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July 1982 75p

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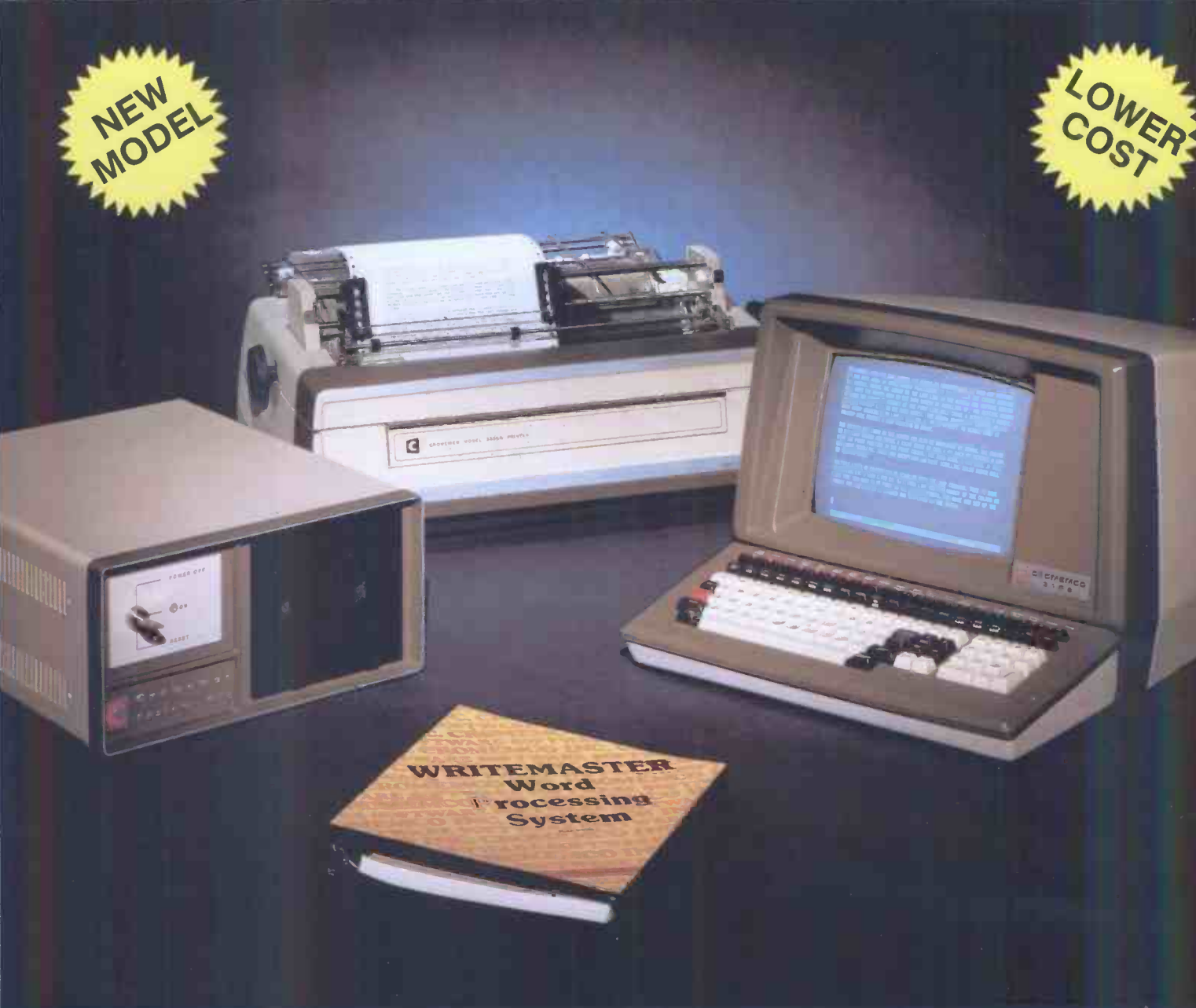
ANATOMY OF THE BBC MICRO

We delve into what the manual doesn't tell you



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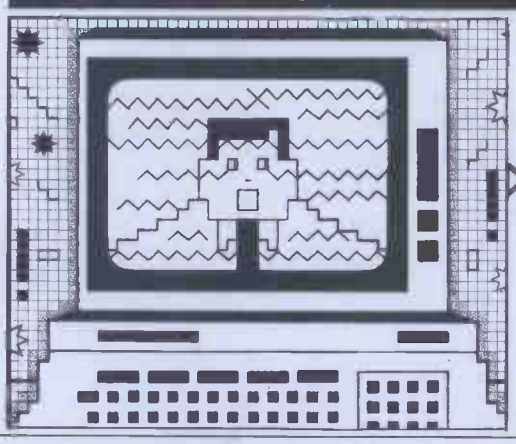

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Vol 5 No 7 July 82

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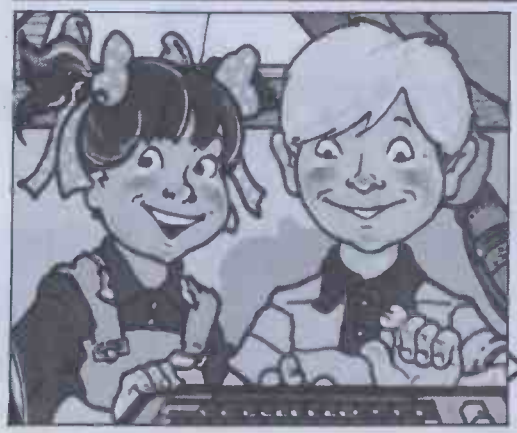
OPINION



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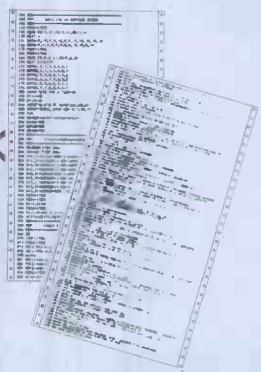

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With its high resolution graphics with 32 characters over 24 lines in 16 colours (256 x 192 dots), 3 tones in five octaves plus noise, and BASIC as standard equipment and options such as other programming languages – UCSD-PASCAL, TI-LOGO and ASSEMBLER – and speech synthesis, you'll find that the TI 99/4A more than compares with the competition. Especially when the starting price is £340 or less. When you want to solve problems there are over 600 software programs available worldwide – including more than 40 on easy-to-use Solid State Software® Modules.

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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 alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. 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 – Fives games plus currency conversion at will – for example, dollars to pounds.

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

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

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

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

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

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

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

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

Cassette G12: Fantasy Games (Psion)
Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.
Price – £4.75.
Programs – Perilous Swamp. Sorcerer's Island.
Description – Perilous Swamp: rescue a beautiful princess from the evil wizar Sorcerer's Island: you're marooned. T 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 ZX8 version of the popular pub game. Bomber: destroy a city before you hit sky-scraper.

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

Education

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

Cassette E2: Fun to Learn series – English Literature 2 (ICL)
Hardware required – ZX81 + 16K RAM
Price – £6.95.
Programs – Poets, Playwrights. Moder 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. Recognise monarchs in an identity parade.

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 on 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 James Galway play? Who composed 'Peter Grimes'?

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

Cassette E8: Fun to Learn series – Spelling 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Series A1-A15. Series B1-B15.
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 on side 2 for program/data storage.
Description – Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information – eg type of membership.

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

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

How to order

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.

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ZX81
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Please send me the items I have indicated below.

Qty	Cassette	Code	Item price	Total
	G1: Super Programs 1	30	£4.95	
	G2: Super Programs 2	31	£4.95	
	G3: Super Programs 3	32	£4.95	
	G4: Super Programs 4	33	£4.95	
	G5: Super Programs 5	34	£4.95	
	G6: Super Programs 6	35	£4.95	
	G7: Super Programs 7	36	£4.95	
	G8: Super Programs 8	37	£4.95	
	G9: Biorhythms	38	£6.95	
	G10: Backgammon	39	£5.95	
	G11: Chess	40	£6.95	
	G12: Fantasy Games	41	£4.75	
	G13: Space Raiders & Bomber	42	£3.95	
	G14: Flight Simulation	43	£5.95	
	E1: English Literature 1	44	£6.95	

Qty	Cassette	Code	Item price	Total
	E2: English Literature 2	45	£6.95	
	E3: Geography 1	46	£6.95	
	E4: History 1	47	£6.95	
	E5: Mathematics 1	48	£6.95	
	E6: Music 1	49	£6.95	
	E7: Inventions 1	50	£6.95	
	E8: Spelling 1	51	£6.95	
	B1: Collector's Pack	52	£9.95	
	B2: Club Record Controller	53	£9.95	
	B3: VU-CALC	54	£7.95	
	B4: VU-FILE	55	£7.95	
	ZX 16K RAM pack	18	£29.95	
	ZX Printer	27	£59.95	
	Post & packing – *only* if ordering hardware		£2.95	

TOTAL £ ____

I enclose a cheque/postal order to Sinclair Research Ltd for £ ____

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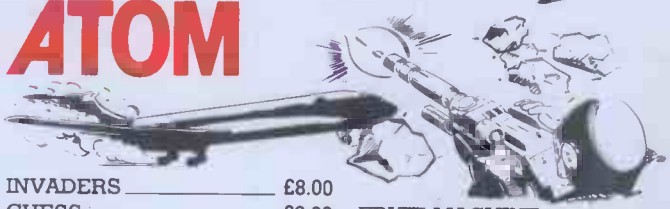

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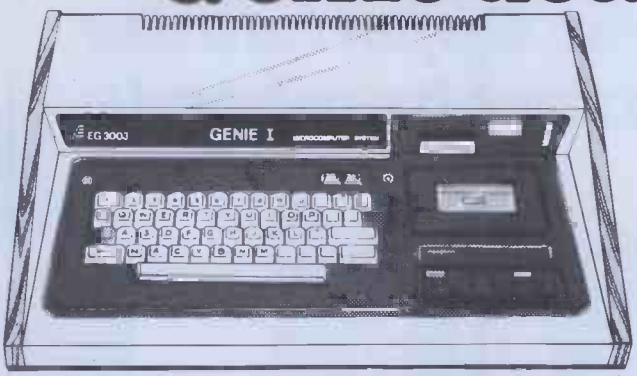

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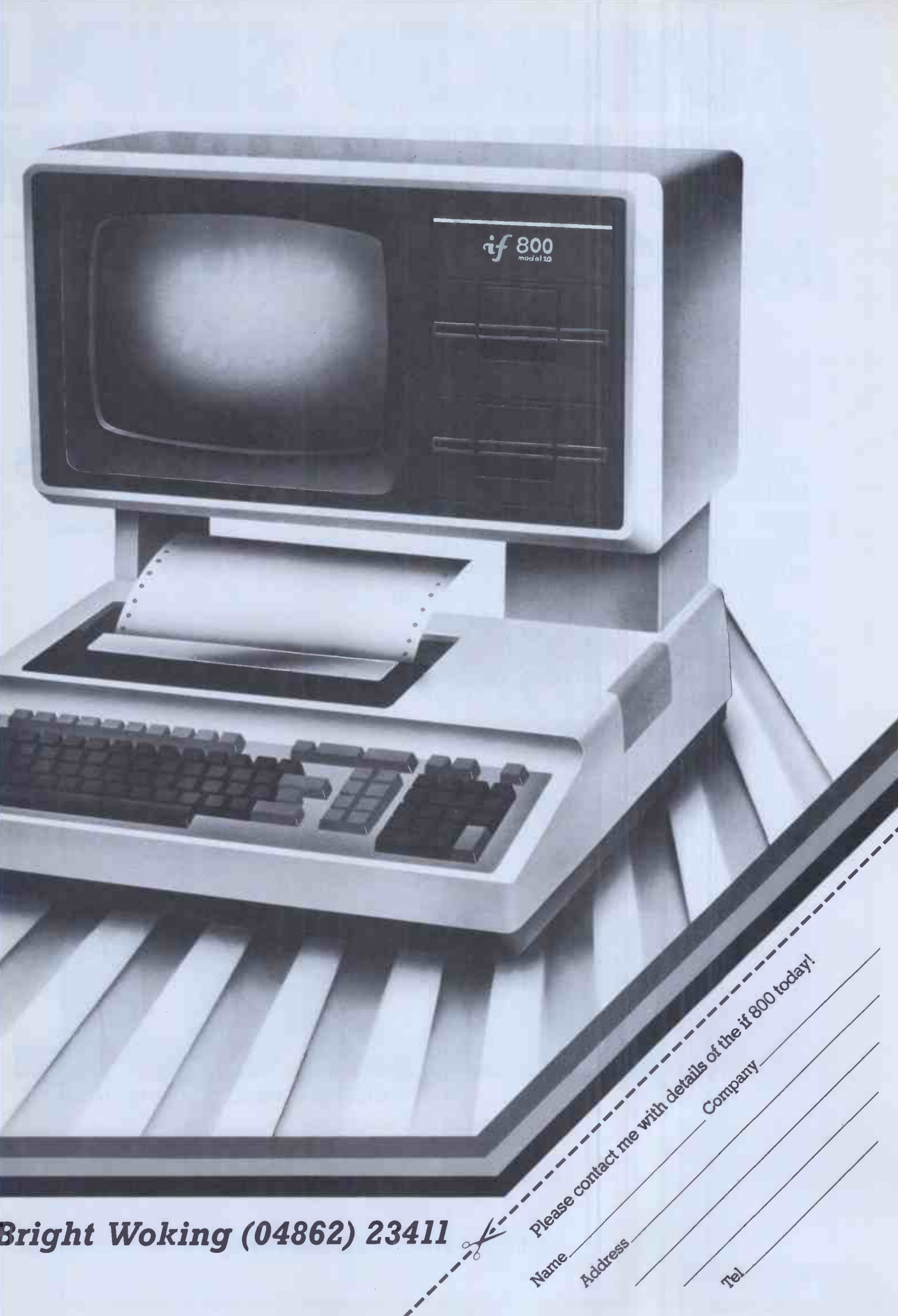

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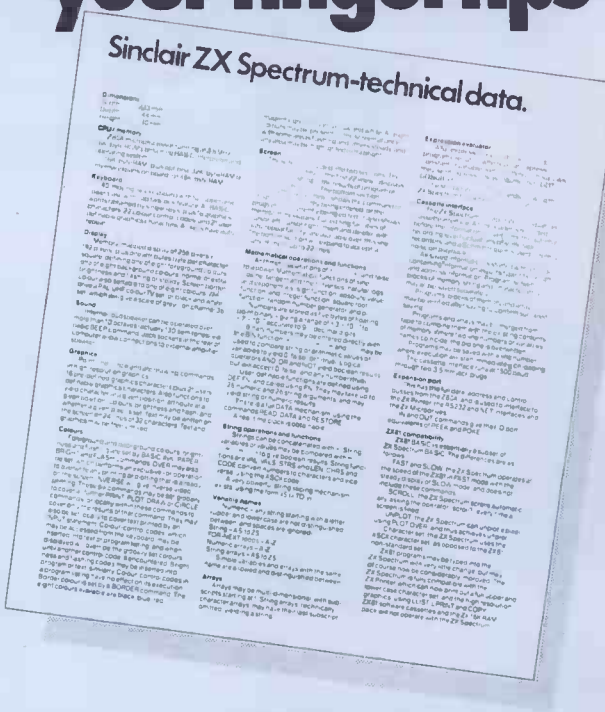
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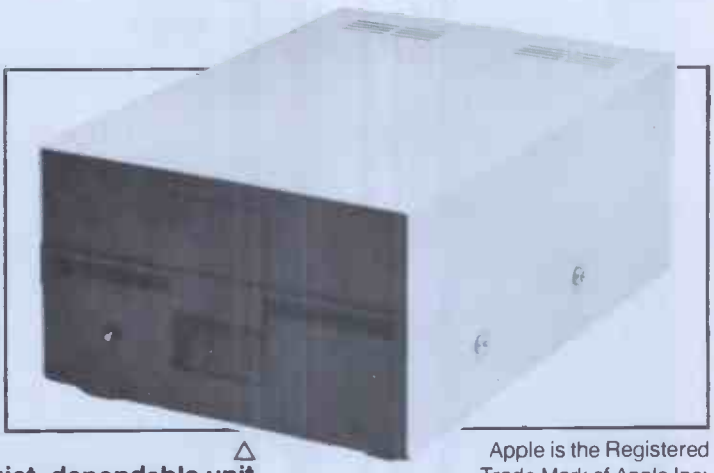

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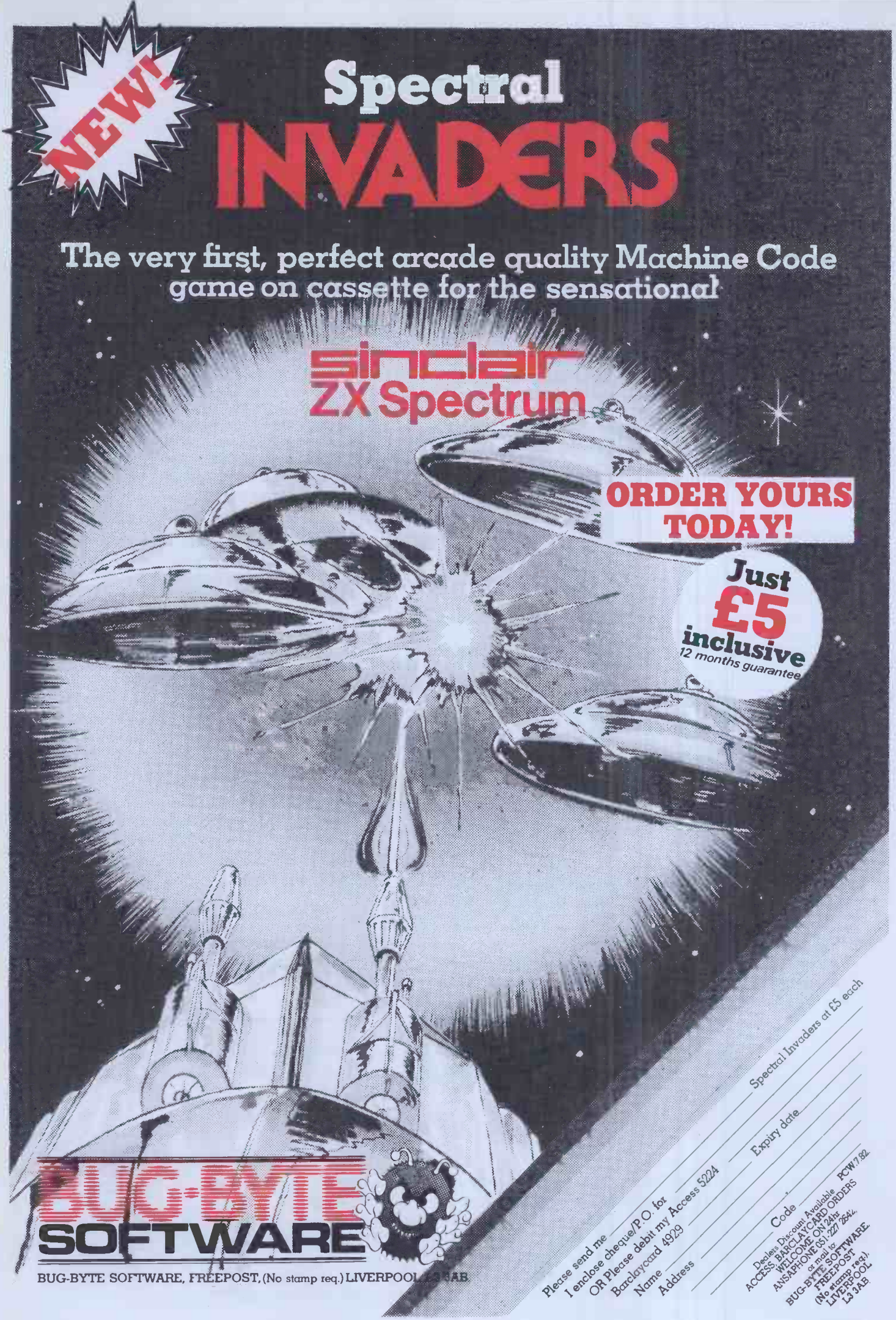

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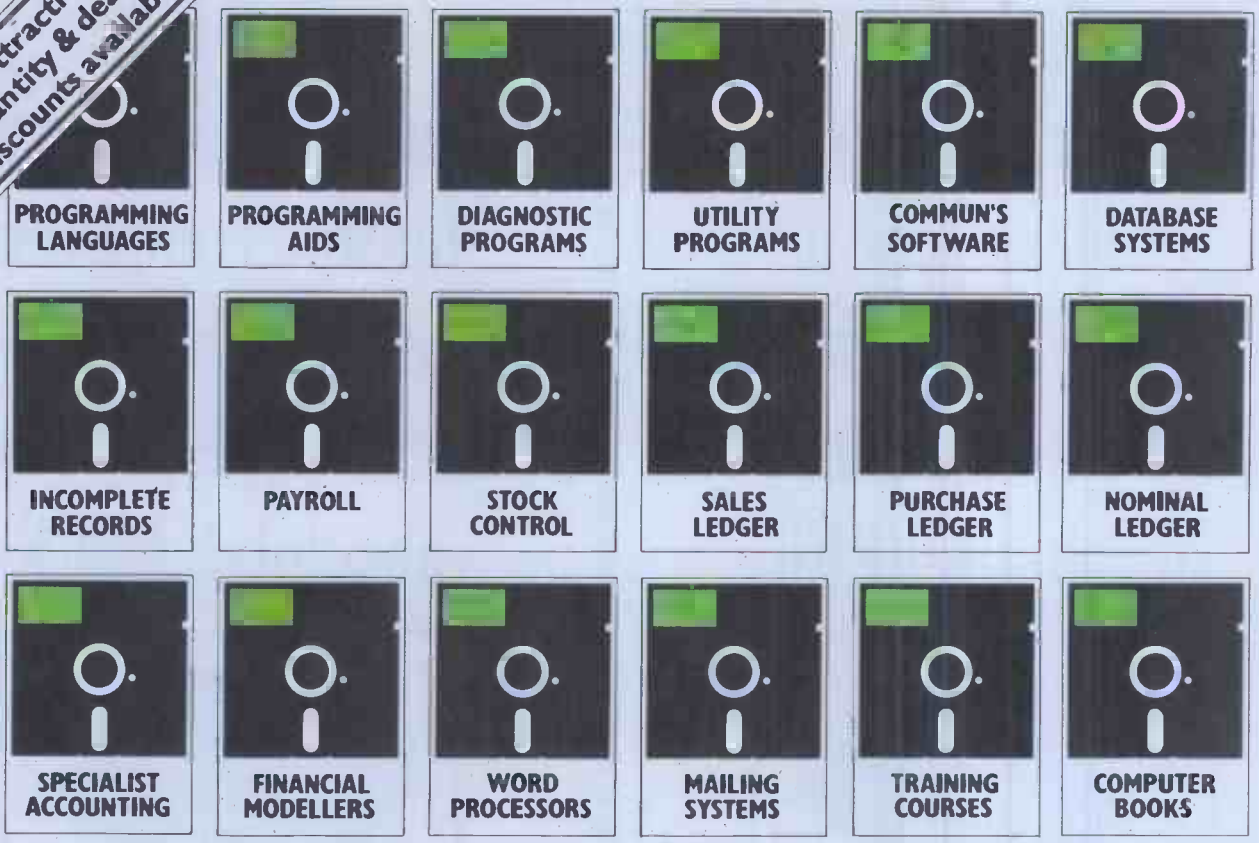

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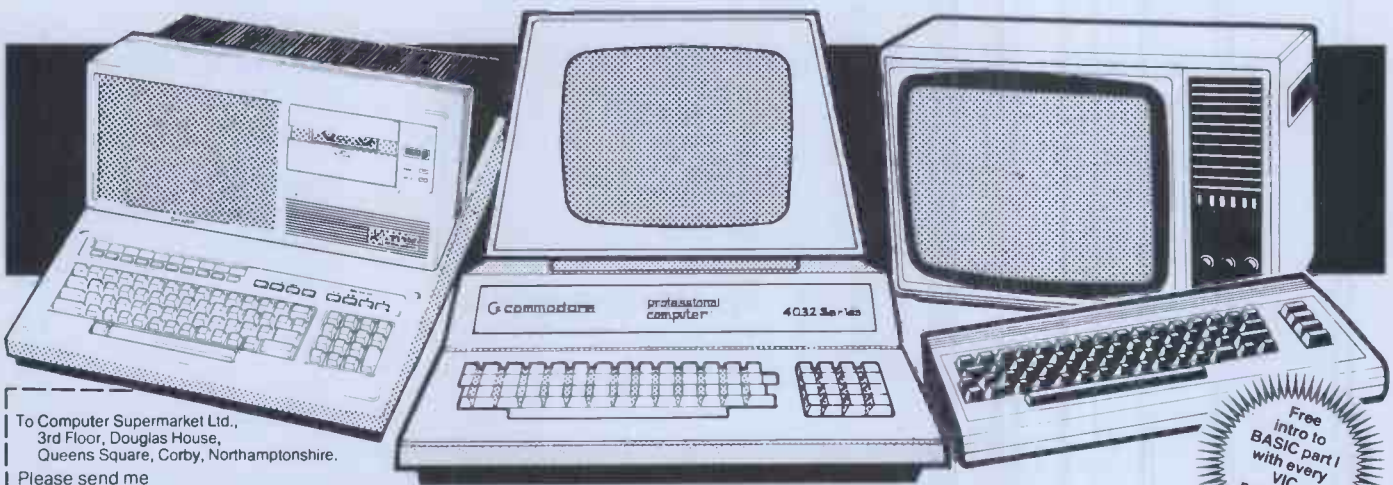

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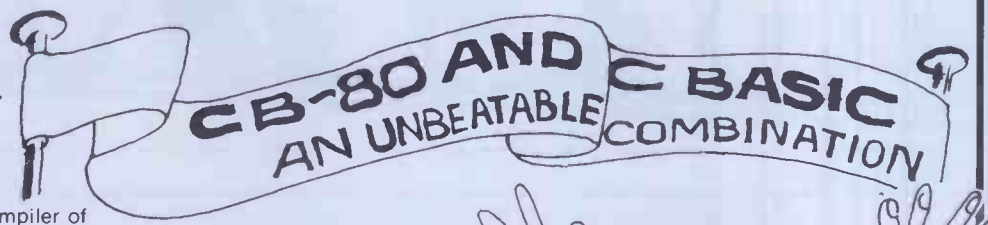

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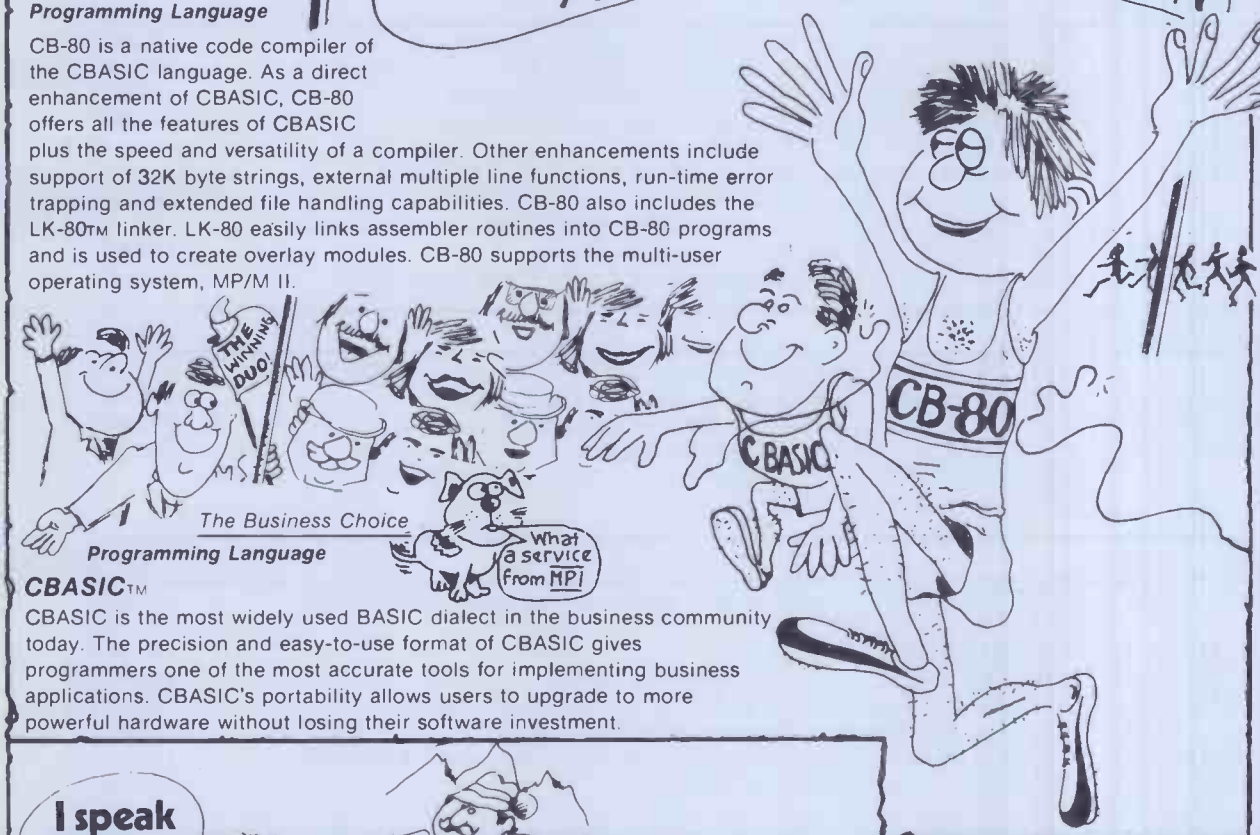

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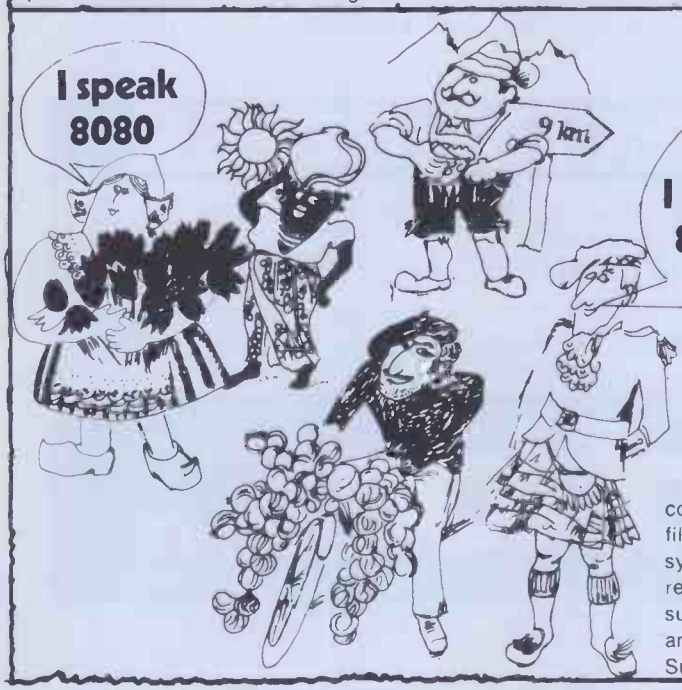

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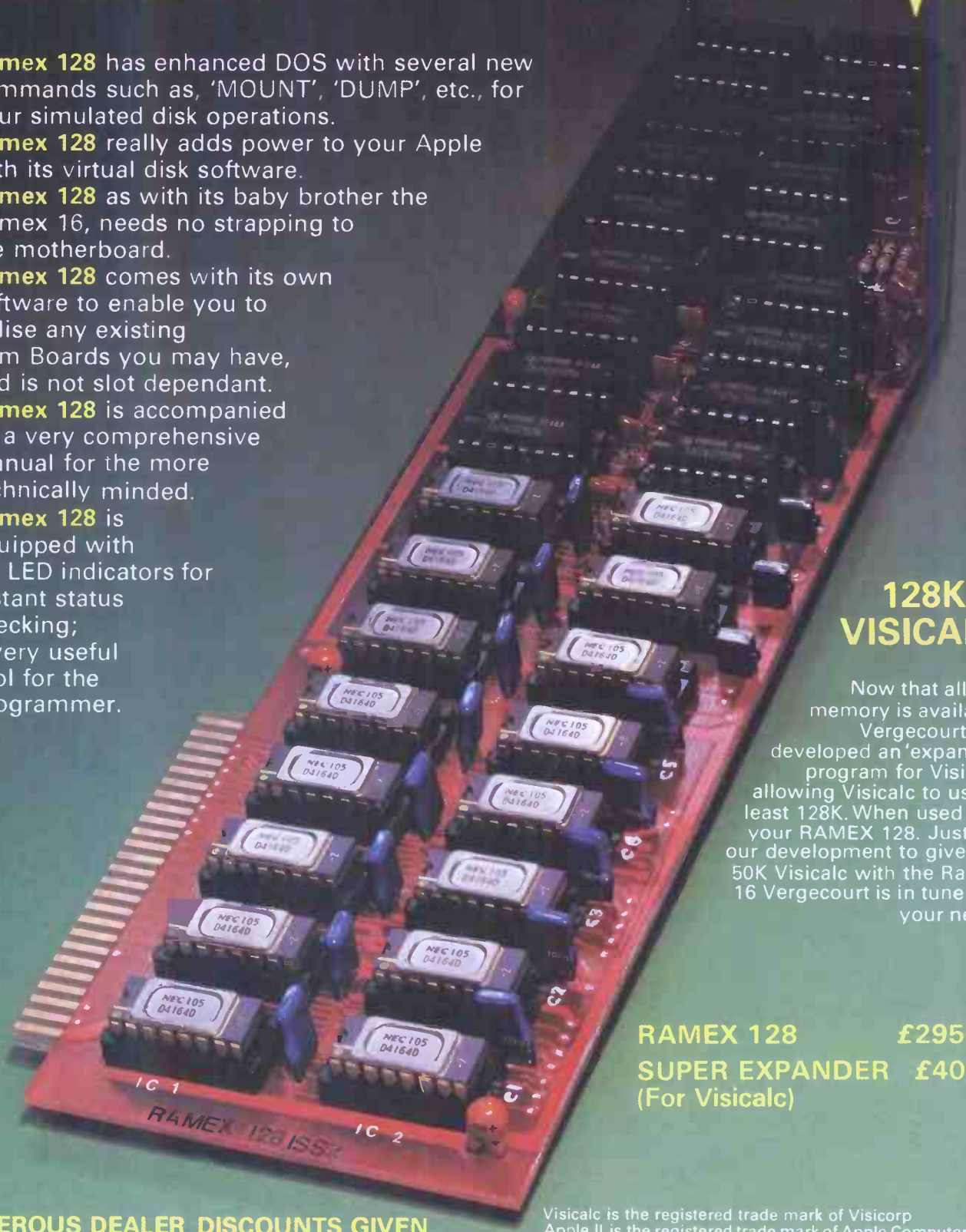

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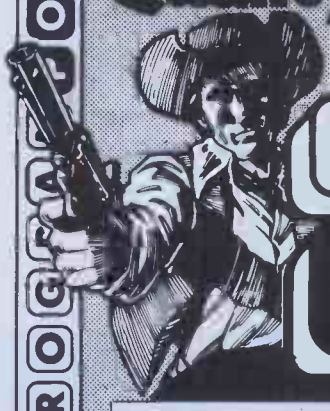

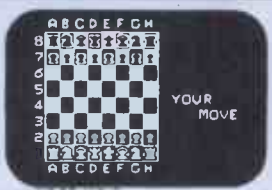

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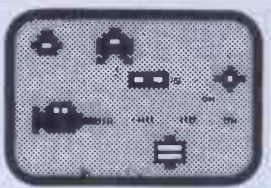

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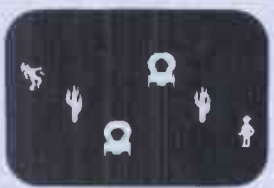

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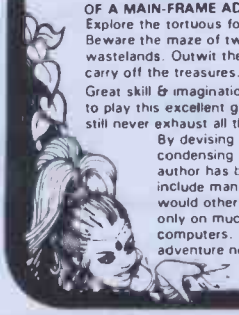

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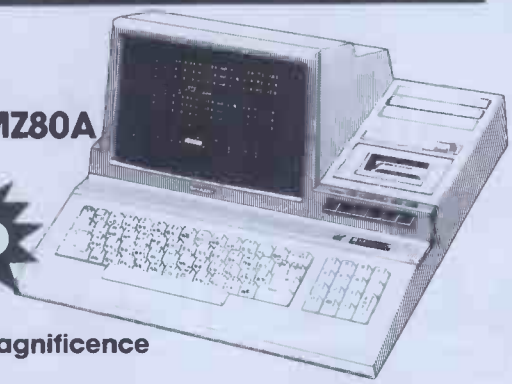

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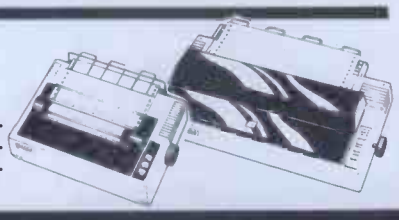

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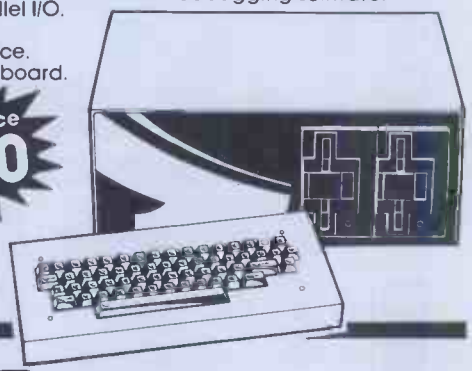

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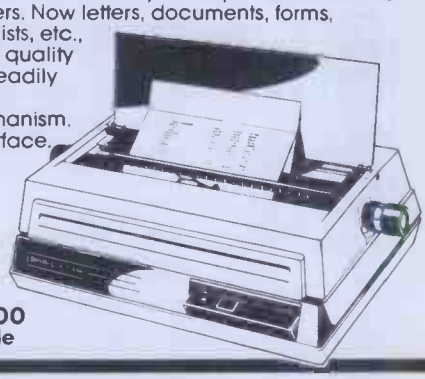

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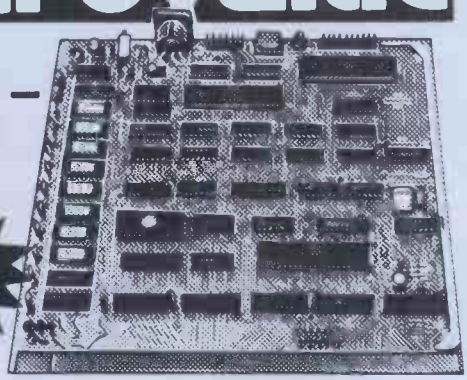

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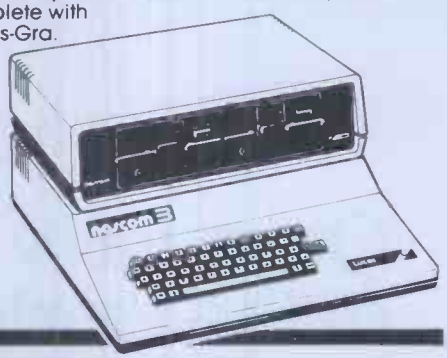

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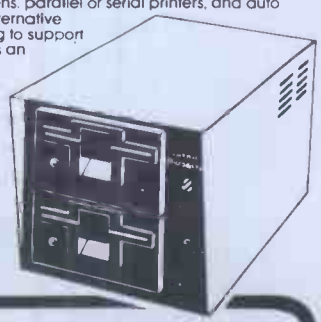

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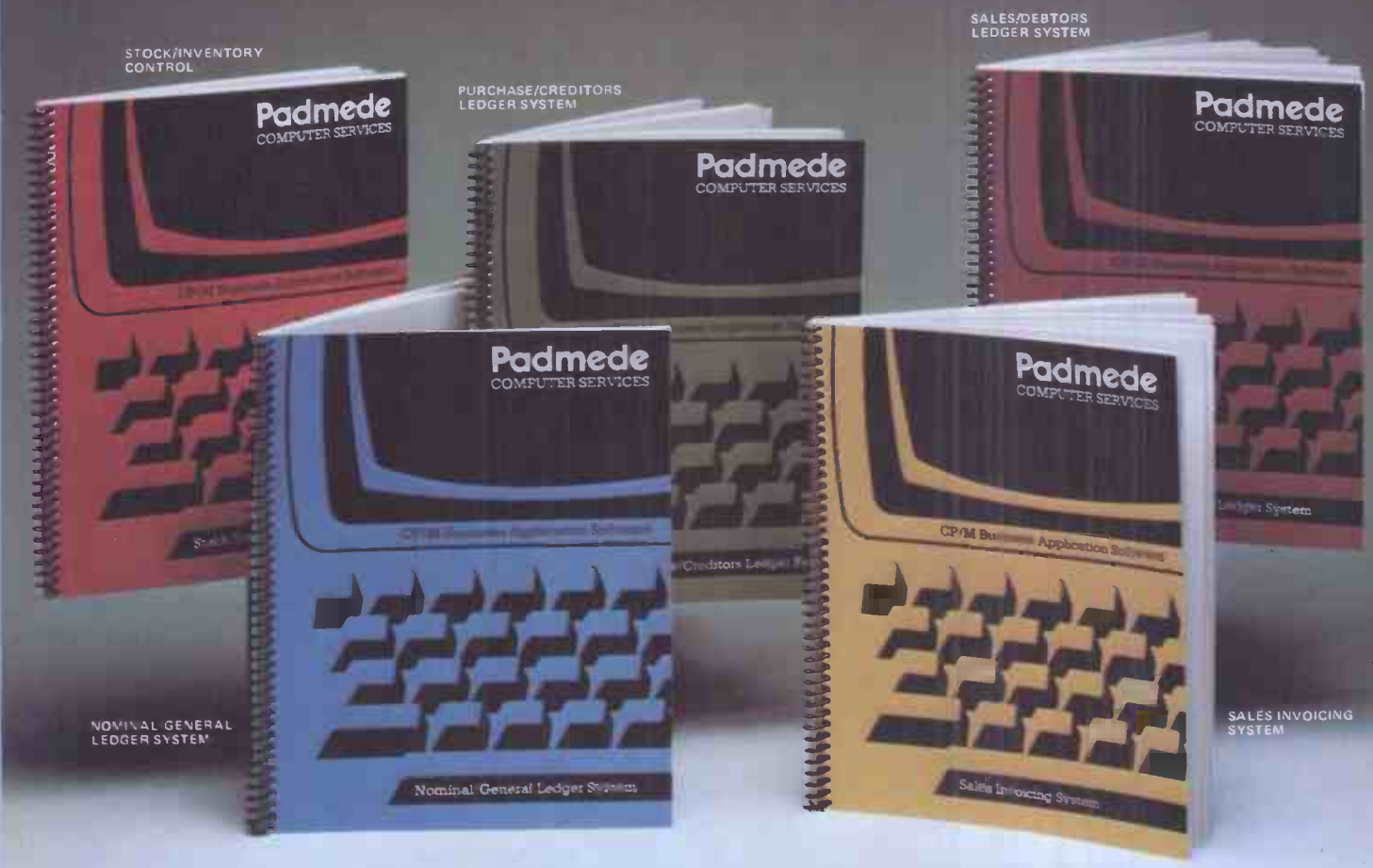

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The 64K Memopak is a pack which extends the memory of the ZX81 by a further 56K, and together with the ZX81 gives a full 64K, which is neither switched nor paged, and is directly addressable. The unit is user transparent and accepts BASIC commands such as 10 DIM A(9000).

BREAKDOWN OF MEMORY AREAS

0–8K . . . Sinclair ROM **8–16K** . . . This section of memory switches in or out in 4K blocks to leave space for memory mapping, holds its contents during cassette loads, allows communication between programmes, and can be used to run assembly language routines. **16–32K** . . . This area can be used for BASIC programmes and assembly language routines. **32–64K** . . . 32K of RAM memory for BASIC variables and large arrays. With the Memopak 64K extension the ZX81 is transformed into a powerful computer, suitable for business, leisure and educational use, at a fraction of the cost of comparable systems.

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TeleVideo

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- *Dual minifloppy disks: 1 Mbyte capacity (TS 802) Single minifloppy disk (.5 Mbyte capacity), plus 10 Mbyte Winchester 5¼-inch hard disk (TS 802H)*
- *Green phosphor CRT (25 rows by 80 columns)*
- *Typewriter-style detached keyboard*
- *Full-screen attributes, editing, smooth scroll, 25th status line, 11 function keys, numeric key pad*
- *2 RS-232C serial ports. These are jumper selectable for any combination of modems or printers*
- *CP/M 2.2 operating system*
- *Attractive tabletop enclosure, fully integrated with CRT, CPU, RAM and disk drives*
- *1 RS-422 high-spped port*

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Both the TS 802 and 802H use the industry standard CP/M 2.2 operating system. This lets the user fulfill a wide variety of information and word processing needs using a multitude of commonly available application programs.

The TS 802 and TS 802H can accommodate serial printers and modems through the RS-232C serial ports.

When it comes time to expand to a multi-user system, you can utilize either your TS 802 or 802H as a satellite user station in the overall system without modification.

Multi-user hard disks

Functional characteristics

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

Read/Write Heads and Disks

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Within the appropriate frames of reference you could ask questions like the following.

Find someone whose name begins with W, who is either in London or Birmingham, and available for work at a salary of less than 10,000.00; and is under 40 years of age, not married, of credit worthiness grade 1, with a car, prepared to travel, and who likes horses, does not mind the hours he works, is congenial and has good references. *When you find such persons* produce a printed list of them showing their names, telephone numbers, and what their salaries are as well as their salary *if increased by 10%* and show their availability for work. At the end of the list enumerate the total of such persons.

Find all stock items that are codes *micro-computers* that are either in warehouse 1 or warehouse 2, where the quantity on hand is more than 50 units, the cost is less than 1000.00, the selling price higher than 2000.00; that are not in cartons, bought from supplier 52, allocated more than 20, rated for tax at 15% and weigh less than 50 lbs. *When you find such categories* then print a report showing the description, cost price, quantity on hand, lead time for refills, what the selling price *should be if raised by 12.3%* as well as the profit in either per-cent or round figures of that projected selling price.

Find all patients who suffered from cold, that are either girls or women younger than 23 years old, and who live in London at a socio-economic grade higher than 3, do not smoke; have more than 3 children, are currently at work and where treatment failed to effect a cure in under 6 days. When you find such persons then print a list showing their age, marital status, income, and frequency of illness in the past 2 years.

Currently you can ask **5 types** of questions **20 times** for a single selection criterion, and then you can compute **10 mathematical relationships** between the questions for the individual **as well as** for the total number of matches. In all some 60 bits of information relating to one record or a group of records on simply one permutation of the selection criterion, with a cross referencing facility as well.

Every word in the system, as well as the file architectures, print masks, and field attributes, is capable of alteration by you without programming expertise (but with some thought).

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Author Tony Winter (M.D.;B.A.Lit;B.A.Hon.Phil; and Lecturer)
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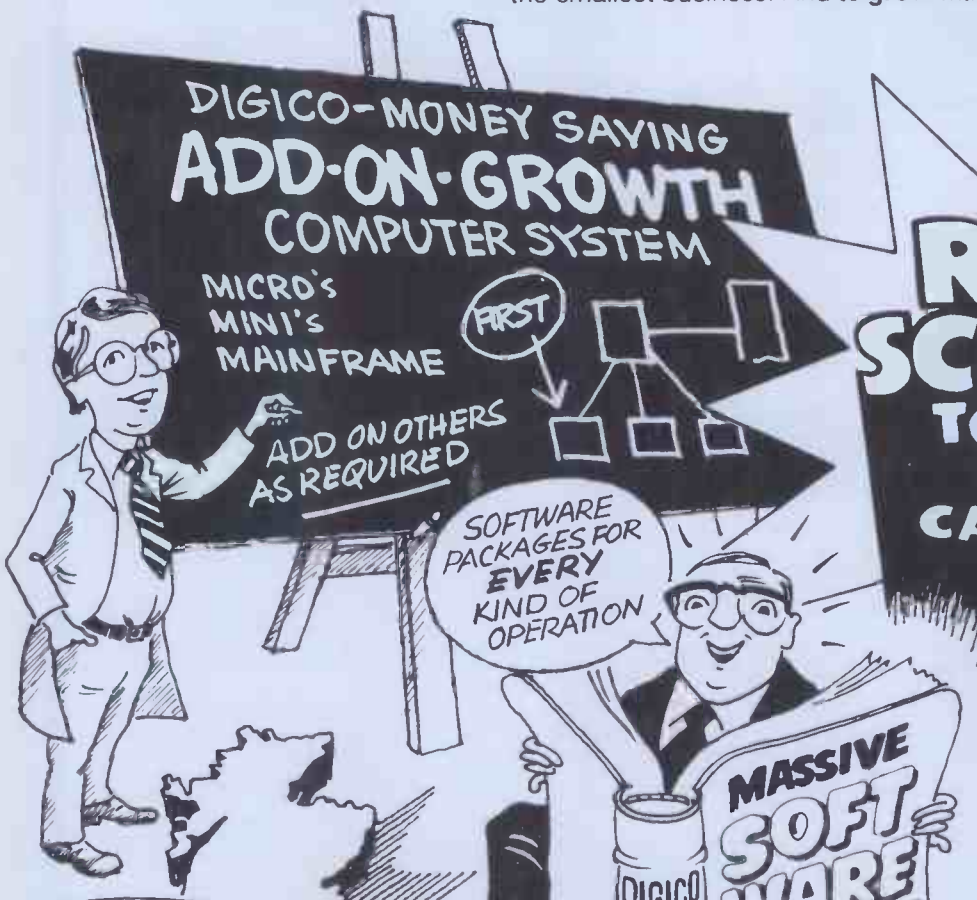

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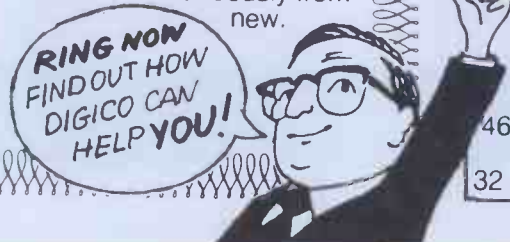

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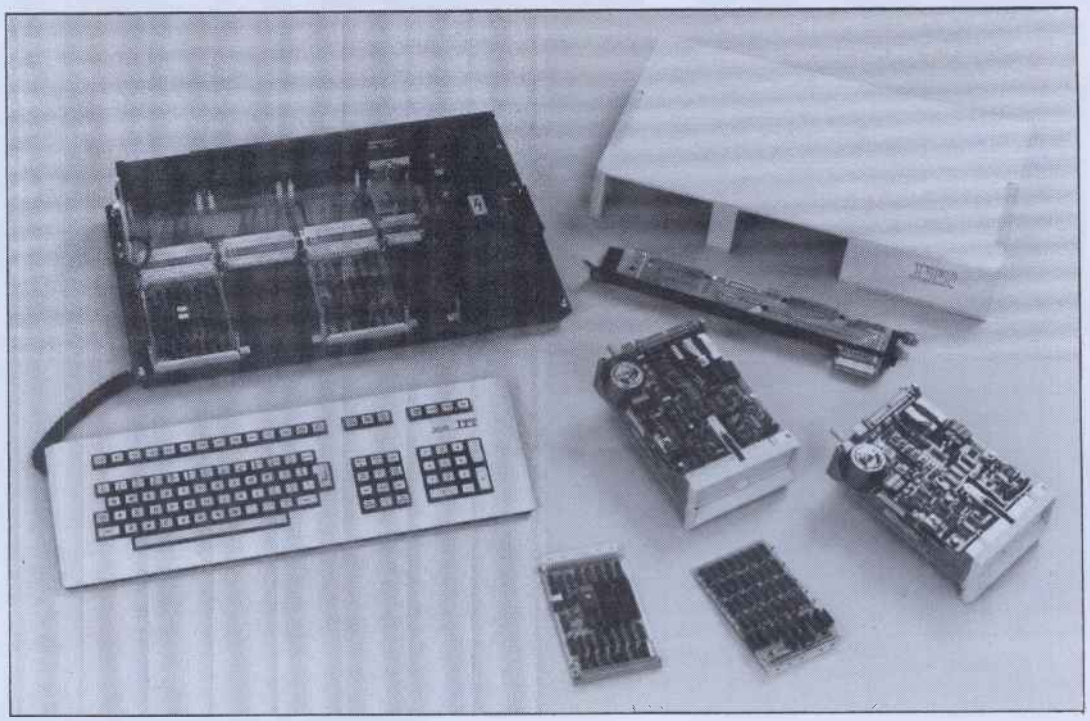

ITT 3030

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INFORMATION TECHNOLOGY 82

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- CP/M, MP/M® — BOS/5,®
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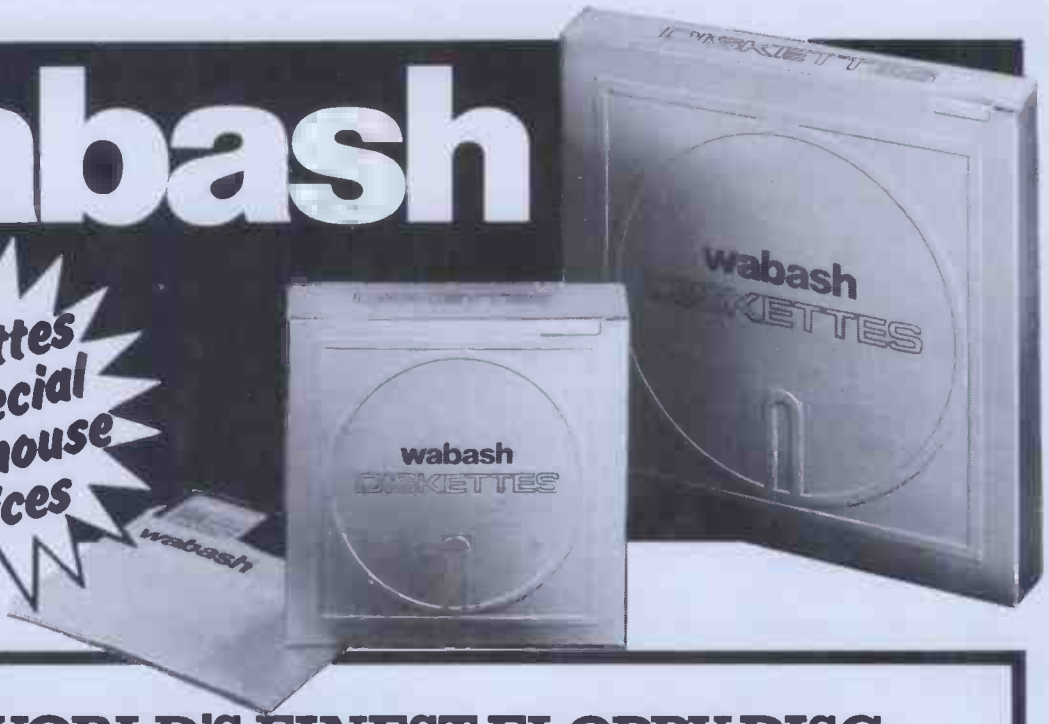

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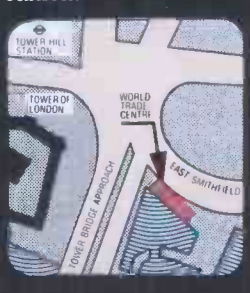

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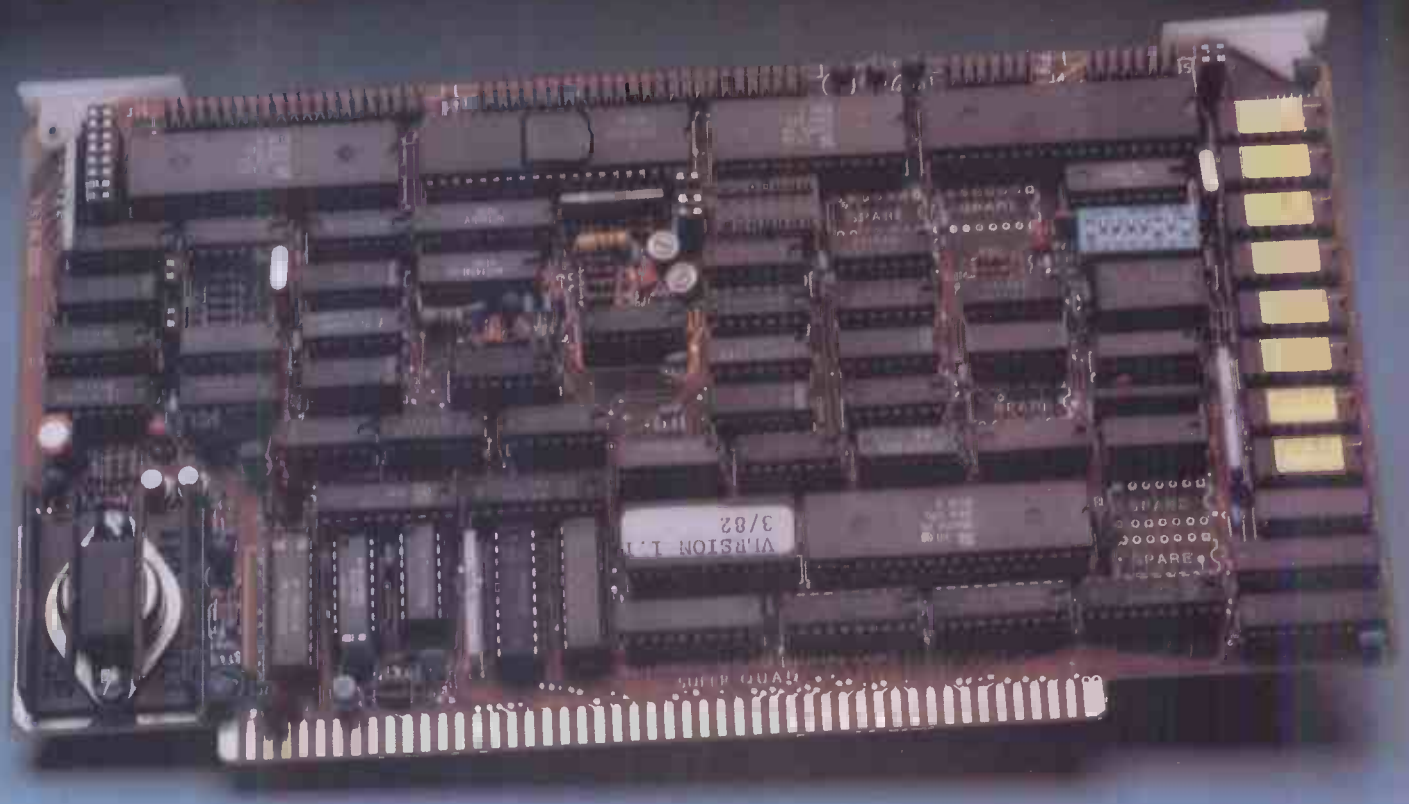

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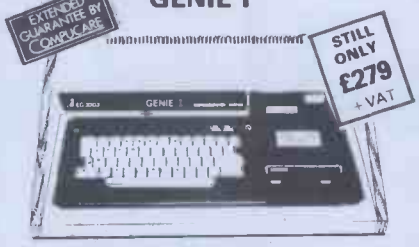

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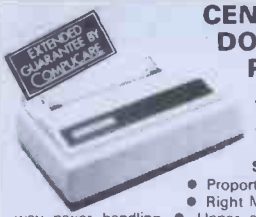

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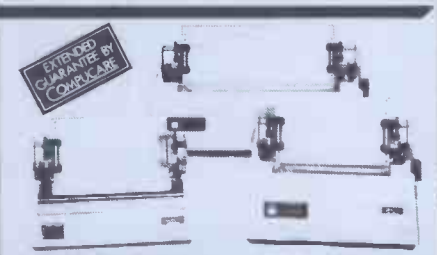

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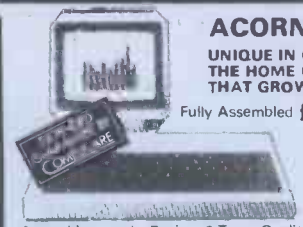

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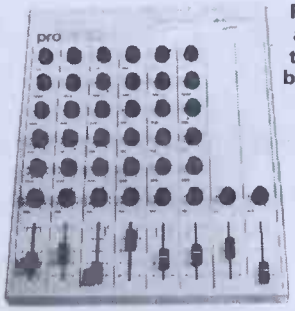

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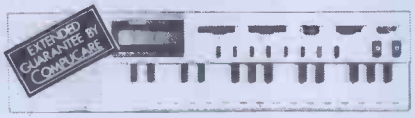

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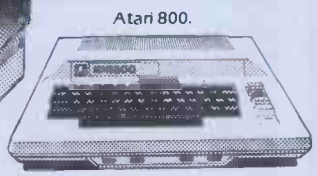

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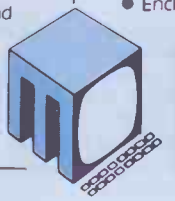

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Guy Kewney delivers his monthly package of micronews.

How secure is 'secure'?

Some points for bravery must be awarded to Hammersmith Hospital. The authorities there are setting up a local area network to hold patient records.

It isn't the choice of technology that must have taken courage — Acorn's subsidiary Orbis seems to have a better-than-average grasp of local nets — but the mere idea of having six computers scattered around the hospital, all with highly confidential records on them. In a country where the bakers sell as much white bread as they do, and where sugar is a major trade commodity, it isn't at all uncommon for people to suffer from intestinal problems but, astonishingly, few people afflicted by piles could bear to have anybody find out. And some medical secrets are even more mortifying.

In a world where there were no secrets, blackmail would be impossible. But there are, and it isn't, and so hospital records just have to be kept secure.

Acorn says that the installation 'will serve as a pilot study for the Department of Health'. With one million patient records accessed 1500 times a day on average, we can bet it will be quite a headache.

Something of the scale of the sort of opposition which could be whipped up can be read in British Medical Association pronouncements.

The BMA is one of many bodies worrying itself to death about 'Data Protection', a subject which never should have been tackled from the protection end.

Rightly, the BMA suspects that a system which requires some Government official to keep a list of computers and what is on them might be a system which doesn't keep too diligent a note of what 'security' forces hold in their computers.

And the BMA obviously also suspects that information in medical computers might find its way into security computers. All that is wrong with the theory is that it is already too late — the information is comfortably stashed away, and cross-indexed, by a great many Home Office and other funny ministry computers.

'The proposal to make police computers exempt from data protection legislation would make it impossible for the medical profession to continue to cooperate with the police,' noted a BMA spokesman in April. The medical profession does work with the police in cases such as baby-battering.

It is a fundamental truth about computer security systems that they are breachable. The more secure they are, the more necessary it becomes for the designer to insert loopholes for his own purposes, for testing. And, also, the more likely the normal users are to put wedges under the automatic doors to save them from having to operate the security mechanisms — both literally and metaphorically.

I'll be impressed by a security system which doesn't try to prevent access. Instead, it must make sure that whoever gets access is identified and cannot shelter behind his own secrecy.

Until then, we will continue to have the absurd fact that information which is supposedly 'secure' is in fact easily obtainable by people with friends who know the passwords and, in order to maintain the pretence of 'security', any breaches of information will be denied. In the case of the Government funny departments, they will even continue to deny that they hold the information (or else they will say that information on what information they hold is classified), while part-time ex-police operators can dig out information at £5 a time from their old colleagues, and powerful industrialists can lean on contacts inside the establishment for what they need to know about you and me.

This may look like an attempt to disguise an Apple II as an Apple III — instead, it's a device which tries to tidy up the II by giving it a single on-off switch, a voltage surge suppressor, and fewer trailing cables, all for £125 (inc VAT). Details from Fletcher Dennys Systems, 01-570 8999.

Fanfare

The Queen's Award which Micro Focus won for 'export achievement' with its CIS Cobol language is really a fanfare, or maybe a prelude, to a truly enormous change in the role of the cheap micro.

Micro Focus started out with a Cobol compiler which did little more than write code as instructed by Cobol statements. That was something its rivals somehow never managed to do (you would think a Cobol compiler had to do that to earn the name, but apparently not), and the result is that the company and its reputation is booming.

More importantly, however, so is CIS Cobol. Each time Micro Focus has something to say about this compiler, it is bigger and better, and by the time this item appears in print, the company will be dangerously close to getting CIS Cobol certified as being equivalent to any giant mainframe Cobol.

And it will soon be available, not just to micro users, but to mainframe computer users too.

That means that programmers in the big City banks, the giant corporations, the government departments, and all the giant administrative beehives that use those enormous IBM and other computers will be able to write their programs on a small, cheap micro and then send them up to the central computer tested and debugged.

Not all of them will do it, of course. Some of them seem to believe that programming is something inherently suited to paper and pencil work, and that however useful computers may be to accountants or lawyers, programmers don't need automation.

The shoemaker's children never get shoes, do they?

Hello friend

'Within a few minutes, it'll be talking to you like an old friend.' Perhaps you recognise the allusion to Clive Sinclair's advertising copy for the ZX81 but this time, it is twisted to indicate that there is something to make the ZX81 talk.

The speech synthesis interface is the latest product from DCP Microdevelopments.

To make it talk, you have to use POKE commands, to force it to search through a list of sounds which cover all the letters of the alphabet, numbers zero to over a million 'and other useful words and sounds,' says DCP of its Speech Pack.

Cost of the basic unit is £50. Extra wordpacks (three extra) are available at £15 each (all including VAT). Details from 2 Station Close, Lingwood, Norwich NR13 4AX.

Prestel push

It is now becoming more important and urgent than ever to get the last step taken in making Prestel usable — that is, to standardise its stupid modem.

Prestel authorities are now recognising how useful its big databases can be to micro owners, and they are cooperating in launching a new viewdata adaptor, through and with Tandata Marketing, which will let them sell software down the phone lines.

The new product is called Telesoft Tantel, which will plug into any micro with an RS232 plug (most of them, these days) and into a telephone line at the other end. As a way of dialling up the Telecom-owned Prestel computers and getting information (or

The comfortable looking man on the left, formerly a schoolboy at Shrewsbury, has just given his company's seven-year-old ICL 2903 to his old school. He has bought an IBM System/34 instead. The bloke on the right is Gilbert Roscoe, the school's Computer Department Head. He looks quite pleased. I wish I could have thought of a similar way of revenging myself on my old school. . .

programs) stored on them, it is pretty good value at £220 including VAT.

If only it could also be used to connect the micro to standard computer interfaces! Technically it could do both, but it needs to be switched from one form to the other when moving from Prestel to normal use. We merely wait for official permission from Telecom, to make life a lot easier Details on 01-546 5144 from Tandata's publicity office.

Same name

There is no obvious reason to imagine that anybody is going to be confused by the similarities between Clive Sinclair's Spectrum and the enormously different giant MicroAPL Spectrum, which has been around rather longer.

Nonetheless, at press time, MicroAPL was making all the noises of a company which planned to make its laywers rich. Let's hope the dispute dies there: MicroAPL now comes of age in one respect, by getting its own user group for the 16-bit machine. Anybody keen to join should contact the secretary, David Quas, at Imperial Group, Bristol (0272) 666961 ext 2380.

Apple push

Owl hasn't waited for permission to give its viewdata adaptor (for the Apple) both Prestel and normal capabilities — not at the same time, of course.

It produces an interface package with its own modem which allows the Apple II to send messages to or receive them from Prestel computers and also to link to other Apples. Used in this way, 'it converts the Apple into an intelligent viewdata terminal with local storage, and can be used for sending messages at a cost which is very competitive compared to telegram or telex charges,' says Owl.

The product is a plug-in card for the Apple, with its own built-in modem, plus a box outside the Apple with a plug to connect to a phone socket, plus a disk with all the necessary software, plus a manual.

Price is £455 including VAT. As long as viewdata television sets cost that or more, I suppose the price isn't really as bad as it sounds. Details on (0279) 723848.

Prestel add-on

The difference between a competition that attracted 160 enquiries and a competition that got 160 entries is not just a choice of words. Unofficially, I gather there were only three entries that were worth serious judging in the Sinclair Prestel adaptor competition.

The prize was shared by Barry Schofield of Lion TV in London, and two employees of Martochoice Ltd, a Hertfordshire computer company.

Unfortunately, details of exactly what these people designed hadn't reached me by press time. If it all turns out to be worth the fuss, I'll let you know about it. . .

CBM cleans up

Commodore is working very hard to make sure that it has cleaned up its 'approved products' act before anybody notices that it needs a wash. Or so I am assured.

It is going to have to work hard. A quick cross-check between the things in the Commodore catalogue of things to add to your PET on the one hand, and the things you know about and would like to buy on the other, will quickly show you that there are some strange inconsistencies.

That is, there are splendid products which are not 'Approved' and some fairly ordinary ones which are. There is a simple explanation and that's the way Commodore used to approve products. It did this very sweetly, by asking the maker of the product to pay it a 'royalty' for the privilege of having the product in the catalogue. No pay, no in catalogue.

Things are changing, an earnest John Baxter (marketing chief) told me recently. Nowadays, the scheme is being heavily improved to ensure that only 'substantial companies' are included — not people who are likely to go bust in between the sending of a customer's order and the arrival of the postman with a faulty product.

Also, Bob Gleadow (the UK boss) added, the scheme is now becoming much more ethical, and the royalties will be re-invested in marketing. The company will promote the catalogue, will contribute promotional money of its own to help, and will merchandise the products in it. Also, products are expected to prove themselves with several sales in the field, and to be evaluated by engineers in Slough, before getting the big Approved stamp.

But the company is sticking firmly by its policy of refusing to take on anybody who won't pay the royalty.

So although the catalogue is now becoming a repository of respectable stuff, there is nothing to say that anything left out may not, in fact, be rather better. I don't quite see what Commodore can do about this, either.

Tax pack

The introduction of a program called Taxpayer 1 into an accounting practice, says Personal Computers, 'would require no staff training — it is no more difficult to use than a desk top calculator'.

The £575 (including VAT) package runs on Apple II and the beauty of it, from Personal Computers' point of view, is that it is like Coronation Street — it should run and run. You don't buy it: you subscribe.

'Subscribers will receive annual or more frequent updates, as the law is amended,' says my informa-

Once upon a time, there were record players which could take a dozen or so of your 78 rpm records and drop them one at a time on top of each other, playing each one as it is dropped. It gave the effect of a very scratchy long-player with crashing noises and breaks for tea every four minutes.

Apparently this auto-change disk drive gives all the storage of an eight megabyte hard disk, costs around £1400, and is actually quite quick to whip one disk in and the old one out.

Symbiotic Computer Systems managed to make me feel timid not to trust the thing. But I still think I'm more interested in the five megabyte Seagate type drive the company has bought in enormous bulk through Honeywell Bull in France, and is selling at somewhere between £1450 and £1600 (which they said they thought was definitely the top price they might ask for it) with interfaces to Xerox 820, Apple, NEC, and IBM personal computers.

You may not have heard of this company before, by the way. I guess you will hear of it in the future — it has apparently received considerable financial backing from the government-sponsored ICFC.

Details on 01-680 8606. And just to put it all in context, Templeman Software has announced a dual eight-inch floppy disk for Apple users. It provides two megabytes, it costs £1,900, and they must wish they were dead. Condolences on (0789) 66237.

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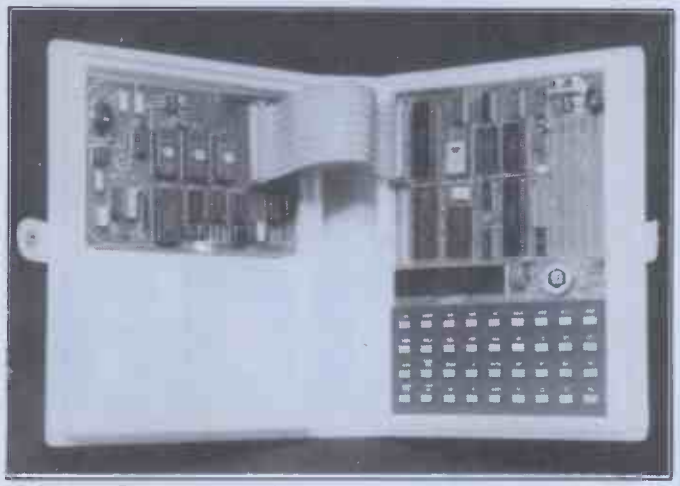


The MicroProfessor (see 'Flight trainer').

tion handout happily, adding: 'it costs £400 plus VAT (£460) for annual renewals.'

The authors, Taxation Software, reckon it can take an accountant between five minutes and half an hour to process one of his clients through the system, 'depending on the speed of input' (how fast you type) and how fast your printer works.

Details on 01-626 8121.

TI software

If you can write a £6 cheque to Stephen Shaw, you can get software to play games on the Texas Instruments 99/4 home computer. Packages now released include biorhythm, crossword, blackjack, black box, and box lines. There is also a 'Mortgage Amortisation Schedule' package, said to be 'great for planning monthly payments over several terms, and comparing them to allow for the best length of loan'.

Details from S Shaw, 10 Alstone Road, Stockport, Cheshire SK4 5AH.

Flight trainer

Just because it is possible to build a winning micro-mouse around a Sinclair ZX80 or 81 computer, that doesn't mean that it is easy. On a new machine (also costing £70) from Flight Electronics, it is possible that a beginner might learn how to do the job, however.

'Unlike personal or home computers,' says Flight, 'which usually teach their users about the application software, the MicroProfessor educational set, or MPF, instructs its operator in the hardware and engineering software of the basic micro chip.'

The set, says Flight, is a 'simple microcomputer system with a Z80 central processing unit, memory, and some input/output devices.'

That understates the equipment quite a bit.

From the photograph, it looks as though the machine has no ordinary letters on the keyboard. However there is (as on the ZX81) a removeable keyboard overlay, which can be changed to make the thing work in a small Basic, despite its incredibly primitive display.

It does let you get at the internal bits of the processor, however, which is virtually the only way of learning machine code programming.

And, for an extra £65, you can buy a speech synthesis board to plug into the central plus an EPROM programmer board for £75.

This machine is never going to be the popular toy that the ZX81 became but (without actually testing one out) I think it is likely to produce more computer engineers amongst its younger users.

Details of the Microprofessor from Flight House, Quayside Road, Bitterne Manor, Southampton SO2 4AD; phone (0703) 34003.

Taped software

Normally people don't supply 'business software' on tape, so Gemini Marketing's range of database, accounts, mailing list and stock control programs (each at £20) is unusual. The price, I suppose, reflects the normal thinking — that people who have a system without disk drives probably aren't very rich. Details from Quay House, Quay Road, Newton Abbot, Devon TQ12 2BU, phone (0626) 62869.

Ultimate horror!

I just have to try out Trader Jack, a Monopoly type game on the Sinclair ZX81 — it's the description that has sold me.

Try this: 'At the start of the game, the program kindly credits you with $40,000 to purchase SUPPLIES, CARGOES, FITTINGS, CREW'S WAGES, and a SHIP.'

After that, it says: 'You're on your own. You get a choice of 4 SHIPS all offered by a native whose fees resemble those of an ESTATE AGENT. . .'

Wow! No game of the adventure sort has *ever* offered a monster of comparable horror to the ESTATE AGENT! I'm sold, I'm sold, shiver my flesh, make my timbers creep. . .

Details on Luton (0582) 454456 from Work Force director Derek Tidman, Price £7.00

Extra graphics

Provided you have expanded a VIC-20 with an extra 3k memory, you can use GraphVICS to draw high resolution pictures. The package provides a new area of memory in which a screen is held, and the user can look at either the normal VIC memory picture, which is usually used for text, or the expanded GraphVICs area.

The product is released by Michigan software producer Abacus Software, PO Box 7211, Grand Rapids, Michigan 49510, phone (616) 241 5510.

IBM memory

IBM micros now can get more memory: add-on boards are available from Electronic Office Services in London for anybody who can afford the 'highest quality multi-layer printed circuit bases, which keep signal distortion to a minimum, and maximise the radio frequency interference performance.' At £280 for a 64 kbyte board, rising to £1130 for a 512 kbyte board (that's half a megabyte) all that impressive verbiage better be more than just waffle. Details on 01-248 6971.

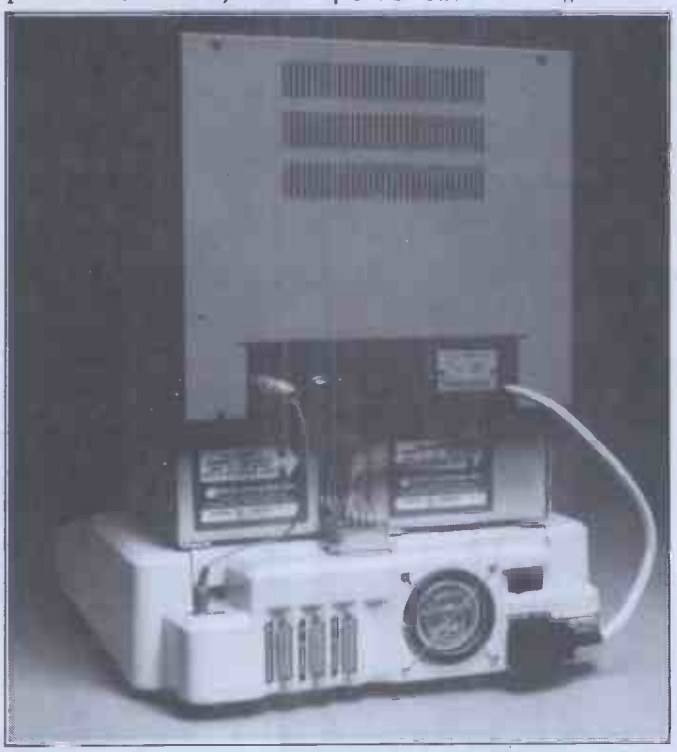
More Sirius software

Independent software for the ACT Sirius: following TABS' early release of versions of its integrated accounting packages, Graffcom has followed up by announcing that its ISBS-F range of software is available now. Details on 01-727 5561.

8088 chance

I think there is a genuine career opportunity here for anyone with £300 or so: a 'low-cost evaluation system' for the Intel 8088 microprocessor, the chip inside the IBM and Sirius and new Commodore and several other micros.

The fact of the matter is that there are going to be a million and one of these chips around — and still, hardly anybody knows how to program the thing. Almost all the software running on the



This tidy backside belongs to a nice, old-fashioned Apple II without the normal plateful of spaghetti. It is achieved by a product called Applefan, which not only sucks cold air through the nine expensive add-in cards that you've undoubtedly plugged into your machine by now (to give 80-column display, and serial interface, and add-on language memory, and Pascal, and a modem, and a colour card, and a Z80 softcard, and a clock, and a voice output) but tidies all the tangled wire coming out of all these devices into something that looks like any modern micro. You buy this useful box from Data Efficiency for £70 — details from your Apple dealer (or from 0442 63561 if you are the local Apple dealer).

See Adda for Osborne

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IBM and Sirius so far has been produced by the one or two companies with this expertise — or has been translated from Intel 8080 or Zilog Z80 programs.

If you don't believe me, watch the soporific way Wordstar runs on a Sirius compared with its speed on the Osborne — it's almost as slow as a Superbrain.

The 8088 is five times (at least) as fast as the Z80 but nobody has written proper code for it yet.

This evaluation system, the EV88, is no luxurious automatic teaching machine. It has minimal memory, minimal software aids, and needs a power supply — but at least you can sit down with the 8086 manual and learn to program in assembler code.

Details from LFH Associates, 40A High Street, Stony Stratford, Milton Keynes, tel: (0908) 566660.

Caxton's Cardbox

Cardbox, the new program from Caxton for storing and indexing any information you care to type into your computer, works better on a micro than similar products used to work on mainframes.

This challenging claim was made by the program's author, the highly articulate Martin Kochanski (pictured).

His logic is staggeringly obvious: 'Programs like this used to exist, and things like Stairs on big IBM computers were very similar. But their drawback was the fact that they ran on big mainframes.

'This means that not only is the whole environment more expensive, but it is less easy to use. Most users would not be plugged directly into the computer but would be sitting at an expensive terminal at the other end of an expensive telephone line.

'You can't really be very helpful because the costs of waiting while your expensive computer sends a screenful of instructions down the expensive line, just so that you can type two characters and then wait for another screenful of instructions, are bad enough. Then there is the problem of the time waiting for the information to come down the line.'

Martin Kochanski

It's perfectly true. The program, too, is very nice, and costs £150. I'd say that even if Caxton's boss wasn't David Tebbutt, former editor of *PCW*.

Legal stuff

Solicitors need different software. So says Automatic Information Management, a company which originally produced a solicitor's program called Charter and has now followed it up with DebtCharter, which deals with the accounting of debts to the solicitor's clients. If you are a solicitor, you'll instantly understand (the rest of you shut up, you don't care) and get in touch on (0482) 26971.

Sick leave'81

A new small business record system to let management know what is going on with holidays and sick leave has been crammed into a Sinclair ZX81 by Computatutor of Greenwich. You need an extra 16 kbytes of memory and £10. Details on 01-703 2403 from Warren Newman.

Nascom Pascal

Getting back into the business groove, our almost forgotten favourite old computer from the 70s — yes the Nascom now has Pascal. Lucas has released the language in a tape version at £45 or in an EPROM version at £75. Details on (0926) 497733.

Commodore fights back

Commodore's position as biggest-selling non-Sinclair machine in Britain makes it a target for everybody, and the ammunition being used to attack its position now is the phrase '16-bit micro' of which Commodore has none as yet.

It has announced a new machine which deals with this threat (in a strange sort of way) by being an ordinary 8-bit machine with a big 16-bit chip bolted on the back.

In particular, Commodore feels threatened by the Chuck Peddle machine, the Sirius 1, available through ACT in Britain. And, not to put too fine a point on it, Commodore is fighting back, in two ways. First, it says, there is no need to go for a 16-bit chip like the Intel 8088, because all the software in the world is written for the eight-bit chips. Second, it has the 8088 in its new machine, the CBM-2, or the 700 series (depending if you live in the US or the UK).

The main fear seems to be the possibility that Commodore dealers will start selling the Sirius as well as the PET. Currently, there is a clause in the Commodore dealer agreement which says that dealers must not take on any 'rival machines'.

Dealers have been saying, however, that since Commodore doesn't make any 16-bit machines, the ACT Sirius is not a rival.

Commodore says that its 700 series will be available with the Intel 8088 and 256 kbytes of memory, and CP/M (including Concurrent CP/M-86) by September. That means that the ACT Sirius *will* be a rival, and will dealers please leave it out. . .

You can place your bets on whether there will be any 700 series machines in September. Concurrent CP/M-86, however, is not yet available on the Sirius 1 and software bosses inside Sirius in Santa Cruz assure me that their opinion of the package doesn't indicate any need to rush to sign contracts.

According to one Sirius executive I met at Hanover Fair (courtesy of Commodore, which kindly smuggled a few journalists over on the plane it chartered to ferry dealers into Germany to see its new machines) — the Concurrent CP/M-86 code still has plenty of 'design faults' — not bugs, not yet, just 'design faults' — based on the fact that it is derived from MP/M.

According to Commodore however, the deal is struck, the work is proceeding, the machine is virtually ready, and the code will run on it by September or sooner. I don't necessarily disbelieve them; I just think they have a very obvious vested interest in being optimistic and I'll believe it when I see it.

Whenever the machine does appear, it looks good. It is fast, with a souped-up central processor which runs normal Commodore software, sort of, plus an add-on processor treated very much the way the BBC Computer treats its newly-announced 32-bit add-on — down the Tube.

Pricing, as foretold at Hanover, looks good, too. It starts at £1600 for a two-disk system with masses of memory and quite a load of new features.

Little catch-phrases can be a real give-away once you know what they are hiding. When somebody announces a machine 'mainly for the business market' nobody has to guess for too long before working out that the machine ain't cheap.

Sure enough, the new machine launched by Almarc at the May Online show, the Series-8 micro, starts at £4000 (including printer and some software).

The machine looks familiar: it should. Almarc has always imported Vector Graphic hardware, and 'based on this experience, it has now developed its own microcomputer' and it hasn't departed far from the tried and tested model in this design.

Most of the Series-8 machines are multi-user and people are now starting to say that the MP/M-II software (which shares out the processing time to make multi-use possible) is usably reliable. All the multi-user versions have this program, plus three or more megabytes of hard disk storage. Definitely not for the small-time users.

Details on Nottingham (0602) 52627.

Acorn's Electron

At the game-playing end of the micro market, where the really big money is going to

WHEN YOU HAVE 637 PROSPECTS TO REMEMBER YOU NEED OUR ELECTRONIC CARD-INDEXING AND RETRIEVAL SYSTEM

Many people know Henry VIII had six wives. But few are aware of his 637 girlfriends. Poor Henry! Is it any wonder he laid about them with an axe. Just imagine trying to remember all those first names, addresses, birthdays, pigeon hole numbers and personal details.

With CARDBOX, Caxton's new electronic card indexing system, keeping and retrieving information is simplicity itself. Not only could Henry have found his ladies but he could have kept tabs on all those barons, bishops and bowmen. (Rent demands would have gone on time, confiscations would have been orderly and executioners would have been selected to suit every occasion.)

And he wouldn't have had to understand a thing about computers. CARDBOX looks like your favourite card index on the screen. You draw the card yourself. You decide where you want lines. You make up your own headings. And you fill in the details.

At this point CARDBOX stops behaving like a flat inflexible card. It becomes multi-dimensional electronic paper. You can change any information you want. You can retrieve portions of information. You can print out all or selected information from your cards.

You talk to CARDBOX in plain English. You search your records on key words or on selected criteria. CARDBOX acts like a sieve, sifting through the records reducing the number until it finds only those that meet your needs. You display records on your screen or print them out in a format of your own design. Label production for mailing is simple. You can also use CARDBOX with some of your favourite wordprocessing packages, eg Wordstar.

CARDBOX works on most popular CP/M machines including those with special screens, eg Osborne. Use the CARDBOX Tutorial to learn all about this simple, fast aid to better record management. Study the detailed Reference Manual to take full advantage of its sophisticated features.

See CARDBOX at your local computer dealer. Or we'll send it to you with a dealer list. Call or return the coupon to us.

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Caxton

Supposing that, now that there are lots of Sinclair ZX Spectrum machines around, nobody ever buys another ZX81, there are still half a million possible customers for add-on bits and pieces like this keyboard.

This one is a bit special because it actually fits into the same space as the ordinary ZX81 keyboard, but has proper moving keys. It is supplied by Kempston Electronics, and costs £22.50. What I like about it is the way the designer has managed to make the whole thing look very like the original layout, with very similar letter typefaces, and without the confusing mess that some keyboards make of getting three functions on one key.

Details from 60 Adamson Court, Hillgrounds Road, Kempston, Bedford MK42 8QZ.

be made, here are a few hints about what Acorn will produce to rival the Sinclair Spectrum (they think, and Clive doesn't think).

It will be very like the Spectrum in appearace, with a rather different set of keys. It will be a baby brother to the BBC micro, and largely compatible with it — but without the option of going to 80 column displays, and without any of the input and output lines to link to printers, terminals, and modems.

It will probably concede the edge on price to the Spectrum, but it will probably have a better quality colour display on most ordinary TV sets.

All its keys will be entirely programmable — that is to say that if you want the button with Q on it to show a Greek alpha, an elephant, or a 'Kilroy' wos 'ere' sign, you can make it happen.

It will be called the Electron, and it will possibly be available this year.

Games people play...

Just as toy trucks and dolls can help children learn the language of the people and traffic they will have to cope with as adults, playing with video games today may prepare the adults of the next two decades to react with computers.

Not my own idea, but that of someone called Victor Walling, one of a fascinating clutch of academics unearthed by Atari, in a publicity handout designed to show how useful games are.

I hope that some of the academics have been misrepresented — they read like a 'Pseud's Corner' anthology in all too many cases.

For instance, there is one who is quoted as knowing of 'no hard evidence that violence from blowing up a Space Invader would transfer to normal, day-to-day interactions with other people'. Violence? Ah well, probably some strange new usage of the word. . .

Then there is the psychologist who uses video games as a means of treating depression in teenagers. A fascinating report summarised in Atari's publication, but a bit confusing to find that 'he also plans to use the game as a reward for good behaviour' for some of the aggressive boys who have behaviour problems — he feels that 'the game provides a particularly good reward, compared with jukeboxes and snacks'.

Others are disappointing in their lack of results, presumably because the studies are being turned into somebody's thesis. For example, the chief of the Stress Analysis Research Unit at the Aviation Physiology lab in Oklahoma City, has been testing people — about 25 of them — with bad hangovers.

He's lucky to be alive, really: he tested these unfortunates on Atari games to check coordination and response — and I know what sort of response I would have for a doctor if I complained of a severe hangover, and he asked me to play Asteroids. 'Apparently the study evolved from problems with alcohol use among pilots,' notes Atari, unnervingly.

The really interesting thing about it all is that Atari has donated games and cartridges for research purposes, to most of these researchers who had approached the firm for help in studying these areas. Nice to see encouragement of academic effort, yes — but very revealing. It becomes clear that there is starting to be considerable pressure on Atari from a lobby of people who think that games encourage crime, and train children in violence.

Myself, I agree with the researcher who said that this chain of 'logic' was really a lot of sloppy thinking. But throughout the Atari report, it is clear that many of the researchers quoted assume that they have to somehow justify games, against a rising consensus that they are harmful.

One researcher said that 'the negative response of some of the public to video games may stem from some sort of "technological phobia" but video games are less likely to bring out violent responses than TV'.

Another said in an equally defensive tone that 'the games are absorbing, much like music, but they're not addictive in the technical sense of the word'.

I didn't know anybody thought they *were* addictive in the 'technical sense of the word'.

Profitapple

Any hint of gloom for Apple that may have existed at the beginning of the year can be somewhat dispelled by a quiet read of its second quarter's results. It increased sales by 66 percent over last year, and profit went up 51 percent.

New Acorn coming

Acorn has decided to leapfrog the rest of the world, and leave the 16-bit micro market to the tadpoles. It has announced a 32-bit micro — for around $2000, including a big hard disk.

Nothing could be better designed to illustrate the divergence between the directions in which Acorn is going with its BBC micro and Sinclair with his 'not the BBC micro'.

Acorn gets its first crack at the big American market through the deal it has struck with the builder of the 32-bit micro (National Semiconductor, as attentive readers of this column will have guessed before now).

It also gets a crack at Commodore, Apple and Radio Shack, on their home

The whole point of a needle (hem, hem) is that it is sharp, and can pull thread through fabric. It would be nice, admittedly, if it were unbreakable too — but no seamster would give you a lot of money for an unbreakable needle without a point or an eye.

Similarly, the whole point of a microcomputer is that it is cheap. Admittedly, it would be nice if they were generally much more powerful and sophisticated, but nobody is going to form a queue outside your office for a micro with the performance of a big mainframe if it also has the price tag of a big mainframe.

I'm sorry, NCR, but just because the NCR 9010 has CP/M doesn't make it a personal computer. And starting at £5700 you really mustn't describe it as 'competitively priced'. Go away and try again.

grounds and through their own dealers.

To get the best out of the machine, it will be sensible to get a BBC micro, and hang the 32-bit model on the end of the Tube. However, it will be possible to use any ordinary Petappletandy machine in much the same way, as a terminal to this one, with control being arranged down an ordinary RS232 link.

A 32-bit machine with Unix as its operating system, with a BBC micro as its display terminal, with several megabytes of disk storage, and with a quarter megabyte of internal memory — if Acorn can really do that for $2000 (I don't know what it will be in pounds sterling) then Americans are going to buy.

Other manufacturers are being signed up by Nat Semi now and over the next few months to provide several different versions of its official machine — but all will have a fundamentally compatible operating system, say my sources. All will have the same languages (a deal is still being hammered out to arrange these) and all will be in with a serious chance of beating Intel into the 32-bit market.

TLO training

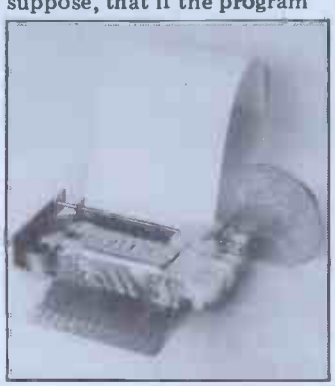
The Last One was always going to make enemies — it was announced in a challenging way as 'all the programs you'll ever need for £260' and a great many people took up the dare to prove that it wouldn't be able to write that many programs, or at least, it wouldn't be that easy.

So the boss of DJ 'AI' systems, Scotty Bambury, is entitled to get a bit uppity about the fact that the National Computing Centre 'will be selling software not produced by themselves, for the first time ever', and that this software will be The Last One.

More, The Last One will be featured in a series of one-day training courses run by the NCC.

You could argue, I suppose, that if the program makes programming skill unnecessary, you shouldn't need a training course to learn the necessary skills. I dare say somebody will say it. Meanwhile you can go on the course, and at the end of it, you will have a copy of TLO for your very own — from which you can work out what the course will cost, can't you?

Details from the NCC or from Bambury's outfit on (04605) 4117.



This is said to be the world's smallest thermal printer. It is supplied by Epson. Details on 01-900 0466.

Humorous maths

A sense of humour is obviously as important as mathematical ability at MacMicro Ltd, where a symbolic algebra system has been given the impressive name of Fully Interactive Algebraic Symbolic Computing (FIASCO) by the proud designer, H J Gawlik. It runs on Commodore 2000 and 8000 micros, it costs a mere £80, and details are available on (0463) 712774.

ZX81 winners

During late April we ran a competition at eight London rail termini to win six ZX81s. Of the 50,000 leaflets given away, almost one in eight were completed and handed in at the collection boxes on W H Smith's bookstalls. Over 5,000 entries were correct and the first six to be drawn out of the boxes were: Paul Berry of Orpington: B C Billing of Carshalton; A M Brown of London WC1; Peter Faircloth of Putney; M B Hill of New Addington; S W Till of Woking.

The puzzle was to find the number of routes from Notting Hill Gate to Liverpool Street on a simplified tube map. The answer was 27. Many thanks to all of you who entered.

Texas talkie

Texas Instruments devotes a lot of effort and funds to research on synthesised speech; the results are to be seen in its speech chips and in products such as Speak and Spell and Speak and Math. These last products give vocally aided instruction, using ROM based vocabularies; in the case of Speak and Spell you can buy further ROM packs to enlarge the repertoire but the range is still rather limited. TI's latest offering, announced in Nice at the end of May, overcomes this limitation by allowing a speech synthesiser to read software encoded as bar-codes on the printed page.

Called the Magic Wand Speaking Reader (wonder what Peachtree thinks about that?), the unit comprises a box of tricks with an on/off switch as its only control, and a hand held bar-code reader which uses fibre-optics. This is scanned over a high-density bar-code in one of the books which will be sold for the device, and the result is a spoken sentence.

See Texas talkie.

Currently the books are designed for pre-school age children and have pictures and written words over the bar-codes. Eventually, however, TI hopes to apply the system to language teaching for adults as well. The synthesis system uses principles recently developed in TI's labs, which break down English speech into 128 'allophones'; these are encoded and stored in ROM and can then be used in combination to build up any word. The high-density bar-code used by Magic-Wand allows a certain amount of inflection to be encoded into the speech, so that the result is less robotlike than previous efforts; the book I tried even had a singing voice ('Twinkle, twinkle Little Star'). The allophone system makes it possible to synthesise other languages by analysing them into a suitable allophone set.

Dick Pountain

The Latest One

Inspired, no doubt, by The Last One, a Michigan city firm called Advanced Operating Systems has launched a $500 program called The Programmer. It runs on the Apple II CP/M version, and the IBM PC, and an ordinary Apple version is planned. And yes, it does everything, too.

Details from Kenneth Jones, at 450 St John Road, Michigan City, IN 46360.

Small floppies

There is quite a difference between £50 and £250, and though a disk drive costing £250 would be nice, a disk drive costing £50 would be astonishingly nice.

Everybody knows that Clive Sinclair has promised us a £50 disk drive for his Spectrum. Some may also know that the Hungarians have produced a tiny disk system, which appeared at the Computer Fair in April, and which then was said to cost £250. And subsequently, I've seen reports that it will cost £50.

The Hungarian unit, imported by a company with the courage to call itself Bats NCI, was invented in 1974, and looks astonishingly like a Japanese invention(?) which is available in Japan but not in Europe. Instead of storing data on floppy disks five inches (or eight inches) across, it stores it inside a rigid plastic cartridge like a music compact cassette, inside which there is a floppy disk three inches across.

According to the Bats people, the reason the Japanese version has taken so long to reach the market is because they have been trying to beat the Hungarian patents.

This doesn't explain the long delay in Hungary's production, nor the confusion over price. If the Hungarian price can be held below £100, including the necessary controller electronics needed to connect it to normal microcomputers, it will take a lot of the wind out of the sails of Sinclair's £50 floppy, because it is known to work already, and his device is still a prototype.

I'm expecting the Bats device to cost around £200, however. We'll see. Details from Bats on 01-349 4511 or 9271, or from Lowe Electronics, importer of the Video Genie on (0629) 2430.

'This new system is selling like hot cakes. Now it's just up to you to design it'.'

The 5th Personal Computer World Show

Barbican Centre, City of London 9–12 September 1982

First of all an apology for telling you how wonderful the show was going to be last month and then not telling you either when or where it was going to be held. This month we've got it right.

At the time of writing (mid May) we had twice last year's show area under contract. That's 2,000 square metres of space which had been booked by some 85 companies and it means that the final show should be at least three times the size of last year's.

Quite a variety of companies have booked their space since the last issue went to press. Bugbyte, from Liverpool, will be there — they seem to be making quite a name for themselves in games for the BBC machine, the VIC and the ZX81. At the other end of the spectrum (sorry!) is Computer Ancilliaries who will be waving the flag for up-market business systems made in the UK. While we're in the office it would be very interesting to know how many shiny new micros are insured in the same way as desks and typewriters. An outfit by the name of Geoffrey Hoodless Associates is going to be at the show trying to change all that.

Creative Computing from the US has been to nearly every other *PCW* Show. The sight of publisher David Ahl in his apron trying to live up to his claim that he never takes anything back from a *PCW* show is one that you shouldn't miss. If your timing is good it's also one of the best ways of getting US-published stuff at really keen prices. Talking about publishers, it's good to see that just about every other micro magazine is going to be at our show.

We have just completed plans to have ZX and BBC/Acorn mini shows within the *PCW* Show. Mike Johnston, who organises the now-legendary ZX fairs that fill Westminster with ZX freaks every couple of months, will be coordinating the ZX feature. By September there should be enough Spectrum software to keep everyone happy. The mini show for BBC/Acorn users is being organised by Small Enterprises who are on 01-930 1612. If your company is exclusively selling products to one of these markets then these special areas are just right for meeting lots of users.

To keep everyone posted about events at the show while they are happening we are working with Telemap to put in a local Viewdata system. Exhibitors will also be advertising on the system so you won't miss those special show offers that you always hear about but never get to see.

If you are a businessman coming to the show to look at the latest professional systems you will be delighted to hear that we are to introduce a special priority ticket system to save time. Anyone booking in advance with either a business card or headed notepaper will be able to use a special 'no waiting' entrance to the show. Advance bookings without the use of the special entrance will also be available as usual for parties arriving together. For details of party discounts write to Timothy Collins at Montbuild, 11 Manchester Square, London W1.

Finally, if you are planing to travel to the Show from any distance we have organised some very attractive travel and hotel packages. For example, packages of a 2nd class rail ticket, a show ticket and one night at the Regent Palace hotel (in a twin room with breakfast) would cost £25.00 from Manchester, £21.50 from Birmingham, £25.50 from Huddersfield and £19.50 from Southampton. A single room is available for £2 extra and each extra night is £10. The packages without travel are £13.50 per night.

If you need further details or want to book, contact Frank Gilbert of Pharoah & Hughes on 01-995 8995.

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CTUK!NEWS

by David Tebbutt

It seems that, despite *PCW*'s ever-increasing size, the Editor still has great difficulty squeezing everything into the magazine. While he still had his foot on my neck, I agreed to give a half-size 'ComputerTown News' a try. One thing which will disappear is the list of towns from which enquiries have been received. I do maintain an index of all enquirers on a computer system so, if you mention the towns and villages near you when you write to me, I'll scour the database and pass on any local contacts to you. Don't forget the SAE if you do write.

We have a little news from existing 'Towns this month. First, ComputerTown Palmers Green, which was started by the folk at ComputerTown Enfield, has now become independent and your contacts there are now Ted Ellerton, Stephen Gorski and Anne Sempkins, the librarian. Rex Shipton is now the official contact at ComputerTown Eastcote. Over the last year or so, Rex has increasingly taken on the lion's share of the responsibility. Another thing that's happened at Eastcote is that we've dropped the booking system we had. Every session was being booked by those already 'in the know' and this was acting as a severe discouragement to those we really wished to attract. In fact, it was becoming more of a club. If anyone in Eastcote would like to start a computer club then please let Rex know (address in Direct Access) because ComputerTown can supply a lot of enthusiastic members. Finally, on existing 'Towns, I had a letter from Richard Powell of South Shields. You may remember that I mentioned recently that he had lost both his job and his mean of transport. It seems that I was misinformed and his company is currently sponsoring him to take a full-time degree course. ComputerTown South Shields will be revived in June. I'm sorry, Richard, for any embarrassment I may have caused you.

I had a number of letter from *School CourseWare Journal* in America. It publishes disks and cassettes, each containing two educational programs, as well as a conventional magazine. Five issues will set you back $75 or $90 depending on whether you choose disk or cassette. At the moment programs are available on PET, Apple and TRS-80, although Atari products will be introduced soon. Further information from 4919 N Millbrook, Suite 2228, Fresno, CA 93726.

Now for the people who look as if they'd get a 'Town going, given the help. If you feel you'd like to give a hand then I just know they'd love to hear from you:

Peter Earthy, 46 High Street, Church Stretton, Shropshire SY6 6BX; Dave Clare, Mid Cheshire Computer Club, telephone Winsford 51374; Charlotte Hursey, Rural Information Officer, Cambridgeshire Community Council, Great Eastern House, Tenison Road, Cambridge CB1 2DU; Edward G Collier, 26 St John's Road, Ludlow, Shropshire SY8 1PG; Lesley Donnelly, Branch Librarian, Hanworth Library, 2-12 Hampton Road West, Hanworth, Feltham, Middlesex TW13 6AW; Bruce Emblem, Hill House, Station Road, Brundall; Lorna Carson, Librarian, Barrow-in-Furness Library, Ramsden Square, Barrow-in-Furness, Cumbria; Roy Pearce, 50 Green Road, Hall Green, Birmingham B28 8DD; Malcolm Rush, 18 Shakespeare Road, St Ives, Huntingdon, Cambs PE17 4TR; Peter Bendall, Flottmoorring 67, 2358 Kaltenkirchen, West Germany; Harry McMahon, Director, Micronet Centre, New University of Ulster, Coleraine, N Ireland BT52 1SA.

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

BRAIN DUMP

Peter Rodwell reports on how he's been killing time waiting for his Spectrum

This is very embarrassing. I had intended to devote this 'Brain Dump' to a crowing report on the delights of owning a Sinclair ZX Spectrum. At the Spectrum launch, somebody asked 'Uncle' Clive about delivery dates and he replied, 'If you order one today you'll get it in two weeks!' Never one to miss a challenge, I promptly filled in one of the order forms thoughtfully supplied in the press packs and handed it to Clive there and then. He looked a little surprised, mumbled something about 'Well, it does say 28 days on the order form' and stuffed it into his pocket.

Precisely two weeks later, a postcard from Sinclair arrived, saying that my order was being despatched. Today, four weeks from the launch, I am still waiting. To while away the time, and only partly as a joke, I have written a word processor for it, entirely in assembler, and I'm currently trying to work out a way of getting the object file across from my Cromemco to the Spectrum without having to convert thousands of hex bytes into decimal and then POKE them all in. I guess I'll have to build a port for the Spectrum and zap it out via the Cromemco's Centronics interface.

Talking of my Cromemco reminds me that I have recently solved a very annoying problem with this machine.

It concerns Cromemco's CDOS operating system, an 'upwards-compatible' version of CP/M. Like CP/M, this contains several intrinsic commands, such as DIR to obtain a directory and REN to rename a file. When you type a command, CDOS first checks to see if what you've typed is one of these intrinsic commands; if it isn't, it then searches the disk directory for a program with the same name which, if found, is then loaded into memory and executed. When that program stops, control is handed back to CDOS — but if you want to re-run the same program there's no way to do so other than by typing the program name again and waiting for it to be re-loaded from disk; there's no facility for re-running the program directly, even though it's still there in memory. What I wanted was a RUN command but I could never figure out how to do it — one tweak which, I'm told, works under CP/M is to create a file on disk called RUN.COM with zero length, so that when you type RUN, the operating system tries to load this in and run it but, as its length is zero, the effect is simply to jump to the program still in memory. This doesn't work with CDOS, which is smart enough to recognise a dummy file when it sees one and reject it.

The solution came when I was looking through a Debug dump of CDOS version 2.36 in search of something else and came across the intrinsic commands look-up table; I found it included a command called REM. This is undocumented in the CDOS manual and using it seems to do nothing. From a very hurried delve into CDOS, it appears that REM might clear up the input buffers but I'm not sure yet. However, it's easy to modify REM to RUN and change the appropriate jump to 0100H and — hey presto! — you have an intrinsic command which allows you to re-start a program. This is particularly handy when using INIT (CDOS's version of Format) to initialise a box of disks; INIT formats one disk and returns to CDOS, so you have to load and run it again for each disk. Now, however, I simply type RUN and it runs again without re-loading. Also, you can use RUN with the 'switches' required by some programs. For example, running STAT by itself gives the normal status printout and stops; if you then want to enter the date, RUN/D will re-start STAT in the date entry mode.

There isn't space here to document these mods so I'm afraid you'll have to wait until next month, when I'll stick them into 'TJ's Workshop'. Meanwhile, if anyone knows exactly what REM is supposed to do, and why, when using RUN with Basic I get a 'Cannot open file' error message for no apparent reason, I'd like to hear from you.

I don't yet know whether CP/M has any similar, unused intrinsic commands which could be altered to provide a RUN; if not, then us CDOS users have scored yet another superiority point! END

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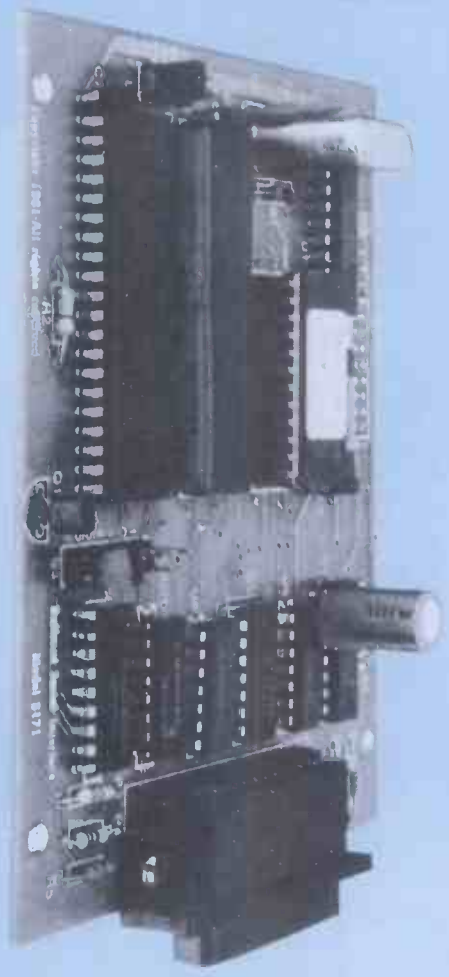

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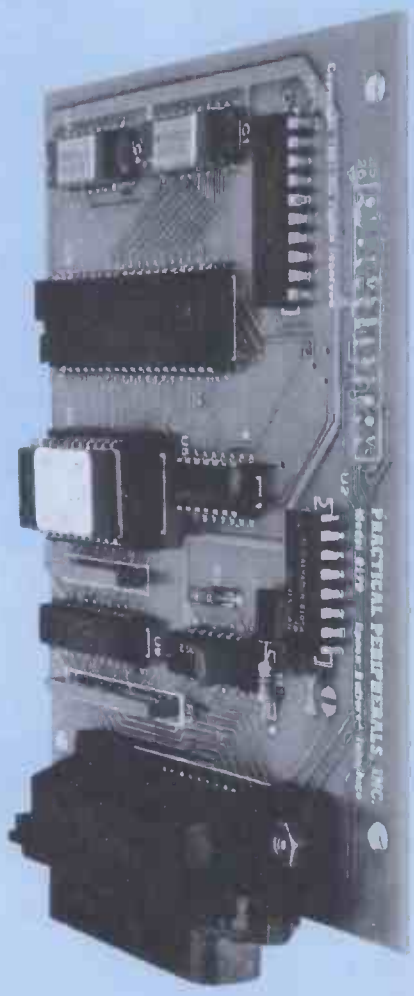

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Even if you're still waiting for your BBC Computer, you can become an expert on the machine with this special, three-part delve into its innards: expansion possibilities, use of the sound generator and a detailed memory map of the system. To kick off, Paul Beverley of Norwich City College talks about expanding the 'Beebon'.

EXPANDA-BEEB!

If you have been trying to sort out how the BBC Computer actually works, either from a hardware or software point of view, you will probably have come to the same two conclusions as I have. Firstly, it's a very complex system, but secondly it is extremely versatile and expandable. Everything possible seems to have been done to ensure that this is not a 'dead-end' machine which you will have to throw away after a year or two when its basic technology is, inevitably, superseded. As you can see from Figure 1, the basic computer is just the starting point for connecting to all sorts of other systems.

Obviously the system supports all the usual peripherals — VDU, cassette, disk, etc — but the most important single feature which ensures that this system will keep going much longer than most is the Acorn Tube. I have no doubt that some other manufacturer could, and possibly will, come out with a machine which, on the face of it, has the same features as the BBC machine, but is only half the price and is available off the shelf. But beware of imitations! If it does not have an Acorn Tube then it will be a dead-end machine.

The Tube

What's so special about the Tube? Well, it's a high speed (2MHz) communication system requiring a quite complex hardware interface (in a ULA!) to pass bytes back and forth between two processors. It uses FIFO buffers and interrupts, so it allows true parallel processing. The idea is that the 6502 on the main board should handle all the input and output (keyboard, VDU, printer, cassette, disk, user ports, etc) which all takes quite a lot of computing time, while the second processor does the language processing, calculations and so on.

The first gain you get from this is that the processing speed, even using a 6502 as second processor, is more than doubled. The reason is that, with only one processor, every time it wants to output some data it has to stop its calculations, output the data and then pick up the calculations where it left off. With two processors, however, the second processor, having done some calculations, simply shoots the data off down the Tube, allowing the I/O processor to deal with it in its own time, and carries on with the calculations unhindered.

Those who are not so keen on the 6502 will be pleased to know that you do not have to use the same processor on either end of the Tube. You could equally well use a Z80 as the language processor so that you can take advantage of its superiority over the 6502 for data processing applications. Also, choosing a Z80 second processor opens up the vast array of CP/M software currently available, since the Z80 second processor board which Acorn is producing is said to be 'fully CP/M compatible'. However, you obviously cannot use any of the CP/M software which is machine specific, so that rules out virtually all the 380Z software, for example.

The other factor giving an overall speed improvement is that both the Z80 and 6502 second processor boards will be working at a clock rate of at least 3 MHz and Acorn is in fact trying to push the speed up to 4 MHz.

Why stop there? Why be satisfied with a Z80? Acorn is at present developing a second processor board using the National chip, the 16032, which, it is also hoped, will run at 4 MHz and Unix, UCSD, Pascal, Fortran, Cobol and at least another half dozen other high-level languages are being talked about for 'sometime in '83'. That would give the machine a level of processing power similar to some of the present day minicomputers at a fraction of the cost and, some would say, with much greater reliability. Acorn says it is trying to get all these boards on the market by the autumn.

Memory expansion

Apart from the gain in speed achieved by using a second processor, there is also a gain in size and speed of memory access. The maximum amount of memory which one 8-bit processor can address is limited to 64 kbytes — and this has to include both ROM and memory-mapped input/output, as well as RAM. The model 'B' BBC Computer has 32 kbytes of ROM, memory-mapped I/O, and 32 kbytes of RAM but, since to make use of the highest resolution of graphics you need 20k of RAM, and since nearly 4k is used up for operating system workspace, serial I/O buffers, sound buffers, soft key buffers, etc, you are really down to about 8k for your program and variable storage.

Paged memory expansion

One possible means of improving on this that has been provided is the capacity for accessing an extra 64k of RAM, ROM or I/O in a 'paged' mode via the 1 MHz extension bus. That is to say, you store the top eight bits of the auxiliary address in a special register (FCFFH) and then as you read and write to locations FD00H to FDFFH you will actually be addressing locations in the specified page of the auxiliary RAM — but obviously this is much slower than accessing the on-board RAM. This is not only because the access is at 1 MHz rather than the 2 MHz at which the 6502 is running, but because of the time taken in setting up the paging register. Also, some thought would have to be given to the software implementation of this system. For more information on this you could get a copy of 'Application Note 1: The 1 MHz Extension Bus', on sale from Acorn.

Second processor memory

If you have a second processor, even an 8-bit one, it will immediately provide an extra 64k of addresses. There will have to be a small 'bootstrap' ROM on the second board in order to get it started on power-up, but Acorn suggests there will be the capacity for 60k of RAM on both the 6502 board *and* the Z80 board. Also, this RAM will be accessed at the full 3 or 4 MHz at which the second processor is running.

If you then go to the 16-bit second processor, you are into the megabyte region in terms of memory capacity. We don't yet know what Acorn will be providing in the way of RAM with the new board, but the 16032 has an addressing range of 16 megabytes (24-bit address)

EXPANDA-BEEB!

which should be enough for most applications! You may think that this amount of memory would be prohibitively expensive, but no doubt by the time the board is in production the price of RAM will be only a fraction of its present cost and 16 megabytes will be reasonably realistic. If you doubt whether Acorn really intends to implement the 16-bit second processor, just take a look at the cassette tape format and you will see that all addresses are 32 bits long, and not 16 bits as in all currently available 8-bit machines.

Language expansion

Anyone who has used the RML 380Z will appreciate the advantages of holding the high level language interpreter in RAM instead of ROM. It makes the system very flexible in that you can use Basic one minute and then, say, Pascal the next. However, anyone who has used the cassette version of the RML 380Z will also know the disadvantages of this idea. The time spent loading 16k of high level language every time you want to use the machine, and the frustration of crashing the machine by over-writing the interpreter through injudicious POKEing, can soon dampen one's enthusiasm for the idea.

In the BBC machine, however, you get what seems to be the best of both worlds. Resident in the machine at any one time you can have up to four different 16 kbyte interpreters. Acorn says that these will include Pascal, Forth and Lisp, a CAD package and a word processor, and also possibly Comal for the ardent structurists! Also I am sure that as this machine becomes more widely used, independent companies will be producing alternative interpreters.

Swapping between languages is simplicity itself. When you first switch on the machine you find yourself in Basic or whichever language ROM you have in the default position, and then to change to another language, you simply say '*PASCAL' or '*LISP'. This can be done either in immediate mode or from within a program; so it will be possible, without the user being aware of it, to change from one language to another *even as a program is running!*

This is possible because, on power-up, the operating system interrogates each of the installed ROMs to find out how much 'private' workspace and how much 'public' workspace it needs. It then reserves the requisite amount of private space for each ROM, decides on the largest amount of public space needed by any one ROM and sets the value of PAGE accordingly. This ensures that the ROMs can all work together without overwriting each other's private workspace but minimises the total amount of workspace by defining a public 'scratch-pad' area.

Command lines

The other very important feature for software expansion is the command line structure. Any command which is prefixed by an asterisk is called a command line and is 'offered' to each of the language ROMs in turn to see if they recognise it. If they do, then they will execute it, but if it is not recognised by any of the language ROMs it will be passed on to the service ROMs — graphics packages, voice synthesiser, user EPROMs, etc, and if it is not on their list of commands it is finally passed to the current file system, disk or net, where, if a file of that name exists, it will be loaded and executed.

ROM cartridges

Another form of expansion which has been provided is the strange-looking hole at the left-hand side of the keyboard. This is not to provide extra cooling but to allow you to plug in ROM cartridges — rather like the Atari games cartridges. These could contain professionally-produced applications programs which, as a matter of interest, will be extremely difficult to copy as they could only be RUN and not LOADed. This will be very useful in situations where the user is to be a complete computer novice. Also they could be used to provide an alternative character set or to give extra vocabulary to the voice synthesiser.

Although I have spoken of these applications of the ROM extension as alternatives, it should be noted that you can in fact have up to 16 ROMs all piggy-backed onto the same connector — that is to say electrically piggy-backed, not piled up on top of each other! So, when a command line is encountered which is not recognised by any of the language ROMs, it will be passed on to the ROMs within the cartridge to check whether each in turn might recognise it.

Machine operating system

It is the use of a very extensive (16k) machine operating system which makes it so easy to change high-level interpreters. What this means is that the sort of things you need to do in any language, such as writing to the screen, reading and writing to cassette, disk, serial I/O, printers, etc, are all provided as firmware subroutines. Many of these routines are vectored so that if you want to intercept them you can redirect them to some code you have written by changing the appropriate vector. Also it means that changing filing systems from cassette to disk or net is just a matter of changing the vectors.

Many of the firmware routines have been provided with expandability. If you look at the VDU calls especially, you will see that many of them are followed by strings of zeros, 'to allow for future expansion'. For example, to change logical colour 1 to actual colour 6 you use 'VDU 19,1,6,0,0,0', the last three zeros being redundant to the call. Similarly, the so-called 'advanced graphics call', VDU23, 0 has to have a total of 10 bytes in it. The third byte is the register within the 6845 CRT controller chip and the fourth is the data that you want to put in it. Then you need to follow it with six zeros. That represents a lot of future expansion!

Incidentally, if you want to 'see' the internal workings of the machine, try this:

MODE 4 (or any other two colour mode).
VDU19,0,4,0,0,0 (change background colour)
VDU23;12;0;0;0 (use zero page upwards as video RAM).

You will then see what an 'interrupt driven machine' looks like.

Extension bus

I have already mentioned the 1 MHz extension bus with reference to memory expansion, but there is much more which can be hung on this bus than just 64k of paged addresses. First of all you could use some of the 64k addresses for memory mapped I/O — such as the 6522 versatile interface adaptor, as is used for the printer and user ports on the basic machine — and you could also address a number of ADC and DAC devices such as the ZN427 and ZN428 which, having tristate buffers, can be put directly onto the data bus. This would then make complex data acquisition systems a distinct possibility. You could also make use of these addresses for your own machine code routines by storing them in EPROM. Acorn is already in the process of producing a suitable programmer for the BBC micro. The list of applications of the 1 MHz bus is endless, limited only by your imagination.

Paged addressing only uses addresses &FCFF to &FDFF, so there is almost the whole of page &FC00 to be accounted for. The idea is that this should be used for memory-mapped devices that only have a small memory requirement. As you can see from the system plan, it is this bus onto which the Teletext and Prestel acquisition units are connected. Here are the preliminary allocations which Acorn is suggesting:

FC00 — FC0F Test hardware
FC10 — FC13 Teletext
FC14 — FC1F Prestel
FC20 — FC7F Not yet allocated
FC80 — FC8F Test hardware
FC90 — FCBF Not yet allocated
FCC0 — FCFE User Applications
FCFF Paging register for 64k paged addresses
FD00 — FDFF Access to paged memory

As you will also see from the system plan, the bus will support Eurocards and there are already a number of these available from Acorn, originally intended for the Systems 3, 4, and 5 but equally applicable to the BBC system. You will, however, need some sort of buffered back-plane if you want to use more than one card — again Acorn is busy preparing one for production at the moment.

The actual Eurocards currently available include a 'universal' interface for digital I/O including 6522 and 8255 parallel I/O chips and a 6850 for serial I/O. Then there's a laboratory interface which has 16 I/O lines, optically buffered with an output drive capability of 3 amps at up to 48 volts, and an analogue interface with two 12-bit DACs and an eight-channel, 12-bit ADC with a conversion time of 100 µs per channel, all controlled by a 6522 VIA. There's also a 32k dynamic RAM card

— but don't forget that it is only accessible in the paged mode and then only at 1 MHz. So if it's extra memory capacity you need, then you should go for a second processor board.

Econet

Another very powerful expansion facility is the Acorn Econet. This will be particularly useful in schools and colleges but could also be put to good use in business applications. It is a simple communication system using only a cheap four-wire telephone type cable to link together up to 254 computer stations which can be Atoms, Systems 3, 4 or 5, or BBC Computers. Apart from allowing any machine to communicate with any other machine, the idea is that you should be able to use it to allow a number of machines to share the use of expensive peripherals such as disks or printers. One of the systems has to be dedicated as a 'file server' and another as a 'printer server', though either of these systems can revert immediately to being ordinary systems if disks or printer are not required. If you divide out the cost of the disks, printer and server systems among the number of other systems which have immediate access to them, its cost effectiveness very soon becomes apparent.

Intelligent terminal

Another exciting possibility for schools and colleges is to use the BBC Computer as a terminal to a mini or mainframe computer. This is made possible by the RS423 interface and the programmable serial processor (another ULA!) which provide bi-directional data flow with control through 'ready to send' and 'clear to send' lines. The RS423 standard is compatible with RS232, but has superior drive capabilities. Since the serial processor is programmable, it is a simple matter to select the baud rates for transmit and receive and these can be any of the standard rates up to 9600 baud — at a push it will even go up to 19,200 baud though Acorn doesn't guarantee its operation at this speed. It is worth noting that the transmit and receive baud rates are set separately so that split rates can be used, ie, when the user transmits, since it comes from a keyboard, its speed is limited and you would therefore use a relatively slow transmission rate, but the big computer's replies can be relatively fast, depending on the length of cable and/or the limitations of any modem.

What is much more exciting is the possibility of using the BBC micro as an intelligent colour graphics terminal. It would seem on the face of it to be a relatively simple piece of programming to allow the mini or mainframe to control the BBC's colour graphics. The idea of a room full of BBC machines linked on an Econet to common disks and printer which could then link straight into a mainframe would be extremely attractive, giving you the best of both worlds — the processing power and memory capabilities of the mainframe plus the independence of the micros. And certainly if we are talking in terms of cost effectiveness for an educational establishment, there can be nothing currently available to touch this system.

I still have not mentioned the on-board A-to-D converters which could be used for games applications or scientific measurement, or the light pen input which has a variety of applications. Then there is the user I/O which employs a 6522 versatile interface adaptor and can be used for a very wide range of control applications. So, even without any major expansion, the machine has quite a fair bit of control capability.

Conclusions

I'm sure there will be various criticisms of this new system, but it seems to me that it has the potential for a very wide range of applications. I think that the area where it will be most heavily used will be education, especially with the Econet system and the possibility of use as dumb or intelligent terminals, but I can also see the system getting quite well used in business applications, especially with the Z80 second processor running CP/M — though I do think it will need a better quality keyboard in this area.

The other area in which it may well be quite extensively used is in scientific and simple industrial control. It represents, in terms of hardware, a cheap solution to many simple control and monitoring problems and a number of companies are already considering its use in terms of IEEE 488 bus applications.

All in all, it seems to me that whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present — although where one leads, others will follow. Judging by the current sales figures, I don't believe that even those recalcitrant ULAs will stop this system becoming the best-selling computer system in Britain and maybe even in one or two other countries.

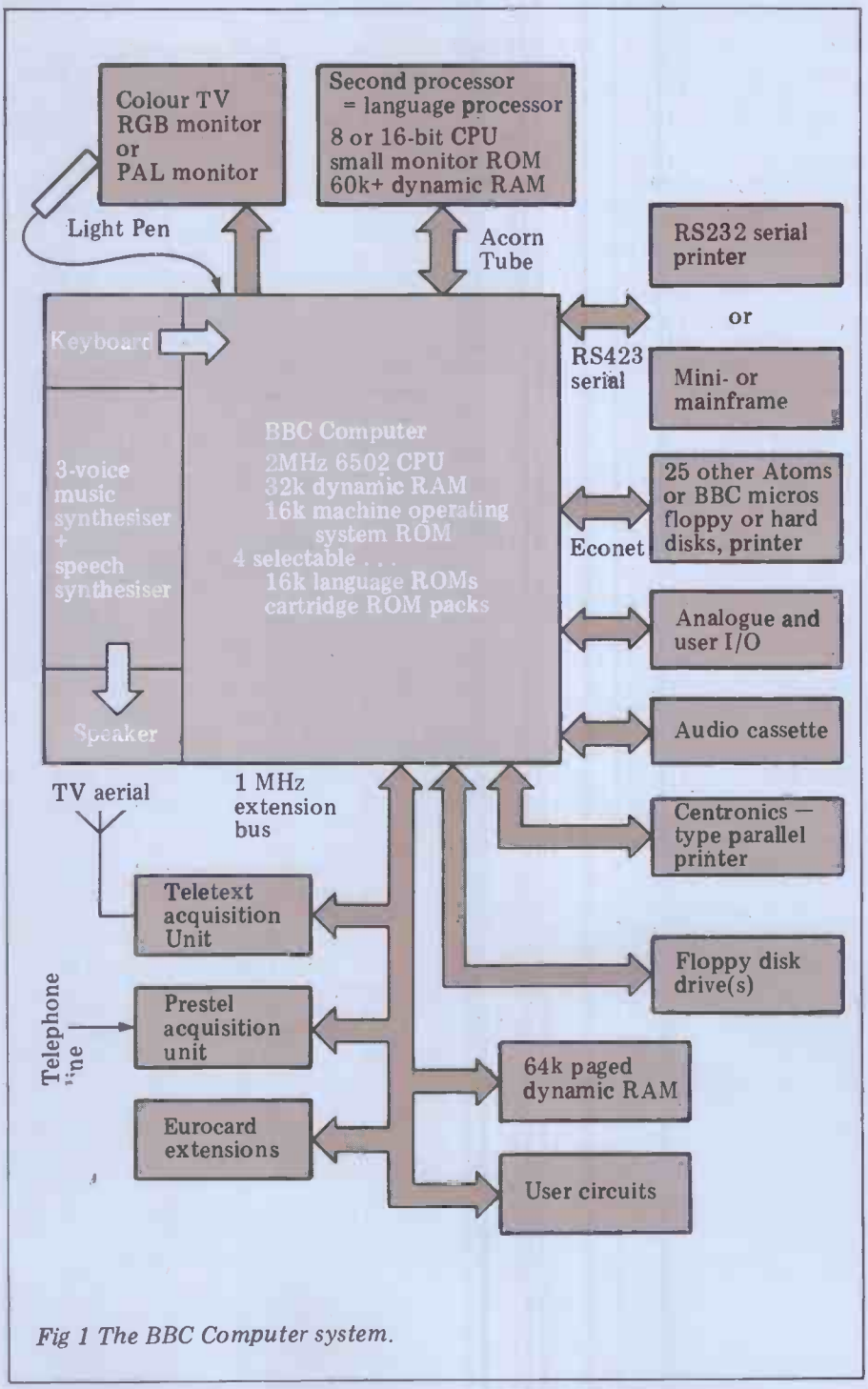


Fig 1 The BBC Computer system.

ANATOMY OF THE BBC MICRO

If you've been struggling to get sound out of your BBC micro, Mark Holmes can help you.

SOUND ADVICE

Many users of the BBC Computer will have been very disappointed to discover the lack of information on the control of the sound generator in the User's Guide. Those of us hoping to learn something from the noise producing programs on the 'Welcome' cassette became more dismayed on discovering that these noises had been created using a short machine code routine accessing the memory-mapped SN76489 directly. The sound generator provides four independent channels, three of which produce independently programmable square waves and the fourth which can be programmed to produce either grey noise or a pulse wave.

The power of the sound generator system lies not in the choice of chip, which is not the most exotic available, but in the software which handles its control. Once a sound is programmed and initiated, the microprocessor is returned to the user. Updating the sound is achieved by interrupting the processor when required, enabling complex sounds to be generated requiring extensive control with the minimum of awareness from the programmer.

There are two commands available from Basic for the control of the generator: SOUND and ENVELOPE. The SOUND command causes a sound request to be added to the sound buffer and thus queued for output. The sound buffer can store up to four SOUNDs for each channel, not including the one currently executing. SOUND is described by one 16-bit parameter and three single byte parameters. The ENVELOPE command is described by 14 single byte parameters defining frequency (pitch) and amplitude (volume) envelopes for a sound. An envelope is a description of how a sound varies in note and volume; a full appreciation of how the shape of the envelope affects the sound produced can only really be gained through experimentation and the process of trial and error.

The SOUND command can be used either to produce a sound of constant frequency and amplitude or to produce a sound predefined by the use of the ENVELOPE command — see Figure 1 which produces a long, low-pitched note.

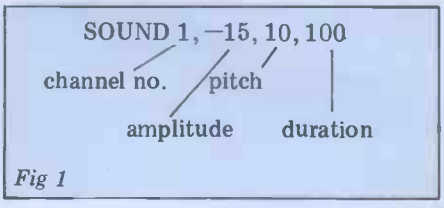


Fig 1

The duration can be in the range of 0-255; a value of 255 gives a note without end and durations of less than 255 define the duration of the note in 50ms units.

The pitch parameter describes the initial frequency of the sound within a range of 0 to 255. The available preset frequencies are based on quarter semitones, I believe.

The amplitude or envelope number can be used either to describe the amplitude of a note of constant pitch and amplitude if it is a number in the range −16 to −1, or to identify a predefined envelope in the range 0 to 15.

The channel parameter is a two-byte value passing four separate items of information. The least significant four bits (or hex digit) describe the destination channel for the sound. As 0 is a reasonable default value for the other sub-parameters (these being the other three hex digits) this parameter will mostly be passed as a single decimal digit in the range 0-3, corresponding to the channel number. The most significant next digit can be a 0 or a 1: if it's 1 the sound buffer will be flushed and the sound passed immediately to the generator, otherwise it will be queued.

The second most significant digit enables the synchronisation of up to four sounds to be played as a chord. The value, between 1 and 3, describes the number of other sounds having the same value for this parameter required before the chord can be sounded, eg:

SOUND &0201, −14, 150, 20
SOUND &0202, −12, 100, 40
SOUND &0203, −10, 50, 60

The third most significant digit may be 0 or 1. This parameter allows a 'dummy' sound to be sent to the generator which has no effect other than to allow the previous sound to be heard when it might otherwise be truncated.

Figure 2 shows the form which the ENVELOPE command takes. The first parameter is an index in the range 0 to 15 which identifies the envelope, as used for the SOUND command. The second parameter, in the range 1-127, describes the time intervals at which the envelope is updated in units of 10ms. This will normally be 1, allowing rapid changes in the envelope, but longer, more extended sounds are possible by using greater values for this parameter. If the top bit of this parameter is set, the frequency envelope will only be run through once even if the end of the frequency envelope is reached before the amplitude or duration terminates the sound; otherwise, the sound will cycle through the frequency envelope, restarting as the end is reached.

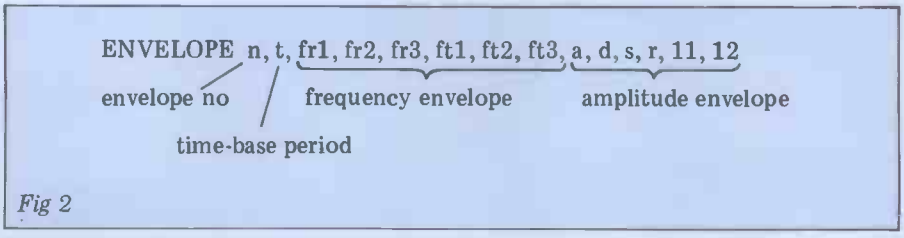


Fig 2

For example, try:

ENVELOPE 1, 1, 3, −3, 3, 20, 20, 20, 127, 0, −127, −127, 126, 0
SOUND 1, 1, 30, 100

or

ENVELOPE 1, 129, 3, −3, 3, 20, 20, 20, 127, 0, −127, −127, 126, 0
SOUND 1, 1, 30, 100

The frequency envelope is separated into three segments for envelope definition. Each segment is described by a pair of parameters which define the segment in terms of a rate of change of frequency and a number of time units for which this rate holds.

fr1, fr2 and fr3 describe the rate at which the frequency changes during a given segment. This rate is described by a value between −127 and 127, where a negative value describes a decreasing frequency and a positive value an increasing frequency.

ft1, ft2 and ft3 are values in the range of 0 to 255 and describe the number of timebase units during which the rate of change is applied — see Figures 3 and 4. If a large rate of change is used over a long period, the sound will cycle through the range of frequencies several times, creating some interesting effects.

The amplitude envelope follows the pattern used by some other sound generating devices, that is the ADSR system (attack, decay, sustain, release). The first four parameters of the amplitude section correspond to these elements and the final two parameters describe the amplitude levels at points within the envelope. The attack parameter describes the rate at which the amplitude rises to level 1 (range 1 to 127). The decay parameter, a slight misnomer, can describe a rate of rise or fall to the second amplitude level (range −127 to 127). The third amplitude parameter, sustain, describes the rate of fall from the second level to the end of the sound as defined by the duration in the SOUND command. The sustain parameter, like the release parameter, describes the rate of fall of the sound after the 'official' end of the sound. This part may be truncated by a following sound in the same channel and so use of a dummy sound may be called for — see Figure 5.

If the value of decay is 0, the sound will continue at an amplitude set by level 1 until the end of the sound. If the value of sustain is 0 then the sound will continue at level 2. If the value of the

release parameter is 0, the pitch and the amplitude reached at the end of the duration will be continued *ad infinitum*.

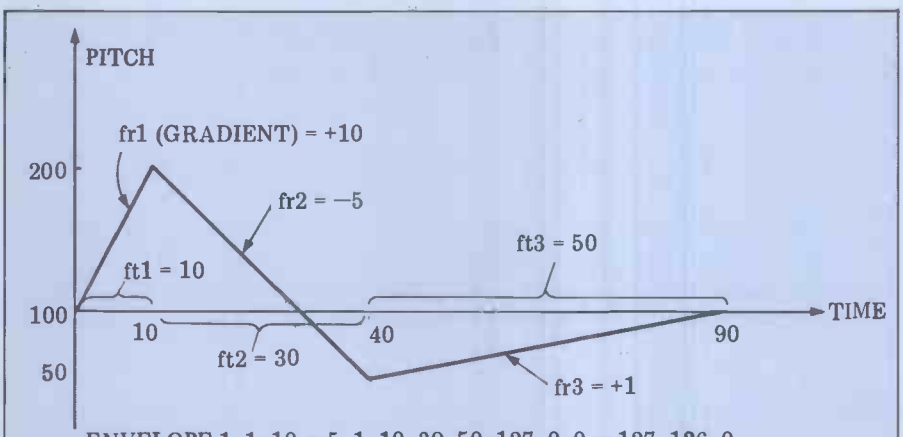
Channel 0, the 'noise' channel, is controlled principally via the pitch parameter of the sound command. If bit 2 of this parameter is set then the channel will produce grey noise, otherwise it will produce a pulse wave. Bits 0 and 1 control the frequency of a pulse wave. If both bits are set then frequency will be linked to the frequency of channel 1, eg:

```
10 ENVELOPE 1, 1, -1, 1, -1, 40, 40,
   40, 127, 0, 0, 0, 20, 0
20 SOUND 1, 1, 30, 40
30 TIME=0:REPEAT UNTIL TIME>500
40 FOR I=0 TO 7
50 SOUND 0, -15, I, 100
60 PRINT I
70 NEXT I
```

This short program demonstrates what sounds can be made via the noise channel. The FOR. . . NEXT loop index used to provide the different value for the 'pitch' parameter of SOUND is printed out as each SOUND is placed in the sound buffer. The first five values are rapidly printed as the sound buffer fills up, subsequent numbers are printed more slowly as vacancies occur in the buffer on the termination of the earlier sounds. There is no synchrony between the printing of the numbers and the sounds emitted.

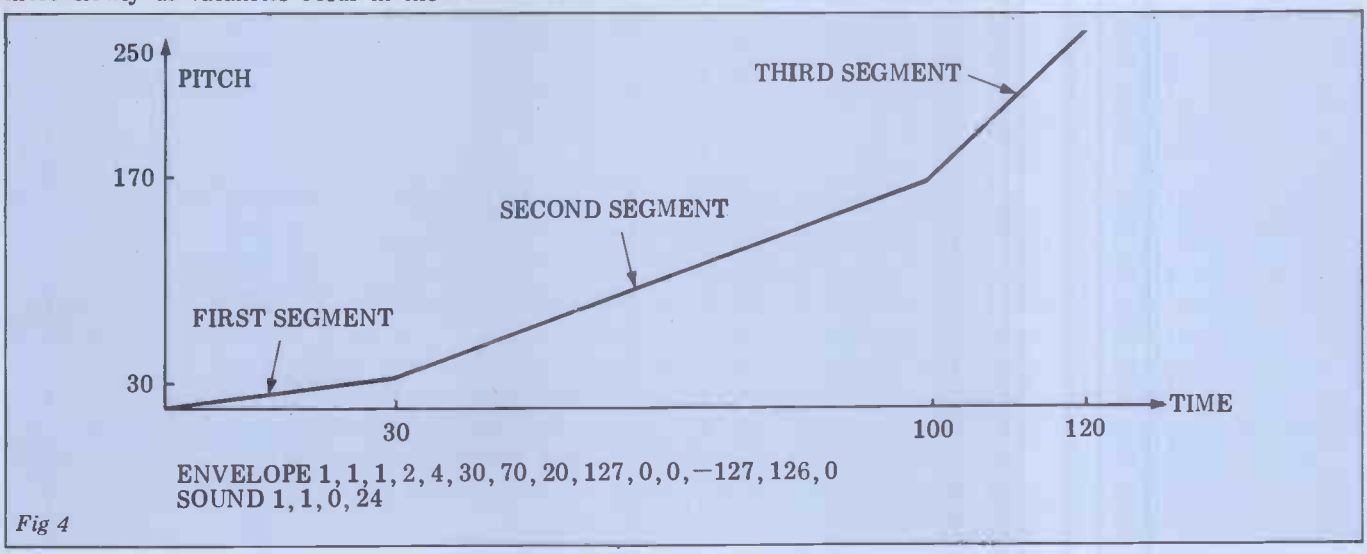
The actual duration of a generated sound will depend on either the duration as defined in the SOUND command or the description of the amplitude envelope in the ENVELOPE command that is the sound will end if the amplitude reaches 0. The value of the release parameter will have no effect if this occurs.

To achieve maximum effect from the sound generator, I recommend you use an external speaker. A 3-4in speaker placed in a suitable box or tube for resonance, produces a considerable increase in volume and improvement in tone. A 3.5mm jack-socket enables the connection of the external speaker, hi-fi amplifier or an earphone. The latter may be advisable if the computer shares the living room with other members of the family.



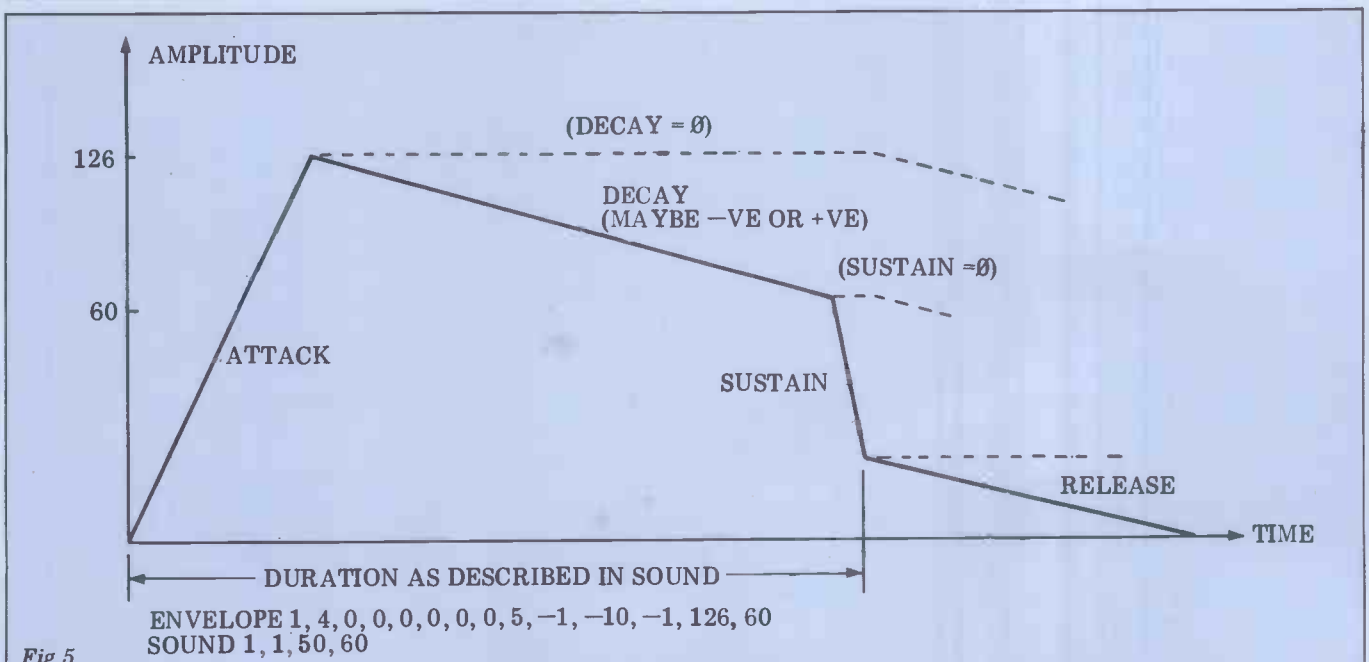

```
ENVELOPE 1, 1, 10, -5, 1, 10, 30, 50, 127, 0, 0, -127, 126, 0
SOUND 1, 1, 100, 18
```

Fig 3




```
ENVELOPE 1, 1, 1, 2, 4, 30, 70, 20, 127, 0, 0, -127, 126, 0
SOUND 1, 1, 0, 24
```

Fig 4




```
ENVELOPE 1, 4, 0, 0, 0, 0, 0, 0, 5, -1, -10, -1, 126, 60
SOUND 1, 1, 50, 60
```

Fig 5

A Guide to good British Software

"Lesson No. 1 What is DMS?"

DMS is Britain's best selling records management program for micro computers. You can think of DMS as a computerised super-efficient filing cabinet. Nearly 3000 companies, colleges, hospitals and other organisations use DMS to increase efficiency.

"What machines does it run on?"

It runs on all Commodore Machines, plus virtually any micro with an operating system known as CP/M or MP/M. This includes the ACT SIRIUS, the NEC PC 8000, the Rank Xerox 820 or 860, Superbrains, Apples with CP/M cards, the ICL Personnal Computer. The Rair Black Box, the Sharp MZ 80B, the LSI M2 and M3, and the Caltext, and all machines with standard 8" disks.

"Who uses it?"

It's designed for use by managers, secretaries and clerical staff. They use it to make life easier by storing their personnel records, their student or patient records, their stock records, library lists, contract records, customser and client records, parts files, property and policy records etc etc.

"How do I use it?"

All instructions are in everyday conversational English, so you need never have used a computer before. Just tell DMS what information you need to store, then type your records on to disk. Once they are on there you really start to reap the benefits. For instance DMS will find an individual records for you to check, amend or print, or it will find all those which meet various parameters handling batches of record faster than you could imagine possible. It can sort them into any order needed to print lists, or transfer the information into your wordprocessor (eg Wordstar, Spellbinder, Wordcraft, Wordpro and User Written Software etc) to do selective mailing. It even gives a little extra help by printing labels to match. Or it can do some clever calculations. Or print reports, write letters, to your own special layouts. Every facility is designed to save you time, remove those tedious clerical tasks and make your organisation more efficient. More than anything, DMS allows you to have all your information at your fingertips as soon as you want it.

"How much does it cost?"

Work on the Commodore version costing around £290, and the CP/M versions from £400. Staff can be trained on regular courses run at our training centre, and both versions now have their own internal mini word processing system.

"What about Lesson No. 2?"

Ring Compsoft Ltd, on
Guildford (0483) 898545,
or write or visit us at
Hallams Court,
Shamley Green,
Nr Guildford, Surrey GU4 8QZ.

We also have a well trained regional dealer network.
Ring us for details.

David Christensen has been taking the Basic ROM apart and reports his findings.

MAPPING OUT THE BEEBON

One of the useful features built into the BBC Computer is the built-in assembler. This facilitates the writing of very powerful machine-code programs, but the process can be made easier still if existing firmware routines can be called. To make this possible, I have compiled a memory map for the machine.

The map is derived from one of the first released machines, which the Department of Industry used for prizes in its MAP schools competition. I would like to thank Portsmouth Grammar School's Computing Department, and in particular the Director of Computing, Mr Roy Thornton, for allowing me to use their BBC micro for this map.

The machine, originally a Model A but upgraded to allow it to talk to a printer, had the language installed in ROM, but the Machine Operating System (MOS) was only in EPROM. Since this gave 'No filing system' errors with *DISK/C and *NET without checking the presence of the required hardware and since there is no room to add these functions, Acorn must be going to substantially update the ROM from the version I studied. For this reason, I am giving here only the memory map of the Basic used areas.

Throughout the map I have used hexadecimal as the numbering system for addresses. To be consistent with the BBC usage, I am using '&' to represent hexadecimal.

What the map covers

The memory map is in several parts. The page usage section summarises the use of each page of memory (a 'page' is a block of 256 bytes; &X00 to &XFF — this would be Page X).

The action addresses section lists all the Basic keywords, with the token that represents each, and their action addresses (where applicable). Keywords with tokens less than &8F do not have their action addresses stored in a table and neither are they jumped to from the standard despatching routine. Instead, they are dealt with as they are encountered — ie, the procedure is along the lines of 'get byte from Basic text. Is it &84? If so, jump to &9B14, else carry on'. Because of this, they may be dealt with in more than one place — the location I have given is the principal one. A token of &8D precedes a line number in text. The line number is stored neither in ASCII nor hex but in a complicated manipulation of the hex of the number. The reason for this is not readily apparent — I would be grateful if anyone could enlighten me on this subject.

The zero page locations section outlines the use made by the language of zero page. Not every use of each location is given, otherwise locations like &37,38 would need about a page each, but I have tried to include all the important ones. Much of zero page is not used. In the Model A machine I was using, none of &50 — 9F was used, although the user guide only guarantees that &70 — 8F is reserved for the user.

The ROM locations section gives the locations of various routines in the Basic ROM. Where applicable, I have given the entry points to the routines — they may well go lower in memory than the location specified, as well as higher. The map is not continuous — there are some routines between those given which I have not stated, either because they are fragments which on their own perform no function or because they are unimportant.

Basic interpreter operation

The basic operation of the interpreter is very much to Microsoft standards, although there are several striking differences compared to something like PET Basic. The most obvious is the existence of a Basic stack, located at the top of Basic memory (ie, just below HIMEM) which moves downwards. It is used as a temporary store for anything from variable references (when evaluating expressions) to the entire used part of the processor stack (when performing PROC, etc). The Basic stack pointer is a two-byte pointer in memory locations &04,05.

Another obvious difference is that there is no routine in the BBC micro equivalent to CHARGET in the PET. This means that, as far as I can see, the only way of adding extra commands to the Basic is to intercept the error handling routine and to test for a new command when a syntax error is encountered. The error handling routine can be intercepted because of one of the peculiarities of the BBC micro — when an error condition is encountered, the interpreter executes a 6502 BRK instruction located immediately before the error message. The BRK handling routine, after restoring the stack and pointing &FD,FE to the location of the BRK instructions, performs a JMP (&0202) which normally jumps to &B433 which performs ON ERROR. Note that if no ON ERROR is provided by the user, the interpreter still needs a Basic error handling program to execute and for this reason &B433 — &B460 contains the text of the following Basic program:

```
REPORT: IF ERL<>0 PRINT
"at line"; ERL;
PRINT: END
```

It is conceivably possible, therefore, that the contents of &0202,0203 could be altered to point to a routine which would check for additional commands and afterwards re-enter execution of the Basic. It would, however, be much more difficult than intercepting CHARGET on the PET. This use of the BRK vector would make it difficult to include a monitor in any later versions of the ROM.

The writer(s) of the interpreter seem to have a strong dislike for indexed loops. This means that the firmware is slightly faster, but much larger, than the equivalent 'indexed' written version.

The overall form of the interpreter could be described as 'well structured'. For instance, the main 'evaluate expression' subroutine, if entered at the highest possible level (which is one above the normal entry point of &9B03), proceeds as follows:

```
928C  JSR  &9B03
9B03  JSR  &9B4C
9B4C  JSR  &9B76
9B76  JSR  &9C1D
9C1D  JSR  &9DAE
9DAE  JSR  &9DFD
9DFD  JSR  &AE1B
AE1B  LDY  &1B
etc.
```

This nest of subroutines can be entered at any level, depending on the range of keywords allowable in the expression to be evaluated. Examination of these stages in this nest of subroutines also clearly shows the operator hierarchy.

The arithmetic in the interpreter contains several nice features: when rounding, it performs the binary equivalent of rounding to the odd last digit in a number when the next least significant one is 5, eg 33.15 rounds to 33.1 while 33.25 rounds to 33.3. Also, square roots are calculated by using Newton's successive approximation method and performing only five iterations after the initial approximation.

Most arithmetical routines test to see if integer arithmetic can be used, and use it wherever possible. This is another of the speedy features of BBC Basic.

MAPPING OUT THE BEEBON

For example, using one of A% to Z% as the control variable in a FOR loop is about three times as fast as using a floating point variable. Also,
FOR I% = 1 to 10000 :
A% = B% + C% : NEXT
is twice as fast as
FOR I = 1 TO 10000 :
A = B + C : NEXT

The method of storing variables is very different to that used in, for example, the PET. Separate regions are not allocated for numeric, string and array variables, but they are all put one after another from TOP (the end of the Basic program) upwards. As well as this, the 'system integer variables', ie, @% to Z%, are stored from &0400 onwards @ % at 0400, A% at 0404, B% at 0408, etc) and the memory from &0480 onwards is used to keep a catalogue of the variables:

0482,3 points to first variable starting with A
0484,5 points to first variable starting with B
04C2,3 points to first variable starting with a
04F4,5 points to first variable starting with z
04F6,7 points to first definition of a FN
04F8,9 points to first definition of a PROC

Within the variable storage area, all variables are stored according to the same general format, as shown in Figure 1. The top of the variable storage is pointed to by &02, 03, which I have called VARTOP.

The program is stored according to the format in Figure 2.

One of the few things I have found that could be called a mistake in Basic is to do with the allocation of strings; if the following program line is encountered:
100 A$ = "ABCDEFGH"
then ABCDEFGH is transferred into variable storage space.

This also occurs when data is read from DATA statements. This means that, for example, allocating a 100 byte-long value to a string from data statements actually uses 200 bytes of memory. You might not consider this too much of a problem, but with a Model A in Mode 4 with, say, a 600-byte program, you only have 2k of RAM available for variables. If you wanted most of your variables to be strings stored in data statements, you would then find you had a meagre 1k at your disposal, not the 2k you might expect.

This problem cannot be avoided with the method of manipulating strings used in the BBC micro, but a slightly different method would allow the string pointer to point into the Basic program text.

I have come across several interesting facets of the language: TAB (x,y) does not skip over characters on the screen, but under certain circumstances erases them with spaces; EVAL (" ") gives 'no such variables' rather than the 0 you might expect; INPUT "ENTER X", X, "ENTER Y", Y is a valid syntax; the SOUND command has the following syntax: SOUND OSC, CHANNEL, FREQ, DUR, where OSC is the voice number 0-3 (0=white noise generator), CHANNEL specifies the envelope to be used (if it is negative, the 'default envelope' is used with a volume equal to the absolute number given with −15 = max volume), FREQ is 0 − 255 and DUR is 0 − 254 (255 means 'don't stop'); ENVELOPE is followed by 14 parameters, which are signed bytes (ie, 255 = −1): ENVELOPE CHANNEL, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, VOLUME. It is not easy to describe what all of these do, but some of the simpler ones are shown in Figure 3. With the white noise generator, there are eight basic sounds selected by frequencies 0 − 7. Programmers writing rifle-range type games may be interested in this sound:
ENVELOPE 1,0,0,0,0,0,0,0,0,1,0,254, 100,128
SOUND 0,1,5,1

See page 88 for further details of SOUND and ENVELOPE.

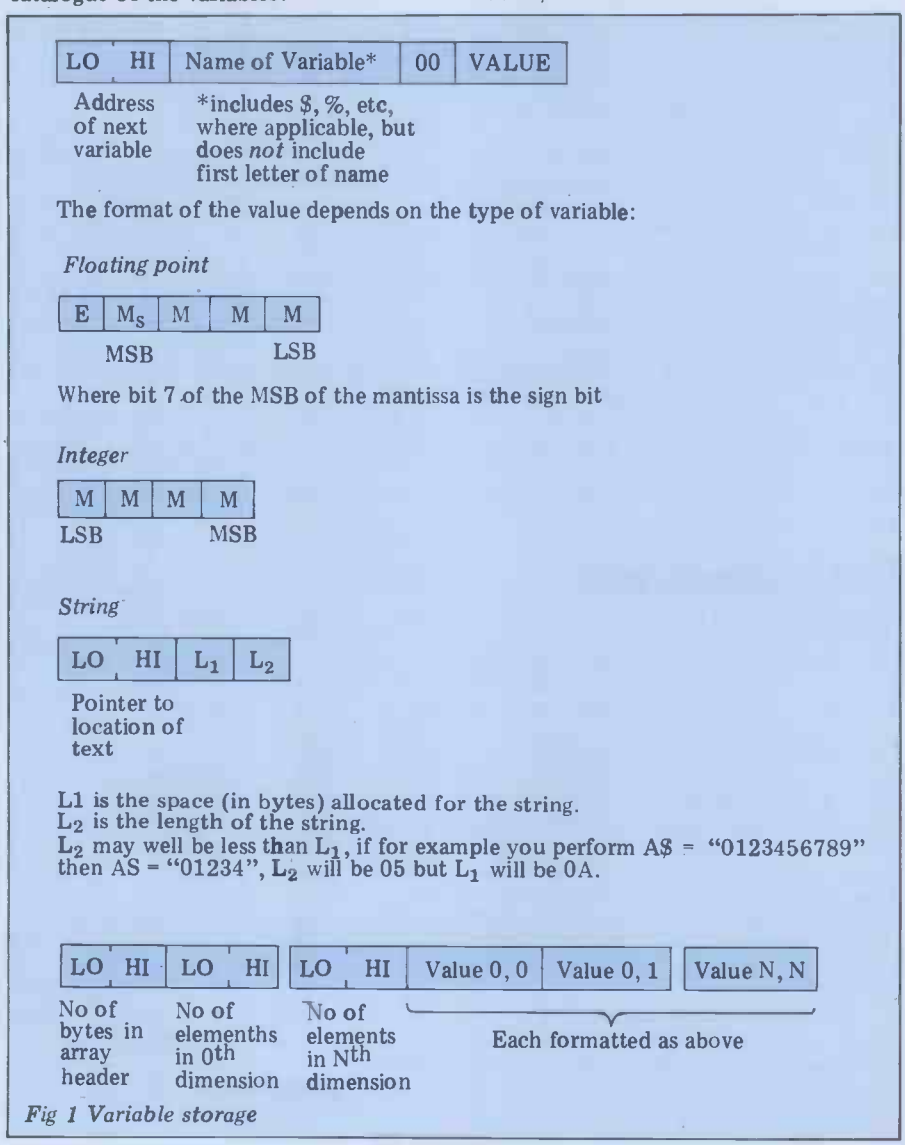


Fig 1 Variable storage

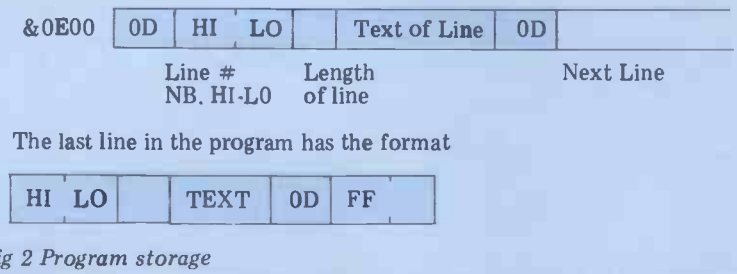


Fig 2 Program storage

Useful routines

Figure 4 outlines some of the most useful routines. Many of the mathematical functions (eg, SQR, LN, etc) can l accessed from machine code by calling an address three higher than the action address, but this will not work for all of them (eg, LOG).

If you want to write hybrid Basic/assembler programs, as most machine-code programmers will, then variables can be transferred into and out of machine code using the very powerful 'CALL' command; this is best explained with an example. Suppose you want to access from machine code the values of the variables A, B% and C$, and the machine code starts, very imaginatively, with the label 'BEGIN'. Then the Basic statement would be
CALL BEGIN,A,B%,C$
This would set up a parameter block at &0600 onwards which would contain &0600 03 05 AB 0F 04 BC 0F 81 CD 0F.

This shows that there are three parameters (from &0600): the first is

floating point (&0601 = 05) and is located at 0FAB; the second is integer (&0604 = 04) and is located at 0FBC; the third is a string variable (&0607 = &81) and is located at 0FCD.

For a full list of what type of variable is represented by which number, see the user guide description of CALL.

The 'value' (in the same sense as that used in the description of variable storage, above) of each variable is stored starting at the location given. Note that for a string this is the 'String Information Block' as outlined above.

When a variable needs to be manipulated, it must first be unpacked from memory. This is done by storing its type in &2C, and its address (ie, that given in the parameter block, even for strings) in &2A,B. Then JSR &B35B. Integer variables will be unpacked in IAC, floating point into FAC#1 and string variables into the string buffer. Note that this is on top of the CALL parameter block, so if you want to access the parameters after string manipulation, it would probably be best to transfer the parameter block (from &0600 to &0600+ (06FF) inclusive) into Page 13 (ie, &0D00 onwards) and use the latter as parameter block. Of course, this latter region will be used for other things if you have disks!

Values can be reallocated to variables as follows: for a numeric variable, store the type of the variable in &39, and the type of result you have obtained in &27 (ie, saying whether it is in FAC#1 or IAC), and point to the value of the variable in &37,38. Then JSR &B4E3. For a string variable, store the value of the string in &0600 onwards, its length in &36 and point to the variable's 'string information block' with &2A,2B. Then JSR &8BD3. This will work when the length of the string is now longer than the space originally allocated, and will then allocate a new space.

Other points

Graphics can be accessed from machine code using the VDU codes via OSWRCH &FFEE or &FFE3). For further details see Chapter 7 of the user guide. POINT cannot be performed via OSWRCH and must be done as follows: store the coordinates of the point in the order Xlo, Xhi, Ylo, Yhi in consecutive memory locations. Make XR, YR, lo-hi point to the first of these, load the accumulator immediately with 9 and JSR &FFF1. The location immediately after the four given will contain the result — if it is negative, the point is off the graphics screen.

Many of the '*' commands are described in the *User Guide* but some are not, or only partially. These include:

*DEBUG: This does nothing at all on the version I studied.

*MOTOR: *MOTOR 0 turns the cassette motor off; *MOTOR 1 turns the cassette motor on.

*NOTAPE: this turns off the tape filing system. Attempting to use the tape before *TAPE or TAPE3 will give 'No filing system'.

*SPOOL: *SPOOL "FILENAME" performs the reverse of EXEC, causing all output to be copied to the tape. This is reversed (ie, default o/p restored and file closed) by *SPOOL with no filename.

Many of the *FX commands are outlined in the user guide. Some that aren't are:

*FX0: gives firmware message ("OS EPROM 0.10").

*FX4: selects keyboard mode. *FX4 1 means that INKEY$, GET, etc, will return ASCII values for certain control keys including cursor keys.

*FX11,x: sets delay (by x, which must be a number not a variable) before a key repeats when held down, in 100ths of a second. The default value is 50.

*FX12,y: Sets delay between key repeats, default of 7.

*FX15,0: Clears keyboard buffer.

*TVa,b: modifies the video display output. 'a' modifies the vertical sync position, which means that if your display has one line missing off the top of the screen, *TV255,0 will rectify this (since 255 = —1). Similarly, to get a missing bottom line back on the screen, *TV1,0 will solve the problem. However, this will not work if the display is too tall, only if it is in the wrong place. 'b' modifies the interlace mode of the display, and is of little practical use unless you are contemplating taking pictures of the display. Note that *TV only takes place when the MODE is changed.

If you want to stop the cursor blinking annoyingly throughout your program, then !&FE00 = &10200A should solve the problem. The cursor can be retrieved either by moving the copy cursor, or with !&FE00 = &10720A in mode 7, or !&FE00 = &10670A in other modes.

▶

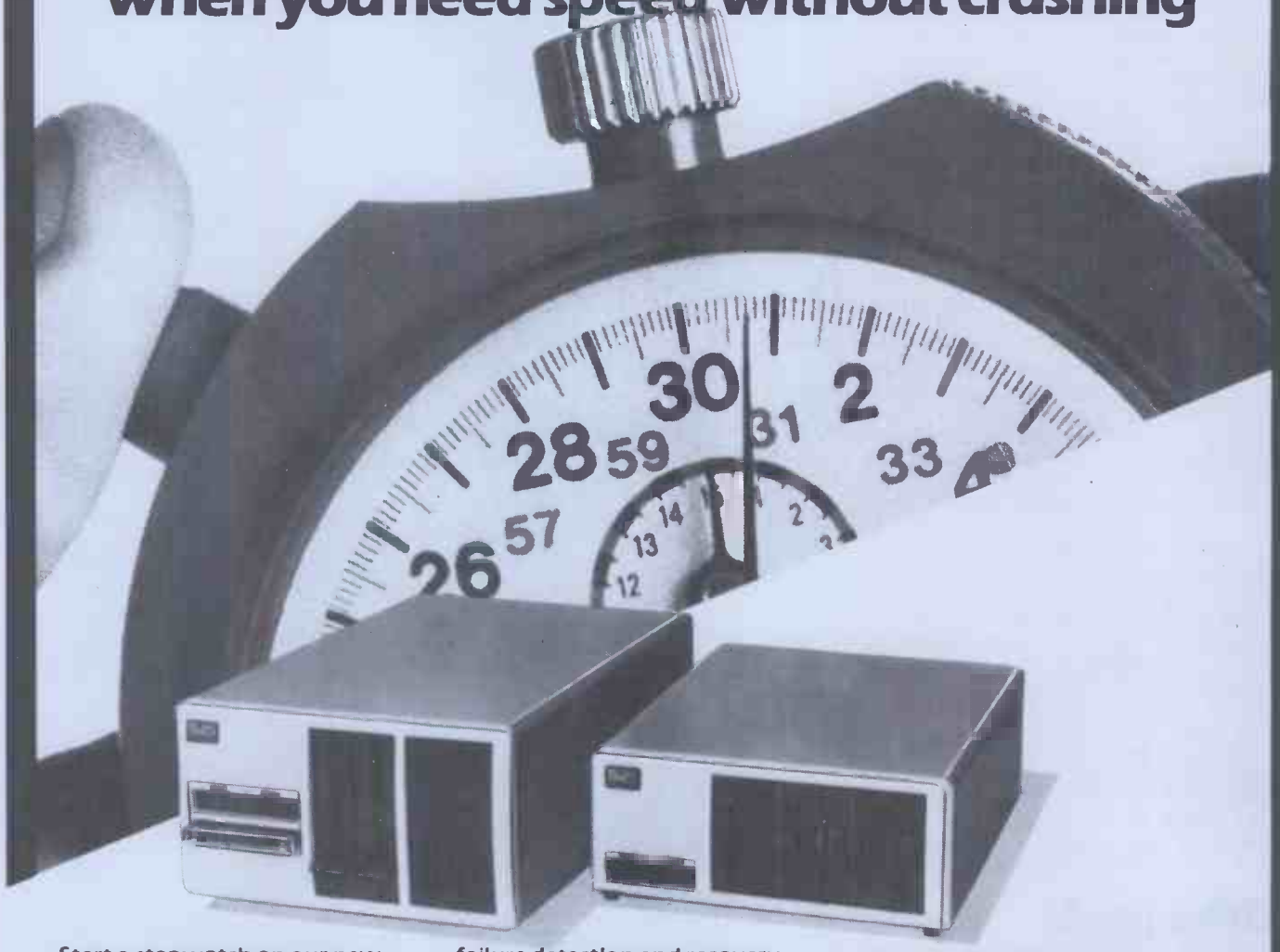
Parameter	White Noise Generator (OSC = 0)	Tone Generator (OSC 1—3)
P2	Speed of Execution	Delay on Attack
P3	Basic Attack 'Melody'	Frequency sweep speed (Fss) on Attack
P4	Basic Sustain 'Melody'	Fss on sustain
P5	Basic Decay 'Melody'	Fss on Decay
P6-8	Modifiers of P3 —5 respectively	
P10	Attack Speed	
P11	Sustain parameter	
P12	Decay Speed (use 128 — 255)	
P13	Start volume on Attack (which will also affect the speed at which sound will repeat)	

Fig 3 Envelope parameters

Address (&)	Function	Set Up	Output
9834	Test escape key	None	If escape not pressed, has no effect. Else performs same function as Basic would.
B571	O/P char in AC updating COUNT	Char in AC	Uses AC only
AE9C	Evaluate ASCII for Hex and store result in IAC	(&19),&1B points to the start of the text	In IAC. AC=&40 on exit.
BC17	Input string from keyboard into string buffer at &0600	None	&37,38 points to the start of string (at &0600) YR= no of chars in string
AC5A	Calc VAL of string in buffer	&36= Length of string eg, JSR &BC17 STY &36 JSR &AC5A will work	If result is a (small) integer then AC = &40, result in IAC else AC = &FF, result in FAC#1
AE1B	Evaluate simple expression	(&19),&1B points to start of text	As &AC5A
9ED0	Assemble ASCII string of number	If number in IAC, YR = &40 If in FAC#1, YR = &FF Decimal o/p if &15 is +ve, otherwise in Hex.	Stored in &0600 Length in &36
A691	FAC#1 = 0	None	In FAC#1
A6A4	FAC#1 = 1	None	"
A6B0	FAC#1 = 1/FAC#1	None	"
A50E	FAC#1 = FAC#1 + variable	&4B,4C points to value of variable	"
A505	FAC#1 = FAC#1 — variable	"	"
A50B	FAC#1 = variable — FAC#1	"	"
ADA0	FAC#1 = —FAC#1	None	"
A661	FAC#1 = FAC#1 * variable	&4B,4C points to value of variable	"
A6F2	FAC#1 = FAC#1 / variable	"	"
A6B8	FAC#1 = variable / FAC#1	"	"

Fig 4

TURBOCHARGED PERFORMANCE:
when you need speed without crashing



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MAPPING OUT THE BEEBON

Page number	Use
&00	Zero page
&01	Processor stack
&02	OS use
&03	OS use
&04	0400-0480 system integer variables 0481-04FF variables catalogue
&05	FOR/REPEAT/GOSUB stack
&06	String buffer
&07	Line input
&08	Sound, envelopes
&09	RS423 transmit buffer
&0A	RS423 receive buffer
&0B	Soft key buffer
&0C	Character definitions
&0D	Disk workspace
&0E	Start of Basic program buffer
&0E-3F	Model A Basic/user RAM
&0E-7F	Model B Basic/user RAM
&80-BF	Language ROM
&C0-FD	OS ROM
&FC-FD	Fred & Jim expansion buses
&FE	Memory-mapped I/O
&FF	OS ROM

Table 1 Page usage

Location	Function
00-01	LOMEM lo-hi
02-03	VARTOP (top of variables)
04-05	Basic stack pointer
06-07	HIMEM lo-hi
08-09	ERL lo-hi
0A	Offset for text pointer
0B-0C	Text pointer
0D-11	RND store
12-13	TOP lo-hi
14	No of chars in PRINT field
15	Flag - bit 7 set => hex o/p for PRINT
16-17	ERROR vector default to &B443
18	PAGE hi byte
19-1A	Secondary text pointer
1B	Offset for 2ndary text ptr
1C-1D	Ptr - reset to PAGE
1E	COUNT
1F	LISTO option
20	TRACE flag &FF=on
21-22	Max TRACE line number
23	WIDTH
24	No of REPEATs left
25	No of GOSUBs left
26	15*no of FORs left
27	Variable type: &00=string, &40=integer, &05=f/point &A4=FN, &F2=PROC, &00=byte
28	OPT value for a-sembler
29-2B	Assembled code buffer
2A-2D	IAC (integer accumulator)
2A-2B	Pointer to variable
2C	Variable type
2E	FAC#1 sign / POINT parameter
2F	FAC#1 overflow/underflow byte
30	FAC#1 exponent
31-34	FAC#1 mantissa
35	FAC#1 rounding byte
36	Length of string
37-38	Object loc in assembler RENUMBER ptr Ptr for variable name in DIM Line crunching ptr Action address JMP vector
39	Length of variable name
39-3A	No of bytes into array that variable is ptr to keyword table RENUMBER/DELETE line no
3B-3C	Ptr for RENUMBER/No of inserted spaces in LISTO
3B	FAC#2 sign
3C	FAC#2 over/underflow byte
3D	FAC#2 exponent
3E-41	FAC#2 mantissa
42	FAC#2 rounding byte
3C-3D	Ptr used in DEF
3D-3E	Ptr used in search for line/ crunching
3F	Array type: &05=f/pt &04=string
3F-47	Hex o/p nibbles
42-47	Numeric work area
43	Temp store used in calculating exponents
48	Counter in series evaluation
48-49	Ajustments factor for ASCII/ f/point conversion
4A	Temp store used in calculating exponents
4B-4C	Ptr to current variable
4D	File no temp store
4D-4E	LISTO pointer/INPUT flags
4F	
50-6F	Not used in basic Model A
70-8F	Guaranteed empty
90-FF	ROM workspace
FD-FE	Pointer to error message
FF	Flag: -ve if escape pressed

Table 2 Zero page locations

37-38	Pointer to file name
39-3A	Load address: 4 bytes, least to most significant, &3B set FFFF
3D-40	Execution address: 4 bytes as above
41-44	Program save - lower limit: 4 bytes as above
45-48	Program save - upper limit: 4 bytes as above

Table 3 Zero page load/save block

8000	Jump to language initialisation
8003	Jump to cold start
8007	ROM titles
801F	Language initialisation
806D	Table of keywords & tokens
835A	Action addresses - lo bytes
83CB	Action addresses - hi bytes
84AE	Assembler tables
84ED	Assembler entry point
856A	Output hex of AC then a space
8570	Output hex of AC
87E4	Get byte from ASCII
87ED	Crunch one word
88AB	Test char in AC: C=1 if alphanumeric
88CA	Get char from line
88D3	Crunch entire line of text
88D9	Crunch part of text
8A13	Get byte from Basic text, pointed to by (&19), &1B
8A1E	Get byte from Basic text, pointed to by (&0B), &0A
8A35	Check presence of ',' and move text ptr to it
8A80	Warm start
8B14	Evaluate next statement
8B7E	'Type mismatch error'
8BAA	Deal with '=' on start of line (in DEFFN)
8BC3	Deal with '*'
8BD0	Allocate value to string variable
8C36	Perform $xxxx = string
8C4B	'No room' error
8C5B	Pull string off stack into buffer
8CCD	Perform PRINT#
8E3E	Out message pointed to by (&19),Y within quotes
91D7	Increment IAC
91EB	(&2A,2B) = (&2A,2B)*(&3F,40)
928C	Eval expression, result in IAC
9292	Get Integer parameter from Basic text
941B	Search for FN/PROC
9429	Search for variable pointed to by (&37,38), length of name in &39
94AD	Set up FN?PROC references
94BC	Set up new variable name
94F7	Clear newly-created variable
9548	Set up variable references (&2A,2B) points to variable
95A9	Set up variable reference
967B	Set up string variable references
96AB	Set up array references
9789	Check array subscript size
97E2	Check '=' and then evaluate RHS of expression
97FA	Check next char is '='
9810	Skip rest of statement testing escape
9826	Move past code
9834	Test escape key

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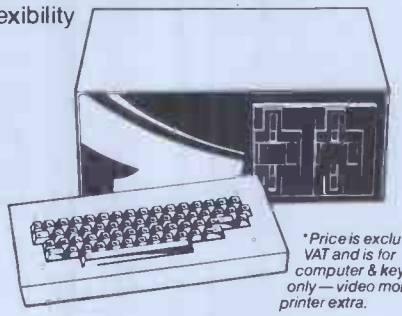

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MAPPING OUT THE BEEBON

9839	Syntax error
9851	Move to next statement with trace output if necessary
9893	Copy pointers then evaluate expr
98D6	Do TRACE output if req
98C2	Search for ELSE & execute it
98F1	Out decimal for no in &2A,2B, lo-hi
9942	Search Basic for given line no, if not found, C=1
9B03	Evaluate expression (main entry point)
9BEF	Concatenate strings
9DFD	Evaluate expr & get non-space char into XR
9ED0	Assemble PRINT output string
9E81	Assemble hex output string for PRINT
9EB9	Assemble floating point output string
A04B	Convert AC to dec ASCII & store in string buffer
A057	Store char in string buffer, incr'ing pointers
A06C	Get f/point number from ASCII
A188	FAC#1 = FAC#1*10 (acting on mantissa only), preserving AC
A1CB	Get sign of FAC#1
A20F	Copy FAC#1 into FAC#2
A23E	FAC#1 = FAC#1/10
A2AF	Convert fixed to floating
A2F4	Normalise FAC#1
A33F	Unpack variable into FAC#2
A37E	Pack FAC#1 to memory
A3A3	Unpack &046C onwards to FAC#1
A3A6	Unpack variable to FAC#1 - pointed to by (&4B,4C)
A3D8	Round FAC#1
A3F2	Floating to fixed conversion
A463	Clear FAC#2
A476	Convert sign in &2E and mantissa in &31-4 to signed integer in &31-4
A4C4	Incr mantissa of RAC#1
A4DE	Swap variable and FAC#1
A61E	FAC#1 = FAC#1*FAC#2
A68B	Test for under/overflow
A691	Clear FAC#1
A6A4	FAC#1 = 1
A6B0	FAC#1 = 1/FAC#1
A6B8	FAC#1 = Variable/FAC#1
A6F2	FAC#1 = FAC#1/Variable
A889	Power series evaluation
AC5A	Calc VAL of string in buffer & store in FAC#1
ACFA	IAC = NOT(IAC)
AD94	Make IAC positive
ADA0	FAC#1 = -FAC#1
ADB5	Complement IAC
ADDC	Scan input line
ADF8	Scan string
AE1B	Evaluate single part of expr - final destination of Evaluate Expression subroutines
AE85	Check ')' present after evaluating expression
AE9C	Get IAC value from hex in text
AF07	Convert byte in AC to fixed pt in IAC
AF19	Put AC,YR lo-hi into IAC (clearing higher bytes
AF85	Move &00XR to &00XR+3 into IAC
B141	Search for DEF in Basic prog
B25F	Pull processor stack off Basic stack
B27C	Transfer variables into FN/PROC
B35B	Unpack variable specified (type & locn) by IAC into IAC/FAC#1/string buffer depending on variable type
B433	Entry to error-handling routine
B443	Default error vector for ON ERROR, contains 'REPORT:IF ERL<>0 THEN PRINT "at line";ERL;[new line] PRINT:END
B4DD	Evaluate expression and then...
B4E0	Get variable descriptor from Basic stack then...
B4E3	Assign value to numeric variable
B4F2	Store value of IAC in variable
B53A	Out char in AC, de-crunching if token
B571	Out any char, updating COUNT
B57B	Out space, updating COUNT
B911	Deal with ON ERROR
B9ED	INPUT#
BC17	Input string into buffer
BC1D	Input line of text after printing AC as prompt
BC42	Out <CR>, clearing COUNT
BC4A	Remove Basic line from program (specified by line no in IAC), C=1 if line not found
BCAA	Insert line into Basic program
BCE9	Cold start
BD38	Reset Basic pointers
BD69	Pack FAC#1 onto Basic stack
BD96	Incr Basic stack ptr & point (&4A,B) to f/point variable now below it
BDA8	Push value of variable (type spec by AC: 00=string,f/point;&40=fixed pt) onto Basic stack
BDAC	Push IAC onto Basic stack
BDCA	Push string (&0600 to <CR>) onto Basic stack
BE02	Pull IAC from Basic stack
BE23	Pull variable descriptor off Basic stack
BE42	Lower Basic stack ptr, checking memory available
BE5C	Store IAC in &00XR to &00XR+3
BE7A	Load program then...
BE88	Re-link Basic program
BEAB	TOP = TOP+YR
BEDE	Get parameters for load/save
BFAE	Get file# (for PRINT#, INPUT#, etc) into AC and YR

Table 5 Inside the Basic ROM

Token	Address	Keyword
80	9B54	AND
81	9DE7	DIV
82	9B2F	EOR
83	9DDE	MOD
84	9B14	OR
85	--	ERROR
86	--	LINE
87	--	OFF
88	--	STEP
89	8DF2	SPC
8A	8DD9	TAB(
8B	--	ELSE
8C	--	THEN
8D	--	line no
8E		
8F	BF50	=PTR
90	AEEF	=PAGE
91	AEE3	=TIME
92	AF2B	=LOMEM
93	AF32	=HIMEM
94	AD8D	ABS
95	A8C6	ACS
96	AB56	ADVAL
97	ACC4	ASC
98	A8CC	ASN
99	A907	ATN
9A	BF78	BGET
9B	A989	COS
9C	AF26	=COUNT
9D	ABE7	DEG
9E	AFCE	ERL
9F	AFD5	ERR
A0	AC12	EVAL
A1	AAB4	EXP
A2	BF4F	EXT
A3	AEF9	FALSE
A4	B1C4	FN
A5	AFE8	GET
A6	ACD3	INKEY
A7	AD08	INSTR
A8	AC9E	INT
A9	AF00	LEN
AA	A804	LN
AB	ABCD	LOG
AC	ACF7	NOT
AD	BF85	OPENIN
AE	BF81	OPENOUT
AF	ABF0	PI
B0	AB64	POINT(
B1	AB92	POS
B2	ABD6	RAD
B3	AF78	RND
B4	ABAD	SGN
B5	A994	SIN
B6	A7B4	SQR
B7	A6C9	TAN
B8	AF0B	TO or
B9	ACEA	TOP
BA	ABFB	TRUE
BB	AC55	USR
BC	AB9B	VAL
BD	B3EE	VPOS
BE	AFEE	CHR$
BF	B055	GET$
C0	AFFB	INKEY$
C1	B068	LEFT$(
C2	B01D	MID$(
C3	B0C3	RIGHT$(
C4	B0F1	STR$
C5	ACDE	STRING$(
C6	905F	EOF
C7	8ECE	AUTO
C8	BF2D	DELETE
C9	B5B5	LOAD
	B5A0	LIST
CA	8A7D	LISTO
CB	8A3D	NEW
CC	8F37	OLD
CD	BEFA	RENUMBER
CE	9839	SAVE
		Syntax
CF	BF39	error
D0	9239	PTR=
D1	927B	PAGE=
D2	9224	TIME=
D3	9212	LOMEM=
D4	B461	HIMEM=
D5	BF61	SOUND
D6	8E6C	BPUT
D7	BF33	CALL
D8	9326	CHAIN
D9	BF9E	CLEAR
DA	8E57	CLOSE
DB	8E5E	CLG
DC	8AED	CLS
DD	8AED	DATA
DE	90DD	DEF
DF	93A5	DIM
E0	8A50	DRAW
E1	9310	END
E2	B49C	ENDPROC
E3	B7DF	ENVELOPE
E4	B8B4	FOR
E5	B8EB	GOSUB
E6	932F	GOTO
E7	9893	GCOL
E8	BA62	IF
		INPUT
E9	8B57	LET
EA	92D5	LOCAL
EB	935A	MODE
EC	93A1	MOVE
ED	B6AE	NEXT
EE	B934	ON
EF	93EF	VDU
F0	93AE	PLOT
F1	8D33	PRINT
F2	92B6	PROC
F3	BB39	READ
F4	8AED	REM
F5	BBFF	REPEAT
F6	BFE6	REPORT
F7	BB00	RESTORE
F8	B8D5	RETURN
F9	BD29	RUN
FA	8A59	STOP
FB	9346	COLOUR
FC	9243	TRACE
FD	BBCC	UNTIL
FE	B4CC	WIDTH
FF	9839	Syntax error

Table 4 Basic action addresses

END

P FOR PERFECT?

Sue Eisenbach and Chris Sadler start a three-part look at the UCSD p-System.

As programmers we were ripe candidates for the microcomputer revolution when it came to Britain in 1978. We had been working on a course timetabling program on a large remote batch-oriented mainframe. The program consisted of 1500 lines of Algol 68, all of which the remote mainframe insisted on spooling out in front of any results. Unfortunately, the local site set a limit of 700 lines of output per run and had very strict operators. We were unable to find out how to either suppress the listings or get the line limit lifted. Our rather extravagant solution was to submit the program 10 times for each data set. This ensured that the output of one run would finish printing while the operator was taking a coffee break.

Once the project was completed, we decided that there had to be a better method of producing programs. The new personal computers had great appeal. We were not really worried about the limitations of the hardware. What we lost in absolute computing power we would more than make up in availability — our machine could run continuously all weekend if need be. What we were concerned with, however, was the state of micro software. It seemed that all that was around was Basic and assembler, neither of which had much appeal. Then we saw a small ad in *Byte* magazine for something called UCSD Pascal.

History

In the early '70s Ken Bowles and Mark Overgaard at the University of California at San Diego (UCSD) foresaw the advent of microcomputer systems. They were teaching programming in an environment similar to the one we found so frustrating. In 1974 they, with a group of students, started a project to develop software for the up-and-coming inexpensive hardware. Rather than producing a cut-down version of mainframe or mini system software, the UCSD project aimed to provide the single user with a congenial environment in which to develop programs.

The main feature of the congeniality took the form of specifically designing the interaction between user and system to occur via a VDU screen. Most operating systems at the time (and this is still the case today) were designed to interact through a slow-printing terminal so that the machine's response (the 'promptline') tends to be a terse one or two-character (eg, A>) message, which cannot convey very much information. Using the faster screen, on the other hand, the p-System is able to display as its promptline a list of the commands available in the current mode — clearly a great deal more information for the user. (If there are more commands at a particular level than will fit on one line, then a '?' will bring up the next line.)

The other side of interaction is input from the keyboard and good system software should keep its input requirements to a minimum. On a printing terminal, this consists of having short utility names (eg, PIP) whose options are controlled by sub-commands ('switches') which appear on the same line. With the screen-oriented p-System, however, since all the available commands are displayed in the promptline, each utility is selected by a single character and the particular options filled in by subsequent prompting and (usually single character) replies. Although helpful for the novice, this scheme might sound slow since several responses are required from the user instead of just one — but there is a type-ahead buffer so that expert users who know what they want can type in at full speed.

The second decision which the UCSD group had to make concerned the hardware on which the software would run. To keep options open, and in order to cash in on the expected drop in hardware prices, this decision had to be deferred as long as possible. The classic way of doing this had been inspired by Wirth in his design of an implementation for Pascal. Instead of producing a compiler for an actual machine, he wrote one for an ideal 'pseudo' or p-machine. From there it is relatively simple to produce a p-code 'interpreter' program which simulates the p-machine on a particular real system.

The UCSD team's idea was to extend this concept to the entire operating system. They started with a Pascal compiler which produced pseudo-code for the p-machine. Then the system software (editor, file-handler etc) was written in Pascal. Now the entire system could be moved (including all application programs) from machine to machine as new, cheaper computers appeared, simply by writing a new interpreter. (This approach would have been useful to, for instance, Digital Research, which now has to try to get its creaking 8080-based software running on the new, powerful 16-bit 8088/8086 and 6800 systems.) Of course the interpreter cannot execute p-code as fast as the 'naked' processor could execute its own machine code but, in general, p-code programs are more compact than native-code programs and so what you lose in speed you gain in space.

Work done in American universities is frequently done against the background of the 'public domain', whereby work funded by public money should be available on demand to members of the public. Accordingly, the first few versions of the UCSD p-System (up to version I.3) which ran on DEC PDP-11s and LSI-11s were in the public domain and were distributed as such. Subsequent versions were somewhat differently funded and began to migrate from machine to machine, so that versions I.4 and I.5 could run on 8080/Z80 systems and version II took in the Apple as well. By the time they had hit version II.0 the University of California was making a lot of money, so much so that by 1979 the Internal Revenue was becoming interested in reversing the direction of funding.

The University gave Bowles two choices — close down the Pascal project altogether or move the revenue-earning parts of the operation (ie, the distribution and support of p-Systems for the public) off the campus. Accordingly, Bowles revoked all the licences that had been issued from version I.4 onwards (including ours!) and began looking for a buyer. The obvious microcomputer software house, Microsoft, was not particularly interested in his terms and Bowles insisted on dealing only with firms which had a 'track record'. Eventually, in 1980, SofTech, a major American software house (whose main work is in military contracts), set up a special division (SoftTech Micro Systems) which became the new licensee for the UCSD p-System.

At present there are an estimated 100,000 p-Systems (compared with 300,000 CP/M systems) in existence; the majority (approximately two-thirds) of which are Apple Pascal systems; but there are also Pascal Microengines (a Western Digital product which implements the version III p-machine in micro-code) and an increasing number of SoftTech's new version IV. There are p-interpreters for 8088/8086, Z80, 8080/8085, 6502, 6809, TI9900, PDP and LSI 11, VAX, Z8000 and 68000 processors.

Several manufacturers support the p-System as an operating environment (sometimes exclusively) for their systems — notably Philips, Western Digital, Apple, Texas Instruments and IBM; and anyone who scans the Japanese micro magazines will be surprised at how frequently the characters 'UCSD' turn up among the Kana. For owners of systems whose manufacturers don't support it, SofTech provides 'adaptable' systems. In particular the 'CP/M adaptable system' can be brought up on any standard CP/M system, extracting information about the underlying hardware from the CP/M system software.

Many people associate UCSD with its famous Pascal compiler: few realise that, in addition, it provides a development environment for programming in Fortran 77, Basic, APL, Lisp, Modula-2 and various assembler languages (and cross-assemblers). There is an active Users' Society in the US — USUS (the UCSD p-System User's Society — about 1000 members) and in this country USUS(UK) (about 150 members). Both of these bodies hold frequent conferences and share a software library which is available free to all members.

Prices

The price of the p-System depends on from whom it is bought, which version

of the p-System is purchased and whether extra memory is required. The version that runs on the Apple II requires additional memory (to make it a 64k system) and can be purchased for £225. The Apple III p-System is available for £150. The version II p-System is available for the North Star Horizon for £180, while the version III p-System is included in the price of the MicroEngine. Version IV for the Superbrain can be bought for £350. SofTech sells all its software unbundled and has recently announced price rises. The operating system and compilers are $400 each (30 percent discount for educational establishments) while smaller pieces of software tend to be between $50 and $100. These prices are all for object code only. SofTech charges vast sums (eg, around $20,000) for source code of different components of the system.

In contrast, source code of Version I.3 (in the public domain) should be available soon from the USUS library.

SofTech's address is: SofTech Microsystems, 9494 Black Mountain Road, San Diego, CA 92126, USA. USUS(UK)'s address is: Mark Woodman, Membership Sec USUS(UK), Department of Mathematics, The Open University, Walton Hall, Milton Keynes.

Applications software

Many people say that the p-System is too academic for the real world because it lacks a sufficiently wide applications base. The question of applications packages is particularly acute today as relatively cheap 16-bit systems come onto the market. Of the 8-bit operating systems, CP/M undoubtedly has the most applications packages, but the bulk of these are written in 8080 assembler, which is not directly executable on the 8086/88 (let alone on the 68000 or Z8000). Apparently the conversion process has proved non-trivial (even with the aid of proprietary packages) and the results tend to execute at about the same speed so, for all the new technology, the customer may as well stick to the Z80. There is more to portability than getting 'A>' to come up on the screen.

Knowing about this problem, most manufacturers of 16-bit systems looked about for a good 16-bit operating system under which new applications packages could be developed. They came up with Unix, which provides a development environment for professional programmers with lots of powerful utilities. Unfortunately, its user interface is also designed for professional programmers, and the history of microcomputing reveals that fortunes are made by providing computer power to the user rather than to the programmer, so Unix-based systems are unlikely to have immediate, pervasive market appeal. Besides, being a minicomputer operating system (whatever machine it's actually running on), Unix is fairly greedy about resources (memory and disk) and the current crop of 16-bit machines don't have the required storage capacities.

Although much less famous than either of these, the p-System seems to lie midway between the two (and appears to offer the best of both worlds); like CP/M, it has an applications base (although smaller); like Unix, it provides a good program development environment (although not so well equipped with utilities).

On the next page is a list of applications packages which run on the UCSD p-System. We have only listed those which we know to be available in Britain. (SofTech supplies a catalogue which lists some 139 packages from 81 suppliers, mostly American.) Most of those listed were developed on and are supplied for Apple computers, these being the most populous group of p-Systems. Unless they depend on graphics (which can be ported — see next article) there is probably no reason why they shouldn't run on other p-Systems, but enquiriers should check this with individual suppliers.

We'd like to thank Edinburgh Regional Computer Centre Microcomputer Support Unit, Tom Short and Cornelia Boldyreff for their help in compiling the list. We're sure it isn't comprehensive and would be interested in hearing from anyone who knows of or supplies a package which could be included.

Conclusion

Programs written under the p-System can be ported from one microsystem to another, either in source or (pseudo) object form. Given its not insubstantial applications base, therefore, the p-System should be of interest not only to the end-user but also to software developers wishing to keep afloat in the rising tide of technology. In two subsequent articles we plan to look at the p-System in much more detail, starting with the operating system, its philosophy, design and utilities; and concluding with a description of all the language translators available on the system. To finish up we have reproduced a diagram originating from SofTech which purports to explain how the portability works. The hexagonal shape is used by SofTech as a symbol for a self-contained module — touching modules communicate with one another.

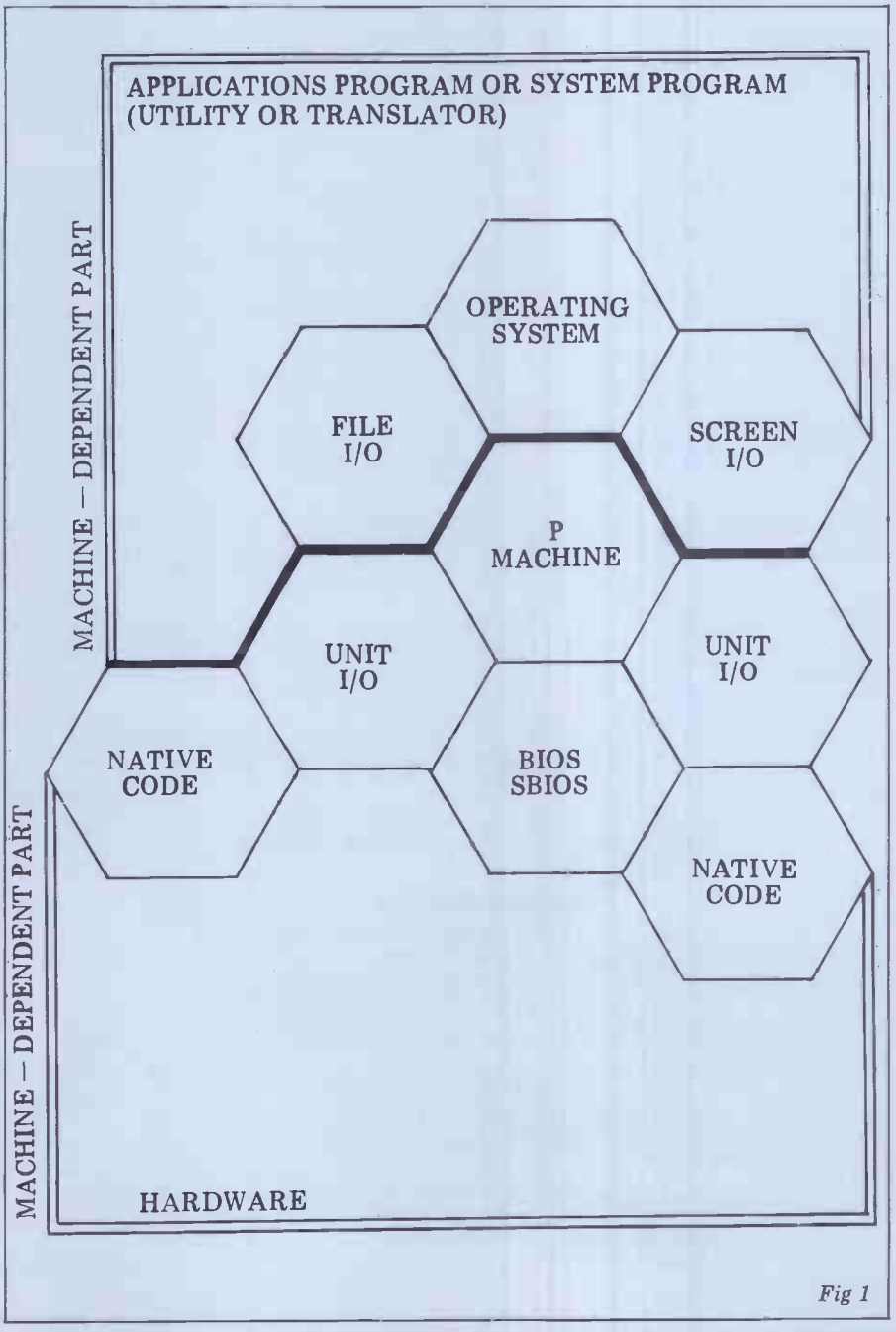


Fig 1

P FOR PERFECT?

Accounting and business

Financial Controller (integrated suite) for all p-Systems, £250 per package; Systematics International Microsystems Ltd, Cleves House, Hamlet Road, Haverhill, Suffolk, phone (0440) 61121.

Jarman Systems: (suite) for Apple and other p-Systems, £490-£550 per package; Jarman Systems, 110 Western Road, Tring, Herts, phone (044282) 6841.

Orbit: (integrated suite) for Apple, £855; Vlasak Computer Systems, Vlasak House, 8 Stuart Road, High Wycombe, Bucks, phone (0494) 448633.

SPI Business Packages: for all p-Systems, price on appl; Asolv Ltd, 12-14 Church Street, Basingstoke, Hants, phone (0256) 68935.

Educational

Cyclops: an audio-visual presentation preparation tool and delivery system, for Pascal Microengine, up to £14,000; Cyclops Project, Open University, Walton Hall, Milton Keynes MK7 6AA.

Little Genius: computer-based programming course for Apple, £49.95; Little Genius Ltd, Suite 504, Albany House, 324 Regent Street, London W1, phone 01-580 6361

Pascal Tutor: computer-based Pascal programming course for Apple, £79; Pete and Pam Computers, Waingate Lodge, Waingate Close, Rossendale BB4 7SQ, phone (0706) 227011.

Filing systems and databases

Apple Pascal Database: for Apple, £250; Ormbeta Software, Ormskirk Computer Services, Wheatsheaf Walk, Burscough Street, Ormskirk, Lancs, phone (0695) 77043.

Infotree: hierarchic information management system for Apple, £39.95; Pete and Pam Computers, Waingate Lodge, Waingate Close, Rossendale BB4 7SQ, phone (0706) 227011.

Omnis management system: full multi-key ISAM system for Apple II (£174) & Apple III (£225); Blyth Computers Ltd, Wenhaston, Halesworth, Suffolk, phone (050270) 565.

Mailing list: for all p-Systems, at cost of media for USUS members; USUS (UK) library, Ann Macintosh, ERCC Microcomputer Support Unit, 59 George Square, Edinburgh EH8 9JU, phone 031-667 1011 x 2300.

PISAM: 3-level ISAM system for all (large) p-Systems, £500; IBC Computer Systems Ltd, Sunderland House, Sunderland Street, Macclesfield, Cheshire SK11 6JP, phone (0625) 616399.

Quest III: relational database management sytem for all p-Systems, £350; Asolv Ltd, 12-14 Church Street, Basingstoke, Hants, phone (0256) 68935.

Financial modelling and planning

Decision Modeller: extension package for Micromodeller (see below) for Apple, £535; Applied Computer Techniques Ltd, Shenstone House, Dudley Rd, Halesowen, W Midlands B63 3NT, phone 021-454 8585.

Job control costing: for Apple, £195; Pete and Pam Computers, Waingate Lodge, Waingate Close, Rossendale BB4 7SQ, phone (0706) 227011.

Logicalc: electronic 'spreadsheet' for all p-Systems, £150 (Apple £75); Asolv Ltd, 12-14 Church St, Basingstoke, phone (0256) 68935.

Micromodeller: financial modelling package for Apple, £595; Applied Computer Techniques, Shenstone House, Dudley Road, Halesowen, W Midlands B63 3NT, phone 021-454 8585

Microplanner: interactive critical path project planner for Apple, £695; Microplanning Services, 8 Howecroft Gardens, Bristol BS9 1HN, phone (0272) 684530.

PERT critical path anylsis: time analysis and resource allocations for any 64k system, £1000; IBC, Sunderland House, Sunderland Street, Macclesfield, Cheshire SK11 6JP, phone (0625) 616399.

Games

Adventure: for all p-Systems, cost of media to USUS members; USUS (UK) library, Ann Macintosh, ERCC Microcomputer Support Unit, 59 George Square, Edinburgh EH8 9JU, phone 031-667 1011 x2300.

Blackjack, Castles, Othello, Spacewar, Startrek, Wumpus: (as above).

Miscellaneous

Datalogger: real-time data-logging package for Apple, £350 plus 'customisation'; Eicon Research Ltd, Viking Way, Bar Hill, Cambridge, phone (0954) 81825.

Unix subsystem: the p-System as a program on any time-sharing Unix system, £500 (£50 for Universities); South West Universities Regional Computing Centre, University of Bath, Claverton Down, Bath BA2 7AY, phone (0225) 60371.

Programming aids and utilities

Advanced system editor: enhanced screen editor for any p-System, POA; Asolv Ltd, 12-14 Church St, Basingstoke, phone (0256) 68935.

Artist designer: colour graphics editing system for Apple £29.95; Pete and Pam Computers, Waingate Lodge, Waingate Close, Rossendale BB4 7SQ, phone (0706) 227011.

Convert: Converts Basic to Pascal files for Apple, £25.95; Blyth Computers Ltd, Wenhaston, Halesworth, Suffolk IP19 9DH, phone (050270) 565.

Cross referencer: Debugging tool for all p-Systems, from USUS (see above).

Disku: access to Pascal files at block level, for Apple, £29.95; Blyth Computers Ltd, Wenhaston, Halesworth, Suffolk IP19 9DH, phone (050270) 565.

Formulex: callable routines for data-entry screen forms for Apple, £34; Pete and Pam Computers (see above).

Linkdisk: Apple DOS 3.3/ Pascal file handling, £55; Anglia Computer Centre, 88 St Benedicts Street, Norwich NR2 4AB, phone (0603) 29652.

Linkvideo: screen handling package with data validation for Apple, £45; Anglia Computer Centre, 88 St Benedicts Street, Norwich NR2 4AB, phone (0603) 29652.

Map program: Debugging aid from USUS (see above).

MCC Pascal utility package: for Apple, £40; Micro Computer Connections Ltd, 41 High Street, Egham, Surrey TW20 9DS.

Pascal animation tools: animations frame editor for Apple, £34; Pete and Pam Computers (see above).

Pascal graphics dump: Paper Tiger, Anadex or Spinwriter/ Qume screen dump for Apple, £21; Pete and Pam Computers (see above).

Pascal programmer: useful set of pre-linked routine for Apple, £79; Pete and Pam Computers (see above).

Pasdos: DOS 3.3 — Pascal file transfer for Apple £39.50; Aurac Control Systems, 12a Baldwin Street, Bristol BS1 1RZ, phone (0272) 292966.

Pilot animation tools: used with Pilot Authoring System to design and store animation sequences, for Apple, £34; Pete and Pam Computers (see above).

P-Sort: callable sorting routines for Apple, £38; Pete and Pam Computers (see above)

Pretty printers: two programs to layout Pascal source code, from USUS (see above).

Pascal transfer program: a file transfer program, from USUS (see above).

Screen formatter: screen formatting package, for Qupro Q-Engine, £120; Qupro Data Systems Ltd, Qupro House, Greenacres, Woolton Hill, Newbury, Berks.

Tridee: 3-D graphics package for Apple, £49.95; Leicester Computer Centre Ltd, 67 Regent Road, Leicester, phone (0533) 556268.

UCSD-to-CP/M: programs to convert to and from CP/M file formats, from USUS (see above).

Vector MZ long integer package for Vector Graphic, £50; Essex Electronics Centre, University of Essex, Wivenhoe Park, Colchester, phone (0206) 862286 x 2267.

Special purpose

Bookshop management (ro from USUS (see above), free to non-profit co-operatives.

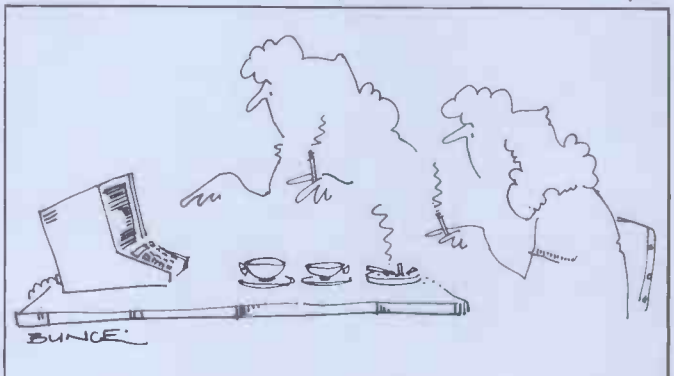
Insurance broker package: accounts and records, BIBA approved method, for all p-Systems, £1000 (approx); IBC, Sunderland House, Sunderland Street, Macclesfield, Cheshire SK11 6JP, phone (0625) 61639.

UCCA package: provides access to UCCA computer, for Vector Graphics, £1000; Mike Jones, The Computer Centre, The University of Essex, Wivenhoe Park, Colchester, phone (0206) 862286.

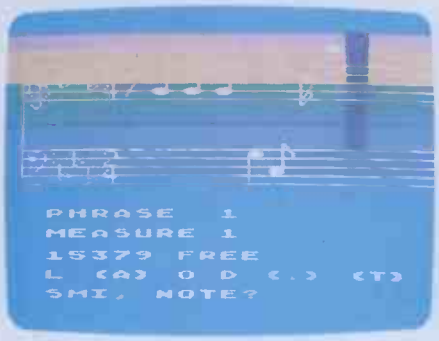
Text processing

Quille: word processor for Q-Engine, £120; Qupro Data Systems Ltd, Qupro House, Greenacres, Woolton Hill, Newbury.

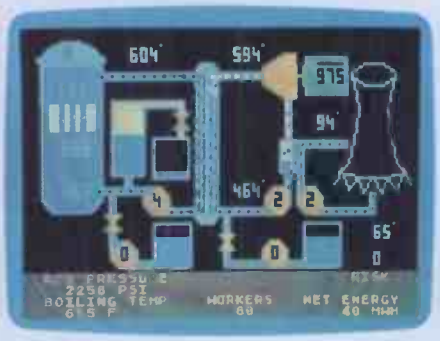
Word processor: text editor with address insertion for all p-Systems, £200; IBC, Sunderland House, Sunderland Street, Macclesfield, Cheshire SK11 6JP, phone (0625) 616399; END



'I told you Miriam! In all probability he's being unfaithful every Tuesday!'



Music Composer



Scram

Graph-it

Intro to BASIC 1

Star Raiders

European Countries

Missile Command

Basketball

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BRAIN WITHOUT BRAWN

BENCHTEST PERSONAL COMPUTER

The Newbrain portable microcomputer, announced over two years ago, has now arrived on the market. Dick Pountain checks it out.

When the Newbrain was announced to the world two years ago the design concept was significantly in advance of anything that had been seen in the field of hand-held computing. About the size of a hard-back book, it was to have a built-in display, battery operation and a large internal ROM capacity to hold applications software.

Since that announcement the original company, Newbury Labs, has sold the project, having encountered production difficulties, and has returned to its main business of producing terminals. The Newbrain was at one time in line to be the original BBC Computer but production difficulties intervened and the rest is history. The specification has been revised from its perhaps over-ambitious original form and the machine has now been launched onto the market by its new owners, Grundy Business Systems. In those two years the market for hand-held and portable computers has been changed considerably by the introduction of the Sharp and Casio models and the Osborne 1, and Grundy is no longer stressing the hand-held aspect of the Newbrain but rather offering it as a low-priced compact computer for business and educational uses; though the development of a fully portable model still continues and it is intended to be launched later this year.

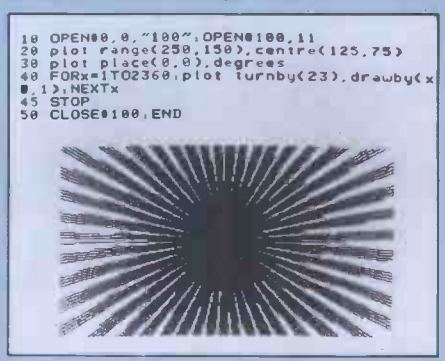
Hardware

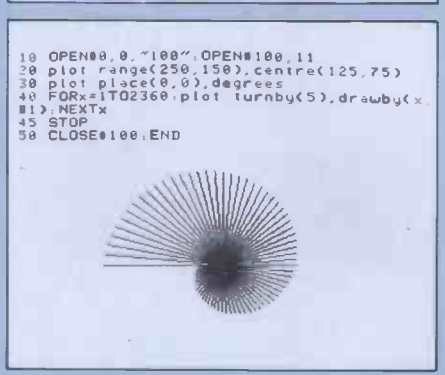
The model tested is the Newbrain AD, which has a built-in display and the option of 40 or 80 column screen width. The unit is housed in a very robust moulded ABS case measuring 11x6x2 inches with the 16-character green fluorescent tube display at the top right hand corner. The rest of the case top is taken up by the keyboard which, although at first sight looking like a calculator type with its widely spaced keys, is a normal pitch typewriter one. In fact the size of the keyboard dictated the overall size of the machine. The 62 keys have slightly concave tops and a good positive feel so that, unusually on a machine of this size, touch typing is perfectly possible. The keyboard is fully debounced and has sufficient rollover to allow fast typing speeds. The layout is that of a standard typewriter without numeric keypad and with the addition of Control, Escape, Stop, Graphics, Repeat, Home, Insert and Teletext keys, plus four cursor keys and a proper space bar.

Turning to the back of the case reveals a row of sockets for power, expansion bus, printer and modem and two tape recorders along with phono outlets for monitor or UHF TV. Unfortunately the peripheral sockets are non-standard industrial-type connectors, so you'll be relying on the manufacturer for all your plugs and leads. The printer and modem ports are RS232/V24, the modem one being bidirectional and programmable between 75 and 9600 baud.

One clear departure from the original hand-held idea becomes apparent; the power supply is not on board but comes in a separate metal box. It supplies three voltages (6.5, 13.5 and −12v) and runs perilously hot. Curiously no power on/off switch is fitted either to the computer or the power supply and one would be well advised to switch off at the wall when leaving the machine for any length of time. Opening up the case reveals why the powerpack is outboard; there simply is no room for anything more. Two and a half boards fill the case, containing around 80 chips, an enormous number compared to some recent designs. The processor is a Z80A running at 4MHz and it serves 32k of RAM and 28k of ROM as well as a lot of discrete TTL logic. To get rid of the heat generated by this mass of NMOS circuitry the boards are arranged in a sandwich, the filling of which is a matt-black alloy extrusion the width of the case which is attached to the chunky alloy back plate holding the I/O sockets and acts as a heat sink. In use it becomes very warm, but no trouble was experienced on this account. Between the board containing the keyboard circuitry and the processor board is a paxolin sheet to prevent electrical contact. The quality of construction is far from skimpy, and remarkable at the price; all screws go into brass collets moulded into the case and the boards and ribbon connectors are of almost military ruggedness. I was prompted to wonder how much the Newbrain would cost if it used 64k RAMs and ULAs, 'sticky tape' connectors, self-tappers into plastic and other minimum-cost technology — or, alternatively, how much profit are certain other manufacturers making?

Supplied, (but not included in the £229 price) with the Newbrain was a





Samples of hi-res plotting

Photography by Chris Stevens

10in green screen monitor and a standard Panasonic miniature cassette recorder. The former provided a steady sharp picture, particularly in reverse video modes, and had separate brightness and contrast controls on the front panel; it was fairly tricky, however, to find a combination of settings that gave a good display in both modes without requiring a re-adjustment.

Firmware

The 28k of ROM aboard the Newbrain contains an operating system, Basic and a maths and graphics package — of which more later. On power up the operating system checks all the RAM, producing a seemingly random 'garbage' output on the line display; after a few seconds control passes to the monitor which announces 'Newbrain Basic Ready'. The ROM also contains an unusually large character set of 512 symbols which includes the 96 ASCII characters (with 95 replaced by £), Greek letters, Scandinavian characters, other European accents and so forth. Viewdata, games block graphics and line-drawing symbols are in there as well.

To access all these different fonts a system of control codes of Byzantine complexity has been implemented. Only 255 of the characters may be displayed at any one time, and these are produced from the keyboard by using the Shift and Graphics keys to get alternative characters from a key. Which part of the ROM set is available can be set by sending Control W followed by a digit from the keyboard; three bits of the binary representation of this number select upper or lower ROM, full or half character set (ie, ordinary letters still available) and normal or reverse field. For example Ctrl W 1 gives reverse video Ctrl W 7 gives Greek and other symbols. The number of combinations is perplexing and the modes appear to interact with one another in unpredictable ways, leaving you stuck with strange displays and error messages in Greek. You can always get back to the ordinary keyboard by Shift Escape, however.

Other control codes clear the screen, move or read the cursor position, turn the cursor off, and delete or insert lines and characters (the latter is also supported by a hardware key). There are 32 codes in all and they provide a comprehensive set of screen controls.

Another curious omission is that no hardware reset button is provided. The designers may believe it to be uncrashable but while messing around with the Ctrl W codes I managed it; it is also possible by opening silly or forbidden streams to the operating system.

The editor is fully screen-oriented and has some unusual features such as upward scrolling through a Basic listing and provision for making and unmaking new lines out of Basic lines which wrap around the screen. The cursor controls auto-repeat, and this, together with the Insert key (insert mode remains active until a cursor key is pressed) and deletion via Shift <—, allows for very rapid and easy editing. The editor and related topics such as the length and width of a screen are more properly discussed in the next section under Software, as they are intimately connected with the unusual philosophy of the operating system.

All of the above applies to the Newbrain connected to a monitor or TV; when used with the built-in display it can only display upper case ASCII and 64 rather odd-looking symbols, due to the limitations of the 14-segment matrix. Editing is of course line only. The display is a 16-character window

This is the way you reset

BRAIN WITHOUT BRAWN

onto an 80-character line and scrolls sideways in answer to the <— and —> cursor keys.

Software

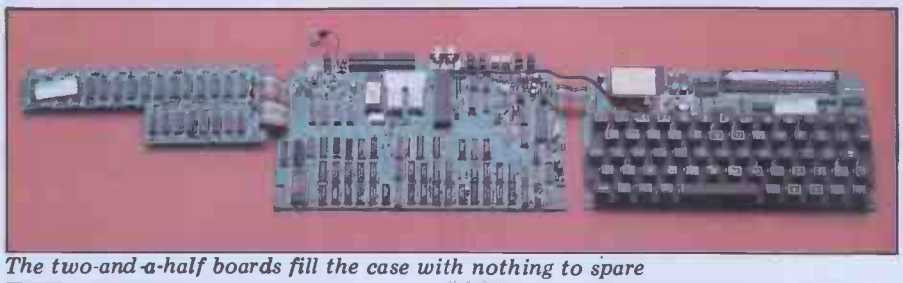
The Newbrain's operating system is a highly modular set of programs which are designed to provide a degree of hardware independence. It is separate from the ROM Basic which interfaces with it through a high-level program called OS, the core of the system. This in turn interfaces with IOS, the I/O handling module which can call device drivers for the various recognised devices. IOS treats all devices in an identical fashion as single-byte serial devices. The screen editor itself is one such device, called XIO, and is the means of communication between the user and a Basic program. Other devices are the two cassettes, line display, two configurations of the keyboard, modem and printer.

All input and output to devices is performed via data-streams (or simply 'streams') of which 255 may be open at the same time. The fundamental operations are OPEN a device on a stream (for INput or OUTput), INPUT from or OUTPUT to a stream and CLOSE a stream. If all this sounds a little abstract, you're right; it takes quite some time to get to grips with what's happening especially if you're used to a more (or is it less?) transparent I/O system via Basic or CP/M. But it has some interesting and useful consequences for the use of the machine.

For instance, it is possible to have multiple copies of a device open on different streams. If the screen editor is copied in this way you can have as many separate screen 'pages' as there is room for in RAM; each screen can be written to and displayed independently by OPENing it on stream n and then calling INPUT#n from a Basic program. Each such screen can have up to 255 lines, the physical VDU screen being a 24-line window which can be scrolled up and down. The choice of 40 or 80 columns is made by attaching a parameter string to the OPEN statement such as "s100" which would give a 40-column ('s' for 'short') by 100-line display. On power up the operating system opens the monitor with a 100-line screen as the console device; to use the line display you must open it with OPEN# 0, 3 as stream 0 is always the console and 3 is the line display's device number. OPEN#0,4 opens both monitor and line display together.

Another powerful and interesting consequence is that Basic is enabled to handle interrupts directly by means of an ON BREAK GOTO statement which directs program execution to a suitable routine when the STOP key is pressed; combined with error-trapping this means that application programs can be made virtually foolproof as there should never be any need to leave the program.

Lastly, the addition of new devices becomes very easy as there are about 248 device numbers currently unused.



The two-and-a-half boards fill the case with nothing to spare

By writing a suitable driver program and adding it to IOS's device table the new device is incorporated. But, more important, commands for using the device from Basic (or other high level language) can be added without changing the Basic ROM. This is because Basic routines are called by vectoring from an address in low memory; new routines such as the Maths, Graphics and Statistics packages currently available can be added to the existing set. When the paged memory expansion system is released this will allow up to four megabytes of ROM routines to be supported. This is why the Newbrain team is adamant that this is not a disk or a cassette operating system; it's a general purpose one.

The Basic is unusual in two ways: firstly that the ANSI standard has been preferred to the almost universal Microsoft 'standard' and secondly that it is an interactive compiling Basic. The first time a program is run it is compiled, a line at a time, to pseudo-code and this is the code which is run. Compilation is not necessary on subsequent runs but the source code is retained in memory to allow interactive editing and debugging. In some exceptional circumstances, such as shortage of RAM space, the object code may be deleted after execution by the dynamic memory management activities of the operating system. Some commands, such as CLEAR and DELETE, also destroy the object code. Limited syntax checking is done at compilation time. As can be seen from the Benchmark timings, this results in better than average execution times.

The choice of ANSI standard will not affect most users as it still looks very much like Microsoft; the structured controls IF. . .THEN. . .ELSE, DO. . .WHILE, etc, have regrettably not been implemented. The principal different statements are LINPUT in addition to INPUT, which accepts lines including commas as input, the addition of INSTR to the string-handling functions to perform substring searches, and NUM, which returns 'true' if a string contains a valid numeric input. Variable names are two characters and arrays have at most two dimensions, but there is no limit to the length of strings (to be exact, there is a 32k limit!). PEEK, POKE and CALL give access to memory and machine code routines, space for which can be RESERVEd above the top of Basic programs.

ON ERROR GOTO and RESUME [line number] are both supported. The error messages are unfriendly numbers (200 of them!), though they do identify which section of a multistatement line is the culprit — eg, ERROR 59 AT 30:2. Quite a few of the errors for the graphics package are listed as 'not used' in the manual, which is only a draft document.

A line of Basic can occupy a whole screen — ie, up to 25 lines or 937 characters.

The supplied maths package (in ROM) performs floating point arithmetic to 10 significant figures with the unusually large dynamic range of $10^{\pm 99}$. It supports the usual trig and log functions.

File I/O is straightforward once you understand the operating system. A datastream is assigned to the relevant device (the cassette recorders are devices 1 and 2) with the options (added to the OPEN statement) of adding a filename and selecting the file buffer size in 256-byte blocks. Random files are treated in the same way as sequential, and by using PUT# and GET# you can write bytestreams to tape. With the supplied recorder, tape operations were totally reliable, as they were with my own micro-cassette pocket recorder.

The Graphics package, which I saw in pre-release form, adds 20 new statements to Basic to provide high-resolution plotting facilities. It is used by opening an editor screen and then opening a graphics screen (device 11) 'on its back'. This results in a scrolling text area of from 0 to 29 lines above a high-res area of 8 to 250 scan lines. Two levels of resolution — 640 or 320 dots per line — are selected in the open statement.

The plotting statements are unusual but powerful. The plotting point is

Socket panel is also a heat sink

Power supply is 3-voltage

regarded as a 'pen' (something like a turtle) and the commands fall into two groups — those which move the pen in the direction it's facing by a given distance (whose names end in BY) and those which move to an x,y coordinate. They are further split into those which leave the pen at the end of the new line (MOVE) and those which leave it at the beginning (DRAW). Combined with two commands for absolute or relative pen rotation, these allow easy implementation of turtle graphics and of plotting in polar coordinates as well as ordinary cartesian plots. The commands are invoked by using PLOT — eg, PLOT DEGREES, TURNBY(30), DRAWBY (10,1) would turn the pen through 30 degrees and send out a line 10 units long leaving the pen where it is. One seeming inconsistency is the inclusion of PLACE(x,y) which moves the pen without drawing, but not its complementary PLACEBY(d), which would be invaluable in polar plots; however this effect can be achieved by combining other commands.

The size of the plotting unit is decided by a scaling command RANGE, and CENTRE fixes the origin. Three of the commands, ARC to draw curves, FILL to fill areas and AXES, which draws labelled axes, were not running but will be in the final version. This is a well thought out and powerful package.

I was also supplied with an early version of a text processor package on tape. While not really a word processor, it allows the entering and storage of text which it 'cleans up' into justified form; it is driven from a menu of options.

Documentation

Two levels of manual are intended to be made available for the Newbrain; a user guide and a technical manual for programmers.

I received a pre-draft of the former and frankly it was not impressive. The bare bones of the Basic are adequately covered with listing of reserved words and examples of the syntax. The operation of the control codes is covered in a terse and hurried fashion and the error messages are documented (with the exception of those which arise in using the graphics). However, the Newbrain operating system is somewhat unusual in its extreme formality and abstraction, where all you see are logical devices and data streams. It will be sufficiently unfamiliar to many users to require a fair bit of explaining, with lots of examples and step by step instructions on the use of the OPEN# and CLOSE# statements and the input and output procedures. It is to be hoped that this will be there in the released versions; in the pre-draft these matters are dealt with in an abbreviated and academic fashion, eg, 'the default back-up store is seldom a sensible console', which left me and I suspect many other 'lay' users floundering by trial and error (200 errors to be exact).

Expansion and potential use

Expandability is an important part of the Newbrain design philosophy. The first step is a module soon to be released which contains the hardware for paged memory addressing, sockets for expansion ROM and parallel user I/O ports. This module and others will be housed in a box the size of the computer but 1in deep; this clips underneath the unit. With this fitted, up to 4Mb of ROM and 2Mb of RAM can be addressed — the accent being on the former as much of the software is planned to be released in ROM. RAM modules of 64, 128, 256 and 512k are planned, as is a battery back-up module which allows 75 minutes' use away from the mains and which is really only intended for protection against power failure and preservation of data in RAM for short journeys. Other modules promised contain CP/M (in ROM) and extra RS232 ports to allow networking and sharing of peripherals. All of the software so far announced will be presented in ROM modules — namely a Z80 Assembler, Comal, Statistics and Word Processing packages.

Disk drives are promised for the near future, with the option of CP/M as the op system. Serial printers can be hung on the RS232 port of the 'naked' Newbrain; device 8 is configured for such a printer and has programmable baud rate.

Late in 1982 a model M Newbrain is intended which will have the rechargeable battery backup and memory paging hardware built in. An A model without the line display is already on sale.

Who will use the Newbrain? The maths capability and graphics make it suitable as a low-cost machine for scientific and educational purposes; its small size would be a boon on the crowded laboratory bench, and its communication ability would permit a school to share disk drives to serve many pupils for small outlay. For business use it suggests itself more in a data-capture role than for accounting or heavy data processing tasks. With suitable bulletproof software in ROM it has many virtues as a machine for stock control and order entry tasks; the independence from a monitor/TV provided by the AD model is attractive here. Indeed 2000 have already been ordered by an OEM firm which is installing them in chemist shops for ordering by telephone and for labelling. It has the advantage over a dedicated hand-held data-capture terminal in that it can be used for limited word processing and other general duties as well. Its role as a portable computer for managers, running WP and spread sheet programs, as envisaged in the original publicity is heavily compromised by the lack of real battery operation. You won't be using it on trains or airliners with only an hour of battery.

Finally it will appeal to the serious hobbyist — defined as one who is not bothered by the lack of colour and sound but wants a low-priced, expandable system with powerful facilities. The relative unfriendliness of the operating system will not be a deterrent to such buyers as it would be to first-timers.

Conclusions

The Newbrain is a well-made computer with some powerful and flexible software and hardware features designed into it. It has all the facilities to allow good bulletproof software to be written, and if this is supplied in ROM it will offer good value as a serious small business computer for even inexperienced users. In its naked form it is somewhat unfriendly to use, due to the very formal design approach and the (at present) poor documentation. Professional programmers and serious hobbyists will soon come to terms with this, however, and will then find that it offers a lot of serious computer features at a toy computer price.

There are some annoying omissions on the hardware side, such as a power switch and reset switch. It is also difficult not to reflect on what this design could achieve if it had been built with CMOS technology (like, for instance, the Sharp PC1500). The power requirements of the NMOS used are such that true battery operation with a sensible battery life is going to be very difficult to achieve.

Nevertheless, in its present form it is a lot of very useful hardware for the price.

Benchmark timings

BM1	2.0
BM2	5.8
BM3	19.2
BM4	17.5
BM5	19.2
BM6	32.0
BM7	48.8
BM8	7.0

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

Technical specifications

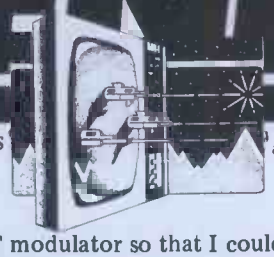
Processor:	Z80A 4MHz
RAM:	32k expandable to 2Mb
ROM:	28k expandable to 4Mb
Keyboard:	62 key standard, typewriter, repeat key, 4 cursor keys.
Cassette:	Accepts user's recorders (two) with remote control.
Disks:	Not currently available.
Display:	Built in 16 char x 14 segment fluorescent display. Accepts b/w monitor or TV, 40 or 80 col by 24 line. 640 x 250 hi-res in graphics mode.
Ports:	1 bidirectional RS232, parallel expansion bus, two cassette ports.
Languages:	ANSI Basic, Assembler, Comal

Prices

Model AD (as tested)	£229
Model A	£199
ROM Expander Module	£ 80
RAM Module 64k	£ 75
128k	£135
256k	£245
512k	£445
RS232/V24 Expansion 8 Channel	£145
16 Channel	£225
32 Channel	£395
Battery Backup Module	£ 45
Model M (available June)	£269

(all prices exclude VAT) END

SCREENPLAY

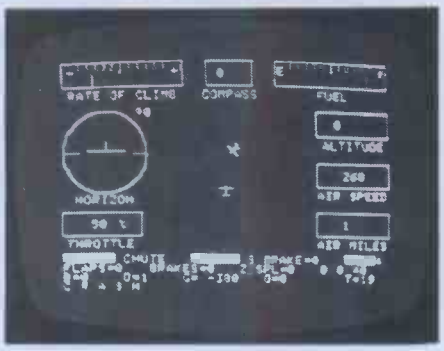


This month Dick Olney reviews games for the Apple II.

This month I've been playing some of the games available for the Apple II microcomputer. Although this machine is rather different to most of those I've previously covered, and is not marketed as a games machine, there is a considerable volume of such software available for it. Apple itself produces very little in this area, but this is made up for by dozens of (mostly American) software publishers. The configuration I used was a 48k Apple II Europlus with a single mini disk drive and the Applesoft ROM with an automatic boot feature. The machine was fitted with a colour card and UHF modulator so that I could plug it directly into my television.

Apple will supply a set of games paddles for £15, but for most of the games I used a sort of universal joystick with dual buttons and paddle-emulating slide switches as well as the stick itself. This is manufactured in Texas by TG Products, and is undoubtedly the best-designed games controller I've used. The price of the system would be £1293 for the machine and extras with an additional £29.95 for the joystick (ex VAT). This is clearly more than most people would be willing to pay just to play games, but I'm sure there are plenty of people with Apples who spend at least some of the time doing just that.

All of the games were of course supplied on 5¼in disks. Although I have concentrated here on real time arcade-type games I should point out that this machine is also notable for the many Adventure games available for it. Note that star ratings are based on a maximum of eight and reflect those qualities most appropriate to the nature of the game.



GAME: Jet Fighter Pilot
PRICE: £16.50
SUPPLIER: Instant Software

This is a fairly standard flight simulator in which your mission is to take off, chase and destroy an enemy aircraft and then land back at the airport. Though the program makes no real use of graphics (it's entirely in black and white) the flight information panel is reasonably comprehensive, as are the controls. Vertical and horizontal attitude are controlled by the paddles (or in my case the paddle surrogates on the joystick) while all other functions such as throttle, flaps, missiles and brakes are accessed through the keyboard. The program does a scan every second or so to determine the status of the fighter and changes the readings accordingly; an approach which takes a little getting used to from a playing point of view.

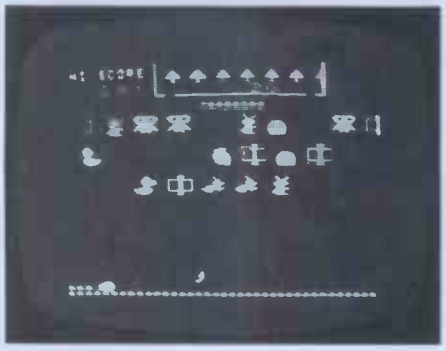
The extensive features this game provides in terms of control and navigational aids means that a fair degree of skill is required to play it well, but the rather uninspired presentation make it less exciting than one might expect. At one point the program crashed due to a RETURN without GOSUB error. I've no way of knowing how often this might occur, but there didn't seem to be anything particularly unusual about the circumstances.

PRESENTATION: **
ADDICTIVE QUALITY: ***
VALUE FOR MONEY: *

GAME: International Grand Prix
PRICE: £15.95
SUPPLIER: Riverbank Software

Given the front view from a racing car your task is this game is to use the paddle or joystick to drive as quickly as possible around a racetrack (no surprises there!). The interesting thing about this game is the number of options. Firstly there are five international circuits to choose from, each of which has all the elements of its real life counterpart. You can choose the number of laps, amount of fuel on board and difficulty level (zero to seven determines road surface skid potential) as well as manual or automatic transmission. The button on your paddle or joystick is used to accelerate the car. For manual transmission, taking your finger off the button for a second changes gear and with automatic you can stabilise your speed using the cruise control (space bar). The array of options and crisp presentation cannot however conceal the uninspired and rather dull nature of this game.

USE OF GRAPHICS: ****
ADDICTIVE QUALITY: **
RESPONSE TIMES: *****
VALUE FOR MONEY: ***



GAME: County Fair
PRICE: £14.95
SUPPLIER: Datamost

This game, another arcade descendant, combines some of the playing technique (though not the speed) of Space Invaders with the 'cuteness' of Packman. It's based on a shooting gallery, and involves moving a small gun along the bottom of the screen firing at various objects above you. You have a limited number of bullets and when they are finished the game is over. If you fail to hit the white ducks they fly down and eat up a good portion of your ammunition, but apart from this the targets are completely passive, though their numbers are steadily replenished so you have to be quick. Occasionally rows of bullets appear at the top of the screen with plus or minus signs by them and these, if hit, will increase or decrease your stock of bullets. In addition there is a row of 'trees' in white lines at the very top of the screen which you only hit through a narrow gaps in their surround. If you manage to clear the entire screen your bullets are replenished and a new, slightly speedier, frame begins. The presentation of this game is impeccable with its hopping rabbits and flying ducks and though it is somewhat trivial in principle I thoroughly enjoyed playing it.

USE OF GRAPHICS: *****
ADDICTIVE QUALITY: ****
RESPONSE TIMES: ****
VALUE FOR MONEY: *****

GAME: Epoch
PRICE: £17.95
SUPPLIER: Sirius Software

Written by Harry Miller, this game is a true real time interpretation of Star Trek in which all movement and firing is controlled by the joystick or games paddles. Though it lacks the complexity found in more traditional games of this genre (there are no charts, scans or textual commands) the excellent use of graphics and control precision made it a joy to behold. You are under attack by four different types of enemy craft which can only be destroyed by a direct hit at the centre of their mass. To achieve this you position the crosshair sights over the alien ship before firing your missiles. These crosshairs dictate direction of motion as well as aim, and though of course they actually always remain in the centre of the screen, the impression of three-dimensional movement is surprisingly effective. One of the controller buttons gives acceleration and the other deceleration, and pressing them both together achieves self-repeating fire power. As well as alien ships there are stationary enemy bases which can again only be destroyed by accurate central hits.

The constraints upon your degree of destruction are fuel, ammunition and time — the game ends if any one of these runs out. The amount of fuel decreases steadily during any change of speed (though not while in stable motion) and also drops if you are hit by alien fire. Ammunition level, of course, depends on how many shots you fire. Both of these can be completely replenished by driving through the porthole of a friendly base, requiring careful navigation. Time is lost at a steady rate whatever you do and can only be regained by travelling through the centre of a time portal. These are great fun, involving steering the ship through a colourful corridor of gateways.

The fundamental principles of this game resemble the real time section of Atari's Star Raiders, though saying this does not do it justice. It is certainly one of the best games of this type that I've come across. If you've got an Apple II with a colour set up then you *need* Epoch.

USE OF GRAPHICS: *******
ADDICTIVE QUALITY: *****
RESPONSE TIMES: ******
VALUE FOR MONEY: *****

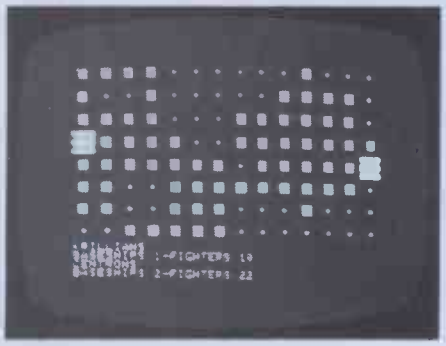
GAME: Firebird
PRICE: £14.95
SUPPLIER: Gebelli Software

Although this game has a very familiar feel about it I can't actually remember seeing anything quite like it. The scenario is a building, made up of 72 rectangular rooms, which is under attack from a firebird racing through the sky and dropping incendiary eggs at random. The latter set fire to a room, eventually destroying it and forcing its occupant to leap from the building. You can put the fire out (if you're quick enough) by positioning 'Piggo the fire-fighting pig' next to the room and dousing it with water; failing this you must attempt to catch the unfortunate occupant before he falls to his death. Moving Piggo and his ladder and squirting water are all controlled by the keyboard, and specific keys can be redefined to best suit your play.

If you manage to catch one of the falling victims you must take him to the top of the ladder where he will eventually be rescued by a circling helicopter. You should do this quickly since Piggo can only carry one person at a time, and cannot squirt water with his hands full. For each person saved the helicopter will replace one room; dropping it onto the top of the smallest column. The only hazard you encounter is if one of the people falls directly on top of Piggo, in which case he will topple off the ladder. He has three lives and the game ends when these have been used up or (more often the case) when two complete columns of rooms have been destroyed. If you manage to save the entire bottom row when all other rooms have burnt down you start a new frame.

It takes some time to get used to this game, though it is well worth the effort. Firebird is well thought out and professionally presented, and should certainly provide plenty of entertainment. It is a little surprising that there is no joystick option, though the keyboard controls are satisfactory (they give incremental rather than continuous motion) so this shouldn't put you off.

USE OF GRAPHICS: *******
ADDICTIVE QUALITY: *****
RESPONSE TIMES: ***
VALUE FOR MONEY: ******



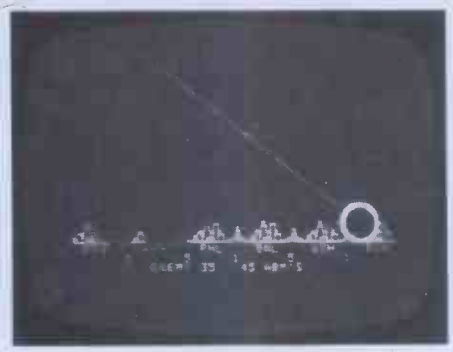
GAME: Galactic Wars
PRICE: £20
SUPPLIER: Apple

This is one of Apple's own 'special delivery' software packs and as such is nicely packaged with a backup disk supplied. There is a short manual on how to play the game, which at first sight looks quite complex — though this is in fact a little deceptive. Galactic Wars is a two-player game based on familiar concepts which is played on an eight by fourteen grid of 'star systems'. At the outset each player is provided with a homebase containing five, ten or twenty 'baseships', and at each turn any number of these can be moved to adjacent star systems. This is done using the games paddles (the joystick is not really satisfactory for this game) to move a prompt cursor, pressing the button when it is in the desired target position. Each baseship carries a limited number of fighters, one of which is left behind to guard each star system visited.

The 'Krillians' always move first and the idea is that the 'Centron' player does not watch his opponent position his ships. After the Centron moves, the program scans for battle situations; that is, star systems occupied in some way by both players. Battles are fought with each player controlling a single ship in an Asteroids-style shoot out, with the number of fighters a player has in the star system determining how many hits his ship can take before it is eliminated. When all star system disputes have been settled a new movement phase begins, and on each complete cycle new ships are provided at the home bases dependent on the number of star systems you control. The winner is the first person to conquer his opponent's home base.

Certain aspects of this game require careful strategy but the overall effect is rather weak somehow, partly due to the very basic battle scenario. Despite this I can see two enthusiastic players becoming quite addicted.

USE OF GRAPHICS: ***
ADDICTIVE QUALITY: ****
PRESENTATION: ***
VALUE FOR MONEY: ***



GAME: ABM
PRICE: £13.95
SUPPLIER: Muse Software

As you may have guessed, this is a variant of the popular Missile Command, Atari's version of which I covered in April. It is in fact virtually identical except that you have five missile bases firing two different sizes of missile. Your task is, of course, to shoot down approaching nuclear warheads in an attempt to protect the east coast of the USA from its impending (and indeed inevitable) demise. Paddles or the joystick are used to guide the target sight and ABMs are sent ploughing towards its position at the press of a button. The precise action of the control unit can be customised at beginning of play, though apparently only once. In the original game the sight would leave a marker immediately you fired, whilst remaining active, allowing you to launch missiles as frequently as you wished. In ABM, however, the sight disappears while your missile is in flight and thus you can only launch them one at a time, a serious defect as it entirely changes the nature of play. The bombers and formidable 'smart missiles' seen in Missile Command are also sadly lacking in this game. I must admit that I like it anyway, so although I rate this 'cover version' a poor copy I should add that it's a good substitute.

USE OF GRAPHICS: ****
ADDICTIVE QUALITY: *****
RESPONSE TIMES: *****
VALUE FOR MONEY: *****

GAME: Olympic Decathlon
PRICE: £14.95
SUPPLIER: Microsoft

This glossy athletics simulator from Microsoft is likely to receive a mixed welcome from gamesters. The manual insists that paddles or a joystick are necessary — these are in fact only used in two of the events; the shot put and the hurdles (neither of which were exactly my forte!). Mostly the game demands rapid finger movement over the keyboard, often literally using two fingers as legs as if running. Up to six players can take part, each entering their names into the computer, and there is the opportunity for unlimited practice before the decathlon proper. Each event is heralded by a little fanfare, and full instructions are displayed throughout with the option to look at the scoreboard at any time. The graphics and presentation are flawless, but the general pace of the game is rather slow because of the low percentage of the playing time during which you are active. The long and high jumps were my favourite events, closely followed by the pole vault. I must admit I found the frantic finger pumping in the track events rather boring and tending to cause severe knuckle cramp; but I suppose this mirrors reality in some ways! Essentially this is ten quite simple games neatly compiled into an exclusive games package (they are even accessed from disk individually). Although the actual 'events' are, in themselves, rather trivial and unlikely to stimulate the hyperactive Defender freak or intrepid Star Trekker, Olympic Decathlon should appeal to the family audience where it would undoubtedly provide many hours of amusement.

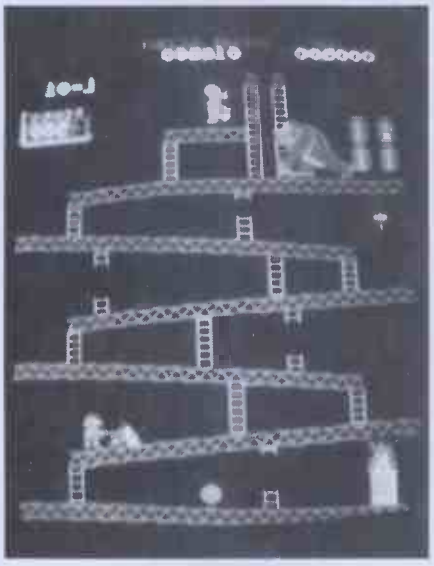
USE OF GRAPHICS: ******
ADDICTIVE QUALITY: ***
PRESENTATION: *****
VALUE FOR MONEY: *****

Conclusion.

As I mentioned in the introduction, the Apple II is neither designed nor marketed as a games machine. Despite this, the quality of the graphics and lack of memory limitations make it an admirable instrument for such pursuits. The games I have seen are varied and colourful and often of a quality much closer to that of their dedicated arcade peers than on smaller machines. Any Apple II users currently restricting their machines to more serious pursuits would be well advised to investigate its leisure potential.

Jet Fighter Pilot was supplied by Calisto Computers of Birmingham and Galactic Wars by Apple. The joystick and all other software was loaned by Peter and Pam's Computers.

ARCADE ACE



This month I have chosen a game whose variety has always impressed me, despite my inability to really master it. The oddly named Donkey Kong sets you the task of rescuing a maiden from an enraged gorilla. At the outset the gorilla carries his victim to the top of the screen and, using a four-way joystick, you control a little 'jumpman' who must ascend the various levels to save her. The problem is that our oversized primate is not too happy about your presence and spends his time rolling heavy barrels down at you. Luckily you have the ability to leap over these as they approach — but the timing of this is critical. There are a couple of mallets dotted around and if you manage to grab one of these you have a limited period of time in which you can smash the barrels before they reach you. To add further to your problems, as time passes increasing numbers of fireballs arrive to chase you.

The first frame is a simple configuration of girders and ladders with the main problems being the barrels and fireballs. If you manage to get to the top Kong makes off, carrying his reluctant victim to a new vantage point, and as the game progresses the scenarios become increasingly complex with lifts, conveyor belts and boiling vats to be negotiated. When you have successfully completed four screens the girl is finally released and the game starts again with increased ferocity. Donkey Kong combines simple controls with an interesting selection of game tasks. This, together with its colourful graphics, makes it almost as much fun to watch as to play and puts it at the forefront of the current move away from space shootouts.

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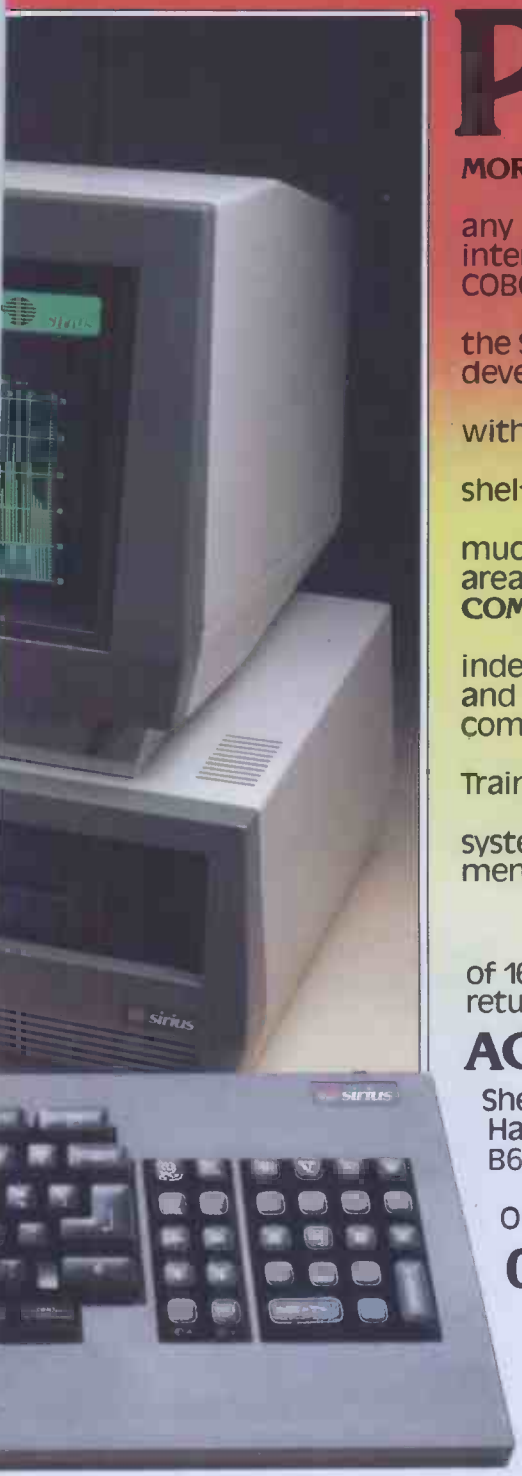

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THE MIMI 801

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PERSONAL COMPUTER

Photography by Karin Craddock

Mike Curtis reviews a CP/M based machine of British manufacture which can be had for £1350.

The Mimi is a new British computer, aimed directly at the most competitive section of the market, the small business sector. It is in competition not only with such well-established machines as the Superbrain but also with the flood of Japanese machines which is just hitting us. To succeed against this very stiff competition, then, a machine will have to offer some obvious advantage in price or performance; experience has unfortunately shown that being made in this country is no longer sufficient to guarantee even sales at home, let alone in Europe and the rest of the world. I am pleased to be able to report that British Micro has produced a machine that looks as though it will stand at least a sporting chance, and may well be able to capture a sizeable chunk of the ever-growing market.

Hardware

The Mimi comes, like so many of its competitors, with processor, keyboard and twin 5¼in minifloppy drives in a single unit, though without a monitor. I must admit to preferring this arrangement to the all-in-one adopted by so many companies; I like to see video circuitry kept as far away as possible from the rest of the electronics and I appreciate being able to position the screen at the most comfortable position. There is obviously a good case for putting as much as possible in one box, but one major advantage of keeping the monitor separate is that the Mimi is quite light and it's quite reasonable to carry it around, with a monitor in the other hand!

The case is quite attractive; it's the traditional off-white/grey/fawn colour so beloved of computer manufacturers. It is not quite rectangular — the keyboard narrows slightly towards the front and the top of the case slopes down slightly towards the back, which makes it a little more aesthetically pleasing than some of its competitors, and means that a monitor standing on the top of the case is at a good angle for viewing without having to be propped up. The Design Centre chose the Mimi for a six-week display in London and another in Glasgow.

The two disk drives are mounted horizontally above the keyboard, leaving a little space beside them for a panel showing the maker's logo and two LEDs; one is labelled 'Halt' — I don't know under what conditions this one lights up as it never did while I was testing the machine, despite 'Halting' on a few occasions.

The keyboard itself is standard qwerty layout and feels robust and pleasant to use. There are some nice touches, showing the sort of attention to detail that is normally the prerogative of the Japanese: the keys come in various shades ranging from light grey for the normal alphanumerics to darker shades for the different types of control keys; there is a separate numeric keypad with its own return key (labelled ENTER), minus sign and comma as well as the decimal point. Four cursor control keys, in black, are conveniently situated together on the right-hand side of the main set of keys; unfortunately they did not control the cursor, at least not on any of the software that I was using — Wordstar for example, used the more normal control functions.

Above the main set of keys is a row of unlabelled mid-grey keys with a black 'BRK' at one end and a black 'HOME' at the other; neither of these did their proper job, 'BRK' being the same as control 'DEL' and 'HOME' being control—Z. The 15 keys in between were various control characters — useful provided that you could remember which was which. The 'ESC', 'TAB' and 'BS' (BackSpace) did work correctly. There are the normal CTRL, SHIFT, SHIFT LOCK and CAPS LOCK keys and all keys except for these are auto-repeating. The keyboard is not programmable in the normal sense — the interpretations for every key are stored in a 2716 EPROM, so any variation is possible by blowing a new ROM; the intention presumably is to tailor the keyboard to fit the application. Machines which are bought as a part of a complete system should (I hope!) have all keys labelled so as to reflect their actual usage.

Looking at the back of the case reveals a variety of connectors; along the bottom, the edge of the PCB, are from left to right a connector for disk drives 3 and 4, a standard RS232 connector containing two ports, a parallel output port and, finally, a 50-pin bus extension. At the top, on the right-hand side, are an on/off switch and the video coaxial socket. The two RS232 ports inside one D-type connector can be used either for the normal connection of serial devices or for communication between processors. One of the ports is connected to the standard pins in the female D-type socket, the other to a group of normally unused pins. The port connected to the standard pins is configured as a receiver, which may perhaps indicate that one of the possible applications for this machine is as an intelligent terminal, for which it would probably be very well suited. I do not know whether a terminal emulator package is likely to be available in the near future. The printer that I attached happened to use a serial port, which meant that the lines had to be crossed over before it would work. The dual port may be particularly useful in networking where a number of computers may be connected in a ring.

The case comes apart with the removal of seven small screws on the underside. The disk drives, their control circuitry and the keyboard come off with the top and are attached by ribbon cables to a single large board and the very compact power supply left on the base. The main board is very big (410cm x 340cm), occupying virtually the entire base of the machine. Boards this big usually cause some problems in design and manufacture. I understand that British Micro has now split it up onto two boards with the video circuitry on a separate board. This may give greater flexibility and more display facilities as well as easing production problems. The RAM is all in one block at the front right, in the form of 16k dynamic chips.

Next to the RAM is the video controller, the Motorola chip which seems set to become another de-facto standard. The Z80 processor, the ROM, the PIO and the two UARTs, one for each of the RS232 ports, are at the back.

At the left-hand side of the board I discovered a socket for attaching a light pen, which I had not noticed from outside — another potentially useful extra. The disk drives are Pertec.

The interior looks well engineered and the boards are of high quality, as you might expect from a company that has been in the board-making business for a long time before branching out into the micro market.

Big board has been split in two on latest version.

The Mimi comes supplied with a reasonably long mains lead and a video lead with a phono plug on the monitor end. Having plugged those in, a disk can be inserted in drive A (the left one) and the machine switched on; after a brief flash the screen clears to show the message 'Mimi 801', the system size, and the CP/M prompt 'A>'. The Mimi has a cooling fan which makes a reasonably unobtrusive noise — I sat for up to three hours at a time at the keyboard without it ever bothering me. The disks are fairly quiet as well, far more so than many I have heard. The normal size to run CP/M is 62k, the top 2k of RAM being used for the video display. When using the graphics the top 16k is taken up so CP/M has to be run in under 48k. There is 4k of ROM at the top of the memory map which contains, among other things, a simple machine code monitor called Simon, but this is switched out of the map when CP/M is booted in. The display can be either 80 or 64 characters wide, with 24 lines; the 80 column display came up as the default on my machine. The manual states that 64 should be the default and also gives the patches that have to be made to the I/O routines in order to change from one to the other. I did try to effect this patch to convert to 64 lines but found the contents of the various memory location were not as the manual showed and it did not seem terribly important. The 80 column width did run over the edge of my screen, losing about the last 4 characters in every line, which could have been a peculiarity of my monitor or the dot-clock not set properly. It did not seem too matter too much, anyway; Wordstar came with the right margin set at 64 by default and I do not believe I would have noticed had I not deliberately counted the character positions.

CP/M is, of course, the operating system supplied with the Mimi. This means that a vast array of software

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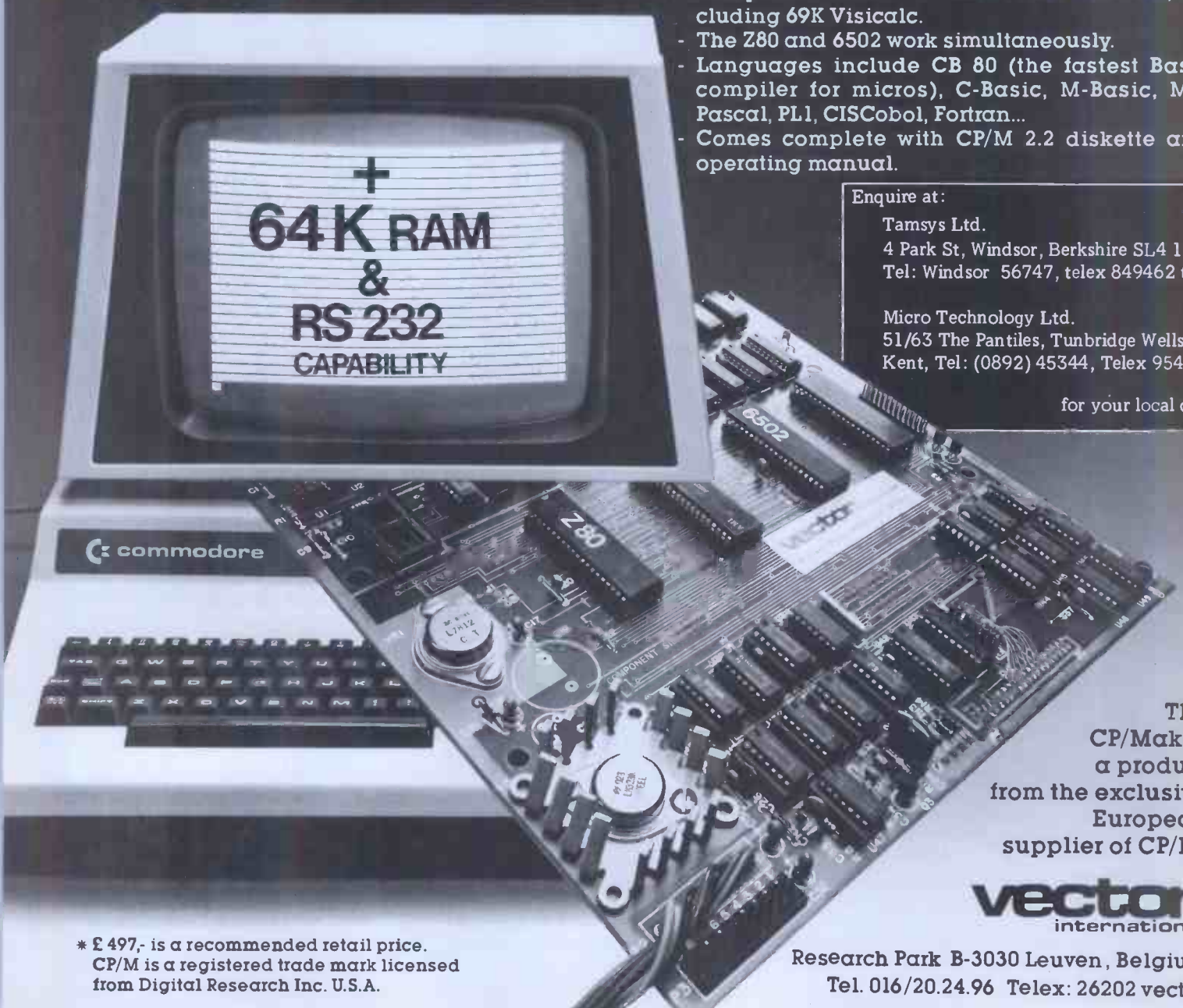

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* £ 497,- is a recommended retail price.
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becomes available, in theory at least. There is usually some snag, and versions of CP/M differ somewhat from machine to machine; this one seems to be a straightforward version 2.2 with BIOS version 1.1. There are a couple of extra utilities supplied to supplement the usual CP/M ones — Format and Backup. The Mimi uses a rather unusual disk format, which has certain advantages in terms of speed of access and capacity, but has the side effect of making it incompatible with other systems, so there is no chance of putting a disk from another system in and expecting it to work straight away. The disks are double-sided double-density and use a sector size of 512 bytes instead of the more usual 128. The heads access the track on side 0 followed by the track on side 1 before moving on to the next track, which saves head movement, so the disk appears to have 35 tracks each containing 20x512-byte sectors. CP/M expects to find 128 byte sectors so software is interposed to fool CP/M into seeing 35 tracks of 80x128-byte sectors. The sector skew is left variable on this system. The skew is the order in which sectors are accessed; there will usually be some processing after a sector is read which means that the physically next sector will have passed the head, and if that was the next one to be read you would have to wait nearly a whole revolution before it comes round again. So the idea is to skip a few sectors and hope that the next sector that you actually want to read is in exactly the right position when you try to read it. The number of sectors that you skip is the skew factor, which is normally set at some average value. The Format program allows you to set the skew factor when you format a new disk, allowing you to squeeze the best performance out of your disk for a particular application. I do not think that this will make very much difference in the majority of applications and most people would find a skew factor of 2 the best compromise. I experimented with a few different values and it made no detectable difference, but then nothing of what I was doing was in any sense time-critical. Backup is a useful command to create a backup copy of a disk, system track and all; unlike many such utilities, this one only copies the sectors which are not empty, saving a little more time. Both Format and Backup did seem to work quite quickly, though I did not have another machine around to compare them with directly. The larger sector size brings capacity bonuses as each disk can hold a full 340 kbytes. The software people at British Micro have attacked the problem of incompatibility and I was provided with a disk which, when booted up, reconfigured one of the drives to accept Superbrain 'QD' double-sided double-density disks, another clear indication of the market at which this machine is aimed.

RS232 connector contains two ports.

Software

The form of Basic I used was the standard CP/M MBasic, about which plenty has been written in the past. I was also given a preliminary form of a graphics package which took the form of an extension to MBasic. The graphics facilities on this machine are quite nice. Two resolutions are available: 512x256 and 256x256. Resolutions in powers of two would seem to make sense and might make possible some improvements in speed through good software design; the benefits of a square resolution should also be quite apparent, particularly for drawing graphs. I found the graphics quite impressive — the speed was good and the resolution fine enough for nearly all purposes. There is a graphics demonstration program to show off the features, which include double-width characters, free mixing of graphics and text, and half-tones.

This was only a preliminary package so the procedure for setting up the graphics extension was rather complicated, involving the loading of the graphics package (a CP/M command), then loading MBasic and finally setting up the linkage from within MBasic. I hope this procedure will be simplified before the package becomes generally available.

The graphics commands available reflect the intention that this machine will be primarily used for business rather than game-playing. There are no direct animation commands, nor any to fill in a block on the screen; but there are commands to draw vertical bars in full or half-tone, which make the drawing of histograms very much easier. Another useful command is DRAW, which takes as parameters the angle at which a line is to be drawn and the length, which I find very much more useful than the normal type of command which specifies the finishing coordinates although this is also available in the form of DRAWTO X,Y.

THE

MIMI 801

BENCHTEST PERSONAL COMPUTER

Graphics and text can be freely mixed anywhere on the screen, and a further useful command, which unfortunately had not been fully debugged in time for me to try out, is DOWN X,Y, 'string' which prints the string vertically down from the specified coordinates, without updating the cursor position.

It is possible to restrict the amount of screen which scrolls to a given number of lines at the bottom of the screen, but there is no other facility for creating 'windows' on the screen. The various routines are also available as a library which can be called from a Basic program, thus making them usable with the MBasic compiler and other languages.

The Benchmark timings show that the Mimi with MBasic is no slouch. The two sets of figures are because of the use of the top 16k of RAM for video; a CP/M system of more than 48k will use this RAM and, because it is shared by the processor and the video controller, access is slower than elsewhere in the memory map. The difference in the two sets of figures for the 62k and 44k systems shows what effect this has. The times are quite fast, even for the 62k system so, with the more efficient disk organisation and the fast graphics, the Mimi is certainly going to hold its own as far as speed is concerned.

Documentation

The documentation that comes with the Mimi is, to say the least, minimal, consisting of a 'Software manual' and some extra sheets detailing the pin layouts of the various connectors and a few pages on the graphics extension. The manual is in fact merely a list of the particular features of CP/M on this machine, with some details of the Format and Backup commands. Some examples of customisation to deal with particular printers are given but the reader is continually being referred to a 'CP/M manual' for more details. I am not overly familiar with CP/M myself, but with the aid of a CP/M manual (and a quick phone call) I managed to configure my printer (a Paper Tiger) to be the CP/M listing device. I would not like to recommend trying any of this to a beginner, but anyone familiar with the innards of CP/M should be able to find their way around without difficulty. The obvious intention is that dealers will put together a complete system based on the Mimi, and this will include application software and user documentation. I understand that the documentation is being revamped, at least in presentation if not in quantity; but I was rather disappointed by what there was. I usually find that CP/M manuals are not the easiest of documents to find your way through. I had no documentation for MBasic and Wordstar, which were the main items of software that I used, but they are both 'standards' of their type so I could find out how to do most things without needing too much experimentation.

Conclusions

The Mimi is a pleasant machine to use. CP/M opens the door to a very wide range of software and the machine's ability to read Superbrain disks and possibly other CP/M machines' disks in the future means that most of this software is going to be available very shortly, despite the Mimi's own unusual disk format. The price of £1350 is very competitive, even after adding on the price of a monitor — a full business system with dot-matrix printer and appropriate software might be had for around £2000, and could show a significant saving over many similar systems.

Initial cost is not everything, of course, and a lot will depend upon the amount of support available for both hardware and software and that will depend on the numbers being sold. There is now, I believe, a network of 19 dealers offering systems based on the Mimi in this country; three types of maintenance contract are available, covering the usual degrees of service. The Mimi is already established in Denmark, Holland, France and Holland; units have been shipped to South Africa, Greece and Iceland and orders have been received from West Germany. British Micro is expecting to move 2500 units this year, which is quite a respectable level of business. It should have some clear advantages over its immediate rivals for, as an indigenous company, it benefits from Common Market regulations and the government tries to maintain a 'buy British' policy where possible. One market which the Mimi could enter quite stongly is the educational one, despite the subsidies in favour of the RML 380Z and the BBC machine; it offers a clear price advantage over the 380Z and would look an attractive prospect to those institutions teaching *about* business systems rather than simply using the computer as a classroom tool. I understand that 12 have already been installed at Nottingham University.

I would like to see better documentation and I would definitely hope that the keyboard will be sorted out so that all key labels reflect their actual functions. British Micro is an offshoot of a company that has been in the board-making business for some time. I think it deserves to succeed even if I might query the wisdom of jumping in at the deep end in what is simultaneously the most competitive section of the market and the one that could well show the greatest upheaval in the near future as new processors and operating systems challenge the Z80-CP/M stranglehold. I liked the Mimi and it created a very favourable impression while sitting on my desk; it is a good-looking, well-engineered, professional system. The only trouble that arose was a fault on disk drive B which started to reject sectors that drive A continued to read perfectly. This only occurred late in the test but by the time I finished this review British Micro had not come back to me about getting it repaired; I hope the company dealing with maintenance can manage a quicker service. A businessman looking for a reasonably priced entry level system could do worse than this new British micro.

BENCHMARK TIMINGS

	62k	44k
BM1	1.7	1.2
BM2	4.7	3.7
BM3	12.4	9.9
BM4	12.2	9.8
BM5	13.1	10.5
BM6	24.3	18.6
BM7	38.6	29.6
BM8	6.6	5.4

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

GRAPHICS COMMANDS

G256	sets 256x256 resolution
G512	sets 512x256
PSET X,Y	lights a pixel at specified coordinates
PRESET X,Y	erases a pixel at specified coordinates
PENDOWN	following graphics statements will display a trace on the screen
PENUP	following graphics statements will not display a trace on the screen
PENERA	following graphics statements will cause any pixels already alight to be erased
PENFLIP	following graphics statements will invert pixels
PENRET	causes the pen to return to the position it was at before the last graphics statement
START@ X,Y	updates current pen position
DRAW a,d	draws a line from current pen position to length d at an angle a to the x-axis
DRAWTO X,Y	draws a line from current pen position to the point whose coordinates are X,Y
SCREEN X,Y	updates the position of the screen cursor on a 64x25 grid
VBAR X,Y,N	draws a solid vertical bar from screen coordinate X,Y for N dots
VBARH X,Y,N	draws a half-tone vertical solid bar
DOWN X,Y,"str"	prints the string "str" downwards from X,Y
CAP	prints current pen coordinates on the screen
CAP@ X,Y	prints current pen coordinates at point X,Y
LCAP	prints current pen coordinates on the CP/M list device
SCROLL N	limits screen scrolling to the bottom N lines

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FIVE OUT OF TEN · MUST TRY HARDER

William Dargue describes his experiences with micros in the classroom

There's no doubt at all that microcomputers are wonderful machines. I've had great fun with them and learnt a lot. But isn't it time that teachers with the micro bug stopped and had a look at where we're actually going in education? Computers are certainly addictive, and just as an alcoholic can think of all sorts of reasons why he should have just one more drink, so micro-mad teachers will justify their machine in education.

I'm a teacher in an inner area school in Birmingham. I had no contact with micros whatsoever until 18 months ago when I was offered a Tandy TRS-80 Level II on permanent loan by Colin Watkins, Birmingham's Primary Computer Adviser and an ex-primary teacher. Tandy, it seemed, was willing to loan a machine to us, presumably to impress the Birmingham Educational Computing Centre, which was then trying to decide which machine to standardise on in primary schools.

I agreed to go on a 10-session Basic course and to report on my experience with the computer, which was to be kept in the classroom full time. Apparently this was hitherto unheard of. Where schools had their own machine they were shuffled round the classes on a rota basis, so that in a two-form entry junior school each class would only have the micro for one morning or afternoon a week, and quite probably not every child would even have a go once a week. Other computers were loaned out by colleges or local authority computer centres and hands-on time would be even less.

It would be interesting to see how the children in my class reacted to the computer being with them all the time, with each child using the machine at least once a day.

So I learnt some Basic. My first shock (perhaps I was a little naive) was finding that computers couldn't do anything until you told them to. They couldn't tell you when Shakespeare's birthday is or how far it is to the Moon. Quite a disappointment at first. And I learnt how you have to tell them how to do every damn thing (worse than kids in that respect!). And I experienced the thrill of running a crude 'What's-your-name? 'Hello-Bill' program. And then times tables! It really was an exciting achievement. Then the TRS-80 arrived. The children were ecstatic and the rest of the staff pretended not to notice.

The first day every child had a go on my wonderful tables-testing program. All day the whole class watched and normal work came to a standstill. After a few days, however, no one took any notice and the children would go and have turns on a rota basis without disturbing the rest of the class at all.

But there had to be a gremlin in the works! From the first we had a problem which I found out later was called 'debounce'. Whatever you typed came up double or worse. It only took a few days for the roars of laughter to stop, however, when the computer said,

Illustration by Derek Matthews

'Hello, Sseebbaassstiann' or, 'Well done, Ppaatssy!' We were later given a very short program by Tandy which could be put in before any other program and that problem was solved.

But there's more! I had terrible trouble loading the programs from cassette. I learnt later that the TRS-80 can be very temperamental about volume and only slight adjustments can mean success or failure. But it meant at first my having to type in programs every morning before school because the program would not load from tape. And can you imagine that with every other character doubling up?

Experience has taught me how to fiddle about with the volume, although it is frustratingly time-consuming and not always successful even now. But there was also the problem of the machine being in four parts: the screen, the keyboard, the cassette player and the power supply. These bits and a hundred different wires had to be got out every morning and taken to the other side of the room where the socket was and all connected up. I coped and even learnt to do it without much effort, but this sort of rigmarole really is not on for a primary school where there are many different subjects to be taught and the demands of other apparatus to be met.

So the children quickly became used to it, though their enthusiasm for using it never flagged (even with a constant diet of tables testing), and other teachers even peeped round the door at it once or twice!

Fortunately, at this point, our primary adviser came up with some new programs. One was a tables-testing program which increased the difficulty as the children improved and which also kept a record of their scores with only a little manipulation of tapes. Another was a program whereby the teacher could type in the week's spelling and the children would type them in on a 'Hangman' basis without the hangman. This was useful because it directly related to classroom work. And a third set of programs was Tandy's own K8 maths programs.

The K8 maths program was great. It is a very carefully worked out American program of arithmetic from the very simplest level (kindergarten) to the most difficult four rules (+, −, x, ÷) practice that you could want. The program will grade the children and then provide practice at their own level. Although there were differences in procedure compared with the way we taught, it seemed to worry the children very little. Other teachers peeped a little more and seemed to be quite impressed with K8. It is, after all, the type of practice arithmetic primary schools still do a lot of.

Other programs were brought in from time to time. The primary adviser gave us a noughts and crosses game. The children enjoyed his sense of humour in the comments the machine produced when it won or lost. There was a maze game where you had to steer a dot round a maze to knock out a number of targets. And a very crude Space Invaders. The children did not tire of the computer at all — they used it usually once a day and sometimes more often, but I made sure that I kept changing the programs often enough to stop them getting bored.

Really it was me who was getting bored. What with the continual humping about of the equipment, the problems in loading the programs, seeing the same drill-type programs all the time and the enormous amount of time and effort involved in producing the very crudest, graphicless programs, the micro began to get me down.

I had no doubt that the children enjoyed it. I was sure it was doing the useful sort of work we often did in class, but I knew it was capable of so much more than I was able to do with it.

Meetings were held from time to time at the Computing Centre in Birmingham and people from various

'Programs need to come from teachers and not from computer experts with bright ideas...'

parts of the country would demonstrate their own programs. Some were designed to be used on a large TV in front of a whole class. These seemed particularly futile: they couldn't compete with a real TV programme, and what's wrong with a blackboard anyway? Many were of the drill-type programs with which I was already very familiar. Others were supposedly decision making programs for use with groups of children. These were fine as long as the programmer had included all the possibilities that the children were likely to come up with, otherwise they ended up as 'guess-what-I'm-thinking' games. It left me feeling that there was nothing much that £500 of equipment could do that any good teacher couldn't do with chalk, talk, pencil and paper.

And then the cuts in education spending began to bite. Birmingham decided it couldn't fund a full-time primary adviser, despite Mrs Thatcher's £9 million for computers in schools. Our primary adviser had to be half-time adviser and half-time teacher. He spent his half-time teaching at our school.

He brought with him another TRS-80 complete with expansion interface and a disk drive. And, most important of all, we had an easily accessible programmer to hand.

So, with two computers, we changed tack. We decided that the computer permanently in a classroom was a great success. This was to be the way forward. But with limited resources it was time to make the machines available to a wider range of children. The two computers were set up permanently in the library on our top floor, where they never had to be moved and where they were within easy reach of our 3rd and 4th year juniors (aged 9-11). Each class was time-tabled for two morning or afternoon sessions using both machines.

Now we had to justify to the teachers what the computers could do. It was amazing how I managed to gloss over the problems and present a God's-gift-to-mankind image of our troublesome micros when faced by a critical staff.

But they were keen to give them a try. So what happened? After an initial surge the whole thing has died a little. Teachers have found it too difficult in practice to keep hopping in and out of the library to check results and solve the minor problems of children who are stuck. It means leaving the whole class for the sake of one child, and that is just not on with primary children. Whereas the micro was in use virtually full-time in one classroom, it is not uncommon now to find both machines unused with a 'Ready' sign on.

However, with an almost resident programmer it has meant that the teachers' criticisms of programs have been acted upon fairly immediately. Small things have been easily altered: we have a time-telling clock program which asks 10 questions which weren't numbered. That would have taxed my ability but has been quickly dealt with. In our tables test there was no way for children to solve problems to which they did not know the answer. We tried supplying them with paper and pencils (remember them?) and counters, but now, if they still fail to get the right answer after a certain number of tries, the screen displays (for example) a grid of 9 by 7 stars for the child to count up. For, say, 23 x 6 it prompts 3 x 6 and 20 x 6 and then adds the answer.

We now have spelling programs and games of Hangman which use a common pool of weekly spelling lists. Our disk drive provides this flexibility.

The disk drive has given my own programming a new lease of life. I've developed a number of programs to better suit my own needs. And at the moment I'm working on a program which produces poems by request. It's a computerised poetry book whereby the poems appear line by line at the speed I've selected with such wonderful graphics as falling snow, winking snowmen, random time clocks and emptying dustbins. It's an as-yet-crude attempt to break away from practice drills and give the computer another dimension than Space Invaders, spelling and tables. If only I had more time!

So, what are my observations after some considerable experience using computers with primary school children? Firstly, let me restate my credentials. I am a class teacher with some small ability to program. My attitude to computers is the same as regards any new classroom tool, whether it be a new type of pen or new paint. I haven't got much money to spend and I'm very critical of advertisers' claims to solve all my problems.

It seems to me that too many teachers involved with computers are being carried away with their own enthusiasms. They feel a desperate need to justify the huge amount of time and money they are spending on micros and are being blinded to the real problems and achievements of the machine.

The problems are massive. One is that micros are as yet too complex to be used by the uninitiated teacher. I'm not denigrating the average primary teacher, whose time is precious, when I say that any apparatus more difficult to use than the blackboard or the textbook or the human voice is likely to be rejected unless it's bloody good.

And what can existing programs offer that a good class teacher can't? The most appealing aspect of a good program is that it has a very important element of personal contact with the individual child and that it can be

GOTO page 180

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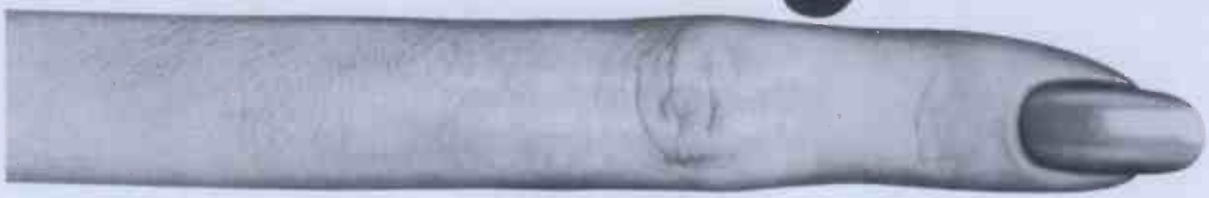

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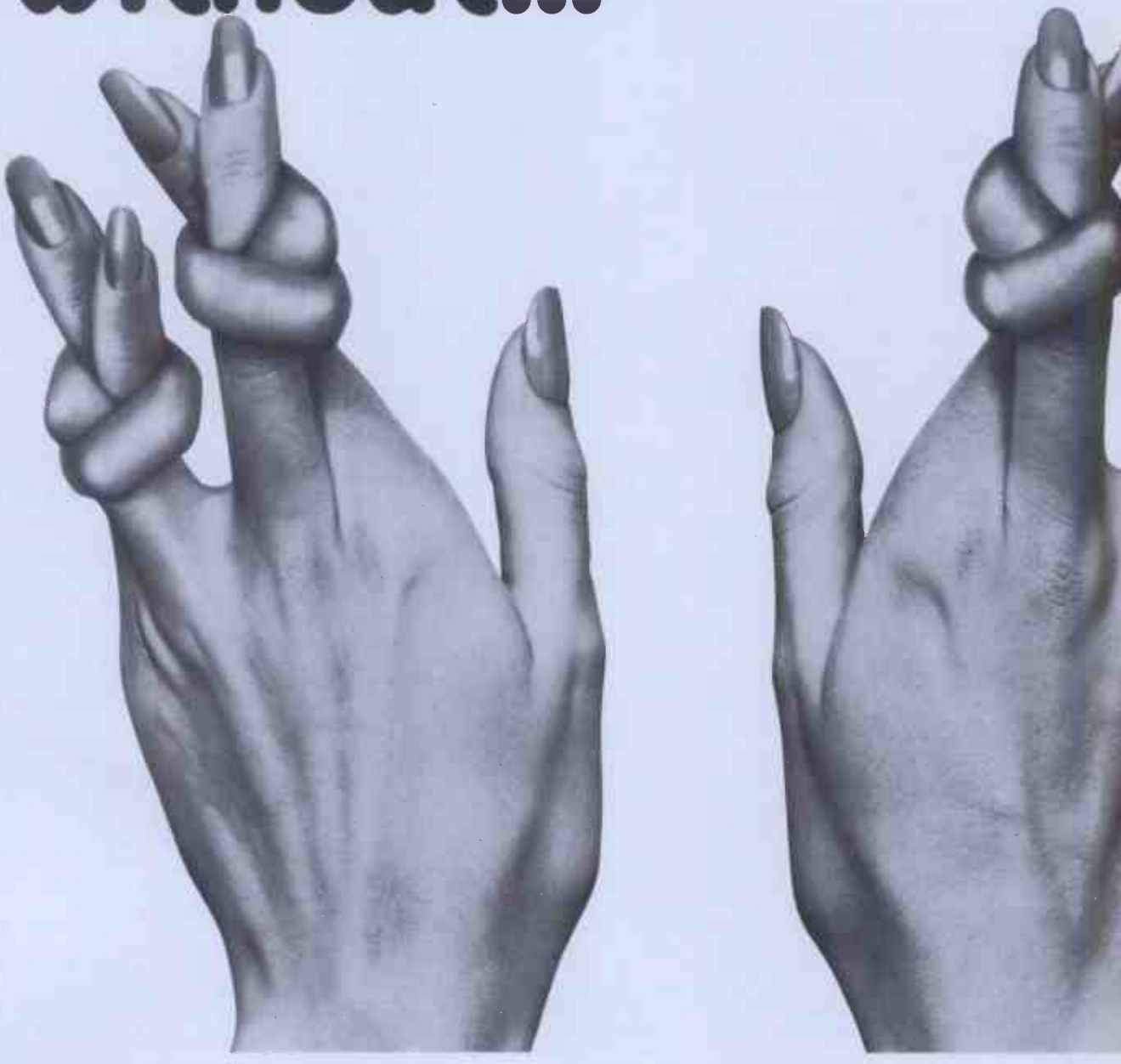

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Getting the strength of insurance

Playing safe is Martin Banks' policy this month.

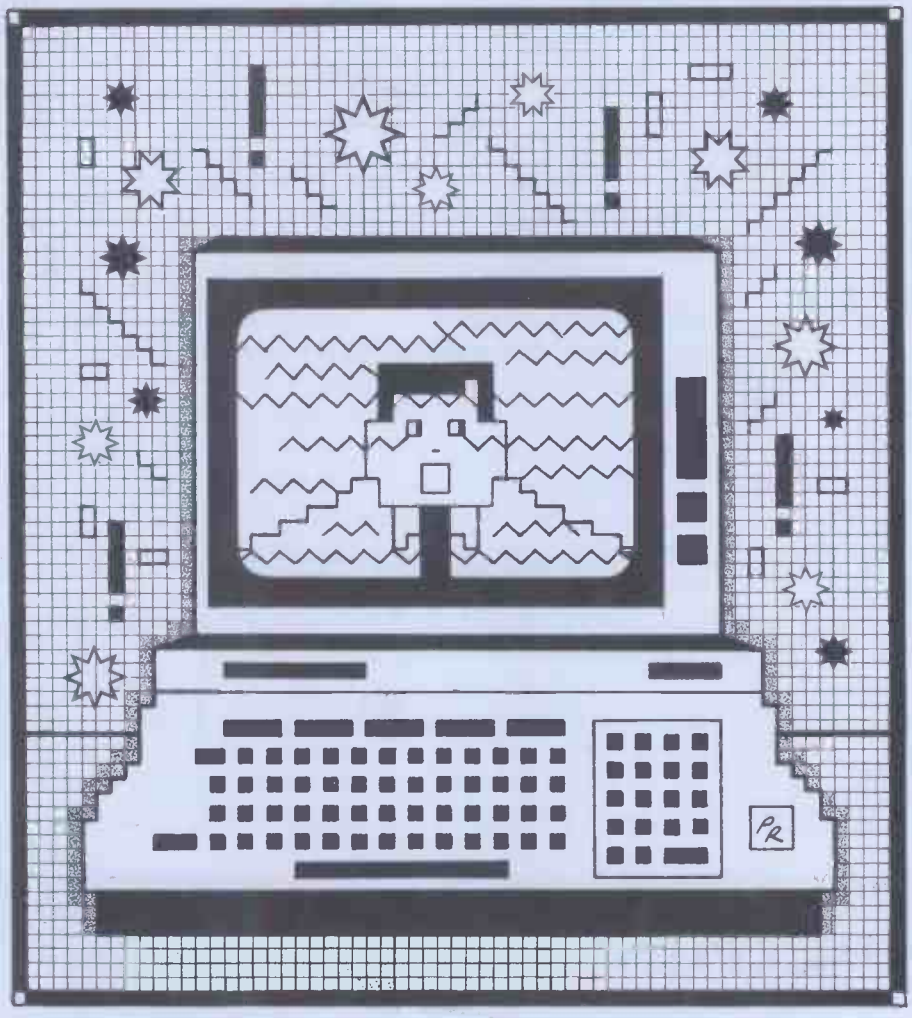


Illustration: Pauline Rosenthal

There is something very civilised about insurance, about the way that we seek to protect ourselves against the loss of a valuable item (or person) so that we can — within the bounds of reason and practicality — replace the loss with something that is just as good.

There is something about insurance that is a problem, however, and that is the way it has become such a complex subject to comprehend. For example, how many of you have ever actually read all the sections of an insurance policy, all the small print that sneaks around the bottom of page 94 of the great tome that makes up the policy? I suspect that the answer is very few.

This does mean, unfortunately, that we regularly place ourselves in the position of having to take a great deal of what is written in such documents on trust. It also means that, however fair and scrupulous the insurance industry is, we are liable to oversell or underprice ourselves on a policy on something we value. We are often going to make fundamental mistakes on policy selection. We are even going to get completely the wrong idea about what a policy will actually provide, and be shocked beyond both comprehension and bank balance as a result.

Despite its civility, therefore, insurance can be a tricky little minefield to negotiate for the unwary, and that is exactly what seems to be starting to happen in the personal computer business.

Many users — the majority if they are sensible — are taking out insurance policies on their brand new machinery when they purchase it from the dealer's shiny showroom. They are not, however, always actually buying what they thought they might be. What they thought they might be purchasing was some form of insured maintenance deal.

It is only later that they find they weren't. What they were buying was an ordinary insurance policy — and that is something completely different.

There are now several companies offering insurance policies that have been developed especially to cover domestically located high technology products; this includes hi-fi and video equipment as well as personal computers. Among them are Commercial Union, Entertainment and Leisure, and British Engine Insurance.

The policies they offer are broadly similar, though obviously a special deal can always be arrived at. Most provide for theft, damage in transit, and the accidental catastrophic failure of the equipment. Under these circumstances the insurance company promises to pay the value of the policy or the replacement value of the equipment as new, subject to all the usual terms and conditions of the policy.

The list of items and events that the policies *do not* cover is, as might be expected, normally extremely long. The Entertainment and Leisure policy, for example, has a list of 17 exclusions, ranging from faulty manipulation, erasure and loss of magnetism of tapes, cassettes or memory banks on to inherent vice (which we can't write about in a family magazine like *PCW*), and ending up with theft from vehicles with removable or soft tops.

All well and good. These are the things one normally tends to find in insurance policies. Sometimes there can be more abstruse items that should be checked, like for example the exclusion of consequential loss over and above the loss of the insured property. This means that, though you have a replace-as-new clause in your policy, you won't be covered for having to hire a system while waiting for the new one to arrive.

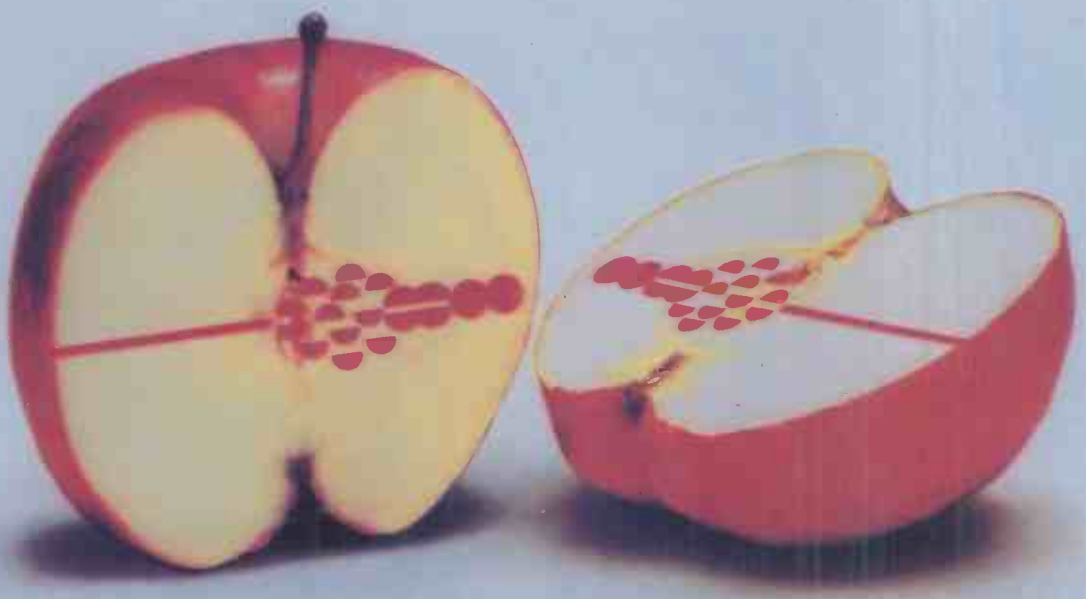
Despite things like that, the policies are useful items to have as the final financial fall-back position, and they are good value for money for what they offer. The Entertainment and Leisure policy, for example, costs £114 a year to cover a system valued at £2500. That covers a system anywhere in the UK, including transit and theft from a vehicle. If the system is insured in a specified building only, it costs £70 to insure.

That is considerably cheaper than the equivalent maintenance contract. Most companies in the maintenance business will look towards charging around 20 per cent of the system's value, per year, to run a maintenance contract on a machine. This can seem a lot to many new users just on the point of signing the cheque for their computer. At its silliest, it represents £13.99 a year to get a maintenance contract on a Sinclair ZX81. The notional £2500 system will cost around £500 a year on that basis.

So what do you get for this amount of money? Well at one extreme it must be said that all you will be paying for is the privilege of having the engineer come out within 24 hours to confirm your diagnosis that, yes, the machine has broken. At that level it is something of a waste of time and money. The more comprehensive contracts will provide such things as a guaranteed call-out time, which can be extremely important for users that base revenue-earning activities on the operation of a computing system; preventive maintenance, which means that the engineer comes round maybe twice a year just to give the machine the once-over and a clean (dirt and dust being a popular source of failure modes); and, finally, skilled engineers. These should be people who know and understand the quirks of a particular system, who can diagnose many faults just from experience but have the ability to find the

GOTO page 179

Great minds think alike.



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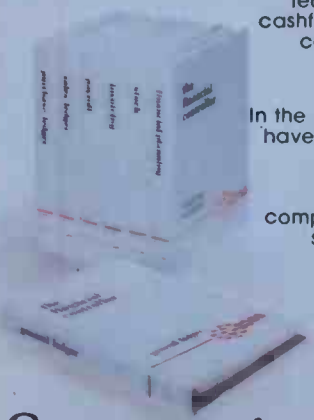

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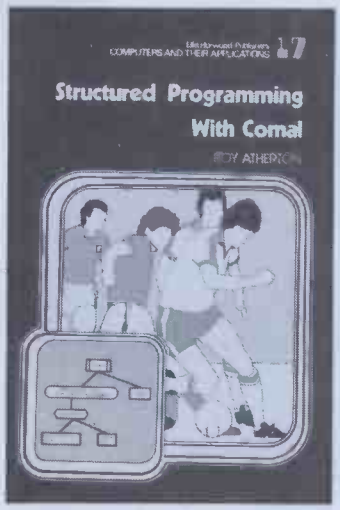
BOOK FARE

By Malcolm Peltu

Innocence is bliss



Structured Programming with Comal by Roy Atherton (Ellis Horwood/Wiley, £18.50 hardback, £6.90 paperback)

Most micro freaks are still in the full flushing delight of computing innocence. Having been armed with a smattering of Basic and oblivious of the complex webs ahead, micro users can set out enthusiastically and uninhibitedly into the computing adventureland.

This attitude has helped personal computing to crack open new frontiers, with blissful innocents going where old computer fogies would have feared to tread. Unaware of the faults of Basic, the micro stars have exploited the language's advantages to the full. But innocence cannot last forever. The Apple II of first knowledge may be sweet and easy but the Apple III of experience has a bitter taste and a toughened core. The thrill of Basic is that it makes programming easy. It breaks down the initial fear of computing but it can be a honeyed trap for the unwary. Programming *per se* is easy but software development can be a complex task.

A few years ago when I roundly attacked Basic in some Bookfares, I was squarely attacked as a computing square. Since then, I believe, there has been a growing and inevitable awareness that there is much computing life beyond Basic. The importance of structured programming and design has been recognised. Pascal is joining Basic as a standard micro language. Other languages, like Forth and Lisp, are being rightfully included in the standard armoury of micro programming.

The trouble with experience, however, is that the joyous simplicity of innocence gives way to murky compromise and complexities. Certainties become doubts. Mistakes may be avoided but so are the crazy risks which turn out to be unexpected breakthroughs. These musings on the loss of innocence have been sparked by reading *Structured Programming with Comal* by Roy Atherton in conjunction with an article by Thomas Green in the first issue of *Behaviour and Information Technology* (which is reviewed fully below).

Comal is the language developed in Denmark by Borge Christensen. It aims to combine the simplicity of Basic with a design that intrinsically promotes the principles of good programming practices and structured design which were previously the preserve of 'grown up' less easy to learn languages like Pascal.

Atherton was one of the founders of MUSE when the acronym stood for 'Minicomputer Users in Secondary Education', ie, in those distant pre-micro days. He has been one of the most eloquent spokesmen for the teaching of good programming practice, not just any old Basic programming. His book on Comal adopts the pragmatic style of most micro books. It is more concerned with doing than theory. He introduces language concepts through example rather than abstract discussion.

This is both the main strength and weakness of the book. It means that newcomers are introduced to structured programming concepts and techniques painlessly and practically. On the other hand, it has insufficient space to explore the wider context of programming theories and developments. As a first step on the road to good programming, this weakness is unimportant. As Atherton comments, in terms of the way he has organised material in the book, 'A good learning scheme is sometimes like a spiral in which topics are treated a bit at a time, returning to previous topics when the time seems right.'

Having provided a basic literacy in structured techniques, Atherton gives the reader the strength to venture forward and, hopefully, to start asking questions.

This is where Green's article provides a healthy reminder that structured programming raises doubts as well as solutions. It will be disillusioning for those Basic innocents, who were exhorted to turn to structured programming as a panacea to cure the ills of Basic, to learn that there is much doubt and argument about best ways of implementing structured programming. But one of the lessons of experience is that there ain't no easy solution to complex problems.

The undisputed virtue of structured programming is that it provides a systematic way of clarifying problems and matching the intrinsic problem structures to the structure of the actual program. There is much dispute, however, over the interpretation and effectiveness of different structured techniques.

Green focuses on the specific issue of the pictorial representation of programs — flowcharts, structured diagrams, etc. Whereas Atherton says that 'it is fairly easy to reject the flowchart as irrelevant to modern methods,' Green suggests that flowcharts may have some value.

Green's general thesis is that there is insufficient evidence to make definitive statements on the best notation to be used for graphical program representations. He describes some experiments which indicate that, in some circumstances, flowcharts can be as effective as stuctured diagrams. His advice is for the 'less sophisticated readership' to stick to flowcharts which are laid out to reflect structure, for example putting different parts of processes well away from each other. For the more sophisticated readership, he recommends structured diagrams based on a notation by Kenneth Bowles, who developed the UCSD Pascal system.

Although Atherton aims at the novice, he sticks to Bowles's method. Having rejected flowcharts out of hand, he does look very briefly at other notations, without going into much historical or background detail.

On balance, Atherton is probably right to stick to a straightforward and practical exposition of structured programming without raising doubts. It is a major leap forward to have a book like Atherton's which addresses itself to the micro world but which is informed by the light of experience and research which dates back to before most micro computerniks were born.

It is pleasing, for example, to see Atherton acknowledge the work of computer scientists like Edsger Dijkstra, Tony Hoare and David Barron, who have contributed so much to software techniques but who are unknown to most personal computer users. I would have liked Atherton to have attempted the task of explaining the contributions that these people have made to computing and the whole background to structured programming and the still hotly disputed issues, of which Green provides an example. But I suppose that would be another book in its own right.

As it is, *Structured Programming with Comal* is an excellent introductory book for total computing novices or for Basic freaks wanting to learn about Comal. As would be expected, concepts are introduced in a way which reflects the significance of program structure rather than just as a collection of descriptions of language functions.

Atherton starts with a brief overview of Comal facilities. He then moves on to data representations and movement (READ, DATA, input and output). The next six chapters are about program structures, beginning with repeated operations, like FOR loops, then moving through program decision making, modularity and procedures to structure diagrams and top-down analysis. There is a useful chapter looking at structured programming with Basic. Which clearly illustrates that, although it may seem to be little more than an extension of Basic, Comal produces programs which are much clearer and intrinsically better structured. The last three chapters are concerned with general programming ideas like sorts, arrays, queues, stacks and files.

Throughout the book, Atherton provides examples that can be worked through. He writes lucidly, with no frills. As the content of the book is based on practical experience with student teachers, it would make an excellent basis for an education course.

Of course, much of the credit for a book like this must go to the nature of Comal itself. Without Comal, Atherton would have had to write about structured programming either as a botched extension to Basic, in relation to a more complex language, or in completely abstract terms. As Atherton says, 'The book follows Borge Christensen's view that there is more to be gained from building on the strengths of Basic than totally rejecting it for the serious deficiencies which have become painfully apparent.'

Comal loses none of Basic's simplicity, which has been so vital in stimulating the enthusiasm of personal computing innocents. At the same time it assimilates the experience of some of the venerable old fogies who know better.

Atherton shows that it is possible to learn about programming at the same

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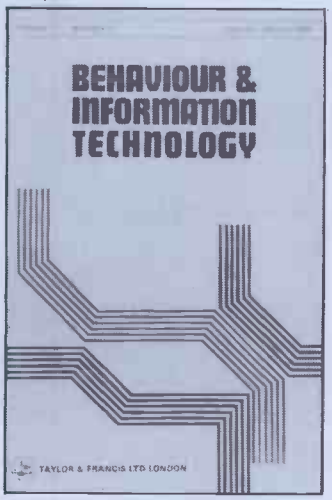
time as learning about good programming principles. With the increased awareness of the benefits of Comal and other structured languages, it will hopefully become possible to ensure that the loss of computing innocence and the awareness of underlying software and systems complexity will still be allied to the enthusiasm and adventurousness of the Basic brigades.

Coming together



Behaviour and Information Technology, edited by Tom Stewart (Taylor and Francis, £34.00 per year; £10 per issue; published quarterly)

'It is becoming apparent that what limits the successful exploitation of (information technology) equipment is not so much the technology but rather how it can be made acceptable and usable. The rate of absorption will be determined as much by human considerations as by technical ones.'

That is how the editor, Tom Stewart, introduces an important new quarterly journal, *Behaviour and Information Technology*. Its aim is to try to discover the key aspects of human human behaviour relevant to information technology and it will involve a coming together from a variety of disciplines, including psychology, sociology, ergonomics, computer science and economics.

It is an ambitious objective to try to cover such a disparate range of topics. The effort is worthwhile. Just as various technologies have merged to create information technology, so are many other areas associated with the uses and impact of the converging technology. This convergence means that experts from different fields need to be informed about each others' work.

Judging by the first issue of the journal, however, Stewart will have a problem in trying to give the journal cohesiveness. The subject matter covers such a wide range that it is difficult to determine any coherent thrust.

As already discussed above, there is an interesting article by Thomas Green of the Department of Psychology at Sheffield University on the use of diagrams to describe programs. The interest of Green's piece, however, is for the light it sheds on the techniques of structured programming rather than any particular insights into human behaviour.

An article by George Colouris of Queen Mary College on designing office systems is very disappointing because it is so brief. It is more like an outline for an article than the completed work. In a journal like this, which has the space to explore matters in depth, more should be given than just an outline of the requirements for an interactive office system.

The inadequacy of Colouris's contribution is overcome by an intriguing examination of some innovative techniques for 'navigating' through a database in an office environment. Robert Spence and Mark Apperley describe work being carried out at Imperial College, London into new techniques of searching for and displaying information in electronic office systems.

Their work draws on pioneering studies at Massachusetts Institute of Technology by Nicholas Negroponti. It involves large screen wall displays, pointing, gesturing, touching, speaking and other non-keyboard interactions.

Spence and Apperley dig beneath the surface but do not get lost in technicalities. They indicate how systems could be developed that match natural human ways of behaviour.

Martin Maguire of Leicester University looks at how keyboard interactive dialogues could be made easier to use and more tolerant of human foibles and variations.

Other contributions include a technically-oriented evaluation of the physical ergonomic characteristics of Visual Terminals; some unsurprised results from an American study of how professionals (like accountants and lawyers) perceive computers; and the role of computing in medical General Practice.

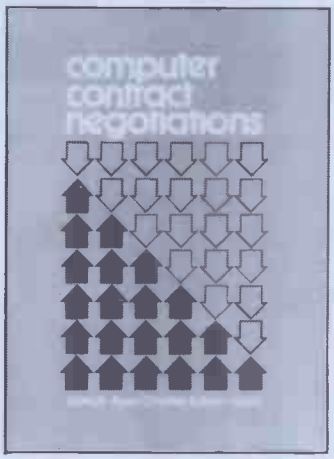
Most contributions in the first issue of the new journal are interesting in their own right. However, they still fail to mesh together.

Given the scope of the journal's objectives, some element of higgledy-piggledyness is inevitable. I hope that, as the journal matures, it will develop a stronger focus which turns the disparate threads into a coherent whole.

There is a vital need to bridge the gap between users and technologists which brings in those specialists who understand human behaviour. The new journal may have got off to a patchy start but it is a bridge that needs as much support as possible if it is to provide a forum for the exchange of experiences, research evidence and views.

As illustrated above by the overlap between Green's paper and Roy Atherton's Comal book, the human dimension can provide added depth to what seems a straightforward technical issue.

Getting a good deal



Computer Contract Negotiations by Joseph Auer and Charles Edison Harris (Van Nostrand Reinhold, £29.35)

The process of selecting an appropriate computer can be a lengthy one. Having sifted through the bumf, the articles, the manuals and the sales chat, a short list may be drawn up, evaluation tests carried out, discussions held with manufacturers and dealers, etc, etc.

At the end of the process, having finally chosen what seems to be the best system, there is a natural tendency to want to get the system in and working as quickly as possible. 'Sign here on the dotted line,' says the victorious salesman. And too often the user signs, without questioning the contract details.

Computer Contract Negotiations provides a battleplan to be used by the customer. The authors indeed see the contract negotiating process as a war. This is because they are mainly writing about American business, which is a warlike environment where the executive's motto seems to be 'kill or be killed'. They are also concerned mainly with large computer contracts where the stakes are high.

The authors base their views on hard experience. Joseph Auer has made a career of computer contract negotiations and set up the first full service devoted to help users to screw the most from manufacturers through the contract. Charles Edison Harris is a lawyer who has specialised in computing.

Together they provide a great deal of practical advice. They also vividly illuminate the darkest recesses of the manufacturers' sales and marketing ploys. Unfortunately, the price of the book, its heavy concentration on large computers and its emphasis on much American law and procedure may put it out of the scope of most personal micro users.

I would recommend, however, that any computer user, particularly in business, gets hold of a copy, at least from a library, and reads and digests the relevant good bits.

For instance, Auer and Harris point out that 'For the contract to do its job as a legal document, it should cover all aspects of the transaction and clearly specify the promises and obligations of each party. The simple fact is that all vendor form (standard) agreements fail to meet the test. Most vendor contracts are blatantly one-sided documents that clearly indicate the user's responsibilities, omit or minimise the vendor's obligation and eliminate or limit the vendor's liability for non-performance.'

The main emphasis of the book is to show how the contract can be balanced so that the user gets a fair deal. This advice is summarised in two useful appendices which provide a checklist of items to be covered in the contract and some selected provisions which could be incorporated into contracts.

Auer and Harris are openly cynical in their view of vendors. They provide a sharp rundown of the ploys deliberately used by suppliers to try to foist onto users standard contracts which are biased in the vendors' favour.

The authors' treatment of the negotiation process as a war leads them, however, into fanciful depths in discussing the psychology of negotiations. They would make excellent tutors for the CIA or KGB. In fact, at one point they actually refer to the use of 'the good guy/bad guy negotiating strategy, sometimes called "The Streets of San Francisco Technique" because of the popularity of the method in TV detective shows.'

Of much more value to purchasers of any size of computer are the chapters covering general contract provisions, maintenance agreements and software agreements. They discuss the need for particular provisions, using examples gained from real experience to show what happens if the provisions are excluded from the contract. They also provide suggested wordings for certain provisions and examine in detail areas, such as expected system performance, which are difficult to pin down in

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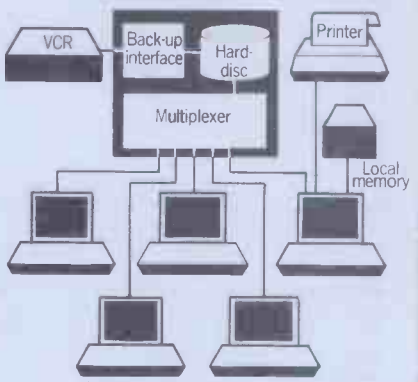

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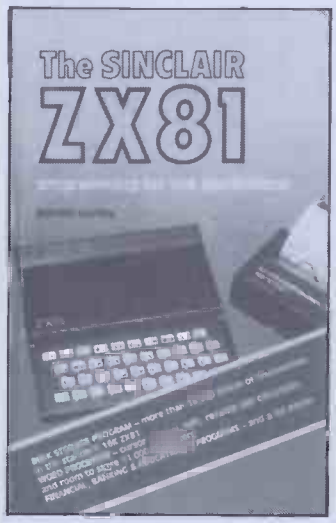
legal terms.

An abridged version aimed at small system users would be an invaluable aid to micro users. But even as it is, Auer and Harris provide much that will be of value. The high cost of the book could prove to be a worthwhile investment if it helps to save money by ensuring a contract is agreed which provides adequate user cover and limits the damaged caused to rotten computers.

Real work on ZX81



The Sinclair ZX81 — Programming for Real Applications by Randle Hurley (Macmillan, £6.95; program cassette, £11.95)

In this book, Randle Hurley attempts to refute the slur most often aimed at the ZX81 — that it is fine for learning the rudiments of programming but is really only a toy and is not suitable for any 'serious' applications. With certain reservations, I would say he succeeds in this aim.

Perhaps inevitably in a book written by a teacher, the material concentrates on educational aspects — there are programs for grading exam results, for sorting students into rank order, and for setting up a school banking progran. These are likely to be of minimal interest to the non-academics among us, but the principles involved should be easily applicable to other areas.

The book starts with an informative chapter on programming techniques. This is primarily concerned with making the most of the ZX memory and contains a series of tips on good programming; covering structuring, byte-saving techniques and idiot-proofing. Hurley's subroutine for allowing inexperienced users to input information is excellent, if a little wasteful of memory — it will allow anything to be keyed in and, via a series of messages, will coax the beginner into presenting information in a form the machine can deal with.

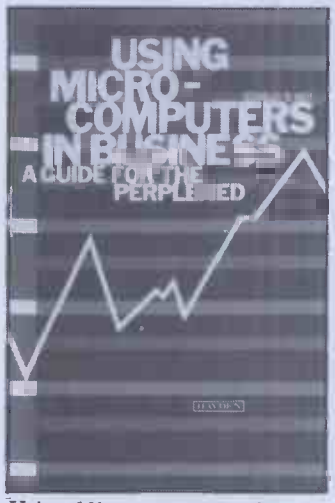
Then, of course, there is the ubiquitous 'Personal Finance' program — automatic updating of your bank account, allowing for regular credits and debits such as salary cheques and standing orders and one-off payments. I must admit that I find these programs hardly worth the bother; you generally spend five minutes waiting for the program to LOAD and another five to SAVE the updated record back to tape — and all for a few seconds of feeding in 'Debit — £6.95 Randle Hurley book'. Hurley's two Personal Finance programs take two and three minutes respectively to load, but personally I find a few seconds with paper and pencil more convenient — in fact, I'd generally rather remain in ignorance of the parlous state of my finances. A word of warning here to people who have bought the program cassette that accompanies this book. At the start you are asked if your account is in credit or overdrawn (C/O). I keyed in 'O' (this should give you some idea of *PCW* salary scales) and was surprised to find that the program insisted on treating my balance as zero. On checking back, I discovered that the program needed an input of zero for an overdraft. This is my major complaint about the book's presentation: the typeface used fails to distinguish clearly between zero and uppercase O — the usual computing convention of putting a stroke through the zero would have obviated this. It's a simple matter to change the program listing to accept 'O' for overdraft, but it's a situation that should never have arisen.

The major 'real applications' covered here are programs for bulk storage and 'word processing'. The bulk storage uses Sinclair's string-slicing facility and claims to store more information than there are bytes in the memory. The 'word processing' program is called 'Word Juggler' is inevitably, very simple, making no attempt to justify text and with major additions and amendations beyond its capabilities. But corrections, sentence restructuring and small additions are not and, given care in reading the instructions, operation of the system is commendably easy. Text is divided into six-line paragraphs, and 57 of these can be held before memory limitations cause trouble. But my objection to any form of word processing on the ZX81 has nothing to do with lack of memory — it's the limitations imposed by the machine's design that cause the trouble. In fact, the thought of having to key in 2000 words on the Sinclair keyboard makes me break out in a cold sweat.

That said, and allowing for the occasional problem caused by the injudicious use of typeface, I was impressed by Hurley's approach. ZX81 users should find plenty to ponder here, and I look forward to the promised follow-up, utilising machine code for more 'real applications'.

Steve Mann

Businesslike



Using Microcomputers in Business — A Guide for the Perplexed by Stanley S Veit (Hayden/Wiley, £7.75)

'Sometimes the magic works and sometimes it does not.' For some obscure reason, that is the quote from the film 'Little Big Man' which Stanley Veit uses as a dedication to his decidedly unmagical book, *Using Microcomputers in Business.*

This is a straight up-and-downer introduction to micros for business applications. There are many better introductions but there are also many worse ones.

Sensibly, Veit starts with applications rather than technology. Following a very brief introduction to computing, he looks at ways in which computers can help businesses, with a whole chapter on word processing.

Other chapters look at database management systems, and how to install and buy systems and computer languages. Refreshingly in a book which basically promotes the wonders of technology, Veit also looks at some limitations of systems and at what to do if the system goes wrong.

At the end of the book, he goes into more detail about how micros actually work. This is a better structure than that adopted by other similar books, which too often start with circuit diagrams and binary arithmetic.

Veit provides brief material on each topic and gives very brief summaries of important products, like Wordstar and CP/M. After going through it, the reader should have a very general idea of what business micros do.

The same, however, is not true of many other cheaper books which are more oriented to the UK market. Sorry Stan. You try hard. But the magic just did not work this time.

Bookends

Bookfare regularly covers a wide range of books about computing. The pace of computer book publishing, however, is accelerating. In order to include more publications, this month we start Bookends, an occasional feature which provides a very brief statement on the contents of books we have received but have not been given the full Bookfare treatment.

The Basic Conversions Handbook for Apple, TRS-80 and PET Users by the Brain Bank (Hayden/Wiley, £6.20). A useful little book if you want to move Basic programs between Apple II, TRS-80 and PET. David A Brain leads a team of people who provide summary lists of equivalent commands between TRS-80 (Model I Level II), Applesoft Basic and PET Basic, as well as variations for TRS-80 Model III and Apple Integer Basic. Graphics capabilities, PEEK, POKE and CALL statements, cursor and control characters and other aspects are also described.

Recursive Descent Compiling by A J T Davis and R Morrison (Ellis Horwood/Wiley, £12.50).
Provides a detailed introduction to compiling in general by examining one particular technique, known as recursive descent. This technique is widely used in compilers for languages such as Pascal and Algol. Readers are expected to be 'fairly proficient' in any programming language with Algol Pascal-type languages being particularly apt. Shows how problems of compiling are overcome using recursive descent techniques.

Practical Programs for the BBC Computer and Acorn Atom by David Johnson-Davies (Sigma Technical Press/Wiley, £5.95).
Examples of programs that run on Acorn's BBC micro and the Atom. Each program is shown first for the BBC machine then for the Atom. The first chapter shows three games. Chapter 2 has programs on graphics patterns, contours, rotation and surfaces. Chapter 3 has anagram, buzz-phrases, limericks and how to create a catalogue. Chapter 4 shows how to manipulate numbers. The last and most interesting chapter looks at how a compiler for a Pascal-like language could be written.

END

COMMUNICATIONS

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

Peltu pelted

As producers of the BBC's Computer Literacy Project over the past couple of years, we've developed a pretty robust attitude towards your contributor Malcolm Peltu. 'Ah well,' we'd say in the office, 'he probably had a tight deadline to meet, can't have had time to check it. They'll probably get it right next week.' Or, on another day, 'it's only old Peltu rabbiting on, everyone knows he's got bees in his belfry.' *(And, presumably, bats in his bonnet — Sub Ed.)* 'But shouldn't we reply?' someone would say, 'put the record straight?' 'No, life's too short — and there's this script to finish.' So it goes. But Malcolm's piece this week ('Has the BBC Microcomputer sent Auntie off the Straight and Narrow?') has risen to new heights, even though it's not exactly breaking new ground. Studded with arresting phrases — 'arrogance of the computer illiterate. . . sheer hypocrisy. . . wriggling excuses. . . sell, sell, sell. . .' — it's challenging, headline-worthy, entertaining. Only one snag though, it bears very little relation to the facts of the case. So may I, as briefly as possible, straighten out the record a bit?

The reason for providing a BBC micro, as we have often stated, was that this was the only acceptable way we could ensure that a well co-ordinated and language-compatible television series, book, correspondence course, high-quality microcomputer and software could be made available to our viewers. Some wanted some parts of this system, others others, and some we knew would want to move from one part of the system to another, as indeed they have done. Surely a public service of powerful educational value, built around a television series? Our trade is, of course, to make programmes, but it is also to provide for other educational needs that arise from broadcast series. This is precisely what we have done, and the public response suggests that it wasn't a bad idea. Over 80,000 people have contacted our Referral Service for help and information, over 60,000 have bought copies of the associated correspondence course. Over 55,000 have bought copies of *The Computer Book*. Over 3,000 enquirers have been referred to courses and clubs. Over 25,000 people have ordered microcomputers, and we are constantly bombarded by requests for software.

To suggest that the project made it seem that computing literacy and programming are synonymous is nonsense. As anyone who saw it will know, the television series, the most public part of the BBC project, was concerned with computing principles and there was very little attempt to teach programming. As a matter of fact we were criticised by a good many viewers for *not* including more on programming, and the demand for the NEC course suggests, that, whether Malcolm likes it or not, a lot of people want to learn something of programming in Basic. But this certainly wasn't what we did in this television series, although we may do more on programming next time round.

To say that the BBC book is more of a support for the microcomputer than for the TV programmes is also nonsense. It hardly even mentions the BBC micro, nor is it, as Malcolm implies, only concerned with personal computers. The book, like the series, is intended to be a layman's introduction to the world of computing.

The BBC is not selling a computer, it is licensing an outside company to do so. There was no suggestion at the end of the programmes that you have to buy a BBC micro to be part of the computer age. People are perfectly capable of making up their own minds to buy a cheaper or less sophisticated machine, as Clive Sinclair can confirm.

To suggest that the television transmission times were deliberately off-peak because the BBC 'wanted to dampen down demand for the microcomputer' is pure eyewash. The transmission times were fixed before we ever decided to have a machine, and at those times we have managed to attract a total of over 1½ million people for each broadcast — about what we expected.

The specification for the computer was neither tailor-made for Newbury nor altered to suit Acorn. The provision of software, which will support a whole range of our new broadcast series, is not against the BBC Charter. Sheila Innes did *not* say that 'Managing the Micro' was designed to be propaganda: it wasn't. What she actually said was that in retrospect we might have preferred the series to be a little more critical of the technology, but that certainly didn't amount to saying we'd set out to 'sell, sell, sell'.

I could go on, but I think I have made my central point, which is simply this: if Malcolm Peltu is going to get on his soapbox, he should take more trouble to get his facts right.

John Radcliffe, Executive Producer, BBC Computer Literacy Project

Draught exclusion

Keep up the good work — *PCW* is fascinating and always has 'something for everyone'. One significant and important omission, however; you have nothing on the rapidly growing area of computer draughting; digitising tablets. plotters, software, etc. I know that there are (vastly expensive) specialist mags which are directed to the trade, and deal with the large systems but there appears to be nothing at all on *micro* applications — which is your field. So — how about a special issue.

M G Mathews, Eaglescliffe

Dunno about a special issue. Mr Matthews, but we do review peripherals from time to time in our 'Checkout' series — Ed.

General malaise

I am writing with reference to Mr Alan Wood's article in your March issue entitled 'A DP Manager's Guide to Micros'. I would like to take the opportunity to correct some misunderstandings and inaccuracies that appear therein with reference to our company's marketing strategies and products,

Mr Wood refers to the microNova as old technology. Such a dismissal fails to take notice of the past and continuing sales success of this product line, whose primary marketplace is *not* that of commercial desk-top micros. Because of the copy date of this issue, the statement also misses the fact that Data General has just announced the microEclipse range of products — which is very new 16-bit technology.

Mr Wood is similarly dismissive of the soon-to-be-launched Enterprise 1000 desk-top micro. His statement takes no account of the true UK marketing strategy that has been set up over the last year in preparation for the launch. As recent press announcements have made clear, the Enterprise *will* have immediate access to what Mr Wood calls 'industry standard software' due to an agreement with Micro Products Software Ltd (MPSL) that has made the BOS/5 operating system available to Enterprise users,

Perhaps the most surprising statement in Mr Wood's article is that Data General 'completely missed the word processing and office automation market'. I have to inform Mr Wood that in the UK alone Data General has several thousand installed machines performing word processing and related text processing fucntions. These are almost all in shared logic environments as the Company made a deliberate marketing decision not to enter a short-term, free-standing WP market.

My apologies for the length of this letter. Of course, I do not expect you to publish it in full, nor would I expect your readers to be particularly interested in some of these high-level products. However, I think I have made the point that glib dismissals of a major supplier should not be made without checking one's facts. Please contact me here at any time in the future if you require such facts about how our company operates and markets its products in the UK.

Tony Richards, Marketing Communications, Data General.

Mr Richards' letter has been abridged — Ed.

Fearsome factors

In response to your 'Factors Freak' in the May 1982 'Communications' columns, I suspect that the answer is, 'not in a million years'. The reason for this (and I quote): 'Multiplying is easy for a computer, but factoring is extremely difficult. For example, whereas two 100-bit factors can be multiplied electronically in a fraction of a second, the reverse process of factoring them might take a million years, even with a one-microsecond instruction time.' ('Electronic Cryptography' — *Wireless World*, 9/80.)

The article I quote from is a discussion on methods of Data Encryption, where the security of the system relies on the above-mentioned facts; ie, knowledge of the factors involved permits the decipherment of text enciphered by the result of such a multiplication. The cipher 'keys' are easy to create and use, but without

the factors being known the 'code' is well-nigh impossible to break — I wonder if that's why D Hunter wants his 150-digit number factorised?

The commonest methods of factorisation are Exhaustive Search, whereby the factors of a number N are found by testing each integer from 1 to N in turn and noting down those which produce no remainder when divided into N (which is the rigorous mathematical definition of a Factor), and an optimised version of the Exhaustive Search which I tend to call Exhaustive Reduction. This works in a similar manner, except that only prime numbers are tested and as each factor of N is found, it is divided into N and the quotient factorised instead.

This method produces the Prime Factors of N, from which all factors on N may be produced by cross-multiplication. For numbers with a lot of factors this method works exceptionally well, and since it is a recursive process (of sorts), it proves rather easy to program onto a computer. The difficulties arise if the number is exceptionally large, and has relatively few factors.

If the 150-digit number you published is 'rich' in (low) prime factors, and a table of prime numbers is available, or can be produced easily by your computer (mine reeled off the first 1000 or so in about 15 minutes) then the task of factorisation merely requires a standard computing 'trick' to con the computer into doing 150-digit arithmetic for you. (Divisions are, unfortunately, the hardest to program!) Itwill also require a mass of machine time, though the judicious use of multiple processors should speed this considerably.

If, as I suspect, this number only has a very few large factors and a handful of smaller ones, then even using a Cray 1 mainframe dedicated to the task might take a lifetime (or several).
A W Bain, Welwyn Garden City

Felonious factors?

The answer to your own question at the bottom of the letter from Saffron Walden can perhaps be found in *Scientific American* for August 1979, where on pages 146 to 157 Martin E Hellman goes into the mathematics of Public-Key cryptography.

One of the possible procedures discussed is that put forward by Ronald Rivest *et al* in April 1977, working in the Laboratory for Computer Science of the Massachusetts Institute of Technology.

This procedure is based on the then-perceived virtual impossibility of factorising the product of two prime numbers each some 50 to 60 integers long.

Mr D Hunter's number might well be just such a product, and it would come then as no surprise at all to learn that he, like many others, is in search of algorithms capable of solving this particular factorising problem.

In fact it is generally believed that the problem is no nearer solution than it was in 1977, and that very recent work on high-speed algorithms for testing primality, whilst tantalisingly close, does not actually address the problem itself.

It is to be hoped that Mr Hunter is not using your columns to break a privately held decryption key. That would indeed be an improper use of them.
D A Fagandini, Dulwich

ZX81 maths and other bugs

Your correspondent Jonathan Empson asks for an explanation of a few results on the ZX81. These observations may help:

1. PRINT (−4)**2 gives error report A/O, ie, 'invalid argument' because the ZX81 tries to evaluate this expression as EXP (2*LN(−4)), and it considers −4 to be an invalid argument for the LN function. In short, there is no provision in the ZX81 ROM for finding powers of negative numbers by using **. You have to use the positive number, taking care of the sign yourself, or use some other expression, like PRINT −4 * −4. VAL behaves like PRINT in this respect.
2. PRINT −4**2 gives −16 because exponentiation (**) has a higher priority, ie, 10, than unary minus, which has priority 9 (ZX81 manual, page 196). So PRINT −4**2 is equivalent to PRINT −(4**2).
3. PRINT VAL " " gives error report C/O, ie, 'not a valid numerical expression' because the ZX81 ROM does not regard the text of the empty string as a numerical expression but as a string expression.
4. The expression X**2 seems to work on my ZX81. If I enter LET X=3 and then PRINT X**2 I get 9.
5. Whether 1 to 3 should be called bugs I have to leave to others to discuss. I have five or six other bugs now in the ZX81 ROM. In view of the wide sales of the ZX81, I wonder if you would like an article on them, perhaps also indicating how all the arithmetical mistakes caused by the original bug (superbug?) traced back to one mistake on addition. I should perhaps add that I am co-author with Dr Ian Logan of Part B of the ZX81 ROM Disassembly, in which I have analysed floating point calculator.
(Dr) Frank O'Hara, Surbiton

Be Thou Our Help...

I have just been reading your review of Wordstar in the free supplement to the May 1982 issue of *PCW*, and I noticed a minor error which I think is significantly unfair to Wordstar.

You state that there is no way to re-configure Wordstar to start at any help level except 3. In fact this is very simple, and full details are given in the 'Customization Notes' manual, which includes well-documented assembly-language listings (with actual addresses) of all the relevant sections of code which any user might wish to alter. Changing the initial help-level involves just changing one byte.

We use Wordstar on a Cromemco, and using the Cromemco Debug it is only two minutes' work to make the necessary change, and write the modified version of Wordstar back to disk (at least, once you have found out how and done it first time) — the same goes for all the other defaults (like left and right margins, lines per page, and so on).

I realise that many users of Wordstar do not have the technical knowledge or software tools to do this, but I would have thought that any good supplier who looked after his customers would be able to make such changes for a nominal charge.

We have a number of different users who use Wordstar on the same machine, and the tendency is for them each to 'customise' their own versions with the defaults they prefer (which are easily changed as I have described).
Prof A C Davies, City University

Yes, you're right but what I really meant was that this facility ought to be easily available to every user rather than limited to those able and willing to dive into assembler language — Ed.

Peaches are off...

I read with great interest Steve Withers' Benchtest article on the Hitachi 'Peach' Personal Computer which is currently on sale in Australia and Japan. It is always valuable to hear the opinions of an independent reviewer.

Unfortunately, UK readers eager to get their hands on the MB-6890 Basic Master Level III Computer will either have to go to Japan, or take a trip down-under. Hitachi has no plans to release this machine in the UK.

However we can promise exciting developments in personal computers in the near future. To quote from the last paragraph in Mr Withers. article — 'who knows what the next year or two will bring?'

We will, of course, make sure that *PCW* readers will be among the first to find out about these new developments.
E C Marshall, Divisional Manager, Hitachi Computer Products.

Too many bugs

I have now had my personal computer for 18 months. During that time I have copied many programs out of diverse magazines but find that due to misprints and errors not more than about one in ten runs first time. The best (!) one so far contained eight errors in 43 lines.

As this is most discouraging to beginners, would it be presumptious of me to ask programmers to take more care with their listings as I presume publishers cannot check out every program submitted?
M Lievers, Leicester

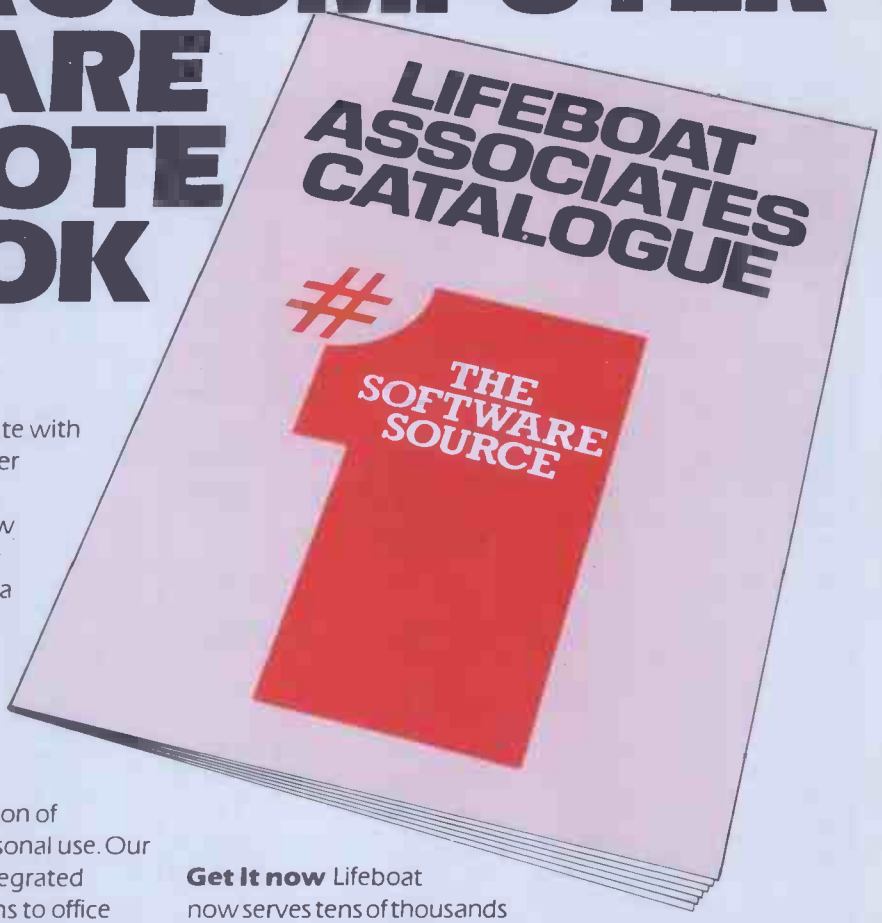
We send out every program we publish to have it checked (apart from the ones I try out myself). Our listings are taken directly fron working cassettes and if ever something does go wrong, corrections are published as soon as we have them. However, yes, I do agree. If a program is considered fit for publication by its author then, it is up to him to see that it reaches us free from errors — Maggie Burton

SBAS vs Comal

I read with interest the article by Borge Christensen ('Is BBC Basic Structured?') in your April issue. In it he makes reference to the fact that 'You must be able to handle branchings globally, ie, with several lines packed and controlled as one block. Comal and Waterloo Basic have this structure, and RML Basic has one that looks very much like it. . .' I think that I should point out to Mr Christensen that RML Basic does not have this sort of block structure, and can only infer that he is thinking of our own SBAS — a fully structured Basic which we supply for the RML 380Z. SBAS includes BEGIN. . . END keywords which enable the programmer to treat several lines as one block in IF. . . THEN. . . ELSE conditions. Also included are REPEAT. . . UNTIL, WHILE . . . DO, CASE statements, procedures, etc.

We believe that SBAS offers significant advantages over Comal, and would hate Mr Christensen to be labouring under a misapprehension.
Spencer Instone, Software Production Associates.

WHEN IT COMES TO MICROCOMPUTER SOFTWARE WE WROTE THE BOOK



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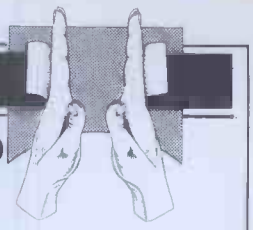

I BEG YOUR PARDON?

The case against computer literacy

David Tebbutt explains why he doesn't believe in computer literacy.

For the last 6000 or so days I have been kidding myself that I believe in computer literacy. Worse, I have diligently preached and even practised what I've been preaching. As a programmer I was always ready to explain bits, bytes, Boolean algebra and flowcharts to anyone who'd care to listen. Later on, as a system designer, I'd spend hours trying to convince reluctant users that their lives would be greatly enriched if only they would adapt their way of working so that it was more in tune with the requirements of my latest system. As a systems analyst, I had a wonderful opportunity to examine and criticise some of the far-out manual methods of my clients. All the time I was convinced that the elegance of computer-enforced logic couldn't fail to make a convert out of the most stubborn user, if only he'd give it a try.

As a data processing manager, I virtually had the power to dictate the way in which users worked. In the early days much input was through punched cards, so it was simply a case of forcing the necessary input information into the 80-column limitation of this medium. Since alphabetic information was hard to unscramble, it also meant that a lot of codes had to be used. Still, if the users wanted the benefits, the argument ran, they simply had to adapt to the requirements of the computer. Then along came visual display units. Together with the ability to allow the users to work in a more natural way, they also brought a chance for them to learn to type and ruin their eyesight.

Not satisfied with this, I then embarked on 1000 or so days of teaching others how they, too, could bring the benefits of 'computer literacy' to their unsuspecting users. My dream then, as I remember, was a terminal on everyone's desk with instant access to all relevant company information. Computer staff from all over the world were attending the courses and then rushing back to implement systems which would bring the greatest benefits to their users. During this time I also learnt an awful lot of new tricks, so I eagerly returned to the coal-face where I spent another 800 or so days implementing a number of elegant systems which matched the companies' informational needs but possibly totally alienated some users who, up 'til then, had probably managed brilliantly with an assortment of wall charts, felt-tipped pens, forms and biros.

'I used to lie awake at nights thinking of the number of new "computer literati" being made...'

Somewhere along the way I discovered micros. A quick look at my company's five-year plan told me that micros didn't even get a look in so I decided to move to pastures new. My dream of a computer on every desk was about to become a reality. For a year or so I devoured every piece of information I could on these microcomputers. To a man, my colleagues thought I had gone off my trolley and when I announced that I was to launch a new microcomputer magazine they tried to convince me that no one would ever read such a thing, Just after I resigned, *PCW* came up for sale so the launch of a new magazine became the relaunch of *PCW*.

I used to lie awake at nights thinking about the number of new 'computer literati' being made. We watched *PCW*'s sales rise from 25,000 to 50,000 then to 75,000. The magazine thickened, and the tide of information flowed through the editorial department, causing great stresses and strains but creating an enormous sense of satisfaction too. On my first visit to the American West Coast, I met Bob Albrecht and Ramon Zamora who had recently started a project there called ComputerTown, USA! This involved taking computers into the local library and introducing them, free of charge, to all interested members of the public. ComputerTown's stated aim was to 'Bring Computer Literacy to the Entire Community' — in this case Menlo Park, California, a town of 27,000 souls.

This project really caught my imagination, so, about six months later, ComputerTown UK! was launched in *PCW*. Now there are 30 or so ComputerTowns up and down the country, all manned by volunteers and all prepared to welcome any member of the public who expresses an interest in computing. ComputerTown acts as the first step for many towards the removal of the computer fear which seems to afflict so many people, probably as a direct result of the awful systems that have been implemented in the past.

After 800 happy days with *PCW*, I left to become a software publisher. I still carried on writing articles and coordinating ComputerTown in my ever-diminishing spare time but my main energies became focused on Caxton and its software authors. Now, I thought, I can spread computer literacy throughout the world. I'll publish programs which people will want to use, which they'll enjoy and which will actually achieve something worthwhile for them. I'll make documentation so thorough that the user will be totally unaware of his transition from computer illiterate to computer literate.

After 100 days or so into Caxton, I received a letter from one Alan Waring, inviting me to give a talk on 'The Importance of Computer Literacy'. Two things bothered me about this. One was I didn't have a clue what to say and the other was that the title sounded awfully pompous. This made me feeel uneasy so I rang Alan and he promised to change the title to something more suitable.

Another 100 days went by and I got a reminder from Alan that I would be giving a talk on 'My Views on Computer Literacy' — 20 days hence. Ah! That's better, I thought, I can now say anything I like. Then I sat down to list my views on computer literacy and, do you know what? After a lot of thinking and a lot of writing, I realised that *I don't believe in computer literacy*. I don't think I ever have. We were all being swept along so fast by the so-called 'micro-revolution' that I don't think we had too much time to stop and question what we were doing. 'Computer Literacy' was a good-sounding label so we preached it here, there and everywhere — but I think very few of us paused to examine exactly what we meant by it. I wouldn't be at all surprised if the term meant something different to each person using it.

'"Computer literacy" was a good-sounding label so we used it here, there and everywhere...'

Well now that I've 'seen the light', it's time for a bit of clarification. No more shall I talk of Joe Public becoming computer literate. That's strictly for programmers, engineers, designers and documentation writers — all those, in fact, who really need to know something about computers. Hobbyists, too, clearly fall into this category. From now on I shall be preaching a new doctrine — that of making computer systems 'People Literate'. That, in my view, is what many of us have believed in all this time. We were seduced by a label and no-one stopped to question it until we were almost too deep in its embrace.

'People Literate' computer systems will have a number of hallmarks. They will be very easy to use, presenting no more barriers to the user than, say, the average washing machine. The user will be prompted and guided by instructions on the screen or, at worst, available on the display at the touch of a button. Wherever possible the key that the user has to press will remind him or her of the function about to be performed. Clear complete documentation should be provided to help the user get to know the system and to learn about things like security measures and recovery procedures if something goes wrong. Ideally, the user should rarely need to look at manuals when actually using the system. I'm sure that you will have all sorts of ideas on what constitutes a 'people literate' computer system. Why not share your views with other readers through the 'Communications' section in this magazine?

Forget computer literacy if you want to change the world. Let's make computers 'People Literate' instead. END

BENCHTEST SOFTWARE

SILICON OFFICE

Kathy Lang reviews a file management system with word processing and network connections.

All the packages I've reviewed so far have been dedicated to file management, although some do allow the running of other programs directly without recourse to the operating system. Silicon Office, from the Bristol Software Factory, runs on the 80-column screen PET and takes an integrated approach, providing facilities for word processing and for transmitting information between Silicon Office systems, as well as the file management functions which are the main concern of these reviews. Thus the user has only a single package to learn, with a consistent user image across the three functions. The approach taken is to use a set of two-letter commands, each of which provides one file, word or communications processing function. For instance, GR tells Silicon Office to get a record from a structured data file, while ET is the instruction to edit a text file. The full set of commands can be displayed on two screens-worth of 'Help' text. To give an idea of the range of commands, these tables are shown in Figure 1. Single commands can be issued from the keyboard and executed at once, or several commands assembled into a 'program' which can then be run by issuing a single command from the keyboard.

Within the file management area, Silicon Office uses fixed-length records indexed on a main key field. The structure of a record must be defined in advance; it can subsequently be changed, but only by defining a new structure and copying all the data across. The user can create an association between the main key field and any other field in the record, so it is possible to access records directly using any one field as the key. The record structure is defined on the screen in such a way that the screen format defines both the way records will be displayed on the screen and the format of the record in the file. Records can be amended, deleted, displayed on the screen and printed. A field in a record in one file may be used as a key to access records in another. You may carry out calculations on field values and store the results in data or work files, or accumulate the results for later display. Limited facilities are provided for selection according to specified criteria. Direct sorting of files would be impracticable, but is unnecessary as the key mechanism can be used to display or print records ordered by the values of any field.

Constraints

Files in Silicon Office are of two kinds: data files and work files. For either kind, filenames may be up to 14 characters long. The two types may not be mixed on a single disk. A data file disk can contain a maximum of three data files with their associated record structure information. Work disks are used to store any number of files of Silicon Office programs, files containing memory variables used for calculations, and word processing files.

When you load the Silicon Office software, it resides entirely in the PET's memory, so the program disk can then be removed; similarly, when writing your own SO programs, these are loaded into memory and the work disk can then be removed. The practical effect is to make six files of structured data available at any one time. This would probably be enough as far as simultaneous access to several files goes, but the restriction to three data files per disk is likely to put a premium on proper record-keeping about what is stored where, and can mean that security copying will take quite a lot of time.

The structure of data files is defined when they are created. The maximum size of record allowed is 252 characters, with no field being greater than 78 characters. Each record has a single key field, which must be the first; the key field must be text, not numeric, and must be at least 10 characters long (if it is longer, only the first 10 characters are used). Data may be either character or numeric; numbers are fixed point, stored using 14 significant figures. The user can decide how great an accuracy is to be used when displaying numbers. Data may also be held in memory using calculator variables — up to 64 numeric variables and up to 26 character variables. Names of data items in files, and of numeric memory variables have two-character names (A$ to Z$). Where the same name has been used for a record data item and a numeric calculator variable, if it is not clear which item a command refers to then the memory variable is 'found' first. There is no explicit 'date' variable type but SO does data-stamp files with their creation date and provide functions to manipulate dates effectively.

PROGRAM OPTIONS

SHORT FORM	FUNCTION	PAGE
!AR	AMEND RECORD	10
!CD	COPY DISK	11
!CS	COPY SCREEN	12
!CR	CREATE RECORD	13
!DR	DELETE RECORD	14
!DS	DISK STATUS	15
!DM	DISPLAY MEMORY	16
!EP	EDIT PROGRAM	17
!ET	EDIT TEXT	19
!EV	EVALUATE	20
!EX	EXECUTE PROGRAM	21
!EB	EXIT TO BASIC	22
!FR	FORMAT RECORD	23
!GM	GET MEMORY	25
!GP	GET PROGRAM	26
!GR	GET RECORD	27
!GO	GOTO	28
!H	HELP MENU	29
!IF	IF .... GOTO	30

PROGRAM OPTIONS

SHORT FORM	FUNCTION	PAGE
!IN	INPUT	31
!IR	INSERT RECORD	32
!LM	LINK MODEM	33
!NR	NEXT RECORD	35
!PD	PREPARE NEW DISK	36
!PT	PRINT TEXT	37
!PC	PRINTER CONTROL	41
!PS	PRINTER SELECT	42
!PR	PRIOR RECORD	44
!SF	SCRATCH FILE	45
!SR	SEARCH FILE	46
!SD	SET DECIMAL	47
!SM	STORE MEMORY	48
!SP	STORE PROGRAM	49
!TM	TRANSMIT MODEM	50
!VF	VERIFY FILE	53
!ZM	ZERO MEMORY	54

Fig. 1

Files may be searched directly only on complete key fields, and for all fields other than the main key field an index file must be explicitly created by writing a short SO program to associate the main key field with the subsidiary key field. These subsidiary indexes (SO calls them inverted files) are not kept up to date automatically when the file changes — you would be wise to include SO statements to do this explicitly in your updating processes, as forming complete index files takes rather a long time.

Input and updating

Silicon Office uses the same mechanism for defining record structures and for describing the way records are to be displayed on the screen. The cursor keys and insert/delete functions are used to 'draw' the format of the record on the screen. A typical record structure/display is shown in Figure 2.

The process of form design is a curious mixture of good and bad features. Being able to input the cursor anywhere on the screen and tell SO to start or finish a field there is great; also the system won't let you exit from formatting if a field is unterminated or if the record is more than 252 characters long. On the other hand, Carriage Return doesn't move the cursor, so to get it to the beginning of a line means moving it explicitly; the box markers which show whether you have created a text or numeric field differ so little I needed a magnifying glass to be sure I could tell the difference; worst of all, you aren't told what the cursor position is, so to create a field, say, 20 characters long means you have to count 20 spaces. You can check the length of the whole record so far, but not the length of individual fields.

Once the file structure is defined, data can be put into the file, amended and deleted with appropriate commands. (When adding data, there is no method provided of carrying over the value of the same field in the previous record, although you could easily do it using SO statements and memory variables.) Access to individual records involves exactly the same methods whether access is for amendment or just display, so I'll describe those methods in the next section.

If subsequently you need to change the file structure, perhaps by adding an extra field, it can be done — but the process is a bit tedious and can take the PET a long time for a file of any size. Ideally one would like to be able to copy the initial format, make the necessary changes, and then copy across all the data into the new version of the file. Within SO, the only way I could find of copying a data file with its associated formatting information was to copy the whole disk; having done so, I couldn't find a way within SO to rename the data file, so I would have been stuck with old and new versions having the same name.

The alternative, which I used, is to create a new record format identical to the old except for the new field, but for a record of any complexity that can take 15 minutes or so, and has lots of potential for error. Then comes the writing of a SO program to actually create the new records and transfer the data. Writing the program was easy — SO programs are straightforward, if a little limited in their facilities — but tedious, since I couldn't find a way to say 'transfer all the data items from the old file to the new'. So I had to write one assignment statement for each field in the record (which is the way it's done in the example in the SO Training Guide). It also took a very long time — well over three hours to copy 250 records containing 21 fields totalling 152 characters, using a system with twin 8050 disks — obviously it should be quicker on a hard disk system but I doubt if it would be a big improvement, as from other runs I did the time seems to be mainly taken up in processing the assignment statements. Using a similar method and a Basic program (which I adapted from a SO example) one can import data from standard ASCII files.

Displaying data

Data is displayed using the same format for all kinds of access, that is, the format used when setting up the file. The approach of using the screen as a 'scratch pad' on which the user can design a data format with the cursor keys is excellent as far as it goes but it needs further development to reach its full potential for the user. Since the record definition and display are tied together completely, there can only be one way of displaying a particular set of records. There doesn't seem to be any mechanism, even within SO programs, to allow the user to show the data differently — perhaps by displaying only certain fields for some operators and the whole record for others. This approach can be particularly useful with records containing a mix of confidential and open information, such as personnel files which might contain both addresses and salaries. Again, you could have two versions of the file, but then the updating process must work double time to keep both copies up-to-date.

Records are accessed either by main key or by record number; if you have set up the appropriate index file and written a short SO program you may also access by other fields. Key fields may be completely specified, or abbreviated to as few characters as you wish; if this results in ambiguity, SO will give you the 'first' record in the file which matches. If you ask for a record which doesn't exist, you will get the record which most nearly matches. For keyed access, only identity with the key value can be requested — you can't say 'find the first record where a type of goods is X or Y and price is less than Z' except by writing an SO program which uses sequential access. Once a record is accessed, you can step through the file using Next Record and Prior Record commands (the latter doesn't work if the preceding Next Record command reaches end of file). The stepping is by record number if your initial access used the number, by key if you used the main key.

As well as accessing records within the 'current' file, you can include a file name with the key, making it possible to switch files. For instance, 'GR keyname' will get the record of the current file with key 'keyname'; 'GR keyname (filename)' will get the record with key 'keyname' in file 'filename' and this file becomes the 'current file' for use with the Next and Prior record commands. Whatever method is used, and whether complete or abbreviated keys are specified, access is very fast — typically three seconds to any record in a file of 1000 records.

If you don't know in which record or field lies the value you are looking for, SO also provides a general search facility. This will take any word or value, and search every field of every record sequentially, starting from the current record in the current file, until it finds a match. This process is very fast — about one minute to find a match on a field in the 250th record of a file containing 21 fields, total size 152 characters, per record.

Printed reports

Silicon Office gives the user a simple facility for taking a 'snapshot' of the screen, which is extremely useful for getting paper copies of disk directories, screen formats and the like. For more formal and complete reports on data files, you need to use the set of commands which Silicon Office provides for word processing. This again is both good and bad. Good because it gives you the flexibility and power of a word processor when setting up reports; bad, because it means that you have to learn quite a bit about the word processing part of SO to get even quite simple reports.

The way the reporting works involves first getting up a format file for your report; this consists of setting a format for a 'typical' page of the report, complete with headings, headers and

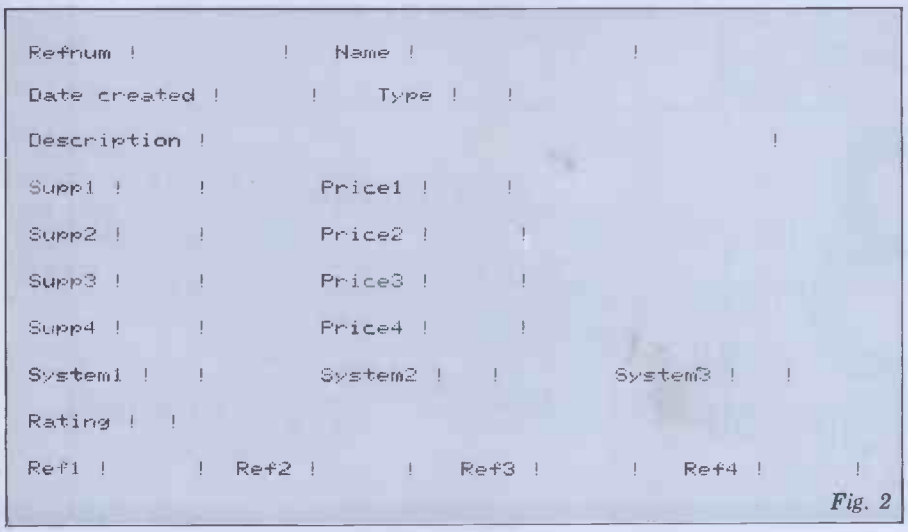

Fig. 2

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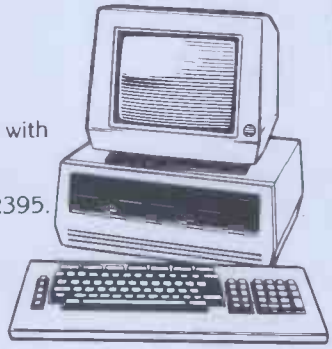
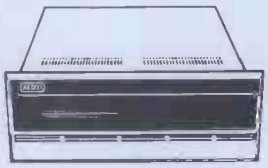
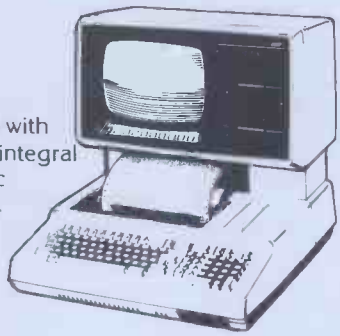


Altos
Up to 4 terminals and 40MB of Winchester Disc.
One of the biggest selling small business systems starting at £2350.
16 Bit system with 8 terminals available soon.



OKI 1F800
Quality graphics micro with full colour screen and integral printer. 64K and Basic are standard – £4750.
Wide range of peripherals available.



LSI M3
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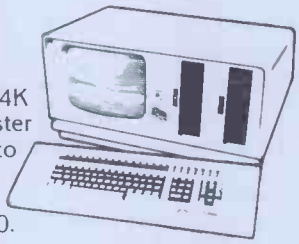
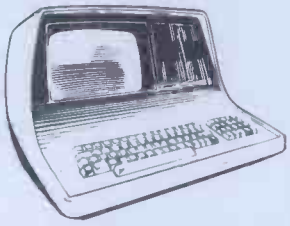


Superbrain
Still a leader in 8 bit price performance. KGB having sold over 400 Superbrains has unbeatable experience on them. From £1875.



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footers. Then you write an SO program which includes a command to print using this format. So you can use the SO commands for keying, selection and so on, and for calculating accumulated totals. You can also use the memory variables to accumulate subtotals, and by having them print as part of the page 'footer' report them each time a field value changes. Report pro formas are limited to a single text page, which might be limiting in some applications.

Selection

Selection is achieved by using IF statements in SO programs. Each IF statement can make a single comparison using the usual comparison operators (less than, greater than, not equal to, etc) and branch on the result — a simple IF. . .GOTO without any provision for ANDing or ORing comparisons within a single IF statement. These can, of course, be built up by branching, but that can be error-prone. When a match is made, the resulting record is displayed on the screen; for how long depends on the SO program. For instance, you can create a new file which is a subfile of an existing file by putting IF statements in a read/write loop; SO will then display the record momentarily while it is being processed. Or you can use a statement which needs a response from the keyboard before the program continues, so you could use this facility to build up programs for scrolling through data files in a variety of ways.

Sorting

Silicon Office doesn't provide any explicit facilities for sorting records. It would be possible to write (slow) SO programs to do so, but the facility for creating indexes on any field makes it largely unnecessary unless you want to order the display of the file on more than one field.

Calculations

The calculation features of Silicon Office are powerful and flexible. The user can have up to 64 numeric and 26 character variables in memory in addition to performing calculations on record variables. Memory variables can be stored in special files, displayed on the screen and printed. All the usual arithmetic operators can be used, including brackets, and the precision to which calculations are carried out can be defined by the user. There are also a number of built-in functions such as MIN and MAX; these include a function to convert numeric variables to character format but not the reverse (though you could write a SO program to do that). One particularly useful function calculates the *period* between one date and another — very useful for, say, checking if an account was issued more than three months before the current date.

Security

Security has at least three aspects: hardware and software reliability and integrity, protection against accidental user error, and protection against unauthorised access. To help with the first of these, SO provides a verification command, which rescues as much as it can from a file which has become corrupted. (It also gives the usual homilies about avoiding such corruption in the first place.) There is no command for logging each transaction to the printer as it is performed, though you could add this quite easily to any SO program, using the Copy Screen facility. Password or other protection against unauthorised access would again have to be provided by the user's own SO program, and there would be nothing to stop any reasonably intelligent person working out how to access files without going through SO programs which checked access. Where security is an important issue, this could be a serious problem, as in the absence of transaction logging there would be no way of telling that a file had been read or written.

Tailoring

I've already mentioned the Silicon Office programming facility. Any command which can be used from the keyboard can be included in a SO program, and with the simple looping and testing facilities provided by IF and GO you can write quite extensive programs to process your data. Programs may not contain more than 100 statements, but they can be chained together without limit; however, like most Basic-like languages, you can't use parameters when calling another SO program, though you can pass data across using memory variables.

The programming provides a good — if crude — facility for flexible manipulation of data; again, though, there are some avoidable nasties which detract from its good points. SO numbers program lines for you, and you can edit the lines using a simple screen editor. However, if you insert lines in the middle of an existing program references to line numbers in loop statements are not renumbered accordingly (as they are, for instance, in the RENUMBER command in Basic); since the initial numbering uses increments of 1, you can't even guard against this by leaving gaps for insertion as you can in Basic. There is no COMMENT statement, so you can't leave reminders to yourself about what the program is doing or what memory variables are supposed to hold — the latter would be particularly useful when chaining programs together and using memory variables to pass information between them. The crudity of the looping instructions — no structured programming here! — can be somewhat error-prone. Last but not least, the error messages are very unhelpful — for instance, I got 'syntax error' when trying to assign a numeric value to a text variable and when trying to load a work program from a data disk.

Stability and reliability

For this review I was lent a complete set of hardware (except for a modem) courtesy of AC Systems of Plymouth and Exeter, as well as the software from the Bristol Software Factory. In the month I was using the system it didn't go wrong once, nor did it lose any files or data. Updates are issued free of charge if needed to correct errors — I understand that Bristol Software Factory does not have immediate plans for adding facilities.

Housekeeping

Silicon Office provides commands for formatting disks for use in SO, for copying disks and for displaying directories of SO disks. You can't copy individual files within SO, nor rename them, and I couldn't find a way to delete data files — there is a command to scratch work files.

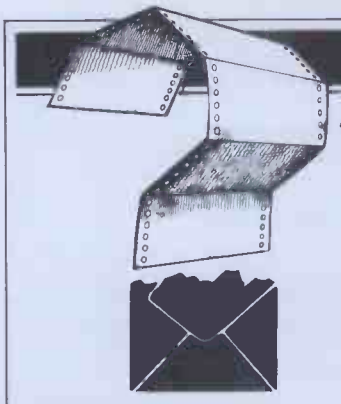
User image

Once again, we have a package which is like the curate's egg — some excellent features, but marred by some unimaginative and inflexible implementation. Some examples: confirmation is required for every command given from the keyboard, which is very irritating for commands like Next Record, lifesaving for Scratch File — and confirmation is with Carriage Return every time! It would be much better to save confirmation for really dangerous commands like Scratch File, and make it something more positive than Carriage Return. The ability to create record formats on the screen is an attractive feature, but the fact that you can have only one such format for displaying records in a single file is a real limitation, and a number of the screen editing features, such as the difficulty of distinguishing between text and numeric fields, made life unnecessarily difficult.

Again, when editing SO programs, you can store and recall programs from disk, which is good. But when you edit an existing program, SO doesn't 'remember' the name of the file whence the program came, and you have to re-enter it when you come to save the edited version again. If you make a mistake, you could end up overwriting another program. The display of help information on the screen is an excellent feature, especially for novices. But SO quite unnecessarily uses two screens to display the summary information, and gives no detail at all except the page number in the manual — and then uses the word 'page' to prompt the user to request the second help text display.

By contrast to the patchy nature of the user image of the package, the documentation is among the best I've seen. There is a Training Guide which takes the user through the basic steps of using all the features of Silicon Office; actual screens are used in plenty (a bit hard to read sometimes) and the instructions are given in terms of 'How To Do. . .' so the user gets the feeling of acquiring information and skills which are actually likely to be useful in practice. The Training Guide also contains a set of sample programs for useful applications. There is a separate Reference Guide, which is also very readable; my only real criticism is that there is no cross-referencing, so that where precise definitions are only in the Reference Manual and a useful example only in the Training Guide you have to do a bit of ferreting about to get the information you need. Both manuals have indexes, though they're a bit limited.

GOTO page 181



COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.

VIC interface

I need a tape cassette deck to go with my VIC-20 computer, but its price here in Athens is nearly £90. Is there any way of using an ordinary cassette recorder?
P Michaelidis, Athens, Greece

Like Commodore's PET/CBM range, the VIC-20 uses a digital data format and also senses the cassette key actions. It therefore requires a special cassette deck. Until recently there was no easy way round this problem, but now one can purchase a 'domestic cassette interface' from Customised Electronics Limited, 155 Marton Road, Middlesbrough, Cleveland TS4 2EN, England. The UK price is £19.55 including VAT (UK postage £1.50 extra).
R D Geere, Editor, Independent Commodore Products User Group

IncomPETable

Why will cassette programs written for the 80-column PET not run on my VIC-20?
W P Scott, Glasgow G13

There are two possible causes. Firstly, if the program contains machine-dependent items such as PEEK or POKE addresses or machine code, then these will probably need some alteration in order to work as intended. Secondly, if the program is Basic throughout, when it loads into the VIC it is re-located. In so doing the pointers that link one Basic line to the next will need to be corrected. You can force the VIC to do this by entering a dummy line at the beginning, such as
0 REM then deleting it.
R D Geere

Arming the VIC

Is there any way in which I could get my VIC-20 to operate a robotic arm of some sort without having to spend a lot of money?
Philip Richardson, Lindfield, Sussex RH16 2DF

It depends what you call a lot of money! Presumably the arm movements are to be controlled by electric motors, either conventional or stepper motor type, and to drive these you will need an interface connected to the user port. Design of this interface will depend to a large extent on the details of the motors. Alternatively, an increasing number of companies are advertising robot arms ready built and tested, some of which will connect direct to the VIC-20.
R D Geere

ZX audio

I am working on the article 'Control your own Substation' in the Oct & Nov 81 issues. So far everything works okay but I am stuck on the audio subroutine on p81, Nov 81. Using a ZX81, what do I enter on line 1, the REM statement — it's not very clear in the article whether I just enter the 27 bytes as listed (IE 62 0 14 etc)? Where does the assembler listing come in?
P Crowley, Preston, Lancs.

The REM statement in line 1 will be used to hold a machine code routine, which will be accessed from Basic with the USR call. In practice you cannot type in the REM statement with all the correct code in it because of the way the ZX81 is designed. So what I have done is to fill the REM statement with 30 or so letter As as you see in the program you refer to. The rest of the program replaces the As with the correct code.

So just type the program as it stands — with the 30 or so As. Then run it and it will keep asking for data (ie, the INPUT statement in line 30). When it does this, just enter 62 (return), then 0 (return) then 14, etc, from the data list in the article until the program ends after you have entered the number 201. (Don't forget to execute CONT after the screen fills up).

Now if you list the program, the REM statement in line 1 will contain a series of odd symbols and Basic words. This is what the ZX81 interpreter thinks is in the REM statement — but of course we will not use the line in Basic but in raw machine code, when the Z80 processor will interpret what we have entered very differently to Basic. As a quick test that all has gone according to plan, wire up the speaker as in the diagram, and execute in Basic: LET X= USR 16515 (in the fast mode). You should hear a beep of about 0.5 sec duration.

All you need in future to produce sounds on the ZX81 is the REM statement in line 1. So you can erase lines 10 to 60, and save what remains on tape.

If ever you want to put sound into a program you are writing, just load from the tape the one-line REM statement and access it with the USR call as described in the article — you can of course change both pitch and duration by using a pair of POKEs before executing the USR call.

You ask where the assembler listing comes in — the answer is that it doesn't. We are not using an assembler to enter the code, but entering it directly in machine code. Using an assembler makes life a lot easier for fairly lengthy programs, but of course, you have to buy (or write!) an assembler first.

Good luck with the rest of the experiments.
D E Graham.

Quick cursor

I need a fast routine for positioning the cursor anywhere on the screen of my 8000 series PET. The two standard methods of using loops with cursor movements and POKEs with calculations are too slow. Can you help?
David James, Twickenham

The following hex code can be placed into locations 0384 to 03AB and be called via Basic using SYS 900,X,Y, where X and Y are the column and row for the cursor.

```
0384  20  F5  BE  20  98  BD  20  2D
038C  C9  A5  11  29  1F  85  D9  20
0394  F5  BE  20  98  BD  20  2D  C9
039C  A5  11  29  7F  85  C6  78  A5
03A4  D9  85  D8  20  67  E0  58  60
```

I hope this solves your problem — it is quite fast.
SW

Computer camps

I have heard that there are such things as 'Computer Summer Camps'. Are there any in the South London area that you know of, and what do they offer?
D Duckfield, Petts Wood, Kent

The only one that I know of that is accessible to you would probably be 'Dolphin Camps' which is running one in the Sevenoaks area. The address is: 'Dolphin Camps', 8-10 Parkway, London NW1 7AA. Please mention that you read about them in *PCW*'s answers page.

To quote from the glossy brochure, 'This is not a summer school in computer programming. We have a wealth of micros, interfacing devices including robots and music synthesisers. However, young people will be able to choose a combination of activities that are sporting, creative and technology based.'

If you or anyone else goes, then I would be grateful to hear what you thought.
SW

Wrong address

In the article 'HP business' in 'Computer Answers' in the April '82 issue of *PCW* you mistakingly gave our address as that of the Association of Professional Computer Consultants.
DBA Computer Consultants, 11 West Halkin Street, London SW1X 8JL.
My profound apologies to DBA. I made the mistake because I wrote to that address when APCC was being founded. DBA is obviously one of the founder members. The correct address is: APCC, 109 Baker Street, London WIM 2BH. Tel: 01-235 7292.
SW

ZX catalogue

Do you know of any ZX81 computer clubs in the Stratford, Leytonstone, Forest Gate area of London? I would also like to catalogue my record collection (approx 200 LPs), and be able to recall and list them alphabetically by artist, song title, record label, and date of the record. Has anyone a program for the ZX81 that will do this, that I could possibly use? You may publish my address for replies.
Diane Soall, 110 Trumpington Rd, Forest Gate, London E7 9EQ.

I personally do not know of any clubs in your area that specialise in the ZX81, but there are two ways to find out. First (and most likely) is to contact (and join) the ZX81 User Group at 44-46 Earls Court Road, London W8 6EJ. Second, look in the *PCW* 'User Group Index' which appears in *PCW* every few months. I would not concentrate too hard on trying to find a group that specialises in the ZX81, but join *any* local group. It will broaden your mind and may lead to greater insights into all aspects of computing.

Your question about cataloging your record collection needs advice from someone who has tried it, but my views are that it will take a huge amount of time to enter

the data and will need endless stopping and starting the cassette (unless you have motor control) while the data is being written. After having done all that you may hit problems, like the ZX81 being unable to hold all the titles in store for sorting purposes. Please seek advice before proceeding on what might be a fruitless task.
SW

Cheapest - but best?

How well does the Sinclair Spectrum compare with other colour micros?
P Beckett, Horsham, Sussex.

'You pays your money and you takes your choice' is the simple answer. It compares very well indeed. But remember that it only costs £125, while the VIC-20, Tandy, BBC Micro, DAI, Apple, Texas, etc, all cost more.

Is a Ford Cortina twice as good as a Mini Metro? It is impossible to say unless you know what you want it for and the same goes for the microcomputer argument. Always write down what you want out of a computer before looking at the market. Then read the appropriate Benchtests in *PCW* and decide which machine best suits your need and pocket.
SW

Beeb leads

Does the BBC micro come with cassette and TV leads? Also I may wish to purchase a colour TV set, so are there any specific makes that you can recommend? Can you also recommend any particular cassette recorders or should I buy the BBC's one?
D Staines, Liverpool

Yes, the BBC Micro comes with a cassette lead and TV lead. However the cassette lead only has a plug on the micro end so it's up to you to place a plug on the other end. The 'provisional manual' (proper one is due out at the end of May) has a connection diagram at the back. The simplest answer is to buy a ready-made-up lead — if you have a DIN plug on your cassette player virtually any hi-fi or radio shop will be able to supply you — stereo or mono will do. If you do buy a ready-made lead it will have a motor control plug, which although not strictly necessary, is useful for file handling.

The TV lead is no problem and fits any TV set. On the subject of the best cassette recorder, you will probably find that most domestic ones will be usable, but a few people have encountered problems, due to the fact that their machines have ALC (Automatic Level Control). The recorder will adjust the recording level to what *it* thinks is the best level. The correct level is about +2dB which is considerably higher than the ALC will allow. The only solutions are to adjust the ALC, which needs a workshop manual, or to obtain another cassette recorder. When buying one choose one with motor control and record level adjustment. If you cannot get the latter then ask to try the recorder out — any decent shop should allow you to do that. Remember — if you insist that you want the machine for recording from the BBC Micro and it doesn't work you are entitled to your money back by the 'Sale of Goods Act'.

Choice of TV — the BBC micro has a mode where you can display 80 characters across the screen. This is essential for word processing, but no TV that I have found (black & white, or colour) gives sufficient quality to be usable; you need to use a monitor set. Try and obtain a TV that has monitor and RGB (red-green-blue) input as well — the only two makes that I have found are Salora and Luxor, and of the two, the Luxor appears better value for money. We are reviewing colour monitors/TVs in the June issue of the Beebug magazine so details of other sets and where to get them cheaply will appear there (see User Group index for details of Beebug's address).
D E Graham, Beebug — National BBC Micro User Group.

Parts problem

In our stores we would like to have a system where part numbers, quantities, etc, are automatically recorded as soon as the receipt or issue is entered on the bin card. This information would then be sent to our main computer. Such a system should both save labour and reduce errors in punching or reading. Can you suggest any suitable terminals? They should be inexpensive, as we may require 15 to 20 of them.
M M Salim, London W1

Without knowing the size of your bin cards, the thickness of the card and whether they are hand-written or typed it is not possible to be as specific as I would like.

However, if they are typed then a reasonably inexpensive printing terminal with a pressure feed platen should handle most types of card. The operator can insert the card in the terminal, and type the required details, which will be printed on the card. At the same time the details will be transmitted to your mainframe, to be received by a suitable program, which will update the file.

Suitable terminals for this are widely available. One which comes immediately to mind as used by many companies is Digital Equipment's DECwriter LA34, which costs about £600 new in this country. Alternatively, you could consider the original Teletype model KSR 33; these are available at about £300-£400 for reconditioned units.

If your cards are entered by hand, your choice is restricted. The one device I know of is the Micropad terminal, sold by Micropad Ltd, Whittle Road, Ferndown, Dorset BH21 7SD, at about £1800 each.

In either case, you may well need special communications facilities to allow your mainframe to accept input from the terminals and you will need to discuss this with your mainframe suppliers.
P L McIlmoyle

Compatible compiler?

I am developing a package on a microcomputer system running under CP/M and MBasic. I have two requirements that I cannot solve and wonder whether the Microsoft Basic compiler would help; is it compatible with MBasic? The problems are that first I cannot disable the 'Control-C' break into Basic; and second, I cannot provide enough protection from people looking at the program listing.
D Johnson, Twickenham

I have not found how to trap the 'Control-C' break-in to Basic, when running under MBasic. However this *is* disabled when the program has been compiled. One way to provide some means of protection against prying eyes is to use the 'P' option when saving the program; (ie SAVE "PROG 1", P). The real way to do it is to use the compiler, though. This leaves no copy of the source once you have compiled and erased it.

The Microsoft Basic Compiler is as compatible as is reasonable with MBasic. As long as you haven't used dynamic arrays or the ERASE statement, then you are unlikely to encounter any problems. A few points are worth considering if you are writing with a compiler in mind:
1. Use integer variables as much as possible as they will speed up the running, and keep the size of the object code to a minimum. This is hardly true when using an interpreter.
2. You can liberally scatter REMark lines around as these are ignored by the compiler. Indent loops as well as this makes the code easier to read.
3. Use long (descriptive) variable names, as again the compiler codes these.

The compiler will also check all your syntax for you, and find unassigned statements. I had an interpreted Basic program running without errors for two years; when I compiled it I found two unassigned GOTOs. Finally, the Microsoft Basic compiler produces object code which is disappointingly slow — it is only about twice as fast; so don't expect startling improvements, especially as most time might be spent on file access anyway.

While on the subject of compilers, I get many enquiries asking about the speed improvement of compilers. I think this is often over-emphasised. If your program spends much of its time accessing files or printing, then a compiler will not make any noticeable improvement, especially if it runs using CP/M which will slow it down anyway.
SW

Nascom replacement

I am considering replacing my Nascom II computer with a more expensive system. One advantage that I have observed of the Nascom over the TRS-80 or Apple is the excellent editing facility. Can you suggest a system which can offer the Nascom method of editing?
A Hetherington, Cleckheaton, Yorks

The screen editing facility on the Nascom is as you say exceptional — I have seen none better and a good many worse, including several mainframes and large minis. I can't recommend anything from personal experience that's quite as good but some word processing packages such as WordStar can be used to edit program files on the screen and provide a good many extra facilities besides. Have you considered the Gemini Multiboard — its intelligent video gives 80 character lines, clears up any display faults and perhaps it may provide Nascom editing? At any rate it offers an upgrade path that has the advantage that it is compatible with the rest of your Nascom. It might be worth ringing up one of the Microvalue dealers (see their advertisement).
Anthony Camacho

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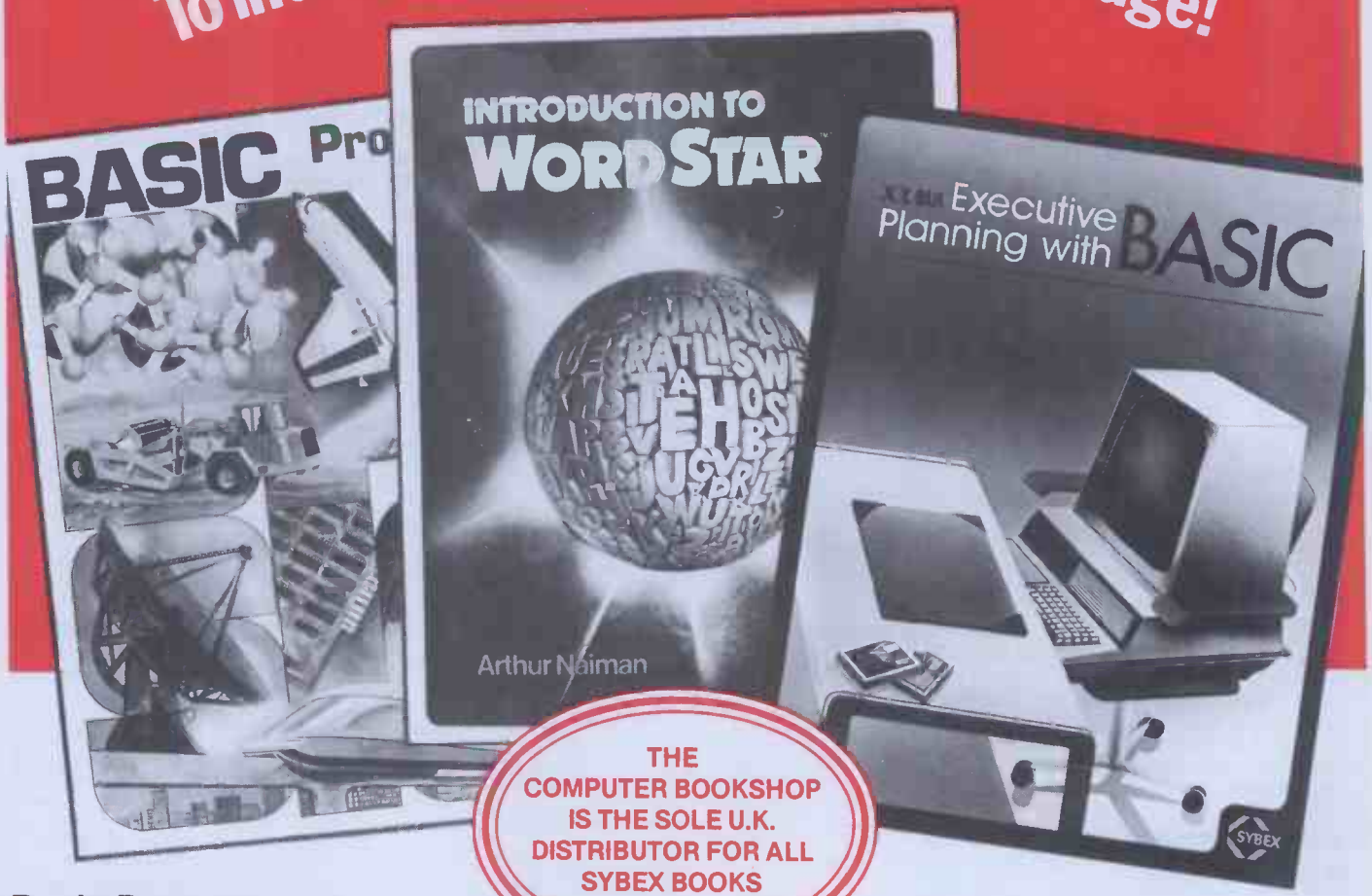

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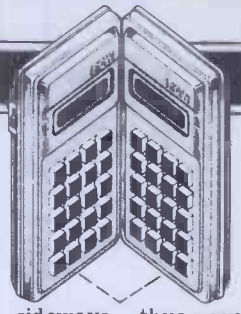
TEXAS ON THE MOVE

Dick Pountain reports on TI's replacement for the TI-59.



It is more than three years since Texas Instruments introduced the TI-59 card programmable calculator which, at the time, put them into the lead in calculator technology. This lead did not last long, however, as Hewlett Packard replied with the HP-41C and CV which featured LCD alphanumeric display, CMOS constant memory and a communications ring interface. Other products from Casio and Sharp introduced Basic language programming and/or friendlier operating systems than the 59, as well as cassette mass storage. The 59 still sells and has a worldwide band of devotees who enjoy getting the most out of its powerful but spartan facilities; nevertheless, for the last three years I and many others who follow the calculator scene have been asking 'when is Texas going to bring out something new?' and receiving no answer. The answer is now here, in the shape of the TI-88 which will be launched in September.

In order to bring you this information I, and a handful of European journalists, undertook a perilous adventure, risking our lives by flying to Nice, enduring the dangerous rays of the Mediterranean sun and inviting an early heart attack by consuming the livers of unwell geese and Roquefort cheese steeped in Armagnac. I only hope you're grateful.

The 88 has been developed in Lubbock, Texas and at TI France in Nice where a few production prototypes are to be seen. It uses CMOS technology, has a 16-digit LCD display (5x7 dot-matrix) and uses cassette for backing store instead of cards. However, it makes some concessions to current 59 users and the huge software base by remark them. Further speed improvements are claimed from the use of a new fast ROM (three times the speed of the 59's) in the operating system.

On the hardware side the 88 is novel in that it uses removable RAM packs which have built-in lithium battery back-up which is good for five years' storage. There are two compartments in the back of the machine which can take RAM or ROM packs (CRAM or CROM as TI has dubbed them). The basic machine has 960 steps of memory built in, as on the 59, but two CRAMs with 1184 steps each would bring this up to 3328 steps maximum. The machine has 130-hour rechargeable batteries and CRAMs, while installed, draw off these and not their own internal supplies. CROMs hold 15,000 steps, and the whole 59 range of library modules will be available with added alpha prompting.

On the firmware side, the 88 has a new and enhanced operating system with some nice features. A very extensive prompting system is built in, making this a very friendly machine to use. On switching on in Prompt mode the 88 asks 'May I Help You?' and then leads into a menu of options, such as selecting a module, setting date and time or inspecting built-in functions. The op code system of the 59 is retained, but now each code has a brief explanation available by pressing INV OP nn. The time and date are provided by a clock-calendar chip which includes day of the week and can be used as an alarm in conjunction with the (single tone) bleeper. Keys called YES, NO and UNKnown are provided to answer menu questions. There is no proper alpha keyboard, the characters being obtained from other keys with an ALPHa shift.

A key called EVAL allows the entry of algebraic formulae without programming; variables are declared by, eg, Defn A, and the formula is entered as written, including implied multiplication (2AsinB). The formula can then be repeatedly evaluated, changing all or some of the variables each time using the YES, NO, UNK, ENTER and CONTinue keys.

In Learn mode four-digit line numbers are automatically provided and all instructions are displayed by name, not code. Editing is by cursor, and the display scrolls sideways, thus overcoming my main objection to the 59 — its dreadful editing facilities. All instructions of the 59 are supported, with the addition of new ones to allow inclusion of alpha-strings, though no string functions are provided; manipulation of text is strictly for prompting, as on the Casio 602p.

The arithmetic precision has been increased by performing 16-digit internal operations and displaying 13, while the number of built-in functions has been expanded to 231 from the 59's 137.

TI-59 software can be run directly on the 88 by keying it in with a Program Development CROM in place; cards cannot be read. TI is, however, encouraging authors to modify software to take advantage of the prompting ability of the 88.

Peripherals are attached via a two-wire serial bus which is to TI's own standard, though in answer to my query the company said that an adaptor to RS232/V24 would be produced later. It can control 128 devices with six active simultaneously.

Current peripherals are a 16-column thermal printer (PC-800) with rechargeable battery/mains operation and a cassette interface box (CA-800) with remote control. Future plans include a bar code reader.

All in all, the TI-88 is a great improvement on the 59 and represents a catching-up with current technology, though I would not accept TI's claim that it is the most powerful hand-held yet; it is certainly the equal but not the superior of the HP-41CV and the Sharp PC1500. There is no doubt that in the hands of an ingenious and experienced programmer the TI 'language' is both more economical of memory and more flexible than Basic, and that the prompting system will make the TI-88 easy for naive users with off-the-peg software or for complex maths. On the subject of language, TI defended its choice by pointing out the large user base of the 59; nevertheless it is pushing ahead with a high-level language machine as well; this is due in late '82 and will have a choice of languages, including Basic and perhaps Pascal in ROM packs.

The only problem I foresee for the 88 is its price. The basic unit will be £289.95 (inc VAT) including one CRAM module, the Master Library Module with English/French/German or Swedish/Italian/Dutch prompting, battery pack and charger. The printer is £199.95 and additional CRAMs and CROMs £37.95. This makes it comparable in price with a variety of fully fledged micros (eg, the Newbrain in this issue) and so means that you must value portability and maths power very highly to consider it. More important, it is significantly dearer than the PC1500 with 11k RAM. I would not be surprised to see this price fall within a year. Watch for a full test soon in this column. END

TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to: **'TJ's Workshop'**, *PCW*, **14 Rathbone Place, London W1P 1DE.** *Please keep your contributions as concise as possible. We will page £5-£30 for any tips we publish (think how much solder and/or Elastoplast that would buy).*

PET COMPUTED RESTORE

Listed below is a routine which allows the user to perform RESTORE to a line number. After running the appropriate Basic loader program for new or old ROMs (Basic 4 and VIC owners will have to make their own alterations), SYS RE, X will RESTORE to line X. The next time DATA is required the Basic interpreter will start searching from line X as if nothing had happened.

This function can be useful in reading information from a table of DATA statements too large to be copied into an array. Considerable memory space is saved with only a slight loss in speed.

The following example uses the routine to get close to the required item, then READs consecutive items until the right one is reached. To READ the Nth string into D$ from the program's own DATA use:

```
SYSRE,100+10*INT(N/8):
FOR X=0TO N AND 7:
READ D$ : NEXT
```

Remember to check that N lies within 0-29 and that RE = 1031. Note that the INT (N/8) and N AND 7 bits refer to the number of items on a DATA line, ie, 8.

The routine is POKE0 into the REM statement on line 0, so once the program has been run only lines 0 and 10 are required. Alternatively the routine can be located elsewhere by changing the value of RE, although I find that having the code in a REM statement is more convenient.

An 'ILLEGAL QUANTITY ERROR' will occur if the line number is not in the range 0 - 65535 and an 'UNDEF'D STATEMENT ERROR' if the line does not exist. The latter of these may be disabled by changing the JMP instruction to BIT (line 110 — replace 4C with 2C), causing RESTORE to the line following.

David McKeran

COMPUTED RESTORE

```
0 REM"RESERVED FOR MACHINE CODE....."
10 RE=1031
100 DATA 20,F8,CD,20,8B,CC,20,D2
110 DATA D6,20,2C,C5,B0,03,4C,EB
120 DATA C7,A4,5D,A6,5C,D0,01,88
130 DATA CA,86,3E,84,3F,60
200 FORX=0TO29:READ D$:DD$=MID$(D$,2)
210 POKE RE+X,16*(ASC(D$)-9*(D$>=
"A")AND15)+(ASC(DD$)-9*(DD$>="A")AND15)
220 NEXT
READY.
```

OLD ROM DATA

```
100 DATA 20,11,CE,20,A4,CC,20,D0
110 DATA D6,20,22,C5,B0,03,4C,DB
120 DATA C7,A4,AF,A6,AE,D0,01,88
130 DATA CA,86,90,84,91,60
READY.
```

ATOM INVERT

Often I find it necessary to print information on the screen in inverted form but many of the ASCII codes available in normal text are not available inverted by using the lock key, for example the numbers.

This program redirects the character output vector but because Atom screen codes are not the same as ASCII codes above 63 it is not just a simple matter of setting the high bit before sending to output, hence lines 310-330.

After typing in or loading from tape, link LL1 (or Link +2800 after Break) and the basic can be erased. If you relocate it make sure you change the initialising routine accordingly.

It is turned on or off via the keyboard by 'CTRL A' or in a program by 'Print $1'. Try experimenting with the EOR value in line 23 0 — it can give your listings a new look!

R Burstow

```
10    REM   ROUTINE TO INVERT TEXT
20    REM
30    DIM LL (6)
40    FOR   I=0 TO 1; P = # 2800
50 [
60:   LL1   LDA@ # 28     Initialise routine
70          STA# 0209     Into character out
80          LDA@#0F       vector.
90          STA#0208
100         LDA@0         Clear # AF
110         STA# AF       ie, normal text.
120         RTS
130 : LL2   PHP           Save
140         PHA           registers.
150         CLD
160         STY# E5
180         CMP @ # 7F    Is it a delete?
190         BEQ LL4       Yes.
200         CMP@ # 01     Is it "cntrl"?
210         BNE LL3       No.
220         LOA #  AF
230         EOR@ # 80     Invert # AF
240         STA#AF
250         BCS LL5       End of action.
260 : LL3   CMP@ # 20     Is it a "cntrl"?
270         BCC LL4       Yes.
280         LDY # E0      Is screen turned off?
290         BMI LL5       Yes.
300         JSR # F044    Invert char. under cursor.
310         ADC@# 1F      Convert.
320         BMI LL6       to
330         EOR@ #60      atom code!
340 : LL6   EOR # AF      Invert or not invert!
350         JSR # FD36    Continue with output.
360 : LL5   JMP# FE5F     exit routine.
370 : LL4   JMP# FE5C     Act on "cntrl"char.
380 ]
390   NEXT I
400   LINK  LL1
410   END.
```

TJ's WORKSHOP

ZX81 MEMORY MANAGEMENT

This subroutine was designed for use with the ZX81 plus 16K expansion board, to show how much memory has been used by a main program for each of the four main RAM areas — 'Program', 'Display', 'Variables' and 'Spare capacity'. The start and finish addresses are also printed under each subheading, and the memory utilisation is printed at the bottom of the screen as a percentage of the total available.

String variables A$ and B$, suitably sliced and added to 16000, generate the PEEK addresses of the RAM boundaries. E$ is an array containing subheadings. The loop 9610 to 9700 carries out all functions except for printing the percentage utilisation, which is undertaken by 9710. Statements 9650, 9730 and 9740 generate the first RAM address which is not available as a PEEK function. The first three characters in B$ are dummies.

The subroutine could be extended to give information about the GOSUB stack, etc, by adding additional addresses into A$ and B$, enlarging E$ to include additional subheadings, and increasing the number in the FOR-NEXT statement, but the format would have to be reorganised to prevent screen overflow. Remember also that the subroutine detracts from the total usable memory available for the main program, so don't overdo it!

If the subroutine is loaded from tape before keying in the main program, it will be SAVEd again whenever the main program is saved and will therefore always be available to keep tabs on the memory situation. When the bottom line says 'MEMORY UTILISATION = 98%' — don't panic. Just erase the subroutine and release a few more bytes.

Any machine code subroutines used in the main program after RAMTOP should not affect the accuracy of the 'Memory status' statement, but any bytes POKEd between STKEND and ERR SP will reduce the spare capacity available without being detected by the subroutine. The machine stack will usually also occupy a few bytes in this area. No attempt has been made to quantify these sources of error because they are normally relatively small, but purists may wish to take the matter further themselves.

The choice of names of the string variables used in the listing was made to avoid ambiguity with those in a specific main program; others may be more suitable for readers' applications.

It might be possible to use the subroutine on a 1k memory provided the centre parentheses of 9710 were changed to 1 — (JA-JB)/1024 and some of the frills were removed. Statements 9500-9600 could be omitted for minimisation after the variables A$, B$ and E$ have been set up and SAVEd onto tape, provided the RUN button is avoided. Any advantage gained by using this routine on a 1k memory should be balanced against the amount of precious memory it uses up itself.

G E Coucher

```
9500 REM MEMORY MANAGEMENT
9510 LET A$ = "396400404386"
9520 LET B$ = "509396400412"
9530 DIM E$(4,10)
9540 LET E$(1) = "PROGRAM"
9550 LET E$(2) = "DISPLAY"
9560 LET E$(3) = "VARIABLES"
9570 LET E$(4) = "SPARE CAP"
9580 CLS
9590 PRINT TAB 9; "MEMORY STATUS"
9600 PRINT TAB 9; " . . . "
9610 FOR E=1 TO 4
9620 LET J1=VAL A$(3*E-2 TO 3*E) + 1600
9630 LET J2=VAL B$(3*E-2 TO 3*E) + 1600
9640 LET JA=PEEK J1+256*PEEK (J1+1) - 1
9650 IF E=1 THEN GOTO 9730
9660 LET JB=PEEK J2+256*PEEK (J2+1)
9670 PRINT AT 4*E, 0; E$(E); TAB 12; (JA-JB)/1000; "KBYTE"
9680 PRINT "STARTING ADDRESS"; TAB 26; JB
9690 PRINT "FINISHING ADDRESS"; TAB 26; JA
9700 NEXT E
9710 PRINT AT 21,3; "MEMORY UTILISATION="
   INT (.005+(100*(1-(JA-JB)/16384))); "P.C."
9720 RETURN
9730 LET JB=16509
9740 GOTO 9670
```

ZERO-COST ATOM SERIAL INTERFACE

A simple interface for V24 (RS232C) serial printers may be simulated using two output bits from the cassette DIN socket, together with a software UART routine. The software first sets one output bit to logic 1 and the other to logic 0, then reverses them, thus generating an output signal of +3V to -3V. This avoids the need for dual-voltage power supplies. While this does not strictly conform to V24 standards, in practice it works with most serial printers. Note that the printer's signal ground must not be connected to the Atom's ground, for example via mains earth.

The connector cable should have DIN plug pin 4 connected to the printer's Received Data line (normally pin 3 of a 25-pin connector), and DIN plug pin 5 connected to the Signal Ground (normally pin 7). The cassette output and the bleeper also use these pins — so cannot be used simultaneously with the printer. Other pins may of course be used (by changing lines 400 and 430), but these are convenient as the bleeper monitors the output signal, while not preventing cassette tapes being read.

The program given should be RUN, and then saved by the *SAVE command which it prints. It may then be loaded in future by *RUN "PRINTER". This version loads over the floating-point variables at #2800. It must be relocated by changing line 30 if floating-point variables are used.

Three entry points are provided:
LINK # 2800 — Use after BREAK to set up OSWRCH without reloading.
LINK LL0 — Prints character in A. All registers are preserved.
LINK LL6 — Front-end for OSWRCH — tests for STX and ETX to turn printer on and off.

To change the baud rate, alter the constants in lines 270 and 290. The values shown give baud rates with better than 0.1% accuracy.

Andrew J V Yeomans

```
 10 REM PRINTER - 17 JAN 82 - A.J.V.YEOMANS
 20 REM LINKS IN V24 PRINTER VIA CASSETTE PORT
 30 A=#2800
 40 DIM LL10;LL10=-1
 50 FOR I=1 TO 2
 60 P=A
 70 PRINT $21;[
 80\SET UP LINK TO OSWRCH
 90  LDA @LL6&#FF
100  STA #208
110  LDA @LL66#FFFF/256
120  STA #209
130  LDA @0
140  STA LL10
150  RTS
160\PRINT CHAR IN A
170:LL0
180  PHA          \SAVE REGS
190  STY #00E5
200  STX #00E4
210  LDX @10      \BITS/CHAR
220  CLC
230  BCC LL4      \SEND START BIT
240:LL1
250  PHA          \DELAY ONE BIT AT
260  TXA          \110 300 600 1200 2400 BAUD:
270  LDY @50      \ 16  50  19    1   35
280:LL2
290  LDX @12      \112  12  16  159    1
300:LL3
310  DEX
320  BNE LL3
330  DEY
340  BNE LL2
350  TAX
360  PLA
370  SEC          \SET STOP BIT
380  ROR A        \GET NEXT BIT
390  BCC LL4
400  LDY @#04     \BIT=1
410  BCS LL5
420:LL4
430  LDY @#02     \BIT=0
440  BCS LL5
450:LL5
460  STY #B002   \SEND TO OUTPUT
470  DEX
480  BNE LL1
490  LDX #00E4
500  LDY #00E5
510  PLA
520  RTS
530\REPLACEMENT FOR OSWRCH
540:LL6
550  JSR #FE52   \NORMAL OSWRCH
560  PHA
570  CMP @#02    \PRINTER ON?
580  BEQ LL8
590  CMP @#03    \PRINTER OFF?
600  BEQ LL7
610  LDA LL10    \TEST FLAG
620  BEQ LL9
630  PLA
640  JMP LL0     \PRINT CHAR
650:LL7
660  LDA @0      \CLEAR FLAG
670:LL8
680  STA LL10
690:LL9
700  PLA
710  RTS
720:LL10
730  NOP         \PRINT ON FLAG
740];NEXT;PRINT $6
750 LINK A
760 @=5
770 PRINT "NOW TYPE"'
780 PRINT " *SAVE ""PRINTER""",
  &A,&LL10'$11
790 END

Size #546 bytes
```

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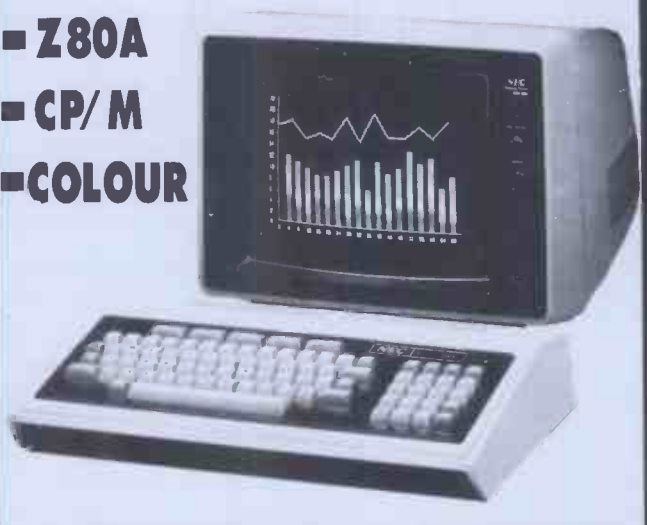

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TJ's WORKSHOP

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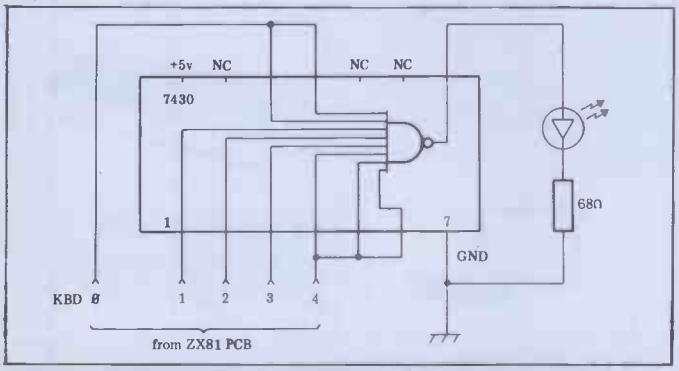
A good place to mount the LED is on the sloping edge just below the lettering 'ZX81', as it is in our line of sight as we look down at the keyboard.

To give the modification a professional appearance a black plastic LED holder should be used. The power rails, ground and +5v can be taken from the holes next to the 7805 regulator chip (centre pin is ground and pin nearest PCB's edge is +5v).

Robin J D Cheng



NASCOM KEYBOARD GET

When displaying large amounts of data it is usual to display one screenful of text and then wait for the operator to press a key before displaying the next. Nascom Basic does not support GET or INKEY$ so a machine-code routine is often written for the purpose. However NAS-SYS monitors have just such a routine at 0008H. Thus if, DOKE 4100,8 is put at the start of a Basic program then whenever X=USR(X) is encountered the computer will wait for a key to be pressed before continuing execution of the program. The value of X remains unchanged.

It should be noted that this method is not breaking the rule about calling NAS-SYS routines directly since location 0008H is a Z80 restart and will therefore be the same for any future versions of the monitor.

A.D. May

SHARP LOGIC

The version of Basic supplied with the MZ-80K has the boolean values for TRUE and FALSE as −1 and 0 respectively. However this can be changed so that TRUE is represented by 1, which is much more useful since in Sharp Basic 'AND' and 'OR' are replaced by '*' and '+'; this can lead to mistakes in logic: eg, TRUE AND TRUE OR TRUE should give the result TRUE but −1 * −1 + −1=1−1=0, ie, FALSE

To make TRUE=1, POKE 8861, 20: POKE 13541, 20: POKE 13561, 20.

To make TRUE= −1, POKE 8861, 30: POKE 13541, 30: POKE 13561, 30.

I hope this will prove useful to other Sharp users.

Simon N Brown

APPLESOFT FORMATTER

In many programming applications it is important to produce nice-looking tables which can be used and understood with pleasure. To make this task easier some dialects Basic and most of the more sophisticated languages have formatters built into them which handle the presentation of numeric output. Unfortunately, Applesoft has no such feature and it is the purpose of this note to offer a flexible formatting subroutine for use in Applesoft programmes.

The subroutine is listed in Fig 1 where it will be seen that, despite its simplicity, it has the following powerful features:

All rounding is correct and symmetric for both positive and negative numbers.

Numbers are presented right justified in a field of specified width. Furthermore they are located so that when printed in columns they line up correctly.

Decimal points are suppressed in whole numbers.

Zeros are replaced by blank space or, if preferred, by a specified string.

Numbers which are too large for the field width are replaced by a specified string and do not throw adjacent fields out of alignment.

A prefix or suffix can easily be added to numbers.

Negative numbers need not be denoted by a minus sign but could use, eg, brackets.

Commas are inserted between thousands in large numbers.

The symbol used to denote the decimal point or to separate thousands can easily be changed.

An example program, listed in Fig 2, shows how simple it is to use the subroutine in a program.

The most obvious improvement is to shift lines 10010-10040 to the calling program. This will ensure that they are only repeated when absolutely necessary and not every single time the subroutine is called. Furthermore, since the calculation of DD would be particularly slow it may be worth taking some extra trouble with this to gain more speed. One possible approach would be to set up an array D with D(I)=INT (10/\I+.5) and subsequently to use DD=D(D) instead of the actual calculation.

A couple of further speed improvements are possible because of specific characteristics of Applesoft. The first of these is to replace all the integer constants by variables of equivalent value because, surprisingly enough, evaluating (L1+1) would be slower than evaluating (L1+Z). The second improvement would be to renumber the subroutine so that it resides as early in the program as possible.

If speed continues to be a problem after these steps have been taken it is possible to gain a little more by deleting line 10090. Commas would, of course, no longer be inserted but otherwise there would be no effect on the operation of the program.

The only significant shortcoming of the formatter is its inability to handle more than nine significant figures. The reason for this is that beyond nine figures the Applesoft function STR$ returns the number in exponent form. However, if that would be acceptable in a particular application the subroutine may be appropriately modified by replacing the right hand side of 10050 by X$=STR$(X):L1=LEN(X$): GOTO 10120.

Michael J Barron

```
10000  REM   ###SUBROUTINE### FORMAT
Requires   X (real number) ; FW (field width) ; D (decimal places)
Returns    X$ (formatted number)

10010 DD =  INT (10 ^ D + .5): REM  Calculate scale factor
10020 S$ = "                    ": REM  Enough spaces to accomodate the widest field width
10030 SS$ =  RIGHT$ (S$,FW): REM   Set string for X$ when X is zero
10040 SN$ =  RIGHT$ (S$ + "N/A",FW): REM   String for X$ when X is too large for the field width
10050 XX =  ABS (X) * DD: IF XX > 999999999 THEN X$ = SN$: RETURN
10060  IF XX < .5 THEN X$ = SS$: RETURN
10070 X$ =  STR$ ( INT (XX + .5)): IF XX < DD THEN X$ =  RIGHT$ ("000000" + X$,D + 1)
10080 L1 =  LEN (X$):L2 = D + 3
10090  IF L1 > L2 THEN X$ =  LEFT$ (X$,L1 - L2) + "." +  RIGHT$ (X$,L2):L1 = L1 + 1:L2 = L2 + 4: GOTO 10090
10100  IF D > 0 THEN X$ =  LEFT$ (X$,L1 - D) + "." +  RIGHT$ (X$,D):L1 = L1 + 1
10110  IF X < 0 THEN X$ = "-" + X$:L1 = L1 + 1
10120  IF L1 > FW THEN X$ = SN$: RETURN
10130 X$ =  RIGHT$ (S$ + X$,FW)
10140  RETURN
```

Fig 1

```
10  REM  PROGRAM TO ILLUSTRATE FORMAT
20 FW = 10:D = 2: REM   Set FW (field width) and D (decimal places)
30 BUFFER$ = "": REM   Empty the buffer
40  FOR I = 1 TO 4: INPUT "NUMBER ? ";X: GOSUB 10000:BUFFER$ = BUFFER$ + X$: NEXT
50  PRINT : PRINT BUFFER$
60  GOTO 30
70  END
```

Fig 2

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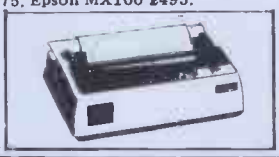

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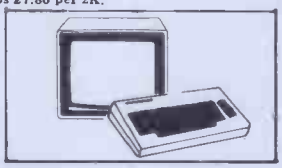

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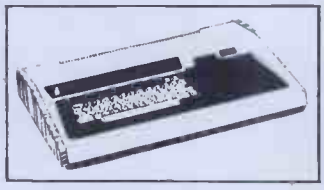

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TJ's WORKSHOP

VIC USER-DEFINED CHARACTERS

Byte map location 36869 (9005H)

7	6	5	4	3	2	1	0

Screen Start — Character Set Start

Fig 1

Value representation of lower four bits of location 36869 (9005H)

Bit	Value if set	Value if not set
0	1024 (0400H)	0 (0000H)
1	2048 (0800H)	0 (0000H)
2	4096 (1000H)	0 (0000H)
3	0 (0000H)	32768 (8000H)

eg,

BITS	VALUE
0110	6144 (1800H)
1101	37888 (9400H)

Fig 2

To find current character set start

```
CT = PEEK (36869) AND NOT 240
TS = (1 - INT ((CT AND NOT 7)/8) * 32768 + (CT
     AND NOT 8) * 1024
```

CT = Lower four bits of location 36869 (9005H)
TS = Address of current character character set

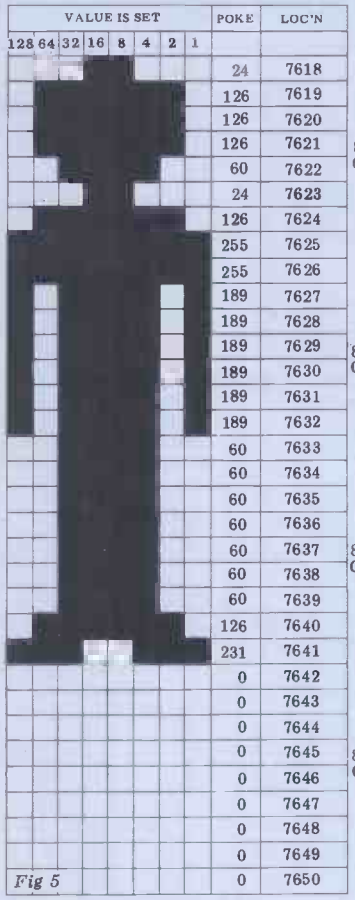
Fig 3

To set character set start

```
CT = ( - INT (TS/32768)) *8 + INT (TS - INT(TS
     /32768) * 32768)/1024
POKE 36869, PEEK (36869) AND NOT 15 OR CT
```

CT = Lower four bits of location 36869 (9005H)
TS = Address of current character set

Fig 4



VALUE IS SET								POKE	LOC'N
128	64	32	16	8	4	2	1		
								24	7618
								126	7619
								126	7620
								126	7621
								60	7622
								24	7623
								126	7624
								255	7625
								255	7626
								189	7627
								189	7628
								189	7629
								189	7630
								189	7631
								189	7632
								60	7633
								60	7634
								60	7635
								60	7636
								60	7637
								60	7638
								60	7639
								126	7640
								231	7641
								0	7642
								0	7643
								0	7644
								0	7645
								0	7646
								0	7647
								0	7648
								0	7649
								0	7650

8x8 CHR$ (0)
8x16 CHR$ (0)
8x8 CHR$ (1)
8x8 CHR$ (2)
8x16 CHR$ (1)
8x8 CHR$ (3)

Fig 5

Example of programming the character set

```
10 POKE 56, 28, CLR
30 TS = 7168
40 CT = (1 — INT (TS/32768) * 8+INT (TS — INT (TS/
   32768) * 32768)/1024
50 POKE 36869, PEEK (36869) AND NOT 15 OR CT
60 FOR I = TS TO TS + 31: READ J: POKE I, J: NEXT
70 FOR I = 64 to 67: A$ = A$ + CHR$ (I) + CHR$ (17)
   + CHR$ (157): NEXT
80 FOR I = 1 to 4: A$ = A$ + CHR$ (145): NEXT: A$
   = A$ + CHR$ (29)
90 PRINT TAB (10); A$
100 DATA 24, 126, 126, 126, 60, 24, 126, 255, 255,
    189, 189, 189, 189, 189, 189, 60
110 DATA 60, 60, 60, 60, 60, 60, 126, 231, 0, 0,
    0, 0 , 0 , 0 , 0 , 0
```

Fig 6a

I have used A$ as a type of defined shape. It uses cursor commands to print one part of the man below another then the cursor is moved to the next printing position.

Changes to part a to use an 8 x 16 matrix

```
20 POKE 36867, 33: POKE 36865, 22
70 FOR I = 64 TO 65: A$ = A$ + CHR$ (I) +
   CHR$ (17) + CHR$ (157): NEXT
80 FOR I = 1 TO 2:A$ = A$ + CHR$(145): NEXT: A$
   = A$ + CHR$ (29)
```

Fig 6b

Ordered plan of steps involved when programming the VIC character set.

1. Draw shapes on paper (see fig 5)
2. Work out POKE values (see fig 5)
3. Work out memory requirements and where to locate the shapes.
4. Write program;-
   a) reserve memory
   b) clear strings and variables
   c) if necessary change screen/character size
   d) set location 36869 (9005H) to character definition start (see figs 1, 2, 4)
   e) Read data lines containing POKE values and POKE into reserved memory.

Fig 7

Some CHR$s, PEEKs and POKEs

CHR$ (17) = Cursor down
CHR$ (29) = Cursor right
CHR$ (145) = Cursor up
CHR$ (157) = Cursor left
CHR$ (8) = Disable Commodore & SHIFT
CHR$ (9) = Enable Commodore & SHIFT
CHR$(14) = Switch to lower case
CHR$ (142) = Switch to upper case
55-56 (37H - 38H) = Top of memory pointer
646 (286H) = Current colour code (try POKEing this to a value in the range of (8 - 15)
36869 (9005H) = Lower four bits are character set start

Fig 8

Start address	Description
32768 (8000H)	Upper case & Graphics (1k)
33792 (8400H)	Reversed upper case & reversed graphics (1k)
34816 (8800H)	Lower/upper case & graphics (1k)
35840 (8C00H)	Reversed upper/lower case & reversed graphics (1k)

From character set (4k) = 32768 - 36863 (8000H - 8FFFH)

Fig 9

In the adverts for the VIC you are told that it is possible to program the character set, but the manual does not tell you how to do this. Programing your own characters would, however, improve your games and animated displays drastically. Once you know how to do this you will have a lot of control over what comes on the VIC screen.

The characters on the VIC can be placed in either of two areas of memory. The starting addresses of these areas are:
0 — 7168 (0000H — 1C00H) inclusive (RAM);
32768 — 39936 (8000H — 9C00H) inclusive (ROM).

The start of the character set in ROM is 32768 (8000H). The address at which the character set starts must be a multiple of 1024. This means that the character set has a minimum movement of 1k (1024 bytes).

Location 36869 (9005H) contains the address of the start of the character set in the memory. This byte also contains some of the screen pointers (the start of the screen RAM if you want to know). When moving the character set we must not alter these. Fig 1 shows a plan of the byte. Fig 2 is a table of values representing the lower four bits which denotes the starting address of the character set.

Once I had worked out how this byte worked I wrote two small programs to find the character set start address and relocate the start of the character set to your own requirements. These programs are Figs 3 and 4 respectively.

You have a choice of an 8 x 8 character matrix or an 8 x 16 matrix when making your shapes. If you use 8 x 8 characters then you need not reset anything. If you require 8 x 16 characters then you should use the following line in your program to convert the VIC to 16 lines of 8 x 16 characters:
POKE 36867, 33:
POKE 36865, 22

You will notice that the size of the screen suddenly grows when you use this routine. The bottom line will be off the screen.

Once you have selected the size of character to use you must reserve yourself some memory in which to store your shapes. Memory locations 55 - 56 (37H - 38H) will contain this. The top of memory is usually set to 7680 (1E00H). If you moved the top of memory down to 7168 (1C00H) then you would have 512 (200H) reserved bytes (Note: 7168 is a multiple of 1024). This could give you 64 8 x 8 characters or 32 8 x 16 characters, because 8 x 8 characters take up 8 bytes and 8 x 16 characters take up 16 bytes. Use the following line to reserve this space:
POKE 56,28 : CLR.

If you reserve this space then you can start your character set at location 7168(1C00H).

To actually make your character I will explain with an example of a small man. You should set out a table for your characters like the one in Fig 5. To work out the POKE value you should add up the values of the bits where a point is to be plotted.

Once you have the POKE values worked out you should POKE them into your reserved memory. This is done by starting at the top of your list of POKE values and POKEing them one after the other into your reserved memory. The first value will be stored at the start of this memory and the second at the start +1 and so on. Fig 6a shows a program to store my small man using four 8 x 8 characters. Fig 6b shows the changes required to use two 8 x 16 characters.

Fig 7 is an ordered plan of the steps involved when creating a character set. The ordering of it is different to the ordering of my explanations because after setting the top of memory you must clear all strings and variables. If this step is done first then you will not lose any of the character set addresses.

Kevin Irving

PCW SUBSET

Alan Tootill presents more useful assembler-language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to: Sub Set, PCW, 14 Rathbone Place, London W1P 1DE

Delay

With great self-control (my BBC micro has just arrived!) I start this month with a Z80 routine. It is a Universal Delay Routine from Dave Barrow of Hemsworth — just what is needed to go with his shape drawing and transforming routines of last March. Dave doesn't think his 6502 version of UDRZ, in 54 bytes, good enough to release. Can anybody do better? And what about a version of this routine in M6800 code?

There are two factors governing the length of the delay: the input value in A, the numerator, and the value assembled from FRAC. FRAC is determined by dividing the system clock hertz by a denominator. If, for example, with a 2 Mhz clock (2,000,000 pulses per second) a FRAC delay of 1/100th of a second is required, the denominator is 100 so the value in FRAC must be 20,000 from 2,000,000/100 =20,000.

To produce a FRAC delay of 1/50th of a second, the value in FRAC will be 40,000 from 2,000,000/50=40,000.

The FRAC delay is then multiplied by the value input in A to give the total delay.

To check this out, take FRAC=40,000 to make the code at label NUMLP: LD HL, FRAC; 21 40 9C and execute the following code for a delay of 200 x 1/150th of a second = 4 seconds:

```
LA A,+200 ; 3E C8
CALL UDRZ ; CD XX XX
jump to your monitor
```

Datasheet

```
;=UDRZ - Universal Delay Routine Z80
;/CLASS: 1
;/TIME CRITICAL?: Yes
;/DESCRIPTION: Accurate delay of 1-256 times
;/              assembled fraction of system clock Hz
;/ACTION: BC <— routine operating time (inc CALL)
;/        Then repeat until A=zero:
;/          HL <— system clock Hz/denominator
;/          HL <— HL-BC
;/          Then repeat until HL<zero:
;/            HL <— HL-33
;/          Then repeat 33 times to use remaining
;/           T-states:
;/            L <— L+1
;/            If L=0 then L <— L-1
;/          BC <— loop operating time
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: A=numerator (00H = 256)
;/OUTPUT: Delay of a/Denominator seconds
;/        A = 0
;/REGs USED: AF
;/STACK USE: 4
;/LENGTH: 30
;/TIME STATES: FRAC*A (inc CALL UDRZ)
;/PROCESSOR: Z80
;
FRAC:   EQU   System clock Hz/Denominator (1223 <= FRAC
;               <= 65536)
UDRZ:   PUSH  BC          ;                          C5
        PUSH  HL          ;                          E5
        LD    BC,FB39H    ; Routine T states negated 01 39 FB
NUMLP:  LD    HL,FRAC     ; Clock Hz/Denominator     21 XX XX
DIVLP:  ADD   HL,BC       ;                          09
        LD    BC,FFDFH    ; DIVLP T-states negated   01 DF FF
        JR    C,DIVLP     ; Div by subtraction til <0 38 FA
REMLP:  INC   L           ; Use remainder < 33 t-states2C
        JR    NZ,REMCNT   ;  by using 13 instead of 12 20 01
        DEC   HL          ; T-states for REMLP exit  2B
REMCNT: INC   C           ;                          0C
        JR    NZ,REMLP    ;                          20 F9
        LD    BC,FB83H    ; Loop T-states negated    01 83 FB
        DEC   A           ;                          3D
        JR    NZ,NUMLP    ; Repeat until A=0         20 EA
        POP   HL          ;                          E1
        POP   BC          ;                          C1
        RET               ;                          C9
```

Timing

For those of us who are going to check the evidence of our senses with our brains where we can, Dave has thoughtfully provided timings for UDRZ — see Figure 1.

There is one slight flaw in all this exactitude: the system hertz. The quartz crystals controlling most of our clock pulses are not absolutely accurate. They have a tolerance, varying with quality, above or below their rated speed of operation. But you are unlikely to notice this unless you get into delays of several hours.

```
                                        T-states
for the CALL                              (17)
URDZ:   PUSH  BC                           11
        PUSH  HL                           11
        LD    BC,FB39H                     10
NUMLP:  LD    HL,FRAC          10
DIVLP:  ADD   HL,BC            )
        LD    BC,FFDFH         ) 61
        JR    C,DIVLP          )
REMLP:  INC   L                )
        JR    NZ,REMCNT        )
        DEC   HL               ) 1052
REMCNT: INC   C                )
        JR    NZ,REMLP         )
        LD    BC,FB83H         10
        DEC   A                 4
        JR    Z,NUMLP          12      -5
        POP   HL                        10
        POP   BC                        10
        RET                             10
                               1149     74

1149 = 047DH, negated
       to FB83H

  74
1223 = 04C7H, negated
       to FB39H
```

Fig 1

6502 arithmetic

Our next Datasheet, from Vincent Fojut now of Altrincham, is an improvement on the 32-bit negation subroutine, SNEG46, we printed in February. Vincent expected that others would have hit on this improvement before him but nobody has so far, unless they are hugging it to themselves.

The improvement hinges on the fact that, although negative indexing is not possible with the absolute adressing modes of the 6502, it *is* possible when using the Zero Page, X and Zero Page, Y modes. This allows the index register to act both as an index register (on a suitably modified base address) and as a counter, counting upwards to zero. Consequently, Vincent's routine, functionally identical to the earlier one, is six bytes shorter and 21 T-States faster. It also frees one of the zero page locations, used in the original version as a counter.

I particularly like the illuminating comment against the SEC instruction, 'prepare to subtract with no borrow'. Illuminating because, in the 6502, the carry set indicates no borrow while in Z80 the carry clear set indicates no borrow. The action of the 6502 SBC instruction is A ← A - Memory - $\overline{Cy}$ and that of the Z80 SBC A ← A - Memory - Cy.

Datasheet

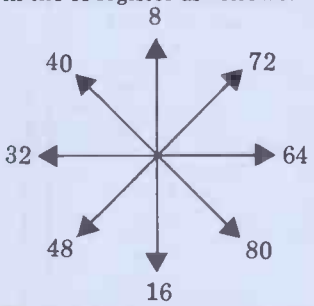
```
;=SNEG46 - Negate 4 bytes
;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: Negates (2s complements) 4 bytes in zero
;/              page with Cy copying the result's sign
;/ACTION: Byte ctr & ptr <— -4
;/        Cy <— 1
;/        Loop until byte ctr & ptr inc'd to 0
;/        Byte <— 0-byte-Cy
;/        Byte ctr & ptr <— byte ctr & ptr +1
;/        Loop end
;/        Cy <— sign of result
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: Locations M1 to M4 contain a signed 32-bit
;/       number with most sig byte in M4 & least sig
;/       in M1
;/OUTPUT: Locs M1 to M4 are negated & the carry is
```

```
;/        set to the resultant sign
;/REGs USED: A,X,P,M1 to M4
;/STACK USE: None
;/LENGTH: 14
;/T-STATES: 71
;/PROCESSOR: 6502
;
SNEG46: LDX   £-4       ; Put negative offset in X    A2 FC
        SEC             ; Prepare to sub with no      38
SNG1:   LDA   £0        ;  borrow. Sub M1 to M4       A9 00
        SBC   M1+4,X    ;  from 0                     F5 ZZ
        STA   M1+4,X    ;  and save                   95 ZZ
        INX             ; Continue if                 E8
        BMI   SNG1      ;  X<0                        30 F7
        ASL   A         ; Put sign in carry           0A
        RTS             ;                             60
```

Moving shapes

Richard Ryder of Macclesfield, who gave us May's revolving spaceship idea, now gives us a routine to move it around a memory-mapped screen. The routine, MOOV, moves a shape consisting of adjacent characters on a single row.

The direction of movement is related to the decimal value in the A register as follows:



This gives a binary representation of the right, left, down and up movements of:

bit 76543210

64 01000000 bit 6 set; move right

32 00100000 bit 5 set; move left

16 00010000 bit 4 set; move down

8 00001000 bit 3 set; move up

The routine has to cater only for these four basic movements because the other possible values of A each set two bits, which cause the desired movement as follows:-

bit 76543210

80 01010000 bits 6 & 4 set; move right and down

72 01001000 bits 6 & 3 set; move right and up

48 00110000 bits 5 & 4 set; move left and down

40 00101000 bits 5 & 3 set; move left and up

Richard wrote MOOV for the Video Genie and I tested it on a Nascom 1 under Nas-Sys 1. It should be clear from the documentation (write in with suggestions if it is not) how to adapt the routine for other memory-mapped Z80 microcomputers. But to give further help in following MOOV to those with other equipment, figures 2 and 3 show the screen memory addresses for the Video Genie and the Nascom 1:

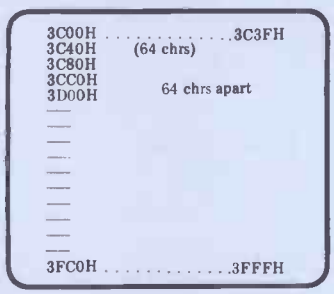


Fig 2 Video Genie

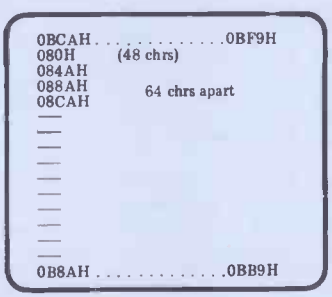


Fig 3 Nascom 1

Nascom's lowest line (by address) is actually the top line of the screen and, as press day dawns, I have made no provision for this.

It should be possible to confine movement to a restricted 'window' of the whole screen, by adjustment to the screen edges and their testing procedures.

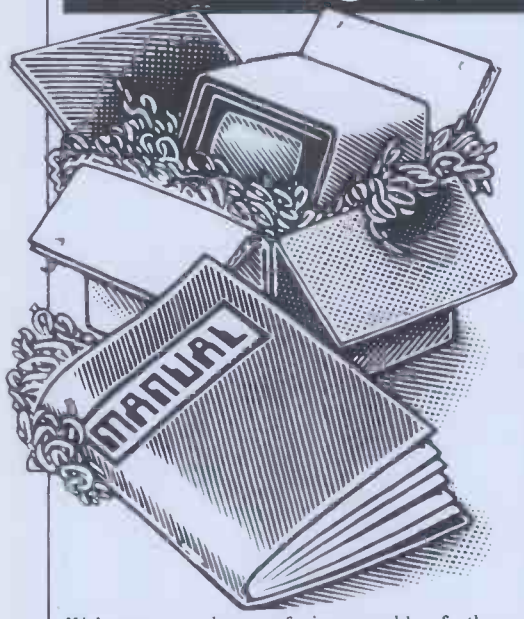
Datasheet

```
;=MOOV - Move shape on memory-mapped screen
;/CLASS: 2 Not relocatable, doesn't save all regs
;/       it could
;/TIME CRITICAL?: No
;/DESCRIPTION: Moves shape of contiguous characters on
;/             the same row, one space left, right, down,
;/             up or diagonally
;/ACTION: If A=64 move 1 space right
;/        If A=32 move 1 space left
;/        If A=16 move 1 space down
;/        If A= 8 move 1 space up
;/        If A=80 move 1 space right & 1 space down
;/        If A=72 move 1 space right & 1 space up
;/        If A=48 move 1 space left & 1 space down
;/        If A=40 move 1 space left & 1 space up
;/SUBr DEPENDENCE: Local in this presentation. LEFT,
;/                 UP,DOWN, RIGHT & DOMV could be filed
;/                 as separate routines
```

```
;/INTERFACES: Video Genie memory-mapped screen needed for
;/            the code given.  Alternate code is given in
;/            comments for Nascom 1.  The routines LEFT
;/            through DOMV must be located contiguously
;/            if all jumps on the displacement are to work
;/INPUT: A = decimal number 64, 32, 16, 8, 80, 72, 48 or 40
;/       HL points to lowest addressed byte of shape to be
;/       moved, low order byte 1st, high order byte next
;/OUTPUT: HL points to shape after it has been moved, lo
;/        byte 1st, hi byte next
;/REGs USED: A, HL, DE
;/STACK USE: 8
;/LENGTH: 126
;/PROCESSOR: Z80
;
MOOV:   LD    E,L       ; Get screen pos'n            5D
        LD    D,H       ;  also into DE               54
        PUSH  AF        ; Save key value              F5
        BIT   6,A       ; Test move right bit 6       CB 77
        JR    Z,NXT1    ; Jump if not set             28 05
        CALL  RIGHT     ;  else move right            CD YY YY
        LD    L,E       ; New pos'n from DE to        6B
        LD    H,D       ;  HL for next routine        62
NXT1:   POP   AF        ; Get back key value &        F1
        PUSH  AF        ;  save it again              F5
        BIT   5,A       ; Test move left bit 5        CB 6F
        JR    Z,NXT2    ; Jump if not set             28 05
        CALL  LEFT      ;  else move left             CD YY YY
        LD    L,E       ; New pos'n from DE to        6B
        LD    H,D       ;  HL for rest of routine     62
NXT2:   POP   AF        ; Get back key value &        F1
        PUSH  AF        ;  save it again              F5
        BIT   4,A       ; Test move down bit 4        CB 67
        JR    Z,NXT3    ; Jump if not set             28 05
        CALL  DOWN      ;  else move down             CD YY YY
        LD    L,E       ; New pos'n from DE to        6B
        LD    H,D       ; HL for rest of routine      62
NXT3:   POP   AF        ; Get back key value          F1
        PUSH  AF        ;  and save it again          F5
        BIT   3,A       ; Test move up bit 3          CB 5F
        JR    Z,NXT4    ; Jump if not set             38 03
        CALL  UP        ;  else move up               CD YY YY
NXT4:   POP   AF        ; Clear stack                 F1
        LD    L,E       ; Get back latest screen      6B
        LD    H,D       ;  address in HL              62
        RET             ;                             C9
;
LHE:    EQU   3FH       ; for Video Genie.  EQU 09H for Nascom.
                        ;  Least sig bits of LH char address
                        ;  minus 1
TPE:    EQU   3BH       ; for Video Genie.  EQU 07H for Nascom.
                        ;  Must = most sig byte of bottom right
                        ;  screen address minus 0040H when (AND
                        ;  ONLY WHEN) off top of screen
DNE:    EQU   3FH       ; for Video Genie. EQU 0BH for Nascom.
                        ;  Must be one less than most sig byte
                        ; of bottom right screen addr plus 0040H
                        ; when (AND ONLY WHEN)off bottom of screen
RHE:    EQU   3CH       ; for Video Genie.  EQU 36H for Nascom.
                        ;  Least sig 6 bits of RH char addr minus
                        ;  SIZ+1
SIZ:    EQU   04H       ; No of characters in shape

LEFT:   DEC   HL        ; Screen pos'n = screen       2B
                        ;  pos'n - 1
        LD    A,L       ; Will this be                7D
        AND   3FH       ;  off the edge               E6 3F
        CP    LHE       ;  of the screen?             FE 3F
        JR    NZ,DW3    ; No - then OK                20 1A
        INC   HL        ; Yes - so get back orig      23
                        ;  position
        JR    DW3       ; Continue                    18 17
UP:     LD    BC,FFC0H  ; BC=-40H                     01 C0 FF
        LD    A,TPE     ; A contains test for top     3E 3B
                        ;  of screen
        JR    DW1       ;                             18 05
DOWN:   LD    BC,0040H  ; BC=+40H                     01 40 00
        LD    A,DNE     ; A holds test for bottom     3E 3F
                        ;  of screen
DW1:    ADD   HL,BC     ; HL=new position             09
        CP    H         ; Test for off screen         BC
        INC   B         ; Test for adjust             04
        DEC   B         ;  to                         05
        JR    NZ,DW2    ;  carry flag                 20 01
        CCF             ;                             3F
DW2:    JR    C,DW3     ; Carry? Yes, so OK           30 02
        SBC   HL,BC     ; No so get back orig pos'n   ED 42
DW3:    PUSH  HL        ; Save new pos'n              E5
        EX    DE,HL     ; New pos'n into HL           EB
        LD    BC,1      ; Seed BC for drawing routine 01 01 00
        JR    DOMV      ; Move shape                  18 15
RIGHT:  DEC   DE        ; Is shape                    1B
        LD    A,L       ;  already at                 7D
        AND   3CH       ;  right edge? (AND 3FH for   E6 3C/3F
                        ;  Nascom)
        CP    RHE       ;  of screen?                 FE 3C
        JR    NZ,RGT1   ; No then OK                  20 01
        DEC   HL        ; Yes so adjust HL            2B
RGT1:   INC   HL        ; Save new                    23
        PUSH  HL        ;  position                   E5
        DEC   HL        ;                             2B
        LD    BC,4      ; Adjust both HL & DE         01 04 00
        ADD   HL,BC     ;  for drawing routine        09
        EX    DE,HL     ;  since must work            EB
        ADD   HL,BC     ;  backwards this time        09
        LD    BC,FFFFH  ; Seed BC =-1 for drawing     01 FF FF
DOMV:   LD    A,SIZ     ; No of chars in A            3E 04
DMV1:   PUSH  AF        ;                             F5
        LD    A,(HL)    ; Get old char                7E
        LD    (HL),20H  ; Wipe it out of old loc      36 20
        LD    (DE),A    ; Put it in new loc           12
        ADD   HL,BC     ; Point HL & DE to            09
        EX    DE,HL     ;  next char in shape         EB
        ADD   HL,BC     ;  ie, BC=+1 or -1            09
        EX    DE,HL     ;                             EB
        POP   AF        ;                             F1
        DEC   A         ; Finished?                   3D
        JR    NZ,DMV1   ; No then continue            20 F3
        POP   DE        ; Yes so get new pos'n in DE  D1
        RET             ;                             C9
```

NEWCOMERS START HERE



This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex**. The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 . . . . E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the programming **language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

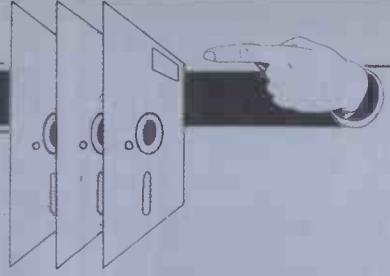
You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.

PACKAGES



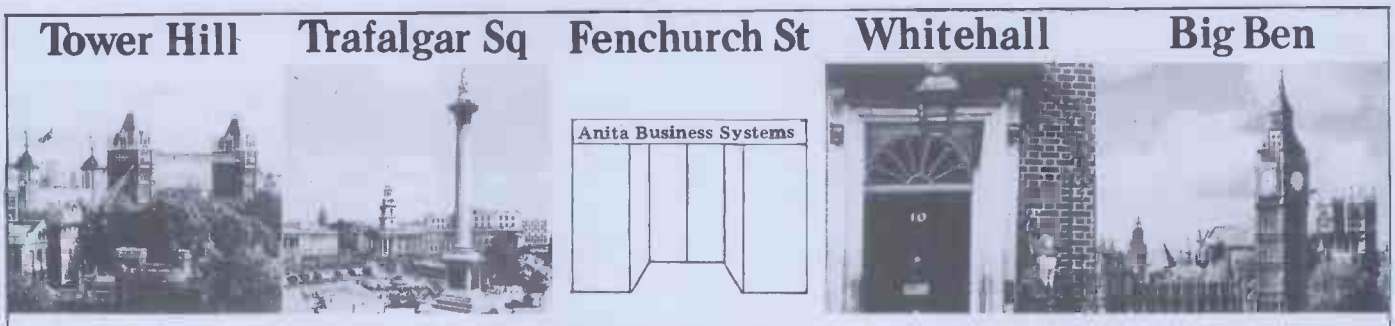
PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to: Dick Olney, *PCW*, 14 Rathbone Place, London W1P 1DE.

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.
All details published are the latest made available — some may have changed since this issue went to press.

Code	Company	Telephone
A1	ACT/Petsoft	021-454 8585
A2	Arden Data Processing	0533 22255
A3	ADP Network services	01 388 1912
B1	B + B Computer Ltd.	0204 26644
B2	Beam Business Centre	061-831-7292
B3	Benchmark Computer Systems	0726 61000
B4	Bristol Software Factory	0272 23430
B5	Byte Soft Systems Ltd	0533 531441
B6	Business Solutions Ltd	01-554-5985
B7	Bromley Computer Consultancy	01 464 8080
C1	CAP-CPP Products Ltd.	01-404 0911
C2	Commodore	01-388 5702
C3	Compsoft	0483 39665
C4	Comput-a-crop	0507-604271
C5	Computastore Ltd.	061-832-4761
C6	Computech	01-794 0202
C7	Compass	Standish 426252
C8	CWP Computers	01-828 3127
C9	C4 Computer Services	0632-664313
C10	Caxton Software	01 379 6502
E1	Engineering Sciences	01-437-4894
G1	Graffcom Systems Ltd.	01-727 5561
G2	Grama (Winter) Ltd.	01-636 8210
G3	Great Northern	0532 589980
G4	Alan Greenhalgh Ltd	01-520-0218
G5	Grade One	Glossop 63819
H1	A.J. Harding	0424 220391
H2	Hartford Software	0606 76265
H3	H.B. Computers	0536 83922
H4	Wordcraft System	0332 760127
I1	Intereurope Software Design	0734 786644
I2	Intex Datalog Ltd	0642 781193
J1	T.V. Johnson	027 620446
K2	Keen Computers	0602 412777
L1	Lifeboat Associates	01-836 9028
L2	Liveport (Exidy Sorcerer Firmware)	0736 798157
L3	Ludhouse (Computing) Ltd.	01-679 4321
L4	Logic Comp Systems	01-222-1122
M1	Micro Computer Applications Ltd.	0734 470425
M2	Microteck.	Orpington 26803
M3	Microsys Ltd	051 426 7271
M4	Microsave	0272 737555
M5	M.A.P. Comp Systems	061-624-5662
P1	Padmede Computer Services	0251 421892
P2	Personal Computers Ltd.	01-626 8121
P3	Professional Computer Services	061 624 4065
Q1	Quill Computer Systems.	051 647 6128/9
R1	Rockliff	051-521 5830
S1	SMG Micro Computers	0474 55813
S2	The Softwarehouse	01-637 2108
S3	Stage One Software	0202 735656
S4	Systematics International	0440 61121
S5	Sumlock Bondain	01-250 0505
S6	Stemmos	01 602 6242
S7	Software Aids Int	01-904 8139
T1	Tridata Micros Ltd.	021 622 6085
T2	Templeman Software	0789 66237
T3	The Micro Solution	0608 3256
T4	Terodec Ltd	0734-664343
V1	Vlasak Electronics Ltd.	0494-448633
W1	Wisbech Computer Services	0945 64146
W2	Westfarthing Comp Services	03265-4098
X1	Xetal	061 682 7555

Applications

Application	Machine	Price	Code
Appointments planner	Challenger	£25	C7
Assembler dev	PET/CBM	£50	L2
Bill of materials	CP/M	£850	B5
	Cromemco	£850	B5
	Superbrain	£450	T3
Bookmakers package	CP/M	POR	B7
Budgeting package	Apple II	£125	P2
	Apple II	£125	T2
	CP/M	£95	B5
	Cromemco	£95	B5
	North Star Horizon	£95	B5
Bureau de change	PET/CBM	£8	H3
Cash flow	Apple II	£125	P2
	Apple II	£80	V1
	Apple II	£100	C8
	CP/M	£250	L3
	CP/M	£95	B5
	Cromemco	£95	B5
	North Star Horizon	£95	B5
	PET/CBM	£8	A1
Cash register	CP/M	£300	T4
Cheque writer	CBM/8032	£90	P3
	PET/CBM	£90	P3
Company secretary	CP/M	£450	C4
Container accounting	CP/M	£750	M5
Contract costing	Apple II	£500	P1
	CP/M	£2000	L3
CP/M & utilities	Tandy Model II	£150	M1
Credit control	Apple II	£98	P2
	PET/CBM	£650	B4
Customer file	Famos	£1000	M2
Database management/Information retrieval	ACT800	£225	H4
	Apple II	£150	A2
	Apple II	£150	K2
	Apple II	£60-140	S2
	Apple II	£150	S5
	Apple II	£75	P2
	Apple II	£100	S4
	Apple II	£100	C8
	Apple II	£125	T2
	CP/M	£150-750	C4
	CP/M	£100	G3
	CP/M	£350	B3
	CP/M	£400	C3
	CP/M	£600	G5
	Famos	£1500	M2
	North Star Horizon	£250	B3
	PET/CBM	£250	C3
	PET/CBM	£325	A1
	PET/CBM	£225	H4
	PET/CBM	£75	B1
	PET/CBM	£50/150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	Superbrain	£300	S6
	Tandy Model 1	£25-80	M1
	TRS-80	£60	S2
	TRS-80	£150	J1
	TRS-80	£32.50	H1
	8000 Series	POR	C2
Dental Records	Apple II	£395	M4
	CP/M	£500	T4
Disk operating system	PET/CBM	£150	B1
Double glazing costing	North Star Horizon	£750	W1
Eire payroll system	CP/M	£650	M5
Estate agent	Apple II	£850	A2
	Apple II	£850	S5
	Apple II	£850	K2
	Apple II	£175	P2
	Apple II	£130	C8
	Apple II	£750	S4
	PET/CBM	£30	H3
	CP/M	£750	C4
	CP/M	£700	B5
	PCC 2000 Simpelec Triton 3	£350	B3
	MZ-80K	£195	W1
	PET/CBM	£25	A1
	Superbrain	£600	S6
Equipment lease/rent/HP	CP/M	£400	G1
File Handling	PET/CBM	£225	H4
Financial modelling	Apple II	£450	P2
	Apple II	£424-535	A1
	Apple II	£360	C8
	CP/M	£400	G1
	CP/M	£95	B5
	CP/M	£425-535	A1
	CP/M	£400	B6
	Cromemco	£95	B5
	North Star Horizon	£95	B5
	PET/CBM	£425-535	A1
	RAIR Black Box	POR	A3
Financial planning	Apple II	£250	S4
	Apple II	£125	A1
	CP/M	£125	A1
	PET/CBM	£125	A1
General ledger/NL	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£455	P2
	Apple II	£225	V1
	Apple II	£295	C6
	Apple II	£250P	S4
	Apple II	£600	T2
	Apple II	£490	L4
	CP/M	£500	L3
	CP/M	£375	L1
	CP/M	£500	C4
	CP/M	£400	G1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£275	S6
	CP/M	£275	S7
	CP/M	£350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	PCC 2000		
	North Star Horion	£400	B5
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£200	C2
	PET/CBM	£200	H3
	Sharp PC3201	£450	P2
	Superbrain	£400	M3
	Superbrain	£400	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	TRS-80	£225	H1
	TRS-80 I	£225/325	T1
	TRS-80 II	£425	T1
	Vector	£400	C5
	8080/Z80	£357	L1
	8080/Z80	£275	G3
General purchase transaction proc.	CBM/8032	£495	S3
Hotel management	Apple II	£525	M4
	CP/M	£525	M4
	RAIR Black Box	POR	A3
Incomplete records	Act Sirius 1	£1200	S1
	Apple II	£250	S2
	Apple II	POR	K2
	Apple II	£425	P2
	Apple II	£450	P1
	Apple II	£490	L4
	CP/M	£750	M3
	CP/M	£250	B5
	CP/M	£975	B3
	CP/M	£750	W1
	CP/M	£1250	M5
	Cromemco	£250	B5
	North Star Horizon	£750	M3
	North Star Horizon	£250	B5
	North Star Horizon	£975	B3
	Superbrain	£750	M3
	Superbrain	£1200	S1
	Tandy Model 1	£40	M1
	TRS-80	£40	H1
Industrial cleaning package	CP/M	POR	B7
Industry Factory loading	Apple II	£360	X1
	CP/M	£3-	X1
	PET/CBM	£300	X1
Industry work study	Apple II	£990	X1
	CP/M	£990	X1
	PET/CBM	£750	X1
Insurance renewals	CBM/8032	£1200	S3
Integrated accts	Altos (CP/M, MP/M)	£300	B1
	Apple II	£450	P1
	Apple II	£300	P2
	Apple II	£855	V1
	Apple II	£600	T2
	Apple II	£1470	L4
	Apple II	£300	W2
	CBM/8032	£1500	P3
	CP/M	£950	L1
	CP/M	£1500	C4
	CP/M	£1100	G1
	CP/M	£990	M3
	CP/M	£690	B5
	CP/M	£850	S7
	CP/M	£900	B5
	CP/M	£1450	B3
	CP/M	£1200	B6
	Cromemco	£690	B5
	Cromemco	£900	B5
	Famos	£2000	M2
	MZ-80K	£150	P2
	North Star Horizon	£950	B3
	North Star Horizon	£690	B5
	North Star Horizon	£900	B5
	PET/CBM	£300	B1
	PET/CBM	£800	S3
	North Star Horizon	£990	M3
	PET/CBM	(£50)	C2
	PET/CBM	£650	J1
	PET/CBM	£650	G2
	Superbrain	£990	M3
	Superbrain	£1200	S6
	Superbrain	£1000	T3
	Superbrain	£1200	S1
	Tandy Model I	£350	M1
	Tandy Model II	£350	M1
	TRS-80	£75	J1
	Vector	£1000	C5
	8000 Series	POR	C2
	8080/Z80	£950	L1
	8080/Z80	£995	G3
Investment portfolio	TRS-80	£20	S2
Invoicing	Apple II	£295	S2
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£140	V1



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ZX81 ROM Disassembly Part A
This book is for the programmer that needs complete answers about the ZX81. Dr. Logan has examined all routines in the ROM and here he comments on each one. It covers all ROM locations from 0000H to 0F54H, and includes all functions except for the routines used in the floating point calculator.

ZX81 ROM Disassembly Part B
In this the companion volume to Part A Dr. Logan covers locations 0F55H to 1DFFH and includes all routines used in the ZX81 floating point calculator.

OTHER TITLES AVAILABLE

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PACKAGES

Application	Machine	Price	Code
	Apple II	£300	T2
	Challenger	£25	C7
	CP/M	£325	L1
	CP/M	£150-350	C4
	CP/M	£250	M3
	CP/M	£150	S7
	CP/M	£100	B5
	CP/M	£200	B3
	CP/M	£300	W1
	CP/M	POR	B7
	Cromemco	£100	B5
	North Star Horizon	£100	B3
	North Star Horizon	£25	M3
	North Star Horizon	£16	B5
	PET/CBM	£350	A1
	PET/CBM	£25-50	B1
	PET/CBM	POR	J1
	Superbrain	£250	M3
	Superbrain	£150	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	TRS-80	£25	H1
	TRS-80I	£75	T1
	TRS-80II	£125	T1
	8080/Z80	£325	L1
Job costing	Apple II	£300	P1
	Apple II	£990	X1
	CP/M	£700	C4
	CP/M	£350	M3
	CP/M	£990	X1
	CP/M	£500	T4
	CP/M	£650	M5
	CP/M	POR	B7
	North Star Horizon	£350	M3
	PET/CBM	£750	X1
	Superbrain	£350	M3
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
Job order control	8080/Z80	£275	G3
Legal precedents	CP/M	£1100	C4
Letter writer	Apple II	£80	V1
	CP/M	£150	M3
	North Star Horizon	£150	M3
	Superbrain	£150	M3
Local government housing maint	RAIR Black Box	POR	A3
Lotteries	PET/CBM	£45	H2
Mailing List	Altos (CP/M, MP/M)	£75	B1
	Apple II	£300	A2
	Apple II	£50-150	S2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£40	P2
	Apple II	£100	S4
	CP/M	£50-150	C4
	CP/M	£250	G1
	North Star Horizon	£195	W1
	PET/CBM	£45	H2
	PET/CBM	£15	A1
	PET/CBM	£75	B1
	PET/CBM	£35	H1
	Superbrain	£140	C9
	Tandy Model I	£40	M1
	Tandy Model II	£75	M1
	TRS-80	£50-150	S2
	TRS-80	£25/38/55	H1
Mail shot	Apple II	£14	S2
	Apple II	£40	P2
	Apple II	£25	T2
	Challenger	£25	C7
	CP/M	£200-360	C4
	CP/M	£90	M3
	CP/M	£75	S7
	CP/M	£50/150	G5
	MCZ Zilog	£250	I1
	North Star Horizon	£90	M3
	PCC 2000 Simplec Triton 3	£450	B2
	Superbrain	£90	M3
	Tandy Model I	£75+	G4
	Tandy Model II	£75	M1
	Tandy Model II	£75+	G4
Membership accting	Apple II	£75	P2
	MCZ Zilog	£250	I1
	PET/CBM	£85	H2
Motor Dealer	CBM/8032	£950+	P3
	Famos	£5000	M2
Order entry/invoicing	CBM/8023	£750	P3
	CP/M	£350	G1
	CP/M	£500	T4
	CP/M	£550	M5
	CP/M	£550	L1
	CP/M	POR	B7
	8080/Z80	£550	L1
Office admin	Apple II	£100	S4
Pad to plotter systems	Apple II	£250	P2
	Apple II	£180	C8
Payroll	Apple II	POR	A2
	Apple II	£200	S2
	Apple II	POR	S5
	Apple II	POR	K2
	Apple II	£200	P2
	Apple II	£375	V1
	Apple II	£375	C6
	Apple II	£250P	S4
	Apple II	£400	T2
	Apple II	£490	L4
	CBM/8032	£375	P3
	Challenger	£24	C7
	CP/M	£450	L3
	CP/M	£475	L1
	CP/M	£495	C4
	CP/M	£500	G1
	CP/M	£390	M3
	CP/M	£500	B5
	CP/M	£450	B3
	CP/M	£425	B6
	CP/M	Lease	W1
	CP/M	£500	T4
	CP/M	£450	M5
	CP/M	POR	B7
	Famos	£1500	M2
	North Star Horizon	£350	B3
	North Star Horizon	£390	M3
	North Star Horizon	Lease	W1
	PET/CBM	£200/350	C5
	PET/CBM	£200/25/195	A1
	PET/CBM	£50/195	I2
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	PET/CBM	£10	H3
	Scorcerer	£250	L2
	Superbrain	£390	M3
	Superbrain	£400	S6
	Superbrain	£250+	T3
	Tandy Model I	£249	M1
	TRS-80	£200	H1
	TRS-801	£218	T1
	TRS-8011	£375	T1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	Sorcerer	£250	L2
	Tandy Model I	£249	M1
	TRS-80	£200	H1
	TRS-80I	£218	K1
	TRS-80I	£218	T1
	TRS-8011	£375	T1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
Perpetual Inventory	CP/M	£150	B5
	Cromemco	£150	B5
Personnel records	Apple II	£98	P2
	CP/M	£450	C4
	MCZ Zilog	£400	I1
	PET/CBM	£85	H2
Petaid report generator	PET/CBM	£250	S3
Petsoft programs	PET/CBM	£160	J1
Postal advertising response package	Apple II	£350	S2
Price lister	PET/CBM	£12	H3
Production analysis	Apple II	£75	P2
	CP/M	£700	C4
	PET/CBM	£300	B1
Production control	CBM/8032	£650	P3
	PET/CBM	£650	P3
Prof appts groups	8080/Z80	£275	G3
Prof appts individ	8080/Z80	£220	G3
Prof client billing	8080/Z80	£330	G3
Programming aids	Apple II	£40	P2
Property management	CP/M	£450-1000	C4
	CP/M	£400	M3
	CP/M	POR	B7
	North Star Horizon	£400	M1
	Superbrain	£400	M3
Purchase ledger	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II	£250P	S4
	Apple II	£300	T2
	Apple II	£490	L4
	Challenger	£25	C7
	CP/M	£500	C4
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£275	S7
	CP/M	350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	North Star Horizon	£400	B5
	Superbrain	£400	M3
	Superbrain	£300	S6
	PCC 2000 Simplec Triton 3	£350	B2
	PET/CBM	£300	B4
	PET/CBM	£95/120/350	A1
	PET/CBM	£200	C2
	PET/CBM	POR	J1
	PET/CBM	£350	H3
	Sharp PC3201	£300	P2
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	TRS-80	£225	H1
	TRS-80I	£225	T1
	TRS-8011	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
Quotation estimating	Apple II	£300	P1
Resource optimiser	Apple II	£295	C10
Sales ledger	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II	£250P	S4
	Apple II	£300	T2
	Apple II	£490	L4
	Challenger	£25	C7
	CP/M	£500	C4
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£275	S7
	CP/M	£350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	North Star Horizon	£400	B5
	PCC 2000 Simplec Triton 3	£350	B2
	PET/CBM	£300	B4
	PET/CBM	£800	C1
	PET/CBM	£95/350	A1
	PET/CBM	POR	J1
	PET/CBM	£200	C2
	PET/CBM	£350	C1
	Sharp PC 3201	£300	P2
	Superbrain	£400	M3
	Superbrain	£300	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	TRS-80	£225	H1
	TRS-80I	£225	T1
	TRS-80II	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
S/L, P/L & stock control	Apple II	£900	P2
	Apple II	£1000	T2
	CP/M	£1000	L3
	CP/M	£900	B5
	Cromemco	£900	B5
	North Star Horizon	£900	B5
Solicitor's complete record accounting	Apple II	£3000	S2
Solicitor's package	Act Sirius 1	£1400	S1
	CBM/8032	£1400	S1
	Compucorp	£2000	Q1
	Superbrain	£1400	S1
	CP/M	£1250	M5
Statistics	Apple II	£150	G3
	Apple II	£100-150	P2
	Apple II	£140	C8
	TRS-80	£45	S2
Stock control/ recording	Altos (CP/M, MP/M)	£300	B1
	AppleII	POR	A2
	Apple II	POR	K2
	Apple II	POR	S5
	Apple II	£150	G3
	Apple II	£80	S2
	Apple II	£75/300	P2
	Apple II	£285	V1
	Apple II	£300	P1
	Apple II	£500	S4
	Apple II	£490	L4
	CBM/8032	£175	P3
	Challenger	£25	C7
	CP/M	£325	L1
	CP/M	£500-1500	C4
	CP/M	£350	G1
	CP/M	£900	M3
	CP/M	£700	B5
	CP/M	£550	B5
	CP/M	£550	B3
	CP/M	£300	W1
	CP/M	£500	T4
	CP/M	£550	M5
	CP/M	POR	B7
	Cromemco	£700	B5
	Famos	£1500	M2
	MZ-80K	£150	P2
	North Star Horizon	£450	B3
	North Star Horizon	£900	M3

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PACKAGES

Machine	Application	Price	Code
	PCC 2000		
	Simpelec Triton 3	£350	B2
	PET/CBM	£12/25/350	A1
	PET/CBM	£195	I2
	PET/CBM	£300	B4
	PET/CBM	£15	A2
	PET/CBM	£300	B1
	PET/CBM	£150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	PET/CBM	£250	R1
	PET/CBM	£35/25	H3
	Sharp PC3201	£300	P2
	Superbrain	£900	M3
	Superbrain	£300	S6
	Superbrain	£450	T3
	Tandy Model I	£30-50	M1
	Tandy Model II	£300	M1
	TRS-80	£48	S2
	TRS-80	£200	H1
	TRS-80	£115	J1
	TRS-80I	£200	T1
	TRS-80II	£375	T1
	8080/Z80	£275	G3
	8080/Z80	£325	L1
Surveying	CP/M	£500	T4
TAP business system	PET/CBM	£125	H2
Text file librarian	Apple II	£125	S4
Time/cost recording	Act Sirius 1	£800	S1
	Apple II	£450	S2
	Apple II	£300	P1
	CBM/8032	£800	S1
	CP/M	£400	G1
	CP/M	£200	M3
	CP/M	£350	B3
	North Star Horizon	£250	B7
	North Star Horizon	£200	M3
	North Star Horizon	£450	W1
	PCC 2000		
	Simpelec Triton 3	£350	B2
	PET/CBM	£300	B1
	Superbrain	£200	M3
	Superbrain	£800	S1
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
Travel agency accts	Superbrain	£800	S6
	Tandy Model I	£225	G4
	Tandy Model II	£225	G4
Travel Agents Dairy	Tandy Model I	£100	G4
	Tandy Model Ii	£100	G4
Travel Ticket Sales	Tandy Model I	£225	G4
	Tandy Model II	£225	G4
Utilities	Apple II	£40	P2
	Apple II	£20	C6
	CP/M	£50	B5
	ITT 2020	£20	C6
Utility set	PET/CBM	£78	H3
Various engineering	Tektronix		E1
VAT	PET/CBM	£17.50	A1
VAT master	PET/CBM	£25	H3
VAT register	TRS-80	£15	H1
Video message	Apple	£200	G3
Warehousing	CBM/8032	POR	S1
	CBM/8032	£375	P3
Word processing	ACT 800	£375	H4
	Apple II	£60	S2
	Apple II	£75	K2
	Apple II	£75	S5
	Apple II	£75	A2
	Apple II	£150-300	P2
	Apple II	£75	J1
	Apple II	£120	V1
	Apple II	£180/95	S4
	Apple II	£30	C8
	Apple II	£500	T2
	CP/M	£150-260	C4
	CP/M	£400	G1
	CP/M	£250	M3
	CP/M	£250	B6
	CP/M	POR	B7
	Famos	£500	M2
	North Star Horizon	£250	M3
	PET	£85/65/40/20	H2
	PET/CBM	£375	H4
	PET/CBM	£25/325	A1
	PET/CBM	£325	C5
	PET/CBM	£75/150	C2
	PET/CBM	£75/150	J1
	PET/CBM	£75/150	G2
	PET/CBM	£35	H3
	Superbrain	£250	M3
	Tandy Model I	£50/75	M1
	Tandy Model II	£175-240	M1
	TRS-80	£30/60/90	S2
	TRS-80	£45/95	J1
	TRS-80	£15	H1
	Vector	£400	C5
	8000 Series	£250	C2
Work In Progress	CP/M	£850	B5

Machines

Machine	Application	Price	Code
ACT 800	Database management/ Word processing	£225 £375	H4 H4
Act Sirius 1	Incomplete records	£1200	S1
	Solicitors package	£1400	S1
	Time/cost recording	£800	S1
Altos (CP/M, MP/M)	Integrated accts	£300	B1
	Mailing list	£75	B1
	Stock control/recording	£300	B1
Apple II	Budgeting	£125	T2
	Cash flow	£80	V1
	Cash flow	£75	P2
	Cash flow	£100	C8
	Contract costing	£450	P1
	Database management/ information retrieval	£150	K2
	Database management/ information retrieval	£150	A2
	Database management/ information retrieval	£60-140	S2
	Database management/ information retrieval	£150	S5
	Database management/ information retrieval	£98	P2
	Database management/ information retrieval	£100	S4
	Database management	£75	P2
	Database management	£100	C8
	Database management	£125	T2
	Dental records	£395	M4
	Estate agent	£850	S5
	Estate agent	£850	A2
	Estate agent	£850	K2
	Estate agent	£750	S4
	Estate agent	£130	C8
	Financial modelling	£360	C8
	Financial modelling	£425-535	A1
	Financial planning	£25	S4
	Financial planning	£125	A1
	General ledger/NL	£3	K2
	General ledger/NL	£3	A2
	General ledger/N/L	£450	P2
	General ledger/NL	£300	S5
	General ledger/NL	£225	V1
	General ledger/NL	£295	C6
	General ledger/NL	£250P	S4
	General ledger/NL	£600	T2
	General ledger/NL	£490	L4
	Hotel management	£525	M4
	Incomplete records	POR	K2
	Incomplete records	£250	S2
	Incomplete records	£450	P1
	Incomplete records	£450	P2
	Incomplete records	£490	L4
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Integrated accts	£885	V1
	Integrated accts	£450	P1
	Integrated accts	£300	P2
	Integrated accts	£600	T2
	Integrated accts	£300	W2
	Integrated accts	£1470	L4
	Invoicing	£295	S2
	Invoicing	£300	P2
	Invoicing	£140	V1
	Invoicing	£300	P1
	Invoicing	£300	T2
	Job costing	£450	S2
	Job costing	£990	X1
	Job costing	£300	P1
	Mailing list	£300	K2
	Mailing list	£300	A2
	Mailing list	£40	P2
	Mailing list	£50-150	S2
	Mailing list	£300	S5
	Mailing list	£100	S4
	Mailing Lis	£25	T2
	Mail shot	£14	S2
	Mail shot	£225	P2
	Pad to plotter system	£250	P2
	Pad to plotter system	£180	C8
	Payroll	POR	S5
	Payroll	POR	K2
	Payroll	POR	A2
	Payroll	£200	S2
	Payroll	£375	V1
	Payroll	£200	P2
	Payroll	£375	C6
	Payroll	£250P	S4
	Payroll	£400	T2
	Payroll	£490	L4
	Personal records	£75	P2
	Postal advertising response package	£350	S2
	Production analysis	£75	P2
	Programming aids	£40	P2
	Purchase ledger	£300	K2
	Purchase ledger	£300	P2
	Purchase ledger	£300	A2
	Purchase ledger	£300	S5
	Purchase ledger	£315	V1
	Purchase ledger	£300	P1
	Purchase ledger	£295	C6
	Purchase ledger	£250P	S4
	Purchase ledger	£300	T2
	Purchase ledger	£490	L4
	Quotation estimating	£300	P1
	Resource optimiser	£295	C10
	Sales ledger	£300	A2
	Sales ledger	£300	K2
	Sales ledger	£300	S5
	Sales ledger	£300	P2
	Sales ledger	£315	V1
	Sales ledger	£300	P1
	Sales ledger	£295	C6
	Sales ledger	£250P	S4
	Sales ledger	£300	T2
	Sales ledger	£490	L4
	SL, PL stock control	£1000	T2
	Solicitor's complete record accounting	£3000	S2
	Statistics	£150	G3
	Statistics	£100/195	P2
	Statistics	£100-195	P2
	Statistics	£140	C8
	Stock control/recording	£150	G3
	Stock control/recording	POR	K2
	Stock control/recording	£300	P2
	Stock control/recording	POR	A2
	Stock control/recording	£80	S2
	Stock control/recording	POR	S5
	Stock control/recording	£285	V1
	Stock control/recording	£300	P1
	Stock control/recording	£500	S4
	Stock control/recording	£490	L4
	Text file librarian	£125	S4
	Time/cost recording	£450	S2
	Time/cost recording	£300	P1
	Utilities	£20	C6
	Video message	£200	G3
	Word processing	£75	K2
	Word processing	£75	A2
	Word processing	£60	S2
	Word processing	£300	P2
	Word processing	£75	S5
	Word processing	£120	V1
	Word processing	£75	J1
	Word processing	£180/95	S4
	Word processing	£30	C8
	Word processing	£500	T2
CBM/8032	Cheque writer	£90	P3
	General purpose transaction proc.	£495	S3
	Insurance renewals	£1200	S3
	Integrated accts	£1500	P3
	Motor trader	£950+	P3
	Order entry/invoicing	£750	P3
	Payroll	£375	P3
	Production control	£650+	P3
	Solicitors package	£140	S1
	Stock control/recording	£175	P3
	Time/cost recording	£800	S1
	Warehousing	£375	P3
Compucorp	Solicitors package	£2[illegible]00	Q1
Challenger	Appointment Planner	£25	C7
	Invoicing	£25	C7
	Mail Shot	£25	C7
	Payroll	£25	C7
	Purchase Ledger	£25	C7
	Sales Ledger	£25	C7
	Stock Control	£25	C7
CP/M	Bill of materials	£500	B5
	Bookmakers package	POR	B7
	Budgeting package	£95	B5
	Cash flow	£250	L3
	Cash flow	£95	B5
	Cash register	£300	T4
	Company secretary	£450	C4
	Container accounting	£750	M5
	Contract costing	£2000	L3
	Database	£350	B3
	Database management/ information retrieval	£150-750	C4
	Database management/ information retrieval	£100	G3
	Database management/ information retrieval	£400	C3
	Database management/ information retrieval	£600	G5
	Dental records	£500	T4
	Eire payroll system	£650	M5
	Equipment lease/rent/ HP	£400	G1
	Estate agents	£750	C4
	Estate agent	£700	B5
	Financial modelling	£400	G1
	Financial modelling	£95	B5
	Financial modelling	£425/535	A1
	Financial modelling	£400	B6
	Financial planning	£125	A1
	General ledger/NL	£500	L3
	General ledger/NL	£500	C4
	General ledger/NL	£400	G1
	General ledger/NL	£375	L1
	General ledger/NL	£200	B5
	General ledger/NL	£275	S7
	General ledger/NL	£400	M3
	General ledger/NL	£350	B3
	General ledger/NL	£300	W1
	General ledger/NL	£425	B6
	General ledger/NL	£500	T4
	General ledger/NL	£400	M5
	General ledger/NL	POR	B7
	Hotel management	£525	M4
	Incomplete Records	£250	B5
	Incomplete Records	£750	M3
	Incomplete Records	£975	B3
	Incomplete Records	£750	W1
	Incomplete Records	1250	M5
	Industrial cleaner package	POR	B7
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Insurance brokers	£995	W1
	Integrated accts	£1500	C4
	Integrated accts	£1100	G1
	Integrated accts	£950	L1
	Integrated accts	£690	B5
	Integrated accts	£850	S7
	Integrated accts	£990	M3
	Integrated accts	£900	B5
	Integrated accts	£1450	B3
	Integrated accts	£1200	B6
	Invoicing	£325	L1
	Invoicing	£150-350	C4
	Invoicing	£150	S7
	Invoicing	£250	M3
	Invoicing	£100	B5
	Invoicing	£200	B3
	Invoicing	£300	W1
	Invoicing	POR	B7
	Job costing	£700	C4
	Job costing	£990	X1
	Job costing	£350	M3

PACKAGES

Machine	Application	Price	Code
	Job costing	£500	T4
	Job costing	£650	M5
	Job costing	POR	B7
	Legal precedents	£1100	C4
	Letter Writer	£150	M3
	Mailing list	£50-150	C4
	Mailing list	£250	G1
	Mailing list	£75	S7
	Mail shot	£200-360	G4
	Mail shot	£90	M3
	Mail shot	£50/150	G5
	Order entry/invoicing	£350	G1
	Order entry/invoicing	£500	T4
	Order entry/invoicing	£550	M5
	Order entry/invoicing	POR	B7
	Order processing	£550	L1
	Payroll	£450	L3
	Payroll	£495	C4
	Payroll	£500	G1
	Payroll	£475	L1
	Payroll	£500	B5
	Payroll	£390	M3
	Payroll	£450	B3
	Payroll	Lease	W1
	Payroll	£425	B6
	Payroll	£500	T4
	Payroll	£450	M5
	Payroll	POR	B7
	Perpetual Inventory	£150	B5
	Personnel records	£450	C4
	Production analysis	£700	C4
	Property management	£450-1000	C4
	Property management	£400	M3
	Property management	POR	B7
	Purchase ledger	£500	L3
	Purchase ledger	£450	G1
	Purchase ledger	£425	L1
	Purchase ledger	£500	C4
	Purchase ledger	£200	B5
	Purchase ledger	£275	S7
	Purchase ledger	£400	M3
	Purchase ledger	£350	B3
	Purchase ledger	£300	W1
	Purchase ledger	£425	B6
	Purchase ledger	£500	T4
	Purchase ledger	£400	M5
	Purchase ledger	POR	B7
	Sales ledger	£500	L3
	Sales ledger	£500	C4
	Sales ledger	£450	G1
	Sales ledger	£425	L1
	Sales ledger	£200	B5
	Sales ledger	£275	S7
	Sales ledger	£400	M3
	Sales ledger	£350	B3
	Sales ledger	£300	W1
	Sales ledger	£425	B6
	Sales ledger	£500	T4
	Sales ledger	£400	M5
	Sales ledger	POR	B7
	Solicitors	£1250	M5
	S/L, P/L + stock control	£1000	L3
	S/L, P/L + stock control	£900	B5
	Stock control/recording	£325	L1
	Stock control/recording	£500-1500	C4
	Stock control/recording	£350	G1
	Stock control/recording	£500	B5
	Stock control/recording	£900	M3
	Stock control/recording	POR	B7
	Stock control	£550	B3
	Stock Control	£300	W1
	Stock control	£500	T4
	Stock control	£550	M5
	Surveying	£500	T4
	Time/cost recording	£400	G1
	Time/cost recording	£200	M3
	Time ledger	£350	B3
	Utilities	£50	B5
	Word processing	£400	G1
	Word processing	£150-260	C4
	Word processing	£250	M3
	Word processing	£250	B6
	Word processing	POR	B7
	Work in progress	£850	B5
Famos	Customer file	£1000	M2
	Data base	£1500	M2
	Integrated accts	£2000	M2
	Motor dealer	£5000	M2
	Payroll	£1500	M2
	Stock control	£1500	M2
	Word processing	£500	M2
MCZ Zilog	Mail shot	£250	I1
	Membership accting	£250	I1
	Personnel records	£400	I1
MZ-80K	Estate agent	£195	W1
	Integrated accounts	£150	P2
	Stock control/recording	£150	P2
North Star Horizon	Budgeting package	£95	B5
	Cash flow	£95	B5
	Database management/ information retrieval	£250	B3
	Double glazing costing	£750	W1
	Estate agent	£750	B5
	Financial modelling	£95	B5
	General ledger/NL	£250	B3
	General ledger/NL	£400	M3
	General ledger/NL	£400	B5
	Incomplete records	£750	M3
	Incomplete records	£250	B5
	Incomplete records	£975	B3
	Integrated accts	£950	B3
	Integrated accts	£990	M3
	Integrated accts	£690	B5
	Integrated accts	£900	B5
	Invoicing	£100	B3
	Invoicing	£250	M3
	Invoicing	£100	B5
	Job costing	£350	M3
	Letter writer	£150	M3
	Miling List	£195	W1
	Mail shot	£90	M3
	Payroll	£350	B3
	Payroll	£390	M3
	Payroll	Lease	W1
	Property Management	£400	M3
	Purchase ledger	£250	B3
	Purchase ledger	£400	M3
	Purchase ledger	£400	B5
	Sales ledger	£250	B3
	Sales ledger	£400	M3
	Sales ledger	£400	B5
	SL, PL + stock control	£900	B5
	Stock control/recording	£450	B3
	Stock control/recordng	£900	M3
	Time/cost recording	£250	B3
	Time/cost recording	£200	M3
	Time/cost recordin	£450	W1
	Word processing	£250	M3
PCC 2000 Simpelec Triton 3	Estate Agent	£350	I2
	General ledger/NL	£350	B2
	Mail Sho	£450	B2
	Purchase ledger	£350	B2
	Sales ledger	£350	I2
	Stock control/recording	£350	B2
	Time/cost recording	£350	B2
PET/CBM	Assembler dev	£50	C2
	Bureau de change	£8	H3
	Cash flow	£8	A1
	Cheque writer	£90	P3
	Credit control	£650	B4
	Database management/ information retrieval	£75	B1
	Database management/ information retrieval	£50/150	C2
	Database management/ information retrieval	£150	G2
	Database management/ information retrieval	£150	J1
	Database management/ information retrieval	POR	C1
	Database management/ information retrieval	£325	A1
	Database management/ information retrieval	£225	H4
	Database management/ information retrieval	£250	C3
	Disk operating system	£150	B1
	Estate agent	£25	A1
	Estate agent	£30	H3
	File handling	£225	H4
	Financial modelling	£425-535	A1
	Financial planning	£125	A1
	General ledger/NL	£200	G2
	General ledger/NL	£1000	C1
	General ledger/NL	£200+	H1
	Industry factory loading	£300	X1
	Industry work study	£750	X1
	Integrated accts	£300	B1
	Integrated accts	£150)	C2
	Integrated accts	£650	G2
	Integrated accts	£650	J1
	Integrated acc	£800	S3
	Invoicing	POR	J1
	Invoicing	£25-50	B1
	Invoicing	£350	A1
	Invoicing	£400	C1
	Job costing	£75	X1
	Lotteries	£45	H2
	Mailing list	£75	B1
	Mailing list	£15	A1
	Mailing list	£45	H2
	Mailing list	£35	H3
	Membership accting	£85	H2
	Payroll	£150	G2
	Payroll	£150	J1
	Payroll	£150	C2
	Payroll	£50/195	I2
	Payroll	£50/25/ 195	A1
	Payroll	POR	C1
	Payroll	£200/350	C5
	Payroll	£10	H3
	Personnel recors	£85	H2
	Petsoft programs	£160	J1
	Petaid report generator	£250	S3
	Prise lister	£12	H3
	Production analysis	£300	B1
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	Purchase ledger	£200	C2
	Purchase ledger	POR	J1
	Purchase ledger	£95/120 350	A1
	Purchase ledger	£1000	C1
	Purchase ledger	£300	B4
	Purchase ledger	£350	H3
	Sales ledger	POR	J1
	Sales ledger	£200	J1
	Sales ledger	£300	B4
	Sales ledger	£800	C1
	Sales ledger	£95/350	A1
	Sales ledger	£350	H3
	Stock control/recording	£150	C2
	Stock control/recording	£300	B1
	Stock control/recording	£150	G2
	Stock control/recording	£150	J1
	Stock control/recording	£195	I2
	Stock control/recording	£12/25/ 350	A1
	Stock control/recording	£15	A2
	Stock control/recording	£300	B4
	Stock control/recording	£35/25	H3
	TAP business system	£125	H2
	Time/cost recording	£300	B1
	Utility set	£78	H3
	VAT	£17.50	A1
	VAT master	£25	H3
	Word processing	£75/150	J1
	Word processing	£75/150	G2
	Word processing	£75/150	C2
	Word processing	£85/65 £40/20	H2
	Word processing	£375	H4
	Word processing	£25/325	A1
	Word processing	£325	C5
	Word processing	£35	H3
PET/ Computhink	Stock control/recording	£250	R1
RAIR Black Box	Financial modelling	POR	A3
	Hotel management	POR	A3
	Local government housing maint.	POR	A3
Sharp PC-3201	General ledger	£450	P2
	Sales ledger	£300	P2
	Purchase ledger	£300	P2
	Stock control	£300	P2
Sorcerer	Payroll	£250	L2
Superbrain	Bill of materials	£450	T3
	Database	£300	S6
	Estate agent	£800	S6
	General ledger	£400	M3
	General ledger	£400	S6
	Incomplete Records	£750	M3
	Incomplete Records	£1200	S1
	Integrated accts	£1200	S6
	Integrated accts	£990	M3
	Integrated accts	£1000	T3
	Integrated accts	£1200	S1
	Invoicing	£250	M3
	Invoicing	£150	S6
	Job costing	£350	M3
	Letter writer	£150	M3
	Mailing list	£140	S9
	Mail sh	£90	M3
	Payroll	£400	S6
	Payroll	£390	M3
	Payroll	£250+	T3
	Property management	£400	M3
	Purchase ledger	£300	S6
	Purchase ledger	£400	M3
	Sales ledger	£300	S6
	Sales ledger	£400	M3
	Solicitors package	£1400	S1
	Stock control	£300	S6
	Stock control	£900	M3
	Stock control	£450	T3
	Time/cost recording	£800	S1
	Time recording	£200	M3
	Word processing	£250	M3
	Travel agency accts	£800	S6
Tandy Model I	Database management/ information retrieval	£25-80	M1
	General ledger/NL	£90	M1
	Incomplete records	£40	M1
	Integrated accts	£350	M1
	Invoicing	£90	M1
	Job costing	POR	M1
	Mailing list	£40	M1
	Mail shot	£75+	G4
	Payroll	£249	M1
	Purchase ledger	£90	M1
	Sales ledger	£90	M1
	Stock control/recording	£30-50	M1
	Travel Agency Accts	£225	G4
	Travel Agents Diary	£100	G4
	Travel Ticket Sales	£225	G4
	Time/cost recording	POR	M1
	Word processing	£50/75	M1
Tandy Model II	General ledger/NL	£90	M1
	Integrated accts	£350	M1
	Invoicing	£90	M1
	Job costing	POR	M1
	Mailing list	£75	M1
	Mail shot	£75	M1
	Mail shot	£75+	G4
	Purchase ledger	£90	M1
	Sales ledger	£90	M1
	Stock control/recording	£300	M1
	Time/cost recording	POR	M1
	Travel Agency Accts	£225	G4
	Travel Agency Diary	£100	G4
	Travel Ticket Sales	£225	G4
	Word processing	£175-240	M1
Tektronix	Various engineering Packages		E1
TRS-80	Database management/ information retrieval	£60	S2
	Database management/ information retrieval	£32.50	H1
	Database management/ information retrieval	£150	J1
	General ledger/NL	£225	H1
	Incomplete records	£40	H1
	Integrated accts	£75	J1
	Investment portfolio	£20	S2
	Invoicing	£25	H1
	Mailing list	£25/38/ 55	H1
	Mailing list	£50-150	S2
	Payroll	£200	H1
	Purchase ledger	£225	H1
	Sales ledger	£225	H1
	Statistics	£45	S2
	Stock control/recording	£200	H1
	Stock control/recording	£48	S2
	Stock control/recording	£115	J1
	VAT register	£15	H1
	Word processing	£45/95	J1
	Word processing	£15	H1
	Word processing	£30/60/ 90	S2
TRS-80I	General ledger/NL	£225/325	T1
	Invoicing	£75	T1
	Payroll	£218	T1

PACKAGES

Machine	Application	Price	Code
	Purchase ledger	£225	T1
	Sales ledger	£225	T1
	Stock control/recording	£200	T1
TRS-80II	General ledger/NL	£425	T1
	Invoicing	£125	T1
	Payroll	£375	T1
	Purchase ledger	£375	T1
	Sales ledger	£375	T1
	Stock control/recording	£375	T1
Vector	General ledger/NL	£400	C5
	Integrated accts	£1000	C5
	Purchase ledger	£400	C5
	Sales ledger	£400	C5
	Word processing	£40	C5
8000 Series	Database management/ information retrieval	POR	C2
	Integrated accts	POR	C2
	Payroll	£250	C2
	Purchase ledger	£250	C2
	Sales ledger	£250	C2
	Word processing	£250	C2
8080/Z80	General ledger/NL	£275	G3
	General ledger/NL	£375	L1
	Integrated accts	£950	L1
	Integrated accts	£995	G3
	Invoicing	£325	L1
	Job order control	£257	G3
	Order processing	£550	L1
	Payroll	£475	L1
	Payroll	£275	G3
	Prof appts groups	£275	G3
	Prof appts individ	£220	G3
	Prof client billing	£330	G3
	Purchase ledger	£425	L1
	Purchase ledger	£275	G3
	Sales ledger	£275	G3
	Sales ledger	£425	L1
	Stock control/recording	£325	L1
	Stock control/recording	£275	G3

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PET 3032... upgraded to Basic 4+ using Disk-O-Pro, 4022 printer, 2031 disk drive, Visicalc, space-saver board, SW32 word-processor, 12 floppies + numerous books. £1550 ono. Tel: 0734 791770 after 5.30 and weekends.

Atari... video cassette plus cartridges, Air-sea Battle, Combat, Space Invaders, Adventure Breakout, Superman, Missile Command. As new worth £260, will accept £195 Tel: 0970 611531.

Acorn Atom... 13K + 12K, floating point ROM, 6522, 74LS244, ext Bus Buffers, All Rear Connectors, Magic Book, Invaders, Fruit Machine, 5v 3A power supply, £135. Tel: Jim Jnr, 01-575 5861.

Nascom 2... RAM 'B' Board graphics ROM, toolkit ROM, case for keyboard/power supply, TV, cassette, £400. Tel: Berkhampstead 74182.

ZX81... Sinc built, 16K RAM, manual, leads and games cassette 1, perf working order, 8 months old, also 'Mastering Machine Code on your ZX81' by T Baker £95. Tel: Worcester 351743.

PET 2001... 8K, 16K memory add on £325, Computhink disks £450, or both for £650 + soundbox, cover, disks + many programs. Tel: Cwmbran 71921 after 6.

ZX81... Sinc built with leads, PSU, manual, 5K RAM, fullsize keyboard and lots of software, only 7 months old, all boxed excellent cond £110. Tel: Malvern 63252.

UK101... 8K RAM, compshop built with new and old monitors, many games incl Space Invaders, home built case, perf cond £150. Tel: Peter Kanssen 01-981 5818 evenings.

Apple II... +48K autostart ROM, disk drive, (DOS 3.3) with Controller 9in B/W Sanyo monitor voltage suppression unit, manuals, Sargonchess, Applewriter, Apple-plot, cashier D/T plan + SSort + more £900 ono Absolute bargain. Tel: 01 504 9615 evenings.

Computing magazines... PCW vols 1 to 4 complete, Practical Computing first 26 issues, 17 other magazines, will not split sets offers over £30. Buyer collects. Tel: Grantham 66890.

V.D.U... Intertec Intertube Intelligent terminal, with numeric key pad £395, Nascom Imp Printer £195, any reasonable offers considered. Tel: 01-337 3345 evenings or weekends.

I.T.T. 2020 (Apple system)... 48K, integer + floating point Basics, hi/low res, colour card, manuals etc £595 or swop for new Rom Pet, also old Rom toolkit £20. Tel: 0293 24504 anytime.

Commodore Pet 2001... large keyboard, green screen, sound box 8K, 3 cassettes + manuals £425 ono. Tel: 01-274 3203 after 7.

TRS80... Level 2, 16K with VDU, cassette, some software, £250 ono. Can deliver Grampian/ Aberdeen perhaps Edinburgh. Tel: Banchory (03302) 4326; Keep trying as often away - hence sale.

UK101... 8K RAM, cased with sockets Ferguson 3T07 cassette recorder, numerous cassettes, programs, books, manuals. All excelleng cond, bargain at £190 ono. Tel: Luton 594539 eve.

Canon A1 Outfit... will exchange for MZ80 or similar outfit, also Casio 502p with cassette will exchange for Sinclair ZX80/81 or similar. Tel: Eye (Suffolk) 870633.

P31 Monitor... 10" green, Crofton Electronics, 3 months old and hardly used. MZ80B forces sale., VGC, horizontal res. in excess of 650 lines, manual inc, bandwidth 100Hz to 8MHz £65 ono. Tel: Jeremy Turner 01-607 3325 (office hours).

Nascom I... S100 expansion with 8K ststic RAM, P.S.U.'s + interfaced IBM I-O Writer (260 col), tiny Basic, + assembler + spare 2708s, 2102's, £250. Tel: 01-435 1248.

Wanted... printer with Centronics parallel interface suitable for Atom, print quality immaterial, must work and cost under £100. Tel: Coventry 74604 after 6.

TRS80... Level ii with CTR 80 cassette recorder, power supply, Tandy instruction manuals Level I and II, TRS80 programs Book, games cassettes, system covers, virtually unused perf cond. £300 ono. Tel: 0934 833452.

ZX81 user group... looking for more computers. If you have an old ZX81 we might buy it, contact Ski ZX-gruppe, Jan Otto Reberg, Bjerkelundveien 15, 1400 Ski, Norway.

ZX81... 1K all leads, manual and power pack several games tapes and a book of 30 programs all inc, factory built £55. Tel: 0532 684148 after 6.

ZX81... Sinc built + 16K RAM, power supply, leads, games cassettes, manual in original packing, only few months old. £110 ono. Tel: 05432 23608.

Pet 32K... upgraded N.R. 3008, cassette deck, toolkit, arrow warm reset, speaker + dust cover extensive software (utilities + games) and books valued £120 inc 18 month old VGC. £650 ono. Tel: 04465 3684.

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ASCII Keyboard. . . Carter 756 (metal mounted), brand new, never used £40. Kemitron boards with sockets, photoboard DCR-Co, MXA-1, £5 each. Buyer collects. Tel: 0283 42558.

Nascom 1. . . factory built, NAS-SYS monitor and 2K integer attractively boxed with keyboard case, full documentation inc Basic and M/C programming manuals £150 ono. Tel: Newbury 34542.

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TRS-80. . . Model 1 16k, Level 2 cpu with green screen VDU, CTR-80 cassette recorder and psu. Lots of software and manuals. Bargain at £375. Phone Cosham 388476 after six.

Video Genie 32k. . . keyboard mods, sound, cover, stand, software including Invaders, Breakout, EDTASM; books and mags. Excellent condition. Over £500 worth. Price £325. Tel: Castleford 515631 (Leeds 26) after 6pm.

PET 2001. . . 8k, small keyboard integral cassette deck. Many games, excellent condition. £285. Phone Stamford (0780) 740416 evenings.

Atari TV game. . . complete, with or without cartridges - Space Invaders, Asteroids, Super Breakout, Adventure, Mazecraze, Circus, Combat. Lot £200, console (including Joystics, paddles, adaptor, + cartridge) £80. Cartridges £offers. Ring 672 6105.

ZX82?. . . 16k ZX81, full size keyboard, user definable graphics, mastering machine code on your ZX81. £30 of programs, Chess Defender, Asteroids, Labyrinth, Centipede & Invaders. £190. Tel: 0734 733404.

Wanted. . . computer with disks running Fortran, word processor, high resolution graphics. Will offer up to £1000. Chris Laycock, 10 Linden Grove, Wellington, Telford, Salop RF1 1QS. Phone: Telford (0952) 55041.

PET 4016. . . 16k, new ROM in as new condition. Has had maximum 40 hours use. Boxed. Cassette player plus games. All manuals, sacrifice £400. Contact: J. Rooney. Phone: Farnham (Surrey) 724322.

Exchange ZX81. . . plus accessories for my 32k Sorcerer with creed printer, toolkit, Invaders, manuals. Superb graphics. Cash adjustment or sell £480. Alternative to ZX81 considered. Ring Alan, St. Annes 0253 725979.

TRS80. . . 16k L.2. expansion interface. Disc drives, 349 & 369. Percom separator. 32k up grade. Monitor and carrying cases. £850. Tel: Potters Bar 54605.

Your HP-41C. . . or TI-59 + accessories for my 10K-Atom + via + buffers + connectors fitted + 8k-RAM-EPROM. Acorn card + EPROM + talking watch, or all for £300. 458-5254m 9pm to 11pm.

Tangerine Microtan 65. . . complete with Tanex, sound effects unit, extra EPROM, dual 6522, lower case and graphics options, power supply and hex-keypad, mini-motherboard, purpose built case with all leads, Microtan book and much software, including Space Invaders and other games. £175 ono. Tel: (0844) 291459, evenings and weekends only.

IBM. . . Golfball typewriter/terminal complete with Centronics type interface, several typewheels, carbon ribbons, £250 ono. May be seen working on RML380Z. Tel: 061-494 0990 evenings only. (Stockport).

Approx. 30 back copies. . . of P.C.W., p.... C.... etc. £12. Buyer collects. Tel: Rickmansworth 70109 after 7pm.

Bigboard. . . all options installed Z80 cpu, P10, S10, disc interface, CTC, 64k RAM, only £300. Tel: 0268 285377 (Basildon).

5k ZX81. . . with printer, microgen Joystick Controller Board and Joystick, Ferguson Cassette recorder, software valued at over £20 with manuals and three other books. Only £150 ono. Tel: 0632 815083.

Tandy Quick Printer II. . . £90 ono, incl. cable & interface. David Kampfner, 4 Gresham Gardens, London NW11. Tel: 01-458 8240.

Sharp MZ80K. . . 48k, 6 months old, full documentation, £430 ono, B'ham (021) 430 6061.

ZX81. . . 16k, sinc built, psu, leads, manual. Cassettes 1, 4. ICL Cass 5. Book 30 progs. £120. Tel: Chelmsford (0245) 321606.

ZX81 sinc built computer adaptor little used printer 16k RAM, four cassettes all unused. Books. Will sell only in total, £135. 021-445 5318.

Acorn Atom. . . 12+12K with PSU, manual and software (inc games). As new £230 ono. Also ZX81 16k RAM pack with games cassette £40. Tel: Rickmansworth 76143.

48k Sorcerer + FMD180 disk drive + software package inc. CP/M, MBasic, Ass/Ed, + Z80 development pack & all manuals. Mint condition. Bargain at £1,100 the lot, or will split. Phone: 01-394 0733 evenings.

TRS80. . . L2, 16k Numeric Kaypad, CTR 80 cassette, All leads, manuals, plus some programmes, 10 months trouble free use, as new, forced sale. £250. Tel: Richard, Epsom (Surrey) 24727.

SOL 8080A-based complete working system. . . 4 16k S100 memory boards, 2 mini-floppy drives, Northstar controller, Northstar Basic, SP, CP/M. Cost £3995. £950 ono. Might split. 01-602 2446.

Sinclair ZX80/81. . . 16k RAM pack almost new, £40 ono. Acorn Atom 12k+12k Acorn built PSU and 2 games cassettes, £225 ono. Tel: Bedford (0234) 857105.

Acorn Atom. . . 12k RAM, 12k ROM, manual, expansion socket, 3 Amp PSU and leads. Acornsoft VDU lower case driver and own sofrware included. £195. Phone Glasgow (041) 959 3035.

Atari 400 16k. . . Atari cassette recorder, Star Raiders, Missile Command, Galaxian, Basketball, Puckman, 1941, Invaders, etc. Joysticks, manuals, American magazines. Cost £600+, accept £500. Will guarantee. Phone Accrington 31573 (Lancs).

Acorn Atom 12k+12k, Acorn built, P.S.U., all leads, manual. Still under guarantee, some educational progs. £195 ono. Tel: Tamworth (0827) 54639.

16K ZX81. . . Sinclair built. PSU; leads; manual. Also six cassettes including "Star Trek", "OS Defender" & "ZX AS" programs. £100. Contact Ormskirk 78540.

32K 380Z. . . research machines computer. As new condition, in original blue case. Buyer supplies their own ASCII keyboard. Complete with Basic software, utilities and documentation. £700. Reading (0734) 594365 (evenings).

Video Genie EG3003. . . 16k, integral cassette, cursor keys, manuals, including £950 worth of software:- Adventures, Arcade Games, utility programs and Scirpsit wordprocessor. Looks new. £500 ono. 01-542 4707 eves.

Superboard III. . . cased 8k Cegmon toolkit Basic 5 and new Basic's 1, 3, 4 software 12in b/w monitor, £225. Phone: Harlow 39406 or Ware 67101.

Televideo TS801. . . 64k IMB Floppy CP/M computer, 6 months old, £1950. Diablo 630 daisy printer, 9 months old £1100. Both fully maintained. Tel: 0273 722240 anytime.

VIC 20. . . with 8k Memory and C2N cassette, All leads etc. PLUS "Getting Acquainted.." book and 2 VIC computing mags. with original packaging. All for £240 (worth £270+) Phone: Hemel (0442) 56576.

CBM/PET 40/32k. . . cassette, manuals, books, Strathclyde course, recent model. £550. Offers. 42 The Newlands, Wallington, Surrey. 01-669 2892 (evenings), 01-668 4315 (days). Consider deal with recent NASCOM 2 or 3 preferred Assembler/Debug.

TRS-80. . . colour 16k, Tandy cassette recorder, Joysticks, £130 worth of software, leads, manuals. 3 months old. Hardly used. Perfect condition. Total cost £650. Sell £495. Tel: Nottingham 235619.

Apple II. . . 48k, 2 disk drives with controller, DOS 3.3 system complete with all manuals and paper tiger printer. £1,500 ono. Tel: (01) 235 0791 (day) — ask for Myles.

ZX81. . . Sinc built, 3 week old 4k RAM pack, altogether 5k of memory, includes all leads, manual, mains adaptor, £70 ono. Contact Barnsley (0226) 723142.

NASCOM I. . . cased P.S.U. 16k board P.I.O. sound zeap and Naspen on tape manual offers. Mr Lacey, Gt Yarmouth 0493 55622.

TRS-80. . . 16k, L2 inc Micro Chess, Backgammon, Black Jack tapes, and learning level two book. Also Editor Assembler, only £300 ono. Tel: 346 7289.

Atom. . . 12k+12k, Acorn built, PSU, cassette lead, Getting Acquainted book, 2 games, Fruit machine, Chess Games, Pack 1 Manual, Price £220. Will negotiate. Phone P. Swali, 445 4208. After 6pm. Little used.

Peripheral sale. . . Dolphin BD80 printer, 120 c.p.s. £189, also BD80P with PET interface, £210. Data dynamics 390 RS232 printer £80. IBM 735 selectric terminal printer., £196. Tel: 0435-830680.

Exchange. . . Multivox preset synthesizer, cost £700 for Sharp MZ80K computer (48k). Tel: 061 486 9601 (eve) or 061 456 8352 daytime.

Casio FX502P. . . with manuals 256 program steps, 21 non volatile memories. I'll throw in a program for 2-D Lunar Lander, £45. Phone 807 8357 after 8pm. Mr. N. Charalambides.

Heath/Zenith H-89. . . 48k RAM. Built-in floppy disk. Microsoft Basic, heath Basic, assembler, device drivers, utilities, HDOS, games (Backgammon, Adventure etc.) about 40 disks, books and spares. Interfaces. £1299 ono. Findhorn (03093) 2260.

Aculab floppt tape . . . for Video Genie with 20 tapes. £150. Centronics P1-printer with Video Genie interface, 5 rolls paper, £130. Sharp PC1211 and CE122 printer £120. V.J. Day, 068-45-4930 evening/weekend.

TRS-80. . . Mod1, 48k, 2 disk drives, cassette, joystick, lightpen, TV (adapted for sound effects), plenty of software on tape and disk, incl. Loos, computer books and mags. £800 ono. Contact Chris: 01-385 9140 after 6.30.

Video Genie 16k. . . 12 months old mint condition, plus over £50 of software. £260 the lot. Tel: Mr Neal, 01-236 9961 during working hours.

Back issues PCW. . . from Dec 78 to Dec 81, £9 the lot. Centronics P1 microprinter £120. Both excellent condition. Tel: Hatfield (07072) 73240.

Nascom 2. . . 32k RAM, graphics ROM. 3A PSU. Sound port. Toolkit on tape. £300. Phone: 01-806 2970 evenings.

ZX81. . . with 16k Ram Pack, 6 Cassettes, 4 Books of Programs, with all leads, transformer and manual. First offer of £90 will also receive compatible tape recorder. Phone Epsom 40210.

Tuscan S100. . . in case, 64k DRAM, one 5¼in. FD50A double-density disk drive, professionally built, with CPM2.2, BASIC, programs and disks. £750. Tel: 01-455 8969, eves.

Supersoft Mikro Assembler chip. with manual, for 32k 2001 new ROM PET £30. Supersoft Asteroids £4. PET revealed £3. PET machine language guide (Abacus software) £3. Tel: Leeds (0532) 677423.

TRS-80 . . . expansion interface with 16k, single disk drive, 15 diskettes with over £500 of software, including Newdos+, disk storage unit, only £430. Tel: 01-540 0474 after 5pm.

Tangerine high-res system. . . 256x256 graphics, 24k, Basic, Forth, system rack and power supply software and full documentation. £650 ono. Tel: 041 427 0172 after 5 o'clock.

Green Screen VDU. . . for Tandy TRS 80, fitted standard DIN plug. No longer required, gone Model 3. £35 ono. Tel: Oxford (0865) 57016.

Superboard II. . . 8k RAM, metal cased, microsoft basic and some games on tape, £150 ono. Write to Terry, 26 Woodside Road, Wood Green, London N22. Chess Challenger 7 levels, £50

VIC 20. . . only 2 months old! Save £20 on an as-new computer — £170, and this includes some programs on cassette! Buyer collects. Tel: Bristol 847181.

ZX81 + 16k RAM. . . Sinclair built, PSU, leads, manual, 2 books & games tapes (Invaders & Defender), still under guarantee (until September), wroth £145, only £110. Phone: 0582 54949.

48k Sorcerer (+ Basic Pac). . . All manuals, two Hitachi cassette recorders with moto-control cables, one Hitachi 9" monitor complete with cables, various software. v.g.c. £550 ono. Tel: Cheltenham (0242) 37954.

PET. . . 8k old ROM integral cassette deck, small key board, games and two tutorial programs, £325 ono. Mr. V. Raffo, 4 The Cottages, St Mary Hosp., Stannington, Northumberland.

PET 32K. . . Basic 4, Cassette with sound box, manuals, books, large quantity software inc. Invaders, Hitch-Hikers Guide etc. Only £25 ono. Tel: Ron (051) 428-1500 (Liverpool) 5-9pm only.

PET 32k. . . new ROM, dust cover, programmers toolkit, CBM cassette deck, lots of manuals, approx. 30 games cassettes, perfect condition, £475. Rod 579 2198 or 631 3131 ext. 2839.

Complete TRS-80. . . 16k, L.II system, inc: Quick Printer II, s/paper, Hitachi 9" monitor, all manuals, power supply, TV modulator, cables. + 50 programs. Inc: Sargon, TBub, Othello etc. Books: "Into TRS-80 Graphics", + 140 top quality mags. Inc: PCW, CT, PC, TRS-80 etc. £350 ono. 01-986 4245.

PET 8k. . . old ROM integral cassette, plenty of software including tutorial programs, microchess, Invaders, Startrek etc. £260. Tel: Selby 618539 after 6 please.

TRS-80. . . L2 16k, boxed, numpad, CTR80 cassette, TV modulator, leads, manuals. 1 year old, books, software (Tandy Startrek, Swords & Sorcery, Mazechase etc). Little used. £335. 0634 721672 evenings.

TRANSACTION FILE

Video Genie. . . system E93003, 16k with sound board. Including over £300 worth of programmes, manuals, leads. Boxed as new. Bargain for quick sale at £250. Phone Newhaven 6153 after 5pm.

APPLE 48k Europlus. . . 7 months old. Good condition. Cassette & Tapes (inc Integer Basic). £600 ono. Tel: 01-304 0953, evenings.

Computer Terminal. . . comprising 9" Motorola monitor, Keyboard, 20 ma loop interface, complete with matching desk. In perfect working order, data and circuit diagrams included for £70 ono. Tel: Macclesfield 31015.

NASCOM 2. . . 32k RAM, NASgraphics ROM, 8k Basic, 3 Amp PSU. Complete with manual, portable TV and cassette recorder — £350 ono. Tel: 0628 5505.

Atari Video Computer. . . "Basic Computing" cartridge plus a set of keyboards — cost £47. Exchange for "Video Chess" cartridge. Tel: Belfast 671734 after 5.00pm.

ZX81. . . Factory built, perfect working order. Complete with leads, manual, adaptor and software. Under guarantee. Bargain at £45. Will deliver free. Tel: 0892 38070 weekends and evenings.

PET 8k. . . new ROM, large kayboard + cassette + programs + dustcover + cassette care kit. £260 ono. Tel: Coventry (0203) 447368 6pm to 7pm any evening.

PPC ROM wanted. . . by new PPC member (7931). If you have one for sale, call Frank on 041 778 2419 any evening after seven.

Atari 400 16k. . . 410 tape recorder, Star Raiders ROM, Joysticks, several cassettes. All under guarantee; only 1 month old. Must sell quickly, hence £300 ono. Phone 01-577 0323, ask for Cliff.

ZX81. . . 16k RAM pack, Sinc built, adapter, leads, manual plus 125 brilliant programmes on cassettes and listings all for £115. Will arrange postage. Tel: (Kemble) 476 after 6.00pm.

ZX81. . . Factory built with 16k RAM, manual, full size querty keyboard, Abbicus controller. Repeat key, Delux woodcase. Tel: Geoff (0632) 405532 or 23, Coniston, Vigo, Bitrley, Co. Durham. £130.

Decwriter LA36. . . (pedestal, keyboard, full listing paper width, tractor feed, RS232 serial interface, 600/300/150/110 BPS) £300 ono. Tel: Uxbridge 56714.

IBM/GTE. . . teletypewriter with cassette tape store and replay (150 BPS golfball typewriter with keyboard and RS232 serial interface). £300 ono. Tel: Uxbridge 56714.

PET 2001. . . 32k RAM including cassette. 4 months old. Value £720. Accept £550 ono. Perfect condition. Genuine reason for sale. Phone: 01-550 4263 daytime. Cash only.

TRS80. . . level II 16k with interfaced KSR teletype £370. Large amount of software including APL, Tiny Pascal, TNLIG, Adventures, Chess, etc. Tel: Colchester (0206) 67908.

VIC-20 Basic System. . . computer and VIC cassette unit. As new only £169.00. Genuine reason for sale. Ask for 'Simon' on Maidstone (0622) 812385.

Hitachi. . . 9" B/W monitor, £75.00. Philips N2234 cassette recorder with counter and ten (10) blank cassettes £30, both with documentation. Tel: Chalford Devon (064 73) 3456.

Superboard 8k. . . cased intermon monitor psu and all cables and manuals extra books on m/c and four games tapes, £150. Phone: Gainsborough (0427) 4627.

Apple II. . . Hardware and peripherals (disks, TV mod etc.), any condition considered — faulty or working, London area or westwards. Tel: 01-848 8334 evenings.

Acorn Atom. . . software wanted by private buyer especially educational aids for young children and good adventure games. Also wanted, colour encoder, toolbox, etc. Please phone Mike Knight Brighton 411327 evenings.

Tandy Line Printer VI. . . bidirectional prints a full 132 columns at 33 lpm hardly used, cost £649.00, accept £500.00. Hardly used. Phone: Caerphilly 882802 or Caerphilly 862280.

ASR33. . . £160. KSR33 £100. ICL Termiprinter, 300 baud, RS232 ASCII, letter quality £225 (P/ex D/beam scope or floppy + controller) ETIBUG/2 5204 eproms £8 each. Tel: 01-890 2535 (day) 078-42-51409 (eve).

VIC 20. . . cassette unit, arfon expansion, VIC revealed, 3k cartridge, super lander cartridge, B/W 12" T.V. £40 of programs incl. Many space Invader type games. Worth £490, asking £390 ono. For quick sale. Tel: Porthcawl (065671) 2651. J. Skinner, 25 Lougher Gdns, Porthcawl, Mid-Glam. S. Wales.

TRS-80. . . 16k mod 1, 12 Monitor, cassette, numeric kaypad. Manuals, 8-cassette Basic course, several books. Machine code progs. incl. Sargon chess, draughts, backgammon, 3D-OXO, flight simulator, data handling system. £340 ono. 01-348 6925.

TRS-80. . . level II Basic/ 16k RAM complete with Tandy green screen monitor, leads, books, p.s.u. covers etc. Pristine condition, little used. £310. Phone: 01-508 4358.

UK101. . . 8k cased, software including super invaders, needs some attention but in working order. Only £140. Offers considered. Tel: 01-864 2149. Eves. or w/ends.

Tandy TRS80. . . 2x80/2x40 disc drives. Directional printer TRS80 pinch feed printer 5" floppy discs. 01-935 3598 anytime.

Line printer mechanism. . . as new condition (unused). ICL 667 Barrel Printer complete with hammer drive electronics (136 Positions). Capable of 720 lines per minute. Suitable for person willing to build control electronics, interface and power-supply. Can supply Technical Manuals and diagrams for an additional £25. Serious offers only please on Reading (0734) 594365 (evenings or weekends).

Apple II. . . Europlus autostart 48k. D.O.S. 3.3 drive with controller, T.V. modulator, Eurocolour card. All the best games, wizardry, alien rain etc. £900. Tel: Castleford 554105 daytime.

Video Genie. . . plus books and £100+ of software including chess and wargame programs. Only 9 months old. Price includes leads and manuals in excellent condition. £260. Tel: (0642) 310381. 16k.

ITT2020. . . 48k autostart. Colour graphics, lower case, TV output, disc drive, DOS3.2, paddles, covers, 4 wks old. Apple II compatible £695. Tel: Bracknell (0344) 24842 extension 2025 (day). 84995 (night).

TRS80. . . 16k, level II, complete with CTR 80 cassette. VDU aculab floppy with extended Basic. Lower case modification. Centronics printer. Manuals, magazines, programmes, sonie games, mostly utilities. £595 ono. 01-449 2909.

ZX81 16k. . . Leads, PSU, manual, ZX81 pocket book. Lots of software including Microgen chess, 'Defender', asteroids, ICI programs and much more...£120 the lot. Phone: Princess Risborough 7294.

Transam Triton computer. . . with touch sensitive keyboard, 2708 EPROM programming kit £300. Motorola 12 inch green screen monitor £70. 4116 50p each, 2708 £2 each, 8080A £3 each. Tel: 0580 891350.

ITT 2020. . . UHF colour, 48k Palsoft, plus integer card, paddles, manuals £380. Two disk drives with 3.2 cards, software, manuals, £180 each. RS232 card £50. 67 Feeches Road, Southend, Essex.

Apple II. . . Europlus 48k, disk drive, Hitachi 9" b/w monitor, £300. Software including Visicalc, 6 months old and hardly used, boxed, £1100 ono. Tel: 01-373 9289 eves.

Save £30 brand new Seikosha printer for sale cheap at £180. Tel: 0733 233110.

ITT 2020. . . 48k two disk drives colour TV, many magazines, lots of books, 30 disks, 20 of them full of programs, etc. £1000 only, 12 Wyberton Low Rd, Boston, Lincs (Haylett).

Acorn Atom. . . 12k + 12k, psu, leads, toolbox including the commands, data, Beep, trace and 1200 band visable cassette loading + 20 more. 5 books + manuals, including Atom magic book, Getting Acquainted + 9 cassettes with over 50 programs including 3d maze, maths pack 1 Galaxians + All issues of the "Atom" + 19 magazines + TS57 prograble calculate. £285 ono. Ring Hindhead 6224 after 6pm.

Sharp MZ80K. . . 48k, Basic and Assembler, many games, 6 months old. £380. Leicester (0533) 547572.

ZX81. . . Sinclair built, 16k RAM, leads, manual, book, Sinclair tape. 5 months old. Excellent condition. £110 ono. Tel: 061-643-5973 after 5 o'clock.

FOR SALE. . . 77-68 CPU; 32K RAM; 16K EPROM, 4K £AM; Teletype; SA400 5¼" drive; Memorex 120v, 60Hz, 8" drive; 2 cassette mechanics; 256x192 unbuilt board for superboard. Offers: 051-653-6918.

TRS80-16K-L2. . . includes PSU, leads to connect to own TV and cassette recorder, manuals, assembler book. Plus many games on tape including Space Invaders, Chess, Adventure, £300 ono. (Best offer accepted). Tel: 01-267 7124 eves.

TRS-80. . . Level II 16k inc. b/w TV, editor/assembler, and some computing books. Good cond. £280 ono. Tel: Mike Hadlow 0732 58261 after 5pm.

ZX81. . . 1k 4 weeks old Sinclair built, PSU leads and manual. Compatible tape recorder which has LED signal and tape counter. 12 programs on tape as well all for £78. 01-986 0272.

VIC 20 Cassette Recorder. . . unwanted Christmas present, brand new, never used. Complete with commodore games cassette and instruction manual. Only £37. Ring Dursley (Glos) 3532.

TRS-80. . . programs and books for sale. Also Texas Instruments PC 100B printer (£75). Sae for details to P. Holland, 28 Carr Green Drive, Brighouse, West Yorkshire, HD6 3LU.

TRS-80. . . 16k, LII with monitor, cassette, covers, manuals, mags, chess, adventures, Corplan, TBug, EDTASM, Spacevaders, Movie, music plus lots more. £395. Mr Smith, So'ton 333209 or Chandlersford 3529 after 6.

ZX80. . . 1k, factory built, PSU, all leads and manual. Software cassette and books included. All in good condition. £55 ono. Tel: 01-720 8029.

Intellivision Mattel and eight cartridges. . . Golf, Ski, Checkers, Car Race, Soccer, Tank, Sea and Space Battle, £220. Phone Camrose 408 after 2pm.

Video Genie EG3003. . . 16k, with games and renumber programs. In good condition with all leads, £280. Tel. Wat. 30855.

Microtan 65. . . Tanex, 19k Basic, X Bug, 8k Ram, Apple ascii keyboard, graphics, lower case, all encased + games software. £220 ono. Tel: Ipswich (0473) 823461 after 6pm.

Casio. . . VL-tone musical inst/ calc, good as new, for sale, with original packing, guarantee (still valid) and 6 supplementary books of music. Worth £42, asking £20. Tel: 679 5382.

TRS 80 Model I Level II. 16k CTR80 64X16 screen (green) instruction books level II basic course (cassette) Price £350. Phone 01-235 8997.

PET 8k . . . Old ROM, Integral cassette desk. Small keyboard. Recently serviced. £235 o.n.o. Tel: 01-950 2749.

TRS 80 1GK L2 + CRT/41, P.S.U., connecting leads and manuals. £50.00 worth of software. In almost new condition. Genuine reason for sale. Hence £250 o.n.o. Phone 0535 34402 (Keighley) John Hopcroft.

8K PET 2001 . . . Old ROM. Built-in-cassette deck, Small keyboard, complete with Dust Cover and Manual. Good condition. £260 o.n.o. Tel: Weston-s-Mare 414634 after 6 o'clock.

Pet 8k small keyboard 2 cassettes well looked after. Games, manuals and program listings. £325. Phone Southend (0702) 544819.

HP67 Card Programmable Calc sith standard card programs, blank cards, manuals, mains adaptor, charger etc. £50. Memory modules for HP41C, chree for £35 or £15 each. 041-946 1521.

48k Sorcerer — as new, all manuals and leads, UHF modulator HAS 5100, RS232, parallel and cassette interfaces. First offer over £350 secures. Barfield, 31 Courtnay Rd, Winchester Hants. Tel: 66720

Pet 32k 2001. Small keyboard, integral cassette. Soundbox—Bish boxes. Some cassettes, manuals. Pet Revealed etc. Little used. £425. Tel: 01-778 9932.

Printer base 2 (Superprint 800HST). Five print densities plus lower case and high density graphics. Parallel and RS232 I/O 2k buffer. £160. (Birmingham) 021 350 6464

VIC 20 four months old with data cassette plus 8k expansion pack £220. Phone Andy on 890 1262.

XX81 16k ram Full-size external keyboard (unconnected). Sinclair built. New. Working order. Manual. Leads. Adapter. Software. "Mastering M/C on your ZX81". Only £120. Tel: after 5 051-625 9612.

Sharp MX 80K 48k toolkit, service manual, machine language, reset switch 100s of programs inc. copy Asteroids, Chess, adventure games. Green screen, all in perfect condition. Only £330. Basildon 555098.

UK101 32X48 8l Cegmon basics 1,3,4,5 toolkit, Eprom board, case 110/300/600 1/2 MHZ 7 amp PSU, sounds board plus programs £250. Also decwriter LA 30S 20MA printer £200. Phone Ambergate (Derbys) 0773 853258

Nascom 2 32k ram, 8k basic, graphics rom, cassette recorder, excellent computer professionally built + stock of computer mags. All for a measly £300 ask for Adrian, evenings 061 766 4145.

Casio FX502P + FA1 cassette interface in exc. condition including overlays, cases, tape, manuals and programme library £45 o.n.o Basingstoke 65876 after 7 p.m.

TRS-80 Mod-1. 48k, 2 printers, 1 disk-drive, software, diskettes, tapes, manuals, books and magazines. £1,000 o.n.o. R.I. Bristow, Stafford (0785) 47367. Can deliver within 25 mile radius.

TRANSACTION FILE

VIC 20. . . games, superb Splat and Cybernauts, colour and sound £2.50 each or both for £4 P&P and cass incl. Tel: Arthur 0204 655393.

SZX81. . . Sinc built, 16K RAM pack, printer, 5 spare rolls, 3 games tapes, manual, all leads, book of games, still under guarantee £120 ono. Tel: 061 761 7278.

Apple II+. . . this Apple talks, 48K with integer ROM card, Eurocolour card, two discs, Supertalker & Huristics packages, serial interface card, DOS 3.3 & 3.2, 10+ diskettes, all manuals, £1350. Tel: 0621 740075.

ZX81. . . +16K RAM, Sinc built + CHRS board, (design own characters ie Space Invaders) + £50 software, chess etc, £160. Consider selling separately. Tel: Plymouth 880781.

TRITON. . . computer 18K of RAM, full 8K Basic plus integer Basic And editor/assembler package. Many extras incl complete set of games, ideal for hobbyist, £550. Tel: 01-794 3950.

ACC NEWS

Rupert Steele of the Amateur Computer Club reports the latest Club news. Contact Rupert at: St. John's College, Oxford.

April was Computer Fair month. Yes, there were no less than two shows in the second half of April, in London, described as some sort of 'computer fair' (I think you could distinguish between them by the typeface of the logo).

Needless to say, lots of people turned up with tickets to the wrong fair and, also needless to say, the ACC was present at both the events. At the first, the ALCC (Association of London Computer Clubs) Computer Fair at the North London Polytechnic, there was a strong hobbyist flavour, with a very strong club presence. The ACC ran the customary club database, and we put hundreds of people in touch with their local clubs.

On the Saturday of the ALCC Fair, the ACC held a symposium entitled 'Your Computer and the Telephone' which consisted of a general introduction to the principles of computer communication over the public telephone network. The discussions included modems and general interfacing hardware, Prestel, bulletin boards and telesoftware (the transmission of programs from pages on Prestel into a micro). Speakers came from many of the leaders in the field, and included representatives from British Telecom (the Post Office to us humble mortals) and CET.

We made a tape recording of the event and hope soon to make available a set of proceedings, either in audio or printed form, depending on whether the treasurer can pawn his wristwatch again to pay for the printing. Anyway, the symposium was a great success, and it pointed the way to the great explosion in information technology that many of us believe is around the corner in IT'82. I think that it won't be long before intercomputer communication via the phone network becomes a standard facility for the hobbyist; all we'll then need is a higher bandwidth telephone system.

The second fair was organised by one of the computer mags (not *PCW* of course, as they organise the '*PCW* Show' in September). There was more of a business flavour, although there was a lot of interest in the ACC stand, and those of other clubs. The ACC was again responsible for administrating the club stands, and provided a worthwhile part of the exhibition, particularly because the commercial stands were a little thin on the ground.

On the Saturday of this show, there was a very productive meeting between representatives of the ACC and key figures in the various national user groups. The meeting was chaired by Robin Bradbeer, the local groups represented included BASUG (Apple), ICPUG (Commodore independent), LASERBUG (BBC machine), National ZX80/81 Group, Sorcerer, TUG (Tangerine), the new 68xx group (6800, 6809, 68000 etc.), and the National TRS-80 User Group.

Initially, the various user groups described their own organisation. Many of these groups had found that the whole thing had become too much to handle on a purely voluntary basis and had had to take on part-time or permanent staff. Most of those who had taken this step used other methods as well as subscriptions to raise the money; this varied from selling the odd book or program to fairly comprehensive programmes of hardware add-on manufacture. Some of the groups, however, are still organised on a voluntary basis.

The national user groups present felt that the ACC was doing a good job of being a national liaison group for all personal computer users, and that they would like to formally ask that we continue to perform this function. The ACC Secretary, David Annal, mentioned the cost to ACC of performing this role, and of organising the club stands at exhibitions, and the national user groups offered to pay towards the cost of this. It was felt that the larger groups, who were not entirely subscription supported, might be able to give more than those who had less money.

The groups generally expressed support for the ACC, and various cooperation schemes were agreed. Finally, the committee agreed to reconvene at the *PCW* Show this September. So if you're the chairman of a large user group that wasn't represented at that meeting, drop a line to me, and I'll pass it on to Peter Whittle, the ACC Chairman.

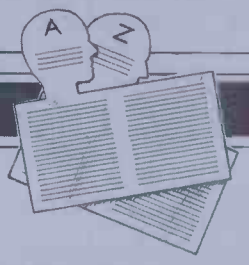
A couple of the user groups at the meeting mentioned this column and, when they discovered that I wrote it, demanded plugs. BASUG is running a course on Pascal in July (so hurry!). It's in Uxbridge and will concentrate on UCSD Pascal for the Apple, although UCSD is meant to be portable so it should (!) be applicable to other machines. Registration fee is £70 for three days, and there is cheap accommodation available. Contact: John Sharp, BASUG, PO Box 174, Watford WD2 6NF.

The National TRS-80 Users' Group will be holding a number of workshops at various places in the next few months. The cost is £3.50 (without food) and dates are as follows: 22 Aug — Bournemouth; 12 Sep — Cambridge; 2 Oct — Birmingham; 25 Oct — London; 31 Oct — Leicester; ? Nov — Manchester. Write to Brian Pain, 40a High Street, Stony Stratford, Milton Keynes for the details.

Another thing that has caught my eye is the Sinclair ZX Spectrum. This is clearly seen by Sinclair as its answer to the BBC machine, with a much reduced cost and (Clive claims) similar facilities. Sinclair has very sensibly included 16k of RAM as standard, rather than fiddling about with unreliable extension packs. The keyboard looks to be better than the ZX80/81 type, and everybody seems very interested. No doubt there will be reviews in the mags by the time this is printed, but I predict (for what that is worth) that this is a winner. The ACC chairman has ordered one, so I'll be able to tell you my impressions in greater detail once it arrives.

A couple of clubs have asked for plugs since last month's column, so here goes. . .

The West Surrey Computer Club meet on the first Thursday of the month, September to June (so you've missed this year's programme), in the Green Man, Burpham, Guildford. As well as the obvious benefits of the venue, meetings are open to people of all levels of experience. Contact Mark Webb, 101 Park Barn Drive, Guildford, GU2 6ER (04862 76111 — work). The Haverhill Microcomputer Club meets at Castle Manor Adult Centre, Haverhill, Suffolk, Contact: Andrew Holliman, 5 Trinity Close, Balsham, Cambridge CB1 6DW.



USER GROUPS INDEX

Here's an update of changes and new clubs.

INTERNATIONAL
Geneva Apple Group (GAG) — group of Apple enthusiasts & owners from Geneva and nearby France. Regular newsletter ("GAG's Letter") and several special interest groups incl machine code, Pascal, graphics, education etc. Would like to enter into contact with other Apple users throughout the world to exchange ideas and information. Contact: Alan Ehrlich, Geneva Apple Group, Ch. Ami-Argand 9, Case Postale 20, CH-1290 Versoix, Switzerland.

Nascom Brugergruppe (user group). Newsletter published 10 times per annum. Meetings and courses arranged in Copenhagen — membership 80 Danish Krone PA. Contact: A Lind, Sidevolden 23, Dk2730 Herlev, Denmark.

NATIONAL
BBC (National) User Group. Monthly meetings, free software library, monthly newsletter. Discounts arranged on future hardware (ie printers). Membership £8 pa payable to above group. Contact: J Craig, 40, Mount Pleasant Ave, Wells, Somerset BA5 2JQ.

Computer Users Club: monthly journal of programs and hints for TRS-80, Video Genie, Atom and BBC machines. Willing to help anyone having trouble with Beeb Basic. Membership £1 Per month (min 6 months). Need to know comprehensive hardware details. Contact: Tony Latham, Computer Users' Club, 72, Sidmouth Road, Welling, Kent.

USUS (UK) — UCSD P System user group. New Membership secretary: Mark Woodman, Dept of Mathematics, Open University, Walton Hall, Milton Keynes. Tel: 0908-74066

USER GROUPS INDEX

COUNTY

Norwich & District BBC Micro User Group: Membership £2 pa (£1 for OAPs & students). Regular meetings and workshops with various speakers. Contact: Paul Beverley, Room B12a, Norwich City College. Tel:0603-60011 ext 233

Mid-Cheshire Computer Club: Meetings 2nd Friday monthly in the main Winsford library (town centre precinct). Contact: Dave Clare, Providence House, 222, Townsfield Road, Winsford, Cheshire. Tel: Winsford 51374

North Herts Computer Club. Meetings 1st & 3rd Fridays monthly at: The Settlement, Nevells Road, Letchworth. Contact: R Crutchfield, 2, Durham road, Stevenage, Herts.

TOWNS

Arun Microcomputer Club. Caters for a wide range of micros. Meetings usually fortnightly — Sundays and Mondays. Contact: Mr P Cherriman, Littlehampton 7607.

NETWORK NEWS

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

Forum-80 Hull. . . (Forum-80 H,Q) Tel: 0482 859169, System operator Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm Sat/Sun 1.00pm to 10.00pm.

Forum-80 London. . . Tel: 01-747 3191. System operator Leon Jay. Electric mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00 pm.

Forum-80 Milton. . . (TRS-80 Users Group 80-Net) Tel: 0908 566660. System Operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00 pm.

Forum-80 Holland. . . Operator: Nico Karssemeyer, tel 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

CBBS London. . . Operator: Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Mailbox-80 Liverpool. . . 051-220 9733, System Operator: Peter Tootill, Electronic mail, downloading TRS-80 information.

ACC. . . members bulletin board, Peter Whittle (0908 44262)

ABC-80. . . Stockholm, Sweden) Tel: 010 468 190522.

University Research Computer. . . Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

Elfa. . . Sweden 010 468 7300 706

Tree Tradet. . . Sweden 010-468 190522.

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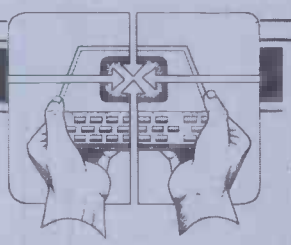

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10 Masons Field,
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Horsham, Sussex RH13 6JP

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18 Purbright Crescent,
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Croydon CR0 0RT.

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Head of Reference Services,
PO Box 4,
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Rushmoor,
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Wokingham,
Berks RG11 5ET

Alan Sutcliffe,
4 Binfield Road,
Wokingham,
Berks RG11 1SL

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Worcester WR1 1DX

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LEISURE LINES

by J. J. Clessa

There was a very good response to our puzzle about the committee of the ladies' golf club — about 260 entries, mostly with the correct solution. The answer was beautifully given in verse by R E L Farquhar of Aberdeen who wrote:

When all the votes were counted
And all the likes and dislikes reckoned,
The captain's place went Audrey's way
With Freda closely second.
Wee Betty became treasurer,
But what a fuss. I guess
If that's the kind of folk who play Golf, I'll stick to Chess.

Nice one, R E L, but unfortunately your name was not the random selection. That honour went to Mr. Geoffrey Tennant of Upper Norwood, London SE19. Congrats, Mr Tennant — your prize is on its way.

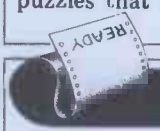
Meanwhile, thanks for all the ideas for puzzles that some of you send in from time to time. It's not always possible to use them, for a variety of reasons, but whenever we do, we certainly acknowledge the originator. Keep the ideas flowing.

Quickie

Using the symbols +, —, / or *, rearrange four fives to equal the numbers one to ten. For example 5/5 * 5/5 =1; 5/5 + 5/5 =2, etc.

Prize puzzle

By subtracting two million from a perfect cube, a number can be obtained which is itself a perfect square of one of the factors of two million. What is that factor (all numbers are positive integers)? Answers, on postcards only please July Prize Puzzle, *PCW*, 14, Rathbone Place, London W1P 1DE, to arrive not later than 30 July 1982.



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ZX81 Hypocycloids

by R Clark

Several readers have written in to ask for more programs for the 1k ZX81. As I've received so many letters about it here is a 1k program which will draw circular patterns on the screen. There is room in this type of program for experimentation and it is useful for demonstrating to beginners how to use the PLOT command in conjunction with functions like SIN and COS.

When the computer requests input all that is required are three numbers, the variables A, N and R. The pattern will vary according to the numbers you assign to these variables.

```
10 INPUT A
20 INPUT N
30 INPUT R
35 REM N*A+R<31, N*A-R<21
```


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PROGRAMS

```
40 FOR T=0 TO 2*PI STEP PI/50
50 LET X=INT(0.5+N*A*COS(T+R)*COS(T+N))
60 LET Y=INT(0.5+N*A*SIN(T-R)*SIN(T+N))
70 PLOT 31+X,22+Y
80 NEXT T
```

BBC Character Generator

by Malcolm Howlett

One of the attractive features of Auntie's micro is the ability to redefine character codes 224-255 in all modes except 7 (Teletext). However, users of the BBC will know that these are defined with VDU 23 followed by the appropriate numbers from 0 to 255, indicating dot positions within the matrix. Working this out can be tedious for a long list of characters, so the following program was written to make this easier.

It prints an 8x8 grid with a cursor on it which can be moved about using W(up), X(down), A(left) and D(right). Dots are placed in position by pressing 'space'; erasure of an individual dot is by moving the cursor over the dot and pressing 'M'. Pressing 'F' will erase a whole grid, and to save one press '*'. The rest of the program is equipped with prompts.

A maximum of 10 characters can be saved on tape at a time for later use. A point well worth remembering is that if the cursor freezes in the middle of a VDU statement while characters are being loaded from tape this just means that the computer is waiting to load the next block. It can look as if the computer has crashed and it is tempting to press 'escape'.

As listed the program uses mode 6 for the grid and mode 7 for the instructions. Once characters have been redefined it is not possible to jump from mode to mode except to mode 7 and back.

Listing courtesy of Acorn Computers.

```
A
 1970MODE7
 1980PROCinstructions
19999MODE6
20100PROCinit
20200PROCgrid
20300REPEATPROCmove
20400UNTIL C$="*"
20405PRINTTAB(23,8);"CHARS LEFT  ";10-II
20410PRINTTAB(0,11);"WHICH CODE ";
20420INPUTC1(II,0)
20425IF(C1(II,0)<225)OR(C1(II,0)>255)PRINT"THAT'S A NO NO! (SEE USER GUIDE)":G=I
NKEY(300):PRINTTAB(0,12);SPC(35):GOTO20410
20440FORA=1TO8:W=128:C1(II,A)=0
20450FORB=1TO8
20455C1(II,A)=C1(II,A)+(CC(B,A)*W)
20460W=W/2
20465NEXTB,A
20470VDU23,C1(II,0),C1(II,1),C1(II,2),C1(II,3),C1(II,4),C1(II,5),C1(II,6),C1(II,
7),C1(II,8)
20475PRINT''"NEW CHAR ";CHR$(C1(II,0))
20490GOTO20010
20600DEF PROCgrid
20700PRINTTAB(0,0);
20800COLOUR5:PRINT"   COLUMNS"';"   12345678"
20900A$="  ROWS  "
21000FORA=1TO8
21100PRINTMID$(A$,A,1);" ";A;
21200FORB=1TO8
21300PRINTCHR$(224);
21310CC(A,B)=0
21400NEXTB
21500PRINT
```


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PROGRAMS

```
21600NEXTA
21700PRINTTAB(23,1);"PRESENT POS";TAB(23,3);"COLUMN";TAB(26,5);"ROW"
22100PRINTTAB(3,2);
22200X=1:Y=1
22300ENDPROC
22400DEF PROCinit
22500VDU23,224,255,255,255,255,255,255,255,255
22600DIM CC(8,8),C1(10,8)
22610II=1
22700VDU19,0,7,0,0,0
22710VDU19,5,2,0,0,0
22800ENDPROC
22900DEF PROCmove
22950PRINTTAB(31,3);X;TAB(31,5);Y;TAB(X+2,Y+1);
23000C$=GET$
23100IFC$="W"THENY=Y-1
23200IFC$="X"THENY=Y+1
23300IFC$="A"THENX=X-1
23400IFC$="D"THENX=X+1
23410IFC$="^"THENPROCgrid
23500IFY<1THENY=1
23600IFY>8THENY=8
23700IFX<1THENX=1
23800IFX>8THENX=8
23900IFC$=" "THENCOLOUR0:CC(X,Y)=1:PRINTTAB(X+2,Y+1);" ";
23950IFC$="M"THENCC(X,Y)=0:PRINTTAB(X+2,Y+1)CHR$(224);
24300COLOUR3
24400ENDPROC
27000DEF PROCans
27005PRINT"(Y or N)";
27010ANS$=GET$:IF(ANS$<>"Y")AND(ANS$<>"N")THEN27010
27020ENDPROC
28010IFII>9THENPRINT"YOU HAVE DEFINED 10 CHARACTERS":GOTO28070
28030PRINTTAB(0,16)"Do you want to define another character?";
28040PROCans
28060IFANS$="Y"THENPRINTTAB(0,16);SPC(60):II=II+1:GOTO20200
28070PRINTTAB(0,16)SPC(60)TAB(0,16)"Do you want to save your characters?"
28080PROCans
28090IF(ANS$="Y")PRINTTAB(0,16);SPC(60):PROCsave
28999MODE7:END
29000DEF PROCsave
29020CH=OPENOUT("CHARACTER")
29025A$="30000DEF PROCchars":PROCbPut
29030LI=30000
29040REPEAT
29045A$=""
29050LI=LI+10
29060FORBB=0TO8
29070A$=A$+","+STR$(C1(II,BB))
29080NEXTBB
29090A$=STR$(LI)+"VDU 23"+A$
29100PROCbPut
29105II=II-1
29110UNTILII=0
29115A$="30990ENDPROC"
29140PROCbPut
29150CLOSE#CH
29200ENDPROC
29900DEFPROCbPut
29905FORAA=1TOLEN(A$)
29910BPUT#CH,ASC(MID$(A$,AA,1))
29920NEXT
29930BPUT#CH,13
29980ENDPROC
31000DEF PROCinstructions
31005PROCheader
31040PRINT'" You may use codes 225 - 255 for user   defining your characters"
31050PRINT"Yes I know it says 224 as well in the   USER GUIDE but I had to use t
hat one    myself."
31060PRINT'" You may SAVE characters on to cassette in the form of BASIC lines w
hich you can";
31070PRINT"add to your programs using '*EXEC""""'    (SEE MANUAL FOR DETAILS)"
31080PRINT'" PRESS SPACE BAR TO CONTINUE"
31090A$=GET$:IFA$<>" "THEN31090
31100PROCheader
31110PRINT'" To make a character you move the CURSOR around the screen using"
31120 PRINT'"       W"
31121PRINT"       ^"
31122PRINT"     AE JD"
```


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PROGRAMS

```
31123PRINT"       y"
31125PRINT"       X"
31130PRINT'" To create a dot PressSPACE BAR"
31140PRINT" To erase mistaken dots Press M"
31150PRINT" To Put character in memory Press *"
31160PRINT" Press ` to erase grid you are workin9   on."
31170PRINT'" REMEMBER I haven't Put in a routine to correct a character wron9ly
entered but this can be corrected by rewritin9 the  character"
31190PRINT'"PRESS SPACE BAR TO CONTINUE"
31200A$=GET$:IFA$<>" "THEN31200
31390ENDPROC
31490DEFPROCheader
31500CLS
31505FORA=1TO2
31510PRINTTAB(9)CHR$(141)CHR$(135);CHR$(157);CHR$(132);"INSTRUCTIONS  "CHR$(156)
31520NEXT
31530ENDPROC
```

TRS-80 Truth

by Mike Costello

This is a single-player game of reasoning in which the player tries to crack a secret rule set at the start by the computer. It is played using a standard card deck but is otherwise unlike a normal card game.

The player's hand consists of the full deck, which is played one card at a time. If a card is in accordance with the computer's rule it is put in a part of the screen reserved for correct plays. If it is not, it is put in the part of the screen reserved for wrong cards. Guessing the rule is indicated by playing eight correct cards in succession, after which a score is given between 0 and 100%. This is based on the number of cards left in the pack and the number of mistakes made.

To play a card, type S,H,D or C for the suit and A,K,Q,J or 2-10 for the rank. A full stop enters the play and backspacing or pressing 'enter' will erase it. Truth will run in 14k on a TRS-80 Model 1 Level 2.

```
10 CLEAR2000:DEFINTA-C,E-M:DEFSTRN-Z:DIMP(13,3),H(13,3),PC(51),PM(51),J1(12),J2(
12),JV(3):ML=3:C=949:RANDOM
20 GOSUB20010
30 CT=52:FORA=0TO3:P(1,A)=" A":P(11,A)=" J":P(12,A)=" Q":P(13,A)=" K":FORB=2TO10
:P(B,A)=STR$(B):NEXT:NEXT'PLAYERS HAND/STRINGS
40 FORA=0TO3:FORB=1TO13:H(B,A)=B:NEXT:NEXT'PLAYERS HAND/NUMBERS
110 CLS:PRINTCHR$(23):PRINT@144,"T  R  U  T  H":PRINT@204,"C1981 M W COSTELLO":G
OSUB64100:A=FRE(Z):PRINT@448,"PLEASE CHOOSE YOUR":PRINT"LEVEL OF PLAY:":PRINT@58
4,"1.  "U1:PRINT@648,"2.  "U2:PRINT@712,"3.  "U3:PRINT@896,"TYPE 1, 2 OR 3"
120 GOSUB10010
130 IFZ="1"THENUS=U1:GOSUB5100ELSEIFZ="2"THENUS=U2:GOSUB6410ELSEIFZ="3"THENUS=U3
:GOSUB6803ELSE120
140 'COME BACK HERE WITH CHOSEN RULE (=HAVE VALUES OF S1-4 & GC)
1010 CLS:GOSUB11010:GOSUB11110:CC=64:CM=320:C5=0:C6=0:K=0
1090 ML=3:C=949:GOSUB50000
1092 IFZ="Z"THENGOTO 64020ELSEGOSUB 17010:IFCJUNK =1THENGOTO1090ELSEGOSUB 3012
1095 IFCT=0THENGOTO 13010,ELSEIFK=0THENGOTO 30010,ELSEFORA=0TO2:JV(A)=JV(A+1):NE
XT:JV(3)=JT:GOTO1090'RECORD OF RIGHT/WRONG LAST 4
1100 'FOLLOWING ARE ALL SUBROUTINES
3012 IFCT=52THENE=1:GOTO3020'FIRST CARD ALWAYS RIGHT
3015 ONGCGOSUB8020,8040,8060,8110,8130,8180,8210,8240,8270,8290,8310,8360,8380,8
410,8440,8450,8460,8470,8500,8510,8520,8530,8540,8550
3020 IFE=1GOSUB 12010, ELSEGOSUB 12105
3030 CT=CT-1:IFCT=0THENGOTO13010,ELSERETURN
5100 GOSUB6910
5400 GC=RND(8):ONGCGOSUB5500,5510,5520,5530,5540,5550,5560,5570'8 BRANCHES
5410 RETURN
5500 S1=X3:S2=XA:S3=V5:S4=V1:S5="":S6="":RETURN
5510 S1=X4:S2=V1:S3=X5:S4=V7:RETURN
5520 L=RND(13):N=P(L,0):L1=L+6:IFL1<14THENNS=P(L1,0)ELSENS=P(L1-13,0):L1=L1-13
5521 IFL1=13THENQ=P(1,0)ELSEQ=P(L1-1,0)
5522 L2=L1+6:IFL2<14THENQS=P(L2,0)ELSEQS=P(L2-13,0):L2=L2-13
5523 S1=N+" TO "+NS:S2=V1:S3=Q+" TO "+QS:S4=V7
5524 FORA=0TO12:J1(A)=0:J2(A)=0:NEXT:FORA=0TO6:J1(A)=L:L=L+1:IFL=14THENL=1
5525 NEXT:FORA=0TO5:J2(A)=L:L=L+1:IFL=14THENL=1
5526 NEXT:RETURN
5530 S1=X3:S2=V3:S3=XC+XD:S4=Y7+" "+Y5+" "+Y4+" "+Y6+" "+Y7+" ....":RETURN
5540 S1=X3:S2=X3:S3=XC:S4=XD:S5=XE+" (FIRST 2 ALWAYS RIGHT)":RETURN
5550 S1=X3:S2=X6:S3=V8:S4=X8:S5=V1:RETURN
5560 S1=X3:S2=X6:S3=V8:S4=X7:S5=V1:RETURN
5570 S1=X2:S2=XF:S3=XG:RETURN
6410 GOSUB6910:GC=RND(10):ONGCGOSUB6420,6430,6440,6450,6460,6470,6480,6490,6500,
6510
6415 GC=GC+8:RETURN
6420 S1=X3:S2=X3:S3=XC:S4=XD:S5=Y5+" "+Y7+" "+Y4+" "+Y6+" "+Y5+" .....":RETURN
6430 S1=X6:S2=X6:S3=XH:RETURN
```


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PROGRAMS

```
6440 S1=V3:S2="IT":S3=XC:S4="THIS RULE:
DIVIDE "+V1+" BY 4, IF REMAINDER = 3 PLAY "+Y7+", IF = 2 PLAY "+Y6+", IF = 1 PLA
Y "+Y5+", ELSE PLAY "+Y4:RETURN
6450 S1=X2:S2=V1:S3=X4:S4=" AND "+X1+" IS CORRECT IF "+V1+" IS "+X5:RETURN
6460 S1=X3:S2=X6:S3="4 TO 6":S4=X8:S5=V1:RETURN
6470 S1=X3:S2=X6:S3="8 TO 10":S4=X7:S5=V1:RETURN
6480 S1=X3:S2=V3+" OR "+X6:S3=V4:S4=V1:RETURN
6490 L5=RND(4)-1:L6=L5:GOSUB6495:L7=L5:GOSUB6495:L8=L5:GOSUB6495:L9=L5:L5=L6:GOS
UB6497:T6=T5:L5=L7:GOSUB6497:T7=T5:L5=L8:GOSUB6497:T8=T5:L5=L9:GOSUB6497:T9=T5:G
OTO6499
6495 L5=L5+1:IFL5>3THENL5=0
6496 RETURN
6497 IFL5=0THENT5=Y4ELSEIFL5=1THENT5=Y5ELSEIFL5=2THENT5=Y6ELSEIFL5=3THENT5=Y7ELS
EPRINT"BUG":STOP
6498 RETURN
6499 S1=X4+" "+X6:S2=V1:S3=T6+" OR "+T7+" AND ":S4=X5+" "+X6+" IS CORRECT IF
"+V1+" IS "+T8+" OR "+T9:RETURN
6500 S1=X1:S2=XF:S3=XG:S4=" ":S5="":S6=X2:S7=XF:S8=Y1:RETURN
6510 S1=X3:S2=X6:S3="WITHIN RANGE 2 LESS TO 2 MORE THAN "+V1:RETURN
6803 GOSUB6910:GC=RND(6):ONGCGOSUB6810,6820,6830,6840,6850,6860
6806 GC=GC+18:RETURN
6810 S1=X4:S2=V1:S3="SAME "+XA+" AS":S4=V2+" ONE":S5="":S6=X5:S7=V1:S8="DIFFEREN
T "+XA+" FROM":S9=V2+" ONE":RETURN
6820 S1="A TO 7":S2=V2+" 2":S3=X1:S4="":S5="":S6="8 TO K":S7=V2+" 2":S8=X2:RETUR
N
6830 S1=X4:S2=XF+" BUT 3":S3=Y1:S4="":S5="":S6=X5:S7=S2:S8=XG:RETURN
6840 S1="EVERY THIRD CARD":S2="IT":S3=XC+XD:S4=Y5+" "+Y4+" "+Y7+" "+Y6:S5="(OTHE
R CARDS ARE ALWAYS CORRECT)":RETURN
6850 S1="COURT "+X3:S2=V1:S3="NOT "+S1:S4=V7:RETURN
6860 S1=X2:S2=V6+Y2:S3=X8+" OR EQUAL TO":S4=V6+Y1+" CARDS":S5="":S6=X1:S7=S4:S8=
X8:S9=S2:RETURN
6910 S1="":S2="":S3="":S4="":S5="":S6="":S7="":S8="":S9="":RETURN
7000 RETURN
8020 IF(F=0ORF=3)AND(HS=1ORHS=2)THENE=1ELSEIF(F=1ORF=2)AND(HS=0ORHS=3)THENE=1ELS
EE=0
8030 RETURN
8040 L=1:IFG=(LORG)IFHD<>(LORHD)THENE=1ELSEE=0ELSEIFHD=(LORHD)THENE=1ELSEE=0
8050 RETURN
8060 E=0:FORA=0TO12:IFJ1(A)=GTHEN 8070 ELSENEXT:GOTO 8080
8070 FORA=0TO12:IFJ2(A)=HDTHENE=1:GOTO 8100 ELSENEXT:GOTO 8100 'WITH E LEFT AS 0
8080 FORA=0TO12:IFJ2(A)=GTHEN 8090 ELSENEXT
8090 FORA=0TO12:IFJ1(A)>=HDTHENE=1:GOTO 8100 ELSENEXT:GOTO 8100 'WITH E AS 0
8100 RETURN
8110 IF(F=3ANDHS=1)OR(F=1ANDHS=0)OR(F=0ANDHS=2)OR(F=2ANDHS=3)THENE=1ELSEE=0
8120 RETURN
8130 IFGT=51THENE=1:RETURNELSEL=1:IFHD=(LORHD)THENLC=0ELSELC=1
8140 IFG=(LORG)THENLF=0ELSELF=1'LF=D E N O M  OF LAST CORRECT
8150 IFG0=(G0ORL)THENL0=0ELSEL0=1
8160 IF(LC=1ANDLF=0ANDL0=0)OR(LC=1ANDLF=1ANDL0=0)OR(LC=0ANDLF=1ANDL0=1)OR(LC=0AN
DLF=0ANDL0=1)THENE=1ELSEE=0
8170 RETURN
8180 IFG=13THENGT=0ELSEGT=G
8190 E=0:FORA=0TO12:J1(A)=0:NEXT:FORA=0TO2:J1(A)=GT+1:GT=GT+1:IFGT=13THENGT=0
8200 NEXT:FORA=0TO2:IFJ1(A)=HDTHENE=1:RETURNELSENEXT:RETURN'WITH E = 0
8210 IFG=1THENGT=14ELSEGT=G
8220 E=0:FORA=0TO12:J1(A)=0:NEXT:FORA=0TO2:J1(A)=GT-1:GT=GT-1:IFGT=1THENGT=14
8230 NEXT:FORA=0TO2:IFJ1(A)=HDTHENE=1:RETURNELSENEXT:RETURN'JUST LIKE 25060
8240 E=0:IFHS=0ORHS=3THENE=1:RETURNELSEIFJV(3)=1THENE=1:RETURNELSERETURN'WITH E
=0 BECAUSE CARD RED BUT LAST PLAYED WAS CORRECT
8255 'END OF LEVEL1 - NOW LEVEL2 TESTS
8270 E=0:IF(F=1ANDHS=3)THENE=1ELSEIF(F=3ANDHS=0)THENE=1ELSEIF(F=0ANDHS=2)THENE=1
ELSEIF(F=2ANDHS=1)THENE=1
8280 RETURN
8290 FORA=0TO12:J1(A)=0:NEXT:FORA=0TO2:J1(A)=A+1:NEXT:J1(3)=5:J1(4)=7:J1(5)=11:J
1(6)=13
8300 FORA=0TO6:IFHD=J1(A)THENE=1:RETURNELSENEXT:E=0:RETURN
8310 IF(G=6ORG=10)AND(HS=2)THENE=1:RETURN
8320 IF(G=5ORG=9ORG=13)AND(HS=1)THENE=1:RETURN
8330 IF(G=7ORG=11)AND(HS=3)THENE=1:RETURN
8340 IF(G<5ORG=8ORG=12)AND(HS=0)THENE=1:RETURN
8350 E=0:RETURN
8360 L=1:IFG=(GORL)THENL5=1ELSEL5=0
8370 IF(HS=1ORHS=2)AND(L5=0)THENE=1:RETURNELSEIF(HS=0ORHS=3)AND(L5=1)THENE=1:RET
URNELSEE=0:RETURN
8380 FORA=0TO12:J1(A)=0:NEXT:L1=G+4:IFL1>13THENL1=L1-13
8390 FORA=0TO2:J1(A)=L1:L1=L1+1:IFL1>13THENL1=1
8400 NEXT:FORA=0TO2:IFHD=J1(A)THENE=1:RETURNELSENEXT:E=0:RETURN
8410 FORA=0TO12:J1(A)=0:NEXT:L1=G-8:IFL1<1THENL1=L1+13
8420 FORA=0TO2:J1(A)=L1:L1=L1-1:IFL1<1THENL1=13
8430 NEXT:FORA=0TO2:IFHD=J1(A)THENE=1:RETURNELSENEXT:E=0:RETURN
8440 IF(HS=FOR(HD=G)THENE=1:RETURNELSEE=0:RETURN
8450 L=1:IFHD=(LORHD)THENL=0
8452 IF(L=0ANDF=L8)OR(L=0ANDF=L9)THENE=1:RETURNELSEIF(L=1ANDF=L6)OR(L=1ANDF=L7)T
HENE=1:RETURNELSEE=0:RETURN
8460 IF(HS=0ORHS=3)ANDJV(3)=1THENE=1:RETURNELSEIF(HS=1ORHS=2)ANDJV(3)=2THENE=1:R
ETURNELSEE=0:RETURN
8470 FORA=0TO12:J1(A)=0:NEXT:L1=G-2:FORA=0TO4:IFL1<1THENL1=L1+13
8472 J1(A)=L1:L1=L1+1:IFL1>13THENL1=1
8474 NEXT:FORA=0TO4:IFHD=J1(A)THENE=1:RETURNELSENEXT:E=0:RETURN
8490 'END LEVEL2 - NOW LEVEL3 TESTS
8500 IFCT>50THENE=1:RETURNELSEL=1:IF(F=0ORF=3)AND(F0=0ORF0=3)THENIFHD<>(LORHD)TH
ENE=1:RETURN
8502 IF(F=1ORF=2)AND(F0=1ORF0=2)THENIFHD<>(LORHD)THENE=1:RETURN
8504 IF(F=0ORF=3)AND(F0=1ORF0=2)THENIFHD=(LORHD)THENE=1:RETURN
```

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PROGRAMS

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8506 IF(F=1ORF=2)AND(F0=0ORF0=3)THENIFHD=(LORHD)THENE=1:RETURN
8508 E=0:RETURN
8510 IFCT>49THENE=1:RETURNELSEIF(F1=0ORF1=3)AND(HD<8)THENE=1:RETURNELSEIF(F1=1OR
F1=2)ANDHD>7THENE=1:RETURNELSEE=0:RETURN
8520 IFCT>48THENE=1:RETURNELSEL=1:IFHD=(LORHD)ANDJV(0)=1THENE=1:RETURNELSEIFHD<>
(LORHD)ANDJV(0)=2THENE=1:RETURNELSEE=0:RETURN
8530 E=1:IFCT>49THENRETURNELSEDL=C5/3:IFDL<>INT(DL)THENRETURN
8532 IFHS=0ANDF1=1THENRETURNELSEIFHS=3ANDF1=0THENRETURNELSEIFHS=2ANDF1=3THENRETU
RNELSEIFHS=1ANDF1=2THENRETURNELSEE=0:RETURN
8540 IFHD>10ANDG<11THENE=1:RETURNELSEIFHD<11ANDG>10THENE=1:RETURNELSEE=0:RETURN
8550 IFC6)=C5AND(HS=1ORHS=2)THENE=1:RETURNELSEIFC6<C5AND(HS=0ORHS=3)THENE=1:RETU
RNELSEE=0:RETURN
10010 Z=INKEY$:IFZ=""THEN10010ELSERETURN
11010 PRINTY1:PRINT@256,Y2:PRINT@512,Y3:PRINT@576,Y4:PRINT@608,Y5:PRINT@704,Y6:P
RINT@736,Y7:PRINT@896,Y8:PRINTY9:RETURN
11110 PRINT@640,"";:FORA=1TO13:PRINTP(A,0);:NEXT:PRINT@672,"";:FORA=1TO13:PRINTP
(A,1);:NEXT:PRINT@768,"";:FORA=1TO13:PRINTP(A,2);:NEXT:PRINT@800,"";:FORA=1TO13:
PRINTP(A,3);:NEXT:RETURN
11210 PRINT@64,"";:FORA=0TO51:PRINTPC(A)" ";:NEXT
11220 RETURN
11310 PRINT@320,"";:FORA=0TO51:PRINTPM(A)" ";:NEXT
11320 RETURN
11410 GOSUB11110'IN FACT DRAWS ACTUAL HAND
11420 RETURN
12010 IFCT<52THENPRINT@844,VM;"CORRECT  ****";:GOSUB65310:PRINT@844,CHR$(30);:GO
SUB65310:PRINT@844,VM;"CORRECT  ****";:GOSUB65310:PRINT@844,CHR$(30);
12020 GOSUB12200:PRINT@CC,Q5;:ZT=P(HD,HS):PRINTRIGHT$(ZT,(LEN(ZT)-1));:IFPOS(0)>
60THENCI=7ELSEIFHD=10THENCI=4ELSECI=3
12030 CC=CC+CI:GOSUB12250:PRINT@C,CHR$(224);:PRINT@C,"";:ZZ=P(HD,HS):ZT=RIGHT$(Z
Z,LEN(ZZ)-1):P(HD,HS)="":FORA=1TO13:PRINTP(A,HS);:NEXT
12040 GOSUB12200:PCC(C5)=Q5+ZT:C5=C5+1
12050 F3=F2:G3=G2:F2=F1:G2=G1:F1=F0:G1=G0:F0=F:G0=G
12055 F=HS:G=HD
12060 JT=2:IFCT=52THENRETURNELSEK=K+1:RETURN
12105 PRINT@844,VM;"A MISTAKE  ****";:GOSUB65310:PRINT@844,CHR$(30);:GOSUB65310:
PRINT@844,VM;"A MISTAKE  ****";:GOSUB65310:PRINT@844,CHR$(30);
12110 GOSUB12200:PRINT@CM,Q5;:ZT=P(HD,HS):PRINTRIGHT$(ZT,(LEN(ZT)-1));:IFPOS(0)>
60THENCI=7ELSEIFHD=10THENCI=4ELSECI=3
12120 CM=CM+CI:GOSUB12250:PRINT@C,CHR$(224);:PRINT@C,"";:ZZ=P(HD,HS):ZT=RIGHT$(Z
Z,LEN(ZZ)-1):P(HD,HS)="":FORA=1TO13:PRINTP(A,HS);:NEXT
12130 GOSUB12200:PMC(C6)=Q5+ZT:C6=C6+1
12140 K=0:JT=1:RETURN
12200 IFHS=0THENQ5="S"ELSEIFHS=1THENQ5="H"ELSEIFHS=2THENQ5="D"ELSEQ5="C"
12210 RETURN
12250 IFHS<2THENC=640+HS*32ELSEC=704+HS*32
12255 RETURN
13010 CLS:PRINT"SORRY, YOU HAVE NOW PLAYED ALL YOUR CARDS AND WE MUST REVEAL THE
RULE:"
13020 GOSUB40010:GOTO40030
17010 CJ=0
17505 Z=LEFT$(ZW,1):IFZ="S"ORZ="H"ORZ="D"ORZ="C"THEN17507ELSE 17700
17507 IFZ="S"THENHS=0ELSEIFZ="H"THENHS=1ELSEIFZ="D"THENHS=2ELSEHS=3
17509 Z=MID$(ZW,2,1):IFZ<>"1"THENIFLEN(ZW)=3THEN17700
17510 IFZ="1"THENIFLEN(ZW)<>3THEN 17700 ELSEIFRIGHT$(ZW,1)<>"0"THEN 17700 ELSEIF
Z<>"1"ANDLEN(ZW)=3THEN 17700
17515 IFLEN(ZW)=3THENHD=10ELSEIFZ="A"THENHD=1ELSEIFZ="J"THENHD=11ELSEIFZ="Q"THEN
HD=12ELSEIFZ="K"THENHD=13ELSEHD=VAL(Z):IFHD=0THEN 17700
17535 IFHC(HD,HS)=0THEN60090'HE'S NOT HOLDING SUCH A CARD
17545 HC(HD,HS)=0:RETURN'SUB TOTAL PLAYER'S CARDS
17700 PRINT@960,CHR$(30);:PRINT@960,"NO SUCH CARD IN THE PACK!";:GOSUB65010:CJUN
K=1:PRINT@960,CHR$(30);:PRINT@960,Y9;:RETURN
20010 Y1="CORRECT":Y2="MISTAKES":Y3="YOUR HAND":Y4="SPADES":Y5="HEARTS":Y6="DIAM
ONDS":Y7="CLUBS":Y8="GIVE SUIT AND DENOMINATION OF CARD YOU WANT TO PLAY:":Y9="I
F YOU DECIDE TO GIVE UP, TYPE:  Z
20020 X1="BLACK":X2="RED":X3="CARD":X4="EVEN":X5="ODD":X6="DENOMINATION":X7=" LE
SS THAN":X8=" GREATER THAN":V1=" LAST CORRECT CARD":V2=V1+" BUT":V3="SUIT":V4="
SAME AS ":V5="DIFFERENT FROM":V6=" TOTAL OF ":V7=" AND VICE VERSA"
20030 VM="****  THAT DISCARD IS ":V8="1 TO 3":U1="BASIC":U2="INTERMEDIATE":U3="A
DVANCED
20040 XA="COLOUR":XB="IT FOLLOWS THE SEQUENCE":XC="CONSISTENT WITH ":XD="SEQUENC
E OF  ":XE="2 ODD ALTERNATING WITH 2 EVEN":XF="PREVIOUS PLAY":XG="MISTAKE":XH="P
RIME NUMBER"
21000 RETURN
30010 A=FRE(Z):CLS:PRINT"WELL DONE! WITH A CORRECT DISCARDS IN A ROW, YOU HAVE W
ORKED OUTTHE SECRET RULE (UNLESS YOU'RE JUST LUCKY). THE RULE IS:
30020 GOSUB40010:GOSUB41003:GOTO40030
40010 PRINT@192,S1" IS CORRECT ONLY IF ":PRINTS2:PRINT" IS "S3;S4:PRINTS5
40020 IFS6)""THENPRINT@448,"AND":PRINTS6" IS CORRECT ONLY IF "S7" IS":PRINTS8;S9
40025 RETURN
40030 PRINT@902,"FOR ANOTHER GAME TYPE:  G":PRINT@966,"TO SEE THE DISPLAY OF CAR
DS TYPE:  D";
40040 GOSUB10010:IFZ="G"THENGOTO30ELSEIFZ="D"THENCLS:GOSUB11010:PRINT@896,"FOR A
NOTHER GAME TYPE: G  TO SEE THE RULE AGAIN TYPE: R";:PRINT@960,CHR$(30);:GOSUB1
1210:GOSUB11310:GOSUB11410ELSE40040
40050 GOSUB10010:IFZ="G"THENGOTO30ELSEIFZ<>"R"THEN40050ELSECLS:GOSUB40010
40060 IFK<>0THEN40030ELSEGOSUB41003:GOTO40030
41003 L1=44-C6
41005 D1=CT/43:D2=L1/44:D3=(D1+D2)*50
41010 PRINT@729,"S C O R E":PRINT"CARDS IN HAND =  "CT;:PRINT@800,"MISTAKES =  "
C6:PRINTUSING"FINAL SCORE:  ###.##%";D3;:PRINT@864,"("US" GAME)
41020 RETURN
50000 PRINT@C,CHR$(30);:PRINT@C,"";:PRINTCHR$(14);
50010 ZW=""
50020 Z="":GOSUB10010
```


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PROGRAMS

```
50030 IFZ="Z"THENPRINTCHR$(15);:RETURN
50040 IFZ="."THENPRINTCHR$(15);:RETURNELSEIFZ=CHR$(8)THENIFZW=""THEN50020ELSEZW=
LEFT$(ZW,LEN(ZW)-1):ELSEIFZ=CHR$(13)GOSUB 50070:GOTO50000ELSEIFZ<CHR$(32)THENPRIN
TCHR$(15):GOTO50000ELSEZW=ZW+Z
50050 PRINTCHR$(14);:IFZ="S"THENPRINTY4;" ";ELSEIFZ="H"THENPRINTY5;" ";ELSEIFZ="
D"THENPRINTY6;" ";ELSEIFZ="C"THENPRINTY7;" ";ELSEPRINTZ;
50060 IFLEN(ZW)<=MLTHEN50020ELSEPRINTCHR$(15):PRINT@960,"YOU'RE TYPING TOO MANY
CHARACTERS";:GOSUB65010:PRINT@960,CHR$(30);:PRINT@960,Y9;:GOTO50000
50070 PRINTCHR$(15);:PRINT@960,CHR$(30);:PRINT@960,"TYPE A FULL STOP TO PLAY YOU
R CARD - DON'T HIT ENTER";:GOSUB65010:PRINT@960,CHR$(30);:PRINT@960,Y9;:RETURN
60090 PRINT@960,CHR$(30);:PRINT@960,"YOU'RE NOT HOLDING THAT CARD!";:GOSUB65010:
PRINT@960,CHR$(30);:PRINT@960,Y9;:CJUNK=1:RETURN
64020 CLS:PRINT@256,"IF YOU ARE SURE YOU WANT TO GIVE UP THE ATTEMPT TO GUESS TH
E    SECRET RULE, HIT ENTER TO SEE WHAT THE RULE IS.  OTHERWISE PRESSANY OTHER K
EY TO RETURN TO THE GAME"
64230 GOSUB10010:IFZ=CHR$(13)THENCLS:PRINT@256,"THE SECRET RULE IS:-":GOSUB40010
:GOTO40030ELSECLS:GOSUB11010:GOSUB11210:GOSUB11310:GOSUB11410:GOTO1090
64100 PRINT@512,"EMJOY, 17 LANGBANK AVENUE, RISE PARK, NOTTINGHAM NG5 5BU";:GOSU
B65110:GOSUB65110:RETURN
65010 FORA=1TO750:NEXT:RETURN
65110 FORA=1TO1250:NEXT:RETURN
65210 FORA=1TO500:NEXT:RETURN
65310 FORA=1TO375:NEXT:RETURN
```

PET Doc

by Bob Chappell

Doc is an 'Eliza' type program — ie, the computer will strike up a conversation with you. The computer will introduce itself as 'Dr Solace', a psychiatrist who wants to know all your problems and will give replies based on your input. Writing a program like this needs cunning logic if it's not to be become nonsensical. Cramming such logic and a good range of responses into 8k is not an easy task, so it is possible to make rubbish out of a conversation with the 'doctor'.

Doc contains full instructions and will run on any PET.

```
10 REM*DOC*BOB CHAPPELL*14/2/82
20 GOSUB380
30 L$=H$:B$="":PRINT"■";
40 GETH$:IFH$=""THEN40
50 V=ASC(H$):IF(V=13ORV=20)ANDB$=""THEN40
60 IFV=13THENPRINT"■":GOTO110
70 PRINTH$;:IFV=20THENB$=LEFT$(B$,LEN(B$)-1):GOTO40
80 IFV=44THENH$=" "
90 IFV<>39THENB$=B$+H$
100 GOTO40
110 H$=B$+" ":L=LEN(H$):IFTI$<"000500"GOTO130
120 PRINT"SORRY,YOUR TIME IS UP.■":K=39:TI$="000000":GOTO240
130 IFL>60THENK=42:GOTO240
140 IFH$=L$THENK=43:GOTO240
150 REM**SPLIT INTO WORDS***
160 FORJ=1TOE:T$(J)="":NEXT:X=0:Z=1:FORJ=1TOL
170 IFMID$(H$,J,1)=" "THENX=X+1:T$(X)=MID$(H$,Z,J-Z):Z=J+1
180 REM**FIND KEYWORD**
190 NEXT:K=41:FORJ1=1TOA:K$=K$(J1):FORJ=1TOX:T$=T$(J)
200 IFK$=T$+T$(J+1)THENK=J1:F=J+2:J=X:J1=A:GOTO220
210 IFK$=T$THENK=J1:F=J+1:J=X:J1=A
220 NEXTJ,J1
230 REM**SELECT REPLY***
240 Z=L(K)+INT(T(K)*RND(0)):IFZ=Z1THEN240
250 REM**CONJUGATE***
260 Z1=Z:R$=R$(Z):IFRIGHT$(R$,1)<>"*"THEN340
270 J$=" ":IFF>XGOTO330
280 FORJ1=FTOX:T$=T$(J1)
290 FORJ=1TOESTEP2:IFT$=C$(J)THENT$=C$(J+1):J=B:GOTO310
300 IFT$=C$(J+1)THENT$=C$(J):J=B
310 NEXTJ:IFJ1=XANDT$="I"THENT$="ME"
320 J$=J$+T$+" ":NEXTJ1
330 R$=LEFT$(R$,LEN(R$)-1)+J$+"■?
340 LX=LX+3:IFLX>17THENPRINT"■";H$"■":LX=3
350 PRINTR$:IFZ=127ORZ=128THENH$="":LX=LX+2
360 GOTO30
370 REM**INITIALISE**
380 PRINT"■":POKE59468,12
390 A=40:B=16:C=142:D=43:E=30:LX=7:DIMK$(A),C$(B),R$(C),L(D),T(D),T$(E)
400 FORJ=1TOA:READK$(J):NEXT
410 FORJ=1TOB:READC$(J):NEXT
420 FORJ=1TOC:READR$(J):NEXT
430 FORJ=1TOD:READL(J),T(J):NEXT:TI$="000000":J=RND(-TI)
440 PRINT"■■■HELLO. I AM DR.SOLACE,A CONSULTANT.
450 PRINT"■PLEASE MAKE YOURSELF COMFORTABLE AND
460 PRINT"TELL ME YOUR PROBLEM.":RETURN
470 REM**KEYWORDS*******
480 DATAIM,IAM,ICANT,IWONT,IDONT,WANTA,WANTTO,IFEEL,CANI,CANTI,CANYOU
490 DATAIDONTYOU,AREYOU,WHO,HOW,WHAT,WHERE,WHEN,WHY,YOUARE,YOURE,YOUR,YOU,MY
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PROGRAMS

```
500 DATASORRY,YES,NO,HATE,LOVE,THINK,DREAM,FRIEND,MONEY,IF,GREAT
510 DATACOMPUTER,FOOD,SHUTUP,GOODBYE,BYE
520 REM**CONJUGATIONS****
530 DATAI,YOU,I'M,YOU'RE,MY,YOUR,AM,ARE,WAS,WERE,I'VE,YOU'VE,MYSELF,YOURSELF
540 DATAME,YOU
550 REM**REPLIES****
560 DATADOES IT WORRY YOU THAT YOU ARE*
570 DATADID YOU THINK I WOULD BE SHOCKED TO HEARTHAT YOU ARE*
580 DATAHOW LONG HAVE YOU BEEN*,DO YOU LIKE BEING*
590 DATAAPE YOU ASHAMED THAT YOU ARE*
600 DATAONE NEVER KNOWS UNLESS ONE TRIES,ONE SHOULDN'T GIVE UP
610 DATAHAVE YOU TRIED HARD TO*
620 DATAHOW CAN YOU TELL THAT YOU CAN'T*
630 DATAWHY WON'T YOU*,WHY DO YOU REFUSE TO*,IS IT WISE NOT TO*
640 DATAHAVE YOU ALWAYS DONE SO?,IS THAT WHY YOU WANT MY HELP?
650 DATADO YOU WISH YOU COULD*,WHY DON'T YOU*
660 DATADOES THAT WORRY YOU?,WOULD YOU LIKE TO*
670 DATAWOULD IT BE SO BAD IF YOU DID*
680 DATABUT WHAT IF YOU NEVER GOT A*,WHAT WOULD YOU DO WITH A*
690 DATAWHAT IF I TOLD YOU THAT I OFTEN WANT A*
700 DATACAN YOU SAY WHY YOU WANT TO*,WHEN DO YOU WANT TO*
710 DATAIS IT YOUR MAJOR AMBITION TO*
720 DATAWHAT DO THESE FEELINGS SUGGEST TO YOU?,DO YOU OFTEN FEEL*
730 DATADO YOU ENJOY FEELING*,DESCRIBE WHAT IT IS LIKE TO FEEL*
740 DATADO YOU REALLY WANT TO*,CAN YOU*
750 DATAWHY ARE YOU UNABLE TO*,WOULD IT HELP IF YOU COULD*
760 DATA"WOULD YOU BE SURPRISED TO LEARN THAT I  CAN*"
770 DATADON'T YOU BELIEVE THAT I CAN*,NOT VERY WELL!
780 DATAPERHAPS ONE DAY I MIGHT*,I PREFER NOT TO*,WOULDN'T YOU LIKE TO*
790 DATAWHY ARE YOU CURIOUS TO KNOW IF I AM*,DO YOU THINK I AM*
800 DATA"SUPPOSE I PREFER AT THIS POINT NOT TO   REVEAL IF I AM*"
810 DATADO YOU PREFER TO ASK THE QUESTIONS?,WHY DO YOU ASK THAT?
820 DATAWHAT ANSWER WOULD YOU LIKE TO HEAR?,IS THAT OF INTEREST TO YOU?
830 DATAYOU REALLY WANT TO KNOW?,WOULD YOU CLARIFY THE QUESTION?
840 DATACAN YOU EXPLAIN WHY YOU ASKED THAT?,I WONDER WHAT LIES BEHIND THAT?
850 DATAPERHAPS ONLY IN YOUR IMAGINATION AM I*
860 DATADO YOU FIND IT AMUSING TO THINK I AM*,WHY DO YOU THINK I AM*
870 DATADO YOU WISH YOU WERE*
880 DATAI THINK IT BEST WE TALK ABOUT YOU NOT ME,I PREFER TO TALK ABOUT YOU
890 DATAWHY BRING ME INTO IT?,YOU SEEM VERY INTERESTED IN ME
900 DATAARE YOU NOT SUBCONSCIOUSLY REFERRING TO YOURSELF?
910 DATAWHAT IS YOUR INTEREST IN MY*,WHAT ABOUT YOUR OWN*
920 DATAYOU SEEM CURIOUS TO KNOW ABOUT MY*
930 DATAIS THAT RIGHT? YOUR*,REALLY? YOUR*,YOUR*
940 DATAPLEASE DON'T CRY,THATS QUITE ALL RIGHT,WHY SO DEFENSIVE
950 DATAWHY ARE YOU APOLOGISING?,THERES NO NEED TO BE SORRY
960 DATAYOU APPEAR TO BE QUITE CERTAIN ON THAT,YOU SEEM CONVINCED OF THAT
970 DATAAREN'T YOU BEING TOO POSITIVE?,WHAT MAKES YOU SAY YES?
980 DATAYOU SEEM VERY CONFIDENT,YOU'RE QUITE SURE?
990 DATAARE YOU SURE?,WOULDN'T YOU LIKE TO THINK ABOUT THAT?
1000 DATAAREN'T YOU BENG A TRIFLE NEGATIVE?,DO YOU MEAN THAT?
1010 DATAWHY NOT?,I THINK YOU REALLY WANTED TO SAY YES
1020 DATAWHY DO YOU DETEST*,IS IT WRONG TO LOATHE*
1030 DATADEEP DOWN DON'T YOU REALLY LOVE*
1040 DATAIS IT WRONG TO LOVE*,HOW REAL IS THIS LOVE FOR*
1050 DATA"ARE YOU SURE THAT IT'S NOT JUST AN      INFATUATION?"
1060 DATAYOU DON'T SEEM SURE*,ONLY THINK*,THINK OR HOPE*,HAVE YOU DOUBTS THAT*
1070 DATAARE YOUR DREAMS FRIGHTENING?,DO YOU DREAM VERY MUCH?
1080 DATAWHAT PEOPLE APPEAR IN YOUR DREAMS?
1090 DATACAN YOU THINK OF A RECURRING DREAM?,WHAT ABOUT NIGHTMARES?
1100 DATAWHAT ARE FRIENDS FOR?,WHY DO SOME PEOPLE HAVE NO FRIENDS?
1110 DATADOES THE SUBJECT OF FRIENDS DISTURB YOU?
1120 DATAWHY DO SOME PEOPLE HAVE LOTS OF FRIENDS?
1130 DATAIS MONEY THE ROOT OF EVIL?,WHY IS MONEY IMPORTANT TO YOU?
1140 DATAARE YOU FREQUENTLY SHORT OF MONEY?,DO YOU THINK YOU ARE POOR?
1150 DATADOES WEALTH BRING HAPPINESS?
1160 DATAONLY IF*,YOU DON'T SEEM SURE
1170 DATA"'GREAT' MEANING OF LARGE,FAMOUS OR GOOD?",WHAT DO YOU MEAN BY GREA
1180 DATADO YOU MEAN BIG*,"WOULD IT BE EXAGGERATING WHEN YOU SAY   GREAT*"
1190 DATACOMPUTERS CAN'T CONVERSE LIKE WE CAN,ARE YOU SCARED OF MACHINES?
1200 DATAWHY DO COMPUTERS SPRING TO MIND?,COMPUTERS ARE ONLY MACHINES
1210 DATACOULD A COMPUTER HELP YOU?,WHAT IS IT YOU FEAR FROM COMPUTERS?
1220 DATAWHAT FOOD DO YOU LIKE MOST?,WHY DO SOME PEOPLE OVEREAT?
1230 DATAWHAT ELSE BESIDES FOOD?,FOOD IS NECESSARY FOR LIFE
1240 DATAPLEASE DON'T TELL ME TO SHUT UP!,WHY DO YOU WANT ME TO SHUT UP?
1250 DATATHAT'S NOT VERY POLITE,WHY ARE YOU BEING SO AGGRESSIVE?
1260 DATA"THAT WILL BE TEN POUNDS,THANK YOU.       @NEXT PATIENT,PLEASE."
1270 DATA"THANK YOU FOR TALKING TO ME.             @NEXT PATIENT,PLEASE."
1280 DATAI WOULD LIKE TO HEAR MORE,GIVE ME A SPECIFIC EXAMPLE,I SEE
1290 DATATHAT IS FASCINATING,I UNDERSTAND,PLEASE CONTINUE,I DON'T UNDERSTAND
1300 DATACAN YOU ELABORATE ON THAT?,LET'S CHANGE THE SUBJECT
1310 DATA"WHY SUCH A LENGTHY REPLY?
1320 DATA"PLEASE KEEP YOUR REPLIES BRIEF"
1330 DATAWHY DO YOU REPEAT YOURSELF?,YOU JUST SAID THAT
1340 DATAPLEASE DON'T KEEP SAYING THE SAME THING
1350 REM**POINTERS TO REPLIES**
1360 DATA1,5,1,5,6,4,10,5,15,5,20,3,23,3.26,4,30,2,32,2.34,3.37,3,40,3,43,8
1370 DATA43,8.43,8,43,8,43,8,43,8.51,4.5,1,4.60,4.55,5.63,3.66,5
1380 DATA71,6,77,6,83,3,96,3.89,4.93,5,98,4,102.5,107.2,109.4,113,6
1390 DATA119,4,123,4,127,2,127,2,129.9,138,2,140,3
READY.
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PROGRAMS

TRS-80 Screen Dump

by C Ridley

For users of the TRS-80 Model 1 Level 2 with the Tandy Line Printer VII this program should provide a useful additional function. It allows the user to obtain a straight copy of the screen by pressing shift '@'.

```
10 '    *** SCREEN DUMP TO LINE PRINTER ***
30 '          BY COLIN RIDLEY  13-10-81
40 DATA
CD,E3,03,FE,60,C0,00,3C,3E,0A,CD,3B,00,2A,06,7F
60 DATA
06,10,0E,40,CD,35,7F,7E,FE,20,FC,32,7F,FE,7F,F4
70 DATA
32,7F,CD,3B,00,23,0D,20,EE,3E,0A,CD,3B,00,05,20
80 DATA
E1,C9,3E,20,C9,C5,0E,08,3E,20,CD,3B,00,0D,20,F9,C1,C9
90 FOR ADDR=32512 TO 32577
100 READ HEX$:GOSUB 150
110 POKE ADDR,DEC:NEXT ADDR
120 POKE 16435,195:POKE 16436,0:POKE 16437,127:POKE 16405,0
130 NEW
150 N=ASC(HEX$)-48:IF N>9 THEN N=N-7
160 DEC=N*16
170 N=ASC(RIGHT$(HEX$,1))-48:IF N>9 THEN N=N-7
180 DEC=DEC+N:RETURN
```

UK101 Screen Converter

by A Britton

This program will convert screen coordinates between five computers and will run on a UK101 with Cegmon. Adaptation to run on a different micro should not present any great difficulty as this listing has a lot of REMs to help you on your way.

Absolute top left screen coordinates may be altered for UK101 as they vary from machine to machine although line lengths should be left alone. Without REMs the program occupies 4k.

```
100 PRINTCHR$(26): REM *** CLEAR VDU ***
110 REM
120 REM INFORMATION FOR SCREEN CONVERTIONS
130 REM
140 TL(1)=32768:LL(1)=40:SL(1)=25:REM PET/CBM
150 TL(2)=53248:LL(2)=40:SL(2)=25:REM MZ-80K
160 TL(3)=15360:LL(3)=64:SL(3)=16:REM TRS-80
170 TL(4)=53258:LL(4)=64:SL(4)=32:REM C1U
180 TL(5)=53260:LL(5)=64:SL(5)=16:REM UK-101
190 REM
200 REM *** TL = TOP LEFT (HOME) POSITION
210 REM *** LL = LOGICAL LINE LENGTH
220 REM *** SL = LINES PER SCREEN/PAGE
230 REM
235 REM *** OPTION FOR CONVERSION TO
240 PRINT"ENTER THE COMPUTER TO WHICH YOU ARE CONVERTING"
250 PRINT:PRINT,"PET/CBM ... 1"
260 PRINT:PRINT,"MZ-80K .... 2"
270 PRINT:PRINT,"TRS-80 .... 3"
280 PRINT:PRINT,"C1U/OSI ... 4"
290 PRINT:PRINT,"UK-101 .... 5"
300 PRINT:INPUT"COMPUTER TYPE (1-5) ";CT
305 REM *** CORRECT ?
310 IFCT<1ORCT>5THEN300
315 REM *** OPTION FOR CONVERSION FROM
320 PRINT:PRINT"ENTER COMPUTER YOU ARE CONVERTING FROM"
330 PRINT:INPUT"COMPUTER TYPE (1-5) ";CF
335 REM *** CORRECT ?
```

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PROGRAMS

```
340 IFCF<1ORCF>50RCF=CITHEN330
345 REM *** SET UP MAXIMUM AND MINIMUM
350 MI=TL(CF):MA=TL(CF)+LL(CF)-1+(LL(CF)*(SL(CF)-1))
360 PRINT:PRINT"ENTER '0' TO EXIT ENTRY MODE."
370 PRINT:INPUT"SCREEN POSITION ";SP
371 REM *** FINISHED ?
375 IFSP=0THENRUN
377 REM *** CORRECT ?
380 IFSP<MIORSP>MATHEN370
385 REM *** CONVERT SCREEN POSITION
390 N1=SP-TL(CF):N2=INT(N1/LL(CF)):N3=N1/LL(CF)
400 N4=(N3-N2)*LL(CF):P1=TL(CT)+(N2*LL(CT))+N4
405 REM *** INSERT PRINTER COMMAND HERE
410 PRINT:PRINT"EQUIVILENT POSITION =";P1
415 REM *** LOOP BACK FOR MORE INPUT
420 GOTO370
425 REM ***
430 REM *** DO NOT ENTER THIS AS PROGRAM
450 REM *** WHEN CONVERTING PROGRAM FROM
470 REM *** A MAGAZINE TO YOUR MICRO, FIRST
490 REM *** LOAD THIS PROGRAM AND WRITE DOWN
510 REM *** ALL THE CONVERTED SCREEN POSITIONS
530 REM *** THE PROGRAM CAN BE COMPACTED A LOT
550 REM *** BUT HASN'T BEEN TO AID CONVERSION
560 REM ***
```

PET Boxes

by Victor Russell

Boxes is actually made up of three games — Boxes, Knight and Ladder. All three are instructive, entertaining and 'user-proof'. They could easily be useful for demonstrations at club meetings, etc.

The program is not well annotated so splitting the program into its three component games would not be very easy. Full instructions for each game are included in the program. As it is so long a good deal of RAM will be needed — at an educated guess about 32k. Boxes was written in Basic 2.0.

```
1 POKE144,48
2 DATA39,117,78,255,40,41,123,77,127,-1,-41,-123,77,127,1,-39,-117,78,255,-40
3 DEFFNP(J)=PEEK(K+(40*(-1)↑J+(-1)↑(INT(J/2)))*H)
4 DEFFNN(I)=INT(RND(1)*10)+48
5 DIMA%(3),B%(3),C%(3),D%(3),F%(3):FORJ=0TO3:READA%(J),B%(J),C%(J),D%(J),F%(J)
6 NEXT:L=33250:B=128:P=160:U=59468:GOTO300
7 FORZ=0TO999:NEXT:RETURN
8 POKEK,(BORPEEK(K))*(VAND1)+P*(V+1AND1):RETURN
9 GETA$:IFA$=""THEN9
10 Q=ASC(A$):W=VAL(A$):V=((W-1)/2)+(W>3):RETURN
11 POKEK,PEEK(K)ORB:RETURN
14 FORJ=0TO3:POKEK+A%(J),P:POKEK+F%(J),P:NEXT:RETURN
22 FORJ=0TO4:GOSUB11:POKEK+1,105:POKEK-40,233:K=K-39:NEXT
23 IFPEEK(K)>60THENRETURN
24 S=S+PEEK(K)-48:GOSUB11:RETURN
26 FORJ=0TO4:GOSUB11:POKEK+1,223:POKEK+40,95:K=K+41:NEXT
27 IFPEEK(K)>60THENRETURN
28 S=S+PEEK(K)-48:GOSUB11:RETURN
30 FORJ=0TO4:GOSUB11:POKEK-1,233:POKEK+40,105:K=K+39:NEXT
31 IFPEEK(K)<99THENGOSUB8
32 RETURN
34 FORJ=0TO4:GOSUB11:POKEK-1,95:POKEK-40,223:K=K-41:NEXT
35 IFPEEK(K)<99THENGOSUB8
36 RETURN
44 GOSUB11:FORJ=0TO1:K=K+A%(V):POKEK,D%(V):NEXT
45 K=K+A%(V):S=S+(PEEK(K)-48)*(VAND1):GOSUB8:RETURN
55 PC=P:N0=0:GOSUB7:IFI>9THEN59
56 IFPEEK(V+2*I)<60THENW=I:GOTO62
57 FORZ=1TOI:IFPEEK(V+2*Z)<60THENW=Z:Z=I :NEXT:GOTO62
58 NEXTZ:PRINT"↖ CAN'T MOVE  YOU";:N0=1:RETURN
59 W=INT(RND(1)*9+1)
```


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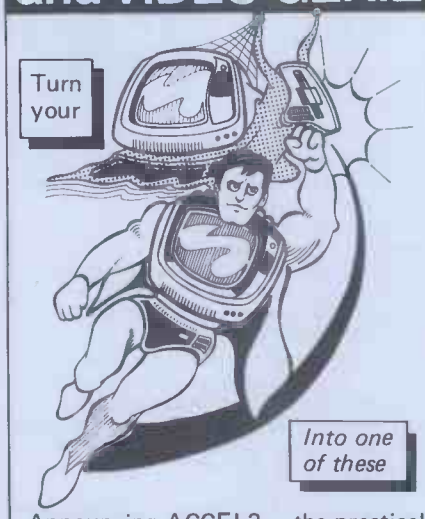

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60 IFRND(1)<IQTHENIFI<>INT(I/10)*10THENW=I-10*INT(I/10)
61 IFPEEK(V+2*N)=PTHEN55
62 IFTGTHENPOKEY+2*W,P
63 PRINT"\Y TURN: ↘ CHOOSE"W"■.□
64 C=C+N:RETURN
66 GOSUB7:PRINT" OUR  TURN          ■■■■■";:PC=102
67 IFI>9THEN70
68 FORZ=1TOI:IFPEEK(X+2*Z)<60THENZ=I:NEXT:GOTO70
69 NEXT:PRINT"□":PRINT" OU CAN'T MOVE: ↘", N0=1:RETURN
70 GOSUB9:IFQ<49ORQ>57THEN70
71 IFPEEK(X+2*N)>60ORC+WDKTHEN70
72 IFTGTHENPOKEX+2*W,PC
73 PRINTA$".□":C=C+W:RETURN
77 IFPEEK(M+A)=93THENGOSUB88:I=4:RETURN
79 M=M+A:POKEM,PC:RETURN
88 FORH=0TO2:M=M-40:POKEM,PC:NEXT:A=-A:M=M+A:POKEM,PC:RETURN
89 I=K-C:IFD+1AND1THENGOSUB55
100 IFDAND1THENGOSUB66
101 RETURN
120 PRINT"□▼↗↖I ■■■":PRINT"\OVE LIKE A KNIGHT AT CHESS, USING EVEN■
125 PRINT"NUMBERED KEYS: THE FIRST NUMBER GIVES■
130 PRINT"THE DIRECTION OF THE 2-SQUARE MOVEMENT:■
135 PRINT"E.G 8 6 MOVES 2 SQUARES UP AND 1 TO THE  ■RIGHT.■■
140 PRINT"□BJECT: GET AS CLOSE TO THE TARGET AS  ■POSSIBLE IN 7 MOVES.
142 PRINT"■■■RESS ■◆↑◆←■ PLEASE, OR ↑ FOR ALTERNATIVEGAME (COVER SQUARES).
145 TG=1:GOSUB9:IFQ=32THEN150
146 TG=0:IFQ<>65THEN145
150 POKEU,12:G$="I□■┌──┐ ■■■■■■└──□■ I"
160 PRINT"□":FORI=0TO4:FORJ=0TO8:PRINTG$,:POKE32809+3*J+120*I,FNN(0):NEXT
170 PRINT"■■":NEXT:K=33061:FOKEK,F:GOSUB14:S=0 A=0
180 IFTGTHENM=INT(30*RND(1)+20):PRINT"■TARGET"M"■
190 GOSUB9:J=W/2-1:IFINT(J)<>JORJ<0THEN190
200 PRINTA$"  ■I";:H=6*FX(J)
210 GOSUB9:W=W/2-1
215 IFINT(W)<>NORW<0ORW=JORW=1ANDJ=2ORW=2ANDJ=1ORABS(W-J)=3THEN210
220 PRINTA$"□":H=H+3*FX(W):IFPEEK(H+K)<48ORPEEK(H+K)>57THEN190
230 GOSUB11 K=K+H:GOSUB14:S=S-48+PEEK(K):A=A+1 IFTGANDA=7THEN260
235 FORJ=0TO3STEP3:FORW=1TO2:H=PEEK(K+6*FX(J)+3*FX(W))
237 IFH>47ANDH<58THENJ=3:W=2:NEXT:NEXT:GOTO190
245 NEXT:NEXT:FORJ=1TO2:FORW=0TO3STEP3 H=PEEK(K+6*FX(J)+3*FX(W))
247 IFH>47ANDH<58THENJ=2:W=3:NEXT:NEXT:GOTO190
250 NEXT:NEXT:PRINT"BOXED IN !■":PRINT44-A"LEFT UNCOVERED.":GOTO290
255 GOTO190
260 I=ABS(S-N):PRINT"TOTAL ="S"■I SO YOU LOSE"I"FOINTS.
270 I=50-I:IFMK<ITHENMK=I
280 PRINT"■■SCORE ="I"■I.■   BEST SCORE ="MK".
290 PRINT"■PRESS ■SPACE■ .
295 GOSUB9 IFQ=32THEN150
296 IFQ<>13THEN295

300 PRINT:POKEU,14:PRINT"□—OR I┌◆─●, FRESS I.■■":PRINT"—OR ↗↖I ■I, - - ↗.
320 PRINT"■■—OR L↑──¯¯_, - - L.":PRINT"■■O END PROGRAM, - - ¯.
330 PRINT"■■■ETURN TO THIS INDEX BY FRESSING ■└─┘ ↗↙
335 PRINT"■INSTEAD OF ■◆↑◆←■ AT THE END OF A GAME.
340 GOSUB9:IFQ=76THEN1990
350 IFQ=69THENPRINT"□":POKE144,46:POKE59468,12:END
355 IFQ=75THEN120
360 IFQ<>66THEN340
400 PRINT:PRINT"□";:POKEU,14:PRINTTAB(15)"_____":PRINTTAB(15)"■I┌◆─●■
J■■■■□■■■ ■I
405 S=0:PRINT" ■SE NUMBER KEYS 1,3,7 & 9 TO MOVE:
410 PRINT"7 MOVES UP AND LEFT ETC.■
425 PRINT" OU SCORE ONLY WHEN MOVING LEFT TO RIGHT";
430 PRINT"(USING KEYS 3 OR 9).■
435 PRINT"I↑●↖─ I↑↖¯: GET A TOTAL AS CLOSE AS" PRINT"POSSIBLE TO THE TARGET.
445 PRINT"↖AXIMUM POSSIBLE SCORE IS 50.■
446 PRINT"↑LI ¯─↗●↓↖✕¯ I↑↖¯: SIMPLY SCORE AS MUCH  AS POSSIBLE.
460 PRINTTAB(5)"■RESS L FOR LARGE VERSION,":PRINTTAB(11)"■◆ FOR SMALL.
470 GOSUB9:IFQ=76THEN980
475 IFQ<>83THEN470
480 PRINT"□■OVE FROM WHITE SQUARE TO FLASHING BALL.
481 PRINT"■■ OU MAY PASS THROUGH A BOX TWICE (NOT
482 PRINT"■CHANGING YOUR SCORE), BUT NOT ALONG THE ■SAME PATH TWICE.■
484 PRINT"■■RESS ■◆↑◆←■, OR ↑ FOR ALTERNATIVE GAME.
485 GOSUB9:IFQ=32THENTG=-1:GOTO490
486 TG=0:IFQ<>65THEN485
490 POKEU,12:PRINT"□■":FORI=1TO5:FORJ=0TO(I>2)*(I-6)-(I<3)*I
500 PRINTTAB(5*ABS(I-3)+J*10)G$;:NEXT:PRINT IFI<5THENPRINT"■■■
540 NEXT:PRINT"■■■■■■■TAB(8)U$W$U$W$:PRINT"■■■":PRINTTAB(3)U$W$U$W$U$W$
560 PRINT:PRINTTAB(3)W$U$W$U$W$U$:PRINT"■■■":PRINTTAB(8)W$U$W$U$
650 FORI=1TO2:FORJ=-1TO1:POKEL+10*I+400*J,FNN(0):NEXT:NEXT
660 FORI=0TO2:POKEL+5+I*10+200,FNN(0):POKEL+5+I*10-200,FNN(0):NEXT
670 PRINT:Z=INT(RND(1)*40)+10:IFTGTHENPRINT"■TARGET"Z
680 PRINT:PRINT"■■■■■■■■■■■■■■■"TAB(32)"●■";:POKE167,0:K=L:POKEK,P
710 FORJ=-1TO1:IFPEEK(K+40+J)=32ORPEEK(K-40+J)=32THENJ=1:NEXT:GOTO715
712 NEXT:POKE167,1:PRINT"■YOU ARE  ":PRINT"BOXED IN !":PRINT"■";:I=0:GOTO765
715 GOSUB9:IFW<>1ANDW<>3ANDW<>7ANDW<>9THEN715
720 IFPEEK(K+AX(V))<>32THEN715
730 ONV+1GOSUB30,26,34,22
```


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PROGRAMS

```
735 IFK=33280THEN746
740 GOTO710
746 I=50-ABS(S-Z):POKE167,1:PRINT IFNOTTGTHEN750
748 PRINT"■TOTAL="S:PRINT"_____":PRINT"■SCORE="I"■S":IFI>MTTHENMT=I
749 I=MT:GOTO765

750 IFS>MXTHENMX=S
760 I=MX:PRINT"■SCORE ="S;
765 PRINTTAB(28)"BEST SCORE":PRINTTAB(30)"IS"I"■.
770 PRINTTAB(28)"■PRESS ■SPACE■
780 GOSUB9:IFQ=13THEN300
785 IFQ<>32THEN780
790 S=0:GOTO490
980 PRINT"■MOVE FROM WHITE SQUARE TO ANY OF THE■
985 PRINT"THREE RIGHT-HAND SQUARES.■■■
987 G$=" ┌─┐■■■└─┘ ":R$="■■■":U$="/┐/■■":W$="\■\■■
990 PRINT" DU MAY NEITHER GO THROUGH THE SAME BOX■
991 PRINT"NOR ALONG THE SAME PATH TWICE.■■■■

992 PRINT"PRESS ■W■A■S■ OR 0 (OR PRESS ONE OF■
993 PRINT"THESE KEYS WHILE HOLDING DOWN A ■CTRL■■
994 PRINT"KEY FOR THE ALTERNATIVE GAME).
995 GOSUB9:TG=(Q>99):IFQ=32ORQ=PTHEN995
996 IF(QORB)<>215THEN995
997 G$=" ┌─┐■■■└─┘ "
999 PRINT"┌─┐":POKEU,12
1000 FORI=1TO3:FORJ=1TO6:PRINTR$G$,:NEXT:PRINT:PRINT:PRINT"■■■";
1010 FORJ=1TO6:PRINTU$W$;:NEXT PRINT
1020 FORJ=1TO7:PRINTG$R$;:NEXT
1030 FORJ=1TO6:PRINTW$U$;:NEXT:PRINT:PRINT
1040 NEXTI:FORJ=1TO6:PRINTR$G$;:NEXT
1060 FORI=0TO3:FORJ=0TO5:POKE32812+6*J+240*I,FNN(0):NEXT:NEXT
1070 K=32929:FORI=0TO2:FORJ=0TO6:POKEK+6*J+240*I,FNN(0):NEXT:NEXT
1080 K=K+240*INT(RND(1)*3):POKEK,P
1085 IFNOTTGTHENZ=30+INT(70*RND(1)):PRINT:PRINTTAB(14)"■■TARGET"Z"■■□■
1090 GOSUB9:IFW<>1ANDW<>3ANDW<>7ANDW<>9THEN1090
1100 IFPEEK(K+B%(V))<99ANDPEEK(K+A%(V))=C%(V)THENGOSUB44
1140 FORJ=0TO2:IFK=32965+240*JTHENJ=2:NEXT:GOTO1185

1150 NEXT:J=0
1160 H=3:IFJ=4THEN1260
1170 IFFNP(J)>32ANDFNP(J)<60THENH=1:IFFNP(J)=78ORFNP(J)=77THEN1090
1180 J=J+1:GOTO1160
1185 IFTGTHEN1200
1190 I=50-ABS(Z-S):PRINT"■■  TOTAL="S";TAB(27)"■SCORE ="I"■■.
1195 IFI>M2THENM2=I
1196 PRINT"■■■■TOP SCORE ="M2".■■■";:GOTO1230
1200 PRINT:PRINT:PRINT"SCORE ="S".";
1210 IFS>MLTHENML=S
1220 PRINT"■■TOP SCORE ="ML"■■.■
1230 PRINTTAB(10)"PRESS ■SPACE■.";
1240 GOSUB9:IFQ=13THEN300
1245 IFQ<>32THEN1240
1250 S=0:GOTO999
1260 PRINT:PRINT:PRINT"BOXED IN !■■":GOTO1230
1990 PRINT"┌─┐■■■└─┘■■■":PRINT"■E TAKE IT IN TURNS TO CHOOSE A NUMBER:■
1992 PRINT"FIRST TO REACH THE TARGET WINS.■■■
1993 PRINT"PRESS ■W■A■S■ PLEASE, OR A NUMBER TO SET  ■MY INTELLIGENCE.
1994 PRINT"■■■OR ALTERNATIVE, WHERE WE CAN'T RE-USE■
1995 PRINT"NUMBERS, PRESS ONE OF THESE KEYS WHILE  ■HOLDING DOWN ■CTRL■.
1996 TG=0:GOSUB9:IFQ>159THENTG=1:W=VAL(CHR$(Q-B))
1997 IFQ=PORQ=32THENIQ=1-.2*TG:GOTO2000
1999 IQ=W/10

2000 G$=" ┌──┐■■■■H■■└──┘■■K" :U$=" ┌──┐■■■■I■■└──┘■■K"
2010 C=0:R$=" ┌──┐■■■■H■■└──┘■■N" :W$=" ┌──┐■■■■I■■└──┘■■K"
2500 TN=TN+1AND1:D=TN PRINT"┌─┐┌──┐■■■■I■■└──┘■■K";:FORJ=1TO8:PRINTG$;:NEXT
2600 PRINT" ┌──┐■■■■H■■└──┘■■N";
2800 FORI=1TO2:PRINTU$;:FORJ=1TO6:PRINTG$;:NEXT:PRINT" ┌──┐■■■■H■■└──┘■■N";
2810 PRINTW$;:FORJ=1TO8:PRINTG$;:NEXT:FRINTR$;:NEXT:PRINT"■■ ■■■      ■■";
3000 FORJ=4TO0STEP-1:K=JAND1:V=J+1AND1:FORI=10■KTO10■VSTEPV-K
3050 PRINT"■"RIGHT$(STR$(J*10+I),2)"■";:NEXT:PRINT"■■";:NEXT:PRINT"┌─┐
3060 X=33528:IFTGTHENPOKEX,102:FORJ=1TO9:POKEX+J*2,48+J:POKEX+80+J*2,48+J:NEXT
3100 K=20+INT(RND(1)*31):PRINTTAB(9)"■ ├↑─┘ ┐"K"■":V=K+80:IFTGTHENPOKEV,P
3150 A=1:M=33288:GOSUB99:FORI=1TO2:GOSUB77:NEXT:IFW=1THEN3350
3160 FORJ=1TON-1:FORI=1TO4:GOSUB77:NEXT:NEXT:GOTO3350
3200 GOSUB99:IFN0THEN3400
3270 FORJ=1TON:FORI=1TO4:GOSUB77:NEXT:NEXT
3350 D=D+1:IFC=KTHEN3380
3360 GOTO3200
3380 IFDAND1THENPRINT"┐";
3390 IFD+1AND1THENPRINT" DU";
3400 PRINT" HAVE WON!  PRESS ■W■A■S■.
3450 GOSUB9:IFQ=32THEN2000
3500 IFQ<>13THEN3450
3550 GOTO300
```


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PROGRAMS

Atari Earth

by Martin Stiby

This is a two player game with a difference, in that each player has a completely different role within the game rather than both players doing the same thing and vying for the higher score. One player controls an alien and the other a satellite which has to ram the alien and destroy it. The concept behind the game is that our planet is being threatened (as always) by the alien who wants to vaporise all of us. The satellite has a time limit in which to vanquish the invader.

Earth is displayed on the screen and both players can hide behind it, although this affords little in the way of protection. Full instructions are provided on request by the program.

To vary the amount of acceleration on both alien and satellite, the value of M in line 545 can be altered. The '{' in lines 10,40 and 3015 is a clear screen symbol and any text to be printed in lines 400, 2000 and 3015 is in inverse video.

```
10 PRINT "}Doest thou require knowledge
    concerning the use of this prog
ram ?":POKE 764,255
20 IF PEEK(764)=255 THEN 20
30 IF PEEK(764)=35 THEN 490
40 PRINT "}  We are being threatened by
an alien":PRINT "intelligence, which is
going to"
50 PRINT "vaporize Earth unless we can r
am it":PRINT "with a remotely-controlled
 satellite"
60 PRINT "which just happens to be up th
ere !":PRINT " There is a time limit aft
er which"
70 PRINT "there is no hope for us !":PRI
NT "  The left hand joystick controls th
e"
80 PRINT "alien and the right hand joyst
ick":PRINT "controls the satellite."
90 PRINT " Both players may hide behind
the":PRINT "Earth, at their own peril !!
":PRINT
400 PRINT "          ANY KEY TO START":PO
KE 764,255
401 IF PEEK(764)=255 THEN 401
490 DIM H(15),V(15):GRAPHICS 7:SETCOLOR
2,3,0:SETCOLOR 0,8,2:SETCOLOR 1,8,8
500 DEG :COLOR 2:FOR A=5 TO 90 STEP 2.95
:X=SIN(A)*30:Y=COS(A)*20:PLOT X+80,Y+40:
DRAWTO 80-X,Y+40
510 PLOT X+80,40-Y:DRAWTO 80-X,40-Y:NEXT
 A:PLOT 50,40:DRAWTO 110,40:COLOR 1:PLOT
 80,80
520 FOR B=26 TO 5 STEP -7:FOR A=0 TO 360
 STEP 20:DRAWTO SIN(A)*B+80,COS(A)*20+40
:NEXT A:NEXT B
530 RAM=PEEK(106)/2+2:FOR A=1536 TO 1620
:READ B:POKE A,B:IF B=34 THEN POKE A,RAM
531 NEXT A
540 DATA 162,120,169,0,157,3,34,202,208,
250,162,50,169,24,157,3,34,157,7,34,169,
60,157,4,34,157,6,34,169,231
541 DATA 157,5,34,104,96,162,120,169,0,1
57,131,34,202,208,250,162,50,169,16,157,
131,34,169,24,157,132,34,157
542 DATA 137,34,169,60,157,133,34,157,13
6,34,169,127,157,134,34,169,254,157,135,
34,169,8,157,138,34,104,96
545 M=0.15:FOR A=1 TO 15:READ B:H(A)=B*M
:READ B:V(A)=B*M:NEXT A:POKE 752,1
546 DATA 0,0,0,0,0,0,0,0,1,1,1,-1,1,0,0,
0,-1,1,-1,-1,-1,0,0,0,0,1,0,-1,0,0
550 POKE 54279,RAM-2:POKE 559,46:POKE 53
277,2:POKE 623,4:HE=53248:HG=53249:POKE
704,88:VE=1547:POKE HE,0
560 POKE HG,0:POKE 705,198:VG=1582:CHE=5
0:CHG=180:SPHE=0:SPHG=0:SPVE=0:SPVG=0:CV
E=50:VME=1536:VMG=1571:CVG=50
```

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PROGRAMS

```
570 HIT=53261:RL=200:LL=46:TIME=500:PRIN
T "}TIME":POKE 53278,0
1000 S=STICK(0):SPHE=SPHE+HK(S):SPVE=SPVE
+VK(S):IF CHE+SPHE>RL OR CHE+SPHE<LL THEN
 SPHE=0
1201 IF SPVE+CVE>88 OR SPVE+CVE<1 THEN S
PVE=0
1220 CHE=CHE+SPHE:POKE HE,CHE:CVE=CVE+SP
VE:POKE VE,CVE:X=USR(VME)
1500 S=STICK(1):SPHG=SPHG+HK(S):SPVG=SPVG
+VK(S):IF CHG+SPHG>RL OR CHG+SPHG<LL THEN
 SPHG=0
1701 IF SPVG+CVG>85 OR SPVG+CVG<1 THEN S
PVG=0
1720 CHG=CHG+SPHG:POKE HG,CHG:CVG=CVG+SP
VG:POKE VG,CVG:X=USR(VMG)
1750 S=ABS(SPVE)+ABS(SPHE):SOUND 0,S*3,8
,S+5:S=ABS(SPVG)+ABS(SPHG):SOUND 1,S*3+4
0,8,S+5
1800 PRINT TIME;"  ":TIME=TIME-1:IF TIME
=8 THEN 2000
1900 IF PEEK(HIT)<>0 THEN 3000
1998 GOTO 1000
2000 PRINT "}OH DEAR THE EARTH HAS BEEN
VAPORIZED":SOUND 1,0,0,0:FOR A=1 TO 10:M
=RND(1)*16:FOR B=20 TO 60 STEP 2
2009 SETCOLOR 4,M,(B-20)*0.375:SOUND 0,B
,12,15:NEXT B:NEXT A:SETCOLOR 4,0,0:FOR
A=30 TO 1 STEP -2:SOUND 0,A,8,15
2010 FOR B=1 TO A:NEXT B:NEXT A:SOUND 0,
0,0,0:SETCOLOR 0,0,0:SETCOLOR 1,0,0:SETC
OLOR 2,10,6:GOTO 3020
3000 SOUND 1,0,0,0:SOUND 0,99,8,15:FOR A
=1 TO 10:POKE 704,14:POKE 705,14:FOR B=1
 TO 30:NEXT B:SETCOLOR 4,A,5
3010 POKE 704,0:POKE 705,0:FOR B=1 TO 30
:NEXT B:SETCOLOR 4,0,0:NEXT A
3015 PRINT "}     EARTH IS SAVED : WELL
DONE":SOUND 0,0,0,0
3020 PRINT :PRINT " Do you want to play
again ?":POKE 764,255
3030 IF PEEK(764)=255 THEN 3030
3040 IF PEEK(764)=43 THEN SETCOLOR 0,8,2
:SETCOLOR 1,8,8:SETCOLOR 2,3,0:B=0:GOTO
550
3050 POKE 764,255:POKE 53277,0:POKE 5326
5,0:GRAPHICS 0:END
```

Correction

MZ-80K Catch in the May issue was the latest program to be printed with an omission in the listing. All that was missing was a POKE at the end of line 10. For tape Basic this should be POKE 10167, 1 and for disk Basic it should be POKE 8048, 1. This will enable the user to access areas of RAM other than video by switching off the Sharp's PEEK protect. If this is not done the machine code which moves the men back and forth won't work as the program won't read keyboard input (which controls the movement of the men). This POKE should make the program work.

Continued from page 126

BANKS STATEMENT

failures that are rare, if not unique.

Having such people available for the user is bound to cost someone — in this case the maintenance company — a great deal of money in salaries and equipment. That is why maintenance contracts are expensive. They are even more expensive, pro rata, for personal computer systems, for the systems themselves are now so cheap. Well, that is only partly true. The computers are inexpensive, but some of the peripheral equipment that goes to make a system isn't. The peripheral equipment often contains a fair element of mechanical gubbins as well, and it is usually those bits that crap-out and require the expensive maintenance. Years ago, the now departed Isherwoods was offering a £20-plus-parts fix on Commodore PETs. For the box alone that fee is probably still economic, but it certainly wouldn't be for disk drives or printers.

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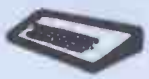

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So maintenance, unfortunately, is expensive. Yet for many users in this country, where what market figures there are indicate a predominance of business and professional users, maintenance is an important aspect of long-term ownership. It would seem that this particular dilemma is the cause of the problems with insurance policies.

It would appear that some users, either through their own misunderstandings or those of the insurance brokers, or even of the few personal computer dealers that also handle insurance policies, are taking out such policies with the firm belief that they are insuring against maintenance.

It is easy enough to write the words: 'Well of course they ain't.' For the users caught in this trap, however, it is not easy, for they do not find this out until it is too late. Here is a 'for instance'.

User has a policy on machine X, which fails. User contacts insurance company which says 'find someone to fix, pay the bill, and we will reimburse'. This is the way things are normally done with insurance policies. User does all this by employing maintenance company. Insurance company then says, probably quite rightly, that the fix was for 'fair wear and tear' so it won't pay. User gets stuck with large bill and risks bankruptcy. It has happened.

Some users seem to assume that the policies being offered are like those commonly found with domestic 'white goods' — things like washing machines, fridges and televisions. Here, because the technology used changes little and then only slowly, it has become possible to predict failure rates and modes accurately. This means that the cost of repairs for a typical year on the installed base of such equipment can be estimated. From this it is possible to offer an insurance policy where the premium is based on this well-known estimate.

The policy is in effect a pre-payment for predictable failures. With items like personal computers it can't be offered in the same way, though many users seem to be assuming it can.

The answer seems to be for users to be made aware that here are two distinct and separate factors: insurance and maintenance. They are not the same animal. Insurance is a good thing to have and no user should be without it. Maintenance is optional, though if the cost of repair is likely to be high, or the time taken to get a fix is important, it will be worth it. END

FIVE OUT OF TEN · MUST TRY HARDER

Continued from page 123

geared to aim at the ability level of the child. But how many good programs are there? In my experience there are very few.

Our machines are too difficult to handle physically. For a primary school a single unit machine is the only practical possibility. If you can't have one micro per class, you've got to hump your one machine around easily.

Cassettes are too slow and inflexible. One head asked me if it would be practical to file all his school emergency address records on cassette. In the case of a serious accident the child could be dead by the time you've loaded the information from tape. What's wrong with a filing cabinet? Disks are obviously the answer. But disks double the price of your equipment.

Which brings us to the question of price. In Birmingham we've just had the remainder of our current capitation (the amount of money allowed per child) frozen for all but essentials. Forecasts for the year ahead bode ill indeed. Our school fund is struggling too with increasing unemployment, and it seems as if we're going to have to start buying necessary things from it. So where does £500 come from to buy a micro? Even if the Department of Industry forks out half, as seems possible, can our primary schools really justify such expenditure on something that has not yet proven its worth?

But don't get me wrong! If Tandy asked for its machines back tomorrow, I would definitely be heartbroken, despite the problems. However I would make no attempt to replace them. I couldn't honestly recommend it to the rest of the staff in view of the hardships we face and will face. And how can other schools?

So where's the future? For one thing the ridiculous situation of incompatibility of micros must be overcome. In Birmingham our secondary schools are standardised on the Research Machines 380Z. With my Tandy I'm unable to use any of their expertise. It seems likely that our primary schools will standardise on the BBC Computer. Despite being in the inner area of the city, I have two children with computers, one with a VIC 20, the other with a PET. I have a friend with a Sinclair ZX80. We might as well live on different planets for all we are able to exchange programs.

The great hope for primary (and secondary) schools must be the BBC machine. Even as a layman, I think its specifications seem to be tremendous.

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With the weight of the BBC behind it and the facility to take programs from off air, it really must set the standard of compatibility for all micros. Let's hope so.

The great worry I have is that it will be supplied with programs by the sort of enthusiasts I've come across at computer courses and meetings. What we need is teachers who are computer-illiterate to assess the real educational and practical value of programs. Programs need to come from teachers and teaching needs and *not* from computer experts with bright ideas as to what would make a good program.

In the meantime, schools with computers must continue to battle on. They must make mistakes for us all. They must be prepared to see all their work go down the drain for the sake of the rest of us. They must forge the way ahead and expect no reward. As for the rest of us; can we honestly justify the expenditure of money and time for something that is as little advanced as the ancient Chinese printing block compared to the printed word of today? I don't think we can.

William E Dargue

END

SILICON OFFICE

Continued from page 147

Conclusions

At £790 for the floppy disk version and £990 for the hard disk, without the hardware, Silicon Office is the most expensive package I've tested. (These prices include a two-year warranty from Bristol Software Factory.) Its file management features are comparable with those of the more limited packages I've reviewed so far. In some areas, such as the ability to specify both file name and key in a single statement, the design of record formats on the screen and the flexibility of layout for reports, it is an attractive package. (I feel I should remind readers again that most of my comments have involved the file management features — I haven't attempted a full review of the word processing and file transmission facilities.) The manual is excellent both as a training guide and for reference.

Against these advantages should be set some serious limitations. The inability to combine keys when selecting records, the lack of any data protection from unauthorised access and the restriction to a single format for the display of records in one file would be serious constraints in many applications. The limitation of 252 characters per file, even taking account of the ability to create linked records through the key mechanism, would often be a real handicap, as would the restriction to three data files per disk. If the ability to combine word and data processing with communications in a single package is of sufficient importance to overcome these handicaps, then for applications of limited size Silicon Office could be a good buy. But, as with all packages which may be used to process large amounts of data, make sure you get a demonstration using files of a realistic size. I found it much slower than most of the CP/M packages I've tested, as regular readers will note when my summary of the Benchtests on all the packages, based on floppy disk systems throughout, is published later in this series.

END

BLUDNERS

MZ-80K 'Catch' in May *PCW* suffered from a serious attack of mischievous gremlins. A POKE was omitted from line 10 which meant that the little men who moved the stretcher to catch the suicides could not move under control from the player.

Users of MZ-80K tape Basic should add POKE 10167,1 and disk Basic users should add POKE 8048,1 to the end of line 10. Hopefully now all those frustrated readers should be able to save many lives. Also, thank you to all readers who offered possible corrections. Although we can't list all the options here (some were rather long and involved!) they were certainly appreciated.

In our free Word Processing supplement in the May issue, we forgot to mention that Magic Wand is now distributed by Peachtree Software International, tel 0628 71011.

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Volume 1 No 6
October 1978
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Volume 2 No 4
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Volume 3 No 6
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Benchtest: Tandy TRS-80 Model II/Benchtest: Sintrom Periflex 630/48/Staff case study/Checkout: Softy Intelligent EPROM programmer/Checkout: Exatron Stingy Floppy/Practical examples of the IEEE-488 bus use/UK101 Nedge/PET Horse Race/Basic & PET Renumbers/UK101 Dogfight/Mk14 frequency counter/Basic Maths Test/PET Sweeper.

Volume 3 No 12
December 1980
Benchtest: Microwriter/Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs: TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligatow Swamp, PET Connect, UK101 Minefield, PET Simon Benchtest: Raannd SP1

Volume 4 No 1
January 1981
Benchtest: Transam Tuscan/Real-time control using trains — part 1/Recover from a data tape disaster/PET Music Multi-user systems — part 1/Programs: TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram

Volume 4 No 3
March 1981
Benchtest: Onyx C8002/Benchtest: Bigboard/Micro music software package/ALC circuit/Commons report/HP 43C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing' PET Bouncy.

Volume 4 No 5
May 1981
Benchtest: Pascal 640/WP Benchtest: Magic Wand/PET colour/Low-cost digital tape system/Using calculator printers on micros/Apple music-making/Multi-user Benchtest: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.

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Benchtest: NEC PC-8001/Multi-user Benchtest: MP/M/Benchtest: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchtest: Wordpro 4 plus/Budget tape interface/Further Casio quirks/Programs: UK101 Zor, PET Chords.

Volume 4 No 7
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Benchtest: Sharp PC-3201/Multi-user Benchtest: Acorn Econet/Case study: Accident investigation on TRS-80/Zilog Z8 family/WP Benchtest: Format-80/Pascal Benchmarks: readers' letters/Quicker Casio computations/Programs: ZX80 Sliding Letters, UK101 Car Rally, TRS-80 Calendar, UK101 m/c code to Basic converter, PET Exam Questions, MZ-80K Designer, ZX91 Sketch Pad.

Volume 4 No 8
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Benchtest: TandyModel III/Viewdata update/WP Benchtest: Spellbinder/Printer survey/Microholism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.

Volume 4 No 9
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Benchtests: Tandy Color Computer, Commodore VIC/Checkouts: Hi-Tech Speakeasy, Tantel/Multi-user Benchtest: HMSOS/

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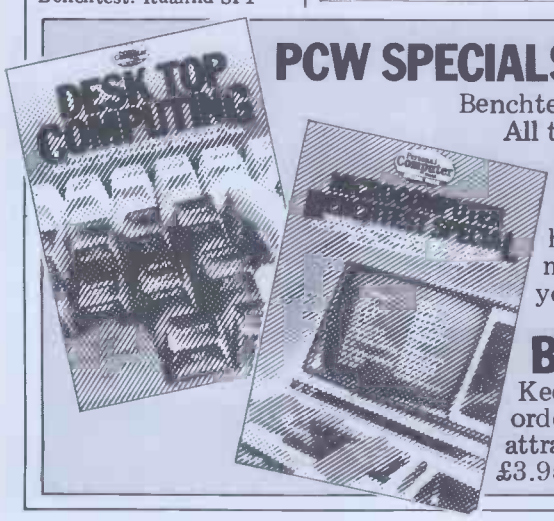

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Volume 4 No 11
November 1981
Benchtests: Osborne 01, IBM Personal Computer. Checkout: Sharp IQ3100 Microtranslator. Calc Corner: Casio fx702p. PCW Show report, Benchmark Summary, Euro Micro Chess Championship report. Programs: TRS-80 Sheepdog trial, ZX81 Sun and Planets.

Vol 4 No 12
December 1981
Benchtests: Sharp MZ-80B Philips P2000/School network/ BBC Micro inside story/ 'Turtle' Graphics for Apple/ Forth language/ Curve fitting/ Calc corner: HP14C review/ Programs: PET Fantasy, ZX81 Battleships and cruisers.

Vol 5 No 1 January 1982
Benchtests: BBC Micro, Xerox 820/Frames of Reference (new series)/ ZX81 Printer Checkout/ Digital Drummer for PET/ Calc Corner: Benchmarks/ Programs: MZ-80K Fortune, TRS-80 Reaction Timing, ZX80 Laybrinth, Apple Letters.

Vol 5 No 2 February 1982
Benchtests: Sirius-I, Casio fx-9000p, Gemini Multiboard/Word Processor Benchtest: Scripsit 2.0/ Plotter Checkout: Watanabe/Hardware feature: High Density VDU card project/Music system: FREQOUT/Calc Corner: Aerial Navigation/Programs: Pet Haemophilia, Pet Cheese, TRS-80 Extra, Sharp PC1211 Exam, Personality test.

Vol 5 No 3 March 1982
Benchtests: Texas Instruments 99/4A, Hewlett-Packard 125/Choosing a Database/Compsoft DMS reviewed/Screenplay (new series)/Calc Corner: Hewlett-Packard Interface Loop/Programs: TRS-80 Solitaire, TRS-80 Ducks, Nascom Business Documents, MZ-80K Race Chase, ZX81 Graphplot.

Volume 5 No 4
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Benchtest: Monroe OC8820/DB Benchtest: FMS-80/Checkout: Sid 1/ Generating screen forms/ Comal/Logo/Brain Dump-

New series/Calc Corner: Casio FP-10 printer/ Programs: TRS-80 Maths & Trig, PET Boot the Cat, ZX81 Resistor & Res code.

Vol 5 no 5 — May 1982
Benchtests: Apple III, Hitachi Peach/Database Benchtest: dBase II/3D Graphics Made Easy/ Equation Solving/Calc Corner: fx 602 quirks/ Programs: PET Mini-Animate, MZ-80K Catch, Apple Maze, Atari Sums For Kids, ZX81 Book Index, PET Stockmarket, Microtan 3D Rotation, Extra for MZ-80K, UK101

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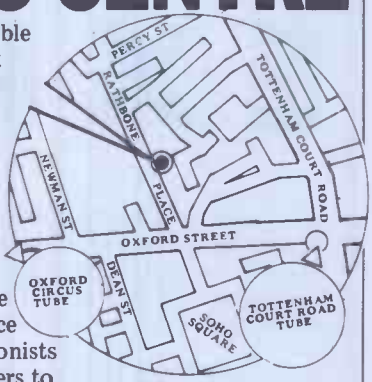

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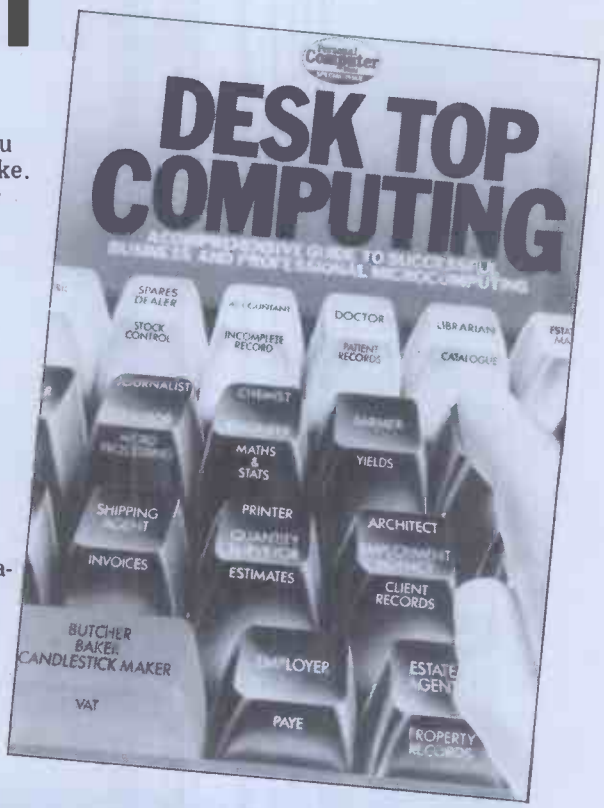

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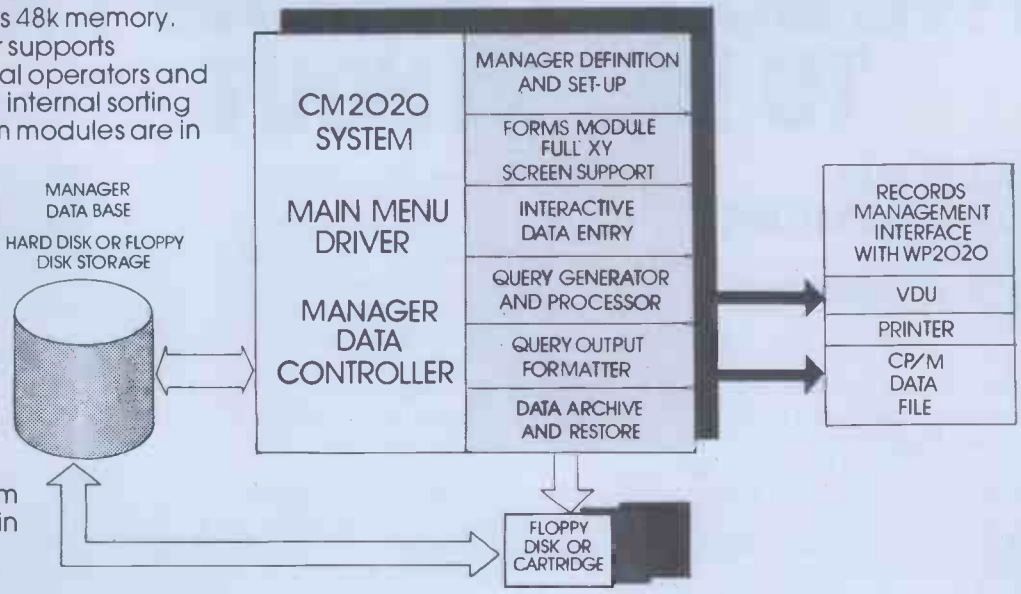

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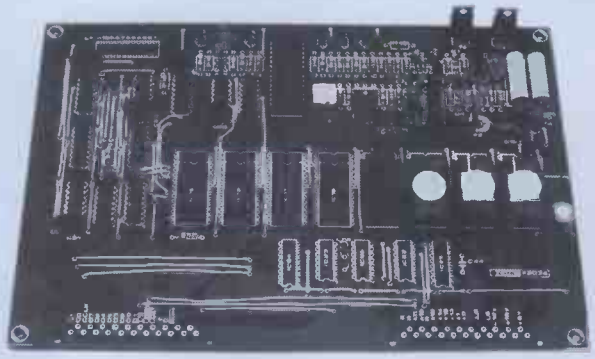

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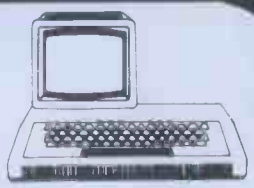

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+5v @ 2 amps DC + 12v @ 800 ma DC
-12v @ 800 ma DC + 24v @ 350 ma DC

and if that's not enough a fully floating 5v output @ 50 ma DC which may be seriesed to give a host of other voltages. All outputs are brought out to the front panel via miniature jack sockets and are also duplicated at the rear on short flying leads. Units accept standard 240v mains input. They are ex GPO and may have minor scratches on the front panels, they are sold untested but in good internal condition. £16.50 each + £2.50 p+p complete with circuit and component list. Transformer guaranteed. HURRY WHILE STOCKS LAST!!

HIGH SPEED DATA MODEMS

A superb piece of engineering made by SE Labs Ltd. to a "no cost spared" spec for the GPO, the Modem 12 is a synchronous Modem for use on DATEL 2412 services, or other data links. Many features include switchable V26 modulation, 2400 baud full duplex 600/1200 standby, auto answer, 4 wire or 2 wire operation. Self test, LED status indication, CMOS technology, modular construction, original cost over £700 each. Believed brand new, supplied complete with PSU etc.

£185.00 + £9.50 carriage + VAT.

*Permission may be required for connection to PO lines.

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S30 front loader, pack change via front door £550 + vat

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+ & – 15v PSU for 2 drives £125 + vat

Carriage & insurance on drives £15.00 + vat fully DEC RK05, NOVA, TEXAS compatable further info on controllers etc on request.

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Professional type mains filters as used by "Main Frame Manufacturers" ideal for curing those unnerving hang ups and data glitches, fit one now and cure your problems! Suppression Devices SD5 A10 5 amp £6.95
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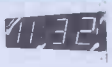
Professional fully cased fan cooled system supply. Standard 240 V ac input with the following DC outputs 5V @ 11 amps + 15-17v @ amps, -15-17v @ 8 amps and +24v @ 4 amps. All outputs are fully crowbar protected and the 5 volt output is fully regulated. Sold tested and in a new or little used condition complete with circuit £55.00 + carr £8.50 + vat DIM 15.5" x 9" x 6"

NATIONAL MA1012 LED CLOCK MODULE

★ 12 HOUR
★ ALARM
★ 50/60 HZ



The same module as used in most ALARM/CLOCK radios today, the only difference is our price! All electronics are mounted on a PCB measuring only 3" x 1½" and by addition of a few switches and 5/16 volts AC you have a multi function alarm clock at a fraction of cost. Other features include snooze timer, am pm, alarm set, power fail indicator, flashing seconds cursor, modulated alarm output etc. Supplied brand new with full data only £5.25
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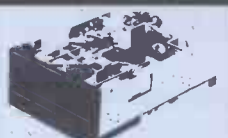

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full technical manual £20.00 alone £9.00 with drive, refund of difference on purchase of drive. Data sheet on request.

SPECIAL new, KODE PSU, drives 2 DRE drives £39.99 + carr + vat

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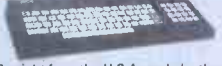

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There are two ways of solving the problem:

1. *Buy a very fast printer. Cost app. £1500 – £2000.*
2. *Buy a buffered printer-interface card for your APPLE. Cost £149.*

The Turbo-card from Torsby Microprocessor, has its own microprocessor and 6K of RAM.

The characters to be printed are transfered into the RAM of the card at machine-language speed. The control of the APPLE is almost immediately returned to the program or key-board, provided you do not exceed the buffer capacity (5,5K).
The Turbo-card transmits the characters as soon as the printer is ready to accept more data.

The Turbo-card increases your system-speed with up to 30% depending on the application.

The Turbo-cardis the first buffered interface card that provide on-board firmware for dumping APPLE Hires-grafics to a printer. The firmware resides in an EPROM. At the moment EPROMs are available for EPSON MX-70, 80, 100, Anadex, IDS Paper Tiger and Centronics 739.

You can use the Turbo-card in just the same way as any other parallel-printer interface card. Just plug it in and go.

Specification

Size: 230x77x10mm.
System interface
Internal: APPLE slots 1 – 7

Processor: 6504
Program memory: 4k EPROM
Other:

Weight: 130 grams
External: Centronics parallel
8 bits, AKN, STROBE
Memory: 6K static RAM CMOS

Glass-Epoxy PC-board. Solder-resist on both sides of board, Component Silkscreen, Goldplated edge-connectors. 1.5M cable including connectors.
Burnt-in more than 10 hours.
Works from Monitor, Basic, Pascal, I/O 1.1 and CP/M.

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Manufactured by STAR Co. LTD., Japan

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And fast! With 80 columns, 80 cps (also 96 and 132 cols.) plus bi-directional, logic-seeking print head.

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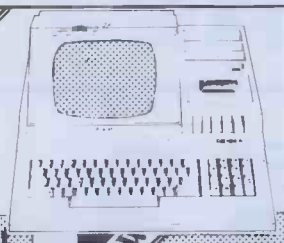
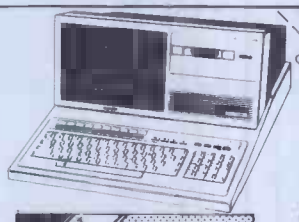


THE MZ80 - A

A SHARPER SHARP



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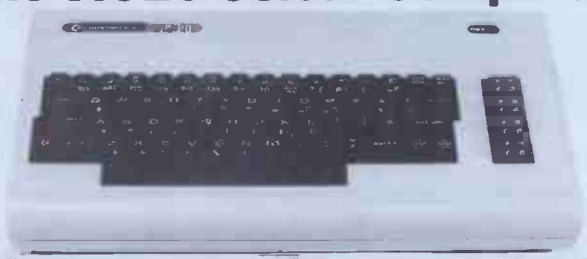

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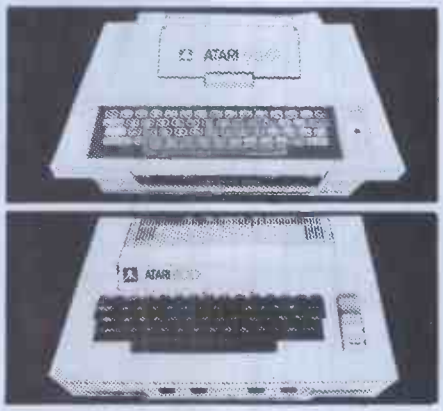

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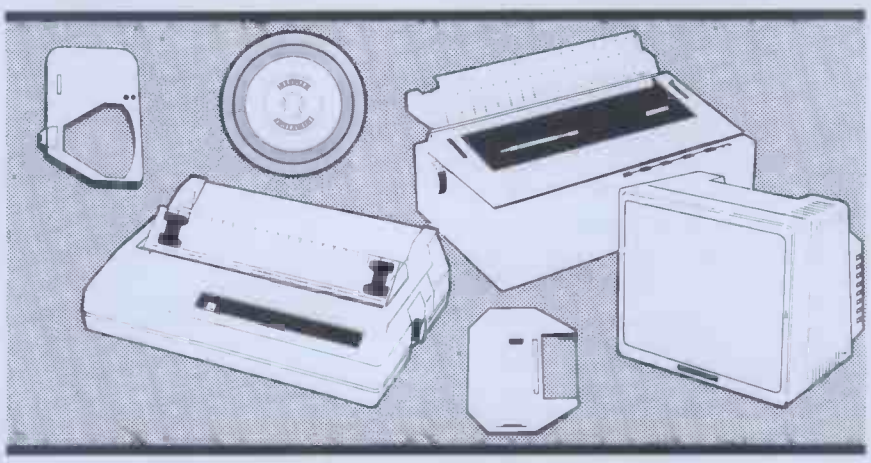

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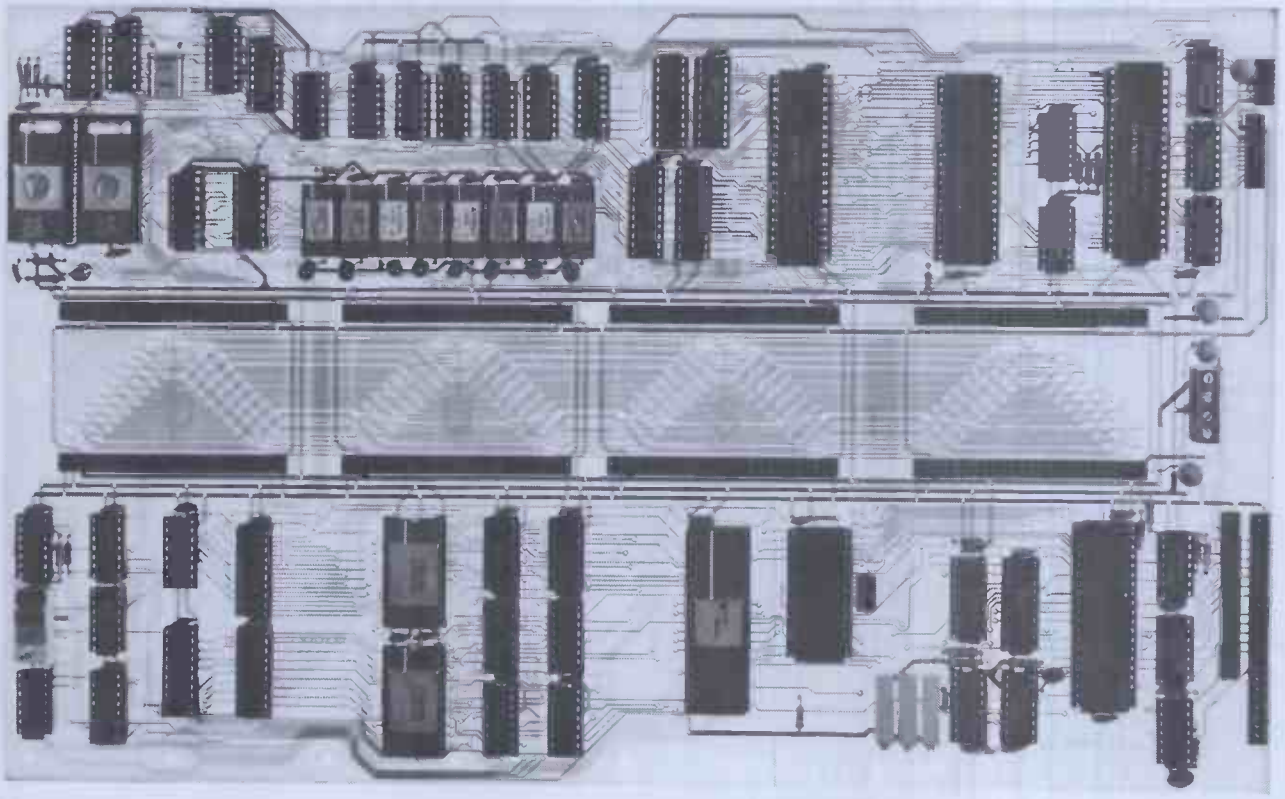

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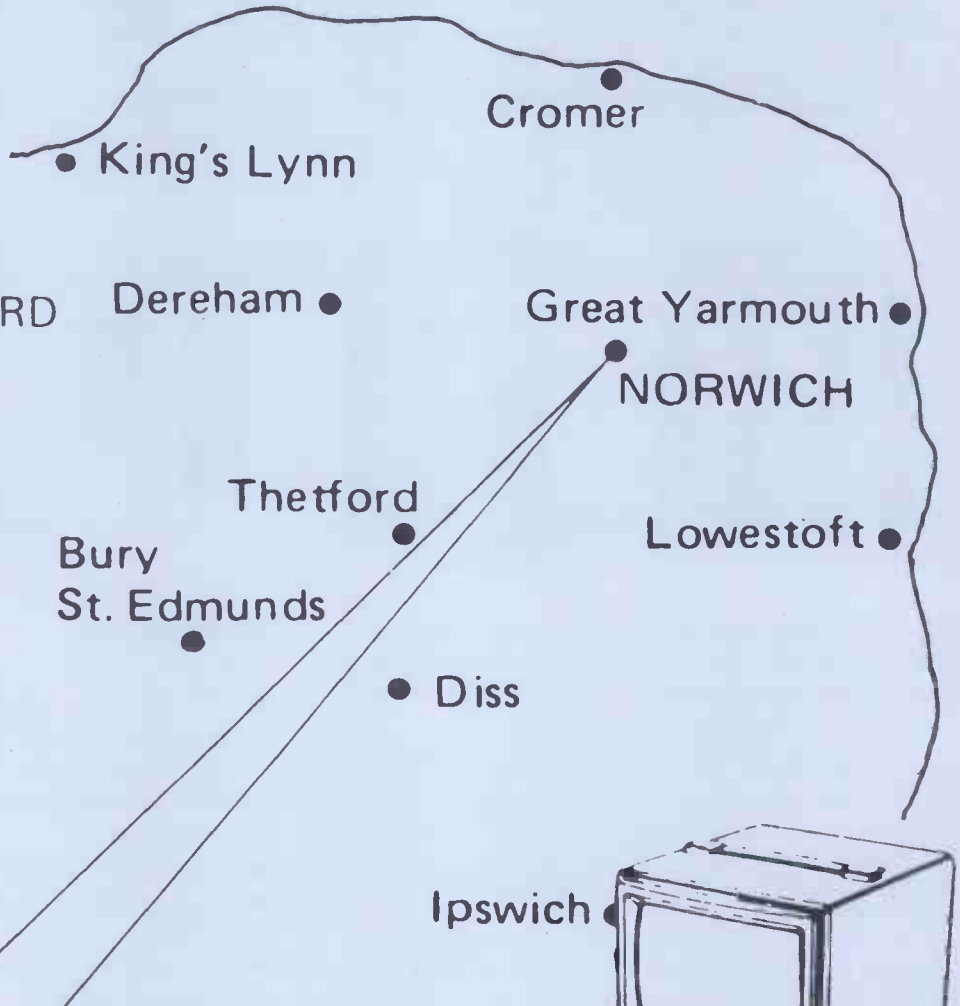

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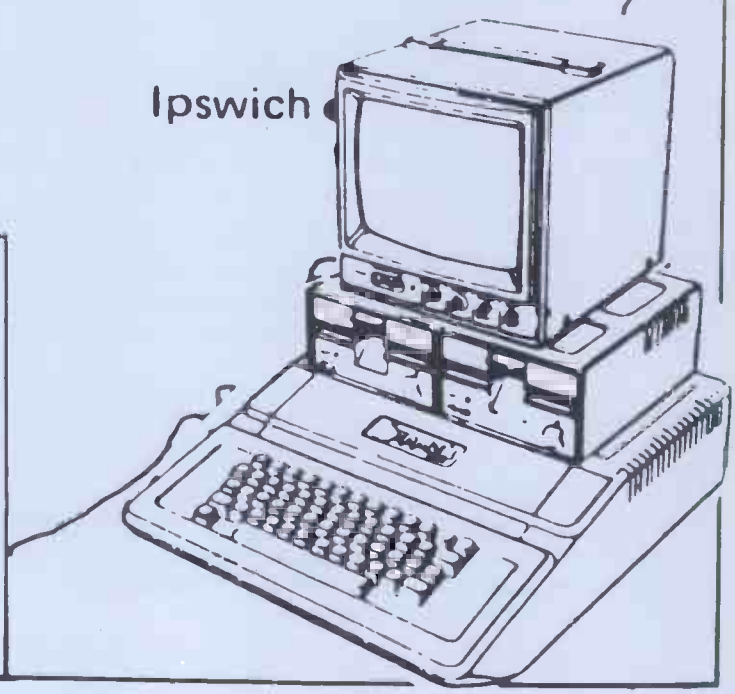

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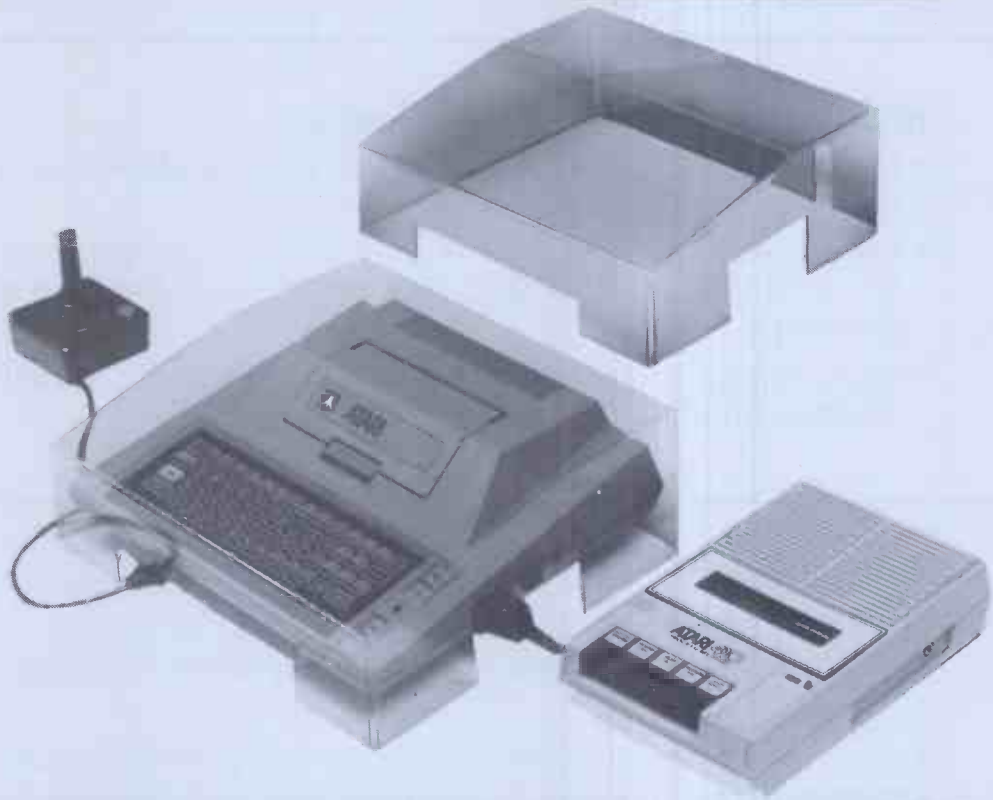

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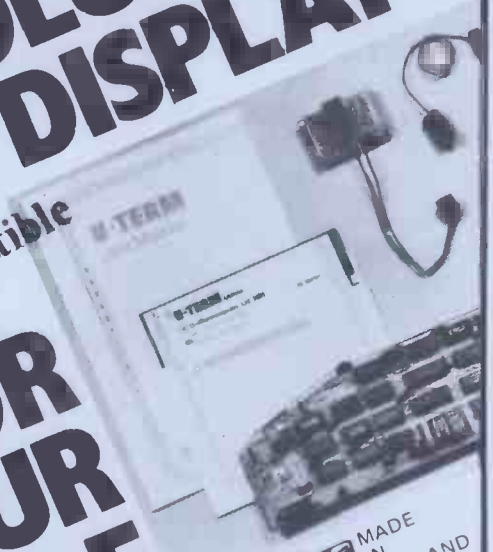

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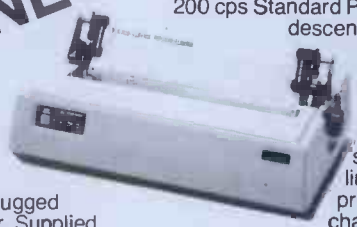

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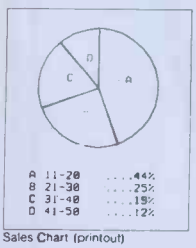

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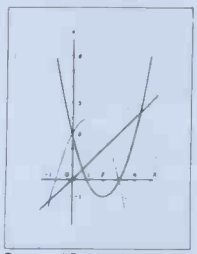
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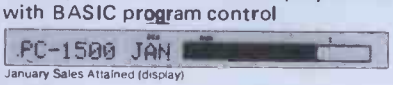

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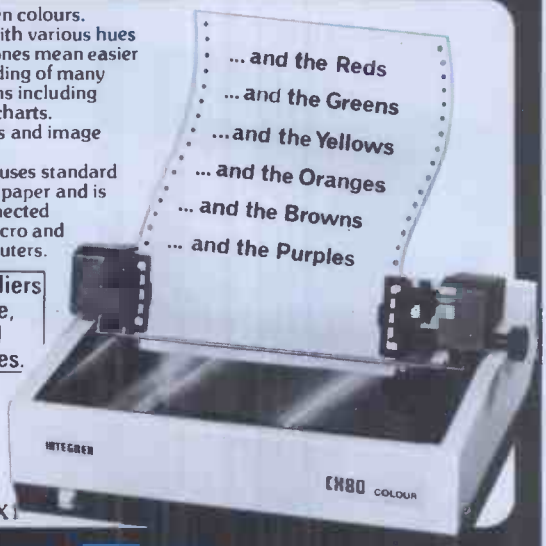

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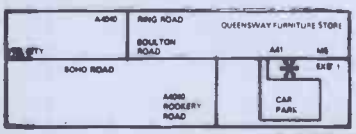

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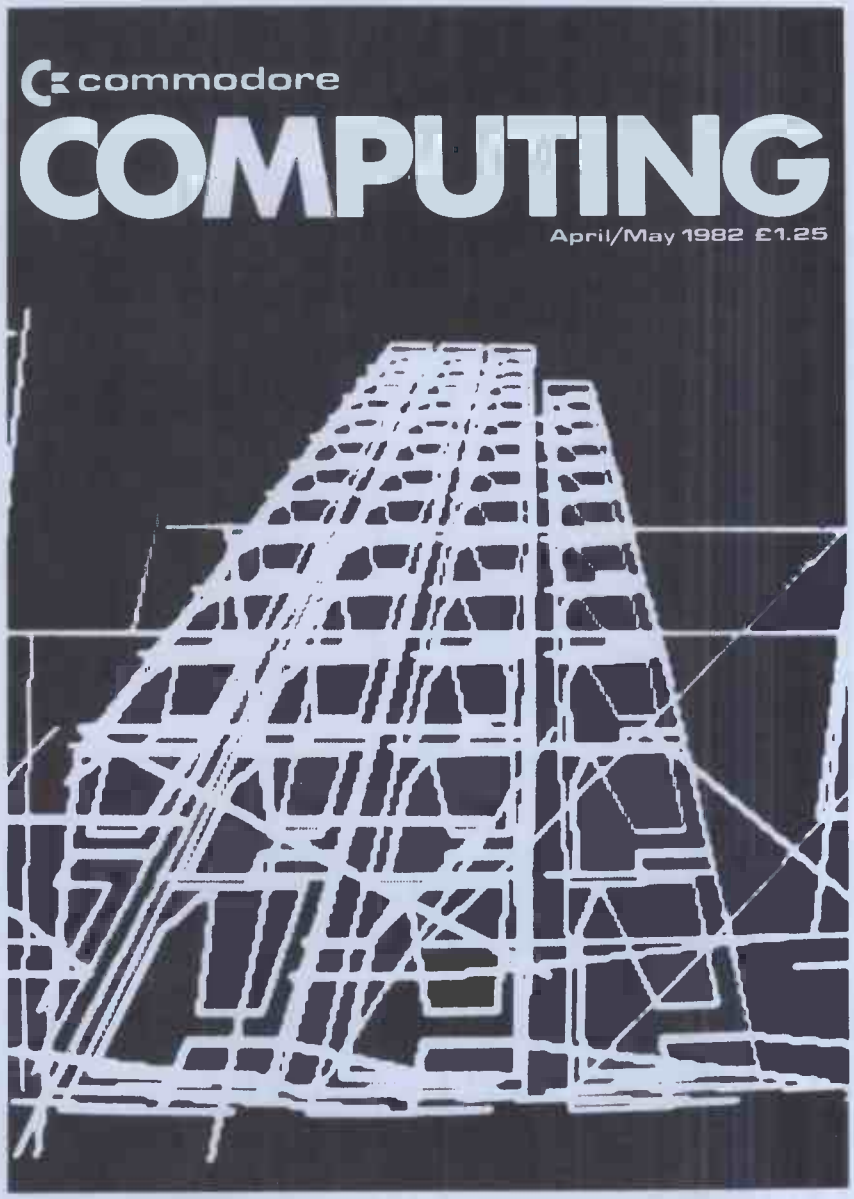

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LISP Functions

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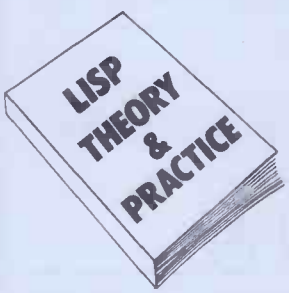

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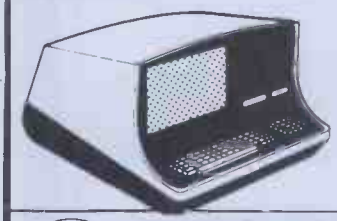

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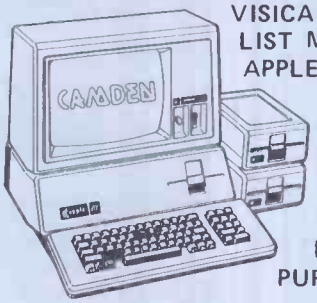

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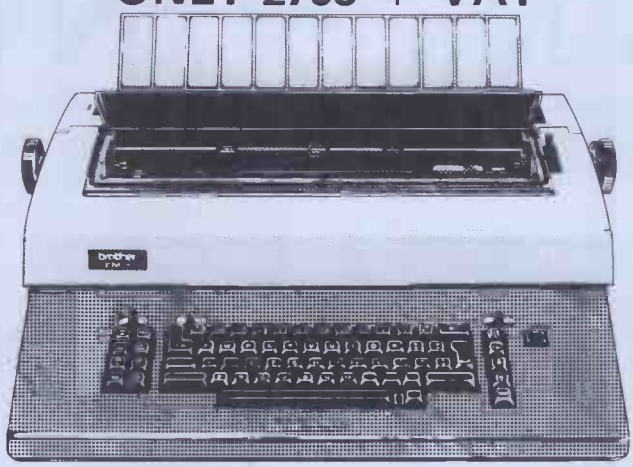

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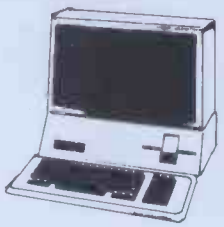

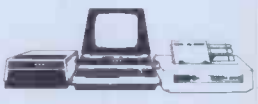

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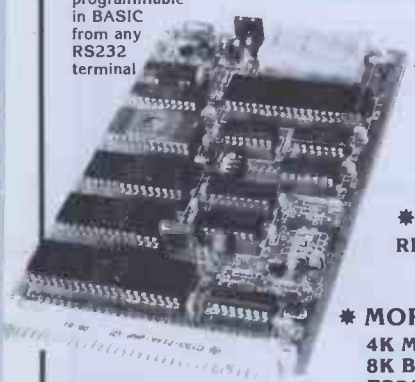

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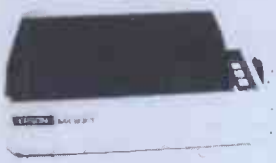

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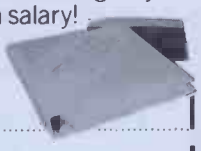

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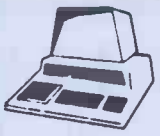

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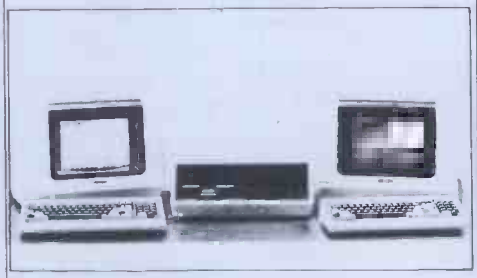

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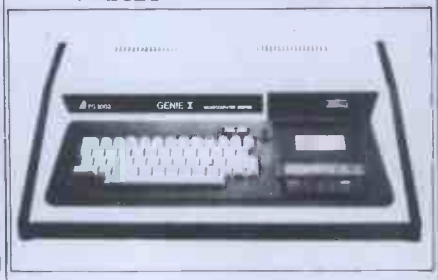

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We describe the design of a light pen for microcomputers. The point on the pen can be used to detect, delete or change characters on the vdu screen. Plus an article on the GPIB (General-Purpose Interface Bus) interface as well as all our usual and unusual regular features.

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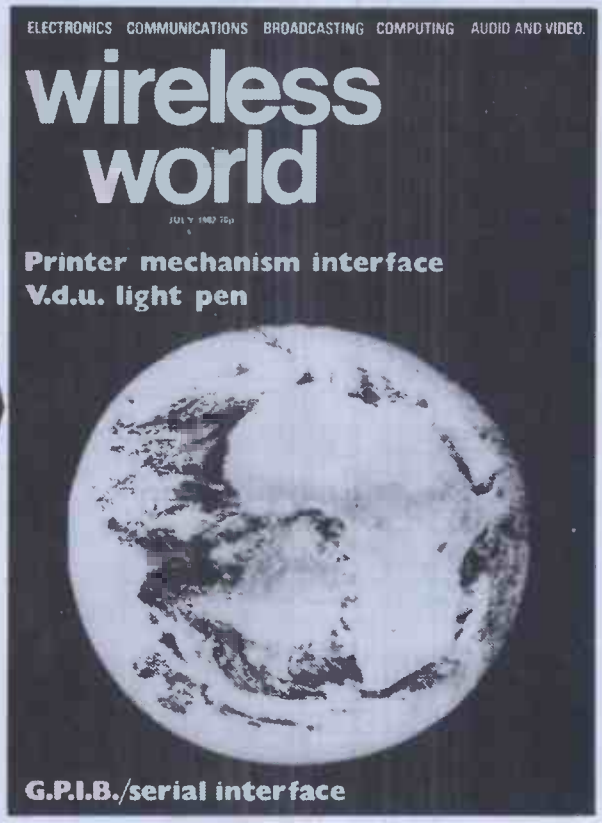

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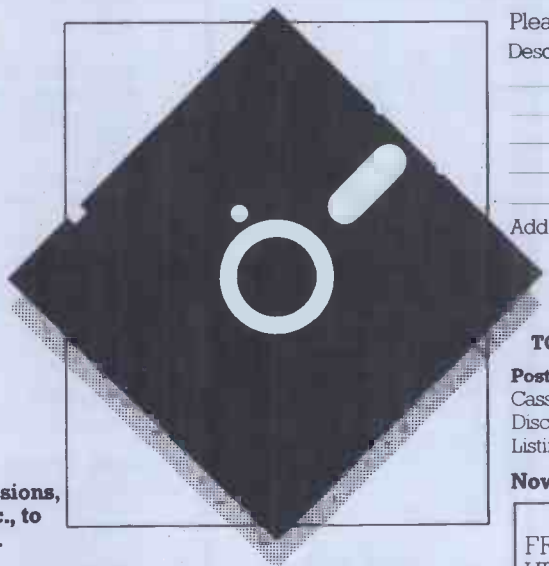

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How many disk drives do I need?
ACCESS will ideally run on 2 drives. However, it will support a single drive system and a version is available for the SyMBfile 5 megabyte hard drive.

How about report formats?
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How is the data stored?
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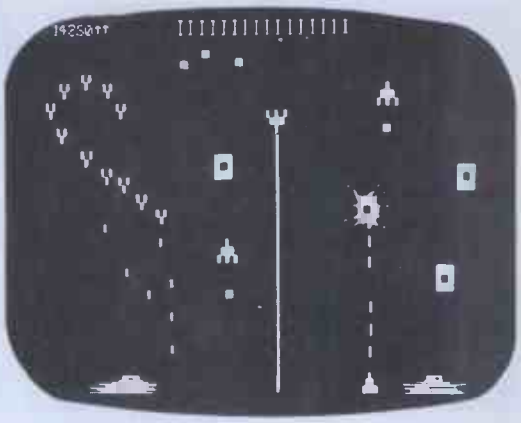

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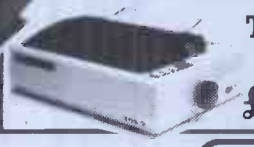

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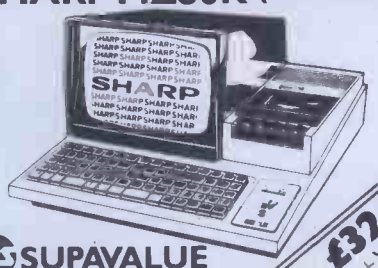

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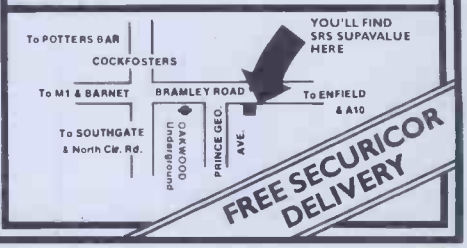

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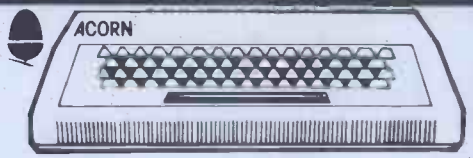

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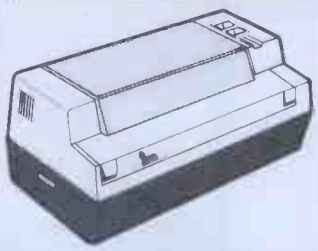

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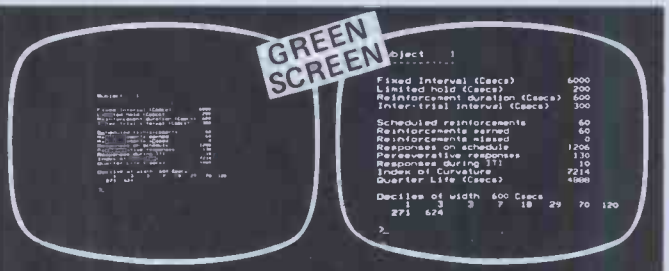

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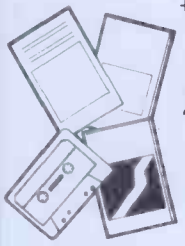

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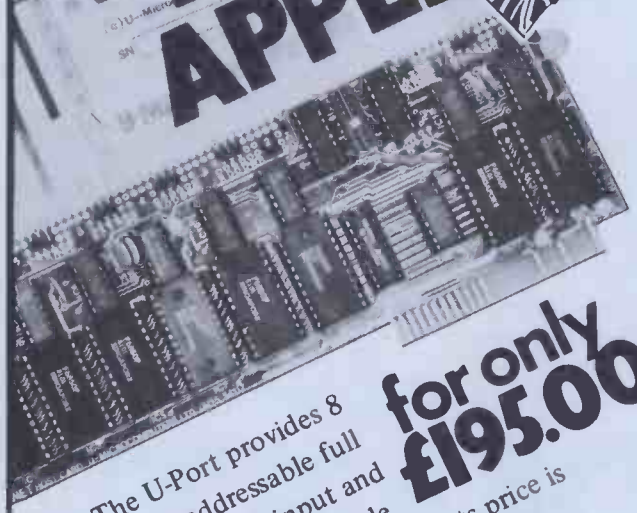

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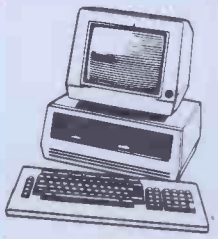

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CHIP CHAT

CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT

Why are the big computer companies so bad at making micros? IBM went to Microsoft for help with its Personal Computer while ICL, Digico and Burrough did OEM deals with, respectively, Rair, Heath and Convergent Technology. As far as we can make out, Data General, DEC and Control Data managed their own designs, albeit very slowly — but that's only as far as we can make out. When questioned, the companies which couldn't produce their own micros tend to come up with phrases like, 'Well, there's no point in re-inventing the wheel. . .' Actually, it sometimes looks as though it's a case of people in the big companies getting fed up with their employers' lack of foresight, leaving to set up on their own and then doing OEM deals with their former bosses. So, if you're a designer with, say, Wang or Prime or Honeywell or Cray and, you can design a micro that's even half decent, resign now and start negotiating. . . Adam Osborne is on the record as saying that the only company capable of offering a serious threat to the Osborne 1 is Sinclair Research. So, now that the Spectrum is launched (but not delivered — see 'Brain Dump'), we're taking bets on a 64k, Z80-based CP/M portable with a bundle of software, at least two Microdrives and possibly a flat screen coming out of Sinclair Research this autumn and selling at — well, less than £500?. . . As we've said so many time before, being a monthly magazine prevents us from bringing really hot, up-to-the-minute news, especially on as changeable a situation as that surrounding the BBC Computer. Here's the latest at the time we went to press — by the time you read it, things will certainly have changed one way or the other: delivery of Model A is down to a 21-day wait for new orders and the backlog has been overcome, but in the meantime the Model B situation has worsened with 12,000 orders outstanding and the end of July being mentioned as the earliest many people are likely to get delivery. . . We can't resist a snipe at Apple UK on this one: for months following its re-launch we tried to persuade Apple's UK HQ in Hemel Hempstead to let us have an Apple III to Benchtest, but without luck. The nearest we got was a letter saying we were on the 'waiting list' and it would be at least six weeks before a machine was available. When, after a further two months, we'd heard nothing, we lost patience and tried to borrow one from a dealer. He was too scared to loan us a machine for fear of terrible reprisals from the Brewer Brothers but 'Big Al' Wood at Digitus wasn't and allowed Dick to live in the Digitus shop for a fortnight while Benchtesting a demo machine. Now Apple has asked if it can buy reprints of our Benchtest!. . . Something of a mystery surrounds Sinclair's ZX Microdrive: is it really a disk in there or could it be a stringy-floppy type of tape? One unkind person has even suggested that the Microdrive at the Spectrum launch might have contained a load of RAM chips. 'Uncle' Clive is being remarkably reticent about the whole thing, refusing to state categorically one way or the other, but it seems probable that it will be a disk and that Sinclair's reluctance to talk centres around the fact that he wants to patent the design before anyone spills the beans. Earlier ideas of using a tape have, it seems, been dropped, at least for the time being, but might be revived if cost/patent/technical problems with the disk prevent its going into production in time for the autumn launch.

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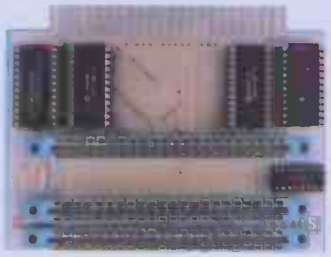

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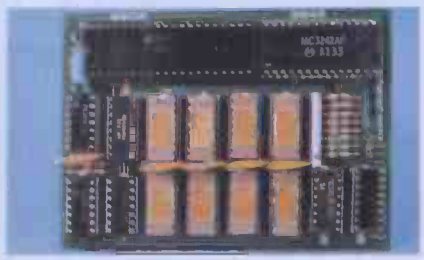

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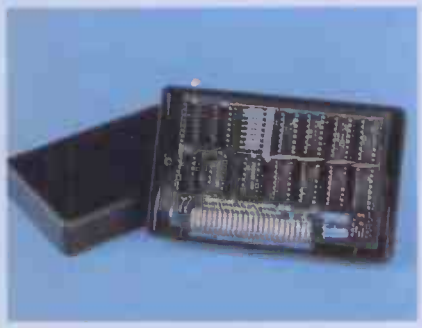

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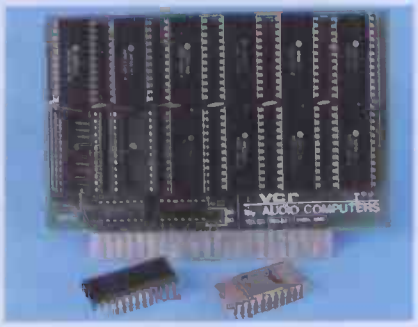

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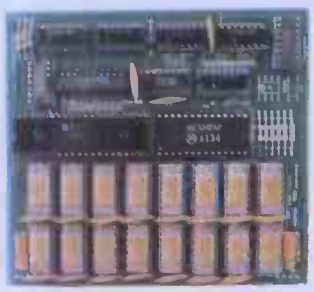

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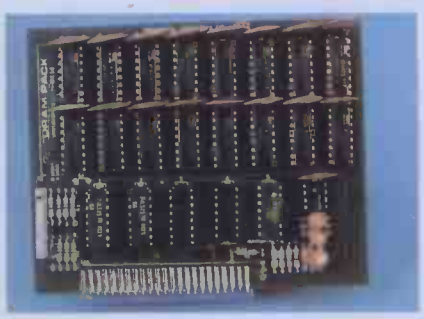

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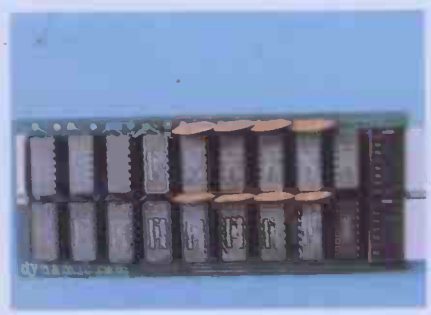

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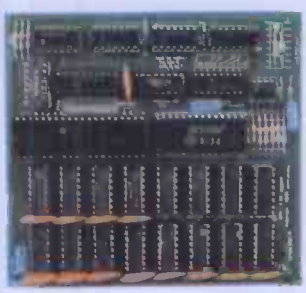

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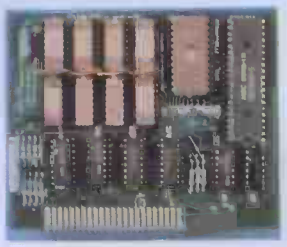

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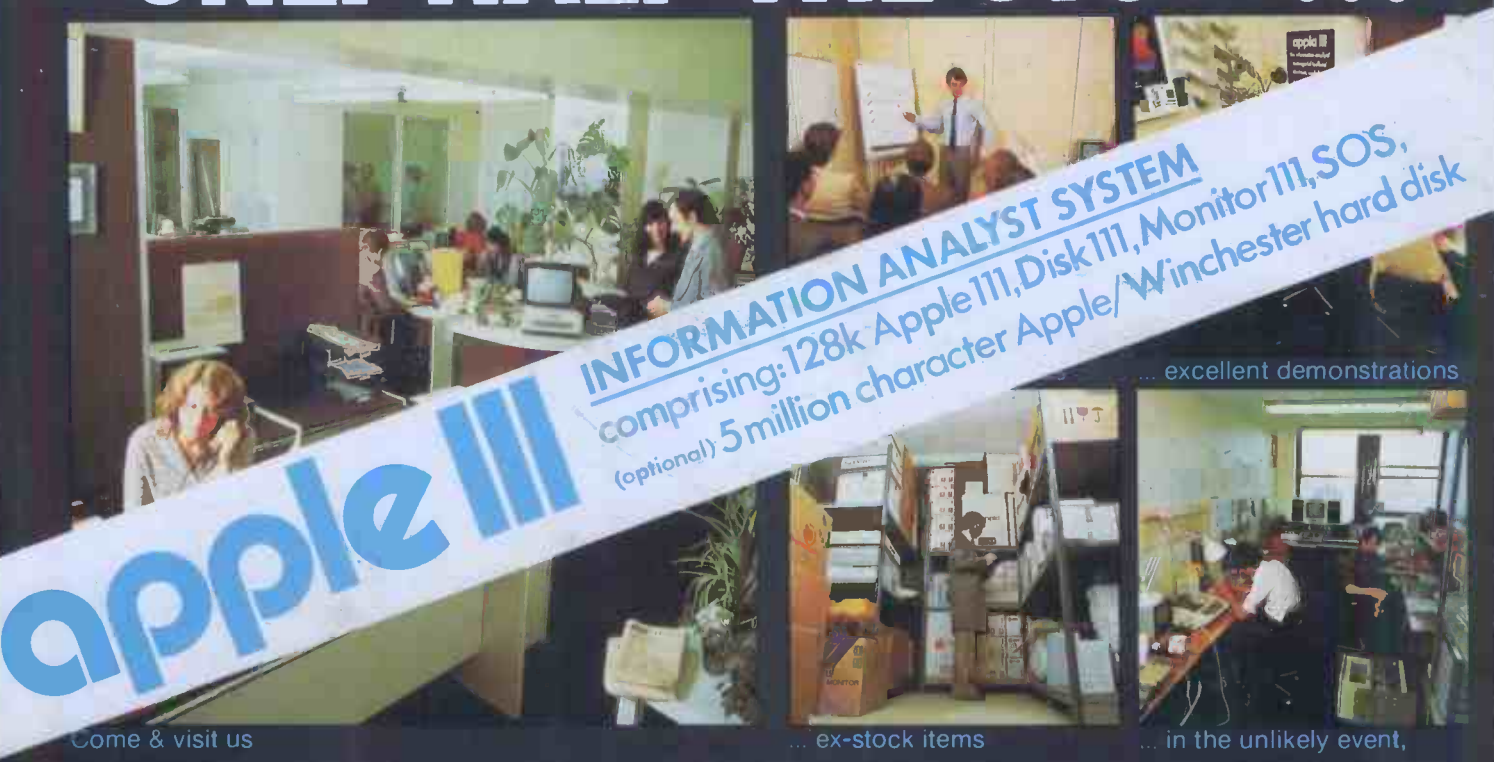

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