam 01-405 5240 (N/A)</td>
<td>8k RAM: 88: ROM: Z80A: 5 x 5100 slots: RS23232 port: TV int: Cint: 1 P/P.</td>
<td>2k monitor: 8k Basic: CP/M: Pascal</td>
<td>High res graphics available. Games expanded to P/D system. BT 1.81. (S&amp;H)</td>
</tr>
<tr>
<td>UK101 (£149)</td>
<td>Comp Shop: 01-441 292 (6)</td>
<td>4k RAM: 6502: full K/B: 16 x 48 VDU or TV int: Cint: RS277: port, Options: 4k RAM £16</td>
<td>2k monitor: 8k: Basic: CP/M: Pascal</td>
<td>Games. Expansion &amp; colour available or fully assembled. (S&amp;H)</td>
</tr>
<tr>
<td>Windrush 6801 (£175)</td>
<td>Windrush: 0692 405189</td>
<td>2k RAM: 68/3/5: 12k EPROM: S/P: 3 P/P</td>
<td>Monitor.</td>
<td>Designed for industrial control &amp; dedicated small systems. (H)</td>
</tr>
<tr>
<td>ZCB (£260)</td>
<td>Almac: 0602 62503 (3)</td>
<td>1k RAM: Z80A: 3 PROM sockets: RS232 port: 3 P/P</td>
<td>Will take any 2760/</td>
<td>£100 bus compatible. Expandable to full system. (E)</td>
</tr>
</tbody>
</table>

**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 RAMs. He sent his ideas to the editor 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 ‘Dragoon’, a 6800 based 32kB machine. It has 16 lines of 32 characters in its ASCII display, and 256x192 colour graphics. Software is the Microsoft
TRANSACTION IDEAS

Readers will be pleased to know that, due to our clever layout ideas, the Transaction Ideas is up-to-date and taken cut down considerably. Ads are accepted on the form below for a flat fee of £2.50. Don't specify issues as we can't oblige. Ads be repeated unless separate forms are sent in.

We will only accept entries from non-commercial readers. Thank you for co-operating.
Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

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Stephen John Bone, 2 Claremont Place, Golders Green, London NW10 NE8 1TL

Alan Hooley, 21, Heath Drive, Tottington, Bolton BL5 4HS

Vernon Quaintance, 50 Beattie Avenue, Norbury, London SW16 4UN

Rex Shipton, 17, Woodlands Av, Eastbourne, East Sussex BN21 4DS

Brian Taylor, Tonbridge Area Library, Avebury Avenue, Tonbridge, Kent

Robin Bradbeer, Polytechnic of North London, Holloway Road, London N7

B J Candy, 9 Oakwood Drive, Gloucester GL3 6XS

Ted Broadhead, 27 Cardinal Road, Leeds LS11 8EY

Andrew Holey, 10 Masons Field, Maidstone, Kent ME21 8QA

Brigitte Gorton, 18 Furmiere Crescent, Newton Abbot, Devon TQ12 5OR

Richard Powell, 22 Duke Street, South Shields, Tyne & Wear

Pam Pollicot, South Ruphill Library, Victoria Rd, South Ruphill, Midlothian

Alan Stalcup, 4 Binfield Road, Worthington, Berks RG11 1SL

Tony Cartmill, 54 Foregate Street, Worcester WR1 1DX

Bill Gibbings, 716 Northfield Avenue, Norwich, Norfolk NR4 6RF

Cez Cooper, 110, Church Rd, Hanwell, London W7.
These alterations and additions to the complete listing published in the August issue. The next full listing will appear in the February 1983 edition

These are all the European networks of which we’re aware. Most are free — but phone them for details.

**Networks News**

Forum 80 Hull... (Forum-80 User Group) Contact: John Wright. Tel 0482 20755. Users group for daily discussions and problem solving.


Forum 80 Holland... (TRS-80 User Group) Contact: Nico Karssemeyer. Tel 01-313 512533. Facilities: electronic mail, program exchange, bulletin board, information service.

CBBS London... (Computer Bulletin Board System) Contact: Peter Blissett. Tel 01-928 5060. Facilities: electronic mail, program exchange, bulletin board, information service.

University Research Computer... (University of Cambridge) Contact: Dr. J. G. B. Whittaker. Tel 021 412 3000. Facilities: electronic mail, program exchange, bulletin board, information service.

Elta... (Elta Information Service) Contact: Dr. J. G. B. Whittaker. Tel 021 412 3000. Facilities: electronic mail, program exchange, bulletin board, information service.

Tree Tradet... (Tree Tradet) Contact: Dr. J. G. B. Whittaker. Tel 021 412 3000. Facilities: electronic mail, program exchange, bulletin board, information service.

**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 Exhb & Conf. Contact: Interbuild Exhns Ltd. 01-496 1951

8-10 Sept

**London**

(Barbican Centre) PCW Show. Contact: Interbuild Exhns Ltd. 01-486 1951

9-12 Sept

**London**

Computer Choice ’82. Contact: James Brooker. Tel 01-486 8686

20-22 Sept

**USA**

(Atlanta, Georgia) Computerised Office Equip Exhb. Contact: Cahners Exhb Group. 0483 38085

19-23 Sept

**London**

(Bloomsbury Crest Hotel) Computer Graphics Exhb. Contact: Online Conferences Ltd. 0924 28211

19-21 Oct

**Wembley**

(Conference Centre) Viewdata Exhb. Contact: Online Conferences Ltd. 0924 28211

21-23 Oct

**Finland**

(Helsinki) Business Machines & Equipment Exhb. Contact: ECL (Exhb Agencies) Ltd. 01-485 1951

19-21 Oct

**PCW 197**
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VIC 20 £152 +VAT
SHARP MZ280K (48K) £327 + VAT
SHARP MZ280A P.O.A.
ATARI 400 (16K) £173 + VAT
ATARI 800 (16K) £390 + VAT
TEXAS T1994 £173 + VAT
VIDEO GENIE (16K) £299 + VAT
ATOM (assembled) £150 + VAT
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MICROMART

Almost 400 entries to the June Prize Puzzle highlighted an easy problem. Several people said that the answer (the four times five) 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 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 his share and hides it, and so on.

Next morning all six men awake and decide to share out the remaining coconuts. Again they divide them into six equal shares and 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**

**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 otherwise it will be lost by NEWing itself out of memory.

---

**S.H. SOFTWARE**

**Video Genie Extended Basic**

**MICROMART**

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Extension Basic . nod (for B/W)

Adjo three keywords to any BASIC: C, PUT, RENUM.

- PRINT, WINDOW, WEND, BREAK, GET,

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And NB allows you to add menu items if it is any.

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**PET File Comparison**

by Lionel Kreamer

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 Fortran-77 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.

---

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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 character R. If you own or are thinking of buying this MKT, you should own "CALC" Power!

---

**“CALC” Power!**

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(CDPC Consultants Limited)

With Eins disk you can read in full from the files @TEM1 and @TEM2. Another 40 columns compication is that the bottom of the display gets overwritten. This, again, can be solved by accessing the comparison files.

 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

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*Currently available for SUPERTAP, VM/380, NASCOMS & GEMINI.

HiSoft also have available:

HiSoft Pascal 3

The text continues with details about the compiler's features, compatibility, and pricing. It is a comprehensive description of the product, emphasizing its speed and affordability.

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 'wrong note' but not a diagnosis. An idea could be offered on that one for future programs.

In mode 7 is the amount of memory used so Music Player would then run on either a model A or B.

The text continues with a list of compiler routines and details about the company's policy and philosophy.

**Note:** The text includes a list of compiler routines and details about the company's policy and philosophy. However, the full content is not provided here due to the nature of the task. The essence of the text is to announce the availability of a new Pascal compiler and to highlight its features and benefits.

---

**For further information, contact:**

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To carry on the tradition of finding 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 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.

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VETS FOR PETS

BBC Radar

by Stephen Smith and Matthew Jones

This game is laid out as a two-part program, the instructions being effective as a separate routine. This is necessary because the memory used by BBC kresses. 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.

PROGRAMS

- 400 BC
- S80 Y(T)=Y(T)+6
- 510 IFPEEK(W-B)ODANDPEEK(W+8)0DANDPEEK(W-00DANDPEEK(W+C)0DTHENGOSUB600
- 520 PRINT: RETURN
- 600 FOR=1 TO 101: FOR=80 TO 255: PRINT: NEXT FOR=1 TO 101: NEXT: READY
- 700 PRINT:CLS:12CDOM 111RIGHIYOU CRASH: FOR=1 TO 101: NEXT: READY

MULTIPLE LINE STATEMENTS ARE USED TO SAVE RAM AND THE LISTING SUGGESTS, THEREFORE, RATHER UNTIDY. RADAR IS A GAME OF QUICK THINKING RATHER THAN REACTION (WHICH MAKES A DIFFERENCE FROM THE 'ZOMBIE' TYPE OF REAL-TIME GAME). RULES FOR PLAY CAN BE READ FROM THE LISTING OF PART ONE.

Part 1

1) TIME = 0
2) OREM "RADAR"
3) PRINT """""""
4) PRINT """""""
5) PRINT """""""
6) PRINT """""""
7) PRINT """""""
8) PRINT """""""
9) PRINT """""""
10) PRINT """""""

The game is played by displaying a radarscreen with a sweeping Arm...which, when it passes a ship tells you the bearing of the ship and indicates it on the screen."

12) PRINT "A ping also indicates this."

The first two ships are then replaced.

14) PRINT "The computer will then tell you how far away the ship is. Either:-""
15) PRINT "The computer will then tell you how far away the ship is. Either:-""
16) PRINT "The computer will then tell you how far away the ship is. Either:-""
17) PRINT "The computer will then tell you how far away the ship is. Either:-""
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MID-RANGE.
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.
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1141 - power. 85p each.
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2114 low power 300ns. 80p each.
100 + 85p each.
4146 - 100ns (BBC RAM).
100 + 85p each.
2166 - 200ns. 185p each.
2166 - 450ns. 185p each.
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MICROSERVE

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16K.

Micromart

206 PCW
5040 FOR I=1 TO 6
5000 REM DRAW BOARD
4700 REM THAT’S ALL FOLKS!!
3370 PRINT "YOU CAN'T MOVE"
3350 REM YOU LIISE
3330 IFFEEK(B+I+164)=OTHENC=C+1:00102000
3310 GOSUB 7700:00SUB 7600
3200 P=0:A$=.74:
3180 PRINT "MOPPWWPW.:CHRS(X3+63);Y3-1"
3140 GOT0 4500
3125 PRINT "ANINNVIN".C."MOVES"
3090 IF MATHEN GOSUB 7000:GOT0 3150
3030 PRINT "NIT'S MY TURN -"
3010 REM
2460 REM "micro cover"
designed, quality, polyester/cotton
3065 WHILE -
The wait has been well worth
2460 REM
"micro cover"
- handmade - micro cover
3035 supplied on a high quality cassette, with a 30 page operating manual.
2460 REM
"micro cover"
- matching fawn colour
3010 REM
4550 IF A$<="N"THEN 4530
4530 GET A$:IF A$="Y"THEN 1000
4510 PRINT "WWWIZINGLY,YOU NON --FLIT"
4500 REM YOU WIN (FLUKE!)
4030 PRINT "aNNI WAS OBVIOUSLY Ti:'':'GOOD FOR YOU!!"
4020 PRINT "aNNI WAS OBVIOUSLY Ti:'':'GOOD FOR YOU!!"
4010 GOSUB 7600:003UB 7600
4000 REM GAME ovFP
3390 REM
3320 PRINT "MIPSSUil WIN!!"
3310 FOR X2=1 TO X2+1:FOR Y2=1 TO Y2+1
3230 X=74:Y=Y4
3270 PRINT "GEMPIEC"
3250 GOSUB 7200:11SUB 7700:00SUB 7600
3220 X1=X3:Y1=13: =X1:Y=Y1
3190 X=X1:Y=Y1
3170 PRINT "; i
3150 GOSUB 7600:GOSUB 7600
3120 PRINT "N44111WOU WIN"
3100 GOSUB 7600:GOSUB 7200
3085 IF MATHEN 3150
3080 NEXT J,I
3060 IF PEEK (B+I+16*J)=0 THEN GOSUB 6000
3050 FOR I=X1-1 TO X1+1:FOR J=Y1-1 TO Y1+1
3045 IF C='2 THEN GOSUB 7100:GOT0 3150
3020 3 iSUB 7200:MA--=03K=0
3000 REM COMPUTER MOVE
2460 REM
2460 REM "micro cover"
designed, quality, polyester/cotton
1200 while -
The wait has been well worth
1180 it's a superb machine
1160 MICRO MART
Come and see us at the PCW Show
Stand 320A. Try out our wide range of very competitive soft-
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VIC-20

VICPEDIA 1

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ENCOUNTER — You've not seen this one yet! (unexpanded VIC). A giant snake with a head! Collect the treasure and escape the tomb before the evil Serpent catches you. THIS ONE ALONE IS WORTH THE PRICE OF THE CASSETTE! Very addictive.

GORGON'S TOMB — a micro adventure. Collect the treasure and escape the tomb before the evil Serpent catches you. THIS ONE ALONE IS WORTH THE PRICE OF THE CASSETTE! Very addictive.

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 the code 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 11 being value (in this case either one or 11 for ace). The program will run on its own, but it is not meant to do so. A list of 52 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.
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There's a hole in my Apple...

code program for you in memory and then save it to disk; when used, the machine code program is merely BRUNed 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 POKe’d in.

After the routine is BRUNed 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, the area of memory required for two hi-res pages is given below as a line of Basic such as:

1 PRINT CHR$(13)+CHR$(4)"BRUN CLEARSp"; &CLEAR

2 POKE 104,64 ;REM for page one

Five points are worth noting when using the &CLEAR, .TO.,.. TO., line. The utility can also be used in the immediate mode as long as it BRUNed 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 address 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 CLEARSp"; &CLEAR 1024 TO 16384

2 POKE 104,64 ;REM for page one

A football pools program is listed that is suitable for Apple or BBC machines. It is not intended to be a complete program for the pools as such, but it does include facilities for the entry of a pool, and a calculation of expected profit. The program is suitable for use in either the Smoking Room pools or for use at home. The program is easy to understand and operate and is designed to be a simple way of calculating your expected profit.

The facilities of the program include:

- Football pools program for Apple or BBC machines
- Calculation of expected profit
- Entry of a pool
- Simple operation

The program is written in Basic and is suitable for use in either the Smoking Room pools or for use at home. The program is easy to understand and operate and is designed to be a simple way of calculating your expected profit.

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. "CLOSESP" resides at $9000 and so the relevant Applesoft program will merely form it and SAVE it. "CLOSESP" 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 $7374) for any machine and then assemble the program as appropriate. Tape users can easily modify these two to their advantage and use "CLOSESP" 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 programs. I can be reached at the Department of Chemistry, University of Manchester Institute of Science and Technology, PO Box 88, Sackville Street, Manchester M60 1QD.
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 help 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 reference 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 infor-

mation about (say) the IEE-E48 interface was virtually nonexistent. Although there are 'packet' 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 Olivetti'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 sys-

tem 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 upper market 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 un-

likely that second sources will appear. The dot matrix printers cost £560 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 Oliveti 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 un-
popular 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 mainte-

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<th>Printer</th>
<th>Speed (cps)</th>
<th>Price (£)</th>
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<td>SEIKOSA GP100A</td>
<td>30</td>
<td>199 + VAT</td>
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<td>EPSON MX100 F/t</td>
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<td>MANNESMANN TALLY MT120</td>
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<td>CX-80 (Colour)</td>
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<td>TEC STARWRITER</td>
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<td>OLIVETTI DY311</td>
<td>32</td>
<td>1100 + VAT</td>
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<tr>
<td>PRISM 132 (Colour)</td>
<td>200</td>
<td>1130 + VAT</td>
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INDEPENDENT NATIONAL USER GROUP FOR THE BBC MICRO

IF YOU OWN A BBC MACHINE, OR HAVE ORDERED ONE, OR ARE JUST THINKING ABOUT GETTING ONE, THEN YOU NEED BEEBUG.

BEEBUG runs a regular magazine devoted exclusively to the BBC Micro (10 issues per year).

Latest news on the BBC project. What you should know before you order a machine. Members' discount scheme on books and hardware. New program listings, regular advice clinic, and hints and tips pages in each issue.

April issue: 3D Noughts and Crosses, Moon Lander, Ellipse and 3D Surface.

Plus articles on Upgrading to Model B, Making Sounds, and Operating System Calls.

May issue: Careers, Bomber, Chords, Spiral and more. Plus articles on Graphics, Writing Games Programs, and using the Assembler.

June issue: Mazzap, Mini Text Editor, Polygon; plus articles on Upgrading, The User Port, TV set and Monitor Review, Graphics part II, more Assembler Hints, Structuring in BBC Basic, plus BBC Bugs.

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Probably the fastest microcomputer in the universe
the **JUPITER ACE** only £89.95.

### Key Features
- Revolutionary microcomputer language FORTH.
- Full-size moving-key keyboard.
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- Fast cassette interface.
- Upper and lower case ascii character set.
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**The Jupiter Ace uses FORTH**

The Ace is set apart from all other personal computers on the market by its use of a revolutionary language called 'FORTH'. Some computer languages are easy for humans to understand, others are easy for computers; FORTH is most unusual in being both. Its underlying principles are so simple that it takes even a newcomer to computers only a few minutes to learn how to do calculations on the Ace, yet the very same principles are powerful enough to allow you to invent your own extensions to the language itself.

At the same time, the memory-saving coded form used to store your programs inside the Ace allows it to obey them very fast — typically in less than a tenth of the time it would take to do the same thing using a different language. Amongst other things, this makes the Ace ideal for games.

FORTH's unique combination of speed, versatility and ease of programming has already made it a prime choice for professional applications as diverse as pub games and radio telescopes, and gained it an enthusiastic national user group. Now the Jupiter Ace can bring this addictive language into your own home.

**Designed by Jupiter Cantab**

Leading computer designers Richard Altwasser and Steven Vickers have a reputation for pushing technology forwards. After playing the major role in creating the ZX Spectrum they formed Jupiter Cantab to develop their latest brainchild the Jupiter Ace.

---

**Technical Specification**

**Software, FORTH**
- Data Structures: Integer, Floating point and String data may be held as constants, variables or arrays with multiple dimensions and mixed data types.
- Control Structures: IF-THEN-ELSE, DO-LOOP, BEGIN-WHILE-REPEAT, BEGIN-UNTIL, all may be mixed and nested to any depth.
- Operators: Mathematical +, -, X, ÷, Logical AND, OR, NOT, XOR, Comparison <, >, =.
- Program Editing: FORTH words may be listed, edited and redefined. Comments are preserved when words are compiled.

**Order Form**

The Jupiter Ace is available only by mail order. Please allow up to 28 days for delivery.

Send cheque or postal order with the form to:

**JUPITER CANTAB, 22 FOXHOLLOW, BAR HILL, CAMBRIDGE CB3 8EP**

Please send me:

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<table>
<thead>
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<th>Part Number</th>
<th>Description</th>
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<td>2532</td>
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Look at our floppy prices... Costs are for packs of ten 5¼" discs from famous manufacturers such as:

<table>
<thead>
<tr>
<th>Description</th>
<th>Price Each</th>
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<tr>
<td>BASF</td>
<td>£15</td>
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<tr>
<td>SSD</td>
<td>£20</td>
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<td>DDS</td>
<td>£23.35</td>
</tr>
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Plastic library cases for 10 floppies

- 5¼" disc case costs £1.90
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<table>
<thead>
<tr>
<th>Product Description</th>
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<tr>
<td>Apple 48K Video Output only</td>
<td>£625.00</td>
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<tr>
<td>16K Add on</td>
<td>£45.00</td>
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<tr>
<td>Disk Drive with Controller (16 sec)</td>
<td>£345.00</td>
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<tr>
<td>Disk Drive without Controller</td>
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### Interface Cards

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<td>Language Card</td>
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<td>Eurocolour Card</td>
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<tr>
<td>1EEE - 48 Card</td>
<td>£200.00</td>
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<tr>
<td>16K RAM Card (48K to 64K)</td>
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### Atari

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<tr>
<td>400 16K Computer</td>
<td>400</td>
<td>£250.00</td>
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<tr>
<td>800 16K Computer</td>
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<td>410 Tape Recorder</td>
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<td>825 80 Column Printer</td>
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<td>850 RS 232 Interface</td>
<td>850 RS 232</td>
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<tr>
<td>16K RAM Upgrade</td>
<td>16K RAM</td>
<td>£62.13</td>
</tr>
</tbody>
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- The Daisywheel Printing Terminal series that sets a new standard for print quality, reliability and serviceability. Unbeatable performance at a realistic price.

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<table>
<thead>
<tr>
<th>Interface Description</th>
<th>Price</th>
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<td>Epson/Sharp Cassette</td>
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<td>Epson/Sharp Disk</td>
<td>£120.00</td>
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<td>Epson/Apple</td>
<td>£65.00</td>
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<td>Epson/TRS 80 bus</td>
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<tr>
<td>Epson/TRS 80 Expansion</td>
<td>£25.00</td>
</tr>
</tbody>
</table>

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APLUS is a 4K machine-language utility that adds the following structured-programming commands to Applesoft basic: WHEN ELSE . FIN. UNTIL WHILE, UNLESS, CASE, SELECT (variable), and OTHERWISE. Multi-line IF . . . FIN statements are also supported. APLUS also allows the use of named subroutines or procedures. A programmer can now instruct a program to "DO CURVE-FIT" without worrying about the location of the "TO CURVE-FIT" subroutine. APLUS automatically inserts "LIST"ed commands to clarify the logic flow. The APLUS "CONVERT" command replaces the above structured-programming commands with "GOTO"s and "GOSUB"s to provide a STANDARD Applesoft program as output. New programs can now be written using "GOTO"-less logic. Existing Applesoft programs can be maintained using APLUS without special conversion.

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The PROTECTOR III is designed to make "protected" copies of a master DISK II disk containing Applesoft programs. The resulting "protected" disks can not be copied by presently available commercial copy programs (the APPLE COPY program, SUPER DISK COPY, the Lawrence copy program, etc.). Applesoft programs on the "protected" disks will "no run" preventing people from using "LISTing" or "SAVEing" programs of a "protected" disk. A USERBACKUP program is provided that can be distributed to enable users to make unexecutable backup copies of protected disks.

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Apple II or Apple II Plus with 48K and 1 or more Disk II drive(s)
This utility will help keep you out of trouble with a "bad block scan option" or if you get into trouble with a "messed up" disk. DISC RECOVERY may save the day with its REDO VTOC option. The RENO VTOC option examines every file on a diskette to detect and correct the following types of errors in the disk VTOC: 1) two files trying to use the same disk sector, 2) part of a file not protected by a "sector-in-use" bit in the VTOC, and 3) "sector-in-use" bits in the VTOC that really aren't being used by any files.

MDC III
Apple II or Apple II Plus with 48K and a Disk drive
MDC III is a very fast, machine-language database program designed specifically for keeping track of the contents of your Apple diskette library. MDC III requires only seconds to read "FILENAMES," "FILETYPES," "FILEIZES," numbers of free sectors remaining on diskettes, and actual volume number from each of your diskettes. Both sides of a diskette can be counted and assigned to the same DISK ID No. MDC III supports a file of the "eleven character" name that can be used in group games, utilities, and other programs or related files together. MDC III supports a "Disk-Storage-Meter." A "FLIP DOS" command allows MDC III to read directories from DOS 3.1, 3.2 and 3.3 diskettes and to store the resulting database on either a 13 or 16 sector diskette.

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- Fast parallel I/O interface usable with ALMOST ANY MICRO.
- Only single +5v supply required.

Pluto executes on-board firmware providing high level functions such as:
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- User-definable characters or symbols
- Spare display memory with memory management facilities for allocating symbol storage space or workspace
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- Write protect memory planes during copy
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- **Microprocessor:** High speed 8088
- **Video buffer:** Separate from user's memory, contained on video adapters (16K bytes colour/graphics, 4K bytes monochrome)
- **Auxiliary memory:** 2 optional internal diskette drives 5½". 160K/320K bytes per diskette
- **Keyboard:** 83 keys. 6ft cord attaches to main cabinet. 10 function keys, 10-key numeric pad, tactile feedback
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Heard about the ACT dealers who received packs of Sirius software from you? Nobody could read the disks — all they got were operating system error messages. When queried, ACT replied that the Post Office in Birmingham was responsible for demagnetising the disks. 'Not possible,' said some of the dealers. 'We called in and picked up our personally,' Ah,' said ACT, 'you must have left them lying next to a telephone and let it ring for several hours.'

...As most of you will by now have heard, PCW has been winning. .. While the disgrace-ful way in which the Bonsai account was handled was the result of an unfortunate mix-up at ACT, the blame for the difficulties in obtaining copies of the basic and the BBC, Model B computer continues (people still waiting after eight months), apparent lack of interest in providing cus-tomers with real information on the part of Acorn, BL (people still waiting after eight months, apparent lack of information from ACT itself?)

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