Personal Computer World

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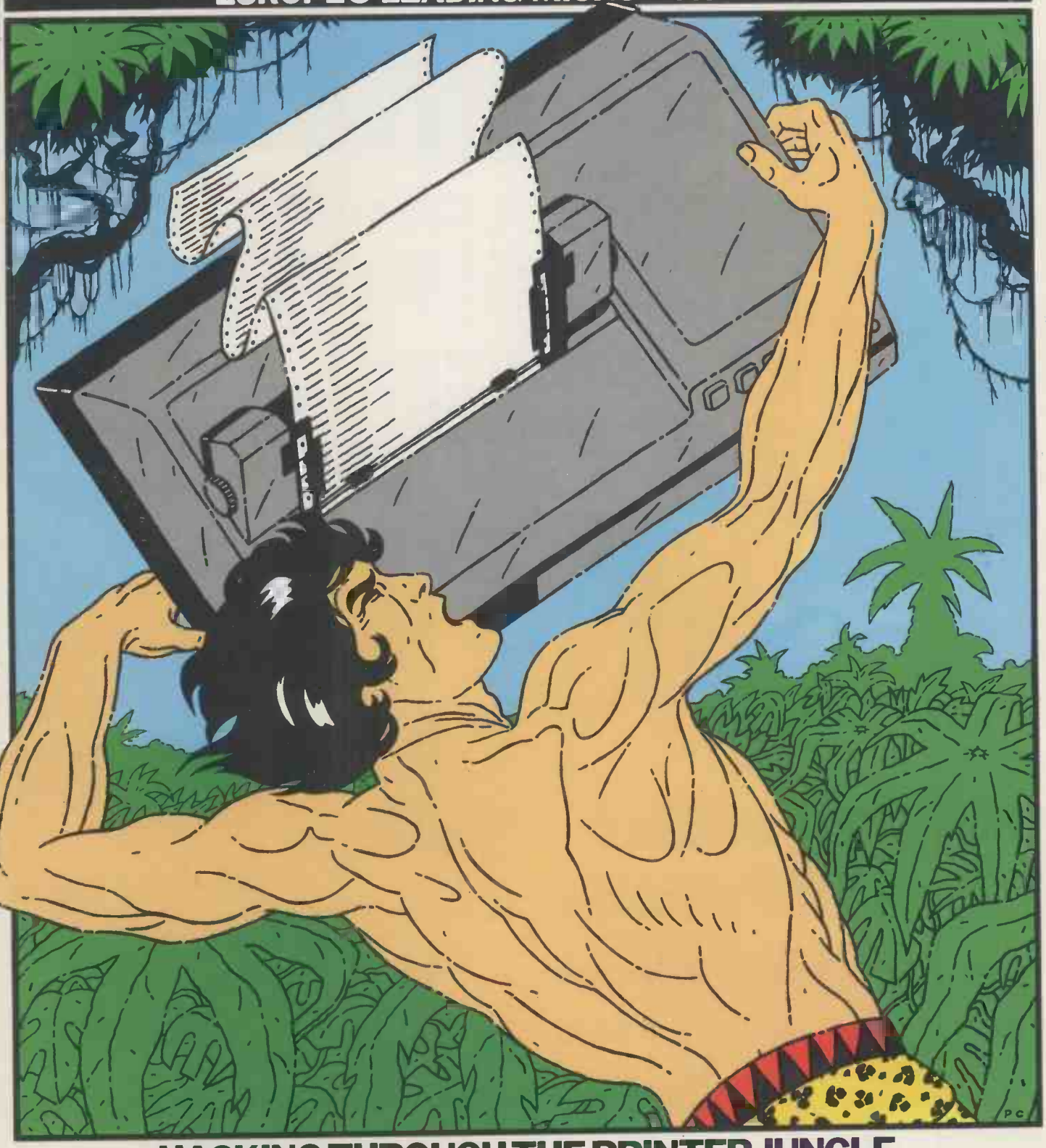

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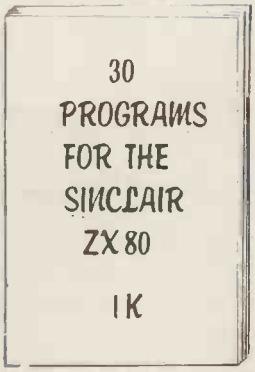

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Sprint 5/45 Daisywheel printer/terminal. Ideal for word processing and general use. RS 232 standard, successfully installed on PET's, Apples, Tandy TRS 80, Sorceror etc...

Wordstar The best word processor for cpm systems. Special version with addressing facility.

Wordcraft Converts a 32k PET & discs into a superb word-processor.

VDU's The most legible VDU's on the market, superbly made and British. All black or seafoam finish. Detachable 62 or 102 key keyboards. Lear Seigler and VT52 emulation.

2684 Microcomputer as VDU's but 2nd Z80, integral disc and CPM, graphics facility.

LA 34 The best desk top , full width, 30cps terminal, 10, 12, 16 characters per inch, optional tractor.

LS 120 180 cps terminal.

11/03 & 11/23 computer systems available with CAP MicroCOBOL, accounts, Autoclerk.

Microline 80 The smallest and quietest desk top printer available (61db) 5,10 or 16 characters per inch, 40,30, 132 wide. Standard machine will take 9.5 inch sprocket feed paper, roll and single sheet. With centronics interface, PET IEEE or user port interface, Tandy TRS 80 directly to keyboard unit without expansion box.

TNW 2000 The only bi-directional PET to RS 232 interface we know that runs Qumes etc. at full speed i.e. 1200 baud £165.00. Also available Teletype 43, North Star, Rair Black Box.

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KINGSTON

KINGSTON — KRK 1

A hardware repeat key for the PET number/cursor pad — a boon to the busy programmer and the ambitious games programme writer. Aided by the detailed instruction programme the average PET owner can upgrade his machine in a couple of minutes without fear of a fatal 'no-no'. **£17.50**

KINGSTON — KRK 2

Initially the KRK 2 was conceived as a definitive full keyboard repeat key. However, Kingston ingenuity has optimized on their patented board accessing techniques to allow two invaluable features to be added:

The first, a warm keyboard reset from otherwise fatal crashes. The second, a selectable keyboard tone which allows touch entry at otherwise impossible speeds. We can say with confidence that this unit is an absolute must for any PET user who wants to get the best from his machine. **£35.00**

KINGSTON — KC 1

A totally new concept in PET's communication with the outside world. At long last the programmer is free from the limitations of the IEEE bus. INPUT, PRINT, LOAD and SAVE to an external RS232 device are now possible without recourse to ingenious/tedious software. A comprehensive on-board firmware package allows all manner of hitherto impossible functions to be achieved including keyboard selectable configuration with full modem control. **£135.00**

KINGSTON — KC 2

Having achieved one level of impossibilities, we knew someone would need more so here it is —

Simultaneous access to two RS232 serial devices or networks with all the features of the KC 1 and more besides. With this device we give PET users serial RS232 I/O capabilities, which the owners of much more expensive machines would envy. **£150.00**

KINGSTON — KSB 1

A twenty-way RS232 multiplexing/switching box with 'mind-blowing' potential — Applications of the unit are legion and range from simple networking through multiple disc sharing to multidevice complexes based on a single processor. **£350.00**

CMC ADA 1200

A low budget IEEE 488/RS232 unidirectional interface, with a proven record of reliability (Field failure rate better than ·1 percent). Since the unit is not addressable it is not recommended for use with the Commodore Disc. **£65.00**

CMC ADA 1400

An addressable IEEE 488/RS232 unidirectional interface, which is proving even more reliable than the ADA 1200 from which it was developed. While it was designed to offer only standard RS232 output it is sufficiently 'beefy' to cope with a number of less demanding current loop applications without modification. **£90.00**

CMC SADI

SADI — The microprocessor based serial and parallel interface for the Commodore PET. SADI allows you to connect your PET to parallel and serial printers, CRT's, modems, acoustic couplers, hard copy terminals and other computers. The serial and parallel ports are independent allowing the PET to communicate with both peripheral devices simultaneously or one at a time. In addition, the RS232 device can communicate with the parallel device. Special features for the PET interface include:

- Conversion to true ASCII both in and out.
- Cursor controls and function characters specially printed.
- Selectable reversal of upper and lower case.
- PET IEEE connector for daisy chaining.
- Addressable — works with other devices.

Special features for the serial interface include:

- Baud rate selectable from 75 to 192000.
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- X-ON, X-OFF automatically sent.
- Selectable carriage return delay.

Special features for the parallel interface include:

- Data Strobe — either polarity.
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Complete with power supply, PET IEEE cable, RS232 connector, parallel port connector and case. **£175.00**

CMC AIM 161

A low budget IEEE 488 16-channel analogue to digital convertor for the competent programmer who wants to 'do his own thing', With a 5·12 volt reference voltage the unit is normally accurate to better than ·5%. **£90.00**

CMC PETSET

An AIM 161 specially configured for plug-in and switch-on use by the less technically graced user. The unit has a number of helpful extras including an input connector board allowing simple screw connection to the outside world. **£135.00**

CMC APPLESET

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CMC TANDYSET

Similar to the PETSET saving that the unit is configured for the TANDY TRS80. **£135.00**

CMC XPANDR 1

Analogue to digital conversion of up to 128 channels can be achieved by simply connecting as many 16-channel AIM 161 units as you need through this smart board. **£40.00**

TNW Corporation

TNW 2000

With over 2,000 units sold, this IEEE 488/RS232 interface can truly be said to be tried and tested. Features include the conversion of both PET and true ASCII, daisy chaining and full address selection.

Standard RS232. **£135.00**
Current Loop. **£150.00**

TNW 3000

A bi-ported, bi-directional IEEE 488/RS232 interface offering everything the discriminating programmer could ask for. Features include independent crystal controlled Baud rate on both ports and fully implemented RS232 with extensive control line options allowing responsive throttling. **£220.00**

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SSM — A10

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Video signals from the Sharp computer are converted to 28MHz and then to 435MHz. Professional standard, vestigal sideband, fast scan TV pictures are then transmitted using 150w of power to feed 176 element antenna. Computer generated pictures have been received over 150kms.

Dear Microfans,

We have been very busy since our letter last month. Sharp have introduced the MZ-80P printer (£517), the dual floppy disk unit (£780), and the PC-1211 pocket computer £91. The floppy disk system is very good giving a total 280K memory per twin disk unit. The printer is tractor fed, capital and small letters plus graphics can be printed at 100 characters per second. We have been using the disks and the printer for two months now and we find them to be reliable and easy to use with the MZ-80K. The new pocket computer has all the usual functions of a programmable calculator plus the convenience of BASIC – it even has an optional cassette interface and commands to operate a printer.

Due to our large volume sales of Sharp Radio, Television, and Microcomputer products we have been able to reduce the prices on the MZ-80K. The 20K model now costs just £459, the 24K model is £477, the 36K is £539, and the full 48K memory MZ-80K is now £577. All our prices include free RED STAR delivery, free membership of the International Sharp User Group, one year's full guarantee, and of course our exclusive offer of 50 free programs. These cover all the aspects of microcomputing and include business, educational, and games programs. Our special dis-assembler, byte searcher, memory dumper, and renumber, are included in this free package alongside the more light hearted Startrek, Cosmic Explosions, and Sharp Organ Keys programs.

As you can see from the above picture I use the MZ-80K for my amateur radio hobby – the Sharp tracks communication satellites for me. We also use the Sharp MZ-80K at work every day to assist in servicing our rental television sets. This application of microcomputers has caused a great deal of interest in the trade and we have recently given three lectures and demonstrations at the Radio Trade Association Conference at Torquay, at a RETRA/PYE "Servicing in the Eighties" training seminar at Edinburgh, and at the Radio Industries Club Gleneagles Conference. There, we took a non technical person from the audience and got him to actually repair a television set being instructed by just the MZ-80K. Since then we are being chased by the National TV Rental firms who want to get the same system. In association with RETRA and PYE we will again demonstrate this application of the MZ-80K at Leeds in November.

The international Sharp Users Group has gone from strength to strength with members in 14 countries. We run this completely independently of Sharp, membership is free if you buy the MZ-80K from us, otherwise it is £3 annually and we will send you the magazines with all the latest Sharp news from Japan and around the World. We will also send you a free "Space Invaders" tape – so you can't go wrong joining, even if you bought your Sharp from another dealer.

We have 60 programs available for the Sharp – send for our price list and ask about our PAYE package which can run on the 20K model. If you are thinking of buying a Sharp write, telephone, or telex for personal service. After all we have been giving personal service to our customers for 40 years and in these troubled times it pays to deal with people who are well established and are interested and involved in the new technology. The latest edition of the Sharp User Group Newsletter details the disks, the printers, the pocket computer, and a great deal of new information about the Sharp MZ-80K – write for a free copy.

Happy computing,
Graham Knight

P.S. Almost forgot to say please add VAT to the above prices and remember we accept Barclaycard and Access.
P.P.S. The Newsletter also has details of the MZ-40K and a review of the recent Japanese micro exhibition.

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Keenstar. A great new range of exciting products that will enable you to exploit your micro to the maximum. Our reputation as one of the country's leading microcomputer consultants and supplier of leading brands is enhanced still further by this latest addition to our extensive range of micros, peripherals, software and services.

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Send off for the new Keenstar catalogue and you will see over 200 interface boards, special applications software and associated products. All designed to let you take the lid off computing. Why go elsewhere when you'll find all you need to build your microsystem under one roof. It's a roof to us, but with the advent of Keenstar there's no ceiling to your system! While you're waiting for your catalogue just browse through the tiny fraction of what is available listed below. Now that Keenstar's arrived you can really let your imagination loose.

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K 20005	N	Wire Wrap Board	30.00
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Outline

each heading desc

Conference (4 and 5 September)

Technology Stream I

Processors and Memory
memory chips – special purpose chips – bit slici – new systems architecture – Motorola 6809 – Intel 8086 – Zilog Z8000 – 16 bit micros

Storage Systems
diskettes – single/double density – single/doub sided – hard disks – 8" Winchester technology fixed/changeable – costs and reliability

Communications
modem technology – PO facilities – data link controls – high level protocols – local area networks – Prestel – personal computer netwo

Systems Review
survey of micro systems – Texas Instruments TI 99/4 – Apple III – Triumph Adler Alphatroni Sinclair ZX80 – other new releases

Technology Stream II

Monitors and Operating Systems
CP/M – MP/M – low level monitors – multi-testi – multi-user operating systems – utility program

Languages
BASIC – Business BASIC – Pascal – PL/1 – API language developments

Programming and Quality Control
program design – debugging tools – project contr – program productivity

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gramme –

s a half-day session

Development Systems
development and programming aids – ROM – EPROM – simulators – testing

Applications Stream

Retail and Distribution
stock control – order processing – point of sale – billing – financial management

Manufacturing
process control – production control – inventory management – job scheduling

Word Processing
special purpose/general purpose hardware – peripherals – displays and printers – cost justification

Professional Office Systems
time recording – client billing – diary management – client services

Teach-ins (6 September)

Game Playing on Micros
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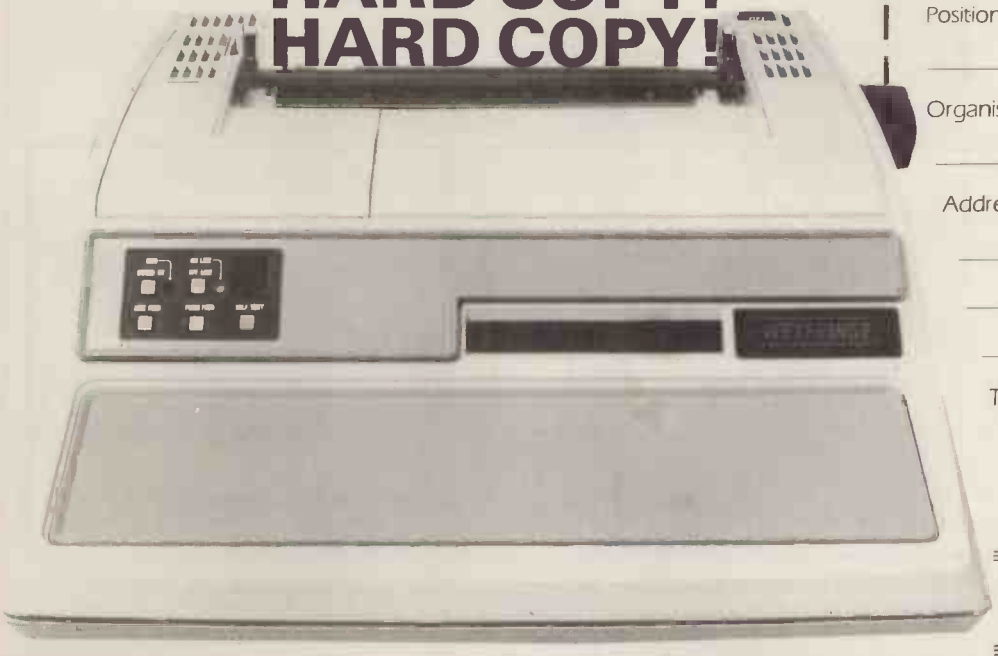

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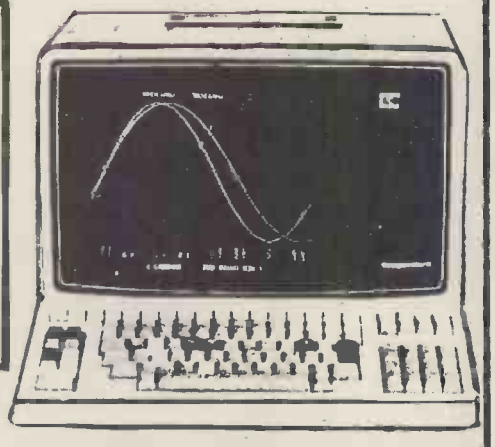

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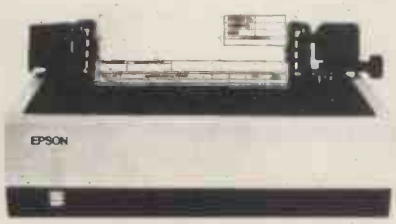

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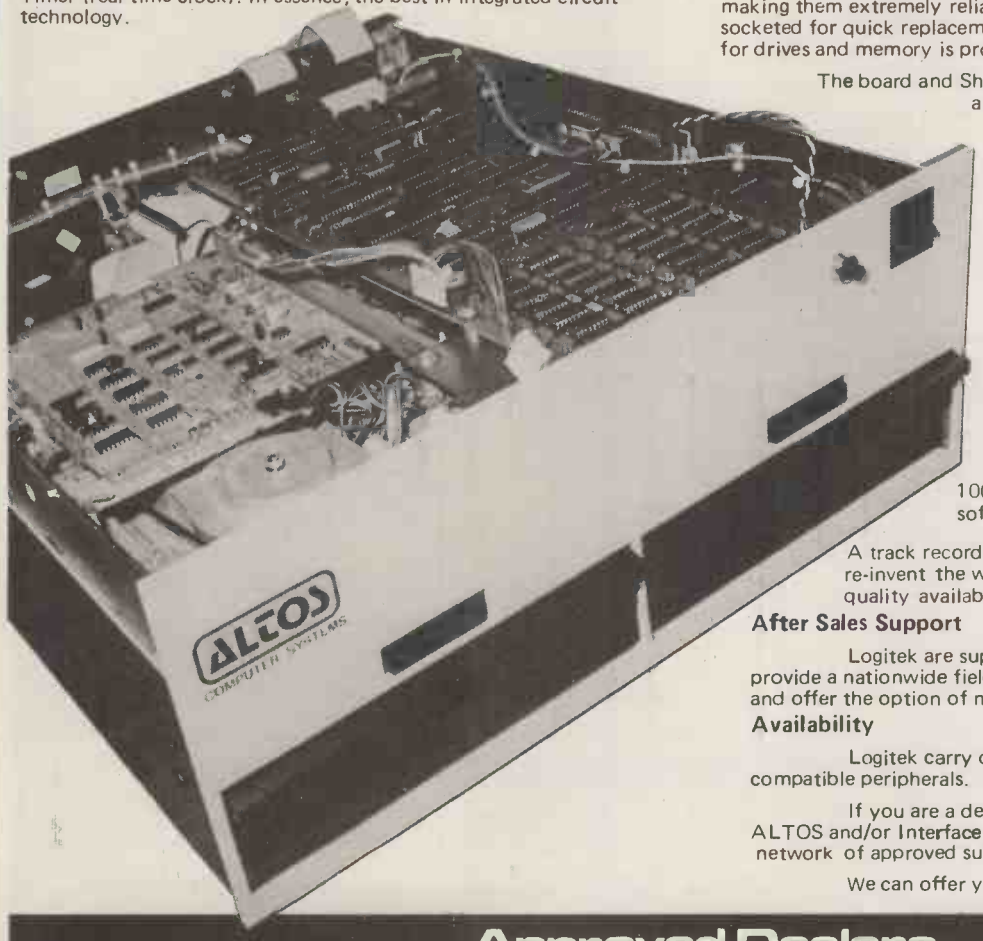

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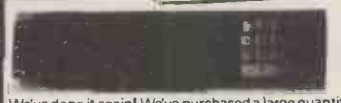

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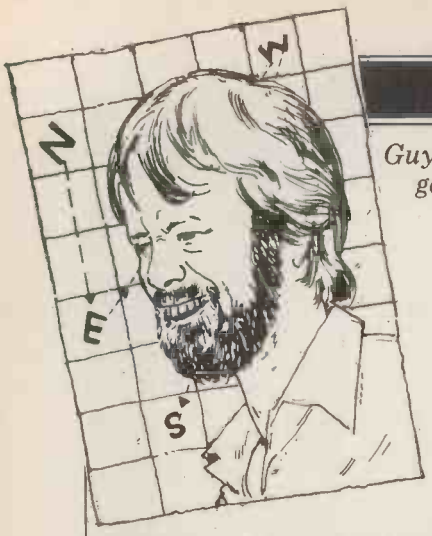


NEWSPRINT

Guy Kewney, PCW's newshound, 'paws' his latest cocktail of product news, rumours, gossip and speculation.

Breaking-in

The way to produce a cheap computer is to put it all on one board, and in one box, a formula followed by the Transam Tuscan.

It's also an S100 computer, which makes it the first such animal. Normally, S100 bus-based computers are described as 'mainframes' because of their apparent similarity to normal computer industry products. They sit in expensive boxes, and have a minimal amount of circuitry on each board, thus requiring the user to buy at least four or five boards to get a working system.

Nigel Stride, director at Transam, claims that the Tuscan includes the equivalent of five boards of 'normal' S100 bus compatible products on one board. This main board will cost £195 plus VAT.

However the really interesting thing about it is that it's aimed to compete directly with large systems built up around PET and Apple — as the following figures, (supplied by Transam) seem to show.

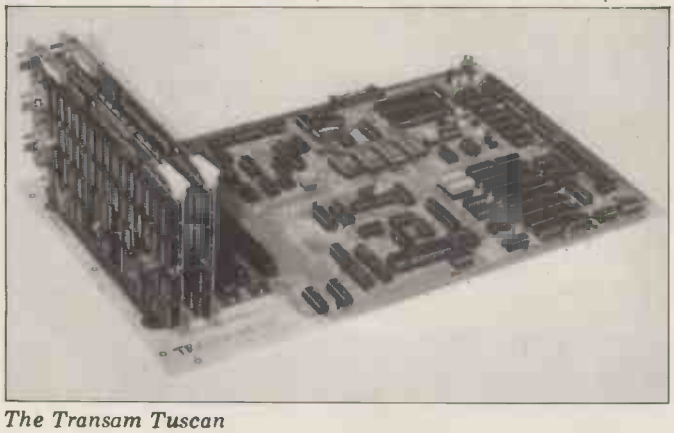
A PET 32k system with dual drives and cables plus a parallel interface would cost £1649. An Apple 32k system with a 16 kbyte expansion memory and similar peripherals would cost £1516. A similar Tandy TRS-80 would come to £1712.

By contrast, the Transam machine would include the standard diskette operating system, CP/M (only the TRS-80 has CP/M out of the above list, and that's a non-standard version) and the S100 expandability, plus a printer interface included as standard, that all comes to £1505.

The machine will no doubt be reviewed in due course in PCW. It's possible that it will be so wonderful that I will instantly agree with Sue Eisenbach, regular contributor to this publication and director of the Advisory Centre of the South Bank Polytechnic.

Sue said enthusiastically: "This is just what we have been waiting for — a Z80 based, S100 computer for a quarter of the price of a Research Machine 380Z!"

It's also possible that this is one of the last chances for a new machine to break through into the market. As things stand, the Appletandypet stranglehold on the software market is still not complete. It remains difficult to find exactly the software you want for those machines, because there's so much dross about, which has to be filtered through. But it's also possible that breaking the grip which Appletandypet has on the minds of software providers (a big market for the software) will require rather more competitive pricing than that offered by the Tuscan. In particular, the Apple price looks dangerously close, and at the £1,500 level, is £11 worth the risk . . . even with integral diskette and CP/M? I'd like to see a little more space between the prices.



The Transam Tuscan

Theirs is the glory

The announcement of the Transam Tuscan has been perfectly timed to benefit from the blaze of good publicity for Transam which was given by Commodore.

Commodore has approved, and adopted, Transam Pascal for use on the PET. The reason is simple enough, it's the only version of Pascal small enough to fit into the maximum 32 kbytes of the PET and leave room for a useful user program; it's also portable enough to be put onto the PET quickly and cheaply.

Transam's software subsidiary TCL Software provides the same compiler on a CP/M diskette for £120.

Just in case the full glory of the achievement hasn't struck home, it should be noted that the Commodore adoption of TCL Pascal is not merely for the UK (important though the UK may be, taking some 20% of the world PET sales), it's world-wide. No other software house had done the work needed to get them into a position to take the prize. Details on 01-402 8137.

Plug-in sorcery

The arcade game company Exidy has sold its Sorcerer to another American company called Recortec, and presumably will become the Personal Micro Computers Sorcerer, when Recortec sets up PMC as its operating subsidiary to market it.

The most noticeable thing about the future of the Sorcerer as planned by Recortec is the decision to keep the Rompak.

Rompak is plug-in software, normally only offered on very cheap video games and by Texas Instruments on its 'home' computer.

It has attractions, Ian Litterick pointed out (Litterick is trying to establish a micro National Computing Centre) because it discourages piracy (nice for the manufacturer) and is quick to load (nice for the user). But it isn't reliable, and it doesn't get into high volume, and, part of the same thing, can't be transferred to other machines.

PMC says it's happy about the Rompak — "We've got the quality problems cleaned up now" — but how convincing a claim this is is a matter of judgement. PMC sells the Hong-Kong built Video Genie, a $500 imitation of the TRS-80. There are some 300,000 TRS-80s out in the field (Radio Shack admits to only 150,000) and some 200 Genies. Perhaps we should save the cheering for a week or two.

Little green Apples

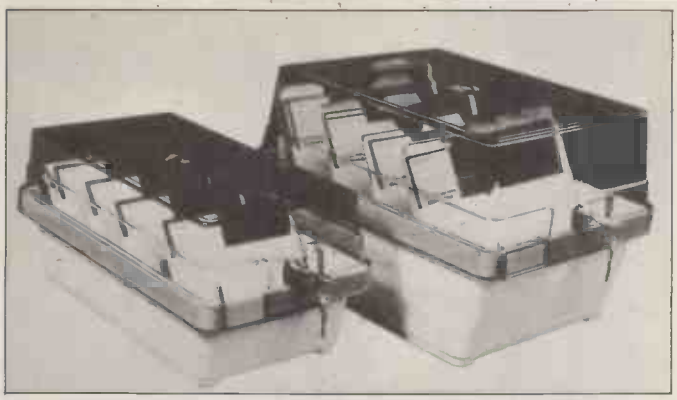
When Apple becomes an Irish computer company, will it mean cheaper computers in Britain?

The question is being most seriously asked by the people who make the alternative version of the Apple II, ITT. Until the two top Apple men — Mike Markkula and Steve Jobs — arrived in London recently to announce the Apple III, the makers of the ITT 2020 thought their future was secure.

It remains possible that Apple is bluffing, in order to get better terms. But the information that Steve Jobs gave me has not been given to ITT direct and that's not the way one starts negotiations when one is anxious to succeed.

The history behind the Apple/ITT deal was, as Jobs put it: "We were a new, struggling company with few resources and they were a big consumer group with manufacturing and marketing ability in Europe. But things have changed."

Indeed they have. The original deal provided ITT with a finite number of Apple II processor boards, which they could adapt to European standards of power and video and market under their own label. When that supply of boards came to an end, the deal would be renegotiated.



The natural successor to the index-card tray is the diskette box. BFI Electronics of Surrey has introduced a box for each size of diskette, capable of storing up to 70. It has a clear top, non-scratch feet, and internal dividers to allow neat storage of just a few. The boxes are said to be airtight and lockable. Details on 01-941 4066.

According to my calculations, based on hints and nods thrown out by ITT a year or so ago, the supply of Apple boards should have seen ITT through to about now.

According to Steve Jobs, who really ought to know, no further deal has been arranged, and if it is, new terms will apply. And, he said specifically, "ITT will not get the rights to make Apple III."

The Irish plans could mean that Apple has no need of ITT any more. The idea is to start with a factory in Cork, and indeed, advertisements to recruit staff have been running in Eire. (A fat lot of good they are doing, by the way. Everybody knows that the minicomputer giant DEC is building a Cork factory, and nobody knows about Apple's plans because, after all, they were secret. So everyone assumes the adverts are to recruit DEC people).

That hiccup apart, the initial plan is to employ around 150 people in Ireland by the end of this year in what is called a peripherals factory but at which Apple II computers will be built. Eventually all European marketing will be handled from Cork, and some 1,430 people will be employed.

Apart from ITT, another discard of this move will be Eurapple, the independent subsidiary which controlled European distribution from its California base. Apple now seems to share my own unenthusiastic view of this arrangement, and is terminating it.

As for the Apple III, it's more expensive, prettier and has more characters on the screen than the Apple II, plus an integral diskette, and you can also stand your book on the keyboard while typing. For the rest, wait for our bench test later this year.

PET payroll

A payroll program which will run on a PET with either Commodore or Computhink disk drives is available from Intex Datalog. It's designed for up to 200 employees, plus 400 ex-employees; some 50 systems have been installed so far, says the maker, and the phone number for details is Eaglescliffe (0642) 781193.

Seek and ye shall find

It was, I think, the late Jean-Paul Sartre who refused to give a young man advice in a ticklish personal and family predicament on the grounds that if he had wanted to be told "stand by your mother," he would have asked a priest and if he had been anxious to be told "abandon home and seduce the wench," he would have asked a soldier friend, and that in asking Sartre, he had shown clearly that he wanted to be told "decide for yourself, don't ask me".

Britain's share in the new chip-making company, Inmos, would appear to be in serious jeopardy, if this logic applies to the visit by Industry Minister Sir Keith Joseph to California.

The Good Knight has had a year or more to decide whether he knew enough about the semiconductor business, and to get basic facts. He could have asked SRI International (and, in fact, he did) and he could have asked MIT in Boston (and he did) and he could have got on the phone to people in California.

The people he actually chose to ask advice from were Intel, through the medium of their publicity organisation Regis McKenna. Sir Keith is not daft: he knows what Inmos's greatest, established, most profitable rivals would say if asked "Is Inmos a good idea?" He was obviously looking for well-expressed, informed and convincing reasons for changing known personal opinions — which had previously been in favour of letting the NEB have the money, to give to Inmos.

Success elevates - like hot air

Commodore, the ex-calculator company which makes the PET, has had a personality reshuffle, with a lot of the company's top marketing people bowing out.

The change should affect American more than British PET buyers, because two of the UK kingpins have been selected for elevation into the international marketing hierarchy.

The reason is simple enough. PET's marketing practices in America have earned it the number three slot although it was ready first, and was cheapest. Tandy is first and Apple second. In the UK, PET is in first slot. Accordingly, American marketing chiefs have been given the boot, and British ones, promotion.

It means that Kit Spencer, the man whose face has appeared on many a Commodore advert in these pages, becomes a nearly-vice-president. He and his Slough-based colleague, Bob Gleadow have been put 'in charge of' international marketing, and 'there is a possibility' that they will be made vice-presidents, according to Dick Sandford, now one of the very top men in the country.

The difference between marketing in America and here is obviously quite important. That difference, Sandford says, is the fact that in America, marketing executives change jobs from one silicon company to another so fast that you hardly have time to see them behind the desk. It's called the revolving door syndrome — an executive comes in one side and out the other. Sometimes, miraculously, he turns from Clark Kent into Superman in the process — sometimes the transformation is the other way.

If that is how business is done on the West Coast, says Sandford, his company is going East — to the Norristown, Pennsylvania headquarters of MOS Technology. It's there the PET was originally conceived by the inventors of the 6502 microprocessor itself; their company was bought by Commodore.

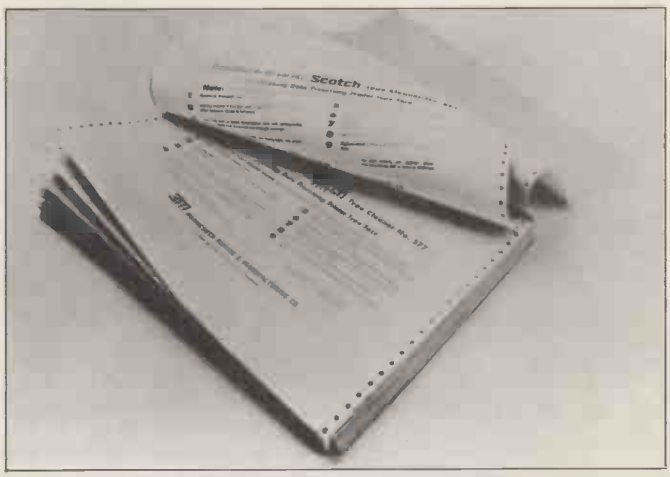
The explanation is interesting but lacks fine conviction. For a start, the factory in Santa Clara is staying, and so is the dealer division boss.

Insiders say two things: one is the unkind suggestion that all the worthwhile marketing people available in California have tried Commodore desks for size and found them uncomfortable, and the second, the unarguable fact that UK marketing has done a good job while California marketing has not.

Just to drive the point home, the one thing UK marketing has done that US marketing has abstained from doing is — advertising. No Commodore advertising has ever been placed by Commodore in the US . . . dealers have, but headquarters has not. In the UK, dealers have contributed to advertising but Commodore has coordinated it. Impressed?

Siriuser and siriuser

Sometime, (way back in the middle of last year) a couple of people with pretensions to a sense of humour decided to set up a partnership to do something serious. They started to produce micro-processor-based professional sound-mixing consoles and they graduated from this into becoming suppliers of



It may look just like computer print-out but it's in fact a printer cleaner. You feed it into your printer and as long as it makes marks on the paper without its ribbon, the type is dirty. When it comes out clean, the type is clean. It's Scotch Type Cleaner no 577: details from 3M on Bracknell (0344) 26726.

software for Ohio Scientific computers. This, they tell me, they still do.

The sense of humour manifested itself in a decision to register the partnership as Sirius Cybernetics, taking their cue from the remarkable radio series, *The Hitchhikers' Guide to the Galaxy*. It has been mentioned (the series, not the company) on these pages in the past.

The first prototype console is due to appear late this year. It's based on the OSI 502 processor board which uses the 6502 microprocessor. The partnership, still being quite serious, then went on to design boards and write utility software, both compatible with the OSI gear, and adding facilities which Ohio had neglected to provide.

The first was a pair of line editor programs, SC101 for the C1 Superboard, and SC 201 for the C2 and C4 Ohio systems. These are sold via the sole distributors, Mutek in Corsham, Wiltshire, and are about to be superseded by a new, faster and more elegant version known as the SC-1202.

Serious things came to an end with a jolt when the partners found mention of a company called Sirius Cybernetics Ltd of Leamington Spa. It was mentioned in these pages too, but the partner concerned, Richard Elen (who edits an audio magazine called *Sounds International*, I think) read it in *Kilobaud*. (*what's that? — Ed*). It's another magazine. (*Is there another one? — Ed*).

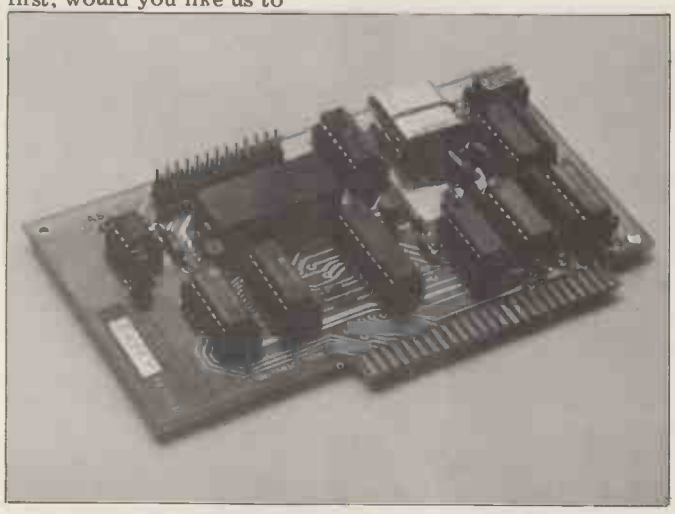
That nice Mr Elen wrote at once to his partnership's namesake, apologising for having inadvertently trodden on toes. Over to Richard Elen.

"We wrote: 'As it seems that we are working in rather similar fields (and listen to the same radio programmes) and as it appears that you quite likely had the name first, would you like us to change ours to something else?' — expecting the answer 'yes'."

Well, continues Elen: "Surprisingly enough, our partnership (which had graciously *not* had notepaper printed yet, just in case) heard nothing of the sort from Mr Sirius Cybernetics *Ltd*. In fact we heard nothing whatsoever. And there was no such company listed in the Leamington Spa phone book (or anywhere else, for that matter). In fact nothing further was head of SC Ltd until our eyes were attracted to a writeup in *Computing* and in the June issue of *PCW*. Here, SC Ltd were mentioned as the producers of a SWTPC compatible memory board — but again, no telephone number was given. Nobody seems to have seen one of said boards, either. Perhaps someone can shed some light on the subject?"

It won't be me. I had a phone call from Mr Cutler of Sirius (Leamington) claiming to resent my suggestion that he was a mindless jerk. I suspected a prank: for those who can't get Radio 4, the marketing division of the Sirius Cybernetics Corporation is defined in the *Hitch Hikers' Guide* as "a bunch of mindless jerks, who'll be the first against the wall when the revolution comes," — quote from the Douglas Adams' script. One could as convincingly pretend innocence about a maternity home called Some Mothers Do Have 'em. I told Cutler as much, and promised to believe in him as soon as he sent me a photograph of his products. It still hasn't come.

The partnership, however, does exist and it's a prime mover behind the UK OSI user group. Contact Richard Elen and George Chkiantz at 12 Bennerley Road, London SW11 6DS, or phone George on 01-228 4839. Or again, contact the distributor, Mutek, on 0225 743289 in Corsham, Wilts.



Wego computers has been appointed distributor for California Computer Systems cards — including interface cards for Apple II, plug-in audio-video attachments to PET, and some S100 products. Details on 0883 49235.

The 'smallest and cheapest acoustically coupled telephone modem on the market', the Sendata Model 1071 weighs only half a kilo and costs £149 from Peripheral Hardware.

The company also imports a slightly larger, faster model 1080: details on 01-941 4806.

Sinclair/Cary -where are they now?

There are still people to whom the Sinclair ZX 80 is merely a number and a few letters — and to whom the news that Sinclair has settled his fight with Chris "Spangles" Cary will come as a perplexing non-informational item. For those of you who want a full resume of the whole fight, I can do little better than refer to the 12 June copy of *Computing*, where there is a long piece explaining it all most lucidly (I wrote it). For the rest of you, the news is simple: Uncle Clive and ex-DJ Chris settled it before they went to court.

The terms of the deal are very pleasing to both sides and anyway neither wanted a long, inconclusive and, most important, expensive legal battle. Cary had set up his new company, MicroAce, in Orange County, California, and was anticipating some problems in supplying the UK kit market; he wasn't all that keen on having to turn out ready-built computers. Sinclair, on the other hand, was equally dubious about supplying kits to the US market.

Uncle Clive had nerved himself up for the effort. He told me, about a week before the hearing of his injunction against MicroAce (preventing MicroAce from copying the ZX80 keyboard), that his original plan had been not to sell kits: "Then I found that a great many American kit buyers were asking for the ZX80," he said, "and we have been very pleasantly surprised by the low number of returns from builders. It's such a simple kit that most people manage to get it working straight away."

So Sinclair had decided to try and sell kits to Americans. It wasn't a simple plan, nonetheless, and the idea that Cary might like to take on the responsibility must have struck like one of those cartoon film 'IDEA!' flashes.

The American sales campaign for the ZX80 doesn't start until August, although both Cary and Sinclair will be showing the device at various trade fairs before then.

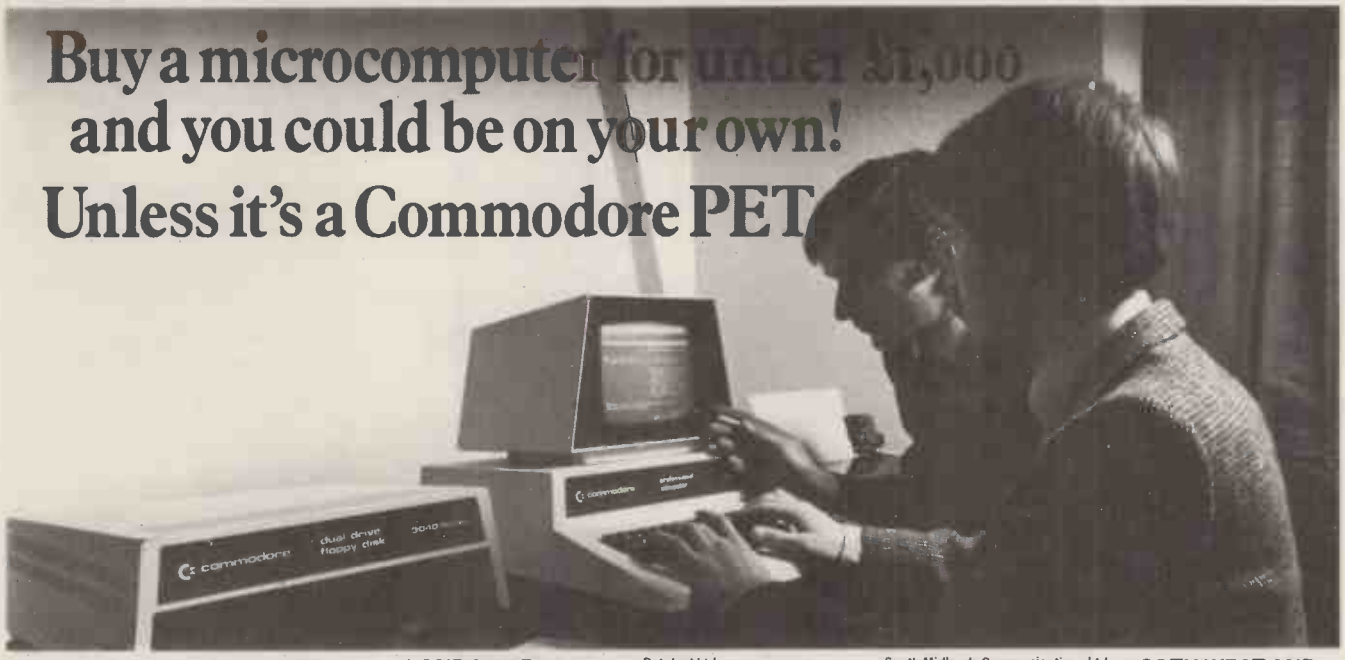
The all-important Federal Communications Commission approval for the microcomputer has been given for the Sinclair machine. It does not broadcast more than the strictly defined limits allow — a situation Uncle Clive has achieved by lining the inside of the case and the underside of the keyboard film overlay with metal, turning the whole surround into a Faraday Cage. The MicroAce does not (yet) incorporate this improvement: however the FCC rules don't apply to kits until January 1981, so this shouldn't prove to be a problem. The nice thing about the whole saga is that one is no longer bound to pretend that the MicroAce is not a copy of the ZX80. The nasty thing about it is that it means the MicroAce will not be sold to UK buyers for £50 after all.

And the fascinating thing is the fact that the Americans will be buying the system for less than the British — despite the fact that it's made in Britain — and even so, Sinclair expects to sell no more than four times the UK market size in the US. He analysed, "I think figures which purport to show that Americans buy ten times what we do, or even 20 times, are derived from products which are launched in America and then sent over to Britain. The market there is always a year, or two years, or even three years, more advanced, so it looks much bigger but I've always found that it roughly follows population."

So: we aren't getting any MicroAces — not legally — because Cary 'submitted to'

Buy a microcomputer for under £1,000 and you could be on your own!

Unless it's a Commodore PET



Commodore produce Britain's number one microcomputer. But we don't stop there. We also insist on providing comprehensive support throughout our national dealer network.

Our dealers can examine your needs and demonstrate which hardware and software will suit you best. Their trained engineers are always at hand and a 24-hour field maintenance service is available. Your local dealer can tell you more about the following Commodore Services.

The Commodore PET

The Commodore PET computer range covers everything from the self-contained unit at under £500 to complete business systems at under £2,500.

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Our software range covers hundreds of applications. Business software includes Sales and Purchase Ledgers, Accounting, Stock Control, Payroll, Word Processing and more. In addition over 50 Petpacks are available covering such titles as Strathclyde Basic Tutorial, Assembler Development System, Statistics, plus our Treasure Trove and Arcade series of games.

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Compatible products of other manufacturers with Commodore's mark of approval are also available.

Commodore Courses

Commodore offer a range of residential training courses and one day seminars. An excellent start. And when you have installed your system the PET User's Club Newsletter can keep you informed of new ideas and latest developments.

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Position _____

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Intended application _____

Do you own a PET? YES ☐ NO ☐

commodore

The makers of this printer are Weyfringe of Cleveland (Teeside) and it's the Century "to meet the print-out requirements of a wide range of microsystems" which apparently means it has an RS232 interface. I am printing the pic only out of a sense of mischief: I like the keyboard. Details on 0642 470121.

(that is, did not contest) the injunction prohibiting UK sales. The question of what we will get is vague. Sinclair himself doesn't say, partly for genuinely commercial reasons of secrecy, partly because of his slight tendency to paranoia when it comes to press statements, and partly because he hasn't yet made up his mind. He will offer add-ons for the machine, is my guess, but just what they will be remains to be decided.

You can ignore, however, suggestions that it's technically impossible to expand the system using the denser memory chips known as dynamic memory. Dynamic memory does need refreshing if the data is not to evaporate, and on the ZX80 micro the Z80 does provide a refresh line which Sinclair has used for controlling the television signal. All these things have been said, and all are true. It's also true, however, that most dynamic memory boards are designed for micros other than the Z80, and include their own refresh circuits. One such will be designed (by somebody) for the ZX80, you see if it isn't.

It won't necessarily be Uncle Clive who designs it, however, Whatever his plans for this market, they don't necessarily involve the ZX80 itself. He's described the machine as a 'nine-month wonder' — a phrase which should not be interpreted too literally, but which certainly indicates his way of thinking.

By this time next year, he expects, I think, to have sold some 20,000 to 25,000 UK systems, and maybe twice as many in America; but he also expects that this will be half the total demand for the ZX80. By then, newer ideas will have arrived in the 'video-calculator' market (as it might perhaps be called). And there'll be many who continue to buy because they've designed courses around the ZX80. And people who have built interesting software which runs only on the ZX80 will generate sales too, because by then inflation and price cuts will have brought the price of a kit down to £50 or less, effectively, and anybody who wants one can have it.

At that point, Sinclair and Cary expect the sales to tail off quite sharply. They may be wrong; I think there's a year more life in the product than they imagine, although of course, it won't be at the present, astonishing level of sales. By the time you read this, Uncle Clive will have passed the 10,000 sales mark, and Cary will have 2000 kits in a California warehouse waiting to go out. That's a remarkable performance. I just hope somebody is showing these figures to the Prime Minister, who still clings religiously to the notion that any commercial venture worth considering will be done by the Thorns, the EMIs, the Plesseys, the Sonys and other established giants. Sometimes, I wonder if, if . . .well, if her belief in the Welfare State isn't actually more deeply ingrained than anybody else's: that Somebody Big Out There Will Look After Us, if we Just Give Them The Chance.

The Currymen

The men who are going to lead washing machine retail chain, Currys, into the micro age have been named as Ian Smith, John Hubble, Geoff Sheridan and Jim Minnis. Smith is in charge of regional sales for London and the South East — which may one day be an onerous task, but for now it involves setting up the Micro C micro shop in New Malden, in south London's suburbs. Hubble covers the West Midlands — and establishes a store in Birmingham, off Union Street; Sheridan is covering the East Midlands from a Nottingham shop; Minnis sets up shop in Bristol.

Learning the game

That rather large company, IBM, is widely believed to have no part in the micro-processor market. True, in America it has set up one or two typewriter and dictating machine shops where the 5100 range of desk-top computers will be sold and software services provided, but that's hardly a threat to Radio Shack (Tandy).

Just as a snippet, an aside to this month's Ingersoll story, I will pass on the fascinating detail that Atari Personal Computers will be distributed in America by Science Research Associates. Science Research Associates? It just happens to be an educational publisher . . . and it also just happens to be a wholly-owned subsidiary of IBM. It may lead to nothing — but it's a step in an interesting direction.

Doublevision

The Doublevision add-on for Apple computers, providing separate graphics screen and print screen, is available through Mike Sterland's company Personal Computers (it was mentioned in our West Coast Faire report — PCW May). Details on 01-626 8121.

This year, next year....

I am anxious to hear from anyone who can prove that Commodore's 8050 disk drive will be available when the company says it will be — in August.

In this industry, products are inevitably delivered later than promised and not much is thought of it. However there was a year's delay between the announcement of the Commodore printer, and its eventual availability; during those 12 months we heard constant and reassuring noises from Commodore that the problem had been overcome and that deliveries were imminent. Similarly, there was nearly a year's delay between the first showing of the PET prototype, and its full availability.

I would assume that Commodore has become a different company, and has learned from its mistakes, but for one fact . . . an ex-employee recently mentioned that many of the components needed for the super new disk drive were not yet even being ordered.

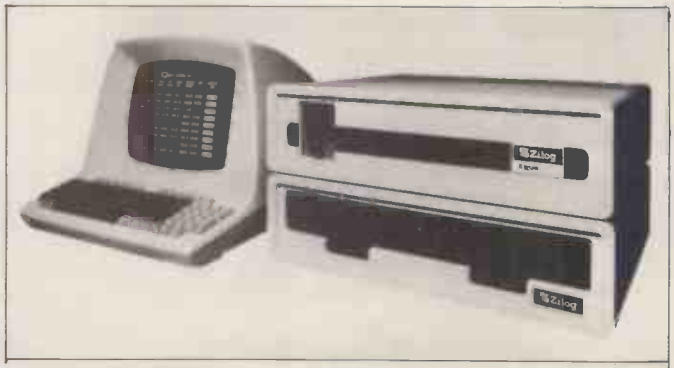
Of course he may have been mistaken, but before I announce the availability of the 8050 I would like more convincing evidence than the appearance of a prototype at the PET Show in London. Don't become anxious: if the proof is readily to hand, I will have it in plenty of time to print it before the product is due to be officially launched — and no harm will have been done.

Brain transplant

Distribution in the UK for Intertec SuperBrain will now be handled by Sun Computer Services of Hampton, Middx. Sun has announced prices of £2650, £1950 and £625 for SuperBrain QD, SuperBrain DD, and Intertube products respectively; details on 01-941 4824.

Success story

The company which owns the software publisher Petsoft



Local networking, says chip maker Zilog, is "a means of tying together diverse pieces of equipment simply and economically within a local area. The lower cost system elements are distributed, while the more expensive ones are shared." This is Zilog's MCZ-2 product range, using Z-net for local networking. Details in the UK on 0628 36131.

has reported turnover increases, and profit increases. For once the figures don't need careful analysis: they are up 79% and 93%, to £5.6 million and £720,000 respectively. Full details from ACT at 5-6 Vicarage Road, Edgbaston, Birmingham B15 3ES.

Be smart

A school which cannot afford to buy more than one PET computer — by order of the local authority — is selling its own computer-aided learning programs publicly to raise money for more hardware. The software was written by deputy head Don Walton, and by a ten year old boy: eight programs are available on cassette tape.

Details from Houghton County Primary School in Cambridgeshire: phone St. Ives (0480) 63398.

Joint concern

If you plan a microcomputer but can't find anyone with a factory, then an astonishing new company being evolved in Bradford should be worth a second thought.

It's being set up by John and Tony Martinez, together with Bradford Council's economic development department. The Martinez brothers have been making micro power supplies for over a year, with their company Microvitec. Now they hope to make video equipment, personal computers, and similar hardware.

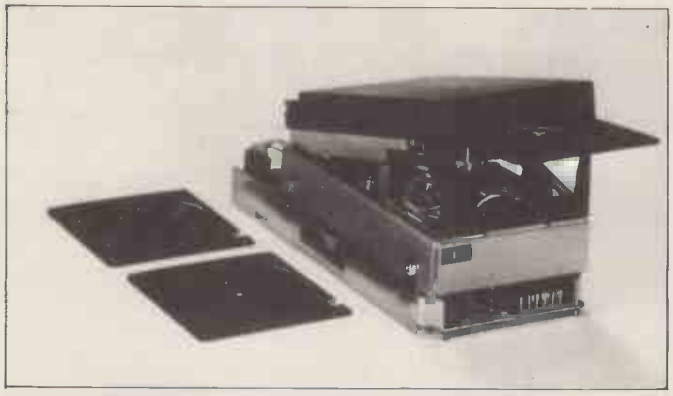
Where the deal really looks interesting is the 'joint factory' idea. Bradford Council will custom-build factories on a £500,000 worth plot of land, either for making Microvitec equipment, or for a company which wants a product made — in which case the factory could be run as a joint subsidiary company. Bradford's economic development coordinator I N Page has details on 0274 29577.

Courses

Courses on microprocessors generally are being organised by the City University with the support of the IEEE. A course on micro trends starts on 11 September for two days; a Pascal programming course lasting four days starts on 16 September; a micro evening class lasting ten evenings starts 13 October and runs to 15 December, and a three-day introductory course on micros runs from 29 to 31 October.

They're not all in London: for details, phone 01-253 4399, or write to Eileen Baker, room E511, Micro Laboratories, City University, Northampton Square, London EC1V 0HB.

Microchips "are like the seven league boots in the fairy tale; those who do not have them will not win the race". So said the Duke of Gloucester's scriptwriter when the Duke opened the Micro 80 Exhibition in Northampton. Rather more impressive was the pronouncement of one of the exhibitors, Horizon Software, that its products (written in Cobol) for Z80-based processors such as TRS-80, North Star Horizon and Superbrain, are guaranteed. The software is guaranteed for a year, and if legislation causes changes, these will be provided even after the warranty period expires. In the pic with the fairy tale Duke is M Shafique, the director of Horizon Software, who makes this promise.



This data storage device looks like a disk drive but it isn't. It only takes 8 kbytes, it takes four seconds to read that 8 kbytes, and it's designed to interface with 8-bit micros. It's such a strange concept that it seems worth printing it just for strangeness' sake. Details on Rye (079 73) 3777 from Roxburgh Electronics.

The company also makes a £280 thermal printer which can print graphics and do video hard copy.

REMove them

In writing a program, the programmer tries to make sure that there are lots of REMarks and spaces (in Basic) to explain what each section of code is doing. The importance of these cannot be overstressed, say software experts — so a product which diligently removes them sounds a bit strange.

The product is a software package called PACKS from Data Associates of Framingham, Massachussetts; it removes REMarks and spaces so that programs will load faster and run quicker. It runs on Tandy TRS-80 micros, working with diskettes. Details of this $20 product from Box 882, Framingham, Mass 01701.

Between the DECs

A piece of computer hardware which could open up a corner of the micro market to the minicomputer giant, Digital Equipment, has been launched in the UK by micro distributor Sintrom.

It interfaces the 'skeleton' of DEC's universal PDP-11 computer range — the skeleton being the layout of wires behind the computer, (and called the Unibus) — to the company's microprocessor LSI-11 range; this uses something called the Q bus. Sintrom's device is the Qniverter.

In so doing, it goes some way to overcoming one of the hardest problems to be encountered in converting from one Digital Equipment system to the other — the block formed by the operating software. DEC software is so complex that programmers trained in one operating system find it impossible to transfer to any alternative, especially when there's the problem of incompatible hardware to overcome.

Sintrom claims that its £450 device will allow Unibus devices — printers, disks and so on — to be put into LSI 11 microsystems, for which special Qbus peripherals are not so readily available and it also allows cheap LSI-11 controllers to be added to an existing Unibus system.

If and when the world puts the LSI-11 on one chip, this device could be a way of circumventing Digital Equipment's control of its market through patents on the Unibus.

The Qniverter is made by Able Computer, but Sintrom will give full details; they're on Reading (0734) 85464.

Cytek seminars

Cytek has transferred its microcomputer software and systems business to Old Trafford, Manchester, and is planning evening seminars for Manchester and Liverpool, with Leeds a future possibility. Details from Sue Matthews on 061-872 4682; the new address is Sandringham House, 9 Warwick Road, Manchester M16 0QQ.

YANKEE DOODLES

Tom Williams, our man in Silicon Gulch, brings the latest look at what's happening on the US micro scene

Some of the industry's leading figures recently gave us a candid and revealing insight into how they see their companies and the micro industry in general both now and in the immediate future.

Speaking at the third annual Rosen Research Personal Computer Forum in New Orleans were Steve Jobs of Apple, Chuck Peddle of Commodore, Bill Gates of Microsoft, John Roach, vice president of Radio Shack, Allan Alcorn of Atari, and many others. These representatives of the industry showed general agreement on how the personal computer market had developed and where it was headed. They even managed to be rather uncertain about the same things, but more on that later.

"...personal computers should be seen as tools which amplify the natural capabilities of the human mind."

Some very interesting observations were made by Apple's Steve Jobs on what he understood by the term 'personal computer', and how he perceived the personal computer beginning to penetrate large corporations. A computer is a 'personal computer', according to Jobs, when a one-to-one relationship develops which gives the user a feeling of independence and power that he could not experience in a large data processing environment or which wouldn't be possible without the aid of the computer. To achieve this relationship, Jobs said, personal computers must include general purpose capabilities, especially data and word processing. The 'nuts and bolts' must be shielded from the user in such a way that the machine itself recedes into the background and the user sees it solely as tool for his particular task. On the bottom line, Jobs says, personal computers should be seen as tools which amplify 'the natural capabilities of the human mind'.

A market for such personal computers is beginning to open up in really large corporations because certain employees are beginning to recognize the value of these machines for their professional needs. Thus, one employee may bring his own computer to work and begin using it for his job. This will attract the attention of others in his department who will start talking about how much easier such a machine would make their lives. Eventually, someone will get the ear of middle management and a number of machines will be approved for purchase. Then other departments will want some. At that point purchasing will say "Wait!" and will approach the manufacturer for volume pricing. At that point the personal computer has done its insidious work and has worked its way into the giant corporation.

There is at last a pervasive realization in the industry that software has become the most important factor in the personal computer market. The slogan 'software sells hardware' has given way to, 'software defines the product', a phrase coined by Bill Gates. All manner of manufacturers are now clamouring for major software houses to adapt quality software packages to run on their machines.

In a sense, this has limited the possibilities of smaller software firms getting a major part of the market to those that already have access to the manufacturer's distribution channel. As an example of this, Microsoft, which started by supplying systems software and languages to manufacturers and OEMs, has recently opened a consumer products division.

"...the personal computer has done its insidious work..."

Dan Fylstra, of Personal Software, another major US software house, discussed the costs involved in producing a finished software product. The most critical consideration, according to Fylstra, is the people involved in writing and debugging the code. Productivity among programmers varies enormously, and the man-hours/weeks/months is the major cost of a software product. The biggest danger to quality software products, Fylstra says, is still software piracy — that supposedly innocent trading between friends.

"Software piracy – that supposedly innocent trading between friends"

Most of the participants in the Forum were pretty clear about their perceptions of the market. They could predict what types of machines would be in demand from the small business and professional user, and companies such as Apple (for small business) and Hewlett-Packard (for the professional) are adjusting their strategies accordingly. But there was one segment of the personal computer market about which the participants seemed to have only vague ideas, and this was the so-called 'home market'.

Jeff Rochlis of Mattel made the very sage observation that in order to appeal to the mass consumer, a home computer had to provide a clearly perceivable value that was unique and not a duplication of some other service. And, he said, it had to do this for under $500. But when he came to talk of exactly *what* that clear value should be, he gave no clear answer, only nebulous mentions of "education, individual finances, communications, etc." This does not reflect any clearly focused idea of the home market which is to be pursued. Nonethless, Rochlis announced that Mattel had already spent over $10 million to develop its Intellivision home computer; they know there's a market out there somewhere, but they're not quite sure just where it is.

A number of interesting announcements were made at the Forum, one of them being that Radio Shack would be marketing a home videotex terminal. The terminal, which contains a modem to plug into the phone and attaches to the aerial socket of a television set, has a colour display of 32 characters and 16 lines. It was developed in co-operation with the US Department of Agriculture in an experiment called 'Project Green Thumb'. This was a Videotex service for farmers in Kentucky which would allow them to access weather reports, listings of latest farm prices, advice on what crops to plant, news, and so on, over a Prestel-like system.

Now Radio Shack has entered into an agreement with CompuServe, which operates one of the two US nation-wide personal computer networks. Under this agreement. Radio Shack will be sole retail distributor for CompuServe, and CompuServe is adjusting its display format to be compatible (including colour) with the Videotex terminal by Radio Shack.

In another announcement, Ed Roberts, president of Zenith Data Systems, announced that Zenith had been working in a mutual development project with the Massachussetts Institute of Technology to develop a 16-bit multi-user microcomputer based on the Motorola 68000. An operating system similar to the Unix system developed by Western Electric Bell Labs had been developed by MIT.

Roberts said that the new machine would have from 7 to 8 Mbytes of RAM, a microprocessor-controlled high resolution graphics display and hard disk storage comprising 10 Mbytes fixed and 10 Mbytes removable storage. The machine, prototypes of which will be available later this year, seems to reflect Zenith's belief that there is still a market for high-end machines in the microcomputer industry.

Roberts added that Zenith, which purchased the Heath Company about a year and a half ago, was working on its own version of a home computer. This machine would be sold through the regular Zenith distribution channel of consumer electronics stores, which in the US is also the outlet for the huge Zenith line of televisions and stereos.

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COMMUNICATION

PCW welcomes correspondence from its readers. Be as brief and concise as possible and please add "not for publication" if your comments/questions are to be kept private.
Address letters to: "Communications", Personal Computer World, 14 Rathbone Place, London W1P 1DE.

Sharp reminder

I recently purchased a Sharp MZ-80K personal computer (an excellent unit) but I have not yet seen any MZ-80K programs in PCW. I realise this is a fairly recent micro, but I'm sure there are a number of MZ-80K users who would like to see programs in your magazine.

I wonder if any programs such as the PET, TRS-80, Apple, etc, can be modified or is it possible to make a conversion sheet to modify PET programs to Sharp. Keep up the good work with an excellent magazine.
Martin Regan, Southport, Merseyside

The fact that we publish so many PET programs is a reflection of the PET's market dominance. We have published MZ-80K programs in the past and we'll publish more if we receive any which satisfy our 'quality/novelty' criteria (see last month's PCW) — Ed.

Anomalies explained

I read with interest your reviewer's comments in the June issue on the results of the disk tests applied to the TRS-80 Model II; he mentioned that the tests to access a sequence of records in reverse order took slightly less time than the same accesses performed in the more usual forward sequential manner.

I looked back through similar reviews in past issues, and in fact the tests accessing records in the reverse order generally do take slightly less time. The exceptions were instances where the forward sequential pass took a surprisingly short time to run, typically less than a quarter of the time expected. The following suggested explanation is based on considerations applied when sizing large mainframes and their application programs to estimate run-times and resource utilizations. The basic ideas are the same because the micro's floppy disk is similar, though smaller and less sophisticated than its non-floppy multi-platter brother.

As explained in the review, the tests were conducted on an otherwise empty disk. So most forward sequential accesses would be to the next sector in the same track, and only occasionally would the head have to change tracks. However, the speed of rotation, and the time taken to do the minimal amount of processing between accesses, would normally be enough to place the head beyond the start of the next sector. The micro then has to wait for the sector to come round again. The cycle time per forward access therefore is that for a complete revolution plus a sector, whereas that for reading or writing backwards through the file would be the time for one sector less than a complete revolution.

Those machines in which the forward sequential tests took a remarkably short time presumably did so because the minimal processing between each access was completed before the beginning of the next sector was reached. However, most application programs would contain more than this minimal amount of processing, and would then require a full revolution of the disk, for which the shorter forward sequential disk test timings would be most misleading.
J M Barnes, Enfield, Middx.

Disabled group

The British Computer Society has a Committee for the Disabled, among whose aims are the development of computer-based aids for the disabled.

There is in this country a number of people developing aids for sufferers from almost every kind of disability, and the advent of the microcomputer has accelerated the trend to new inventions. So far there has been far too little done by way of providing a means whereby such people can get in touch with each other and find out what has been done and what is being attempted; indeed, a wheel has been re-invented on occasion. Many aids have been invented and developed "one-off" by the inventor for himself or for a friend or relation. Such an inventor could have gained help from contact with others working on the same problem or could have helped others working on the same or a similar problem. As a first step towards the information service which we believe esential, the subcommittee is collecting the names and addresses of people and organisations working in this field; we should be very glad to hear from any who are interested whether as sufferers, inventors or manufacturers. We feel sure that this is not merely a national problem and are seeking similar help via organisations for information science in most of the English-speaking world.

May I, through you, ask any who could contribute, or even who wish merely to comment, to get in touch with me, Helen Townley at 117 Wickham Chase, West Wicham, Kent, BR4 0BQ

Tangerine dream

A word of praise for Tangerine Computers. I ordered a Microtan 65 Computer for my son's birthday.

A few days before it was due I asked my wife to give them a ring to find out if it was in the post. They told her there was a breakdown somewhere on the line and it would be delivered in a week or two.

So, the next day I telephoned the firm myself; a gentleman in a firm and civilised way calmed my primitive pent-up anger and let me explain my position. After listening to me he told me there must have been a break in communications; "Cliche", I thought. He told me he would ring me back in an hour's time, which he did. Not only did he find me a computer but had arranged for it to be sent to me at my local station the next day in time for the birthday.

That's what I call a good service, which I have never come across in this day and age. The attitude usually seems to be — we haven't got it, but there are plenty of people on the waiting list.
Derek Clewley, Boreham-wood, Herts.

Coupler addresses

I would be grateful if you could supply me with the addresses of the firms supplying the acoustic couplers and modems as described in your May edition.
D Lindsay, Chester

Several readers have asked for these, so here they are: Anderson-Jacobsen, The Estate Office, Station Approach, Shepperton, Middx TW17 8AP. K&N Electronics Ltd., Cordwallis Street, Maidenhead, Berks. Modular Technology, PO Box 117, Watford, Herts WD1 4PD. Peripheral Hardware Ltd, Link House, Pool Close, West Molesey, Surrey KT8 0HW. Post Office, Postal HQ, St Martins-le-Grand, London EC14. Transdata, 11 Garrick Street, London WC2 — Ed.

MK14 surprise

In the June PCW L V Cooper states that the MK14 uses FFF7H to FFFFH as RAM, instead of 0FF7H to 0FFFH.

This is unfortunately not the case, but even if the monitor did require memory at this location, the MK14 would still work properly as these nine locations are just used to hold images of the SC/MP registers before and after execution of a user program.

The critical RAM address is the 18 bytes from 0F00H which must be present for the monitor to work at all.

The reason that the SC/MP micro has only 12 address lines is that the internal logic will only process 12 address lines.

What this means is that if an instruction (of *any* type) references what would seem to be an address outside of the current 4k block, the carry or borrow to the address line 13 is ignored.

So the monitor instruction at location 000BH, C0 F2 (LD —E) loads from 0FFEH and not FFFEH as might be expected.

Here's a surprise program for MK14s. Load and run at 0F12H.

```
f12 C0 3D F0 3C
f16 F0 3B C8 37
f1A F0 36 C8 34
f1E 1F C8 32
f21 8F 55 C0 2D
f25 D4 7B 9C E9
f29 C4 0D 35 C4 00 31
f2F C4 3F C9 03 8F 00
f35 C4 3F C9 02 8F 00
f3B C4 7C C9 04 8F 00
f41 B8 11 9C EA C9 00
f47 90 C9
```

For the best effect, turn the lights off!
G Phillips (MK14 Users' Group), London NW9

Power pack

In answer to the question about the Powertran Club in the June PCW, there is such a club and those interested should apply to Mr P L Proberts, 50 Cromwell Road, London SW19 8LZ. The annual subscription is £5 (which includes a monthly newsletter) and they also have details of the Mk III monitor.
C J Pink, Rainham, Kent

Bouquets and Brickbats

Your magazine "Hits the spot", as our American friends would say, so I'm glad to join up for a year.

What I like about it is its extrovert attitude. Personal computing is a fast moving subject and it doesn't do any good to be parochial. We need to know all about developments in the USA (especially California) and in Japan too. Your recent article on the 5th West Coast Computer Faire helped a lot.

But you get a brickbat along with the bouquets for the Benchtest on Hewlett-Packard's HP-85. Guy Kewney's article was very informative but I think he missed a point — or perhaps indeed he made it when he wrote that "The business user would do better looking elsewhere. . .". This machine is quite clearly designed for the scientist and engineer. These professionals need technical software, not business software. They want for example packages for statistics, engineering, numerical methods etc. The quality of software is a big factor in people's purchasing decision. Could we perhaps have more information in future on this aspect?
QSE Didcot, Oxon (Real name supplied).

Yes, you're dead right — we should serve the scientific/engineering community better. We would like to hear from people who feel that their experience and writing ability could help us remedy this situation — Ed.

Tape tips

I have recently acquired a Viatron System 21 together with a matching tape drive. If any of your readers have any relevant manuals they would be willing to loan or general information they could pass on regarding this and any other Viatron equipment, I would be very grateful. If there is anyone else out there struggling with one of these things perhaps we could get a Viatron users' group going.

Also, is there a 6800 (specifically MEK 6800 D2) group still going somewhere?
P A Dion, London NW3

Group grovel

We were very pleased to see a review of the OSI C2-4P in PCW April 1980. Apart from the sheer pleasure of seeing a British magazine even *mention* OSI equipment, it was good to see such an objective review in your pages. Your reviewer's comments on OSI's ghastly documentation were particularly apposite; this is one of the areas that we, the UK OSI User Group, are working on. We are intending, among other things, to produce our own Challenger 'manual' in the near future: a kind of 'everything you wanted to know about the Challenger but couldn't find easily in the manual'.

Our current Newsletter includes a modification to give the Superboard a display more like the C2 instead of its normal, somewhat ugly, 32x32 (if you're lucky) format.

Keep up the good work with a great magazine: and please cover more OSI information in the future — no-one else seems to know about them!
Richard Elen/George Chkiantz, OSI User Group, London.

The big time

I recently ran your Basic Benchmark programs on the University of Manchester Regional Computer Centre (UMRCC) CDC Cyber 72 system. The system is based on a Cyber 72 for undergraduate teaching at both the University of Manchester and at UMIST as well as two other systems comprising an ICL 1904S and a 1906A, each of which fronts its own CDC 7600. The '72 is mainly used to provide interactive facilities and as a result supports over 120 terminals distributed over both campuses; it has a 60-bit word length and utilises a three-address instruction format.

The Benchmarks were run under the NOS 1.3—485E operating system using the Basic subsystem and the times quoted include the compilation time.

Bench-mark	Time (seconds)
1	0.060
2	0.056
3	0.088
4	0.085
5	0.132
6	0.242
7	0.329
8	0.409

If you think these are fast then a note in the UMRCC Cyber 72 User Manual will change that — in trying to convey an image of the Cyber 72's power, it states that the 72 has approximately 1/20th of the computing power of the CDC 7600!
N Davies, Manchester.

Gulp! I suppose we'll now have someone running the Benchmarks on a Cray 1! But your timing for BM8 looks wrong — it should be lower than the time for BM7 — Ed.

Conversion wanted

I recently bought an OSI C1P which I want to use with a Teletype 28 ASR so that I can both obtain hard copy and read in programs using the Teletype's paper tape reader. Do you know where I can find an ASCII to Baudot conversion table?
P Knight, Sevenoaks, Kent

Does this help? — Ed.

Symbol	*Baudot*	*ASCII*
A—Z	*1 — 26*	*65 — 90*
Space	*31*	*32*
—	*1*	*45*
?	*2*	*63*
:	*3*	*58*
3	*5*	*51*
%	*6*	*37*
@	*7*	*64*
8	*9*	*56*
(	*11*	*40*
)	*12*	*41*
.	*13*	*46*
,	*14*	*44*
9	*15*	*57*
0	*16*	*48*
1	*17*	*49*
4	*18*	*52*
'	*19*	*39*
5	*20*	*53*
7	*21*	*55*
=	*22*	*61*
2	*23*	*50*
/	*24*	*47*
6	*25*	*54*
+	*26*	*43*

Baudot uses 29 as a letter shift and 30 as a figure shift — hence the duplication of codes 1 to 26.

Calc counters

The following points may be of interest to Mr Buckley (*'The Forgotten Interface'*, *Computer Answers*, PCW May 1980):

— just for raw number-crunching capability a Texas TI-30, or any other cheap non-programmable scientific calculator, is a wiser choice than a TI-58 for interfacing with a micro or some other device (never forget Murphy's Law!).

— built-in debouncing in pocket calculators makes them *very slow* at the input interface, typically no faster than .1 or .2 seconds per input signal (either every single digit or function). Thus, the UK 101, with its fast 8k Microsoft Basic, will usually do better all by itself than if trying to borrow help through a 'tortoise'.

I must add that I use as an alarm timer/seconds counter a battered Sinclair Cambridge (remember them?). I could set it to ring a few years from now (if the batteries lasted that long . . .), and, when not counting time, it still performs happily as a desk-top four-function calculator. Nevertheless, I wouldn't dream of interfacing my TI-58 to my Ohio Superboard — and I think I would succeed in interfacing them, if I cared to, without really 'removing' the TI-58's keyboard, as Sheridan Williams thinks necessary.

Finally, as to Sheridan's suggestion of electro-mechanical 'key-pressers' to interface computer LSIs to programmable calculator's chips, I wonder if he would be thinking also of using thermionic tubes to latch the 'key-pressers' — the resulting dinosaur might even work!
S Sa Nogueira, Lisbon, Portugal

I left a whole slab of chocolate right there on my desk....

Personal Computer World

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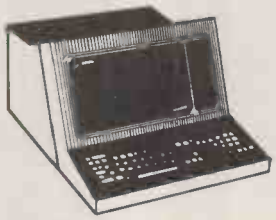

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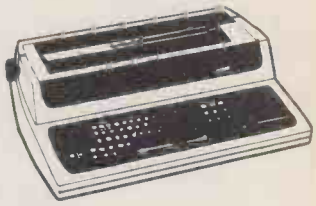

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BENCH TEST

SUPERBRAIN

The early SuperBrain adverts seemed too good to be true — then subsequent delays in its reaching the market place sparked off rumours of trouble. Now that the SuperBrains are here, do they live up to those original ad claims? Sue Eisenbach investigates. . .

Hardware

The Superbrain QD is a single unit personal computer weighing approximately 23kg and with physical dimensions 54cm wide by 57cm deep by 37cm high. Both in appearance and weight it seems like a VDU and, in fact, Intertec do market several VDUs in the same, attractive, white and grey structural foam case. However, in performance terms, it is, of course, a far cry from the humble glass teletype. The top of the case is attached to the base by means of four securing screws. Inside, the system is seen to be divided into four self-contained modules — the keyboard/CPU; the disk drives; the shielded CRT and the power supply. All are easily accessible without further fiddling except for the disk drives which require the release of another two fixing screws (each) before they are detached and available for inspection.

The heart of any SuperBrain is the CPU/keyboard module. This contains two 4 MHz Z80As — one to handle the processor and screen I/O while the other takes care of disk I/O. The SuperBrain QD comes with 64k of dynamic RAM as standard (32 4116s) whereas an ordinary SuperBrain comes with 32k as standard but with sockets for another 32k. The machine also has 1k of static RAM for use by the second processor and 2k of ROM for bootstrapping at power-up. The rest of the board contains the character and keyboard encoder circuitry, the disk controller (FD1791) and the communication electronics — including two serial ports (switchable synchronous or asynchronous) which are under software control. Thus baud rate, parity, the number of stop bits and the transmission mode can be set from the keyboard. A 22-pin cable connector handles power and signals and a second 40-pin Z80A data bus connector is available for future exapansion. At the moment, according to the documentation, a Centronics compatible parallel interface can be connected directly to this bus. Also promised (but not yet available) is an S100 bus adapter to allow the attachment of a single S100 board inside the SuperBrain case, next to the disk drives.

The keyboard generates the full 128 ASCII character set. The 76 keys include a separate numeric pad with a

row of cursor control keys and an alpha-lock. A nice feature is the pair of red keys at the lower corners of they key-board. When depressed singly these have no effect; when depressed together how-ever, the system re-boots itself — a two-handed operation which makes an accidental re-boot very hard to do. The only way I could get the screen to clear was ^L^K^J (where ^ = 'control'), which is not ideal.

The CRT consists of a 30cm P4 phosphor tube mounted in an alumin-ium chassis whose screen displays 24 lines of 80 characters. The white characters on a grey background are composed of a rather cramped 5x7 dot matrix on a 7x10 character field. The result is that some of the lower case letters are somewhat unconventionally formed, especially those requiring des-cenders — the whole gives a vague 'ransom note' impression. The video cir-cuit is mounted in the base of the CRT chassis and is easily accessible.

The SuperBrain QD is supplied with twin Shugart double-sided, double-density mini drives (Model 450) which on the review machine were completely reliable and noticeably quieter than single-sided drives. Each disk holds 338 kbytes formatted (700k unformatted) in G8 sectors at 512 bytes/sector — which makes the reading of normal 128 bytes/sector disks rather complicated. Average access time is 250 milliseconds (35ms track-to-track) with a transfer rate of 250 kbits/second from 300 rpm drives.

The 240 V power supply is fitted in Britain. Bad placement of the trans-formers can cause a screen waver but the review machine's transformers were all fitted behind the drives and caused no discernible interference.

A trepanned SuperBrain — note the heavy shielding between CRT and disk drives.

Software

The system boots in with
"64K SUPERBRAIN QUAD DENSITY DOS VER 3.0 FOR CP/M 2.2"
at the top of the screen. Along with CP/M 2.2, the review machine was supplied with both the compiler and interpreter for Microsoft's MBasic 5.0, Digital Research's new PL/1 compiler, SORCIM Pascal/M and Wordstar. Super-Brain's operating system contains several utility programs to deal with, for instance, the conversion of 128 bytes/sector disks to the 512 bytes/sector required by the latest DOS sys-tem. I never actually succeeded in get-ting this one to work — the program always failed with a 'disk not ready' message, so it can't be as straightfor-ward as it seems and certainly more complex than on some other machines I have used. The two serial ports, on the other hand, can be easily re-configured by means of the program CONFIGUR, whereby the baud rate, parity etc. can be changed simply by selecting the re-quired value from a menu.

PIP contains two functions, INP and OUT, which, according to the manual, allow the SuperBrain to be connected (and to behave as a dumb terminal) to another computer or to permit the transfer of ASCII or Hex files between the two machines. After some hours of struggling to make the connection with an LSI 11 according to the manual, I phoned Encotel, who had provided the review machine, and discovered that an extra signal was required to make con-tact with the SuperBrain.

Once that was accomplished I had no trouble connecting up and transfer-ring files from the LSI 11 to the Super-Brain via INP.

There is a size limitation of 25k per file and this must contain all the dia-logue between the keyboard and the remote processor, as well as the file data itself. It is, of course, necessary to edit this dialogue out to return the file to its original state. I was also able to use the SuperBrain as a dumb terminal via INP, although the SuperBrain was not as dumb as I would have liked. The connection could be broken for instance by rapidly striking one or more of the keys, in which case PIP was liable to abort. Fortunately, upon re-connec-tion, everything was usually all right. Another way to break the connection was to attempt to list rubbish (e.g. a binary file) on the screen in which case PIP again would abort, but the LSI would continue listing out to nothing.

OUT should have enabled the trans-fer of files from the SuperBrain to the other machine. After failing to get this to work, I was informed that this ver-sion of OUT contained a bug, the patch for which was still on its way from America.

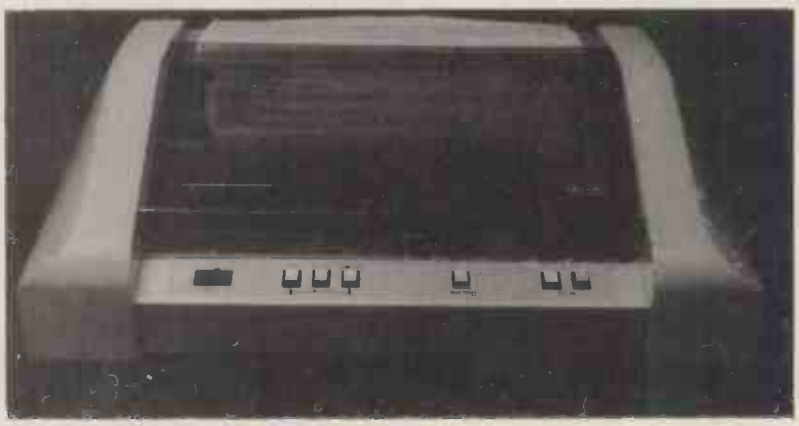
The BIOS portion of DOS is provid-ed as a source program to simplify modifications to the peripheral drivers. The Basics have already been reviewed by me elsewhere *(quite favourably in PCW December 1979 — Ed)*, so we pass to the latest Wordstar which contains the nice feature of displaying a direc-tory listing just before you load the file in, so that forgetful operators can remind themselves of the precise name of the file they require without having to return to operating system level. You can also switch disks (the 'logged — in disk') without leaving Wordstar — so that you could keep all the text files on one disk, and Wordstar itself, write-protected if necessary, on another. Long sessions could ensue without ever leaving Wordstar or having to re-set all those editing parameters — the package becomes more like a full operating sys-tem every time I use it!

Pascal/M is a fairly large Pascal com-piler requiring at least 56k of memory

Technical Data

CPU:	2 Z80A 4 MHz
Memory:	64k dynamic RAM, 1k static RAM, 2k ROM
Keyboard:	76 keys, full ASCII
Screen:	12" white on grey
Cassette:	N/A
Disks:	2 drives, 5¼" double density, double sided
Printer:	N/A
Bus:	Z80A 40-pin data bus
Ports:	2 serial
System Software:	CP/M
Languages:	Basic 80, PL1, Pascal/M, 8080 assembler

The ANADEX DP 9500



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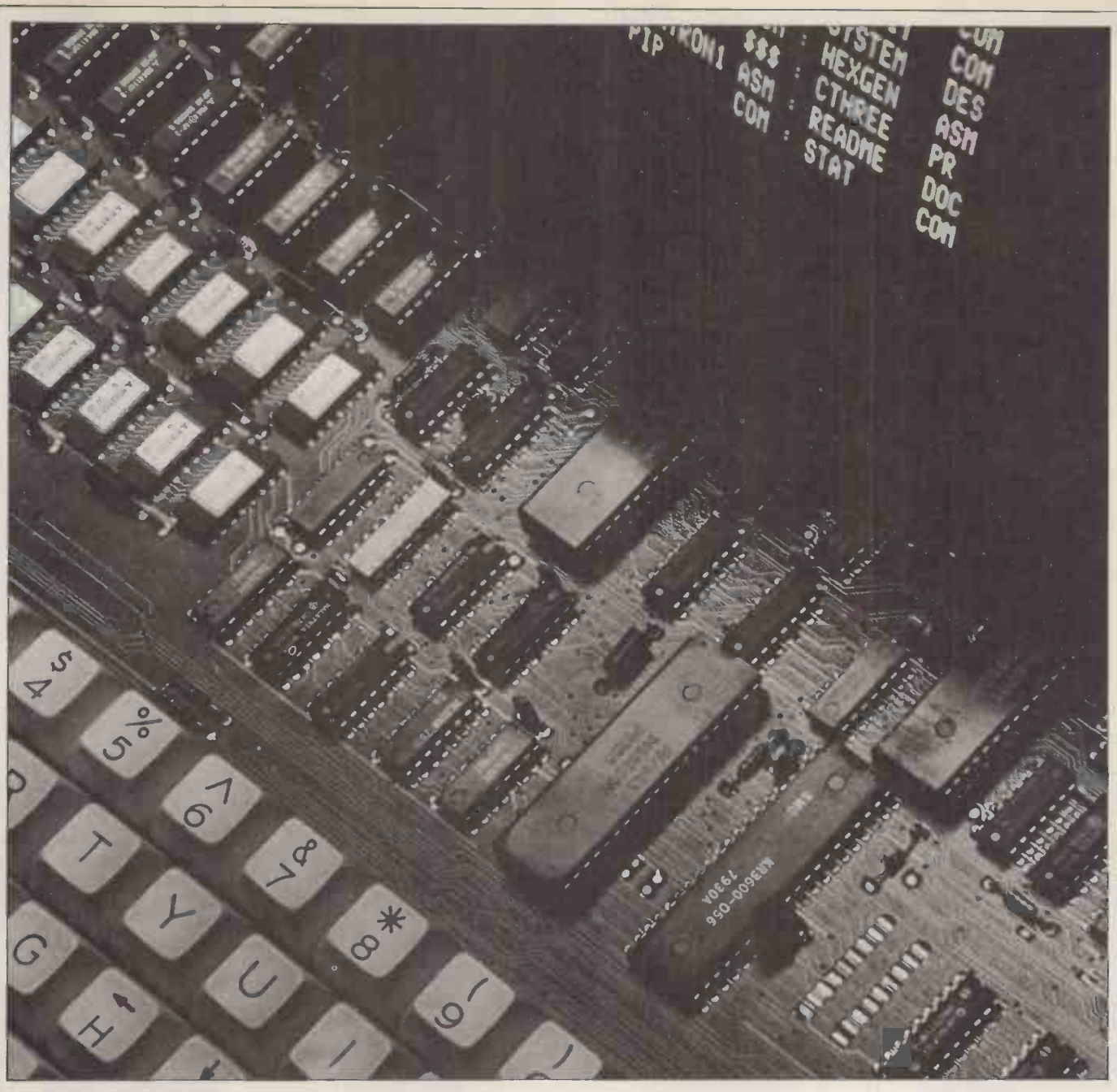

and compiling to pseudo-machine code (p-code). This implementation is 'extended' using UCSD and the definition of ADA for guidance. Such extensions include SEGMENTation, STRINGs and string functions, untyped files, an extended character set for identifier names, direct access files and a random number generator.

Digital Research's PL/1–80 is the first implementation of PL/1 on a micro that I've seen. It is based on the ANSI General Purpose Subset (Subset G). The subset G does not include the following attributes or functions: DEFINED, FLOAT, DECIMAL, LIKE, PICTURE, FILE (allowed only in an OPEN statement), asterisk extents, dynamic arrays, ATANH, DATE, STRING, and TIME VALID; while the following features have been added: %REPLACE, READ and WRITE for variable length ASCII records, GET EDIT extended to full record input in a format, intrinsic functions ASCII and RANK. In order to run a PL/1 program it must first be compiled using a three-pass compiler which produces relocatable machine code, and then linked with the runtime subroutine library before it can be executed.

Potential

With its neat, integral appearance and CP/M operating system, the SuperBrain was designed to fit into a commercial environment. Other than Wordstar, I was not supplied with any application software on the review machine although plenty of CP/M software is available. I was lent a manual for Data Star, a filing system which permits the entry of information via forms on the screen, with range and format checking, into a file with multiple keys. According to its documentation, Data Star allows a user to select records satisfying given criteria and can be used in conjunction with programs in most languages.

Either the second serial port or the Centronics compatible connector can be used to interface a printer to the SuperBrain and that about exhausts the physical enhancements possible on the single stand-alone machine. Although this is not necessarily a limiting factor — 64k RAM and 680k storage constitute a pretty respectable micro-offering in the commerical environment — Intertec's plans to provide a link-up capability through the Compustar and the machine's ability to behave like a terminal of arbitrary intelligence, make the SuperBrain a reasonable prospect for any multi-user or distributed processing application. I particularly liked the fact that the multi-user system allows for the sharing of expensive perhipherals without overloading either the processors or the data-bus — a mistake which some of Intertec's competitors have made to their cost.

As an intelligent terminal in a distributed processing system, the SuperBrain certainly has the right looks and it is compact, about the same size and shape as a fairly standard VDU. Unfortunately, the review machine did not have all the software necessary to turn it into a robust, truly intelligent terminal.

Looking at the machine from an educational viewpoint, it has some limitations. I suspect that the case

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74LS12	.20	74LS51	.18	74LS113	.32	74LS163	.69	74LS241	2.08	*74LS348	1.39
74LS13	.37	74LS54	.18	74LS114	.32	74LS164	1.06	74LS242	2.08	74LS352	1.04
74LS14	.65	74LS55	.18	74LS112	.69	74LS165	.72	74LS243	2.08	74LS353	.92
74LS15	.20	74LS73	.33	74LS123	.72	*74LS166	1.65	74LS245	2.50	*74LS362	4.21
74LS20	.20	74LS74	.30	74LS124	1.39	74LS168	1.71	74LS247	1.09	74LS365	.55
74LS21	.20	74LS75	.40	74LS125	.36	74LS169	1.71	74LS248	1.09	74LS366	.55
74LS22	.20	74LS76	.27	74LS126	.36	74LS170	1.72	74LS249	1.09	74LS367	.55
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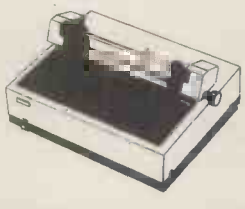
PRINTERS



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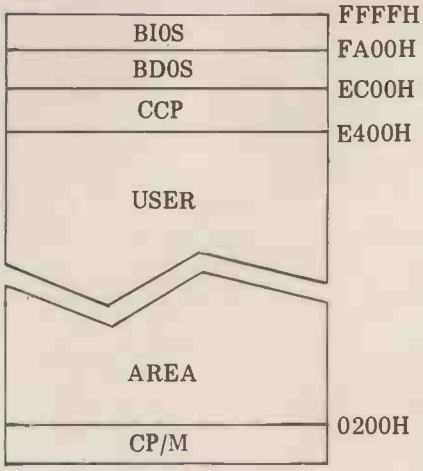

Bench marks

BM1	1.56
BM2	5.25
BM3	14.01
BM4	13.91
BM5	14.77
BM6	26.26
BM7	43.24
BM8	5.56

Disk Tests

D1	0.95
D2	16.41
D3	26.35
D4	14.41
D5	13.02

All times in seconds

would rapidly become fairly shabby after a period of being humped from room to room and bashed about in 'normal' school use. Although the screen is memory-mapped and the user can therefore direct characters to any desired screen-position, there is no graphics capability as such, and there appears to be no obvious method of adding this feature — which is so desirable for the teaching of programming, for Computer Aided Learning and for good computer games. The SuperBrain is also a very unlikely laboratory tool as the only possibilities for interfacing are through the two serial and single (optional) Centronics parallel port.

Expansion

The review machine was fully expanded — a minimal SuperBrain has 32k RAM and two single-sided, double-density drives (340k total). Intertec Data Systems showed two expansion products at the NCC. The first was the Z80A to S100 bus converter which will allow a single S100 card (for example a hard disk controller) to be installed in the case and thus be built into the system. The second way to expand the SuperBrain is to turn it into an intelligent terminal operating in a multi-user system. Intertube has announced the Compustar multiuser system in which up to 15 SuperBrains can be connected to a master processor which controls access to hard disks and printers, etc. The drives will be Century Data Systems 20 Mbyte Winchesters, or CDC 32 Mbyte or 96 Mbyte cartridges. According to the sales brochures, up to four Compustars can be connected to the same cartridge drives. We await developments with interest. . .

Neat and simple. . . rear view of the SuperBrain.

Documentation

The review machine came with a large SuperBrain user's manual, plus six others. The user's manual looks like a mail-order catalogue, complete with thumb-index. After the first few pages of advertising, a table of contents is reached wherein are listed the names of all the standard software manuals available within a CP/M system with Basic 80, plus several sections devoted to the SuperBrain. I found this format much easier to use than the dozen or so independent manuals in a ring binder which one has come to expect from the (better) firms. I was not that impressed however by those sections produced by Intertec themselves. Firstly, they document an ideal system rather than the system that actually exists, and secondly, they tend to gloss over the details which might pin the manual down to one particular SuperBrain specification.

The other manuals provided were for Pascal/M, Wordstar, Data Star and PL/1 (three manuals). The Pascal/M manual has a table of contents, is paginated, indexed and clearly written. It is not a Pascal manual however (since Jensen and Wirth have written one which every Pascal user presumably possesses), but rather a description of how to use Pascal/M in particular, and how it differs from 'standard' Pascal. The —Star manuals are comprehensive but are rather turgid with fairly heavy-handed descriptions of the various processes and procedures — a shame since the programs are really very good.

The three PL/1—80 manuals comprise a language manual, Link-80 operator's guide and an applications guide. They are all paginated and have detailed tables of contents. All are in the same, concise, in-house style as the CP/M manuals. The language manual defines the language but without giving any examples. The Link-80 operator's guide has chapters on the linkage editor, relocatable macro assembler, the librarian, interfacing conventions and runtime subroutines. The applications guide is a tutorial book which provides the examples required to learn PL/1—80.

Conclusion

The SuperBrain is a compact, attractive 'single-box' computer, containing two Z80As and running under CP/M. It's competitively priced in relation to other mini-floppy, Z80A, CP/M systems. It doesn't contain a number of slots for a variety of different boards, so in that sense it hasn't the versatility of some of its competitors. However, its big plus is that it's an integral, stand-alone system.

It has some lovely touches, like the programmable serial I/O ports and the two-button re-set, and apart from some reservations regarding the software which controls the data transfer to another processor, I found the SuperBrain completely reliable, a pleasure to use, and very impressive with the new, quiet double-density, double-sided drives.

At a glance

FIRST IMPRESSIONS	
Looks	****
Setting up	****
Ease of use	****
HIGH LEVEL LANGUAGES	
Basic	****
Cobol	N/A
Fortran	N/A
Pascal	****
PL/1	****
PACKAGES	
Business	N/A
Education	N/A
Home	N/A
PERFORMANCE	
Processor	****
Cassette	N/A
Disk	****
Peripherals	N/A
EXPANSION	
Memory	*
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DOCUMENTATION	***
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GATEWAYS TO LOGIC

CHAPTER 2: ON TO BOOLEAN ALGEBRA

Derrick Daines continues his unique guide to teaching others the basics of microcomputing.

When I was in my teens I 'discovered' the public lending library. It was only half a building — the other half had been destroyed by bombs — and tar-paper was nailed up to keep out the wind and rain. I haunted the place. In there I had uncovered the wonderful world that lay beyond the war-torn streets of Grimsby. Not for me the fantasy of fiction, for I had found the non-fiction shelves and the world of fact to be fairytale enough.

One day I happened to come across the name of one George Boole (1815-1864), a Lincoln mathematician, who was apparently one of those able but slightly eccentric men that the Victorians threw up in abundance. He had written a few obscure papers, a book on symbolism and had even been awarded a medal by the Royal Society in 1844. I felt more than a passing interest. At that time I sang in a church choir and the name of the incumbent was a Reverend Boole. I knew that Rev Boole came from Lincoln and as Boole was not a common name, I reasoned that there was probably some connection.

Accordingly, on the next Sunday I asked Rev Boole if he had had a relative called George who was a mathematician. Oh yes, he said off-handedly, that was his grandfather. He of course had never met him, but he did know that his grandfather had started a school in Lincoln and the story in the family was that after school, George used to potter about upstairs in his little study, 'doing things', but nobody quite knew what. Nobody took much notice of it, he said. There was a faint air of fond indulgence and the conversation lapsed.

About 20 years later, having been abroad for some time, I arrived back in Grimsby and stepped out of the station to be confronted by a news-agent's placard which read, "Local Grandson of Famous Scientist!" My mind leapt the intervening years to that brief conversation with the vicar. Quickly I bought a paper and sure enough, there on an inside page was a photograph of Rev Boole alongside an account of his grandfather's work; it had now become known world-wide as Boolean Algebra.

What had happened? What had lifted George Boole's work from near total obscurity into world-wide prominence — almost a hundred years after his death? In a word, the computer had happened. George had had the wholly original idea of reducing a statement made in English to a single algebraic letter so that it could be manipulated in a manner similar to numeric or ordinary algebra. At the time the idea had had little, if any, practical use but when the computer materialised it was found that the two complemented each other perfectly. Not only was the computer able to manipulate the most complex Boolean statements with consummate ease, but Boolean Algebra also presented the best possible method of describing computer action — a method moreover that could be understood by engineers the world over. It transcended language barriers the same way as mathematics; anyone could understand it, no matter what their native tongue. Not bad for one man's slightly eccentric ideas carried through in his spare time!

Think back to Venn diagrams. Instead of labelling one hoop RED, meaning 'All blocks that are red are inside this circle,' if we label it 'A', then we have taken the first and most fundamental step towards understanding Boolean. Similarly, a second hoop could be labelled 'B', meaning 'All blocks inside this hoop are large.'

A dot placed between two letters is by convention read as AND, so the statement for the overlapping area of two hoops is A.B which means, 'All blocks in this area are both red and large' (Fig 1).

$\bar{A}$ is read as NOT A and is taken to be shorthand (in our example) for 'All blocks in this area are not red', or if you prefer 'No block in this area is red.' The OR statement is a little tricky — take for example 'boys or girls are allowed in'. Do we mean boys only or girls only, or do we mean boys and girls? In fact we use both definitions in common speech, frequently interchanging them as necessary to suit our purpose. To prevent confusion therefore it's wisest never to use OR on its own, but rather always to preface it with the conditional 'exclusive' or 'inclusive'. Exclusive-or of course excludes the possibility of having both attributes at once, while the Inclusive-or allows for this possibility.

Unfortunately there has not until recently seemed to be much common ground in the use of symbolism for either the inclusive-or or the exclusive-or. Mathematicians have used one symbol, industry another and the writers of books on 'sets' yet a third. Moreover, some of these symbols have been subject to change over the years so that switching from one text book to another can be a little confusing. In this series I shall use the addition sign (+) for the inclusive-or and the shorthand term 'ex-or' for the exclusive variety.

'If A then B' or, as it is sometimes called, implication, may be confusing or difficult to understand for some (Fig

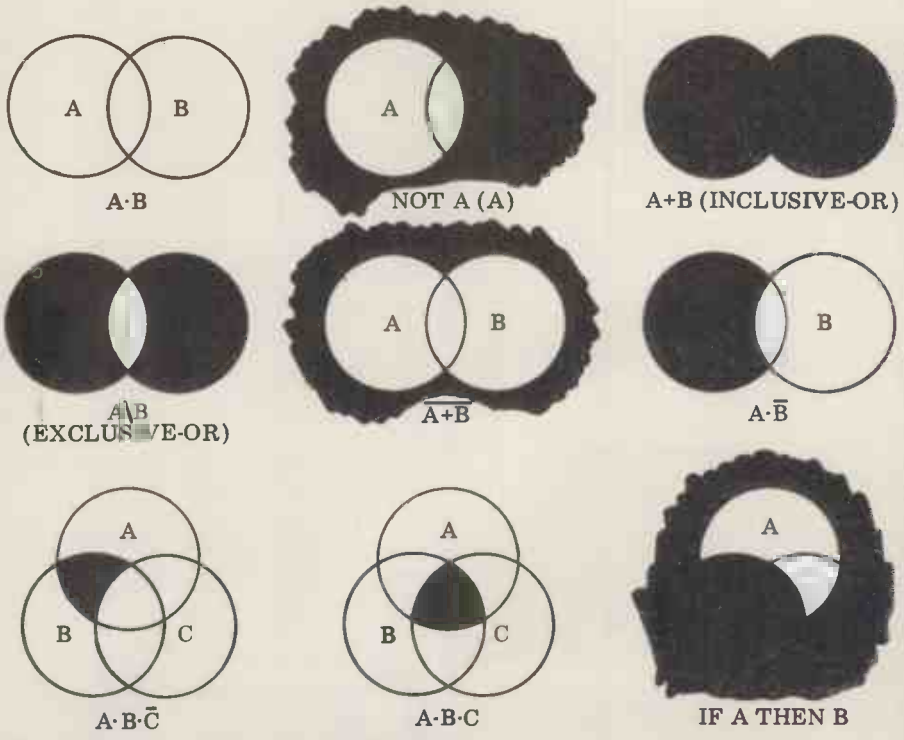


Fig. 1 In each case, the shaded area represents the truth of the statement

1). The clue here is to remember that 'If A then B' has got nothing to say about conditions in C or about the area outside the three hoops. The only conditions NOT allowed are A alone, or A only with C.

The reader is now equipped to study Figure 1 very carefully and should not proceed until it has been fully understood.

Window cards

A window card system for Venn Diagrams was devised by Martin Gardner of the *Scientific American* and modified by Cundy & Rollett for their very fine book, *Mathematical Models* (Clarendon Press, 1960). It's based on the notion that if windows are cut in cards corresponding to different Boolean statements, then holding the cards in superimposition will reveal the logical elements that are true in all the applied statements.

The reader is referred to the work by Cundy & Rollett for a detailed description of a beautifully-devised system of cards of an equilateral shape, the idea being that each card may be made to do treble duty as it's turned around. (Fig 2). This of course cuts down the work of preparation if they are to be used repeatedly. Such a set ought to be in the possession of every teacher expecting to devote a fair amount of time to Venn diagrams and Boolean algebra. Ideally, the sets should be cut out of hardboard or thin ply . . . if varnished, such a set will

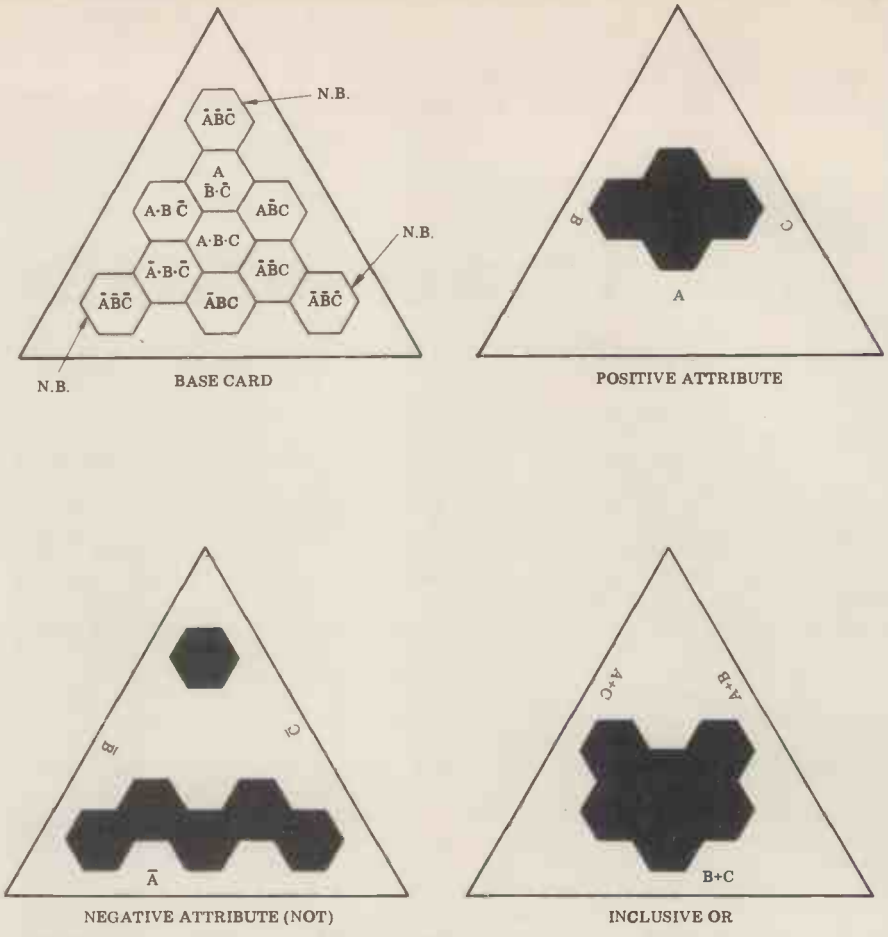


Fig 2 Note that the area outside the hoops has been reduced to three hexagons

give many years' wear. Middle or secondary pupils may gain much from making their own sets of cards, but generally speaking younger children do not have the necessary skills to ensure the accuracy needed for a triangular set.

The simpler type, suited for student construction, should be square — a shape swiftly and accurately cut on a guillotine. A template of hardboard is needed for every ten or twelve pupils, of standard dimensions and with a triangle taped or painted on it — indicating the position of three holes. To use the template, the pupil simply places it over his card and pricks through the three holes, giving him the three centres around which he may inscribe circles of a standard radius — say 1½ inches.

A base card is prepared first as in Figure 3. This is common to all problems. Note that for convenience, the entire area outside the three circles is reduced to an irregular shape at top right. This is a universally adopted and useful convention which removes the obvious difficulty entailed when this area is to be revealed by a window.

A thin overlay card is now required for each Boolean statement, based on Figure 1, where the window is to be the shaded part. It avoids waste if the pupil lightly hatches the area to be cut away and has the teacher check it before cutting is done. The Boolean statement should be written on the face of the card. Note that sometimes little bridges of card should be left to hold inner parts in place.

When all cards representing statements have been cut, they are superimposed over the base card; the Boolean statement common to all (and hence true), is read off the base card through the windows.

The following two examples will suffice to show the type of problem suitable for window cards.

Example 1

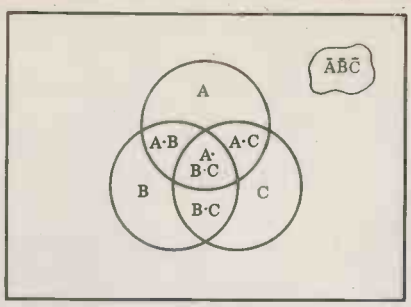
In a certain school where children study French, German and Latin, the following restrictions are imposed. French and German may not be studied together. If Latin is taken, then German must also be studied. At least French or German must be taken. What therefore are the possibilities for study?

We label French as A, German as B and Latin as C. It's then clear that the three Boolean statements are A ex-or B, if C then B, A + B. From these we can produce the three window cards of Figure 3 and if they are superimposed over the base card, we can read that the possibilities are A (French alone), B, (German alone), or B.C (German and Latin together).

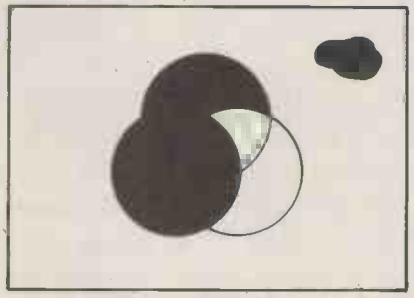
Of course, most people could have solved the problem in their heads, but we are here concerned (i) with proof that the system really does work, and (ii) with a model of how a logical machine would do the job.

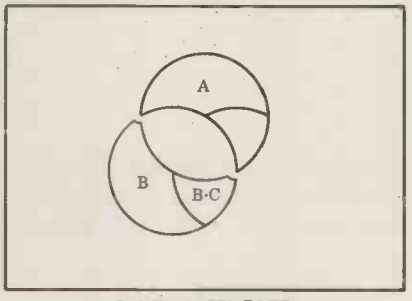
Example 2

Mack, Jack, Bill and Tom are four hermits living on a remote Scottish mountain. One day Tom is found with a knife in his back, very dead. Mack, Jack and Bill trudge many weary miles to report the incident to the police and



BASE CARD


IF C THEN B



CARDS ASSEMBLED

Inspector McPlod takes a statement from each of them.

Mack said, "Ah dinna ken onything aboot it."

Jack, "Bill told me that he saw Mack do it."

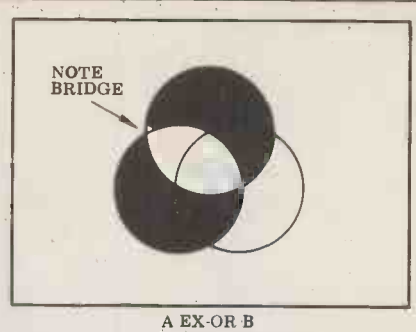
Bill said, "I think Mack and Jack did it together."

If we make two assumptions, (1) that only the guilty lie and (ii) that Tom was not murdered by anyone outside of these three, what are the possibilities? Using his window cards, Inspector McPlod knew whom to arrest for murder. Do you? (The answer is in the Appendix.)

Computer operation

It should by now be clear that Boolean algebra is easily handled by computers because a binary bit can represent one statement — 1 for yes or true; 0 for no or untrue. The reader should be able to see that combinations of binary coded words may represent the most complex Boolean statements and the computer can readily compare binary words in a manner analagous to the window cards — and so determine the truth or falsity of a large number of statements.

Just as the lie detector is not magic but gains results in the hands of a skilled operator from the measurement of skin reaction, heart beat and respiration of the person under test, so neither is the computer magic for it depends upon the rigorous application of common-sense rules. What gives the computer its magic-seeming ability in the eyes of many people is that, being a machine, it can handle thousands of statements at lightning-fast speed.



A EX-OR B

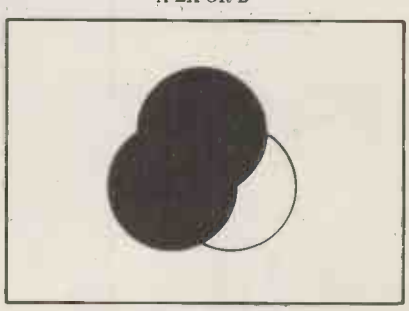

A+B

Fig 3 Black areas are to be cut out

So far we have looked briefly (and superficially) at how the computer can handle Boolean statements. Readers who are especially interested in Boolean algebra will find many books in any library or bookshop that cover the subject far more comprehensively than there is time to do here. In a later chapter we shall see how Boolean algebra can describe computer operation.

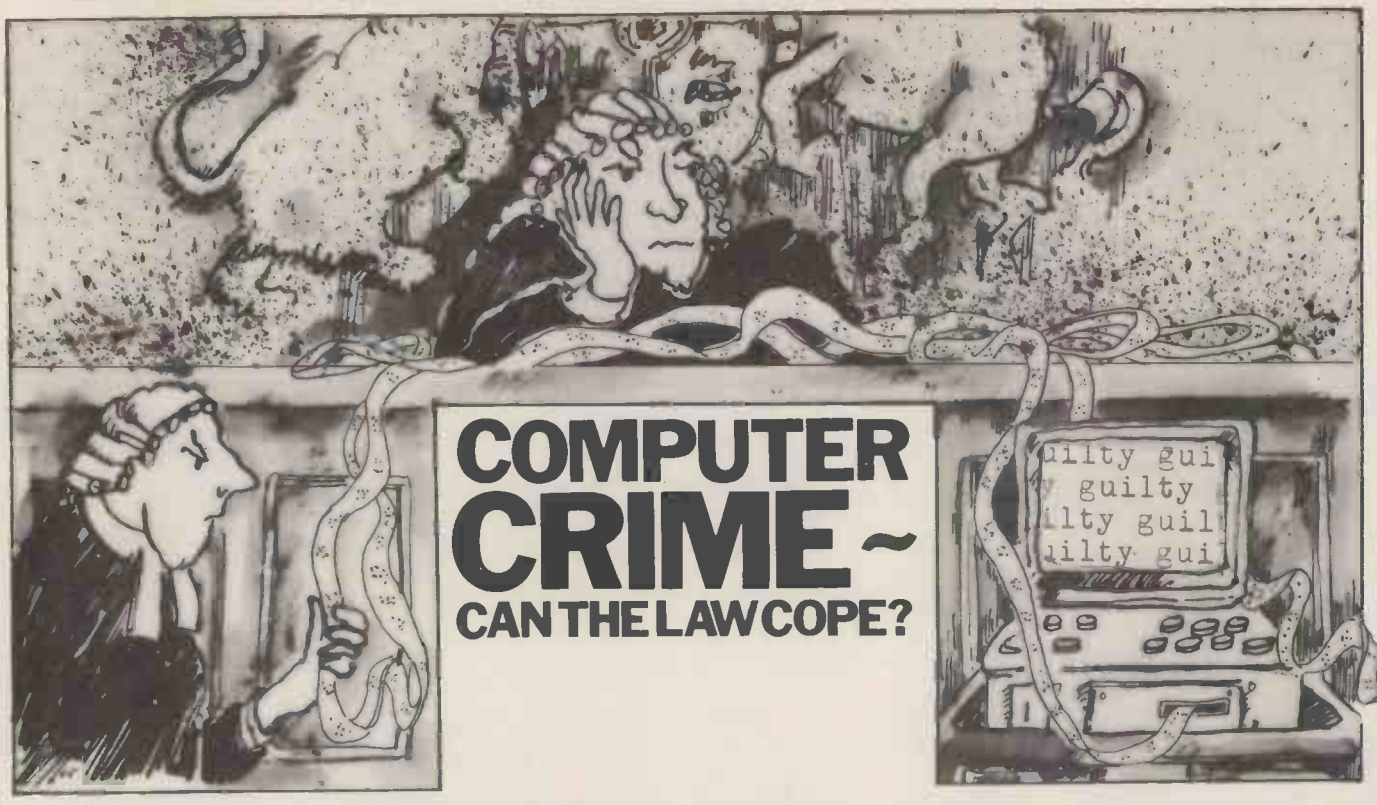
Appendix

The solution to Example 2 is as follows:

Let A=Mack did it; B=Jack did it; C=Bill did it. Now Mack's assertion that he knows nothing about the crime implies that Jack and/or Bill did it. This can be reduced to B + C (remembering that + indicates the inclusive-or). Jack's statement is interesting. If Bill was telling the truth (when he told Jack that Mack did it), then A is true. If not, than he (Bill) was the guilty party and C is true. Jack's statement therefore can be reduced to A ex-or C. Of course, Bill's statement reduces to $A.B.\bar{C}$ (A and B, not C).

We now have three logical statements to consider: B + C; A ex-or C; $A.B.\bar{C}$. If we assemble three overlay cards representing the truth of these statements, no part of the base card shows through . . . nobody killed Tom. Since this is patently untrue, one or more of the statements must also be untrue. Therefore we assemble the three overlay cards in all possible permutations of two, omitting one in turn. If we omit the first card, nothing shows through — therefore Mack's statement must be untrue. That is to say, if he really knew nothing about it, then nobody killed Tom!

Checking further, we find that the same remarks hold true of Jack's statement, while if we omit the last card (that is, check to see if it was a lie), we find that the only possibility remaining is A alone — that Mack did it unaided. This is self-contradictory. If Bill is lying (making him guilty), the only logical conclusion is that Mack did it! Therefore the ONLY TRUE STATEMENT is Bill's; Mack and Jack committed the murder together.



COMPUTER CRIME ~ CAN THE LAW COPE?

Computer fraud, invasion of privacy, software copying and hardware imitations — surely these are all 'crimes'? Commonplace they may be but the law is almost powerless to act. In this 'interrupt' Dr Stephen Castell unravels the issues and points a way ahead.

Information technology and the law

Lawyers can no longer afford to remain ignorant of the potential impact and implications of microelectronics-powered Information Technology.

Mini- and micro-computer word processing, accounting and time-costing systems to aid the lawyer in the (hopefully) more efficient and effective administration of his practice are increasingly developing and penetrating the UK legal market sector. In addition, commercially-available computer-assisted legal information retrieval systems and other information services have at last been launched in Britain (Infolex/Prestel in 1978, Eurolex/BOC Datasolve in June 1980, Lexis/Mead Data and Lawtel/Prestel coming shortly.) The highly-skilled UK lawyer — whose reputation for well-trained professionalism is probably second to none in the world, but whose adoption of business technology anything more advanced than a leather-bound tome and a quill pen in an exciting shade of grey has been on the whole rather less than rapid or enthusiastic — is now being approached on all sides by specially-designed information technology products, services and media; it's becoming increasingly difficult for him to ignore it.

And as fast as he attempts to assimilate, evaluate and decide on such technology as will suit his own individual practice's needs, he is going to have to deal professionally with the wider impact of this whole powerful microprocessor mix of computers, communications, office automation and 'informatics' on business, commerce and, indeed, society at large.

Many observers are viewing with growing concern what they feel to be serious gaps in existing legal norms, concepts and precedents. These are just a few of the issues arising from the growth of Information Technology:

Evidence — What is the status of computer-generated material as evidence in a Court of Law? Should printout be admissible?

Copyright — does material stored on computer media in 'electronic publishing' systems have the usual copyright protections? And if it does, how can an infringement be *detected*, if the transgressor is itself a *computer*?

Software, video and database products — what is the correct 'intellectual property' right to afford to this material to protect it from 'bootleggers' and 'pirates'?

Computer fraud — are there any techno-legal safeguards available to combat one of the world's fastest-growing 'white collar' crimes?

Privacy and security — with an increased reliance on computerised databanks and 'heuristic' programming, what are the individual's legal rights and freedoms? (If a robot is a sentient being, what are *his* legal rights...?) How much legal concern should be felt over the Police National Computer, say, or even over the US military computer that persists in giving erroneous Early Warnings that appear to many to be putting the world on the brink of accidental Nuclear War (Sorry about that madam, just a software fault, you understand...)?

Bad taste/libel/slander/obscene/criminal material — does existing legislation cover electronic media? Is digitised pornography on a disk actionable?

What, if anything, is being done?

The good news is that lawyers themselves are already beginning, it seems, to take some action on these issues, if only indirectly.

The Law Society of England, the English solicitor's professional governing body, has for several years had within its 'Non Contentious Business' remit a Computer Services Committee meeting frequently to consider a number of aspects of the impact of computer technology on the profession. The pioneering UK Society for Computers & Law (formed in 1973), which has links with this Committee and, indeed, with the Law Societies of Scotland, Wales and Northern Ireland, as well as with the British Computer Society, is now an established focus for development and discussion in this area, publishing a seminal quarterly journal and regularly holding seminars and workshops on many relevant issues. (Its Annual Conference, which attracts many hundreds of UK and international delegates, was held this year in early July at York University and featured the widest range of discussion on the topic 'Lawyers in the 80s' — word and data processing systems, information retrieval, Prestel, litigation support, electronic office — together with an Exhibition comprising over 30 commercial participants.)

The Society for Computers & Law addressed in particular the issue of

computer-assisted legal information retrieval and formed a special Sub-Committee which worked long and hard — but quickly — to produce in February 1979 its report 'A National Law Library — The Way Ahead' (available from the Administrative Secretary, 11 High Street, Milton, Nr. Abingdon, Oxon). This was followed at the beginning of 1980 with the incorporation of a new company — The National Law Library Limited (TNLLL), wholly-owned by a new charitable National Law Library Trust and having the financial backing of all the UK Law Societies. From February to May this year TNLLL carried out a whistle-stop seminar tour of more than 20 local law societies all over England, Scotland and Wales, beginning the essential work of educating the 'grass roots' of the legal profession to the joys and challenge of mechanised/computerised law-library facilities. TNLLL having declared itself non-competitive with established commercial vendors of products and services for the legal sector, should therefore have a vital, comfortable and constructive relationship with them. It could above all have a crucial independent and objective role to play in not only assisting the average lawyer in assessment of the bewildering range of products now competing for his attention (and wallet), but also, and in my view most importantly, in taking the lead in coming to grips with some of the vexed issues — such as software protection, copyright, etc. — mentioned above.

These established, corporate efforts are now also beginning to be stimulated by a growing number of individual initiatives — some, again most gratifyingly, by lawyers themselves. To begin with, many of the individuals involved with the Society for Computers & Law have long had personal records as leaders of the 'technology impact on the law' debate, and anyone coming after them must surely be in their debt for their pioneering — and, indeed, continuing — work.

Alistair Kelman, a practising barrister, has recently caused something of a new stir by his outspoken suggestion for amendment to the 1956 Copyright Act, defining a new legal concept of 'transmutation' to cover the intellectual property represented by computer software. He has also drawn the Home Secretary's attention to the implications and shortcomings (to put it mildly) of the ruling in the January 1980 *R v Pettigrew* Appeal Court decision which held that computer printout was not admissible in Court as evidence in Criminal Proceedings. In April, Kelman attracted a standing-room only audience to a British Computer Society Specialist Group meeting (which normally achieves 20 enthusiasts maximum) to hear him discuss these timely issues, and he appeared with similar effect in June on a European study Conferences/Infolex one-day London Conference 'Computer Information Systems & The Legal Profession' with an eclectic presentation on 'The Impact of Computer Technology on Legal Jurisprudence'.

On the specific issue of software protection and, indeed, the related concept of (don't laugh too hard) software 'quality', Graham Ross, a Merseyside solicitor, has put forward some private ideas for a 'Software Register' and associated (but probably unworkable) vetting, registration and arbitration procedures.

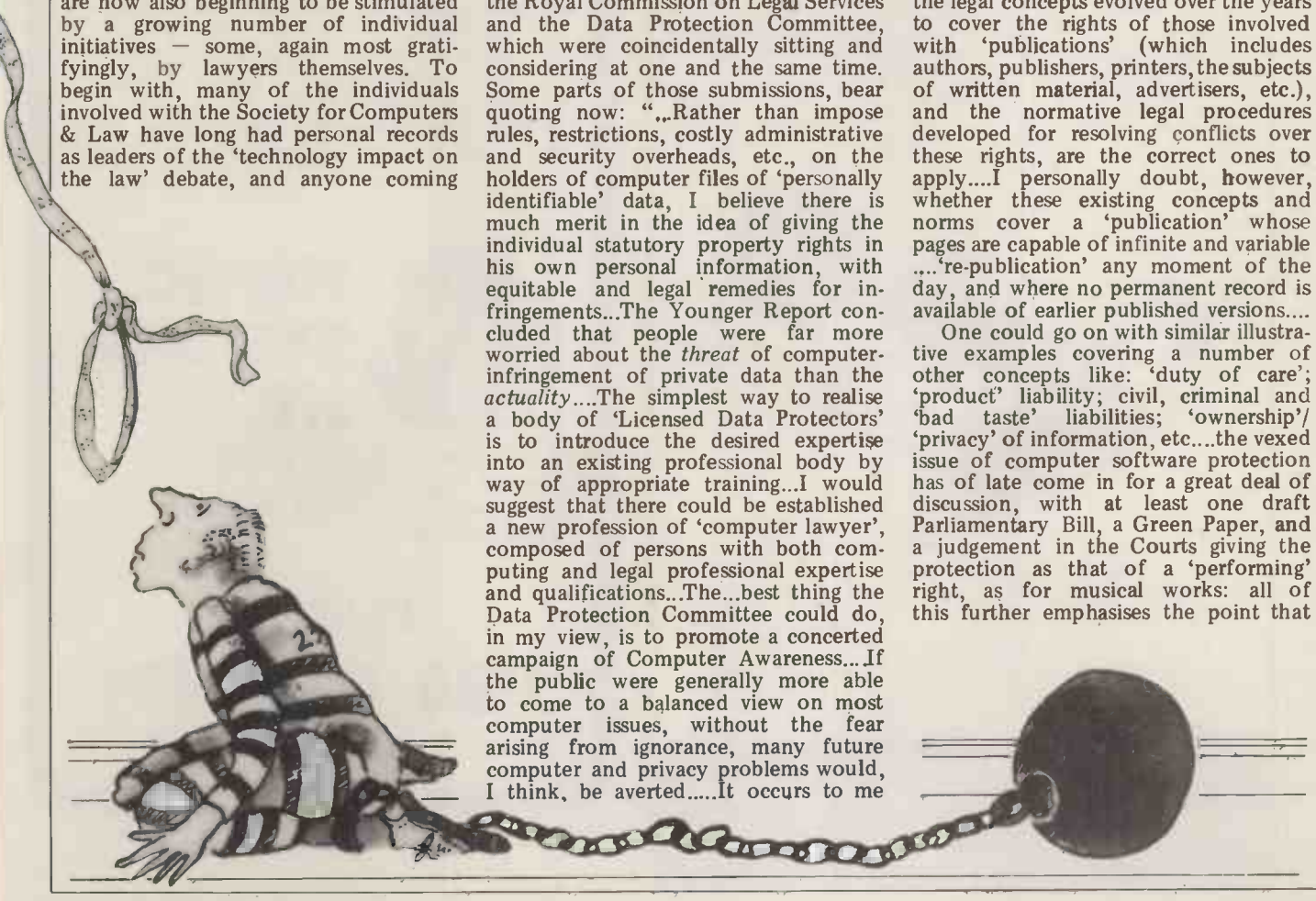
As long ago as September 1976, I made personal submissions to both the Royal Commission on Legal Services and the Data Protection Committee, which were coincidentally sitting and considering at one and the same time. Some parts of those submissions, bear quoting now: "...Rather than impose rules, restrictions, costly administrative and security overheads, etc., on the holders of computer files of 'personally identifiable' data, I believe there is much merit in the idea of giving the individual statutory property rights in his own personal information, with equitable and legal remedies for infringements...The Younger Report concluded that people were far more worried about the *threat* of computer-infringement of private data than the *actuality*....The simplest way to realise a body of 'Licensed Data Protectors' is to introduce the desired expertise into an existing professional body by way of appropriate training...I would suggest that there could be established a new profession of 'computer lawyer', composed of persons with both computing and legal professional expertise and qualifications...The...best thing the Data Protection Committee could do, in my view, is to promote a concerted campaign of Computer Awareness...If the public were generally more able to come to a balanced view on most computer issues, without the fear arising from ignorance, many future computer and privacy problems would, I think, be averted.....It occurs to me that the future impact of computers and associated technology on many aspects of business and private life may have profound legal implications. When considering the future training of entrants to the legal profession,... give some considerable thought to extending the understanding and expertise of legal practitioners into these areas of technology."

More recently, in March this year, I presented at Viewdata '80 (the first major international conference on all aspects of videotex) a paper on 'Prestel and the law'. Again, I quote: "Prestel itself, in common with an increasing number of other Information Technology products and services designed with mass appeal, defies simple definition and itself requires a new conceptualising. For example, by focussing on the various component parts of the system in turn, it may variously be regarded as:

- a publishing medium
- the publication itself
- the means of production of the published text
- the content of the publication
- an (electronic) information system
- an (electronic) communication system
- an intelligent device for searching publications
- a game
- an (educational) toy
- 'the fifth TV channel'
- a computerised databank
- an advertising hoarding.

It may well be that Prestel has a separate and distinct legal status for each of these definitions. For example, if it is to be regarded as a 'publication', then the legal concepts evolved over the years to cover the rights of those involved with 'publications' (which includes authors, publishers, printers, the subjects of written material, advertisers, etc.), and the normative legal procedures developed for resolving conflicts over these rights, are the correct ones to apply....I personally doubt, however, whether these existing concepts and norms cover a 'publication' whose pages are capable of infinite and variable ....'re-publication' any moment of the day, and where no permanent record is available of earlier published versions....

One could go on with similar illustrative examples covering a number of other concepts like: 'duty of care'; 'product' liability; civil, criminal and 'bad taste' liabilities; 'ownership'/'privacy' of information, etc....the vexed issue of computer software protection has of late come in for a great deal of discussion, with at least one draft Parliamentary Bill, a Green Paper, and a judgement in the Courts giving the protection as that of a 'performing' right, as for musical works: all of this further emphasises the point that



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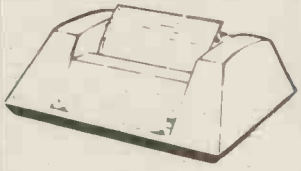

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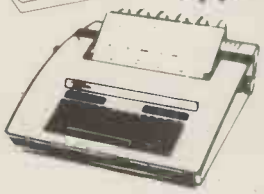

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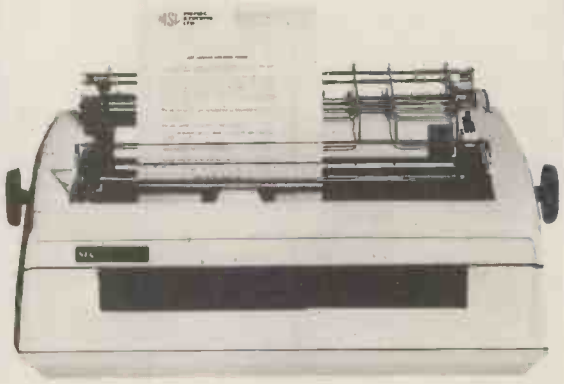

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INTERRUPT

a difficult period of rapid evolution of new concepts lies ahead."

I have suggested that in Viewdate '81 a whole Conference Session be devoted to 'Prestel and the law'....

The way ahead

On 21 May 1980, in the Law Society's 'Guardian' Gazette (the premier legal professional weekly journal), two barristers — John Scannell and Sheila Richardson — and I had published an article "BERTIE, the First Electronic Barrister — Computer Information Retrieval Accepted as Constituting 'Publication'."

The article began: "A specially-designed portable microcomputer and telecommunications system, described by its makers, Luddite Legal Systems Ltd., as 'the world's first ultra-intelligent-machine lawyer' and given the acronym BERTIE (for Barristers' Equipment for the Retrieval of Teleological Information Electronically) yesterday (31 June) became the first non-human advocate to be given the right of audience in an English court. BERTIE successfully defended Mr. Steen C T Pellash in a prosecution for a contravention of the Prevention of Depositors Act 1934".

BERTIE, so this 'case report' goes, successfully gains the acquittal of his client Pellash by:

1) quoting as *precedent* an account of a case which, although accessible by computer-assisted retrieval communicating direct with the computer photo-typesetting system of The Times newspaper, is not to be published as a Times Law Report in The Times itself until the *following day*;

2) assembling in Court all the relevant financial records, in hard copy, of his client's Guernsey bank (the absence of which had been the reason for Pellash's prosecution for suspected fraud in the first place), generated by having on-line access to the counter-entries held in the computer files of all the bank's customers, 'nostro' banks etc..

Spoof this article may have been, but it ends as follows: "Mr. Jack Lennax, prosecuting counsel, said afterwards: 'This case raises a number of important issues, not the least of which is the doubt now cast on *Pettigrew*. The outcome could have a profound effect on all those at the criminal Bar. I shall personally be taking action to see that the Bar Council is fully aware of these matters and responds accordingly.' Later it was announced that Mr. Lennax was to launch a Barristers' Action Group on Information Technology (BAGIT), but at the time of going to press no details of its proposed aims and objectives were available."

Now 'bag IT', who knows, may well be what some entrenched members of the legal profession would like to do with Information Technology and the challenging problems that I have suggested its spread and impact raises. But these problems, if only because of the pressure exerted by the 'information power to the people' of low-cost microcomputer systems, will refuse to be bagged or gagged and, one can be confident, will not just go away. Nor can the normal legal evolutionary process of first tentative actions in court, leading to a pragmatic hammering out of legal norms and concepts in the light of subsequent connected judgements — culminating eventually, perhaps, in a new branch of legislation and regulatory procedures — be allowed, in my view, to take its usual course in this case. Indeed, with reference to the recent Clive Sinclair/Micro Ace controversy, Alistair Kelman has been quoted as saying "Going from trial to trial is a bad way of sorting out an unsatisfactory law".

Information Technology — its impact and ramifications, quickly focussing quintessentially on the nature and power of the Information Resource itself — is far too profound an issue to allow lawyers (and the sometimes crude development process of the practice and administration of legal jurisprudence) to handle it by themselves. (If you don't believe me, I recommend you read John McHale's "The Changing Information Environment", Elek Books, London, 1976, ISBN 0 236 40052 5).

What may be needed is, rather, some focal initiative involving information technologists (that includes, yes — you, the readers of PCW), lawyers and whoever else, which will be an agency for AGITation and for pro-active, catalytic motion: an Action Group on Information Technology, perhaps.

I in fact proposed AGIT in all seriousness in letters two years ago published in *Computer Weekly* and *Computing*, and subsequently in several letters in the *Financial Times*. Briefly, AGIT's main preoccupations were proposed as being the definition of a 'national objective' on Information Technology, which would of necessity include an informed evaluation and analysis of the 'best' legal response on issues like software piracy, privacy/security/fraud, evidence, etc. (perhaps leading to a new simplified legal concept like an 'Information Right'); it would also create more adequate avenues of venture capital financing of Britain's embryo microelectronics-based IT businesses (but that's another Interrupt...)

How many more pirated packages and R v Pettigrew's do we need before we start AGITating?

LEISURE LINES

with J J Clessa

It's quite typical of the computer population in general, and the readership of PCW in particular, that when a problem is given which they can't solve the reaction is not "I can't do it", but instead "It can't be done"!

What arrogance! Anyway it was very satisfying for me, after months of abuse about the problems being too easy, to find one that floored so many. Out of 45 replies only 7 had the correct solution which was $(\frac{4}{12})^2$. If you add 5 to this you get $(\frac{4}{12})^2$ and if you subtract 5 from it you get $(\frac{3}{12})^2$ All of which are perfect squares — obviously the majority of readers assumed that perfect squares implied an integer value.

Anyway, it was easier to pick the winner this month — none of Tebbutt's random number nonsense — and the lucky man is Mr C M Nash of Peterborough. If that didn't brighten your day Mr Nash I'm sure the prize will — 25 lightbulbs are on their way!

Quickie

An old chestnut: If a brick weighs 7 lbs plus half a brick, what is the weight of a brick-and-a-half? Sorry, as usual no answers, no prizes.

Prize puzzle

A woman goes into a supermarket and purchases four items. Before she goes to the checkout she decides to work out the cost using her new pocket calculator. However, she is neither very numerate nor very adept in the use of a calculator. By mistake she hits the X key instead of the + key for each transaction. The result she arrives at is £7.11 and, when she arrives at the checkout, the assistant adds up the items in the normal way and gets the result £7.11. The woman is satisfied and pays, never knowing the stupid blunder she'd made. What was the cost of each item involved?

Answer please on a *postcard* (all letters go in the bin) by 31 August to: Puzzle No 12, PCW, 14 Rathbone Place, London, W1P 1DE.

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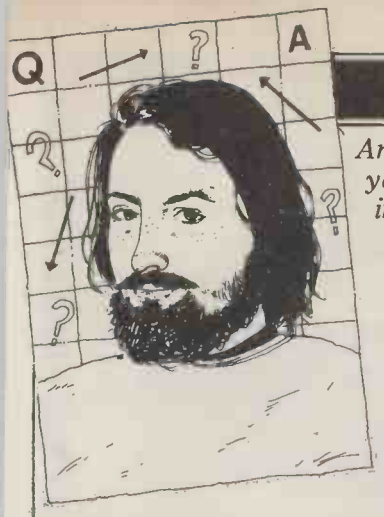


COMPUTER ANSWERS

Answers to questions are invariably published two months or more after arrival; if you require a copy of the reply earlier please enclose an SAE. I am receiving an increasing number of questions from people who stress that the question is NOT for publication — these can be answered but will be charged for at a rate commensurate with the research needed. Send your questions to me, Sheridan Williams, at 35 St Julian's Road, St. Albans, Herts.

More on research

I was most interested to read your answer to the letter about GETting a character from the keyboard of a Research Machines 380Z. Perhaps you would answer another question about the same machine. How do I write a USR subroutine in Basic for some special purpose.
R Tobin, Slough

You will find a brief explanation about USR subroutines in the notes supplied with Basic. It's worth noting, however, that you must be familiar with machine-code programming before you can write a USR routine. It's not possible in such a brief reply to show you how to write a program but I shall outline the main points regarding use of the USR function.

When the statement Y=USR(X) is made in Basic, the variable Y is assigned the value calculated by a machine code program previously written and planted somewhere in memory. USR need not actually return a value, and X could be a dummy variable (i.e. not used or altered by the machine code segment), but the statement must be used in the above form. If this statement were used without any machine code subroutine being available, then you would get an error message. This is because when the USR function is called, Basic will jump to the location pointed to by the 'USR transfer vector', and only an error routine resides there at present.

You will find a table of addresses which will be needed with the release notes for each version of Basic that you have. The best place to put the machine code program is at the end of the Basic interpreter; this area will begin at location BASEND+1. Let's assume that there is a program at BASEND+1; this will probably need to refer to the function argument (in this case X), to be found at 'USR value from'. When the subroutine needs to return a value to Basic we must place the value to be returned in 'USR value to'. Before we can actually run the Basic program with the subroutine inserted we must inform Basic that BASEND is now changed, otherwise it will start storing the program and variables on top of your subroutine; we do this by altering BASEND to include the new subroutine. We must also alter BBUFV which points to the new BASEND+1.

Examples of the uses to which a USR function can be put fall into two categories . . 1) To perform a routine that is otherwise too difficult to write in Basic, for example accessing the real-time clock . . . 2) To perform a routine faster than it could be performed by Basic itself (e.g. multiplication by a power of two could be achieved far faster as a succession of arithmetic left shifts.)
SW

Hard and soft sectors

Please would you explain what is meant by hard and soft sectored disks.
R G Struthers, Fife

A floppy disk sleeve contains three holes — the read/write window, the centre spindle and another called the sector marker window. If you rotate the disk in its sleeve and look in this window you will see a hole pass under it. If, during one rotation of the disk, you only see one hole pass by, then you have a soft sectored disk. On a hard sectored disk you will see 10 or maybe 16 holes, each marking the beginning of a sector. It's essential to use the correct type of disk in a system and this will be either hard or soft sectored.

In soft sectored format the using system may record one long record or several smaller records; each *track* is started by a physical index pulse (prompted by the hole), and then each record is preceded by a unique record identifier. Each field on a track is separated from adjacent fields by a number of bytes which are provided to allow the updating of one field without affecting other adjacent fields.

In hard sectored format, the system may record 10 or 16 sectors per track with each *sector* being started by a physical sector pulse.
SW

Get it?

I have access to a North Star Horizon with a Lear-Siegler ADM-3A terminal, and release 5.0 North Star Basic. I would like a GET command on this machine similar to the one printed a few months ago for the RML 380Z but I don't want to go into machine code; can it be done in Basic? Could you also tell me the upper and lower RAM addresses for screen accessing, for use with the FILL (POKE) statement. I've tried experimenting with various values but I've only succeeded in crashing the system.
Graham Kirby, Pitlochry, Perthshire

There must be many small businesses/ schools/colleges with systems like the North Star Horizon/Cromemco/Rair etc . . . I wonder why I get so few questions about these machines? Anyway straight on to the GET command problem — a solution like Table 1 should work.

The initial FILL statement may vary from system to system but you'll find it by looking in the manual under 'personalising Basic', Here it will tell you how to switch off the 'control-C' break. This is done with a FILL S + 24, 1 where S is the base address for Basic; it's usually 2D00H (11520). You mustn't forget to switch the control-C back on using FILL S+24, 0 before you stop the program. INP(2) checks to see if a key has been pressed and sets the second bit from the right to a one — this is decoded in line 1010. If a key has been pressed (ie A<>0) then to find which it is we use INP(3) which returns the ASCII code of the key but with even parity; so line 1020 strips off the left-most bit. We must now check to see if a control-C (ASCII code 3) has been pressed; if it hasn't we return to the main program. As you can no doubt work out, the key scanning routine starts at line 1000. If you only want to know whether a key has been pressed and not which one, you need only use INP(2).

Your second question can be answered simply by saying that the screen is not 'memory mapped' so there is no area of memory that holds the screen contents. VDUs used with systems like the Horizon always support the routines necessary for moving the cursor around; as I don't have an ADM-3A at hand, the information has been gleaned from the manual kindly sent to me by Lear Siegler.

Firstly you must have the cursor mode switch ON and this is done by means of the internal switches inside the VDU. With the keyboard facing you, look at the set of switches at the back and to the right; set switch 7 to ON (it's labelled CUR CTL so you should find the correct one). To place the cursor in row X and column Y you must transmit from the computer an 'ESC' followed by an '=' followed by the row and column address codes. To clear the screen use CHR$(26), and to 'home' the cursor use CHR$(30).

Here is a defined function that will allow you to implement direct cursor addressing — as used by all professional programmers (none of this scrolling nonsense). To put the cursor in position X, Y just say PRINT FNC$(X,Y) followed by whatever you want there. The program in Table 2 will place random Xs all over the screen.

For those of you with

```
10 FILL 11544,1
20 PRINT"TOUCH A KEY PLEASE ",
30 GOSUB 1000\IF B=0 THEN 30
40 PRINT CHR$(B)
50 GOTO 20
1000 B=0
1010 A=INP(3)\IF INT((A-4*INT(A/4))/2)=0 THEN RETURN
1020 B=INP(2)\IF B>128 THEN B=B-128
1030 IF B<>3 THEN RETURN
1040 FILL 11544,0\STOP
```

Table 1

```
5     PRINT CHR$(26)
10     X=INT(RND(0)*23)
15     Y=INT(RND(0)*79)
20     PRINT FNC$(X,Y),"X"
30    GOTO 10
40REM-------------------------------
1000 DEF FNC$(X,Y)
1010   IF X<0 OR X>23 THEN RETURN ""
1020   IF Y<0 OR Y>79 THEN RETURN ""
1030   RETURN CHR$(27)+"="+CHR$(X+31)+CHR$(Y+31)
1040 FNEND
```

Table 2

other VDUs the same sort of technique will apply, and all you will have to change is the code in lines 1030 and 5. The Elbit VDU and some others also support more advanced facilities such as the ability to clear a whole line, or a portion of the screen and you can also protect parts of the screen from being erased. Good luck and have hours of fun (sorry, work!).
SW

Solving UK's problems

I am writing a program which involves long division of a three byte number by a single byte number, to run on a UK101. It works nicely till the divisor is a number above 7FH — when everything goes haywire. Is this because the UK101 regards single byte numbers above this as negative? If so, how can I overcome the problem?

I would also like to interface my UK101 to my Olivetti ET221 electronic typewriter, both to provide hard-copy from the UK101, and to extend the memory capacity of the typewriter, which includes a Z80. Could this be done in a completely non-destructive way, as the typewriter is still under warranty?
K. P. Wood, Wakefield

In common with other 6502-based machines, (and in fact with most other 8 bit machines), the UK101 uses 'two's complement' notation to handle negative numbers. In this, negative numbers are formed in binary by turning each bit of the number into its opposite (ie. 1s become 0s, and 0s become 1s) and then adding one bit (ie. 00000001) to the result. This leads to positive numbers all having 0 as the leftmost bit, and negative numbers all having 1 in the corresponding position. Hence, as you have correctly worked out, all single bit numbers in excess of 7FH (127 Dec.) are treated as negative.

To overcome this you will have to use two-byte divisors. This is not as difficult as it might sound, as the 6502 instruction set is designed to cope with multi-byte subtraction and division is, of course, just protracted subtraction in essence! For example, the coding to subtract one two-byte number from another is:

```
LDA NUM1
SBC NUM2
STA NUM3
LDA NUM1+1
SBC NUM2+1
STA NUM3+1
```

This takes the first byte of NUMber 2 and subtracts it from the first byte of NUMber 1, storing the result in NUMber 3. The second bytes of the two numbers are then dealt with in the same way. Note that this particular set of instructions takes care of the carry from byte to byte. I hope this information will now let you complete your program.

Your second query poses very much more difficult problems. Not only is there the commercial difficulty of your Olivetti ET221 (a very nice machine!) still being under warranty, there are also formidable technical problems.

Firstly, you say that the Olivetti has a Z80 microprocessor in among its memory, and wonder about interfacing this microprocessor to the one in your UK101. Well the microprocessor in the UK101 is a 6502 . . . and the instruction sets of the Z80 and the 6502 are quite different and incompatible. But that may not be the end to incompatibility problems. It's not particularly likely that Olivetti will have used the ASCII code for representing characters within their typewriter. After all, this code is intended for external communication, and the typewriter is not intended to communicate electrically with anything outside itself.

Now, translating one code into another is not too difficult if you have enough memory to spare to hold the look-up tables, and if (in the case of your typewriter) you know what both the codes are! Interfacing a Z80 and a 6502 is another matter altogether, and might involve them communicating with one another in a common high level language for which they both had compatible compilers, or even using another microprocessor as a go-between (or 'front-end processor' to give it its official jargon name).

All in all, I must recommend against trying to establish any electrical (or electronic) link between your UK101 and your Olivetti ET221. A mechanical link could be more satisfactory, and devices to connect electric typewriters to computers are currently being advertised at between £300 and £400 approx., excluding VAT.
P L McIlmoyle

Nag on display

Every year I am asked to do the commentary for the Pony Club horse trials. I would like to record all of the riders and 'Nags' as print statements in the UK101 I hope shortly to own, thus going to a line number would read the data on the horse and rider — whose competition number would be the same. This simple idea would have a few small refinements.

Firstly, I would like to be able to type in the number of the horse and have the data displayed as a line. This line should correspond to the position of the horse on the course e.g. the last horse just started would be at the bottom of a list, perhaps below a thick line, with the horse before that on the line above, so that as each horse starts below the line the previous one is moved up. How can this be arranged? How can I remove a horse from the VDU that has finished the course?

Also, could you please suggest a SAFE way of providing power for the machine from a 12-volt car battery, with the aim of the battery lasting for up to 10 hours, even with the VDU also running off it?
J.J.W. Spencer, Neach Hill, Nr. Shifnal.

This is an interesting application and one which again illustrates the wisdom of the 'systems approach'; that means sitting down and carefully studying the whole problem before even thinking of writing a program.

Let's look at our actual objectives in a little more detail. The basic aim is to get some information displayed on the VDU in response to the entry of a single number. But from this single number the computer has to decide whether to display the information at the bottom of the screen, which way to move the rest of the display, or whether to delete information already displayed about a horse that has now finished the course. If we sit down to code this up at this stage we will probably think of getting the computer to ask questions such as 'What is the number of the horse?', and 'Delete or add?'. But these questions will appear on the screen, confusing the details of the competitors and taking up valuable lines, so that it might only be possible to show eight horses at a time!

So look at the problem from another angle. What we are saying to the computer is, "here is a number of an entrant — if it's on the screen it must have been entered for deletion — if it's not already on the screen it must be a fresh starter, so display the details on the bottom line". Fine . . . but how can the computer 'know' what's already on the screen? With a memory-mapped screen we could do this the elegant way by directly searching through the screen contents. Now the UK101 has a memory-mapped screen, but we can only get at this in machine code. So let's look at the hard slog method of deleting a line from the screen . . . re-write the whole screen! As it turns out this approach will also let us move the details of the previous starter up past the heavy line.

Instead of storing the competitors' details as PRINT statements, store them as DATA statements, with the competition number as the first item. For example: 120 DATA 17, "PUFFING BILLY", "LIZZIE BORDEN". We can now make use of the UK101's powerful array facilities to set up three arrays of sixteen rows each, with a DIM statement: 100 DIM A(16), B$(16),C$(16). These arrays between them hold all the data that's on the screen. The program can, of course, read the arrays to find what's on the screen, then alter this information in the arrays, clear the screen, and rewrite it with the new information from the arrays.

The way the program will now work is that after setting up the arrays it issues a single INPUT statement followed by a semi-colon. This will only put a "?" on the screen, and keep on the same line for you to enter just the competitor's number. A FOR/NEXT loop is now used to scan array A to see if that number is already in the array, and hence on the screen. If it is, the program should branch to a sub-routine which sets that element of A to zero and the corresponding elements of B$ and C$ to blank (" "). Another FOR/NEXT loop should then be used to write all 16 lines of the arrays to the screen. If the first loop does not find the competitor's number in array A a RESTORE statement should be executed. Yet another FOR/NEXT loop (loops are very useful!) then goes through all the DATA statements with READ A, B$, C$ till a value of A and the corresponding values of B$ and C$ are then put into the last rows of the arrays, after yet a further loop has moved the details from row two to row one and so on till row 16 has been moved to row 14. Yes, row 14. . . for row 15 always holds the heavy line! Now rewrite the screen, and all the new information will be on it, including the heavy line in the right place!

I'm glad to see your concern with electrical safety — high voltages do not mix well with possibly wet grass, not to mention rain! The main problem is, of course, the VDU. I would suggest that you use one of the fairly small (10-12 inch) TV sets specially designed to operate from 12 volt car batteries. As these take no less than 20 watts, the current drain will be under two amps.

The UK101 calls for eight volts. Use a serial voltage stabiliser to reduce the 12 volts of the car battery to this level. Not only will this give better voltage regulation than just a Zener diode, it will significantly reduce the power drain.

This set up should keep you going safely for a full ten hours from a fully charged car battery. Don't expect it to start a car at the end of it, though!
P. McIlmoyle

GETTING IT TAPED

Talib Shaman explains how you might develop software for handling cassette-based data files. Although based on his experiences with a Nascom 1, the story should prove extremely interesting to those considering the same problem on other machines.

Cassette file handling

Some micros do not have the software facility whereby a program can create data (information) files or access and update existing ones. Such a facility is essential in areas where an 'ongoing' record of information is to be maintained (for instance with book-keeping, stock control, payroll, etc). For those of you who do not have such a facility this article offers guidance on generating software that will make good use of the cassette tape for data file maintenance. The practical examples that I include come from software which I developed for the basic NASCOM; I've called it TSAM (Tape Sequential Access Method).

File structure

Supposing we have a stock control system in which it is necessary to maintain the following information about every item in stock:

- Item number or code
- Price
- Quantity in stock
- Supplier
- Re-order level

In a manual system a clerk would maintain a stock file. This could be a book with one page per item, or a tray with one card per item. In a computer system this file could be held on a magnetic tape. On this tape file, items are recorded one after another (serially) and each item is called a record. The *record*, in this example, would hold the item code, price, quantity in stock, etc. (Fig 1). A record therefore would only need to hold values such as for example, A616040. It's up to you to define and know what each part of the record represents — in this case, the first three bytes are the item code followed by two bytes for the price and so on. These different divisions within the record are called *data fields*.

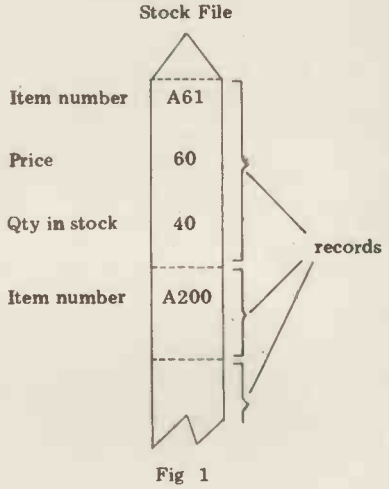


Fig 1

In order to detect where a file starts and finishes on a tape or a cassette, each file needs a *header* and *trailer* record. The file header is physically the first record and the trailer is the last on the file (Fig 2). These records need not be of the same format as the data records. Their format is decided by the software which maintains and accesses the files. One common 'piece' of information which a file header contains, is the file identification.

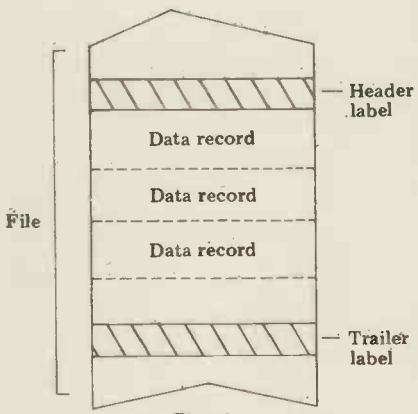


Fig 2

Other typical information is:

- File version (this is incremented as the file is updated)
- Date of last update
- Data record size
- etc.

Usually, the trailer doesn't have much information apart from, in some cases, a count of the records on the file. This, if maintained, would be automatically updated by the software.

Access method

The way a file is organised or structured decides the ways or the methods by which we can access it. A tape file as shown earlier, is organised in a serial fashion — records follow one another physically. With this architecture, records can be maintained in an ascending or descending (sorted) sequence of one or a combination of data fields from those records. These fields upon which the file is sorted are called *Sort Keys*. In our stock control example, the file could equally well be sorted on item number, or price and so on.

Reading a tape file from start to finish is a *serial* access (records are read as they are physically found on the file). However, if the file happens to be sorted, then the access is *sequential* with respect to the sort key.

In the majority of tape file applications, files are maintained in a sorted order. This is so, not only to provide sorted output or reports but also to speed up the location of the required records from the file. If we take an example and suppose that on a sorted control file the record for item A95 is needed, then all we have to do is to read the file and match the stock item number in every record we read against that required until either we find the record for that item or come across an item higher in number (which would suggest that the stock item does not exist).

In the case of an unsorted file, all the records must be read before it can be decided that the item does not exist. Furthermore, in the case of an unsorted file, the search has to start from the beginning, whereas with sorted files, the search can continue from the current position within the file — so long as the value of the key in the current record (stock item number) is lower than the value required (we are assuming an ascending sort, which is true in the majority of cases).

To read a record from cassette into memory or to write a record out takes a long time in computing terms. These time-costly operations are called Physical Input/Output Operations (Physical I/Os). Somehow, these have to be reduced and the way this is done is to move more than one record (a *block* of records) between memory and secondary storage when a physical I/O is performed. Having read a block of records you can then read one record at a time from the block (which is now in memory) and when the whole block is read, another block is transferred from cassette. In this way, we are reading all the records we want but making fewer physical I/Os. Besides other factors, the reduction of these physical I/Os is related to the number of records in a block; the number of records per block is called the *blocking factor*.

To expect every program which needs to access the file to perform these operations and to open and close files etc. is to expect a great deal of code duplication. Instead therefore, a piece of software called the *Access Method* can be used to organise, open and close files and block and deblock records. The user's program can be provided with simple commands to communicate its requests to the Access Method which performs all those complex and, in most cases, hardware dependent tasks like switching between tape units and communicating with the monitor and the operator.

So far we have concentrated on basic terminology and concepts in order to pave the way for the serious topic of designing our data management software. Now, instead of 'throwing' principles and methodologies at you to think about and possible misinterpret, I shall take my actual Access Method (TSAM) and 'walk' you through the

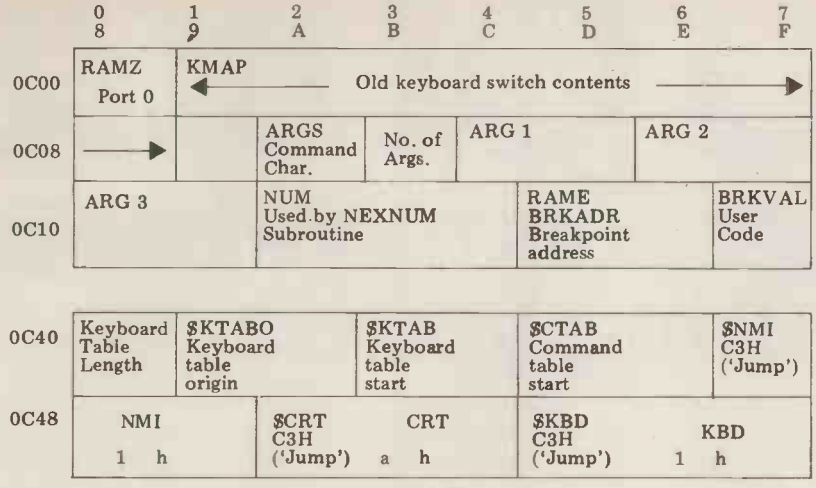


Fig 3

various stages I had to go through in order to develop it.

Background

The design process was made up of the following distinct stages:

- Identifying and conceptually defining the services which the software (TSAM) should provide.
- Understanding how the various data related routines of the monitor are invoked.
- From the two stages above, determining:
  - What monitor routines to modify and how to do it
  - What monitor routines to use directly
  - What new routines to introduce
- Writing and testing the software

This approach was essential in order to take advantage of the existing complex data handling routines already present in the monitor.

Basic requirements

Four basic functions were required:

- OPEN a file

  A function which when *called* by a program, with certain parameters, instructs the operator to mount the required file on a specified free deck for input or output. Upon mounting of the file, the OPEN function, in the case of a new file, generates and writes the header label — or in the case of an existing file, reads the header label and checks that the file mounted is the file requested.
- READ a record

  Whereby a record is read from an opened file. The record is placed in a known area of memory, ready for use by the user program. Once the end of file is detected, the READ function returns a suitable response code to the user program. (All TSAM functions return a response code in a known area of memory to signal completion or error conditions. The calling program should always test these.)
- WRITE a record

  The user program places a record in a certain area of memory and calls this function which outputs it to the corresponding file.
- CLOSE the file

  Having finished with a file, the user program calls this function which writes a Trailer label to that file and frees the deck.

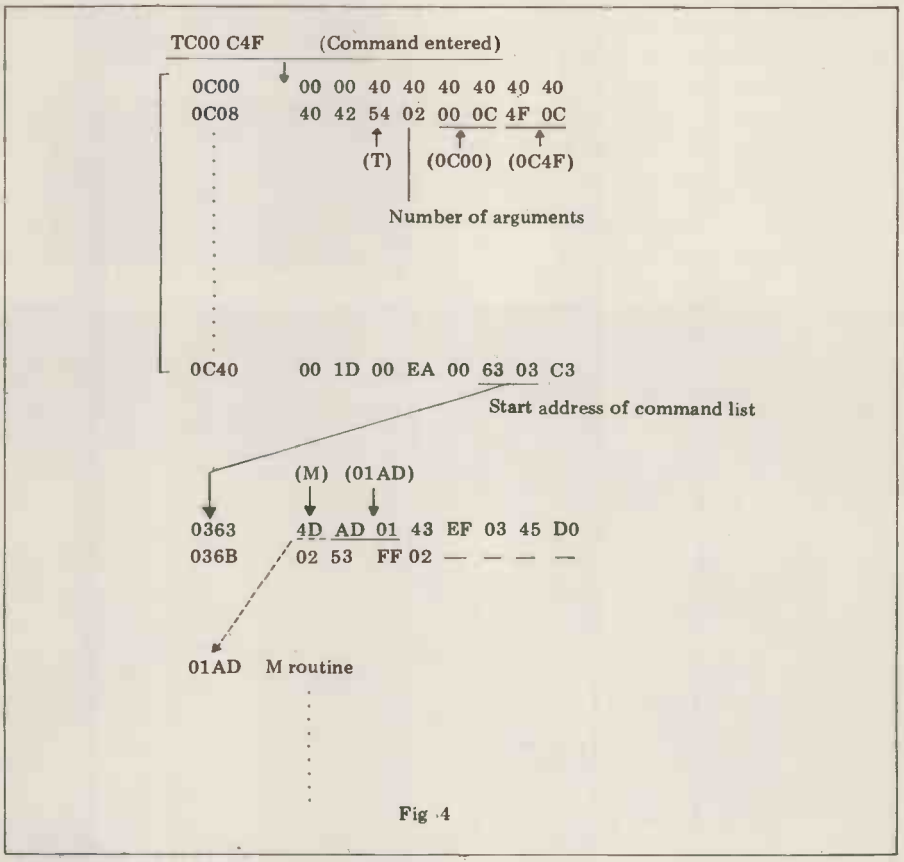
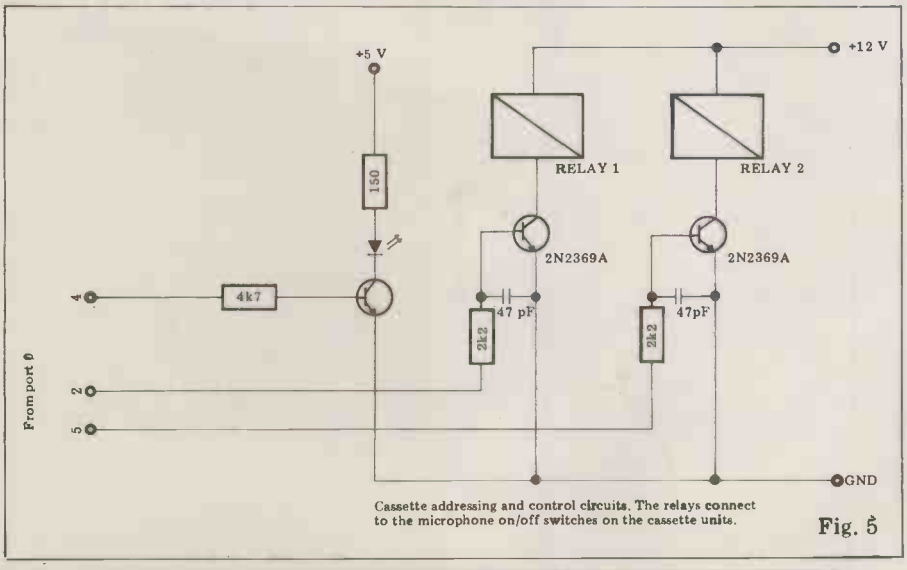


Fig 4



Cassette addressing and control circuits. The relays connect to the microphone on/off switches on the cassette units.

Fig. 5

Another requirement is for more than one cassette deck to be interfaced to the machine and be addressable by TSAM. TSAM also needs to identify and switch on the corresponding cassette to enable record reading and writing and to switch off again afterwards.

Notice that a record, in TSAM version 1 (covered here), may represent a block (more than one record). It's up to the users, if they wish, to handle record blocking and deblocking.

The MONITOR routines

The machine used for TSAM was the NASCOM basic kit (NASBUG with less than 1 kbyte of user memory

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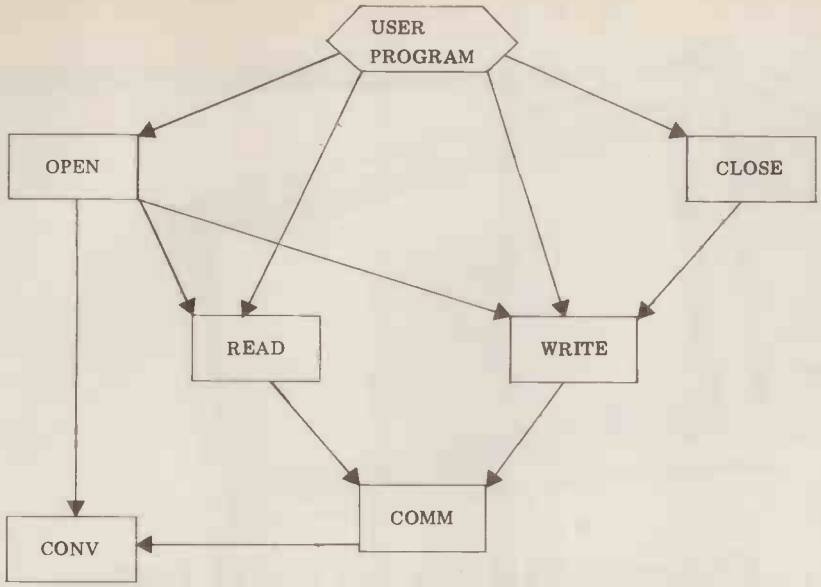


Fig 6 TSAM modules

available).

The Input/Output routines available in the NASBUG are keyboard driven and are:

— LOAD: when invoked from the keyboard, reads a cassette tape and loads the contents into corresponding memory addresses. The file consists of 8-byte records each preceded by a memory address from which they were recorded originally. Header and Trailer labels are represented by a high pitched tone (no actual data).

— DUMP: when invoked from the keyboard with two parameters (Start address and Finish address), writes the contents of memory defined by the two parameters, to the cassette deck. The formatting of data (8-byte records) and Header/Trailer tones, as described under LOAD, is performed here.

An important fact is that only one cassette is supported and the operator has to switch it on/off and engage it in the right mode (Read/Record) prior to invoking these routines.

The Design

It soon became clear that if TSAM was to fit in less than 1 kbyte (leaving room for a user program) without having to interact directly with ports, then LOAD and DUMP routines *had* to be utilised. I also needed to be able to address and control more than one cassette deck.

After some thought and experimentation, I found a way of modifying the LOAD and DUMP routines to suit my purpose. This was made possible through two facts:

— The monitor utilises REFLECTIVE lists for servicing and invoking routines

— The monitor maintains these lists as part of the user RAM. They, therefore, can be modified by software.

The monitor maintains the reflective lists in a table at 0C00H — 0C4FH (Fig 3).

When a command is entered on the keyboard, the monitor moves the command character, the number of arguments and the arguments themselves, to locations 0C0AH — 0C10H of the reflective table.

To tabulate this table, enter (TC00 C4F). In the display, you'll find that these locations are set as follows:

ØCØA	54		(T),
ØCØB	Ø2		(Number of arguments),
ØCØC/D	ØØ	ØC	(=ØC ØØ which is argument 1)
ØCØE/F	4F	ØC	(ØC4F which is the second argument).

What you are looking at is the setting which corresponds to the Tabulate command you just entered.

Having set the command character and arguments, the monitor looks at locations 0C45/46H (which hold the address of the command table) and makes a jump to the address held in there (the address in your tabulation is 63 03H (03 63H).

At address 0363H, there is a command list. This list holds for every monitor command, the command character and the address within the monitor where the routine for this command is found. This shows that the M (Memory) command, for example, starts at location 01ADH.

The monitor scans the list and matches the command character from 0C0AH with one from the command list and jumps to the routine at the corresponding address. (Fig 4 shows the progress from command entry to execution.)

Each monitor routine extracts its parameters from address 0C0BH—0C11H, and it is this that enables TSAM to invoke the monitor routines:

— locations 0C0BH — 0C11H are set accordingly

— a call is made to the required routine

For addressing and controlling the two cassette decks, the spare bits (Q5 and Q2) of port 0 are utilised (Fig 5).

Bits Q5 and Q2 are connected, through some simple switching circuits, to the cassette ON/OFF relays (any low voltage, high speed will do).

To switch a cassette on, the accumulator (RA) is loaded with a suitable value and is output to port 0. The values chosen allow for switching the LED on/off to indicate data transfer.

For data flow between port and cassettes, the existing connections are channelled to both cassettes (Pins 5,3,4 on the main board). The fact that the two cassette input/output lines are joined does not matter, since only one cassette is active at a time.

The 12V line of the PSU is quite adequate and the load on it is quite minimal (use low power/high Z relays).

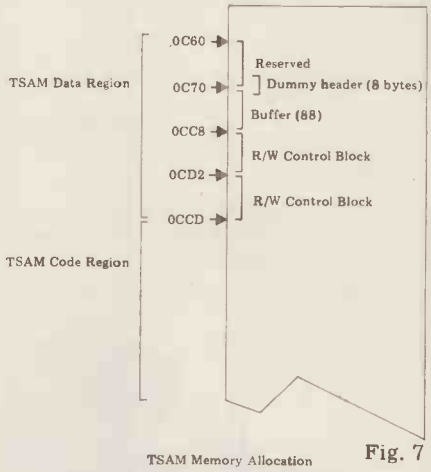
TSAM occupies 575 bytes (06C0H—0E9FH). This includes control blocks, parameters, lists and record buffers (the maximum record size allowed is 80 bytes).

TSAM consists mainly of six modules (Fig 6):

— OPEN
— CLOSE
— READ
— WRITE
— CONV
— COMM

The user program interacts only with the top four modules. CONV and COMM are internal service routines used for converting internal format to display format for communicating with the operator, and for reserving, freeing, controlling, and identifying tape decks.

TSAM divides its memory space into two regions (Fig 7):



TSAM Memory Allocation Fig. 7

— Buffers, Control Blocks and Switches

— Software Programs

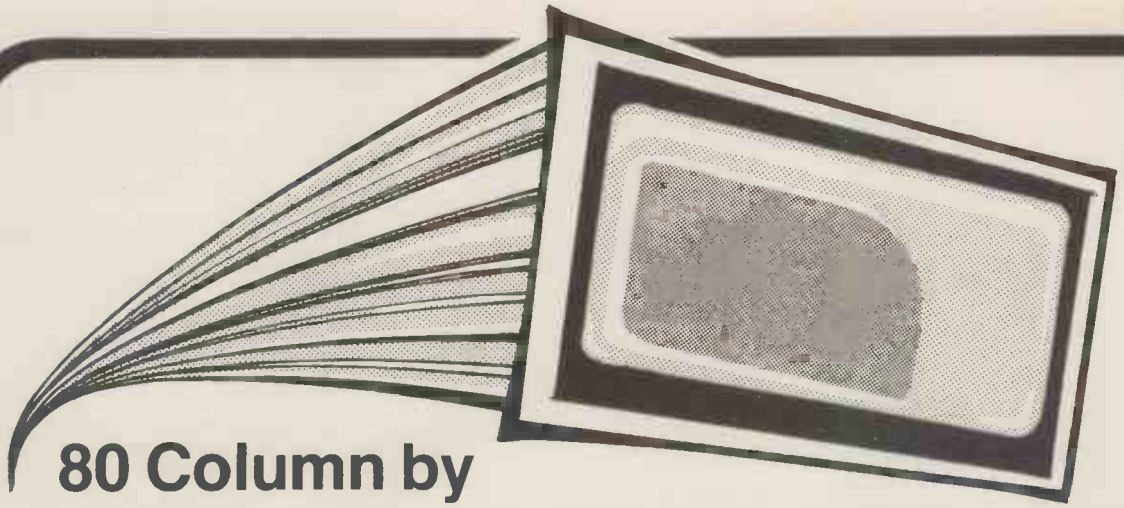
The Data Region must always be reserved for TSAM. The Software Region, however, offers flexibility. The user need only load those modules of TSAM necessary for that particular run. The software is written to be position independent. The only factors that change are the address to which the user program issues the call and the address to which related modules refer. This approach enables economy on memory utilisation — 'you only load what you need'.

In Fig 7, the buffer is the area where the input record is placed by TSAM to write away. The dummy header is an 8 byte block appended by TSAM to reduce the data error rate and allow the cassette to reach the correct speed before data input/output.

The Read/Write Control Blocks are areas created and maintained by TSAM to keep track of active files and cassette decks, there being one for each deck.

The 16 bytes reserved area includes the OPEN block (Fig 8) where the user program supplies various parameters to TSAM like File name, Read/Write indicator and record size. In the same area, TSAM communicates the response code to the user program.

GOTO page 131



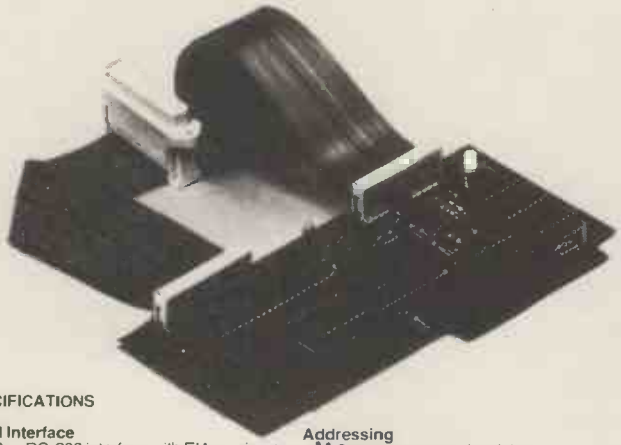
80 Column by 24 Line Plug-in Compatible Board for the Apple II Computer

SPECIFICATIONS

- 80 Columns X 24 lines.
- Upper and lower case data entry using the Apple II keyboard.
- Includes 128 upper and lower case 5X8 dot matrix ASCII character set and inverse alpha characters.
- Characters can be user definable.
- Includes VBC video balance circuit which allows the user to display 80 columns on an inexpensive 8 MHZ CRT monitor.
- Shift lock feature.
- Works with Apple Pascal and Apple Basic.
- Incorporates Pascal and Basic control characters.
- All monitor-type escapes are valid.
- Follows protocols of Pascaland Basic operating systems.
- Compatible with All Apple II peripherals.
- Effective baud rate greater than 10,000 fast scrolling and clearing.
- Synchronous operation with Apple II.
- Can be used with Apple II communication interface board to act as self contained terminal for time-sharing or other applications.

Video Board

Nett	Vat	Total
275.00	41.25	**316.25**



AIO™ Serial & Parallel Apple Interface

TWO BOARDS IN ONE

The AIO Apple Interface allows maximum flexibility for interfacing your Apple II with peripherals such as printers, plotters, terminals, modems and other computers. The AIO can communicate with both serial and parallel devices. It can even interface with both at the same time. And you won't need to write any software to operate the AIO. It comes complete with the necessary software and on-board firmware to handle serial and parallel communications.

SPECIFICATIONS

Serial Interface
- One RC-232 interface with EIA receivers and drivers
- Available handshaking lines --Request--To--Send (RTS), Clear--To--Send (CTS), Data--Carrier--Detect (DCD)
- Rotary switch selectable baud rates--110, 134.5, 300, 600, 1200, 2400, 4800 (9600 and 19200 baud available under software control for printers)
- External clock input for up to 500K baud
- Software controlled modes:
  - — 7 or 8 data bits
  - — Even or odd parity
  - — 1 or 2 stop bits
  - — —1, —16, —24 baud rate divisor
  - — Master reset
  - — RTS mode control
- Double buffered send and receive registers
- Supports full duplex operation

Parallel Interface
- Two bi-directional 8-bit ports
- Four additional interrupt and handshaking lines
- Interface configuration and data direction controlled by software

Firmware
- 256 bytes of on-board PROM

Addressing
- 6 memory mapped registers

Cable Assemblies
- Serial interface-- 6 inch ribbon cable with DB-25 socket
- Parallel interface-- 18 inch ribbon cable with uncommitted end

PC Board
- High grade FR-4 blue epoxy.
- Double sided solder mask with silk screened parts legend and gold-plated edge connector contacts.
- Dimensions-- 2.7"x 6.3" (excluding edge connector contacts).

Miscellaneous
- PROMs and data buffer power-down when not addressed
- Sockets provided for all ICs

A.I.O.

Nett	Vat	Total
105.00	15.75	**120.75**

APPLE III

Interested?? Please ring 051-933 5511!!

Please ring Paul Fullwood or Carl Phillips for other interfacing requirements.

Stack Computer Services Ltd
290-298 Derby Road, Bootle,
Liverpool L20 8LN.
051-933 5511.

STACK
COMPUTER SERVICES LIMITED

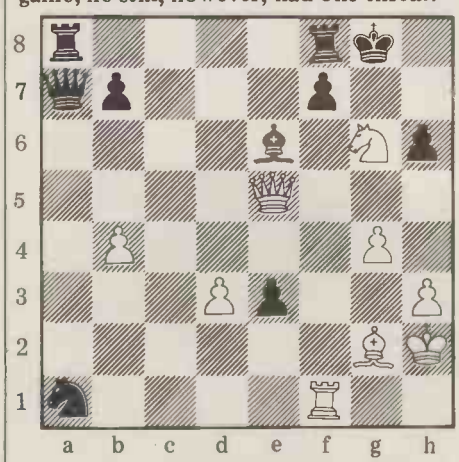
Micro chess is becoming enormously popular — witness the first world championships to be held at the next PCW show. Every month, Kevin O'Connell reports on the 'state of play'.

SUPER SYSTEM

The Chess Champion Super System III* took the Blue Riband of the commercial chess computer industry to SciSys—W Ltd in Hong Kong when it appeared on the West German market last autumn. Available in the UK since the Spring, it took that Riband for three main reasons: (1) playing strength, (2) features and (3) observance of the laws of chess. Now, before I go any further I have to point out that although I hope my assessment of this product is unbiased, it's not a disinterested one, since I did, for commercial gain as well as for fun, help to design the program and the machine's features.

When System III appeared on the market its main rival, in terms of playing strength, was Fidelity's Voice Chess Challenger. I conducted a 17-game match between the two which showed the playing strength to be about the same, at least from the chess master's point of view. The overall result was 10-7 in favour of System III, which was playing at a slight time disadvantage.

System III also came closer than any other program to creating a major sensation when, earlier this year, it achieved a winning position against the human world champion, Anatoly Karpov. The circumstances were unique: the West German department store chain of Horten sponsored a chess tournament at Bad Kissingen to help promote interest in chess and in sales of chess computers, especially the System III. During the tournament a day was set aside when each of the Grandmasters played 25 games simultaneously against an army of System IIIs. After 32 moves of one of the world champion's games, he was a rook down, with a lost game; he still, however, had one threat.



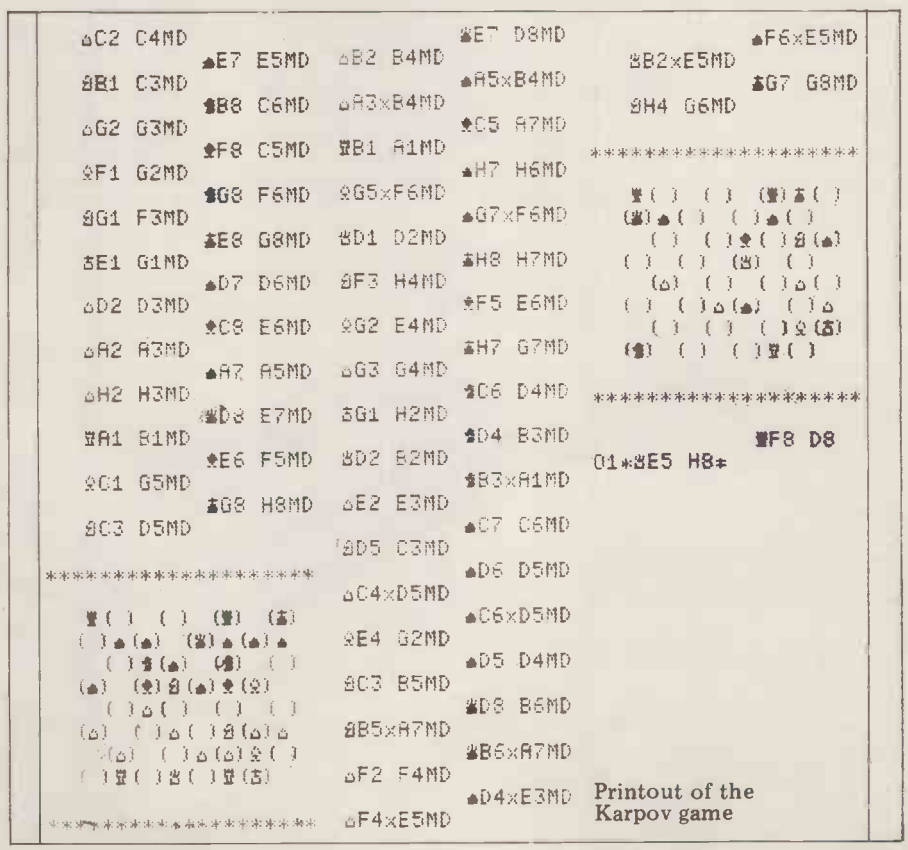
From the diagram, System III (with the black pieces) played Rf8-d8, a blunder that allowed the world champion to save his honour with Qe5-h8 checkmate (Qa7-b8 instead of Rf8-d8 would have won). A horrible end for the program, but history had been made and that game is still making the rounds of the world's chess press.

The most notable features of System III are its four modular accessories. Two of them, a power pack and a CMOS memory, are relatively unexciting, but the other two are major advances on previously available chess machine hardware. An LCD chess board and an electronic printer can be clipped on to the sides of the master unit, as shown in the photograph.

The LCD board solves the problem — around since the first chess computer appeared three years ago — of knowing whether you have the same position on the chess board as the computer has on its internal board. If you do make any mistakes or simply want to change the board position — perhaps because you made a chess mistake, blundering away one of your pieces — then the keyboard system, with its 'takeback' feature and 'enter position' mode allows such changes to be made.

All serious chess players keep records of the games they play and if you have ever played any games against a chess computer, you may also wish that you could consult the moves of a game you played against it. You'll be pleased to hear that a printer is available as an accessory to this versatile system. I show here the printer's output for the game against Karpov referred to above. The print-out includes two diagrams which you can elect to have whenever you like. The repetitive 'MD' indicates that I was using the 'More Data' function which allows you to print out the record of any game,

GOTO Page 131



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 ♙C2 C4MD          ♙E7 D8MD          ♟F6xE5MD
                   ♟A5xB4MD
 ♕B1 C3MD  ♟E7 E5MD  ♙B2 B4MD     ♕B2xE5MD
                   ♙A3xB4MD
 ♙G2 G3MD  ♟B8 C6MD  ♙A3xB4MD     ♝G7 G8MD
                   ♙C5 A7MD
 ♗F1 G2MD  ♝F8 C5MD  ♖B1 A1MD     ♔H4 G6MD
                   ♟H7 H6MD
 ♘G1 F3MD  ♝G8 F6MD  ♔G5xF6MD
                   ♟G7xF6MD
 ♗E1 G1MD  ♗E8 G8MD  ♕D1 D2MD
                   ♗H8 H7MD
 ♙D2 D3MD  ♟D7 D6MD  ♘F3 H4MD
                   ♔F5 E6MD
 ♙A2 A3MD  ♔C8 E6MD  ♔G2 E4MD
                   ♗H7 G7MD
 ♙H2 H3MD  ♟A7 A5MD  ♙G3 G4MD
                   ♕C6 D4MD
 ♖A1 B1MD  ♕D8 E7MD  ♘G1 H2MD
                   ♕D4 B3MD
 ♔C1 G5MD  ♔E6 F5MD  ♘D2 B2MD
                   ♕B3xA1MD
 ♘C3 D5MD  ♗G8 H8MD  ♙E2 E3MD
                   ♟C7 C6MD
           ♘D5 C3MD  ♟D6 D5MD
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 ♜( ) ( ) (♛) (♝)  ♔E4 G2MD
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   ♘(♙) ( )♙(♙)♔( )  ♙F2 F4MD
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                   ♙F4xE5MD
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 (♞) ( ) ( )♖( )

**********

          ♛F8 D8
01♯♕E5 H8♯
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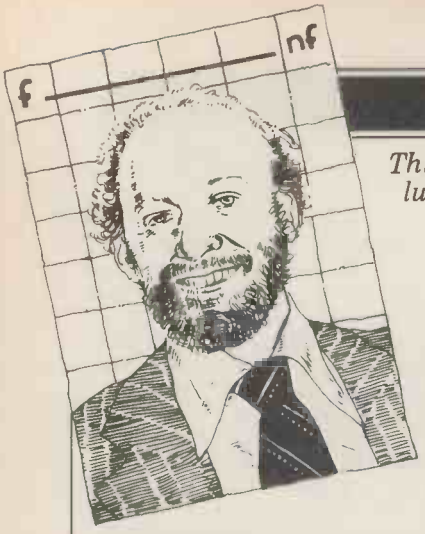
Printout of the Karpov game

BOOKFARE

This month Malcolm Peltu rides the third wave and investigates a couple of revolutions while Peter Rodwell curls up with the latest technical books.



Future shock horror - or clutching at clichés

Alvin Toffler has achieved the kind of immortality dreamed of by philosophers and marketing men (and women). He has coined a phrase that has entered the language and the consciousness of the age in which he lives — *Future Shock*. As the dust jacket of his latest book, *The Third Wave*, explains: in his earlier publication *Future Shock*, Toffler "analysed the disorientation brought on us by the overwhelmingly rapid changes in social structure and technology and showed how far they had affected our ways of thinking and feeling."

As the impact of information technology (micros, computers, et al) is an obvious example of future-shock (*sic*), it's not surprising that Toffler has joined in the rush to publish his own tome on the forthcoming new technological revolution. What is surprising is that *The Third Wave* is such a poor contribution to the futurist debate.

There's nothing new in *The Third Wave*, except a stream of innovative catchphrases aimed at giving Toffler a second stab at immortality by adding a new word to the footnotes of history.

'The Third Wave' is his term for what others have called things like the information revolution, the wired society, the third industrial revolution, post-industrial society, the leisure society, etc. His vision of the future is called 'practopia' which is "neither the best nor the worst of all possible worlds but one that is both practical and preferable to the one we had."

Other new Tofflerisms include 'indust-reality' to describe the view of the world created by the industrial revolution, 'demassifying' to indicate rebellions against mass conformity and 'prosumer' to indicate the integration of the roles of producer and consumer. By the end of the book the text is full of so many Tofflerisms, psychospheres, inter-weave problems and Messiah complexes that it's virtually incomprehensible to someone unfamiliar with Toffler jargon. If the result of understanding the meaning behind Tofflerisms gave valuable new insights into the problems being analysed, the task of reading the 450-plus pages would be worthwhile. As it is, Toffler's crisp racy prose begins to grate because the book seems to reflect the verbal equivalent of the after-effects of a large dose of baked beans: it's windy and repetitive.

Toffler's 'revolutionary premise' (his own description) is that 'we' will not totally destroy ourselves in the turbulent decades ahead and that "the jolting changes we are now experiencing are not chaotic or random but form a sharp, clear discernable pattern." This pattern is the Third Wave, which he claims started in 1955. The First Wave was the agricultural revolution which he dates from 8000BC to the mid-18th Century and the Second Wave was the industrial revolution.

First Wave technology was pretty basic — wheels, levers, winches, hoists and primitive ploughs. Second Wave technology comprised all those innovations associated with industrialisation, such as automated production lines, trains, cars, etc. According to Toffler, Third Wave technology is composed of a mix of developments which are no longer based on the 'classic science' of the Second Wave. He sees information technology, molecular biology, ecology, space science, oceanics, quantum electronics and nucleonics as the main technologies driving the Third Wave.

And he sees information technology playing a central role in the Third Wave by creating what he calls an 'intelligent environment' — which is identical comment to all the other punditry about the 'information/micro/computing/communications revolution' that's been spewing out of the mass media recently and has been the subject of many publications reviewed in Bookfare over the last year (see below for the two latest British Micro Revolutionaries).

All the old familiar faces are in Toffler's intelligent environment — viewdata, electronic funds transfer, the automated office, electronic mail and so on. He's dressed some old hat concepts in new dress. For example, the capability for using information technology to carry out some office work at home is dubbed 'the electronic cottage'. . . very catchy but nothing very new beneath the veneer.

Toffler's wide-eyed technological enthusiasm is summarised by his view that despite the fact that computers can make dangerous errors, he believes they are "among the most amazing and unsettling of human achievements for they enhance our mind-power as Second Wave Technology enhanced our muscle power, and we do not know where our minds will ultimately lead us."

Toffler's mind leads him into a new American, liberal middle class dream. What he seems to have done is to gather together the current obsessions of this strata of American society — ecology, the energy crisis, political malaise, family breakdowns, personal neuroses, social violence, economic recession, international anarchy, etc, etc. Using technology as a framework, he has then tried to determine some kind of optimistic pattern in this chaos. The 'wave theory' is an ideal solution because it's so vague that it cannot be proved or disproved; it signifies only a general progressive movement rather than any single clearly defined development.

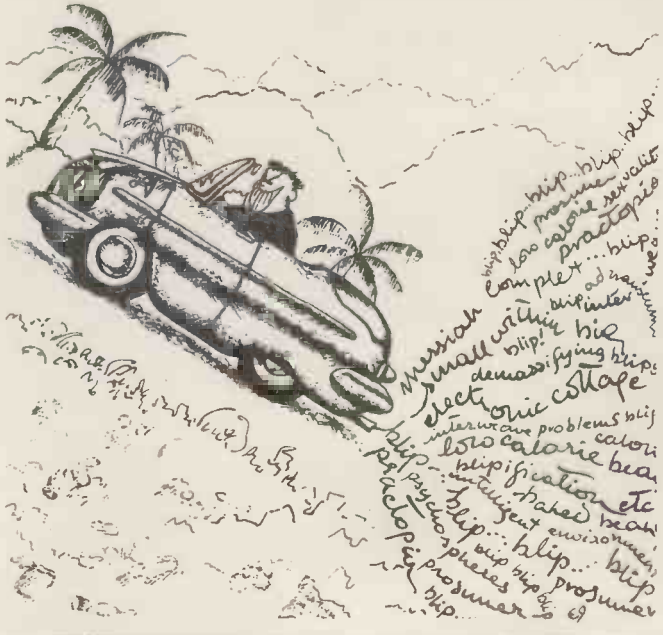
"Never before have so many people in so many countries — even educated and supposedly sophisticated people — been so intellectually helpless, drowning, as it were, in a maelstrom of conflicting, confusing and cacophonous ideas. Colliding visions rock our mental universe," he comments, not so much waving as drowning. After reading your book Alvin, I see just what you mean.

Although *The Third Wave* is interspersed with warnings that the future may be pretty grim and the clashing, overlapping Second and Third Waves might create havoc, Toffler is carried towards his practopia with increasing enthusiasm.

The nature of that practopia is best encapsulated by his electronic cottage. Working from nice comfy homes using word processors, electronic communications and so on is seen by Toffler as an opportunity for re-establishing family and community life. His idea of home, however, obviously differs from the point of view of, say, families in Harlem or Soweto.

He picks up 'blips' of comfort on every possible occasion. He talks of a 'blip culture' in which the confusion of modern life and bombardment of information from a variety of media appears to be a random attack of disembodied blips which somehow eventually gel into "concepts or metaphors that sum up or organise blips into larger wholes." (The sometimes ridiculous flavour of the book can only be judged from direct quotes such as these.)

Blips of Third Wave comfort include what he



calls the "self help movement" — the mushrooming of groups such as the Parents of Gays and Lesbians, Depressives Associated and Citizens to Bring Broadway Back. He believes that this movement indicates a rejection of mass society and standardisation.

This 'de-massification' is one trend which he believes will lead to a philosophy of 'small-within-big is beautiful' which will become possible within the intelligent environment that allows individuals and groups to remain interlinked while living and working within small communities. Computers are assisting in de-massification he claims and in breaking down the obsession with the standardisation that came as a by-product of mass-production.

However, he dismisses any contradictory trends as being the final throes of the Second Wave, rather than accepting that if there is a Third Wave it may be very different to his own vision. There's growing evidence, for example, that office automation could lead to the implementation of automation management methods in white collar work . . . the same trend that once created the manufacturing production line with its attendant emphasis on product standardisation, dehumanisation of work tasks and alienation of the workforce. And where would the standard McDonald hamburger be without computer control?

Society is, if anything, becoming more standardised with America ,the most conformist society of all. In the early 20th Century, at the peak of the Second Wave, American entertainment was anarchic and individualistic. Now, despite a myriad of radio and TV stations and Citizens Band Radio, standard pap is churned out — and the use of electronic technology seems merely to increase the volume of pap rather than change the quality.

The superficiality of *The Third Wave* is epitomised in a section on 'the new image of nature'. Toffler comments, "Whether we examine opinion surveys or the lyric of pop songs, *the visual imagery in advertising* or the content of sermons, we find evidence of a heightened, though often romantic, regard for nature." It's not an uncommon sight in America to see someone drinking a calorie-free drink at breakfast to wash down half-a-dozen pancakes with syrup. Or to see an 'ecologically sound' advertisement for some totally unnatural product like alcohol or even cigarettes. Nobody could seriously take the imagery of advertising as meaning anything other than a carefully planned consumer hook.

Illustrations by Eva Piotrowska

I fear that *The Third Wave* will be overvalued because of Toffler's reputation and his slick journalistic style; it's peppered with quotable quotes and so many new Tofflerisms that one or two may join future-shock in our cultural vocabulary. If it had been written by somebody else, I doubt whether it would even have been published and clearly the decision to provide this sort of space for a review is based more on Toffler's reputation than on any particular merit.

There are many other less pretentious books which say much more in rather fewer words — such as the recent double-barrelled British paperback assault, which is reviewed following the next headline break . . .

PL²

On the same early summer's day, two books were published with the same title, at the same price, by authors with similar names (initials PL) from publishers whose names possess the same first and last letters. The title of the books is *The Micro Revolution*. Their co-incidental publishing graphically illustrated the rush to publish that has followed in the wake of the 'Great Micro Debate', swelling the volume of futuristic predictions to new heights.

It would be a pity, however, if the confusion over names and the volume of other material on the subject caused these two books to be ignored because each, in its own way, is an excellent contribution to the micro discussion. Both are by experienced professional journalists — Peter Large, technology correspondent of the *Guardian*, and Peter Laurie, Editor of *Practical Computing*. Although in some respects their books cover similar territory, they could have been accurately differentiated had Laurie's book (published by Futura) been entitled something like 'a guide to information technology' because it's primarily an easy-to-read introduction to the nature of the technology that may cause the 'revolution'. On the other hand, Large's book (published by Fontana) is primarily about the *applications* of the technology.

Both writers are technological enthusiasts, excited by the technological potential, although aware of possible negative effects. Their differing degrees of optimism are summarised by the (thankfully) different subtitles given to the books. "The microchip that *will* change your life" (my italics) is the Large motto on the front cover; Laurie's, however, is more doubting: "A change for the better or worse?" Neither book says much that has not already been said in the Micro Debate. What is interesting is that they say it in a much more practical and succinct style than Alvin Toffler with his more philosophically rambling approach (see above.)

Peter Large has given an elegant shape to his book by starting with a short story called 'a day after tomorrow' which examines the lifestyles of Jane and Joe Babbage in an idyllic electronic future. Jane is a newspaper editor and Joe a General Practitioner and they live and work in Cornwall using all the facilities of the wired society to carry out the jobs, educate their children and entertain themselves from the end of a computer terminal.

Large systematically shows how the technological elements that compose the Babbage lifestyle, although apparently futuristic in the short story context, are generally available today. The chapter titles indicate the familiar ground covered, including 'Getting rid of money', 'Of satellites and laser light', 'Jobs that have gone' and 'The threat to privacy.'

Using his skill as a reporter and the information available to him on *The Guardian*, Large provides a good, enjoyable round up of the state of the micro art as it was in 1979. He quotes extensively from the Brigade of Pundits who have been quick with micro quotes, which gives the book the feel of an extended newspaper article. Although this immediacy lays itself open to the erosions of time and rapid technological innovation, its main thesis and the trends it indicates are stronger than the transient accuracy of any particular forecast relating to whether a particular capability *is* or *will be* available.

The flavour of Peter Laurie's Micro Revolution is also reflected by the chapter titles, which are simply called things like 'Data', 'Memory Devices' and 'Software.' It seems as if the book was originally conceived as a technical introduction to the subject but was then dressed in 'social relevance' garb in order to catch the Third Wave tide.

This is a pity, because it devalues the uniqueness of the book, which is as an extremely lively educational aid of the 'All you ever wanted to know about computers but were afraid

Apple Price List

Product Code	Description	Retail Price (£)
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A2S1016P	APPLE 16K VIDEO OUTPUT ONLY	695.00
A2M0003	DISC DRIVE WITHOUT CONTROLLER	299.00
A2M0004	DISC DRIVE WITH CONTROLLER	349.00
A2M0016	16K ADD ON RAM	69.00
	CARDS & ACCESSORIES	
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A2B0002	PARALLEL PRINTER INTERFACE CARD	104.00
A2B0003	COMMUNICATIONS CARD	130.00
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A2M0019	PROGRAMMERS AID 1	27.00
A2M0027	AUTO START ROM PACK	38.00
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E2D001	VISICALC DISC & BOOK COMPLETE	95.00

	DOCUMENTATION	
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A2L0002	6502 HARDWARE MANUAL	9.00
A2L0003	6502 SOFTWARE MANUAL	9.00
A2L0005	APPLE II BASIC PROGRAM MANUAL	6.00
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to ask in case you did not understand the answer' ilk. On each subject covered (which includes advanced topics such as artificial intelligence as well as basic Basics) he provides sufficient depth to give a real grasp of the technicalities. In some areas, particularly artificial intelligence, this level might be too deep but it's easy to skip over anything that appears too heavy for personal tastes.

His comments on the social implications of the technology are tantalisingly brief because his anarchic, manic-depressive views provide an individual perspective on what has become a hackneyed subject.

The last chapter of the Laurie book is only eight pages long and is a reprint of articles published by him in the *New Scientist* in a column entitled 'Pig Ignorant.' In this he humorously describes his own futureshock when meeting the computer enthusiasm of his then-twelve-year-old son, which develops into a freewheeling look at the organisational and social power groups which will dictate the shape of the micro revolution. Laurie's book is worth reading just for this Pig Ignorant section for those old lags who feel they already know enough about the technology. For newcomers to the whole subject, the PL2s offer, in their different ways, two of the best micro primers around.

Included in this month's Bookfare were:

The Third Wave by Alvin Toffler (Collins, £8.95)
The Micro Revolution by Peter Large (Fontana, £1.50)
The Micro Revolution by Peter Laurie (Futura, £1.50)

TECHNICAL REVIEWS

by Peter Rodwell

Microcomputer Components Data Book
(Zilog Inc, $5.00)
Despite the wave of publicity given to the new generation of 16-bit processors, you'll find precious few of them actually in the market place right now. One reason for this (other than the technicality that manufacturers are said to be having a hell of a time trying to make them) is that the CPUs by themselves are useless — they need a cast of supporting chips to enable them to function in the environment for which they were designed. Thus, even if you can get your hands on one of Zilog's Z8000 CPUs, you'll not be able to use it to its full capabilities without the extras to hang onto it. But until these appear you can at least read about them in the new Zilog Data Book.

As well as giving pure technical details on the Z8001 and Z8002 chips, the book includes a useful tutorial on these devices, which makes it easier to understand their capabilities than reading a straightforward data sheet. But more interesting still are the support chips which Zilog intends to produce, both immediately and in the future.

Taking prime place among these is the Z8010 memory management unit, which is sufficiently complex to merit its own explanatory tutorial. If you want to use the Z8001 — the segmented version — then you'll need to know all about the MMU to exploit its full potential.

The book also describes the Zilog Z-Bus, designed for use with the Z8000 family. This family includes the Z8034 Universal Peripheral Controller, a slave processor similar to the Z8 with facilities which include 2k of on-chip ROM, three programmable I/O ports and six levels of priority interrupt. Then there's the Z8030 Serial Communications Controller, which gives you two independent full-duplex channels with fully programmable protocols, operating at up to 1 Mbit per second. If that leaves you cold then there's also a couple of pages on the Z8038 FIFO I/O interface unit and one page on the Z8060 FIFO buffer unit.

Coming soon, and thus receiving only a few paragraphs of text each, are three further devices: the Z8016 DMA controller will be able to handle transfers at up to 2 Mbytes per second, and to keep things sorted out Zilog also intends to give us the Z8065 burst error processor. But what *is* interesting is the proposed Z8052 CRT controller, which will be handy for word processing, scientific and mathematical applications as it allows all sorts of wonders such as mixed typefaces, vertically and horizontally-split screen formats and "simple line drawing capabilities".

At the back of the book are three memory devices, the Z6115 and Z6116 dynamic RAMs, respectively 8k x 1 and 16k x 1, and the Z6132 4k x 8 'quasi static' RAM. Quasi static means that it's a dynamic RAM chip with on-board refresh circuitry which makes it look like a static chip as far as the rest of the system is concerned. This is such an obvious solution that I can't understand why it wasn't done right from the start; maybe it's something to do with the ". . . high-performance depletion-load double-poly n-channel silicon-gate MOS technology. . ." which Zilog use to make it.

On more familiar ground, though, there's a whole section at the start of the book devoted to the Z80 family, one addition to which is the Z80 DART (dual asynchronous receiver/transmitter), which offers two separate full duplex channels, both with modem controls, and should prove useful if you don't need the synchronous capability of the Z80 SIO.

Machine Language Programming from the Ground Up
Hubert S Howe Jr (A J Harding (Molimerx), £8.50)
This book is inaccurately titled as it deals not with machine language programming as a general subject but with assembler language programming for the TRS-80. Having said that, though, I must immediately add that it's a useful guide for anyone wanting an introduction to low-level Z80 programming; it's also handy for any TRS-80 owner who wants to 'get inside' the machine.

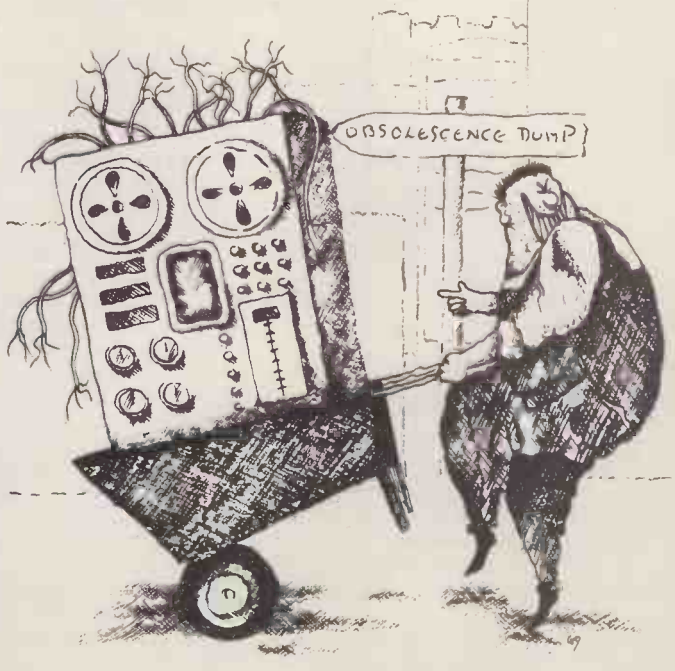
Of the book's 17 chapters, five deal exclusively with various aspects of the TRS-80. The remaining 12 cover in detail the concept of low-level programming, number bases, the Z80's architecture and instruction set, assembler language programming in general and those of its various aspects which are likely to be of greatest difficulty for the beginner. This latter group includes using the stack, reading and printing numbers, organising arrays and tables, moving data, integer, BCD and (briefly) floating point arithmetic, logical and bit operations and 8 and 16-bit multiplication and division. Each of these subjects gets a separate chapter and all are likely to be useful to the owner of any Z80-based system. There are plenty of programming examples.

TRS-80 owners will find the five machine-dependent chapters useful, even for Basic programming in some cases. The Level II Basic ROM is thoroughly dissected and addresses given for all the main subroutines, although, as the book points out, only a few of these (I/O sub-routines, for example) are useful for assembler programming. Particularly handy is a list of all the RAM locations used by the Basic interpreter, with notes of their functions. The final four chapters deal in detail with cassette I/O and tape formats, USR subroutines in Basic, TRSDOS disk subroutines and a final, rather short, look at disk files.

The book is an amalgamation of a series of articles which the author wrote for the US *TRS-80 Monthly News Magazine* and although it has been Anglicised there are one or two references to American products which may not be available here. The author does occasionally let his transatlantic enthusiasm get the better of him; consider, for example, "The execution of one line in a Basic program may require millions or even billions of machine instructions" or, more oddly, when discussing the speed at which data are transferred between disk and RAM, ". . . this is so fast that it cannot be done in Basic at all."

At first sight the book seems a little over-priced, considering that it has been typed on a word processor and printed by Battle Instant Print, but then you're paying for the information it contains rather than for a masterpiece of the printer's art.

The 'ground', up from which the book progresses, is as far as I could discover, the correct pronounciation of 'mnemonics'; in case you wondered, it's "nem-on-iks".



Eva Piotrowska

COMPUTER GAMES

by David Levy

DEBATING DRAUGHTS

Up to now this series has been devoted entirely to the general principles involved in writing programs to play intelligent games. This month we start on a new tack, with upcoming articles that will describe specific games in some detail and comment on the most notable work in each field. From now on I shall be happy to accept readers' letters for consideration. These should be written in English and addressed to me at 104 Hamilton Terrace, London NW8 9UP, England, and while I shall endeavour to answer the most interesting letters within future articles, **under no circumstances** *will any reader receive a personal reply — I'm sorry but I'm much too busy.*

The subject of the present article is the game of draughts (known as checkers in North America and dames throughout much of continental Europe). I have already described one of the learning techniques employed in Arthur Samuel's checker program; now we shall be making a closer inspection of other aspects of this famous project. The article will conclude with some additional comments on computer learning, as applied to games.

Samuel's checker program

Arthur Samuel began to program checkers in 1952, using an IBM 701 computer. It was rewritten for the IBM 704 in 1954 and the following year the first learning mechanism was introduced.

The fundamental program structure employed a minimax tree search, since the alpha-beta algorithm had not yet been invented. All moves were examined to a depth of 3-ply, and the program would look selectively at moves at the next ply, provided that:
(i) The move was a capture;
(ii) The previous move was a capture; or
(iii) The move offered the opponent the chance to exchange men.

At the next ply the program ignored all moves for which the previous move was not a capture, and at the sixth ply and deeper levels in the tree only capture moves were examined. By the time the program reached this depth the number of moves being examined from any position was small, but it was still possible for the program to find itself getting involved in ridiculous capture sequences, and so at a depth of 11-ply the search would terminate if either side was more than two kings ahead (an overwhelming advantage). At 20-ply the search terminated under all circumstances so that the program did not run out of memory for storing the tree.

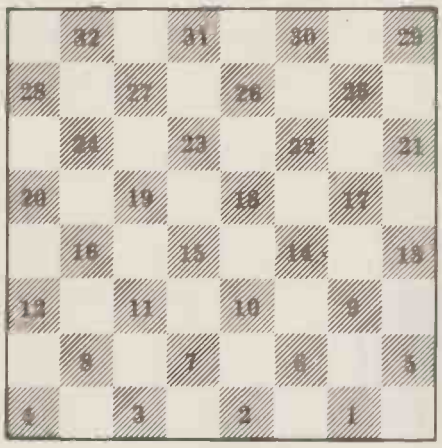
Samuel's criteria for pruning the tree were chosen in such a way as to encourage the evaluation of positions that were quiescent, and to discourage evaluation in turbulent positions. The concepts of quiescence and turbulence are perhaps better understood when related to the two different aspects of game playing: strategy and tactics. Strategy involves planning and manoeuvering. Tactics (e.g. capturing) are used to punish blunders and to convert a strategic advantage into something more concrete, such as material. The argument in favour of Samuel's approach is that the three ply of exhaustive search gives the program some strategic grasp of what is happening, while the deeper tactical search ensures that it does not perform erroneous evaluations in turbulent positions. The necessity to restrict the deeper search in this way is clearly dependent on the nature of the game and the number of branches at each node of the tree (the branching factor). The number

of positions evaluated in an alpha-beta search is roughly proportional to $b^{d/2}$ where b is the average branching factor and d is the depth of search, and anything that can be done to reduce the 'b' will produce a combinatorial improvement in playing speed.

The evaluation function used in the early version of Samuel's program employed 39 terms or features, only 17 of which were in use at any one time. The features were temporarily suspended from duty if and when it was found that they did not contribute significantly to the evaluation process. Correlation measurements indicated which of the 17 features currently in use were the least effective, and once the effectiveness dropped below some threshold value they were replaced by the features at the top of the reserve list, while the rejects were added to the bottom of the reserve list. Material was the dominant feature, and Samuel recognized the need to encourage the program to trade off pieces when it was ahead but to avoid exchanges when behind. This may be accomplished in various ways but the most reliable is probably to determine the value of

$$(\text{program material} - \text{opponent's material}) \times \frac{\text{(greater side's material)}}{\text{(lesser side's material)}}$$

A full list of the other features in the linear part of the evaluation function is given below. There were in addition some non-linear terms in the function. In the following list the board notation is as used in the draughts (checkers) literature:



ADV (Advancement)
The parameter is credited with 1 for each passive man in the 5th and 6th rows (counting in passive's direction) and debited with 1 for each passive man in the 3rd and 4th rows.

APEX (Apex)
The parameter is debited with 1 if there are no kings on the board, if either square 7 or 26 is occupied by an active man, and if neither of these squares is occupied by a passive man.

BACK (Back Row Bridge)
The parameter is credited with 1 if there are no active kings on the board and if the two bridge squares (1 and 3, or 30 and 32) in the back row are occupied by passive pieces.

CENT (Centre Control I)
The parameter is credited with 1 for each of the following squares: 11, 12, 15, 16, 20, 21, 24 and 25 which is occupied by a passive man.

CNTR (Centre Control II)
The parameter is credited with 1 for each of the following squares: 11, 12, 15, 16, 20, 21, 24 and 25 that is either currently occupied by an active piece or to which an active piece can move.

CORN (Double-Corner Credit)
The parameter is credited with 1 if the material credit value for the active side is 6 or less, if the passive side is ahead in material credit, and if the active side can move into one of the double-corner squares.

CRAMP (Cramp)
The parameter is credited with 2 if the passive side occupies the cramping square (13 for Black, and 20 for White) and at least one other nearby square (9 or 14 for Black, and 19 or 20 for White), while certain squares (17, 21, 22 and 25 for Black, and 8, 11, 12 and 16 for White) are all occupied by the active side.

DENY (Denial of Occupancy)
The parameter is credited with 1 for each square defined in MOB if on the next move a piece occupying this square could be captured without an exchange.

DYKE (Dyke)
The parameter is credited with 1 for each string of passive pieces that occupy three adjacent diagonal squares.

EXCH (Exchange)
The parameter is credited with 1 for each square to which the active side may advance a piece and, in so doing, force an exchange.

EXPOS (Exposure)
The parameter is credited with 1 for each passive piece that is flanked along one or the other diagonal by two empty squares.

FORK (Threat of Fork)
The parameter is credited with 1 for each situation in which passive pieces occupy two adjacent squares in one row and in which there are three empty squares so disposed that the active side could, by occupying one of them threaten a sure capture of one or the other of the two pieces.

GAP (Gap)
The parameter is credited with 1 for each single empty square that separates two passive pieces along a diagonal, or that separates a passive piece from the edge of the board.

GUARD (Back Row Control)
The parameter is credited with 1 if there are no active kings and if either the Bridge or the Triangle of Oreo is occupied by passive pieces.

HOLE (Hole)
The parameter is credited with 1 for each empty square that is surrounded by three or more passive pieces.

KCENT (King Centre Control)
The parameter is credited with 1 for each of the following squares: 11, 12, 15, 16, 20, 21, 24 and 25 which is occupied by a passive king.

MOB (Total Mobility)
The parameter is credited with 1 for each square to which the active side could move one or more pieces in the normal fashion, disregarding the fact that jump moves may or may not be available.

DIA (Double Diagonal File)
The parameter is credited with 1 for each passive piece located in the diagonal files terminating in the double-corner squares.

DIAV (Diagonal Moment Value)
The parameter is credited with 1/2 for each passive piece located on squares 2 removed from the double-corner diagonal files, with 1 for each passive piece located on squares 1 removed from the double-corner files and with 3/2 for each passive piece in the double-corner files.

MOVE (Move)
The parameter is credited with 1 if pieces are even with a total piece count (2 for men, and 3 for kings) of less than 24, and if an odd number of pieces are in the move system, defined as those vertical files starting with squares 1, 2, 3 and 4.

NODE (Node)
The parameter is credited with 1 for each passive piece that is surrounded by at least three empty squares.

OREO (Triangle of Oreo)
The parameter is credited with 1 if there are no passive kings and if the Triangle of Oreo (squares 2, 3 and 7 for Black, and squares 26, 30 and 31 for White) is occupied by passive pieces.

POLE (Pole)
The parameter is credited with 1 for each passive man that is completely surrounded by empty squares.

RECAP (Recapture)
This parameter is identical with Exchange, as defined above. (It was introduced to test the effects produced by the random times at which parameters are introduced and deleted from the evaluation polynomial.)

THRET (Threat)
The parameter is credited with 1 for each square to which an active piece may be moved and in so doing threaten the capture of a passive piece on a subsequent move.

Different sets of weightings were tried in the evaluation function and an initial set was chosen by playing through a series of checker games from a book and computing the correlation coefficient of the moves chosen by the program and those chosen by the original (human) player.

Rote learning

The most elementary type of learning worth programming is the storing of a large number of game positions together with their scores as determined by the evaluation function. Samuel pointed out that if a score for a position was arrived at as a result of a 3-ply search, the next

MOVE	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6
1 – 5	0.07	0.09	0.12	0.06	0.05	0.05
1 – 6	0.11	0.18	0.15	0.06	0.07	0.02
etc.	. . . . .					

time this position is encountered as a terminal node in the tree (say at depth 3) the evaluation of the root position will be made on the basis of a search which has, in one variation, been examined to a depth of 6-ply. In this manner a program with a large storage capability could learn to play a game such as checkers rather well. The problem facing personal computer users is clearly one of space, and without a floppy disk system the task will be impossible for any moderately interesting game. Even with a floppy, games such as checkers will very soon use up all available memory.

Move-phase-tables

Another method of learning, described in 1974 by Arnold Griffith, is quite unusual. Griffith discovered that in each particular phase of the game a certain move would, fairly consistently, either be a good move or a bad move. This is an oversimplification of his thesis, but it will suffice for the purpose of this article.

Griffith analysed a number of games from draughts books. Whenever an expert player made a move, Griffith noted the move and defined the position arising after that move as a 'strong' position. A position which would have arisen after an alternative move was assumed to be less desirable, and hence termed a 'weak' position. He then tabulated all the possible forward moves, of which there are 49, and for each forward move he noted the proportion of occasions in which this move led to a strong position in each phase of the game (1st ten moves, 2nd ten, 3rd ten, 4th ten, 5th ten and move 50 onwards). The first rows of his table are shown above.

When the program came to evaluate a move it could simply look up the table entry corresponding to the particular move and the appropriate phase of the game. One way of utilizing such a method would be to employ Michie's probabilistic approach described last month, since this would provide a more global view of whether a particular path in the tree was heading in a desirable direction.

I must confess that I find Griffith's method somewhat curious, but it appears to work to a certain extent in draughts, and presumably the same will be true in other games which (a) have a fairly restricted move set, and (b) have a dependence relationship between the various phases of the game and the moves themselves. In chess, for example, the move of the king towards the centre of the board is usually very undesirable until the end game is reached, but the game is so complex that very few rules of this type could be used for phase-tables, and the number of possible chess moves is so vast that the whole approach would be useless. I would be very interested to hear from any reader who successfully applies the phase-table method to a game playing program.

Monthly tasks

In previous articles I have set a monthly task to test the readers' understanding of particular principles in the programming of computer games. Since this month's article heralds a new phase in my series, in which I shall be concentrating on specific games, I will not be setting any more tasks for the reader. I hope that some of you will write successful game playing programs, and that you will write to me with any interesting ideas or discoveries.

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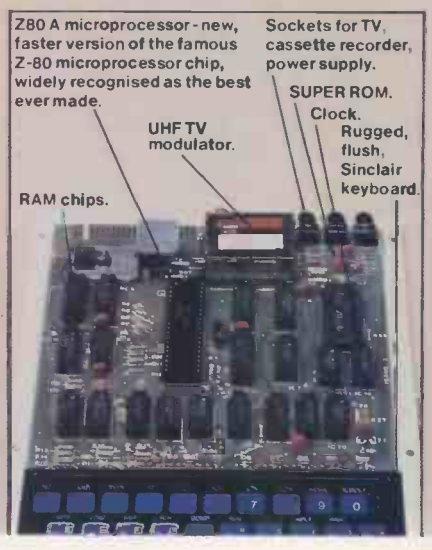

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ROMPLUS+

A useful feature of the Apple II is its seven-slot expansion motherboard which allows you to plug in all sorts of interesting devices. Apple itself very sensibly encourages other companies to develop these add-ons, one of which is the Mountain Hardware ROMPLUS +, reviewed here by Dr Robert Beynon.

The Mountain Hardware ROMPLUS + permits the Apple II user to commit important machine code programs to EPROM or ROM, and to call these 'customised' programs as required. Six ROMs or EPROMs may be accommodated on a ROMPLUS+ board giving 12 kbytes of user defined firmware in total (Fig 1).

Most people will probably buy a ROMPLUS+ with the Keyboard Filter already on board. This is a clever piece of firmware which greatly expands the potential of the Apple II by allowing the following capabilities:

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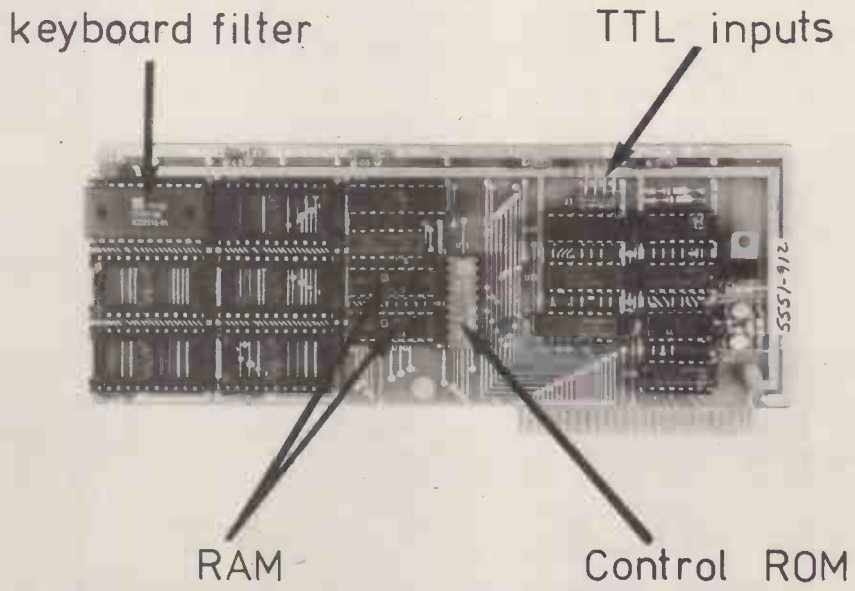
3. User definable character fonts
4. User definable macro-commands
5. Multiple-coloured text

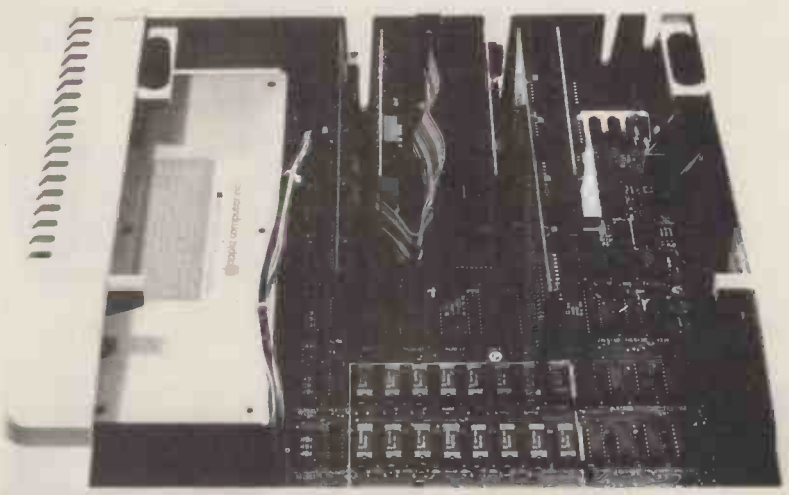
From this list alone it's apparent that the combination of ROMPLUS+ and Keyboard Filter is a powerful addition to the repertoire of any Apple II. In the scientific and educational fields this product fills an important gap in the available facilities.

Figure 1



The ROMPLUS+ with Keyboard Filter installed in socket #1; 255 bytes of RAM may be used as a scratchpad by the ROMs and are mapped into the region CFF0H—CFFEH. This RAM may be activated or deactivated at will.

Figure 2



Easy system expansion. From left to right, Apple Integer Basic, high speed serial card (driving a plotter), parallel output card (driving a printer), the ROMPLUS+ and the disk controller.

Installation

The package, which is supplied ready-built, is accompanied by a disk containing demonstration and utility programs (DOS 3.2) and two manuals . . one for the ROMPLUS+ and one for the Keyboard Filter. Explicit instructions are given for the installation of both products (in our case the Keyboard Filter was already inserted in Socket #1 on the ROMPLUS+). The ROMPLUS+ can be plugged into any slot except slot #0 and is ready for initialisation. The demonstration programs do not assume that the ROMPLUS+ is in a particular slot because the manufacturers have provided a program, called SLOT FINDER, which locates it automatically. This program is also supplied as a text file so that it can be tagged onto user programs using the EXEC command. This approach is elegant and precludes the interminable swopping over of cards that can otherwise occur (Fig 2).

Initialisation

Initialisation of the ROMPLUS+ from either Basic or the monitor is achieved by means of the normal peripheral commands; PR# (slot) or IN# (slot) where (slot) is the number of the slot

containing the ROMPLUS+; therefore it's initialised in the same way as any other peripheral card. Then, a second command must be given that can be intercepted by the controlling firmware on the ROMPLUS+, and which specifies the number of the ROM or EPROM to be used (usually 1 in the case of the Keyboard Filter). This command must also select one of the four entry points into the Keyboard Filter software. These are:

A: First time initialisation using graphics screens
B: Re-initialisation using graphics screens
C: First time intialisation using text screen
D: Re-initialisation using text screen

The entry point selected affects the features that will be available because of the type of display that is used. A and B both use the 8 kbyte high resolution graphics memory areas (Fig 3) and permit text and graphics with upper and lower case. C and D use the normal 1 kbyte text screen area and do not allow graphics or lower case unless a new character generator ROM has been fitted.

With the keyboard filter initialised, a whole new range of facilities are available using single key commands that are intercepted by the firmware. (A list of these commands is given in Table 1) Let's look at some of those features in more detail.

Mixed text and graphics

Although the original Apple design did not allow for mixed text and graphics several software solutions have been developed in the past, with varying degrees of difficulty associated with their use. The Keyboard Filter makes all these solutions seem laborious by comparison. When initialised in the graphics mode (options A or B) the Apple uses the area of memory from 2000H to 4000H (8 kbytes) for all of its screen display. This is the normal high resolution graphics area that permits plotting to a resolution of 280 x 192 individually addressable points. The point plotting, line drawing, shape scaling and rotating commands may be used as normal. In addition, however, text may be displayed on the screen (but at a much greater memory overhead). Mixed text and graphics are now easy; treat the screen either as a text page (using the PRINT, HTAB and VTAB commands) or as a graphics page (using HPLOT, HPLOT TO, DRAW, SCALE, & ROT commands) and develop properly annotated graphs or diagrams! (Fig 4)

Multiple character sets

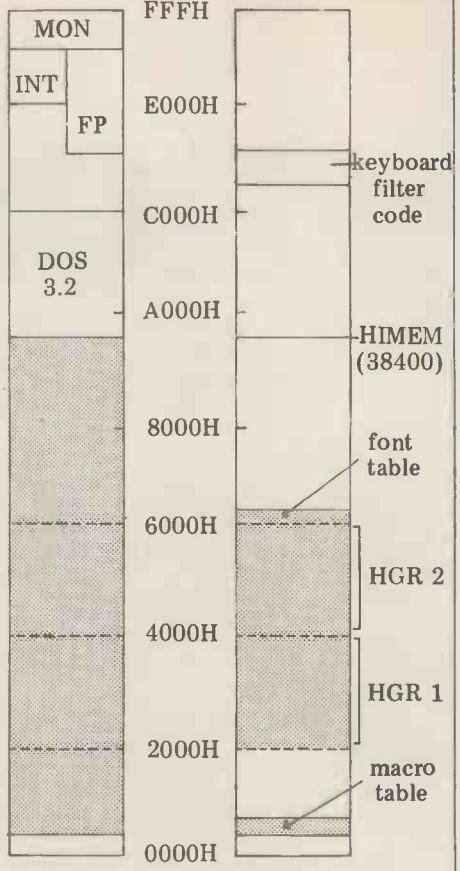
When using the Keyboard Filter in graphics mode a character set comprising upper and lower case letters is used. The CTRL—L command switches between normal or upper case and lower case letters. The lower case characters cannot be used in Basic and give syntax errors so it's useful to be able to revert to upper-case-only operation. Lower case may, however, be used in PRINT statements for display on the graphics pages. This can cause problems as printing on the bottom line of the screen will cause scrolling of the page, including all text and graphics!

The Keyboard Filter also allows the use of alternative character sets or fonts. Alternative fonts can be useful for providing additional characters (mathematical or Greek symbols for example) or sideways lettering, etc. These fonts occupy 1 kbyte each and are stored in RAM starting at the default location of 6000H — just above the second page of high resolution graphics (HGR2 in Fig 3). Selection of different fonts is by means of the CTRL—F command, followed by the number of the font required.

Several fonts are supplied on the disk and may be loaded at will. Most of them are used in the demonstration programs and are of limited value in any other context. Any of the fonts may be displayed in different colours provided that consideration has been given to the idiosyncrasies of the Apple's colour display (no mixing of odd or even vertical lines in the character).

Editing functions

For Apple users who do not have the old ROMs the Keyboard Filter brings the editing facilities up to and past those given by the Autostart ROM. Editing is initiated by means of a CTRL—E command, immediately after which the I, J, K, M keys control cursor movement. Screen copying or erasing, using the 'forward arrow' and 'back arrow' keys is active and the REPEAT key works with all of these. The cursor control is exited by pressing any other key, which is displayed as normal — an improvement on the Autostart ROM which loses the first character after the cursor control mode is exited. The most useful feature is provided by pressing CTRL—W. This moves the cursor to the far right of the screen (or text window) and copies the line as it goes. Editing the first few characters in a 200-character line involves considerably less time and reduces the opportunity for faulty copying of strings — an attractive addition to the Apple's facilities.



Apple II memory map. (a) Normal memory map — the shaded area indicates user workspace (including two graphics screens) with DOS 3,2 installed. MON= monitor, INT= Apple Integer Basic, FP = Applesoft Basic. (b) The areas of memory used by the Keyboard Filter and ROMPLUS+ are shaded.

Table 1

Command		*Function*
CTRL—C	Normal	Stops program or listing
" D	Normal	DOS control character
" E	Edit	Allows cursor control*
" F	Font	Selects new font*
" G	Normal	Rings 'bell'
" H	Normal	Backspace
" I	Inverse	Toggles inverse mode
" K	Peripheral	See text*
" L	Lock	Simulates shift lock
" M	Normal	Carriage return
" O	Overstrike	Allows overprinting
" P	Page	Switches display page
" Q	Peripheral	See text*
" R	Raw	Toggles raw mode
" S	String	Prints a keyboard macro*
" T	Tint	Selects colour of text*
" V	Shift key	In modified Apples — see text
" W	Copy	To end of line — see text
" X	Normal	Terminates current line
" Z	Zap	Clears current screen

The single key commands used in controlling the functions of the Keyboard Filter. The command CTRL—V is used with Apples that have a modification allowing normal use of the Shift Key. (We have not tried this modification as we are unsure of its effect on Apple operation without the Keyboard Filter activated). Commands marked with an asterisk must be followed by other characters to complete the instruction.

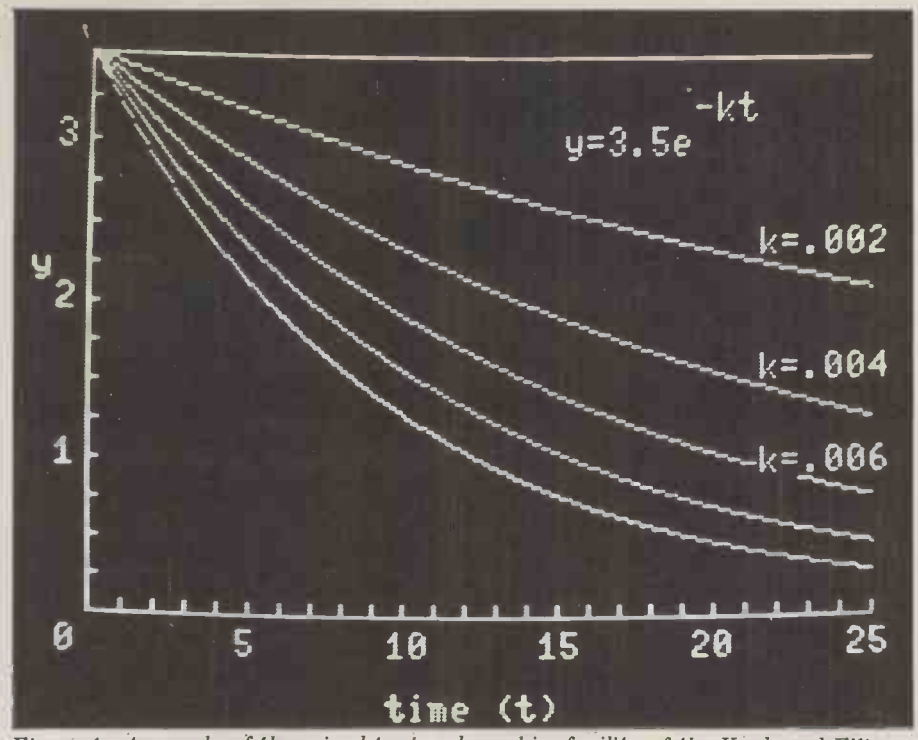


Figure 4 A sample of the mixed text and graphics facility of the Keyboard Filter.

Keyboard macros

The Keyboard Filter allows the definition of 60 'keyboard macros', defining a macro as a sequence of commands that are executed by entering a single character from the keyboard (prefixed by a CTRL—S). The commands consist of a string of up to 63 characters that may include control characters or carriage return. For example, CTRL—S C might cause the execution of the macro string 'CATALOG (carriage return)'. Their use is restricted to direct mode, however, as programs cannot call macros. (Also, using one macro to call another, in the words of Mountain Hardware, makes the Keyboard Filter "very, very confused"!). Macros are stored in a table at the default value of 800H.

Demonstration and utility programs

The demonstration and utility programs are all supplied on disk — I do not know whether cassette users are catered for. Owners of Europlus Apples be warned — all but one of the programs are in Integer Basic! (A word of thanks here to Roy Stringer of Microdigital — an Integer card was sitting in slot #0 within one hour of a frantic telephone call). The demonstration programs are really impressive and include 1 inch high Gothic script and a little man running across the screen. All of the features of the Keyboard Filter are demonstrated and illustrate its potential.

Three utility programs are provided — a font editor, a macro editor and the previously described 'slot finder' program. The first two are good quality programs which allow the user to define his own font tables or macro tables and are comprehensive and easy to use.

It was a pleasure to run these high-quality programs. The software support for this product is excellent apart from the provision of Integer Basic programs; hopefully this will be rectified in the future.

Memory conflicts and solutions

The Keyboard Filter manual discusses the most probable memory conflicts that are likely to arise, usually with systems having less than 48 kbytes of RAM. Fig 3(b) shows the areas of memory that can be used by the Keyboard Filter. Because both high resolution graphics pages may be used one problem may arise by division of the available memory space. Between the lowest memory location 800H (LOMEM) and the beginning of the first graphics page 1FFFH, only 6 kbytes is available if that page is used. The second block of memory, from 6000H to 9600H (HIMEM) constitutes a 14 kbyte block which could be used if the lowest memory location was altered to 6000H. Alternatively, if only one graphics page was required (HGRI) then LOMEM could be set to 4000H — giving 22 kbytes for user programs. Note that the font table uses a section of memory at 6000H — right in the middle of program space. In practice this is unimportant as the font tables (and macro tables) contain no address-sensitive information and can be relocated at will (instructions are provided for doing this).

The other type of memory conflict arises in the reserved ROM space of the memory map (above 6000H). The Keyboard Filter occupies the address space from C800H to CFFFH, an area normally reserved for ROM on peripheral cards. As the ROMPLUS+ is addressed as a peripheral card this should mean that a printer card for example, could not be used simultaneously with the ROMPLUS+. In fact, the Keyboard Filter maintains its own set of addresses which allow it to activate or deactivate other peripheral cards such as the parallel printer card. Problems arise, however, with cards such as the high speed serial interface, because this card uses the same memory space for control ROMs. When the Keyboard Filter activates the serial interface card, the response of the latter is to deactivate the former! No solution to this problem exists . . . cards such as the ROMPLUS+ and the serial card or the clock card cannot be active simultaneously.

Conclusions

This brief resumé of a powerful piece of hardware cannot do full justice to its potentialities. The ease of use of most of the facilities and the provision of good utility software combine to make the ROMPLUS+ and Keyboard Filter a very attractive feature. It will also be interesting to observe the appearance of new ROMs or EPROMs which slot into the sockets on the ROMPLUS+. The text/graphics facilities alone are enough to justify purchase of this peripheral — the other features provide additional reasons. If I sound impressed then I have conveyed my personal opinions correctly.

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YOUNG COMPUTER WORLD

Compiled and written by Derrick Daines

I was taken to task recently about my piece two months ago in which I urged the LEAs to standardise on machines. The person giving me the wigging said that it had been done already. Well, this is certainly true of some LEAs but the majority have yet to act. I might also add that, in my view, the LEAs that have acted have done so in a very short-sighted manner.

Take my own LEA for example — it has standardised on three computers, but each is in the £1000 price bracket! As if this wasn't bad enough, the LEA compounds the problem by taking years to process a school's application for a computer and even then can still refuse permission. The effect of all this is that schools are turning to their own resources. . . approaching industry, their PTAs, or running special campaigns. Some schools will even purchase a machine out of their general allowance, preferring to deprive other areas of need rather than be without a computer indefinitely. I think they're dead right — I even paid for ours out of my own pocket!

Without aid of some kind, no school can afford a £1000 computer so they go for something cheaper; then the LEA's so-called standardisation is seen for what it is — inadequate to say the least. Once there was a cartoonist called Lowe who used to depict the TUC as a cart-horse. If I could draw, I'd show the LEAs as dinosaurs!

Another, and more serious, criticism of my standardisation plea is that it might freeze investment in schools at the level of technological development reached at the time the standardisation was made. This is true — it could be argued that my own LEA has done just that and frozen installations at the development level of five years ago — but surely there's a world of difference between a permanent freeze and a set of responsive guidelines. I get the impression that hardly anybody in the LEAs knows what's going on. They move only after years of intense pressure and in the meantime schools are on their own — which is about where I came in.

The editor tells me that he will be delighted to give extra space to those who wish to enter this particular fray. If you feel moved to write in, please make it clear that it's in connection with YCW. I look forward to hearing from you — I think!

Letters

The Postbag this month has produced a bumper crop of programs, letters and so on, so I'd better get reaping right away.

Alan Nicholls (15) of Romford wrote an interesting letter offering oscilloscopes for sale — he wants to buy an Acorn Atom. Normally, this sort of offer would go into the small ads., but I was amused by his remark that he has '. . . been studying Basic more than (his) schoolwork.'

It's not unusual you know — several Universities and Colleges have reported that even mature students have to be forcibly prised away from their consoles. Many students even showed signs of forming emotional attachments to their computers, to the detriment of other studies and social activities. Of course, it conjures up a gorgeous image of young fellows smooching with a computer, but I kid you not! Some tutors got very worried about it. (Not to mention the girl-friends, I shouldn't wonder!)

Personally, I believe that the tutors over-reacted. They saw students totally engrossed in what they were doing and thought it unnatural. That may be a comment on students — but it might equally as well be a comment on the standard of teaching. The tutors were obviously not accustomed to that sort of attention at their own lectures!

Having said all that however, I must in honesty admit that I find the computer very addictive. Perhaps there ought to be a Government warning stuck onto every machine, as there is on cigarettes!

There is a very real danger that Alan Nicholls will find himself doing even less homework than at present if be buys his Acorn. This may make him a whizz at computing, (see my bit last month about the advantages of that) but even I have to admit that there's more to education than just learning to program a computer.

I'm afraid that a faux pas (foul up to you) occurred when we printed Paul Bowden's Snap program some time ago. Apparently lines 30, 40, 50, 60, 70 and 90 should have read 'DOKE' and not 'POKE'. (Oops!) Anyway, Paul wrote a very nice little letter putting us right. Sorry, Paul. I would imagine that those readers using the machine for which it was written would have spotted the mistake by now.

The Anthony Gell School of Wirksworth, Derbyshire, sent us the first 'awe inspiring issue' of a magazine produced by their computing department. I found it enormously interesting and full of good things; articles, programs, games and so on. It runs to 10 pages and is offered very cheaply to schools. Interest is mainly on the PET, because they have seven of them!!! They welcome any contributions — write to Peter Avis, Head of Maths. Oh, I almost forgot, the magazine is called "Lemming", yes "Lemming".

The London Correspondent of TROS/Radio Netherlands, Willem Kootstra, wrote in offering us the free gift of a teleprinter all complete and working. I was happy to collect it and deliver it to a Midlands School, where it is now doing sterling duty; I am delighted now to give him public and sincere thanks. Are there any more like you in Holland (or anywhere else for that matter)?

Programs received

Basic Subroutines, Slalom, by Andrew Roos (14) of Marlborough. Number Base Change for the Texas TI-53, by P. Ballister (13) of London. Laser Battle by Duncan Batey (12) of Vence, France. Words and Space Defence by Stewart Sargaison (14) of Berkhamsted. Atomic Orbitals Density Plotter by Craig Dibble (15), of Bristol. Spacewalk by Steven Dix of Rugeley. TRS-80 Graphics by Torstein Kongshem of Oslo, Norway. Pilot Interpreter for the PET, by Paul Robson (16) of Norwich. Universal Calendar by Paul Selvey of Nottingham. Nascom 2 Memory Checker by D. I. Tate of Cheadle. Number 'Simon' and Biorhythms by Gary Knott (16) of Morden. Surround by R. A. Develyn (16) of Horsham.

That's a whole lot of programs to receive in one month and — as I've said before — I'm enormously impressed.

Space Defence by Stewart Sargaison

```
 4 F=9:F2=9:D8=9:PRINT"G♥GJGJINSTRUCTIONS (Y OR N)"
 5 GETR$:IFR$=""THEN5
 6 IFR$="Y"THEN50000
10 PRINT"G♥"
11 DATA134,125,760,810,820,97,650,86,691,2:FORT=1TO10:READD:POKED+32768,42:NEXT
12 RESTORE
13 REM SET UP SCREEN
20 FORT=32768+22*40TO32768+25*40-1:POKET,102:NEXTT
30 FORT=32768+22*40+30TO32768+23*40-2:POKET,65:POKET-40,100:NEXTT
50 FORT=32768+23*40+30TO32768+24*40-2:POKET,T-(32768+23*40+29)+48:NEXTT
61 PRINT"GQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGJGJGJGJGJGJGJGJGJGJGJGJGJ
GJGJGJGJGJGJGJGJGJGJGRBASEG-"
69 REM ALIEN HEIGHT
70 D=INT(RND(TI)*19+1)*40+32768
71 E=E+1:IFE=10THEN3000
72 PRINT"GSGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQGQALIEN CRAFT:"10-E
73 PRINT"HITS:"F3"GS"
79 REM POKE ALIEN ON SCREEN
80 POKED,43:POKED+1,61:POKED+2,45
90 POKEL,32:L=D
100 FORT=1TO5
110 GETR$:R=VAL(R$)
120 IFR>0THEN150
130 NEXTT
150 IFR=0THENGOTO300
160 GOTO400
300 D=D+1:IFD-7=INT(D/40)*40THEN320
310 GOTO80
320 POKED,32:POKED+1,32:POKED+2,32:GOTO70
400 P=32768+22*40+29+R
402 FORT=32768+22*40+30TO32768+22*40+38
403 IFPEEK(T)<>32THEN405
404 NEXTT:GOTO4000
405 POKEP,32:P=P-40
410 IFPEEK(P)=32THEN80
415 D8=D8-1
420 POKEP,32
430 P=P-40
435 IFP<32768THENPOKEJ,32:POKEJ+40,32:GOTO80
440 IFPEEK(P)<>32THEN10000
```

GOTO page 130

DIALOGUE STRUCTURE AND DESIGN METHODOLOGY

David Hebditch looks towards dialogues in this, his second visit to the man/machine interface

Before considering methodologies in detail, it's perhaps appropriate to examine the *structure* of dialogues in typical commercial microcomputer systems.

The generic use of the term 'dialogue' may be applied to a group of related and structurally or syntactically similar exchanges with the system. The grouping might be related to terminal types or application areas. For example, a 'forms mode dialogue' can take place on a display and a conversational dialogue on a serial printer. Clearly, order entry is likely to be different in style from interactive program development.

Within each 'dialogue' there may be a number of 'transactions' (see Figure 1), each being a self-contained exchange with the computer and comprising one or more input and one or more output messages. A Sales Accounting Dialogue might include an Order-Input Transaction, a Credit Note Transaction, a Customer File Update Transaction and so on.

In turn, each message will consist of a number of data items plus various formatting and control characters.

Figure 2 illustrates how a user might have access to a *transaction handler* which will enable him to select the transaction-processing routine he wishes to talk to. Once in the transaction he can get to another by returning to the handler or, in some cases, by going directly via a 'next transaction' field in the input format. This is shown in more detail in Figure 3. The transaction selection may be performed by selecting from a menu list or by entering a transaction code.

There are strong arguments for dialogue design to be one of the first activities in the design of the overall system. Computer usage is likely to be well integrated with the jobs of the user staff. So, from that point of view, the collection of dialogues can act as a definition of total system functionality.

The system designer's involvement with a dialogue may be relatively short-lived. On the other hand, many users may have to live with it for a number of years. Also, the designer's perception of 'ease-of-use' and 'ease-of-learning' is likely to be quite different from that of the ultimate user. The message here is that the user *must* be involved in the development of the dialogue; experience shows that this approach always pays dividends. When the system is being developed for no particular user or group of users (e.g. a package) it's important for the designer to carefully monitor the initial installations.

Figure 4 illustrates the recommended sequence in the design of dialogues. The approach is essentially 'top down' (what else!) and corresponds to the general structure of dialogues illustrated in Figure 1 above. Subsequent articles in this series will discuss each of the design stages in more detail.

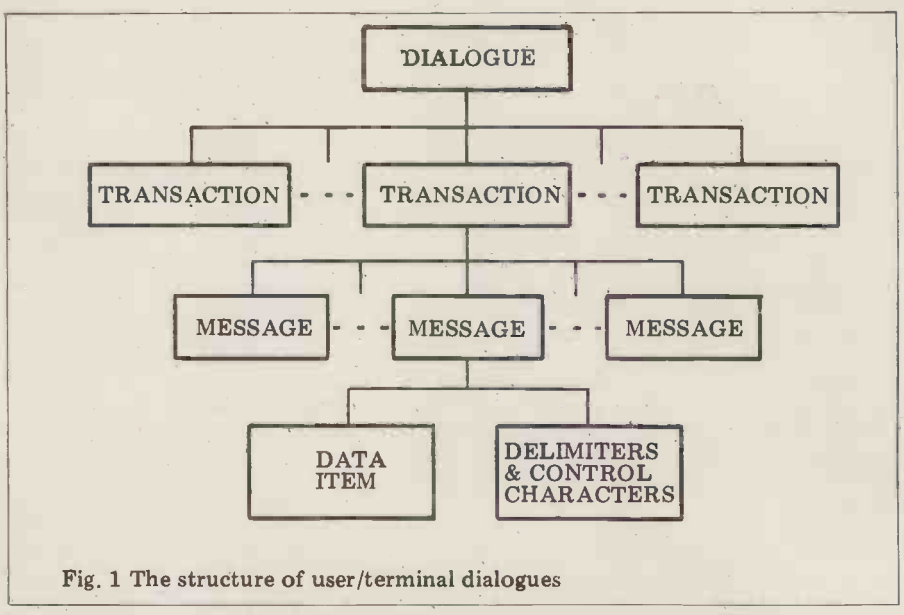


Fig. 1 The structure of user/terminal dialogues

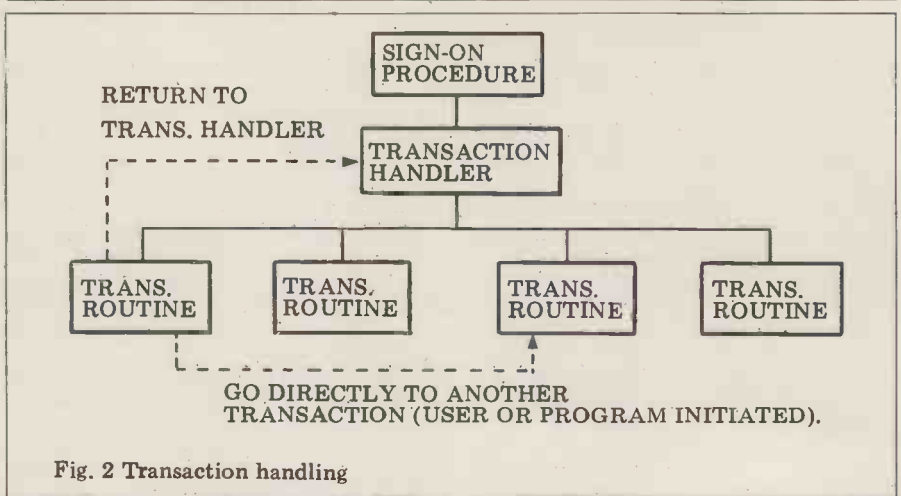


Fig. 2 Transaction handling

Note that *error-handling* is difficult to isolate to one step in the process. In practice, the error-handling mechanisms of a dialogue can cause more design and development problems than any other aspect. One of the major benefits of a system where the user interacts directly with the computer is the resultant improvement in data quality. It is urged, therefore, that this consideration be kept in mind during *each* stage of the design process.

Choosing the most appropriate *style* of dialogue is probably the most crucial stage of the design process. The implications of getting it wrong can be fearful. In three case histories I know quite well (two in the private sector and one in the public sector) major mainframe computer projects had to be scrapped (at losses ranging from £90,000 to £300,000). In each instance the dialogue style selected was quite inappropriate to the user environment; one too complicated, one too long-winded and other too inefficient. Program structures tend to correspond very closely with dialogue structures and revising the latter is often just not feasible.

Figure 5 attempts to illustrate the complexity of relationships between the various dialogue styles and their influencing factors. In fact, the number of combinations is unmanageably large. A process of reduction, therefore, needs to be applied to the various influences. The designer needs to work through the areas shown, specifying all the influencing factors. Each of the styles described in next month's article will produce varying degrees of 'fit' with the chosen influences.

Experience with this technique has shown that it's best to view the process as one which *deselects* inappropriate styles rather than the other way around. Only careful thought and discussions

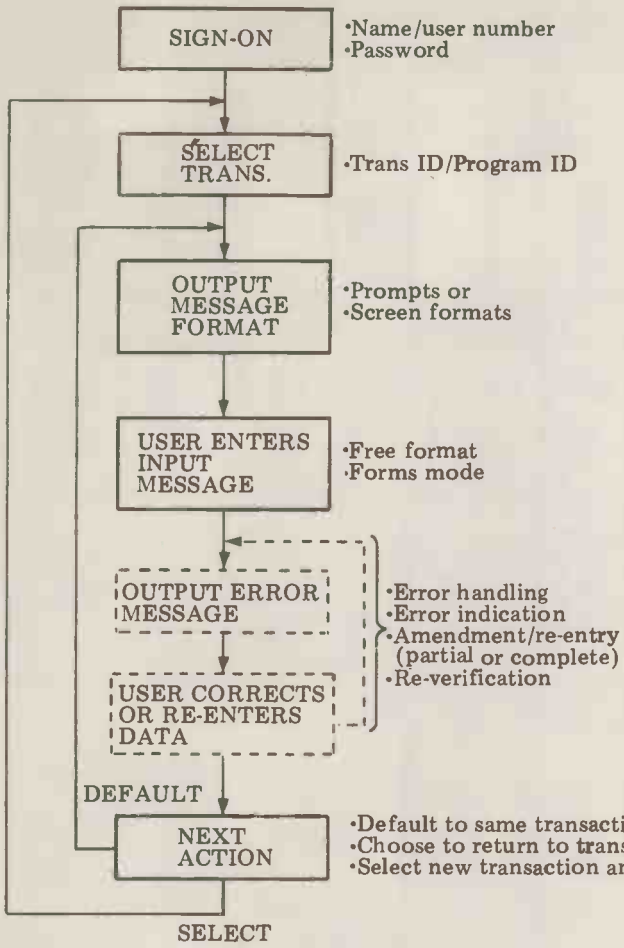
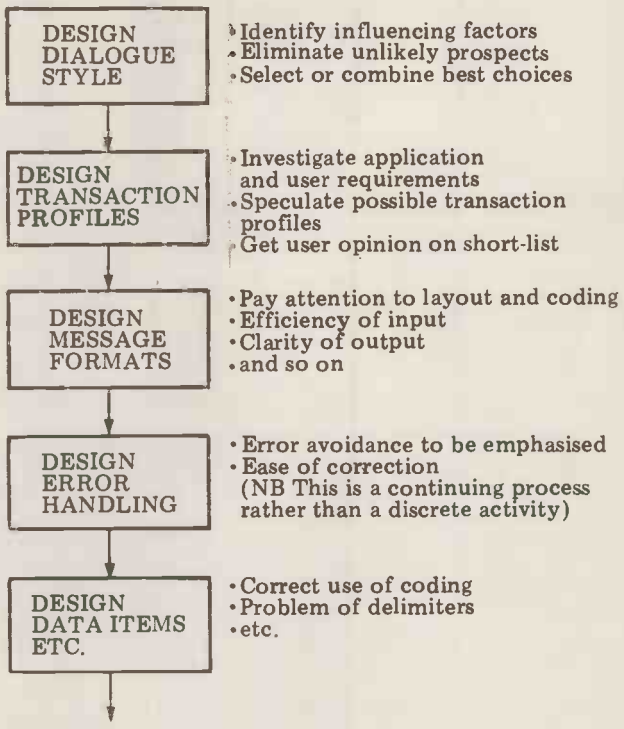


Fig. 3 Profile of a typical dialogue

Fig. 4 a structured approach to dialogue design



with users can get the best combination of styles.

Next month I will begin a review of the main styles of dialogue available to the designer of microcomputer based systems.

1 Purpose	Enquiry/Data Input/Database Admin.
2 Operator Type	Specialist/ Regular/Casual
3 Operator Roll	Active/Passive
4 Operator Intelligence	High/Average
5 Operator Tolerance	High/Low
6 Level of Training	Less than 5 mins/Less than 1 day/More than 1 day
7 Response Time	Less than 1 sec/1-4 secs/ Over 4 secs/ Over 15 secs
8 Volume of Data	High/Low/ Input/Output
9 Terminal Type	Slow Keyboard-Printer/Fast Keyboard-Printer/TTY-Compatible VDU/ Commercial VDU
10 Local Processing	Intelligent Terminal
11 Complexity of Data	High/Low/ Input/Output
12 Multiple Applications	Multiple Applications per terminal

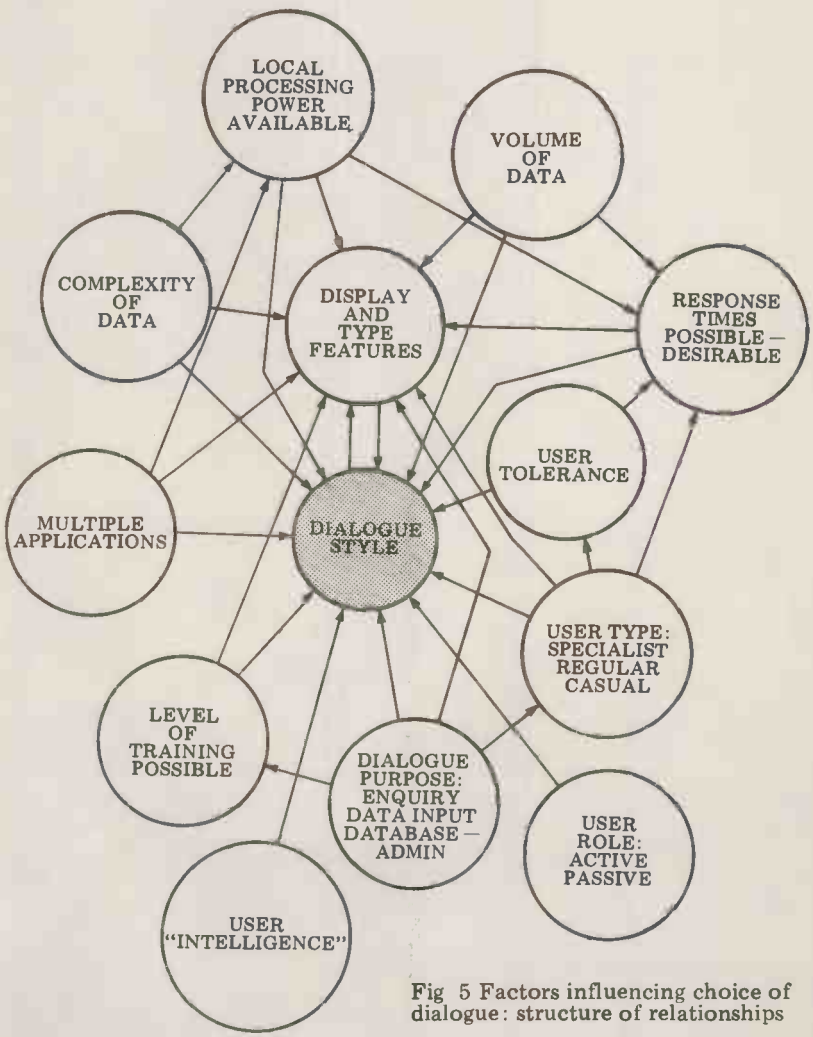


Fig 5 Factors influencing choice of dialogue: structure of relationships

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A SWITCH IN TIME

If you're going on holiday and can't bear to miss 'Crossroads' then your computer could make a useful (if expensive) time switch to control the family video recorder. Alternatively, as John Nottage explains, a number of other devices may be controlled by way of this simple, handy interface.

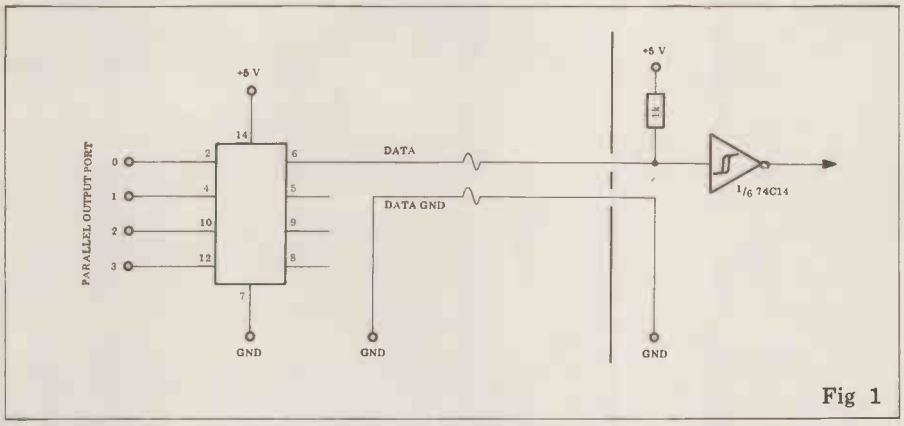


Fig 1

The system outlined here, which produces multiple function control from a few components, relies on simple serial data. By sending a predetermined number of pulses from a single output port, up to 15 different operations can be controlled and only a single pair of wires is required to send the data over distances of up to several hundred metres. Timing lines are not needed. The system is slow enough to enable the serial data to be programmed in Basic; at the same time it's quite capable of operating at machine language speed.

The hardware of this system can be made to drive almost anything. It was originally designed to control a Grundig video recorder, thereby enabling several different recordings to be made without any intermediate resetting. The all-electronic operation of the Grundig lends itself very well to this form of control; by using some type of solenoid on the record, stop and channel change functions, it should be possible to use the system to control other makes of video recorder.

Computer output

The most versatile device to attach to the output of the computer seems to be the National quad line driver type MM88C29. This integrated circuit uses almost no current from its single 5 V supply and has an on resistance of about 20 ohms; it can drive lamps, relays and solenoids directly, as well as feeding down long lengths of cable to a schmitt trigger such as the 74C14. The circuit using one MM88C29 is shown in Fig 1. Data is encoded in Basic as a number of pulses — between two and 16 pulses to give 15 different functions; the use of one pulse is avoided to reduce the chance of a spurious signal affecting the system.

Decoder/Controller

Fig 2 shows the circuit for the

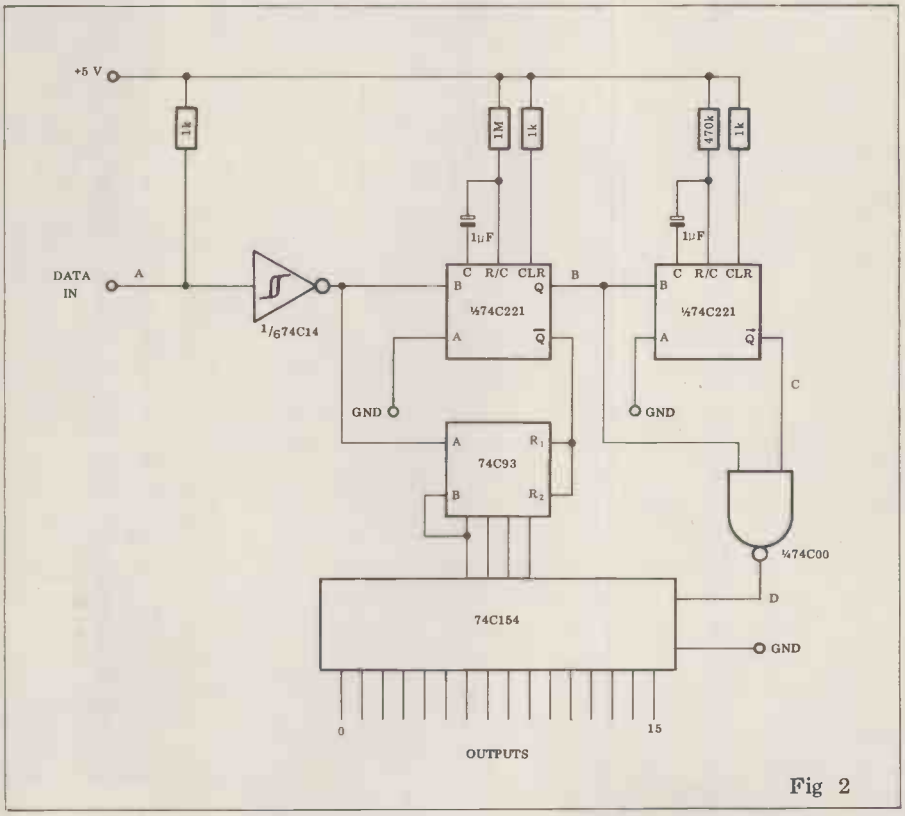
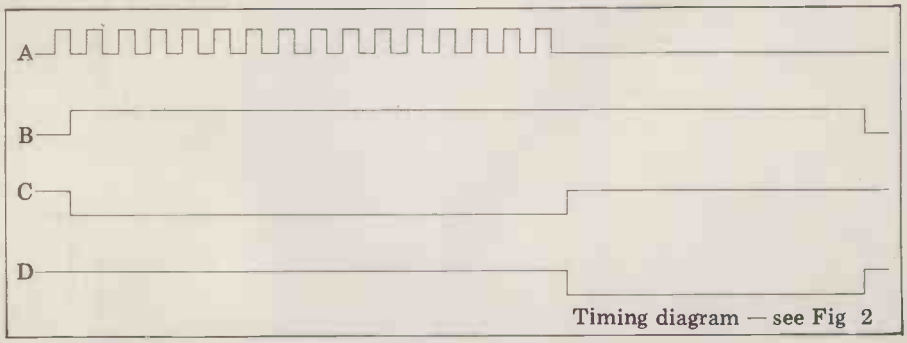


Fig 2



Timing diagram — see Fig 2

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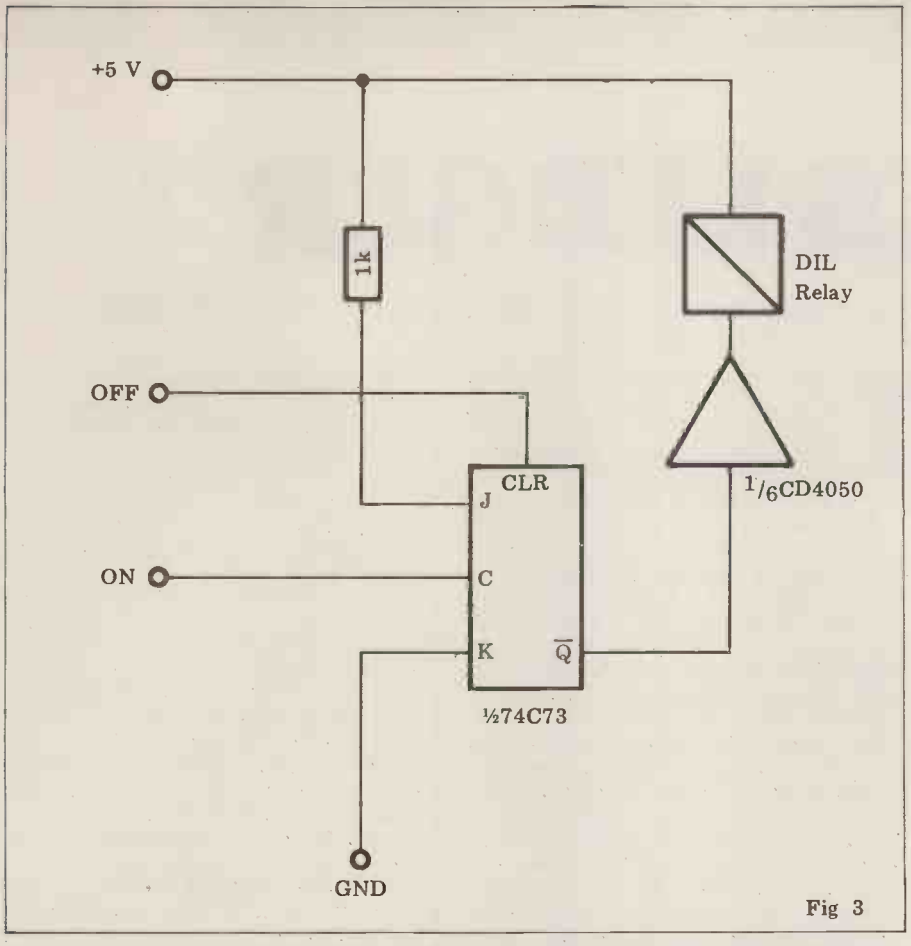

Fig 3

decoder and basic controller. The serial data is fed from the MM88C29 into 1/6th of a 74C14 hex schmitt trigger. The resulting clean output is used to trigger half a 74C221 monostable, which in turn triggers the other half. The continuing series of input pulses is counted by the now enabled 74C93 binary counter. After the output of the second half of the 74C221 goes high again the resulting low from the output of the 74C00 enables the 74C154 4 to 16-line decoder for the remainder of the duration of the output pulse from the first half of the 74C221. This gives an output pulse from the appropriate pin on the 74C154 of about half a second.

It requires one pulse to trigger the system, so an input signal from the computer of three pulses will give a one half second negative pulse from output pin 2 on the 74C154. Similarly, six pulses will produce the pulse on output pin 5. The timing of the monostables can be adjusted to suit the type of program, though the values given will work for both machine language and Basic. Changing the values of the first half of the monostable will increase or decrease the duration of the main output pulse. The timing of the second half is set so that 16 pulses at Basic speed can be input while its Q output remains high. This time can therefore be reduced for a machine code program and the timing on the first half reduced by the same amount if needed.

Optional circuit additions

A simple addition to enable the system output to switch some device on and off is shown in Fig 3. The pulse clocks the 74C73 and switches the relay on; another output is then used to clear the device and switch the relay off. Note that the 74C series of CMOS ICs will not drive relays directly but the hex buffer type CD4050 will happily drive a dual-in-line (DIL) relay. For larger current supply, the MM88C29 is again the useful choice.

If you intend to use the controller to drive a video recorder then you can adapt the circuit in Fig 4 to most solenoid control functions. In the original circuit, six channel change relays were chosen. This was entirely due to the availability of a suitable 7-pin plug and socket to connect the controller to the small panel of DIL relays soldered into the body of the VCR immediately behind the channel select module. The Grundig already has a remote control socket, so this, combined with the channel change connection, is the only extra requirement. Again all DIL relays are used, each with a buffer in series.

Assembly

The whole decoder can be assembled on a small piece of Veroboard using a Verowire wiring pen to produce a neat and reliable result in a short time. Power requirements with CMOS ICs are tiny, so a small 100 mA transformer is adequate. If the device is only used for pulse generation, not for holding relays, then battery operation would be practical. Two or three 0.1 µF decoupling capacitors should be connected between +5 V and chassis at points around the board.

Software

The following subroutine is taken from a complete recording schedule control program for an 8k PET. Other computers should require equally simple routines. The only input needed is C, which in the case of VCR control would be the channel number. A value of C=7 is used for stopping recording.

First set the output port:

```
50 POKE 59459, 1: POKE 59471, 0
```

Now the subroutine:

```
10000 FOR I=1 TO C+1: REM SETS NO. OF PULSES
10010 POKE 59471,1
10020 POKE 59471,0
10030 NEXT I: RETURN
```

This routine, when incorporated in a complete program, can provide full and precise control of many different devices including audio and video recording. It can be programmed as far in advance as you wish — but don't forget leap years and British Summer Time! The other problem on the PET is the inaccurate clock but it's quite easy to allow for this in the software. In my own PET I found it gained a little over five seconds an hour; I overcame the difficulty by subtracting five seconds every hour and seven seconds every 24 hours and the clock is now within one second a week when running my recording program.

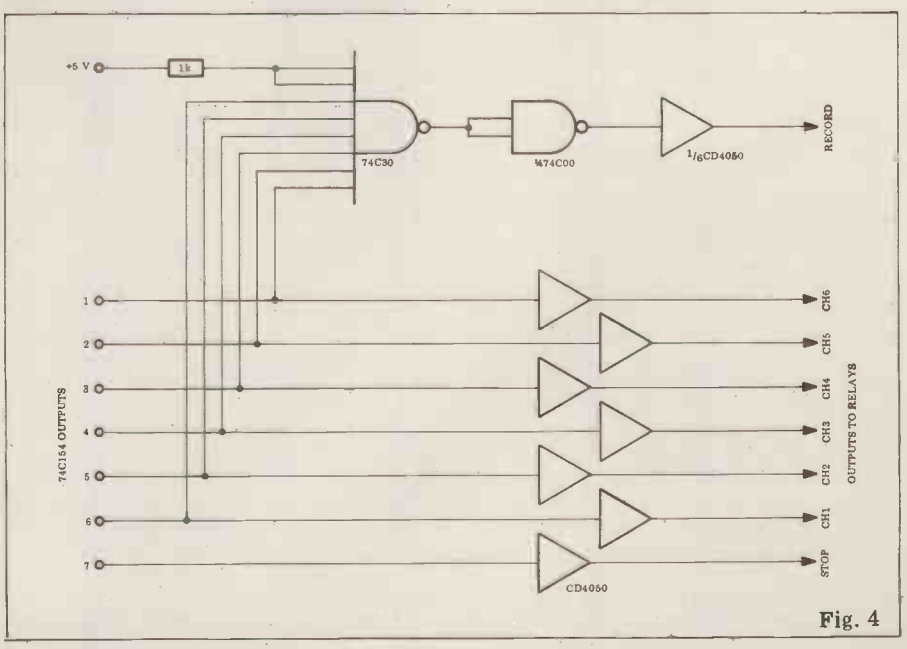

Fig. 4

SALES LEDGER 2

Mike Knight of Mike Rose Micros returns to 'Sales Ledger' and peruses and reports on available documentation.

No matter what our business the prime function is to sell — be it goods, services or expertise; therefore the heart of a company's success lies in close control of its customers' payments. This month I'm taking another look at this important field — The Sales Ledger.

Functional requirements

1. We must be able to post any transactions to the account of the customer concerned, whether invoices, credit notes or cash.
2. We will need to have aged balances to enable us to keep a close eye on our customers indebtedness and also to help us to fix a credit limit on each customer.
3. Allocation of cash against invoices will be essential as will. . .
4. Analysis of VAT amounts.
5. We will wish for a free choice of accounting system, either balance forward or open item; in some cases we may ask for the ability to change easily from one to the other.
6. Our accountant will wish to see postings to the Sales Day book and Cash book.
7. Some of us may want remittance advices to allow our customers to tell us which invoice they are paying.
8. Certainly we will all wish to see the ability to link into other functions such as Invoicing, Nominal Ledger or Stock Control even if it's not needed at the present.

PETACT SALES ACCOUNTING
This package is available on Commodore disk or cassette from Petsoft, Birmingham (021-455 8686) or any of its countrywide dealers. The 7 programs are written in Basic and Assembler and will link to Petact Invoicing. The minimum hardware required is a 32k PET, 80 col printer and either disk drive or cassette costing £1950 or £1450 respectively. The package costs are £120 for the disk version and £95 for the tape. The ledger is based on a balance forward system with open item for the current month, and comes supplied with a concise operating manual which gives a step by step 'idiots guide' to system operation. Petsoft runs regular seminars and courses in its Birmingham Training Centre and its dealers will provide training if necessary. All programs are continuously maintained and any bugs or corrupted programs are fixed or replaced. Pre-printed stationery should be available ex-stock from your local dealer. Petsoft is always happy to answer any customer queries and offer advice and guidance by phone or letter.

PADMEDE SALES LEDGER SYSTEM
The system is disk based and available from Padmede Computer Services, Odiham (025671 2434) or any of 30 dealers countrywide. The package, costing £300 and consisting of one program written in Applesoft Basic and machine code, is fully linked to Padmede's nominal ledger. The minimum hardware required is a 48k Apple II with two disk drives and a printer, costing approximately £2000. The system will also run on the ITT 2020. Either Padmede or its dealers usually install this package as part of a turnkey system and will provide training as required — usually for between half a day and a day. Advice and guidance is always available and backup is provided either by the dealer or on a direct hotline to Padmede and any corrupted program will be replaced. Some customisation is relatively simple as the system is parameter driven. The package is supplied with a users manual of a very high standard, which obviously has the first time buyer in mind. There are hints on transferring from your existing system and a very sensible section on protecting yourself from disaster — which makes good reading for any micro-user.

TRIDATA
This package was first reviewed in January 1980 and the only changes are that Tridata now offers both customisation and training services at a cost of £98 per day.

S.N.I.P.
Our regular readers will recognise this product instantly — it's the 'S' part of Benchmark's system (St. Austell 0726 61800) and as usual is available both as a stand alone package or as part of the fully integrated suite (Sales, Nominal, Invoicing and Inventory and Purchase). We've looked at the package as a whole (June 1980), the Purchase Ledger (February 1980) and also the Inventory section (July 1980), The stand alone price for Sales Ledger is £250 and the system is designed to run on a 32k North Star Horizon with 2 disk drives, VDU and printer at an approximate cost of £3725. Each package is set up to the user's volumes and customised with the user's company name. There's a 90 day warranty on the software during which time it will be supported free — bugs discovered outside this period will be notified to the user and an amended program supplied for the cost of the disk. The package comes complete with full media including security diskettes, system specification and full operating instructions of a very high standard.

GRAFFCOM
The package, costing £450, is available from Graffcom Systems Ltd., London (01-734 8862) or from its main distributor, Lifeboat Associates, London (01-836 4663); there are also a number of dealers. It's designed to run under CP/M and requires 48k of memory, 2 disk drives, VDU and a printer (ask Graffcom for its list of compatible machines). Support is available over the phone to all registered users and if the problem cannot be resolved, Graffcom will investigate further in-house and in turn advise the user of the position. Tailoring can be undertaken and estimates are quoted on receipt of outline requirements. The package can be used as a stand alone system or in conjunction with Graffcom Integrated Small Business Software Order Entry, Invoicing, Name and Address and General Accounting systems. I've not seen the Sales Ledger Manual but in general Graffcom's documentation is of a high standard.

G.L.A.S.
This system was reviewed in both January and June 1980 and there have been no significant changes.

GRANT BUSINESS SYSTEMS SALES LEDGER
Reviewed first in January 1980, there are just a few additional comments I wish to make. The customer has the choice at the time of purchase whether to maintain an open item or brought forward accounting system, although open item is generally recommended. In addition to the 5 hours free editing, the Micro Computer Centre will make further amendments to any package at a cost of £10 per hour. The package is now available to run on Apple computers.

Due to lack of sufficient documentation or information at the time of going to press the following packages have not been included in the grid.

ADVANCED BUSINESS SYSTEM
This package was reviewed in the Stock Control section last month (July 1980). The Sales Ledger is part of the Stock Control/Invoicing/Sales Ledger package costing £1000. The average sales ledger volumes based on a single CBM 3040 dual drive are 400 sales accounts with 1400 sales transactions — but volumes can be adjusted between ledgers and transactions to meet client requirements. I've not seen the operator guide for the Sales Ledger section as this is being updated at present. The system runs on a CBM 32k with 3040 disk drives and a 3022 tractor printer at an approximate cost of £2200; it can be expanded up to double 3040 disk drives, making the hardware costs

£3100. There's a £300 charge for software amendments for this expansion.

SALES CONTROL SYSTEM
This package is supplied direct from Compsoft Ltd., Guildford (0483 39665) at a cost of between £1500 and £2500. It's designed to run on a PCC 2000 64k computer costing £6000 and this hardware can be expanded up to a 5 user 80 Mbyte System. Two printers adds another £3000 to the price.

The package includes 1000 Customer files, 1000 Product files, 300 Order files, 3000 Accounts received and 99 VAT codes. There are 6 programs which are written in Basic and linkages to other packages are possible. Compsoft provides installation, training, full phone and site backup and will customise any package for you. Although I've not seen the user manual, if it's of the same standard as the Information Retrieval System documentation (reviewed May 1980) it will be concise, easy to read and should present no problems to the first time user — whilst fulfilling the needs of the more technically-minded among us.

POWERSALES
This sytem will be available in October 1980 from Arclon Associates Ltd., London (01-445 2878). I've only seen the systems specification and so cannot comment on the documentation; it does, however, appear to bode well of things to come.

COMPUTACCOUNT SALES LEDGER
Available from Computech Systems, London (01-794 0202) and priced at £295, Computaccount's Sales Ledger is designed to run on Apple or ITT 2020. . . that's 48k with 1 or 2 disk drives, a 132 col printer and a TV or monitor (average price £2200). The company will provide installation, training, advice and guidance and both telephone and site backup. It will also replace free of charge any corrupted program if the medium is not damaged. The volumes quoted for the minimum configuration are: up to 500 customer accounts, up to 1600 transactions, over 100 user selected analyses and ageing over four user selected variable periods.

OTHER SALES LEDGER PACKAGE SUPPLIERS

Grant Business Systems 01-876 6609, Compsoft 0483 39665, Arclon Associates 01-445 2878, Computech 01-794 0202, Isher-Woods 0582 416202, Logma Systems Design 0204 389854. Tridata 021-622 1754.

Having covered all the chosen applications once and the two major ones twice, this month marks the close of the 'Systems' section in its present form. From next month we shall be presenting a bi-monthly grid which will show the application packages offered by machine and supplier. The 'in-between' months will give an update of any additional packages notified to PCW.

We shall also begin a new series which will take the prospective user through all the stages necessary for a successful purchase and installation of a microcomputer system.

TASKS AND VOLUMES		PETACT SALES ACCOUNTING	P.S.L.S.	TRIDATA	S N I P	GRAFFCOM	GLAS	GRANT BUSINESS SYSTEMS
TASKS								
Post invoices		*	*	*	*	*	*	*
credit notes		*	*	*	*	*	*	*
cash		*	*	*	*	*	*	*
Allocate cash				*	*	*	*	*
Unallocated cash					*	*	*	*
Balance Forward		*	*	*	*	*	*	*
Open item				*	*	*	*	*
Mixed system								
Aged balance		*	*	*	*	*	*	*
Aged Debtor analysis		*	*	*	*	*	*	*
Statements		*	*	*	*	*	*	*
VAT analysis			*	*	*	*	*	*
Sales Day book			*	*	*	*	*	*
Cash Day book					*	*	*	*
Link to invoicing			*	*	*	*	*	*
Link to nominal ledger				*	*	*	*	*
Link to stock control						*	*	*
VOLUMES								
Max customers		1000	900	999	500		200	999
Max transactions		3500	4500	1350	2000		1400	1350
COSTS (in £s)								
Package	Disk	120	300	225	250	450	1000	750
	Tape	95						
Min hardware	Disk	1950	2000	3334	3725	Varies	2500	2335
	Tape	1450						
Total	Disk	2070	2300	3559	3975	Varies	3500	3085
	Tape	1545						

Dick Pountain is on holiday. This month our own Peter Rodwell presents a very interesting program sent in by one of our readers.

PENTATHLON FOR FX502P

International politics rarely rears its ugly head in this corner but I'm sure that at least some of you must be pondering the weighty question of whether or not to heed Mrs Thatcher's call to rally round and boycott the Olympics.

Even if you never contemplated spending this summer in Moscow but are still a sports fan, the news that Olympic TV coverage is to be drastically reduced must have come as a blow. So this month, to soften that blow, here's a Pentathlon program by S Williams which you can run on your FX502P and which will enable you to win (and award) yourself your very own Gold Medals.

Program description

The program consists of five independent games and an accumulating 'scoreboard'. The size of memory available necessitates simple models for each game, and they have been written to provide enjoyable entertainment rather than to stick strictly to mathematical approximations.

The sports available are somewhat unusual and are unlikely to be adopted by the International Olympic Committee as replacements for the present five. They are Pistol Shooting, Discus, Hang Gliding, Bowls and Show Jumping. Each game follows a route similar to that given by the flow diagram of Fig 1. The displayed variables are position of target, windspeed or height of jump. The control functions consist of shot position, angle of throw, angle of attack, velocity or roll, or speed of jump.

Each game is worth a maximum of ten points towards the total score and the games may be played in any order, although 1,2,3,4,5 gives a varied Pentathlon. To start, key P0. This clears the accumulator and sets a constant in M6.

Pistol shooting

P1 — The display will show a field of nine '1's, representing the shooting range, with a randomly positioned '8' as the target. During the following pause, the player enters the position of the '8', counting from the *right*. If correct, the '8' is removed and a new target is set. If incorrect, the target remains and another is added. A shot is only accepted at the new target. At the end of ten shots the number of hits is displayed, followed by the cumulative total.

Discus

P2 — A random windspeed will be displayed. This will remain constant during the game. The angle of throw must be adjusted down from the optimum 45° for still air, in order to take account of the wind. After each throw, the length will be displayed. Three throws are permitted, the longest being taken to calculate the game score. This will be displayed at the end and added to the accumulator.

Hang gliding

P3 — Launched from a height of 100 m, the player has to maximise his distance travelled overland by altering his angle of attack, according to the speed of a randomly gusting headwind. The optimum angles of attack are 5° for a wind of 10 m/s up to 20° for still air. The windspeed will be displayed at the start of the game and after each 10 m drop. During the following two-second pause, the angle of attack must be entered and the cumulative distance travelled will then be displayed. On touchdown, the final score is calculated and displayed as before.

PENTATHLON PROGRAM LISTING

P0,INV MAC	Clear all (M)emories.
1,0,Min6	Load M6.
5 steps	
P1,INV SAC	Clear M's 7,8,9.
MR6,Min0	Load shot counter.
INV 10^x,/,9,=,Min1	Generate field of '1's. Store.
LBL 0	
GSB INV P7,+,1,=,INV INT, Min2	Generate random no. between 1 & 2. Store.
MR1,/,MR2,INV 10^x,=	Select target position in field
INV FRAC,*,MR6,=,INV INT,MinF	according to random number.
8,INV x=F,GOTO 0	Check if target set. If so, reselect.
MR2,MinF,GSB INV P6,M+1,M+1	Set new target.
1,M—8	Readjust score.
MR1,INV PAUSE	Display targets. Enter shot.
INV x=F,GSB INV P6	Hit? If so, remove target.
INV DSZ,GOTO 0	Loop x 10
MR8,GSB INV P8	Display game total. Add to Acc.
45 steps	
INV P6,—,1,M+8,=,INV 10^x *,7,=,M—1	Remove target and adjust score.
10 steps	
P2,3,Min0	Set throw counter.
1,MinF,—,INV RAN#,Min1	Generate random windspeed
=,Min2,MR1,*,2,0,=	between 0 and 20 m/s.
LBL 0	
HLT	Display windspeed. Enter angle of throw
tan,/,MR2,=,INV $\tan^{-1}$,Min3	Calculate length of throw.
sin,*,MR3,cos,*,1,4,0,=	
INV x≥F,MinF	Select longest throw. Store.
INV DSZ, GOTO 0	Loop x 3.
INV PAUSE	Display longest throw.

Bowls

P4 — The 'jack' is positioned randomly between 0 and 10 m from the player. This distance is displayed. A 'roll velocity' between 0 and 10 m/s is entered and the score is calculated from the separation distance of the bowl from the jack. This is displayed after each roll. Roll velocity and distance travelled are not linearly related. Three rolls are permitted and the scores are totalled. The maximum score possible declines for the second and third roll, so it pays to make the first one count. The final score is displayed and added to the accumulator.

Show jumping

INV P5 — The height of each of nine fences (6,7 or 8 ft!) is displayed in turn and, within 1 sec, a 'jump speed' of 3, 4 or 5 must be entered (no entry results in breakneck speed). A time for the jump is derived and time penalties are added for an unsuccessful jump. The faster the jump and higher the fence, the greater the chance of penalties. The cumulative time is displayed after each jump and the score is derived and displayed at the end of the course.

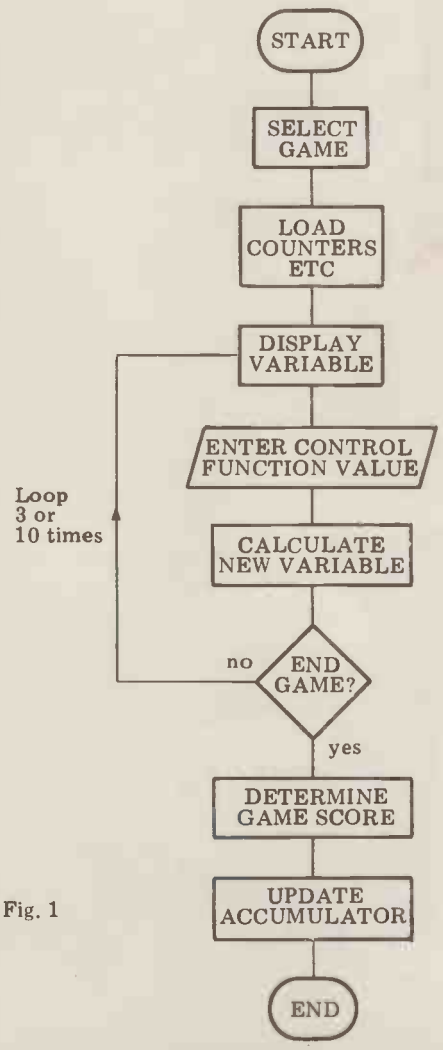

Fig. 1

```
MRF,/,7,GSB INV P8          Display game total. Add to Acc.
                    41 steps
P3,INV SAC                  Clear M's 7,8,9
MR6,INV x²,Min0             Load height counter.
LBL 0
GSB INV P7,MinF             Generate windspeed.
/,(,1,3,—,.,6,*             Part calculation of hor. travel.
MRF,INV PAUSE,INV PAUSE     Display windspeed. Enter angle
                            of attack.

INV x=F,GOTO 2              No input? If none, end game.
=,MinF,1,1,5,—,1,x↔MF       Part calculation of hor. travel.
INV x≥F,GOTO 1,INV 1/x
LBL 1
*,1,5,=,INV INT
M+8,MR8,INV PAUSE           Accumulate. Display distance
                            travelled.
MR6,M—0,MR0,INV PAUSE       Display new height.
INV x=0,GOTO 2, GOTO 0      Loop x 10.
LBL 2
=,MR8,/,MR6,INV x²          Display game total. Add to Acc.
GSB INV P8
                    55 steps
P4,INV SAC                  Clear M's 7,8,9
3,Min0                      Set roll counter.
GSB INV P7, Min1            Generate random 'jack' pos. Store.
LBL 0
—,HLT                       Display jack pos. Enter roll vel.
INV x²,/,9,=                Calculate bowl/jack seperation.
INV ABS,+/—,+,MRO,+         Calculate score.
2,=,INV INT
+/—,INV x≥0,AC,+/—          Turn negative score to zero.
INV PAUSE,M+8               Display score and accumulate.
MR1,INV DSZ,GOTO 0          Recall jack position. Loop x 10.
MR8,GSB INV P8              Display game total. Add to Acc.
                    32 steps
INV P5, INV SAC             Clear M's 7,8,9
.,6,7,8,6,6,8,7,6,7         Heights of fences.
LBL 0
*,MR6,=,Min1                Load course.
INV INT, MinF               Select new fence.
INV x=0,GOTO 2              End of course? If so, go to 2.
6,—,MRF,INV RND 1,INV PAUSE Display height of fence. Enter
                            jump speed.
INV x=F,9                   No entry? If none, assume 9.
*,M+8                       Accumulate jump time.
MRF,=,INV 1/x,*,3,=,MinF    Calculate value of jump.
INV RAN#,INV x≥F,GOTO 1     Successful jump? If so, go to 1.
8,M+8                       If not, add 8 time faults.
LBL 1
MR8,INV PAUSE               Display elapsed time.
MR1, INV FRAC               Select next fence.
GOTO 0                      Loop x 9.
LBL 2
1,1,—,MR8,/,7,GSB INV P8    Display game total. Add to Acc.
                    56 steps
INV P7,INV RAN#,*,MR6,=     10 x random number.
                    5 steps
INV P8,=,INV INT, INV PAUSE Display game score.
M+5,MR5,HLT                 Accumulate and display current
                            Pentathlon score.
                    7 steps
                            Total steps: 256
```

Memory contents

0 — Counter
1 — Working Register
2 — Working Register
3 — Working Register
4 — Not used
5 — Event Accumulator
6 — Constant '10'
7 — not used
8 — Game Accumulator
9 — not used
F — Test/Working Register

.0 to .F — not used

NOTATION

* means multiply (x)
/ means divide (÷)
INV is equivalent to 2nd Function.

STAY ON THE LEADING EDGE

It isn't easy! Few industries are changing as rapidly as microelectronics. We ought to know — *Personal Computer World* is Europe's leading micro magazine and in living up to that claim, each month PCW brings you reports on the latest hardware, software, education and business developments, answers your questions and gives you the most interesting features and programs.

Not only were we Britain's first micro publication but we were also the first to sponsor our own exhibition in the UK. So if you want to keep on the leading edge of micro technology come to the Third Personal Computer World show at the Cunard International Hotel, London, 4 — 6 September.

Last year's PCW show was a great success and this year it will be bigger than ever! The Show will feature a massive display of the latest hardware, software and literature, courtesy of manufacturers and dealers from around the world. You'll be able to take part in or watch the first official World Microcomputer Chess Championship and attend Micro UK, a three-day event of conferences, seminars, teach-ins and round table 'meet the expert' discussions.

Further details of the Microcomputer Chess Championship are available from David Levy, c/o PCW. Use the reply card for further Show information or tickets, or write directly to Timothy Collins, Montbuild Ltd., 11 Manchester Square, London W1M 5AB.

The 3rd Personal Computer World Show

"At this rate (11.30am on 2nd day) we will cover our very considerable costs at the show with the sale of our minor products. We also have at least three months' worth of follow up work on orders from the business sector."
Michael Dean, Managing Director, Katanna Management Services

"We have met a complete spectrum of the potential buyers of our products. It has been a marvellous show for us."
David Taylor, Managing Director, Heath (Zenith)

"The interest of the overseas trade visitors has been absolutely outstanding."
Peter Oldershaw, General Manager, ACT Petsoft

"This show has done more for the image of the Society that any other we have participated in."
Martin Carrington, Technical Information Officer, British Computer Society

"This exhibition is the one and only national rallying point for the home enthusiast."
R. Warren, Amateur Computer Club

"We are very pleased with the show. We have seen all of the people we wanted to see."
Graham Clifton, Transam Components

"We have taken about £4,000 in cash and enquiries worth about £40,000 on just one item alone. We are delighted with the quality of visitor."
Marketing Manager, Keen Computers

"A fine exhibition for the businessman to see a completely different way of meeting his needs."
Philip Virgo, Secretary of the Parliamentary Computer Forum

"On the strength of this show, we will certainly exhibit next year."
Clifford Shilling, Managing Director, C.S. Microcomputers

"At 11 o'clock on the first day of the Show we had done enough business to pay for the stand. Everything else was pure profit."
Colin Stanley, Director, HB Computers

"The layout and planning of the exhibition was perfect for this type of show."
Chris Mead, Sales & Marketing Director, CIS Ltd

"The quality of the visitors has been excellent. We have had a very successful show."
Ted Russell, Tandy Corporation

NEWCOMERS-START HERE

What follows is a brief guide for the microcomputing novice. It has been designed for quick reference — with all the key words in bold type; of course if you're feeling adventurous, you're welcome to read it right through. Whichever way, we trust you will find it helpful. 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 sixteen in which the letters A to F represent the values 10 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 are (yes, it's plural) accepted and output by the computer in 'human' form, inside it's a different story — they 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 halfway 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 them 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, circuity 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 microcomputers; 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 10 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 system allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an acoustic coupler, which has two 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.

DIRECT ACCESS

IN STORE

Britain's most up-to-date and comprehensive guide to the selection of microcomputer equipment, compiled for PCW by Richard Olney of Heuristic Consultants.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 80 (£790)	CCS Microsales: 01-444 7739 (TBA)	16-40K RAM: Z80A: C: 12", 16x40 b&w VDU: 4680 bus: IEEE 488: RS232 port: option — dual 5¼" F/D (160K, own DOS), £895	DOS: BASIC:	Graphics loudspeaker with 128 effects: Viewdata compatible: (S)
ACT System 800 (£3950)	ACT: 021 455 8686 (50)	48K RAM: 6502: dual 5¼" F/D (800K): 12", 30x64 VDU: 1 S/P: 1 P/P	MDOS: BASIC: A: PL/M: *Forth: Fifth: Cesil: Pilot*	Fully IBM compatible K/B: high resolution graphics: available with dual 8" F/D (2.4MB), £4950: (E)
Alpha Micro (£8,200)	Alpha Micro (UK) Ltd 01-250 1616 (TBA)	64K-16M RAM: 16 bit: dual 8" F/D (2.4MB): 6 S/P: modular	multi-user O/S: BASIC: M/A: Pascal: U	Expands to 1200 MB, 32 terminal system: (E)
Altos ACS 8000 (£3,398)	Logitek: 02572 66803 (TBA)	64K RAM: Z80: 1K ROM: dual 8" F/D (1MB): 2 RS232: 1 P/P	CP/M: *BASIC: Fortran: Cobol: Pascal: M/A*	(S&H)
Apple II (£695)	Microsense: 0442 41191 (190)	16-48K RAM: 650Z: 8I/O slots: option — single 5¼" F/D (116K) £349	O/S: BASIC: *Pascal:* games:	280x192 high res graphics: integer BASIC in 6K ROM (S)
Athena 8285 (£7955)	Butel-Comco Ltd: 0703 39890 (TBA)	64K RAM: 8085A: dual 5¼" F/D (644K): 12", 25x80 VDU: 150 cps printer: RS232C port: options — dual 8" F/D (2MB)	AMOS: T/E: BASIC: *Cobol: Fortran: Pascal: APL: M/A*	Extended ASCII K/B with numeric pad: graphics: many fully integral configurations possible: (S)
Atom (£120)	Acorn: 0223 312772 (N/A)	2-11K RAM: 6502: Full keyboard: C int: T.V. int: 20 I/O lines: 1 P/P	BASIC in 8K ROM: A: Cass OS	High resolution graphics on bigger model: colour monitor O/P: loudspeaker (B)
Attache (£7,000)	R.H.Thorpe Ltd: 0276 29492. R.J.Spiers Ltd: 0603 416573 (TBA)	48K RAM: 8080: dual 8" F/D (616K): 9", 16x64 b&w VDU: 180 cps printer	ExBASIC: *Fortran*	(S)
Billings BC-12FD (£4,295)	Mitech: 04862 23131 (TBA)	64K RAM: Z80A: dual 5" F/D (640K): 12", 24x80 b&w VDU	DOS: BASIC: *Fortran: Cobol: A*	8" F/D (2MB) to replace 5", £6,000: additional dual 8" F/D, £2,750 (S)
Canon BX-1 (£3,850)	Canon Business Machines (UK) Ltd: 01-680 7700	64K RAM: 6800: Single 5¼" F/D (65K): 12", 25x80 VDU: 5xV24 ports: options — single 5¼" F/D (65K), £1,500	DOS: ExBASIC: *A:*	Also supplied with integral thermal printer instead of VDU: (S&H)
CBS Mk 2&3 (£5900;£8648)	Compelec: 01-636 1392 (N/A)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: 132 col, 30 cps printer: 2 S/P: 1 P/P	CP/M: BASIC	Mk. 2 with 2MB F/D, £5,900. Can upgrade to Mk.3 — £8,150 (11MB H/D and 4 more S/Ps): Desk mounted: Up to 44MB H/D possible, £4,529 extra: multi user system with 208K RAM, £10,648: (S&H)
Challenger 1P & C2 (1P, £238; C2, £404)	CTS: 0706 79332: MBM: 01-980 3993. Mutek: 0225 743289. Millbank Computing: 01-549 7262. U-Microcomputers: 0606 853390. Byte Shop: 01-518 1414	4-32K RAM: 6502: C int: RS232 port:	O/S: BASIC: A: *ExBASIC*	D/A conv: col capability: 8K microsoft BASIC in ROM: option — dual 5¼" F/D (160K), £550: for C2, dual 8" F/D (1.15MB) and 20MB H/D: runs OSI business software on 8" F/D. (S)
Challenger C3 (£2,334)	As above	32-56K RAM: 6502, 6800, Z80: dual 8" F/D (1.15MB): 2-16 S/P	OS65U: BASIC: *CP/M: Fortran: Cobol*	Also C3B & C3P H/D modules: 74MB for about £10,000: (S&H)
Comma VO3 (£4,200)	Comma: 0277 811131: (N/A)	32K RAM: LSI 11: dual 8" F/D (512K): 4 serial DLU11S ports: modular	*RT11 O/S (£750): BASIC: Cobol: Fortran*	Many configurations possible: (H)
Compucolor II (£998)	Abacus: 01-580 8841: (6)	8-32K RAM: 8080: 13", 32x64 8-colour VDU: single 5¼" F/D (51K): RS232 port	ExBASIC (ROM): A	16K module, £1,078: 34K, £1,209: maintenance and programming manual available: (I)
Compucorp 625 (£6,000)	Compucorp: 01-952 7860: (17)	60K RAM: Z80: dual 5¼" F/D (700K): 9", 16x80 b&w VDU: 40 cps printer: 1 RS232 port	A: BASIC: U	Also 655 model with 320K F/D capability and 12", 20x80 VDU — £4,345 (B)
Cromemco System 2, System Z2H, System 3 (£1,995/£4,998/ £3,293)	Comart: 0480 215005; Datron: 0742 585490; Microcentre: 031 225 2022 (20)	64K RAM: Z80: dual 5¼" F/D (346K) Sys 2 and Z2H... dual 8" F/D (1.24MB) Sys. 3: S/P: P/P	CDOS: *BASIC: Cobol: Fortran; Multi-user BASIC: A:*	All systems expandable to multi-user (2—7 users), £3,455 £6,400: 11 and 22MB options: also dual 8" F/D (996K) on Sys. 2 and 3: (E)
DAI (£998 48K)	Data Applications (UK): 0285 2588 (TBA)	12-48K RAM: 8080: C int: 24x60 VDU int: RS232 port: Over 20 industrial ints: 2 C ints	BASIC (ROM): U (ROM)	Up to 255x335 resolution graphics: 3 notes and noise generator: PAL output to TV: games paddle
Diablo 3000 (£9450)	Business Computers Ltd: 01-207 3344 (TBA)	32K RAM: 8085: dual 8" F/D (1.2MB):12", 24 x 80 b&w VDU: 45cps printer	DOS: DACL: A: U:	Selection of business packages supplied in price: (S)
Digital Microsystems DSC-2 (£3525)	Modata: 0892 41555 (10)	64K RAM: Z80: dual 8" F/D (1.14MB): 4 RS232 ports: EIA port	CP/M BASIC-E: CBASIC: *Cobol: Fortran: Pascal*	14 or 28 MB H/D available or additional F/D units: (H)
Durango F-85 (£8,250)	Comp Ancillaries: 07843 6455 (12)	64K RAM: 8085: dual 5¼ F/D (1MB): 9", 16x64 green VDU: 132 col 165 cps printer: N/P	*O/S: DBASIC*	Takes up to 5 work stations: fully integrated system: options — additional dual 5¼" F/D (1MB) and 12 MB H/D: (S)
Dynabyte DB8/1 (£1,500)	Dynabyte UK/Europe Ltd: 0723 65559 (6)	32-64K RAM: Z80: S100 bus: 2 RS232 ports: 1 P/P	CP/M: BASIC: Cobol: *Pascal*	Expands to multi-user system: option — dual 8" F/D (1MB), £2,000: also DB8/2 with dual 5¼" F/D (400K), £3,000 (E)
Equinox 200 (£7,500)	Equinox: 01-739 2387 (N/A)	64-256K RAM: Z80: 10MB H/D: 1 S/P: 1 P/P	CP/M: CBASIC: *cobol: Fortran:*	Multi-user MVT/FAMOS available in place of CP/M: (S/H)

List of Abbreviations

A Assembler
B BASIC
C Cassette
E Extensive
F/D Floppy disc
G/C Graphics card
H Hardware
H/D Hard disc
I Introductory
Int Interface
M/A Macro assembler
N/A Not available
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

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

DIRECT ACCESS

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Euroc (£7,995)	Eurocalc Ltd: 01-405 3113 (TBA)	64K RAM: 8080A: dual 8" F/D (1MB): 15", 25x80 b&w VDU: 132 col 140cps printer	CP/M: CBASIC: A: U:	A year's maintenance and stationery supply inc: (S)
Executive Minicomputer	Binatone 01-903 5211	See Video Genie		
Exidy Sorcerer (£749)	Liveport Data Products 0736 798157 (27)	16-48K RAM: Z80: RS232: 1P/P: S100 connector: 30x64 VDU I/O: option — dual 5¼" F/D (630K), £1200	O/S: ExBASIC (ROM): *Editor: A: CP/M: Algol: Fortran*	High resolution graphics capability: 32K version, £799: 48K, £849: User programmable character set: (I)
HP 85 (£2,240)	Hewlett Packard Ltd: 0734 784774 (16)	16-32K RAM: C.P.U.: 5" 16x32 b&w VDU: C (200K): 64 cps printer: RS232 port: 4 P/P	BASIC:	Full dot matrix graphics: N/P: compact portable unit: (S)
IMS 5000 (£1,935)	Equinox: 01-739 2387 (20)	32-64K RAM: Z80: dual 5¼" F/D (320K)	CP/M: CBASIC: *Cobol: Fortran:*	3 drives option: (S&H)
IMS 8000 (£3,515)	As above	64-256K RAM: Z80: dual 8" F/D (1MB)	CP/M: CBASIC: *Cobol: Fortran: MicroCOBOL*	Multi-user MVT/FAMOS available in place of CP/M: (S&H)
IMSAI VDP 42 (£3,900)	Computermarket: 0603 615089 (TBA)	32-64K RAM: 8085: dual 5¼" F/D (400K): 9", 24x80 b&w VDU: 1 S/P: 1 P/P	IMDOS (CP/M comp): A: ExBASIC: U: *CBASIC: Cobol: Fortran*	Supports 8 additional F/D drives: also available, VDP 44 with F/D (780K), £4,400: (H)
IMSAI VDP 80 (£6,200)	As above	32-64K RAM: 8085: dual 8" F/D (1.2MB): 12", 24x80 b&w VDU: 1 S/P: 1 P/P	IMDOS: A: ExBASIC: U: *CBASIC: Cobol: Fortran*	(H)
ITT 2020 (£867)	ITT: 0268 3040 (15)	16-48K RAM: 6502	Monitor: A: ExBASIC: Dis A:	360x192 high res graphics: ExBASIC in 6K ROM: options — single 5¼" F/D (116K), £425; 16K RAM, £110; RS232 port, £96: 32K system, £931: 48K system, £995: (B)
LSI M-One (£5995)	LSI Computers: 04862 23411	8K RAM: 8080: dual 8" F/D (1.2MB): 12", 24 x 80 b&w VDU	FMOS: A	A choice of standard business package included in price: (S)
LSI M-One Model 5 (£9900)	As above	16K RAM: 8080: dual 8" F/D (2.4MB): 2x12", 24x80 VDU's: 120cps bidirectional printer	FMOS: A	One of the VDU's is for inquiry only: (S)
LX-500 (£3,500)	Logabax Ltd: 01 965 0061 (13)	32K RAM: Z80: dual 5¼" F/D (180K): 12" 25x80 b&w VDU: 100cps printer	DOS: BASIC: A	Other printers available: (S)
Megamicro (£6.080)	Bytronics: 0252 726814 (5)	256K: 8080A: dual 8" F/D (1MB): 12", 20x80 b&w VDU: 120cps printer: 2 S/P: 2 P/P	CP/M: U	(H&B)
Microstar 45 Plus (£4800)	Microsense; 0442 41191 (30)	64K RAM: 8085: dual 8" F/D (1.2MB): 3 S/P: RS232 port	STARDOS: CP/M: BASIC: Cobol: Fortran	(E)
MSI 6800 (£1,203)	Strumech: 05433 4321 (5)	16K RAM: 6800: C: 9", 16x64 b&w VDU: 1 S/P	BASIC: Mini A: U	Up to 8 serial or parallel ints possible: (S&H)
MSI 6800 System 1 (£2,175)	As above	32K RAM: 6800: dual 5¼" F/D (160K): 9" 16x24 b&w VDU: 1 RS232 port	DOS: BASIC: U: *A: Fortran*	As above: option — dual 8" F/D (624K), £1,640: (S&H)
MSI 6800 System 2 (£7,500)	As above	56K RAM: 6800: single 8" F/D (312K): 10MB H/D: RS232 port: 9", 16x64 b&w VDU	DOS: BASIC: Multi-user BASIC: A	Rack mounted: options — dual 8" F/D (624K), £1,640; 10MB H/D, £4,250: (S&H)
MSI System 7 (£5,200)	As above	56K RAM: 6800: dual 5¼" F/D (640K): 9", 16x24 VDU: 1 P/P	DOS: BASIC: A	Choice of FDOS, SDOS or Flex: also option — 10MB H/D: (H&S)
Nanocomputer (£420)	Midwich: Waltham Cross 29310 (TBA)	4K RAM: 2K ROM: Z80: C int: 8 digit LED: K/B: RS232 port: 4 P/P	Machine language: *BASIC: A: T/E:*	Designed for hardware education: expandable to 64K RAM system with F/D: (E)
North Star Horizon (48K, £4,650)	Comart: 0480 215005; Comma: 0277 811131; Equinox: 01-739 2387 (20)	24-56K RAM: Z80A: dual 5¼" F/D (360K): 15", 24x80 b&w VDU: 150 cps printer: 2 1 P/P	DOS: BASIC: *CP/M Cobol: Fortran: Pascal*	(E)
Oxford Minicomputer	Binatone 01-903 5211	See Video Genie		
Panasonic JD740U; JD840U (£4550, £5500)	Teletronix: 01-262 3121 (10)	56K RAM: 8085A: 2-4K PROM: dual 5¼" F/D (570K) JD740U: dual 8" F/D (2MB) JD840U: 12", 24 x 80 b&g VDU: 3xRS232 ports.	CP/M: BASIC: *Microcobol*	Also available — JD700U with 140K disc capacity, £4175; JD800U with ½ MB disc, £4750 : (S)
Pascal Microengine (£2,080)	Pronto: 01-599 3041 (TBA)	64K RAM: MCP 1600: 2 RS232 ports: 2P/P: options — dual 5¼", F/D (1MB), £1550: dual 8" F/D (2MB), £1950	BASIC: Pascal	CPU has user written word set: : (s)
Periflex 630/48; 1024/64 (£2500; £3300)	Sintrom:0734 85464 (5)	48K RAM, 630/48: 64K RAM; 1024/64: Z80: dual 5¼" F/D (630K), 630/48: dual 8" F/D (1MB), 1024/64: 2xRS232 ports: 1 P/P: Options — dual 5¼" F/D (630K) £859; dual 8" F/D (1MB) £1025	CP/M: *BASIC: Fortran: Cobol: A*	One day installation training on site included in price (S&H)
PET 8k, 16k, & 32k (£450, £550 & £695)	Commodore: 01-388 5702 (150)	8-32K RAM: 6502: C: 9", 25x40 VDU: IEEE 488 port: option - dual 5¼" F/D (353k), £695: same but (800k), £895	O/S: BASIC (in 8k ROM) *Forth: Pilot*	Disk controller for 8k model £30. Now 8032 with 80 column screen (32k) £895: (I)
Powerhouse 2 (£1,175)	Powerhouse Micros: 0422 48422 (TBA)	32-64K RAM: Z80A: 5", 27x96 b&w VDU: 1 P/P: RS232 port	FDOS: BOS: BASIC: *ExBASIC: (14K EPROM), £260*	Graphics card available, £190: option — dual 5¼" F/D (700K): (I)
Rair Black Box (£2,300)	Rair: 01-836 4663 (N/A)	32-64K RAM: 8085: dual 5¼", F/D (160K): 2 RS232 ports	CP/M: BASIC: Cobol: Fortran: M/A	16K RAM expansion, £250; dual 5¼" F/D (520K)' £1,000: (H)
Research Machines 380-Z (£1,048)	Research Machines: 0865 49791 (N/A)	16-56K RAM: Z80A: C: RS232 port:	Tiny BASIC: graphics: *A: ExBASIC: CBASIC: Cobol: Fortran: Algol: CP/M: U:*	Designed for education: high res graphics being developed: options — dual 5¼" F/D (168K), £895 and dual 8" F/D (1MB), £1,695: 56K version, £1,654: (S)
SDS 100 (£4,290)	Airamco: 0294 57755 (11)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: S100 bus: RS232 port: N/P: 1 P/P	CP/M: A: ExBASIC: *Cobol: Fortran*	Facility for 8K PROM: (E)

IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
S.E.E.D. System One (£2,175)	Strumech: 05433 4321 (4)	32-56K RAM: 6800: dual 5¼" F/D (160K): 9", 16x24 b&w VDU: RS232 port	DOS; BASIC: U: *Fortran: Cobol: M/A*	Up to 8 I/O ports: max of 4 F/D drives: option — dual 8" F/D (624K): (E)
Semel 1 (£2,900)	Strutt Electrical: 0822 5439 (N/A)	16-64K RAM: Z80: single 8" F/D (250K): 12", 24x80 b&w VDU: RS232 port	BASIC: *Cobol: Fortran*	Supports up to 8 drives option — single 8" F/D (250K), £500: (I)
Sharp MZ-80K (£480)	Sharp Electronics (UK) Ltd: 061-205 2333 (50)	6-34K RAM: Z80: C: 10", 24x40 b&w VDU: option - dual 5¼" F/D (280K), £780	BASIC (in 14K ROM) A	Graphics: loudspeaker: 18K RAM version £529; 22K £549; 34K £599: (B)
Sinclair ZX80 (£100)	Science of Cambridge: 0223 311488 (N/A)	1-16K RAM: 780-1: C int: T.V. int: full K/B: 44 pin expansion port	4K BASIC in ROM	CPU is NEC 3.25 MHz version of Z80A: available as kit, £80: mains adaptor £9:(S)
Sirocco (£3,900)	Elvingate Computers: 069 245189 (TBA)	64K RAM: Z80: dual 5¼" F/D (940K): 12", 24x80 VDU: RS232 port	CP/M: CBASIC: *Cobol: MBASIC: Fortran*	Direct memory addressing: memory mapped VDU: free standing keyboard: option — 10MB H/D : (S&H)
Smoke Signal Chieftain 1 (£3,050)	Windrush Micro Designs 069 245189 (TBA)	32-64K RAM: 6800: dual 5¼" F/D (160K): 12", 24x80 VDU: 112 cps printer: RS232C port	DOS: BASIC: *DBASIC: RBASIC: A: Fortran: U*	Also Chieftain 3 with dual 8" F/D (1MB), £3,950 (E)
Solitaire WP & BS200 (£6,750&£7,950)	Solitaire KPG: 01-995 3573 (TBA)	64K RAM: 8085: 14" VDU (with own CPU): 45 cps printer: CPU port: dual 5¼" F/D (700K) with "WP", and dual 8" F/D (960K) with "BS200"	DOS: BASIC (optional on the "WP")	All Solitaire systems are compatible: graphics on 11x13 dot matrix: (S)
Solitaire/HBS100 (£9,500)	As above	64K RAM: 8085: 10MB H/D: 14" VDU (with own CPU): 200 cps printer: CPU port	DOS: BASIC	Up to 8 interface terminals can be used: also HBS200 with 20-80 MB of H/D: HBS100 limit is 40MB: (S)
Sord M100 ACE (£2,650)	Midas Computer Services Ltd: 0903 814523	48K RAM: Z80: single 5¼" F/D (143K): 12" 24x64 col VDU RS232 port	O/S: BASIC	With colour graphics: 8K ROM: option — single 5¼" F/D, £300: (I)
Sord M223 (£3,500)	As above	64K RAM: Z80: single 5¼" F/D (350K): 12", 24x80 b&w VDU: S100 bus: RS232 port	O/S: BASIC	Other configs possible: extra F/D, £450: (I)
SPC/1 (£3755)	Digital Data: 01-727 6668 (TBA)	64-1024K RAM: 8085A-2: dual 5¼" F/D (180K): 24x80 b&blue VDU: 2xRS232 ports: options — single 8" F/D (IMB) £1090; 20 MB H/D £7650.	Mikados: COMOL: Parcal: *A*	Large choice of extras and peripherals, with 32K RAM and single F/D (no Pascal) £1995: (S)
Superbrain (£1,995)	Icarus: 0632 29593 (TBA)	64K RAM: 2xZ80: dual 5¼" F/D (320K): 12", 25x80 b&w VDU: S100 bus: RS232: TRS80 port	CP/M: A: *BASIC: Cobol: Fortran: APL Pascal*	Limited graphics: mainframe int available: options — dual 5¼" F/D (320K): dual 8" F/D (2.4MB): 8-120 MB H/D: (S&H)
System 80 (£1505)	Nascom: 02405 75155 (20)	16-48K RAM: Z80A: single 54" F/D (280K) 80 cps printer: TV: int: RS232 port: option — single 5¼" F/D (280K) £240	CP/M: 8K BASIC	Choice of EPROM firmware (extra): colour graphics £140 (kit): (S&H)
Tandberg EC10 (£5,000)	Tandberg: 0532 35111: (N/A)	50K RAM: 8080A; single 8" F/D (250K): 12", 25x80 b&w VDU: RS232 port	ExBASIC (24K): Multi-user BASIC: A: U: *Cobol*	(S&H)
Tandy TRS 80 Level 1 (£380)	Tandy: 021 556 6101 (200)	4-16K RAM: Z80: C: 12", 16x64 b&w VDU	BASIC: A:	BASIC in 4K ROM: upgradable to level 2: (I)
Tandy TRS 80 Level II (£515)	As above	4-48K RAM: Z80: C: 12", 16x64 b&w VDU: RS232 int: 1 P/P	BASIC: *M/A: Fortran*	16K machine includes N/P: 4-16K upgrade, £120 (£85 without pad): max config, £1,005: option — single 5¼" F/D (78K), £478 (max of 4): (I)
Tandy TRS80 Model 2 (£2290)	As above	32-64K RAM: Z80A single 8" F/D (500K) 12", 24x80 VDU: 2S/P 1P/P	DOS: BASIC	Keyboard has numeric pad: 64K version, £2250: (S)
TECS (£1,600)	Technalogics: 051 724 2695 (TBA)	16-56K RAM: 6800: 8K PROM: RS232 port: C int	BASIC: *T.DOS: Prestel: Monitor:*	256 ch graphics: Prestel compatible: plugs into standard TV: option — dual 5¼" F/D (320K), £800: (S&H)
TEI 208 (£3,841)	Abacus: 01-580 8811 (5)	32-60K RAM: 8080/8085: dual 5¼" F/D (320K): 9", 24x80 green VDU: 3 S/P: 3 P/P	CP/M: *BASIC: Cobol: Fortran: Pascal: Algol*	(S&H)
TEI 212 (£4,886)	As above	32-60K RAM: 8080/8085: dual 8" F/D (1MB): 15", 24x80 green VDU: 3 S/P: 3 P/P	CP/M: *BASIC: Cobol: Fortran: Pascal: Algol*	(S&H)
Terodec DPS 64/1-4 (£3,014)	Terodec (Micro-systems) Ltd: 0344 51160: (TBA)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 b&w VDU: 2 S/P: 3 P/P	CP/M: *BASIC: Cobol: CBASIC: Fortran: Algol: Pascal*	TMZ 80, enhanced model in integral work station, £5,495 (with 4MB F/D): DPS 64 with 2MB F/D is £3,319: options — dual 8" F/D (1MB), £1,150: dual 8" F/D (2MB), £1,455: (S&H)
TI99/4 (£750)	TI: 0234 67466 (TBA)	16K RAM: 26K ROM: 9900: 24x32 b&w VDU: 2 C int: RS232 port	OS: BASIC	Various peripherals available soon; can run 16 colour TV screen: (S)
Triton L8.2 (£611)	Transam: 01-402 8137 (N/A)	32K RAM: 8080: C int 16x64 VDU int: 1 S/P: 1 P/P	OS: A: Pascal: M/C: *BASIC: CP/M*	Graphics: 5¼" or 8" F/D are available: (S&H)
Vector Graphics MZ (£2,595)	Almarc: 0602 625035: Sintrom Microshop: 0734 85464: Metrotech 0895 57780: (5)	56K RAM: Z80: dual 5¼" F/D (630K): 3 S/P: 2 P/P	DOS: BASIC: A: *CP/M2: Algol: CBASIC: Cobol: Fortran: Pascal*	Includes PROM burner: also System B with graphics and N/P, £3,195: (E)
Video Genie EG 3003 (£378)	Lowe Electronics: 0629 2817: Binatone: 01-903 5211 (N/A)	16K RAM: Z80: 500 bps C: 32x64 TV int: extra C int: 1 P/P	BASIC: *M/A: Fortran*	BASIC in 12K ROM: graphics available: F/D under development: Binatone call *their* 16K model "Executive Minicomputer" and a 4K version, "Oxford Minicomputer" — prices TBA: (I)

List of Abbreviations

A Assembler
B BASIC
C Cassette
E Extensive
F/D Floppy disc
G/C Graphics card
H Hardware
H/D Hard disc
I Introductory
Int Interface
M/A Macro assembler
N/A Not available
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

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

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Telephone 021-455 8585 Telex 339396

IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software/ Firmware	Miscellaneous (Documentation)
Zenith WH-11A (£4,359)	Heath Ltd 0452 29451 and 01-636 7349 (N/A)	LSI 11: 16-32K RAM: 25x80 VDU: S/P: P/P	*O/S: BASIC: Fortran: A: U:*	PDP 11 compatible: option — dual 8" F/D (512K): (S&H)
Zenith Z89 (£1,490)	As above	16-48K RAM: Z80: single 5¼" F/D (102K): 12", 25x80 b&g VDU: RS232	*BASIC: A: H.DOS: CP/M: MBASIC: CBASIC: Fortran*	3 drives option: (I)
Zentec (£5,700)	Zigal Dynamics Ltd: 02405 75681 (1)	32-64K RAM: 2x8080: dual 5¼" F/D (512K): 15", 25x80 b&w VDU: RS232 port	O/S: A: U: *BASIC: Micro Cobol*	User programmable character set: option — dual 8" F/D (1MB): (S)
Zilog MCZ 1/05 (portable): MCZ 1/20A (£4200, £4800)	Micropower: 0256 54121: Memec: 084421 5471 (N/A)	64K RAM: Z80: dual 8" F/D (600K): RS232 port: MCZ 1/20 A only. . . 1P/P: option— 10MB H/D, £7100	RIO: O/S: *Cobol: BASIC: Fortran: Pascal* 1/05. . .M/A: U 1/20A. . .PLZ: *U*	Available desk top or rack mounted: Debug in 3K PROM: 1/20A runs multi-user Cobol and has up to 5 terminals and 40MB possible: (S&H)
Z Plus (£4,000)	Rostronics: 01-874 3665 (TBA)	32-64K RAM: Z80: dual 8" F/D (1MB): 2 S/P: 2 P/P	CP/M: A: U: *BASIC: Cobol: Fortran: Pascal*	(S&H)

SINGLE BOARDS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software/ Firmware	Miscellaneous (Documentation)
Acorn (£65)	Acorn: 0223 312772 (N/A)	1.1/8K RAM: 6502: EPROM socket: Hex K/B: C int: 8 digit LED display: up to 16 ports: options — Eurocard 64 way connector: VDU card: Full K/B card	½K monitor: *BASIC*	Kit: programmable address linking; on board 5V regulator: available assembled, £79 (S&H)
Aim 65C (£265)	Pelco: 0273 722155 (4)	1-4K RAM: 6502: 12K ROM: full K/B: 20 char LED display: 20 char thermal printer: Cx2: RS232 port.	A: Dis A: T/E: 8K monitor in ROM	Available as S100 system with A or BASIC in ROM (£480) from Portable Micros (0280 702017): they also have briefcase version (£750) (E)
Cromemco SC (£260)	Comart: 0480 215005 (17)	1K RAM: Z80A: 8K EPROM sockets: RS232 port: 3 P/P: option — S100 bus.	*Monitor and control BASIC in EPROM*	5 program interval timers: can put own BASIC programs in EPROM (E)
ELF II (£114)	Newtronics: 01-348 3325	1/4K RAM: RCA 1802: Hex K/B: 2 digit LED: TV int: C int: RS232 port: options — 4K RAM, £69; full K/B; VDU card	1K monitor: A: Dis A: T/E: *BASIC:* 244	TTY, n-line decoders: low resolution graphics (high resolution available) kit (H)
Explorer (£295)	Newtronics: 01-739 1582 (15)	4K RAM: 8085: Hex K/B: RS232 port: S100 bus: C int: options — 6 slot S100 £32; 8K EPROM sockets £50.	2K monitor: *CP/M: BASIC*	Programmable 14 bit counter: kit (S&H)
H8 (£262)	Heath: 0452 29451 (TBA)	4K RAM: 8080A: Octal K/B: 6 digit LED: speaker: options — single 5¼" F/D (102K), £399; 16K RAM, £314; C int, £72	1K monitor: *BASIC in RAM: FORTRAN: T/E: A: U:*	Kit (S&H)
Hewart 6800S (£299)	Hewart: 0625 22030 (N/A)	16K RAM: 6800: full K/B: VDU int: 2xC int; 1 S/P: 2 P/P: option — 16K RAM, £90	1K monitor: A: T/E	Can be upgraded with 6809 (H)
Hewart 6800 MkIII (£152)	As above	1K RAM: 6800: VDU board: options — single 5¼" F/D (75K), £350; PROM programmer, £32: calculator board, £32	1K monitor	(H)
Mk 14 (£39.95)	Science of Cambridge: 0223 311488 (N/A)	8060: 1/4-2K RAM: Hex K/B: 7 char LED: options — VDU int (32x16 with graphics), £29; C int, £6; PROM prog, £10, 2K memory expansion, £15	Machine code	Designed for control applications rather than high level computing expansion (H)
Microtan 65 (£69)	Tangerine: 0353 3633	1K RAM: 6502: 16x32 T.V. int: options — TANEX board, 7K RAM, 6K ROM, 8K BASIC; 3S/P	1K TANBUG monitor: *BASIC*	Optional 64x64 pixel graphics:(E)
Nascom 1 (£165)	Nascom: 02405 75155 (20)	4K RAM: Z80: full K/B: TV int: 2 P/P: 1 S/P	2K monitor: *BBASIC: tiny BASIC: A: T/E: U*	Now available as Nascom 2 with 8K RAM and 8K microsoft BASIC in ROM, £295 : (S&H)
77/68 (£90)	Newbear: 0635 30505 (N/A)	4K RAM: 6800: LED: C int: VDU int.	1K Monitor: *BASIC:*	Expandable to racked Nascom compatible system: (B)
SBC 100 (£135)	Airamco: 0294 57755 (11)	1K RAM: Z80: 8K ROM: S100 1 S/P: 1 P/P: option — voltage regulator	*1K monitor: DOS in ROM*	Kit: available assembled, £196 (E)
Superboard (£188)	MBM: 01-981 3993 (N/A)	4-8K RAM: 6502: 10K ROM: full K/B: VDU int: C int: options — RS232; single 5¼" F/D (100K), £316; 8K RAM, £188	BASIC in 8K ROM:	Available with 32K RAM and single 5¼" F/D, £867 (S&H)
SYM-1 (£160)	Newbear: 0635 30505 (N/A)	1-4K RAM: 6502: bps C int: VDU int: 2x6522 ports: option — TV int.	4K monitor: *BASIC: A*	Can be expanded to 64K RAM (S&H)
Triton 4.1 (£286)	Transam: 01-402 8137 (N/A)	2K RAM: 8080: 3K ROM: full K/B: 16x64 VDU or TV int: C 1 S/P: option — 2K RAM, £30	1K monitor: 2K BASIC: U	64 character graphics: 8 levels interrupt: kit (S&H)
Triton 5.1 (£294)	As above	2K RAM: 1K VDU RAM: 8080: C int: T.V. int	1½K monitor: 2½K BASIC: *A: Dis A: 8K BASIC: Pascal*	Graphics facility: disc interface running CP/M, about £200: (S&H)
Triton L5.2 (£296)	As above	¼K RAM: 8080: C int: 16x64 VDU int: keyboard: 1S/P: 1P/P	1.5K monitor: 2.5K BASIC	Graphics: kit form: easily expandable
Tuscan (£170)	As above	8K RAM: 8K ROM: Z80: 6xS100 slots: RS232 int: T.V. int: C int	8K monitor: or 8K BASIC	DD disc controller, £195: graphics: (S&H)
UK 101 (£219)	Computer Shop: 01-440 7033	4K RAM: 6502: full K/B: 16x48 VDU or TV int: C int: RS232 port: option — 4K RAM, £49	1K monitor: 8K BASIC: *Dis A: U*	Graphics: will run Superboard software (S&H)

List of Abbreviations

A Assembler
B BASIC
C Cassette
E Extensive
F/D Floppy disc
G/C Graphics card
H Hardware
H/D Hard disc
I Introductory
Int Interface
M/A Macro assembler
N/A Not available
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

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

DIRECT ACCESS

USER GROUPS INDEX

As promised, here is a complete printout of our User Group Index. If we have failed to include YOUR group, then please address the relevant information to PCW (User Group Index), 14 Rathbone Place, London W1P 1DE. Notification of changes will also be appreciated. The next full listing will appear in PCW's November edition. In the meantime we shall of course continue to publish User Group Index update information — as and when it reaches us.

NATIONAL

11s Users Group. A sort of help service only. No meetings no newsletter. Contact: Pete Harris, 119 Carpenter Way, Potters Bar, Herts. EN6 5QB. Tel: 0707 52091 or 01-248 8000 Ext. 7065.

The 6502 Users Club. Hoping soon to hold regional and national meetings, they offer "support, encouragement and fellowship". Contact: Walter Wallenborn, 21 Argyll Ave., Luton, Beds LU3 1EG.

77/68 Users Group. Quarterly Newsletter. Free membership for 1st year if you buy the 77/68 instruction manual, £1.50 thereafter. Contact: Newbear Computing Store, 40 Bartholomew St., Newbury, Berkshire.

9900 Users Group TIMUG. Contact: Chris Cadogan, 21 Thistle Downs, Northway Farm, Tewkesbury, Glos.

Amateur Computer Club — 2650 Library. No meetings, no newsletters, the library serves to act as a help point for disseminating 2650 related data on demand. Contact: Roger A. Munt, 51 Beechwood Drive, Feniscowles, Blackburn, Lancs BB2 5AT (0254 22341).

Minicomputer Users in Secondary Education (MUSE). MUSE is the national organisation for coordinating activity in schools, teacher training institutions, colleges of technology and so on. Meetings are held on both a regional and national basis. For full details on MUSE's range of activities, contact the Treasurer, R. Trigger, 48 Chadcote Way, Catshill, Bromsgrove, Worcestershire.

Exidy Sorcerer Users Group. Newly formed, and a division of the U.S. User Group. Fee is £5 p.a. Write, stating what hardware you own to: Andy Marshall (Micro44), 44 Arthurs Bridge Road, Woking GU21 4NT (04862 66084).

UK Intel MDS Users Group. Contact: Lewis Hard, 29 Chaucer Rd., Bedford.

Ithaca Audio S100 bus UK User Group. Contact: Dave Weater, 16 Etive Place, Cumbernauld, Glasgow 067 4JE. Phone 02867 36570.

MK14 Club. Bi-monthly magazine called "Complement and Add". Contact: Geoff Phillips, 8 Podsford Rd., London NW9 6HP.

Independent PET users Group. Contact: IPUG, 57 Clough Hall Road, Kidsgrove, Stoke-on-Trent, Staffs.

Research Machines Ltd. National User Group. Contact: M.D. Fischer, PO Box 75, Oxford, OX4 1EY, for a registration form.

UK Apple Users Group, Contact: (Keen Computers) 5 The Poultry, Nottingham. Tel: 0602 583254/5/6.

Central Program Exchange. Full membership (£25 Europe, £40 overseas) provides 30 free programs p.a. Small User Service (£10 Europe, £20 overseas) provides 10 free programs p.a. Contact: Mrs Judith Brown, The Polytechnic, Wilfruma St., Wolverhampton, WV1 1LY.

Cosmac Users Coub (proposed) For People using the RCA 1802, Cosmac ELF, ELFII, Super ELF etc. Those interested contact James Cunningham at 7 Harrowden Court, Harrowden Road, Luton LU2 0SR (enclosed sae, please).

TRS-80 Users Group. Contact: Brian Pain, 40a High St., Stony Stratford, Bucks.

ZX80 Users Club. The group's aim is to create and share software which will fit within the machine's 1K RAM. Membership is free and first move will be to distribute a newsletter. Address to write is: c/o Tim Hartnell, 93 Coningham Road, London W12.

Ohio Scientific UK User Group. Independent of OSI, an important role will be the disentangling of poor documentation. There will be regular newsletters and membership is at present £5 per year. The group will initially be concerned with the practical aspects and applications of OSI systems — rather than with games. Contact Tom Graves at: 19a West End, Somerset, BA16 0LQ.

National Personal Computer Users Association. The NPCUA is intended to pool the vast combined resources of owners and users of all types on personal computers in the UK, and to disseminate information between members. Projects, newsletters and bulk discounts possible. Nominal subscription is £8. . . send SAE for membership application form to Secretary E.J. Keeley, 11 Spratling Street, Manston, Ramsgate, Kent.

Medical Micro Users Group. Set up to enable medical micro users to locate programs already written in their field by other medics. Newsletters and meeting in the pipeline — contact P.J.V. Dixon, c/o MEDICOM, 1-2 Hanover Street, London W1.

UK Pet Users Club. Contact: Commodore Systems Division, 360 Euston Road, London NW1 3BL.

British TI Users' Club. A loose association of owners and users of Texas Instruments programmable calcs, the club exists for the purposes of information and program exchange (and is in no way sponsored by TI). The main activity is production of a (roughly) monthly newsletter and membership costs £5.50. Details from 2 Woodside Crescent, Clayton, Newcastle-under-Lyme, Staffs ST5 4BW.

ZX80 Users Club. Bi-monthly newsletter. Low cost software. Technical support. Subscription £6 (UK), £10 (overseas). Contact: D. Blagden, PO Box 159, Kingston upon Thames, Surrey, KT2 5UQ. (s.a.e. for further information).

COMP 80 Users Group. Monthly newsletter. Annual subscription £5. Contact: Philip L. Probetts, 50, Cromwell Road, Wimbledon, London, SW19 8LZ.

SOUTH

Independent PET Users Group — South. Free membership — meetings the first Wednesday of every month. £1.50 to receive monthly newsletter. Contact: John C. Nuttall, 56 West Street, Shoreham-by-Sea, Sussex BN4 5WG.

NORTHWEST

Amateur Computer Club — North west group. Meetings 1st and 3rd Thursdays monthly at St. Peter's Chaplaincy, Precinct Centre, Oxford Rd., Manchester. Contact: Jane Lomas, 9 Crescent Court, Alderfield Rd., Chorlton, Manchester, M21 1JX. Tel: 061 881 1933.

TRS 80 — North West Group. Subscription £5. Newsletter £3 (for 6 issues). Meetings last Wednesday monthly (not Dec) at the Stag Hotel, Carswood, Nr. Wigan. Contact: Melvyn D. Franklin, 40 Cowlees, Westhoughton, Bolton, BL5 3EG. Tel: 0942 812843.

Northwest Computer Club. Fortnightly meetings. 25p attendance fee. No subscriptions. Contact: John Lightfoot, 135, Ashton Drive, Frodsham, Warrington, Cheshire, WA6 7PU. Tel: 0928-31519.

IRELAND

Computer Education Society of Ireland. A voluntary organisation that consists of a national body and an expanding number of local branches. Their brief is to monitor computer education in Ireland *National CESI* (£3 p.a.) — Dairmuid McCarthy, 7 St. Kevin's Park, Kilmacud, Blackrock, Co. Dublin. *Cork branch* (£1 extra) — Michael Moynihan, Colaiste an Spioraid Naomh, Bishopstown, Cork. *Dublin branch* (£1.50 extra) — Jim Walsh, C.B.S. Naas, Co. Kildare. *Limerick branch* (£1 extra) — Sr. Lourda Keane, Convent F.C.J., Laurel Hill, Limerick. *Waterford branch* (£1 extra) — Mr. Hugh Dobbs, Newtown School, Waterford. *Kilkenny branch* (£1 extra) Sr. Helen Lenehan, Presentation Secondary School, Kilkenny.

WALES

Gwent Amateur Computer Club. Covering the Gwent and Cardiff areas, the club has its own computer room and technical library. Meetings are held once a week on Wednesdays at 10 Park Place, Newport. Contact Ian Hazell on 0633 277711 (office hours).

SCOTLAND

The Grampian Amateur Computer Society. They meet every 2nd Monday of the month at the Holiday Inn, Bucksburn, Aberdeen and there's a monthly newsletter. For more details, contact M. Basil, Orton Cottage, Burnside, Lumphanan, Kincardineshire, Grampian Region (033 983 284).

The Scottish Amateur Computer Society. Meetings are on the 1st Wednesday of each month in the Lothian Room of the Grosvenor Hotel, Edinburgh — also in Fife on the 4th Wednesday of each month. . . locations variable. Details from Secretary, Alistair MacPherson, 6 Curriehill Castle Drive, Balerno, Edinburgh 14.

AVON

Bristol Computing Club, £3.00 p.a. Meetings 3rd Wednesday, monthly. Contact: Leo Wallis, 6 Kilbirnie Rd., Bridge Farm Estate, Bristol, BS14 0HY. Tel: Bristol 832453.

Brunel Technical College Computing Club. The club divides into two sections. . . the "skilled" and the "not skilled". They share alternate Wednesdays at the College. Contact: S.W. Rabona at 18 Castle Road, Worle, Weston-Super-Mare, Avon, BS22 9JW (0934 513068).

Compukit User Club. Details, contact P. Crabb Esq., 21 Jones Close, Yatton, Avon (0934 834808).

BERKSHIRE

The Thames Valley Amateur Computer Club. Meetings are on the first Thursday of every month and from November on, that will be at "The Southcote", Southcote Lane, off the Bath Road, Reading, Berks. Starting time, 7.00pm. Contact: Brian Quarm (Camberley 22186) OR Brian Steer (Slough 20034).

CLEVELAND

Cleveland Micro Computer Users Group. Adult Meetings 3rd Tuesday monthly, under 18s — 2nd Tuesday. Yearly subscription £2 (⟨18), £3 (18-21), £5 (21+). Journal. Contact: J. Telford, 13, Weston Crescent, Norton, Cleveland.

DEVONSHIRE

Exeter and District Amateur Computer Club. General meetings 2nd Tuesday monthly, specialist meetings 3rd or 4th Tuesday. £5.00 p.a. Contact: Doug Bates, 3 Station Road, Pinhoe, Exeter, Devon.

Plymouth and District Amateur Computing Club. Subscription £5.00 p.a. Meetings last Wednesday monthly. Contact: Keith Gould, c/o JAD Ltd., 21 Market Ave., Plymouth 62616 or 2 Brook Rd., Ivybridge 2399.

COUNTY DURHAM

Computer Club. Business & Word Processor section meets Fridays 7.30, Scientific & Recreational Saturdays 10.00. Contact: L. Boxell, 8 Vane Terrace, Darlington. Tel: 0325 67766.

Northeast PETS. Contact: Jim Cocallis, 20 Worcester Road, Newton Hall Estate, Durham. They meet the 2nd Monday of each month for software tuition and the 3rd Monday for hardware tuition (both in addition to normal activities). They start at 7.00pm and meet in the PET Lab, Newcastle Polytechnic, Ellison Building, Newcastle upon Tyne.

EAST ANGLIA

Anglia Computer User Group. Contact Jan Rejzl, 128 Templemere, Sprowston Road, Norwich NR3 4EQ.

EAST MIDLANDS

East Midlands TRS-80 Independent User Group. Free newsletter from Mike Costello, 17 Langbank Avenue, Rise Park, Nottingham NG5 5BU.

ESSEX

TRS80 User Club (Chelmsford). Now part of the National TRS80 User Club. Contact: Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.

The Colchester Microprocessor Group. Meetings held at the University of Essex on the second and fourth Wednesdays of each month — 7.30 pm start. Membership is open to all, on payments of £5 annual sub (£1 for full-time students). Contact: the Information Centre at the University on the evening of the meeting.

Compukit User Club. Details, contact Adrian Waters, 117 Haynes Road, Hornchurch, Essex RM11 2HX (Hornchurch 40490).

Springfield Computer Club. Special interest in Sorcerer but beginners and others welcome. Meetings 1st Friday monthly. Contact: Stephen Cousins, 1, Aldeburgh Way, Springfield, Chelmsford, Essex CM1 5PB. Tel: 0245 50155.

GLOUCESTERSHIRE

Cheltenham Amateur Computer Club. Meetings, 4th Wednesday

USER GROUPS INDEX

DIRECT ACCESS

monthly, 7.30pm start. Contact: Mr, M. Pullin, 45 Merestones Drive, The Park, Cheltenham, GL50 2SU (Cheltenham 25617).

HAMPSHIRE

Southampton Amateur Computer Club. Meetings 1st Wednesday monthly (not July, Aug, or Sept.). Contact: Paul Dorey, Department of Physiology, University of Southampton, Southampton, SO2 3SU or Tel: Paul Maddison on Winchester 4433 Ext. 6955.

HERTFORDSHIRE

Harpenden Microprocessor Group. They hold meetings every fortnight, cover a wide range of interests and attract members from the area around Luton, St. Albans and Welwyn. Contact: David James, 5 Ox Lane, Harpenden, Herts AL5 4HH (05827 5366).

KENT

Medway Amateur Computer and Robotics Organisation. Contact: Tony Aylward, 194 Balmoral Rd., Gillingham, Kent. Tel: Medway 56830.

North Kent Amateur Computer Club. Meetings, the second Tuesday of each month — usually at the Charles Darwin School, Jail Lane, Biggin Hill, Kent. The sub is £2.50 per annum (£1 for students). More members are needed. . . contact: Barry Biddles at 3 Acer Road, Biggin Hill, Kent (09594 71742).

LANCASHIRE

Merseyside Microcomputer Group. Several sub-groups including: 380Z User's Group (Alan Pope on 051-548 500 Ext 189); Computer Education Society (Mr M. Trotter on 051-652 1596); SC/MP Special Interest Group (Bob Perrigo on 051-677 6716); PET Special Interest Group; 6800 and 77/68 Special Interest Group; Apple Special Interest Group. The Secretary is John Stout of the Dept. of Architecture, Liverpool Polytechnic, 53 Victoria Street, Liverpool L1 6EY (051-236 0598).

North Lancs User Group. Contact John Robinson, 12 Harold Ave., Blackpool, Lancashire.

LEICESTERSHIRE

The Leicestershire Personal Computer Club. Meetings held the 2nd Monday in each month, at Leicester University and Loughborough University alternately. They start 7pm. Membership is £2 per annum (£1 for under 16s). Contact: Miss Jill Olorenshaw (Club Secretary) c/o Arden Data Processing, Municipal Buildings, Charles Street, Leicester (0533 22255) OR Mr Dick Foden (Club Chairman) at 11 Gaddesby Lane, Rearsby, Leicester.

LINCOLNSHIRE

Lincolnshire Microprocessor Society, Various meeting places. For up-to-date information, contact the Hon. Sec., Mr Eric Booth, Senior Common Room, Bishop Grosseteste College, Newport Lincoln.

LONDON

Southgate Computer Club. Meetings 1st Wednesday and 3rd Thursday monthly during term time. Newsletter. Contact: Paul Woolley, Southgate Technical College, High Street, London N14 6BS. Tel: 01-888 6521.

East London Amateur Computer Club. Meetings 3rd Tuesday monthly. £2.50 p.a. (½ price to school students). Contact: Dr. Graham Crisp, 45 Leadale Ave., Chingford, London E4 8AX. Tel: 01-520 6010.

The North London Hobby Computer Club General meetings held on a Wednesday evening, once a month — specialised topics on three evenings each week. Location: The Polytechnic of North London. Contact: Robin Bradbeer (Chairman) at the Dept. of Electronic and Communications Engineering, Polytechnic of N. London, Holloway, N7 8DB (01-607 2789).

SELMIC (South East London Microcomputer Club). £5 subscription. Meetings at Woolwich Polytechnic. Contact: John Williamson, 129 Greenvale Rd., Eltham Park, London SE9 1PG. Tel: 01-850 4195.

Croydon micro/small computer group. Contact Vernon Gifford, 111 Selhurst Road, London SE25 6LH.

LONDON & SOUTH EAST

Sharp MZ-80K User Group. Contact: Joe L.P. Seet, 16, Elmhurst Drive, Hornchurch, Essex, RM11 1PE. Tel: 04024 42905.

MIDDLESEX

Sunbury Amateur Computer Club. Membership free. Contact Mr S N Taylor, 8 Priory Close, Sunbury on Thames, Middlesex. TW16 5AB. Tel: Sunbury 86649.

Harrow Computing Group. Meetings on alternate Wednesdays at 7pm in room G43 of Harrow College of Higher Education. They welcome anyone with an interest in computers — with or without a machine. Membership is free. For further information contact Bazyle Butcher, 16 St. Peter's Close, Bushey Heath, Herts WD2 3LG (01-950 7068).

IPUG setting up in Teddington. Interested? Contact: G. Squibb, 108, Teddington Park Road, Teddington, Middlesex.

OXFORDSHIRE

Oxfordshire Microcomputer Club. £5.00 p.a. Contact: S. C. Bird, 139 The Moors, Kidlington, Oxford OX5 2AF Tel: Kidlington (08675) 6703.

Microsoc the Oxford University micro group holds shared meetings with the Oxford Microcomputer Club. Contact: M. Bourla, St. John's College, Oxford.

SURREY

Richmond Computer Club. Held the second Monday of each month at the Richmond Community Centre (20p per meeting), members have the use of a good range of equipment. Contact: Robert Forster, 18a The Barons, St. Margarets, Twickenham, Middx (01-892 1873).

Surrey Microprocessor Society. (SUMPS) Covering Surrey plus bits of South London and other adjacent counties. Anyone interested in joining, call Mike on 01-642 8362.

SUSSEX

A Crawley computer club has recently been formed, open to anyone interested in personal computing, with or without computing facilities. The intention is to hold meetings weekly, and publish a monthly or bi-monthly newsletter. Details, contact either Mr J. Fieldhouse, 18 Seaford Road, Broadfield, Crawley, West Sussex (Crawley 542509) — or — Mr J. M. Clarke, 31 Hyde Heath Court, Pound Hill, Crawley, West Sussex (Crawley 884207)

WARWICKSHIRE

ACC (Midland) Group. They meet every 3rd Saturday in room P109 at Lanchester College, Coventry . . . no sub, no magazine. Contact: Roy Diamond (Chairman), 27 Loweswater Road, Coventry, Warks (0203 454061).

WEST MIDLANDS

Research Machines 380Z. West Midlands User Group. Further details from: Peter Smith, Birmingham Educational Computing Centre, Camp Hill Teachers Centre, Stratford Road, Birmingham, B11 1AR. Tel: 021 772 6534.

West Midlands Amateur Computer Club. Meets the 2nd & 4th Tuesday of each month, usually at Elmfield School, Love Lane, Stourbridge, West Midlands. Annual sub is £3 (£2 if full time student). . . visitors welcomed without obligation. For more information contact John Tracey of 100 Booth Close, Kingswinford, West Mids (0384 70097).

Compukit User Club. Details, contact S.H. Grisvenor Esq., 11 Bernard Road, Oldbury, Warley, West Midlands (021-422 3298).

YORKSHIRE

Shipley College Computer Group (Sorcerer/6800). They meet Tuesdays (software) and Wednesdays (hardware/advanced) between 7.00 & 9.00 pm. Contact Paul Channell on Shipley 595731.

West Yorkshire Microcomputer Group. Formed following an inaugural meeting on October 23rd, a varied diary of events has been drawn up. For details contact the Chairman, Phillip Clark, Care Computer Services, 15 Wellington Street, Leeds LS1 4DL (0532 450667) OR the Secretary, Keith Knaggs, Price Waterhouse & Co., Leeds (0532 448741).

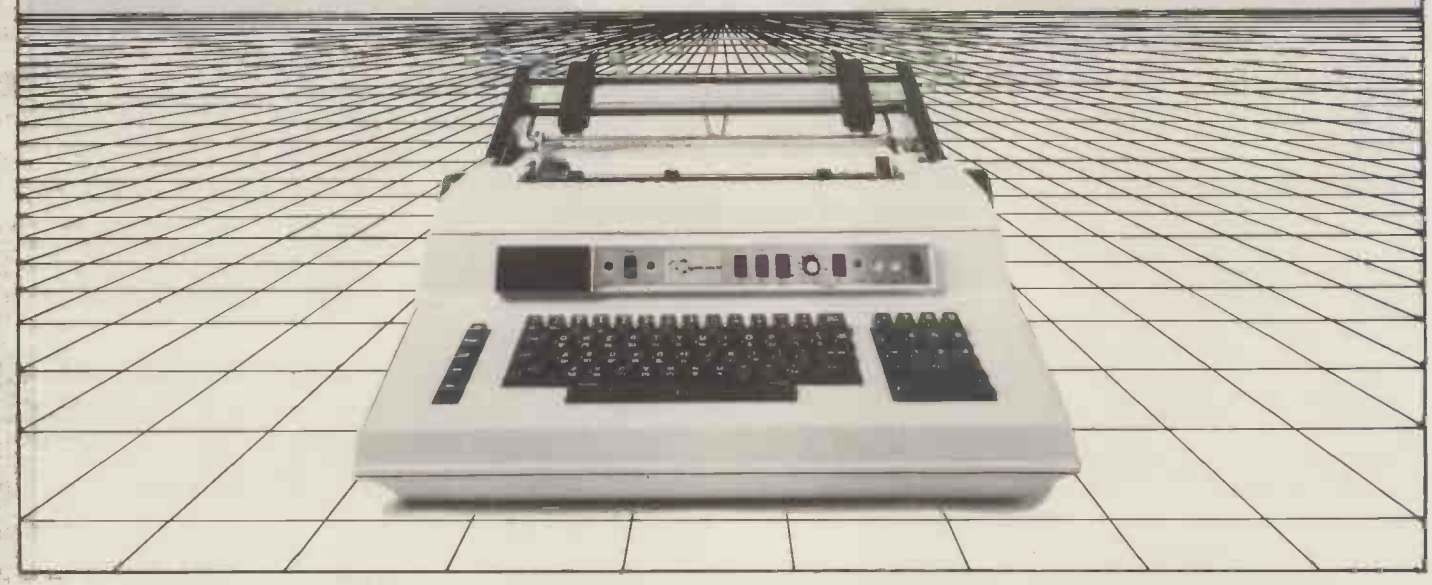
South Yorkshire Personal Computing Group. Meetings are on the second Wednesday of each month in Room F135, St. Georges Building, Sheffield University. Experts and beginners welcomed alike, contact Paul Sanderson (Secretary), 8 Vernon Road, Totley, Sheffield S17 3QE (0742) 351895.

DIARY DATA

DIRECT ACCESS

London, England	1980 Microcomputer Show. Online Conferences Ltd., Cleveland Road, Uxbridge, UB8 2DD. Tel: 0895 39262	July 22 — July 24
Birmingham, England	Computer Graphics '81 Exhibition. Online Conferences Ltd., Cleveland Road, Uxbridge, UB8 2DD. Tel: 0895 39262	Aug 11 — Aug 13
Philadelphia, USA	Personal Computing 80. (America's largest East Coast micro show). PCAF '80 c/o Philadelphia area Computer Society, Box 1954, Philadelphia, Pa 19105	Aug 21 — Aug 24
Salford, Lancashire	1980 Salford Microprocessor and Microcomputer Exhibition. Dr E A Flinn (Exhibition Director), Dept. of Electrical Engineering, University of Salford, Salford M5 4ET. Tel: 016-736 5843	Sept 2 — Sept 4
London, England	The 3rd Personal Computer World Show. Montbuild Exhibitions Ltd., 11 Manchester Square., London W1M 5AB. Tel: 01-486 1951	Sept 4th — Sept 6th
Stuttgart, Germany F.R.G.	Hobby Electronics Exhibition CES (Overseas) Ltd., Bridge House, 181 Queen Victoria Street, London EC4. Tel: 01-236 0911.	Sept 10 — Sept 14
Paris, France	SICOB. French Trade Exhibitions, 54, Conduit St., London W1R 9SD. Tel: 01-439 3964.	Sept 17 — Sept 26
Plymouth, England	Business Equipment Exhibition BEX. Douglas Temple Studios Ltd., 104b, Old Christchurch Rd., Bournemouth, BH1 1LR	Oct 1 — Oct 2

Clearly ahead of its time.



Line Printer	Matrix Printer
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When you buy what is regarded as the best daisywheel printer terminal in the world - the Qume Sprint 5 - you expect a backup service to match. ISG Data Sales Ltd., your official UK distributor of Qume terminals, provide just that:-

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Dedworth Road, Windsor, Berkshire.
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Telex: 849110.

TRANSACTION FILE

DIRECT ACCESS

For sale

PET 2001 . . . 8k, green screen, soundbox, books, 15 tapes, Microchess etc, cost £750 8 months ago, as new, accept £450. Tel Swanley (0322) 60150.

Compukit UK101 . . . fully assembled and working with case, switchable 1/2 MHz, 4K RAM, 8k Microsoft Basic, 2k monitor, extended monitor and games on tape, plus R Zaks Programming the 6502, all for only £270 ono. Tel Mike on 01-534 5331 (Forest Gate, E7).

Creed Envoy . . . data printer, ASR, ASCII, V24, upper/lower case, handbook, £250. Tanberg TDC 3000 digital cartridge recorder, documentation, £100. Nascom keyboard £25. Tel Doug Mounter, Walton (0953) 882110.

Nanocomputer . . . Z80 trainer with breadboard and 3-vol manual, diagrams, etc. Cost over £430, as good as new. Texas TI59 prog. calc. with mag. card storage, full documentation, two packs mag cards, spare battery charger/mains adapter, good as new, £165 ono. Both must go asap! Tel 031-664 3877 evenings & weekends.

Teletype . . . ASR33, excellent cond, RS232/V24, stand, isolation transformer, lecturn, 110 baud, switch selectable simplex/duplex, single step on tape reader. Interface to Nascom II without mods. Haggle around £250. Tel Brian Steadman, 021 360 6731.

TRS-80 . . . Level II 16k, with numeric pad, expansion interface, disk drive with DOS, editor/assembler package, PSU, all manuals and program aids, cost over £1100 at today's prices, accept £800 ono. Tel James Blake, Aldeburgh 2393 (evenings) or write Roundhill Cottage, Saxmundham Road, Aldeburgh, Suffolk.

TRS-80 . . . printer interface, commercial unit, operates from cassette port, £12. Also Radio Shack editor/assembler (manual & cassettes), £10. Tel I R Sinclair, Hedingham (Essex) 61004.

ASR 33 . . . Kode teleprinter, current loop interface, inc. service handbooks, spare paper rolls, £320. Farnborough, Hants, (0252) 42921 (evenings).

Westrex . . . KSR33 Teletype with stand, ASCII, RS232, works with Nascom, £250 ono. Tel Ipswich 714716 (evenings/weekends).

PET 2001 . . . 8k, 7 months old, little used, green screen, soundbox, TIS workbooks, lots of programs, £440. Tel 01-597 4364.

UK101 . . . 8k cased, runs at 1/2 MHz, RS232 in and out, (very fast Basic at 2 MHz), £330 inc games & utilities. Tel Erith 35868.

Nascom II . . . fully built and working, as new. 32k memory expansion, graphics, assembler language tape, full documentation and tape drive relay, £420. Tel Luton 503321 after 6 pm.

For sale or swap . . . for 8k PET, Sinclair ZX80 & adaptor, carrying case etc, £90. Centronics LS01 dot matrix printer, hardly used (ex ODO 11/40), tractor fed, parallel interface, stand, £475. Tel Uxbridge 56574 evenings. not weekends.

Acorn . . . 6502 microcomputer, built and working, inc. all documentation, £75 ono. Tel Ilkley 600437 (evenings).

Unfinished . . . project, PET 2001 8k with IBM golfball typewriter for conversion to printer. House purchase forces sale, £650. Tel Karl 01-831 6781 ext 242.

For sale . . . Programming the 6502 and 6502 Applications Book by Zaks, cost £7.50 each, yours for £11 for both. Plus Electronic Computers by Westwater, free! Tel Dumbarton (0389) 64384.

Micro books as new, half price inc postage. Small Computer Systems Handbook, Sol Libes, £3.30. An Introduction to Microcomputers — Vol 1, A Osborne, £3.60, Computer Dictionary and Handbook, Sippl & Sippl (hard cover 750 pages), £7.75, Programming the 6502, R Zaks, £4.10. A McMillan, 18 Torridge Road, Keynsham, Bristol BS18 1QQ.

Acorn . . . microcomputer system 1, built & tested with PSU and manual, £85 inc p&p. Tel 0526 43089.

PET 2001 . . . 8k plus manuals plus instructional and games cassettes, £350 ono. Tel 01-761 0743 (home) or 01-580 4468 ext 3271.

PET. . . CBM floppy disk drive, £675, brand new. Texas TI59 calculator, £145. Tel 0386 870841

PET 2001-8 . . . only 3 months old, green screen, fitted soundbox with good games software, £500 ono. Tel Sunbury-on-Thames 84239.

8k memory boards . . . SWTP type MP-8, built and tested, S50 bus, £98 each. Tel Cambridge (0223) 314934.

Nova 820 . . . 16 bit minicomputer with 32k word memory, home-brew teletype interface with manual and schematic. £300. ASR33 Teletype with pedestal in good cond., £250. Tel Pete 01-570 8057, evenings.

Computhink. . . 800k dual disk unit complete with DOS logic board for PET. Inc full operating and fitting instructions, technical help if required, only 6 months old, perfect order, bargain at £800 ono. CMC-ADA 1200 PET to RS232 interface for Teletype 43 and others, £50 ono. Tel Flintwick (0257) 2221.

Sharp MZ—80K . . . 5 months old, perfect cond., 6k RAM after Basic loaded, manual & programs inc personal accounts, Othello, Space Invader, £500. Tel Sheffield (0742) 302124.

PET 8k . . . Old ROM, good cond., £415. PET tool kit, £47. Tel Hoddesdon 44640.

UK101 . . . built and working, with TV output lead, cassette I/O sockets, 4k user RAM, new monitor in EPROM, fully cased, £200 ono. Mr A Harris, 43 George Road, Farncombe, Godalming, Surrey or tel Guildford 893883 ext 38 (day only).

77-68 . . . professionally built CPU board, all ICs socketted, fully tested, plus Newbear PCBs: 4k RAM, VDU1, MON1 and design manual for 77-68 system and notes. Mr C North, 29 Kent Road, Harrogate, N. Yorks. Tel Harrogate 62241.

Exidy Sorcerer . . . 32k, Basic and development packs, UHF modulator if required, £595 ono. Pullen, Reigate 48906.

Philips Videopac . . . computer with 3 cartridges (2,4,11). Must sell, getting PET. Complete, £130 ono, must collect. Tel Port Talbot 87472.

Basic . . . for Nascom 1. Nascom's Super Tiny Basic in 3 EPROMs, surplus to requirements (I've got 8k Basic now), complete with documentation £28. Tel Melrose (089 682) 2832 after 6pm.

Nanocomputer . . . plus power supply, unused, £240 ono. Tel John Reid on Aylesbury 86500 (work hours).

SS50 6809/6802 Processor Board . . . (Percom), board can use 6809 or 6802 CPUs. Onboard ACIA, PIA, 1k RAM, Psymon monitor; board can be used standalone if required: 1 Meg and 16 Meg addressing — unused, £100. Tel 0455 35621 (evenings/weekends).

Nascom 1 . . . 8k Microsoft Basic. 16k memory, Vero Case, Keyboard Keyboard Cabinet, PSU and documentation — £325 ono. Tel 0704 28472.

Grandstand Colour TV Game Console . . . eleven cartridges — bowling, mazes, blackjack, spitfire, nim and mindreader, video whizball, doodling, shooting gallery, tic tac toe, robot war, torpedo alley, dodge it, space war, pinball with many variations — £100. Ring Mike Carlton on Sheffield 78555 (ext 4063) — office hours.

Acorn System 1 . . . assembled and tested, almost unused. Also Rodnay Zak's "Programming the 6502" — £50. Tel 0287 24288.

Acorn Micro (Eurocard) . . . extra RAM, PSU and full documentation and circuit diagrams for connection to P.E. VDU. Hardly used — £75 ono. Tel 0783 229121

Nascom 1 . . . with T4, UHF modulator and 'colour graphics' (can be used on B&W TV). Computer, PSU and tape all built into wooden case with auto cassette turn off. Manuals, books, tapes and programs supplied — £160 ono. Tel Liverpool (051) 708 9765.

ASR 33 Teletypes . . . one good condition (£150), the other tatty (50). Also Sinclair ZX80 ono. Tel Ware 67519 (after 5pm).

77-68 . . . 4k RAM board (low power), £55; rack, £15; backplane with five connectors, £10. Also 6800 mini board (copy of Heathkit ET3400) separate housed hex keyboard/display. Built on Vero 8 x 8 inch card (77-68 compatible) c/w 1k monitor and 512 bytes RAM — ideal dev system. Less CPU and 3 x 74LS241 chips, £65. Tel Medway (0634) 573183.

Grandstand/Fairchild . . . fully programmable TV game, 1 year old, works properly, £50 ono (includes power supply, plug, box, instructions and 1 cartridge. Cost me £80). Also 3 cartridges: spitfire, baseball, breakout — £10 each or £30 the lot. Alternatively, Game plus the cartridges, £80. All in good condition, tel Barry on 01-501 1661 (after 7pm before 6/9/80 — then after 5pm).

Sym-1 micro . . . 4k, old and new monitors, 8k Basic in ROM Tangerine 1648 VDU (UHF output), 5 amp PSU, Alpha-Numeric keyboard (cost £100+) plus full set of manuals and tech notes — £350 ono. Contact Mr N Smith, 116 Holborn Hill, Millon, Cumbria LA18 5BW, or phone Millom (0657) 3591.

VDU Cossor DIDS 401-2A . . . 1k buffer, editing, new CRT fitted, spare keyboard unit, full technical manual. Requires external sync drive. Don't know if it works, hence £45 or why? Tel 01-951 0305 (evenings).

TRS-80 Level II . . . 16k system complete with cassette, keyboard, latest video display. As new, still under guarantee, software, £495 ono. Tel 01-644 9454 (Sutton).

Sinclair ZX80 computer . . . fully assembled, including all leads and power supply. Brand new, £85. Contact Mr F Van Dyken, 1 Wyndham Road, Woking, Surrey — Tel 04862 22581.

PC100C . . . printing unit for TI58/59, 9 months old — £120 ono. Tel 021-353 4209.

S100 16K dynamic RAM boards, factory assembled by Altair, on-board refresh and timing, unused. Full doc, only £90 each. 8080 CPU board (full kit) by Byte magazine — £55. Tel 0632-468041 (evenings).

1 x Prototyping board, 1 x Motherboard PCB, 18 slot, 1 x S100 8k RAM PCB, some sockets — only £35. Also 1 x 2112 and 1 x 8212, first £3 takes them. Write to Karl, Rose Cottage, Lower Frankton, Oswestry, Salop SY11 4PB.

MK14 . . . fully working, cased with PSU, tape interface, extra RAM and RAM I/O, keyswitch keyboard, all doc plus Kemitron programming guide and Micom assembler — £55 inc postage. Also spare SC/MP chip (INS 8060N) MkII version — £5.50 inc postage. Tel 0969 23462 (after 6pm).

Wanted

PAL 11-S, LINK 11-S and ED-11 . . . paper tape software wanted for standalone DEC PDP 11-05. I have the computer and the manuals, but no tapes! Contact N. Charnley, 9 Aston Street, Oxford or Tel 0865 725475 (evenings).

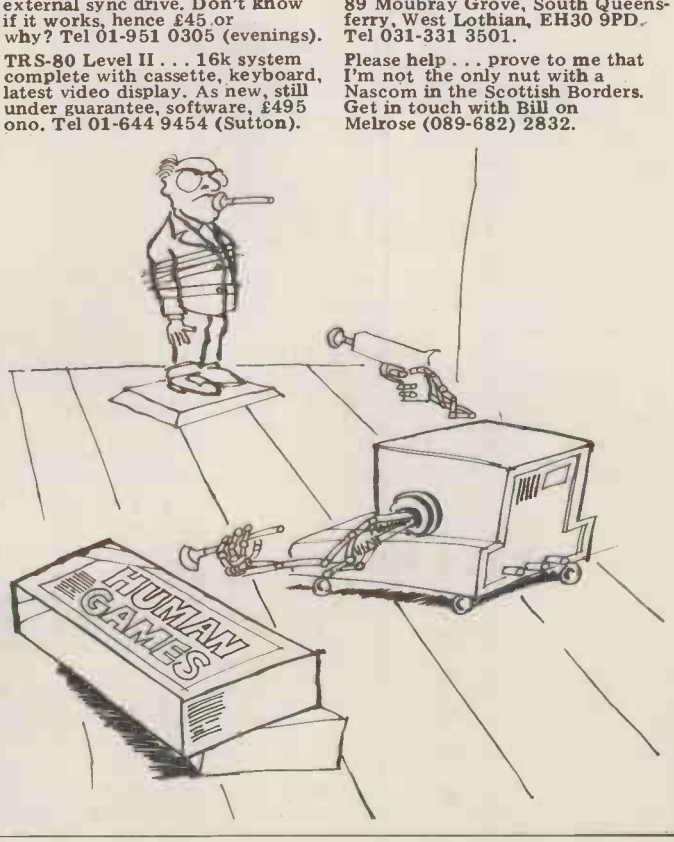
Mains Transformer Design Program . . . wanted for 32k PET. Please phone Mr Tidman on 01-948 3702.

Help . . . could any reader who can supply technical information concerning a Sperry Univac twin digital cassette unit manufactured approx. 6 years ago. Kindly contact John on 0440 3660.

Nascom 1 memory board . . . 8, 16 or 32k, must be less chips; also will consider 8k Basic in ROM. Phone Chris Rose on Tiverton (08842) 57657 — day — or Tiverton 57886 — night. Or write to 3 Belmont Road, Tiverton.

TI59 . . . with PC1000B/C print cradle. Must be in good working order with documentation. Around £200. Contact P. Fairlamb, 89 Moubray Grove, South Queensferry, West Lothian, EH30 9PD. Tel 031-331 3501.

Please help . . . prove to me that I'm not the only nut with a Nascom in the Scottish Borders. Get in touch with Bill on Melrose (089-682) 2832.



Stephen Lee

PRINTERS

by Mike Dennis

There are over a hundred printer manufacturers in the world today and the wide range of facilities they offer frequently causes of a great deal of confusion. This month's exhaustive review sets out to explain how the various types of printer work and what options they offer; an easy-to-understand reference chart has been included to help you choose the printer most suited to your requirements. Every manufacturer and distributor whose name we could muster was asked to send as much literature (including operator and service manuals) as possible. Happily the response has been enormous.

For many of us, our first introduction to printers (or 'hard-copy' devices) was with the old teletype (TTY) . . . it was both excruciatingly slow and very noisy. Still, in its time the TTY was synonymous with hard-copy and it wasn't until the advent of the dot-matrix mechanism that any real change took place in the status quo. From that day on there has been a seemingly endless stream of improvements but, although the cost has dropped quite dramatically in a number of areas, the printer still comprises a major part of a system's total cost.

However, to the business user they are essential and, as program listings disappear off the top of the screen at an ever increasing rate, other computer users soon place a printer high on their list of priorities. The problem is — which one?

Basic concepts

Printers consist of three main components — the printing mechanism, a way to move the paper about and the controlling electronics. In addition there are other minor components such as a power supply, case and, where applicable, a ribbon. However, the heart of any printer is the printing mechanism itself and this is worth a comprehensive examination in its own right.

The first thing you notice is that some mechanisms are common to many printers. Some individual printer manufacturers buy-in the mechanism from an OEM supplier and then add the rest of the components to their own particular specification. This is one of the main reasons behind the proliferation of printers and, although the various suppliers were asked to disclose any areas of common interest, many were rather coy about it. Unfortunately that made true cost comparisons and value-for-money assessments all the more difficult.

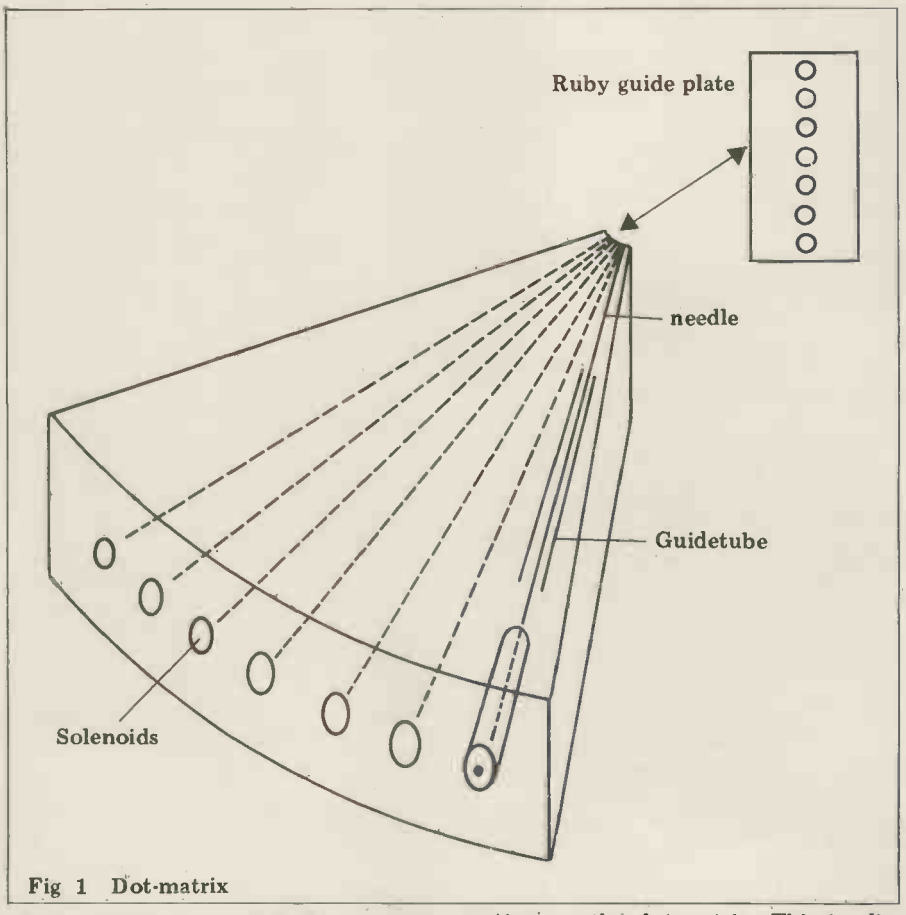


Fig 1 Dot-matrix

The mechanisms themselves can be defined by three basic characteristics.

1 How the character is placed on the paper. *Impact* types such as the TTY use a hammer or similar object to strike the paper with the appropriate character. *Non-impact* types such as thermal printers as the name suggests do not strike the paper but use alternative methods.

2 How the character is formed. Fully-formed characters such as those in normal typewriters will print the whole character simultaneously. The alternative is to assemble the character by printing dots into a pre-defined pattern — the dot-matrix. This implies several printing actions to print one character whereas fully-formed characters require only one.

3 The number of characters printed or assembled at a time. If it's only one character, then the printer is a *character* printer. The alternative method is to print a whole line of characters in one go — the *line* printer.

All the various types of printers are summarised in Table 1 according to their characteristics; these I shall now examine in greater detail.

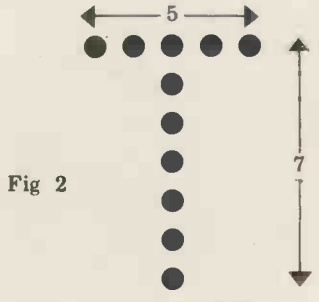


Fig 2

Impact printers

The earliest form of impact printer was the ubiquitous teletype or teleprinter and models such as the Creed 7B can still be picked up for around £25 on the second-hand market. The characters to

Table 1

IMPACT	NON-IMPACT
Dot-matrix	Thermal
Golf-ball	Electrosensitive
Daisy-wheel	Ink-jet
Drum	Laser
Chain	Electrographic
Comb	
TTY	
Spinwheel	

FULLY-FORMED CHARACTERS	MATRIX
Golfball	Dot-matrix
Daisy-wheel	Comb
Drum	Thermal
Chain	Electro-sensitive
Spin-wheel	
TTY	

CHARACTER	LINE
Golfball	Drum
Daisywheel	Chain
Spinwheel	Comb
TTY	
Dot-matrix	
Thermal	
Electrosensitive	

be printed are arranged as small printing elements or 'type-slugs' and they lie in grooves around an annular ring. As the code for each character arrives at the TTY, this ring is rotated until the correct element is in the firing position. A hammer then strikes the element which in turn presses a ribbon against the paper and the character is typed.

Each element has to be capable of printing two characters since there's insufficient room to fit all the elements around the ring. Shifting between the two character sets is accomplished by moving the whole carriage assembly on which the paper is mounted. Upon receipt of the 'figures' code, the carriage latches mechanically and thereafter all printing codes access the figures character set. The mechanical latch is reset to its other position only when the 'letters' code arrives, and from then on the 'letters' character set is printed.

Not a lot happened in the printer world until the arrival of Centronics and the dot-matrix mechanism. Early examples of this type of mechanism shared one common feature, namely a vertical row of pins or needles that were attached to solenoids or electro-magnets. When energised, they 'fired' the needle at the ribbon and thus made a mark on the paper — see Fig 1. The actual number of needles fired at any one time would depend on the character to be printed; the print-head mechanism or needle assembly would then move one column along, fire the next selection of needles and so continue to build up the desired character until complete. For example, the letter B would require all seven needles to fire for column 1 whereas the letter T would only need the top needle. Thus any character could be made up or assembled by firing the pins in a pre-defined dot-matrix. As can be seen from Figure 2, the early matrix dimensions had five columns and fired up to seven needles.

Since the needles needed to hit the paper both quickly and hard in order to maintain print quality and speed, the solenoids had to be large and powerful. This, in turn, meant that the needles had to be bent to make room for them which, in turn, meant more friction and heavier hammers. As the needles slid up and down their guides a couple of rather unpleasant things happened. One, the tube bores wore out and two, the friction generated heat, reducing maximum operating speed and useful life. Another disadvantage with the somewhat limited matrix of 5 x 7 was the comparative coarseness of the printed characters — diagonals in particular suffered badly.

The first problem has been cured in a number of ingenious ways. The early arrangement was for mounting the solenoids in the horizontal plane but since this has meant angling some of the needles quite severely many manufacturers now mount them radially. Thus the needles don't have to be bent as much which in turn means lower friction and wear, and less heat generation — resulting in an improved printing rate and head life. Another bonus is that the needles can be made harder which again enhances the print quality and head life. As you can see many compromises have to be made when designing dot-matrix heads and it's hardly surprising that firms like DRE use computer assistance to optimise head design.

Another improvement is to separate the needle from the driving solenoid; this is the basis of the 'ballistic' or 'free-flight' head. The principle is to hold the needle back against a spring and to release the stored energy at 'fire' time. After the needle has printed the dot, it rebounds and this rebound energy is used in conjunction with a smaller solenoid to compress the spring again, ready for the next release — see Figure 3.

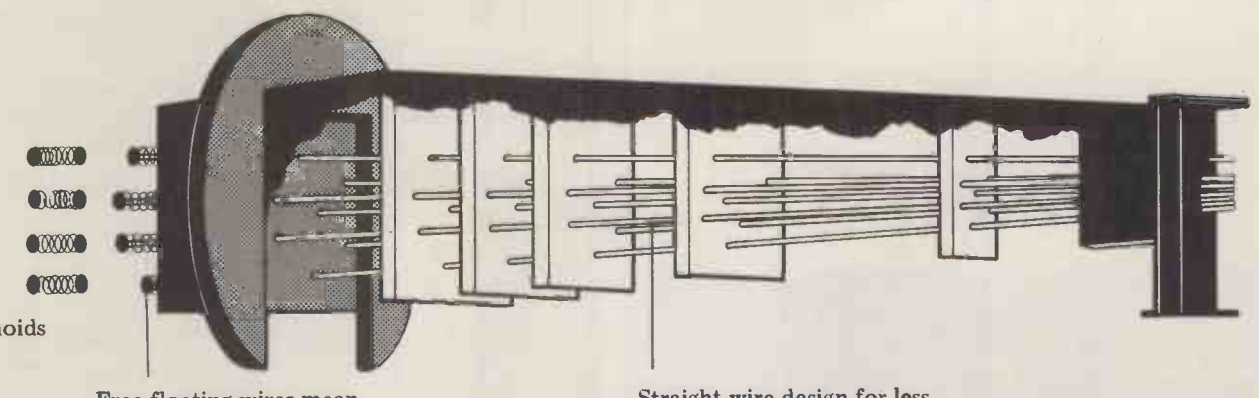
This idea of storing energy appears in Facit's Stored Force Flex Hammers. Here the solenoids are arranged in a semi-circle and the needles are replaced by very hard 'pips' mounted directly onto the armatures; these pivot when the power is applied. This drives the 'pips' towards the paper and, providing the hammer travel is kept low (so Facit claims), head life is lengthened considerably — see Figure 4.

The problem of legibility has been partly overcome by the use of finer matrices — such as 7 x 7 or 9 x 7. Table 2 lists the currently available formats and Fig 5 shows a 9 x 7 half space float. In fact, some of the dot-matrix formats are so fine that Japanese (or Katakana) characters can be printed — which is really going some. Of course, since each needle can be fired individually, it didn't take the printer manufacturers long to realise that virtually any character could be printed provided the original matrix dimensions were fine enough (hence 7 x 9) and the necessary control was available (at this point, enter the microprocessor). This explains the Nx9 or Nx12 that some manufacturers supply, the N meaning that the number of columns needed to make up a character is a variable and under program control. If a large number of columns is used then the fidelity of the printed character is improved and approaches that obtainable from a typewriter. An increase in characters can be printed, although many printers have no lower-case descenders. This gives rise to that horrible looking format where the tails of p, q, y etc. sit up on the line . . . thus pqy. Some of the 7x7 formats boast true descenders but very often the descender is in fact quite minimal. You really have to buy a printer with a 9 needle head if you're after superb descenders; then you're also likely to get underline capability as well.

Table 2

Common formats		other formats	
H	V	H	V
5	7	6	7
7	7	8	7
9	7	8	8
9	9	10	9
N	9	11	9
N	12	15	14

Fig 3



Free-floating wires mean fewer parts and longer trouble-free operation.

Straight-wire design for less friction and heat for greater durability.

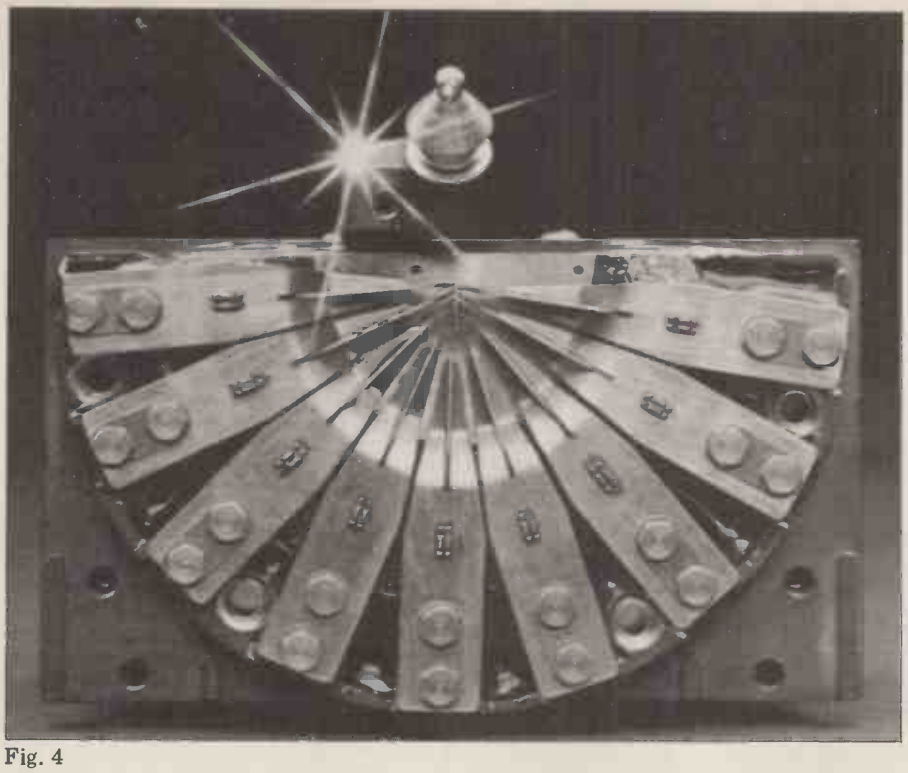


Fig. 4

There are many other advantages to be gained from microprocessor control and some of these will be discussed later. However, one significant trend emerging and, currently being marketed or developed by a number of manufacturers (such as Binder — Racal Recorders — and Centronics) is the dual-purpose printer. These work on a fine dot-matrix format that's capable of typewriter quality printing. This is of particular importance in word-processing applications. There's a penalty of course . . . in this case a slowing down of the printing rate because more dots have to be printed per character. When speed is of prime importance (such as when printing listings) then the matrix format can be 'coarsened-up' for much faster output.

The nett result is to have two printers in one and the ability to switch between the two types of performance with a software switch. The Binder 41 32KP can either print a standard dot-matrix at 240 cps (characters per sec) or a 'correspondence' font at 85 cps. Currently the average price of this type of printer is still high but I wouldn't mind betting it'll drop quite a lot before too long.

I've dwelt on dot-matrix printers at some length — because it's in this area that some of the most exciting developments are being made. However there are other types of impact printer.

Daisy-wheel print elements are very similar to typewriter slugs in that they're fully-formed although in this case, mounted on the ends of radiating metal spokes — see Fig 6. You can see, perhaps, a slight similarity with the TTY. Upon receipt of the appropriate character code, a ROM inside the printer will effect rotation of the wheel so as to correctly line up the wanted character with the hammer, and also decide on the appropriate hammer velocity. The wheel is then struck. Currently, the number of characters or 'petals' on a wheel is limited to a maximum of 96 although Qume does offer the facility of simultaneously mounting two daisy-wheels at a time, making a total of 192 available characters. The alternative to this is to use the 'spinwheel' as used by the NEC Spinwriter. Here 64 petals are bent up, effectively increasing the radius and enabling 128 characters to be fitted (there being two characters per petal).

Apart from the obvious advantage of superior print quality, one daisy-wheel can also be easily exchanged for another of different typeface; there are over 100 such typefaces currently available. There are differences too in the materials used to make the wheels, Qume tending to opt for plastic, with Diablo preferring metal (although I see that it does now offer both). There are arguments both for and against and, although metal wheels last longer, with plastic wheels coming out at around a third of the cost, that's one argument that doesn't hold much water. The only slight advantage that metal wheels have is in producing a marginally crisper print. Plastic wheels, however, are so cheap you can stock up with three times as many different type-fonts for the same cost. Yet another advantage of plastic wheels is that, being lighter and therefore possessing less inertia, they can be spun round faster than metal ones. The printing speed — always one drawback of the daisy-wheel — is typically a maximum of 55cps with plastic wheels and only 45cps for metal. For many uses this speed is too low and you can see why there is the feverish development in matrix printers that I discussed earlier.

Another feature of daisy-wheel printers, often overlooked, is that if you purchase the version with a keyboard (which usually costs about another £200) since you can operate it in a 'local' mode, you've effectively made yourself an electric typewriter for only '£200'. Where else can you buy one of that quality and at that price? And a final plus . . . the daisy-wheel is the only printer I know of that's capable of printing sub and super-scripts.

The last of the impact devices to be considered (at least as far as 'character' printers are concerned) is the faithful IBM Selectric and variations thereof. These are now appearing on the re-furbished (second-hand) market with suitably modified insides and an interface to suit your computer. The printing mechanism in this case is a golf-ball; a fully-formed character printer, the individual symbols are raised up from the surface of a metal ball. This ball is attached to a mechanism of almost frightening (well, it is to me!) complexity which twists and raises the correct portion of the ball into the firing line. In common with other hairy mechanical devices, the golf-ball print speed is quite slow — about 15 cps. The print quality, however, is superb . . . some would say the best as it's effectively an electric typewriter. Again, it offers the advantage of having exchangeable typefaces, although you have to be 100% certain that the electronic interface fitted can handle your choice; with the differing golfball layouts available, you might well end up printing gibberish.

Non-impact printers

The two main types of non-impact printer are electro-sensitive and thermal. Both operate on a similar basis to matrix printers but instead of needles they use (respectively) an electric field or a heat field. Both require special paper and the electrosensitive type is that nasty looking silvery stuff. The thermal paper is creamy-white in colour and produces quite a readable print . . . far less objectionable in my opinion. A typical price for thermal paper is £2.00 for an 80' roll — which makes it fairly expensive — while the other type is cheaper. The advantages of both thermal and electro-sensitive are a relatively high speed (about 40 cps for the Trendcom 100 thermal printer) and an almost sublime silence when in operation — it sounds so effortless. One possible disadvantage, apart from the special paper, is that the paper width is sometimes limited (less than 5") but there's an increasing number of manufacturers (Trendcom included) now offering an 8½" width.

Another, perhaps more serious, disadvantage inherent in both designs is that only one copy can be made at a time as opposed to up to 6 that some of the impact printers can manage.

Typewriter modifications

Last but by no means least in the mechanisms is a strange beast that defies any classification in the printer camp per se. I refer to the Keypak which is a handy device and clips over an existing electric typewriter keyboard. Small solenoids in the Keypak then depress and actuate the existing typewriter keys. Restrictions are that the typewriter must have a powered carriage-return and a certain amount of adjustment of external timing delays is needed to suit the particular typewriter used. What you get is, effectively, correspondence quality print at whatever maximum speed the

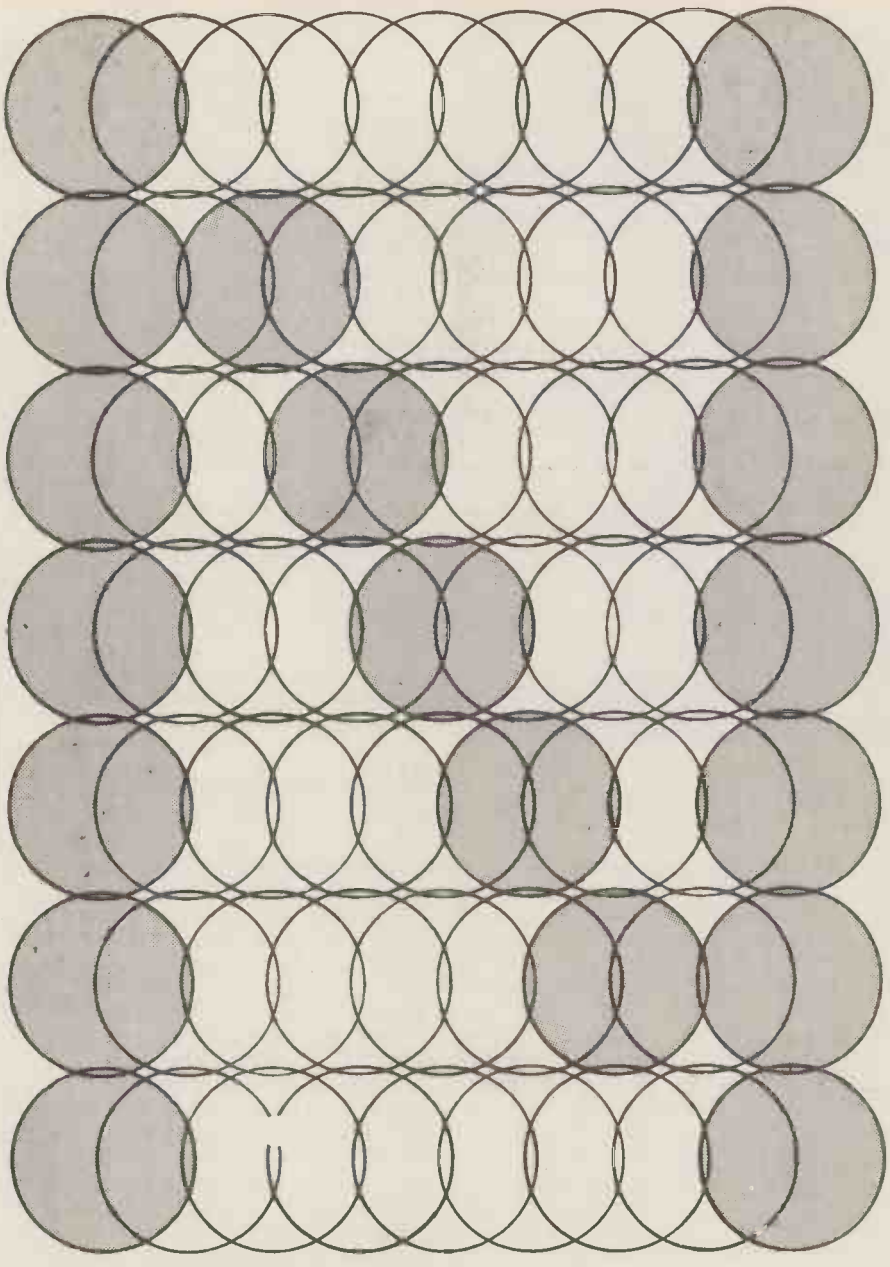


Fig. 5 9 x 7 Half space matrix font

typewriter will run. I also hear rumours of another add-on that lives underneath the keys but was unable to find out any more information on it.

Line printers

If throughput is a problem then the line-printer is just the job for you, although you will find most of them rather expensive.Three methods of printing are used — namely the drum, the chain and the comb all of which print a complete line in one go. Both drum and chain methods use fully formed letters and also strike the *paper* against the ribbon and then on to the character on the chain or drum. This is known as 'back-striking'. as opposed to the 'front-striking' mechanism of the ordinary typewriter where it's the character that does the striking. In the drum printer, the characters are arranged in rows down the axis of the drum — a complete row of 132 A's (assuming it's a 132 column printer), then a row of B's etc. Behind the paper is a row of 132 hammers, each being activated when the appropriate character passes it. For one line of print to be made the drum must revolve once. The paper then moves up to the next line and the process is repeated.

The chain, or train, mechanism comprises a series of metal slugs joined together and driven along a guide channel in front of the paper and ribbon. Each slug comprises one character and, when it reaches the appropriate column, the paper is struck from behind by the corresponding hammer — very similar in fact to the line printer.

A closely related mechanism is used by the band printer but this time the characters are impressed on a metal band that is then used in a similar fashion to the chain or train. One advantage of the band printer is that bands can often be changed quite easily, to effect repair or font change. If the character set is duplicated in either chain, train or band then a speed improvement will result. The actual number of hammers also varies and the maximum throughput occurs when there is one hammer per column on the paper. This makes the printer correspondingly more expensive and so, to compromise, some printers share one hammer between two or four columns and the mechanism or the paper is moved sideways during printing.

The third type of line printer uses the 'comb' mechanism. Pioneered by Tally it's a compromise between the number of active elements (hammers) and the printing speed. The comb has 132 teeth and on the end of each tooth is a hardened 'pip' — see figure 7. Behind the tooth is, wait for it, yes — an electro-magnet! The design is quite ingenious because, to print a dot, the required comb is pulled back with the magnet and then released . . . whereupon the tooth flies back and strikes the ribbon on to the paper. This is only the first dot in the character that we are building up and the comb is then moved sideways to the next dot position within character and the required teeth fired. Don't forget that since we have 132 hammers we could be building up 132 characters simultaneously. When all the dots have been fired for the first row, the paper has to be advanced by one dot row position ready for the next row of dots to be printed. However, to save time the comb row moves over in the opposite direction. The comb therefore reciprocates along the print line, making 3½ complete cycles per character row — see Figure 8. The end result is a printer with no fast-moving parts or requirement for critical timing.

A different principle is used by OKI in its line printers. Here either 22 or 33 small solenoids are used with the needles attached directly to the armatures. Because they are mounted at right angles to the paper there's no question of bending the needles and so normal dot-matrix type problems are eliminated. Each hammer or solenoid is shared between 6 or 4 characters respectively and each character is then assembled in a similar fashion to the 'comb'.

Cautionary note

The important point with any quoted line speeds/minute is that it depends on the number of characters per line, and this applies to all *types of printer. Also remember that although a uni-directional printer may be quoted as having a printing speed of 120cps — time will be wasted while it does a carriage return. The* effective *throughput will be less than a printer running at the same quoted characters/sec, but with bidirectional printing capacity.*

Paper control

There are three main types of paper movement or control, the most common being the 'pin-feed' which uses computer listing paper with sprocket holes down each side. At the end of the platen (the roller that the paper goes round) are spikes or 'pins' that locate with the holes in the paper and drive it along at line-feed time. The drawback with early versions was that the distance between the sprockets was fixed and so you were stuck with using only one size of paper. The alternative was to purchase different platens to suit different paper types and some manufacturers have gone along that line by simplifying the changeover procedure.

Another method is to do away with the platen altogether and have a

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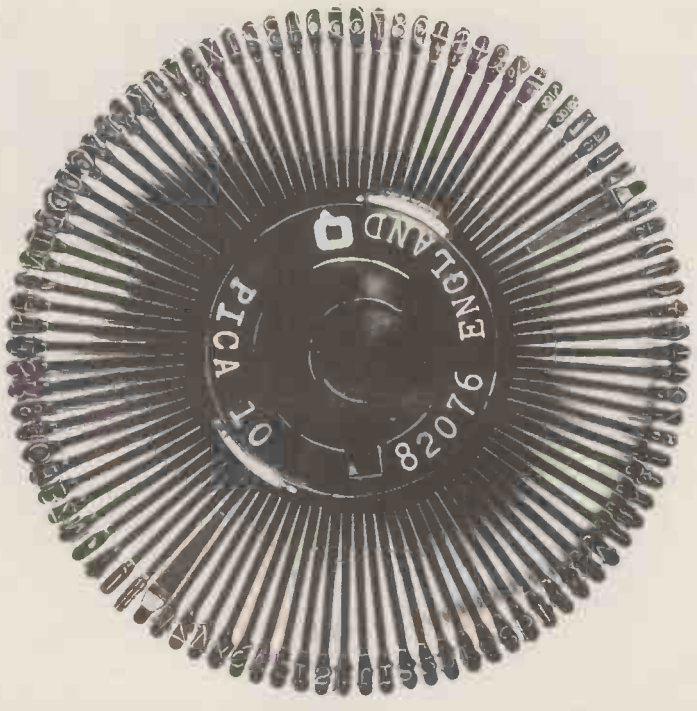


Fig 6

narrow strike plate behind the paper fire-line and then to pull the paper over this plate. In this case the sprockets are mounted on a separate rod along which they can be slid to accommodate different widths of paper. The disadvantage with some of these pin-feeds is that the paper is not under very tight control as there is no tension holding it back below the print line. This turned out to be a problem, especially with forms such as invoices etc, and so the adjustable tractor was developed. This device (standard fitting for some, while an optional extra for others) can be adjusted for paper width and also provides a firm 'traction' path through which the paper is driven. Another feature is that for about 3 inches above the print line, the paper is held flat which makes reading while printing much easier. This 3 inch path also means that there are more teeth in contact with the paper than with the pin-feed and so there is less chance of the paper jamming or tearing.

Where the control of paper movement is really critical — when graph plotting for example — then the technique is to use a double-tractor mechanism both before and after the strike plate. The paper is therefore really gripped tightly and pulled hard back against the strike plate. The double-tractor also means that the paper can be moved backwards which again is a great asset when graph plotting. Don't automatically think that the forms-tractor is always better then the pin-feed because some of these tractors that are optional extras can move about a bit, albeit by only a tiny amount . . . a small point that you should be aware of.

The next method is the friction feed and this is used where sprocket holes are taboo — for instance when writing to your girlfriend! The operation is identical to a typewriter and usually works fine. The only problem arises when continuous stationery is used as, after a time, no matter how carefully you insert the paper it will gradually creep along the roller; you end up typing off the sheet.

Friction feeds are definitely for those who detest invoices with holes down the side. The alternative name to this feed is the 'single-sheet' feed and, as the name suggests, you put in the sheets one at a time. Well, computers are supposed to save you time, remember, and it can be irritating to stand around feeding the thing. Therefore a handy gadget to have at this time is the single-sheet feeder which takes approximately 200 single invoices or letter heads and will feed them one at a time into the guts of the printer, print them and then stack them up neatly for you in a little tray!! The drawback is that the gadget costs about £750 and tends to be used only with daisy-wheel printers.

Paper can be fed or loaded into the printer from a number of directions. One of the easiest is from the top where it goes in like a typewriter, and one of the worst is where it goes in the back — as in the Microtek. Other options offered are bottom feed and front feed, although bottom feed may be a factory fitted option.

Many printers fit 'paper-out' indicators that either light a lamp or buzz where appropriate. Among the paper terms that you may come across is 'fan-fold' where the paper is folded alternately, as in a fan; this makes storage of the printout much more manageable. Most printout paper is fan-folded. Some paper comes as two-part and with or without a carbon; copies can be easily made. If you're going to make copies, then make sure that your printer is capable of producing the required number at a time. Printers such as some Facit models feature a 'floating' print head that automatically compensates for different thicknesses of paper whereas some others need the hammer intensity and head adjustment to be performed manually.

There are extra features that are worth looking out for (which are not always automatically provided but that you might find important) . . . for instance printers with facility for winding the paper forward or backwards manually; it's also nice to be able to tear off the paper at a convenient point. Many printers have the tear-off point some way on from the print line which means that you can't start new sheets from the top of the page.

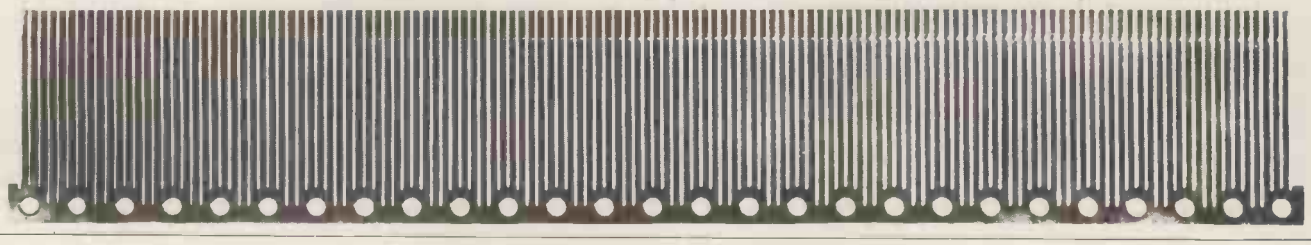
In general terms paper handling is fairly straight-forward and there aren't usually any great problems. Remember, though, that friction feeds do mean that you can print on virtually any form of paper . . . even stencils and offset litho masters and that is often quite important.

This next section is one closely associated with paper — the choice of ribbon. Features to look out for here are the life of the ribbon, how easy it is to replace and how much it will cost. The current buzzword appears to be the 'Mobius' loop where both the top and bottom halves of the ribbon will eventually be used. Some use 'intelligent' ribbons — such as Qume's Multistrike which is supposed to wind the ribbon on only as far as the width of the last printed character, thereby lengthening the ribbon's life. For really excellent print quality you need a 'singlestrike' (or carbon) ribbon which, although producing exemplary print, only lasts for one pass and then has to be thrown away. Some printers feature two-colour printing (usually red and black) and there's even a superb colour printer by Trilog that uses a three colour ribbon in the company's own colour plotter/printer.

Taking Control

Some of the modern trends in microprocessor control have already been mentioned but, before I expound on the

Fig 7



other advantages, I ought perhaps talk a bit on the simpler (?) task of interfacing. Printers interface to their host computer via either a serial or a parallel interface.

Because printer mechanics are much slower than electronics, many serial interfaces operate at a slow baud rate. Sometimes the maximum speed at which a printer will work (eg. 55cps) falls between two of the standard electronic baud rates — here, 300 and 600 baud. If the computer transmits at 300 baud then the printer is not being used at its fastest pace but at 600 baud, the speed is too high for it. The answer adopted by many manufacturers is to include a buffer (usually up to around 2k) inside the printer which will absorb occasional bursts at the higher rate without losing any characters. The problem of baud rate matching is still there and if the computer transmits a large chunk of data — eg. a listing — then the buffer will overflow in a very short time. If this type of operation is anticipated, it's important to make sure that whatever serial interface is used possesses a handshaking control that can inhibit the computer from sending any more data after the printer buffer has been filled up.

The proper answer is to use a parallel interface and there's a so-called standard — the Centronics interface. Many people advertise that they follow this standard but occasionally I have known people to run into trouble; certain elements within the interface didn't quite tie up as well as they should have — check therefore that your computer will interface satisfactorily. Handshaking is inherent in parallel interfaces and thus data transfer rate is not a problem.

Another aspect of control is the VFU or Vertical Forms Unit which uses tape cartridges, punched tape or microprocessors and ROMs to govern the vertical movement of paper. The simplest example is the 'forms-length' switch that tells the printer how many lines there are on the form, thus enabling it to move the top of the next form after the previous one has been printed. I refer, of course, to continuous stationery. Other, more sophisticated, VFUs allow movement to one of several predefined positions on, for example, an invoice. These might mark the head of form, the start of an address, the first item line and the total box. Some manufacturers even provide battery backup to maintain the forms information in the event of a power failure!! The whole trend seems to be to shift a lot of the intelligence associated with form presentation from the computer into the printer and to offer the user more and more flexibility; personally I think that too much flexibility can often confuse the issue.

The matrix printers also have a field day, thanks to microprocessor control. Apart from those facilities that I've already mentioned, there are other goodies such as the ability to change the number of characters per line or even to print double height, width or size characters; others allow multiple printing passes along the line to build up exotic characters. The enhanced matrix printers are heavily microprocessor controlled and perform many of these functions.

Word processing hasn't been ignored either as several printers will justify the text for you and proportionally space it. The principle behind proportional spacing is that for ease of legibility each letter doesn't occupy the same horizontal space. When allowance is made for this fact (ie. the print head doesn't move along the same amount for each character) the result looks much better.

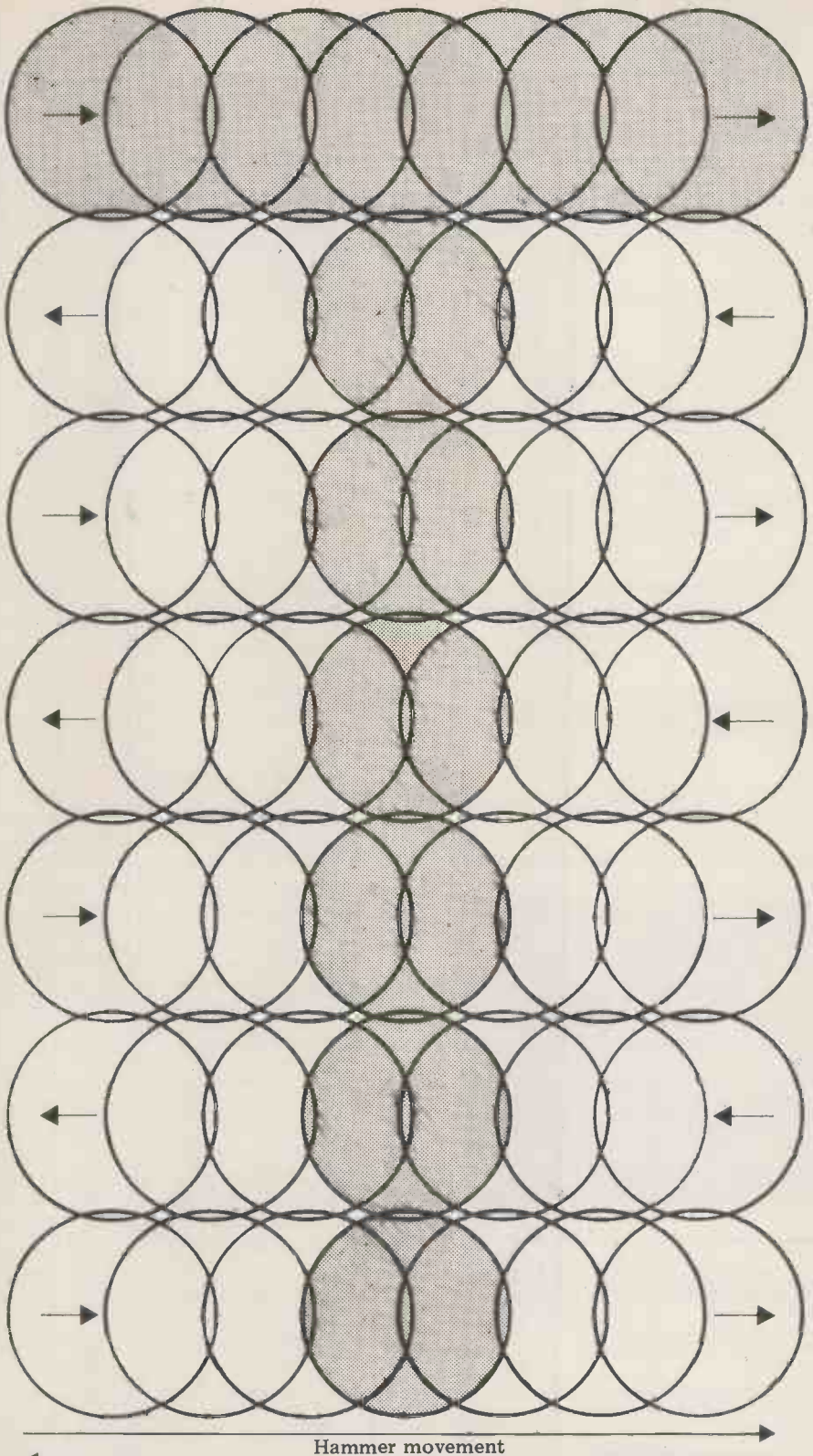


Fig 8

Conclusions

I hope the foregoing has given prospective buyers some help in finding their way through the printer jungle. If I could crystal ball gaze then I'd say hang fire for a while as I suspect there are some interesting printers lurking in the wings, particularly in the area of dual-purpose and enhanced matrix printers. My advice for buying is to take your time and to decide what exactly are your requirements before

looking at *any* printers. That way you stand least chance of being swayed by all the frills and furbelows in your search for the printer that's right for you. Also important, of course, is that you buy at the right price.

Acknowledgements

My thanks go to all the manufacturers who took the trouble to reply to our requests. Particular thanks go to OKI, Walters Microsystems and Intelligent Artefacts. Personal thanks go to Ed Sturmer of Memec, Mike Jordan of ISG, Richard Bond of Racal Recorders and Joe Hemani of DRE. Brickbats go to Commodore and Tandy for sending absolutely nothing and to Sharp for sending information on disk drives.

Using the chart

You will find that many figures in the chart are approximate; you should therefore only use it as a 'broad-brush'

	Agile (ISG Windsor 57955)	Anadex 09905 6333			Intelligent Artefacts 022020 689	
Model	A1	DP 1000	DP 8000	DP 9500	Base 2 M80B	700
Print mechanism type	DW	DM	DM	DM	DM	DM
Line or character	CR	CR	CR	CR	CR	CR
Speed cps Max	55		112	200	80	60
Min				120		
Lines/min Max				200		90
Min				60		13
Characters/line 80						
132						
other		40		175/220	72/96/120	
Characters/inch horizontal		12		10/16		10
Lines/inch vertical		6		6/8	6	6
Proportional spacing						
Bidirectional printing						
Justification						
Multiple copies						
Ballistic head						
Matrix format			7x9	7,9 or 11 x9	7x5	7x5
Change print size						
Change type font						
No. in character set		64			21	
Headlife (million chrs)				100/650	100	
Descenders						
Underlining						
Ribbon life normal					5	
(million chrs) carbon						
Mobius loop type?						
Graphics						
Bidirectional movement						
Pin feed						
Tractors						
Dual tractor						
Paper widths Min						
Max						
Friction feed						
Sheet feeder						
Paper cutter						
Serial interface						
Max baud rate		2400	9600	9600	19200	
Buffer Opt.			2048		1920	
Fixed		104	12			
Parallel interface						
Parallel transfer rate (ch/sec)		1000	1000			C
Self-test						
VFU						Opera
Switchable forms length						Horiz.
Punched tape						
8 Channel cartridge						
Electronic + No. channels						
Paper-out sensor						
Measurement in inches width		11	19	27	14	25
depth		16	14	15	10	20
height		6	7	8	3	8
Approx weight (lbs)		11		35	9	60
Cost		£450	£575	£995	£390	£1257

This printer is similar to Qume but configured as required

outline for making a preliminary choice. Where options are available they are indicated and a brief word given on the facilities offered. Don't assume, because a feature is missing, that a particular printer hasn't got it. It may mean that it simply wasn't mentioned in the literature. The converse may also hold true. Another point to bear in mind is that many facilities are inter-related — such as selection of characters per line versus speed.

To repeat, this chart is by no means exhaustive although it certainly exhausted me preparing it!! Make a few preliminary selections, send for the actual literature and, armed with your new found knowledge, ask a few pertinent questions.

A few printer/keyboard combinations that are usually considered as being terminals are not included in the chart, the distinction in some cases being a bit nebulous.

	Centronics Burgess Hill 45011							
701	702	703	704	730	737	753	779	780
DM	DM	DM	DM	DM	DM	DM	DM	DM
CR	CR	CR	CR	CR	CR	CR	CR	CR
60	120	180	180	100	80/50	130/150	60	60
120	260	370	400			260	90	90
25	50	70	70			50	21	21
10	10	10	10	10		10	10/16.5	10
6	6	6	6	6		6	6	6
7x5	7x7	7x7	7 or 9x7 or 9x9	7x7	Nx9 or 7x8	Nx9	7x5	7x5
			96	96	96			
				4	4			
				10	10			
			9600					
			256	80				
t r o n i c s					S t a n d a r d			
controlled vert forms posn.								
25	25	25	25	15	15	25	20	20
20	20	20	20	11	11	20	18	18
8	8	8	8	5		8	8	8
60	60	60	60	12	12	60	45	45
£1399	£1635	£1935	£2022	£525	£656	£2022	£995	£1081

		Centronics Burgess Hill 45011			DATAC 061-941 2361		
Model		781	791	Screen Image	DM1 40P	DM1 80P	52
Print mechanism type		DM	DM	E	P	P	I
Line or character		CR	CR	CR	CR	CR	
Speed cps	Max	60	60		80	120	
	Min						
Lines/min	Max	120	210		120	90	
	Min	43	45				
Characters/line	80						
	132						
	other			40x24			40
Characters/inch	horizontal	10	10				
Lines/inch	vertical	6	6				
Proportional spacing							
Bidirectional printing							
Justification							
Multiple copies							
Ballistic head							
Matrix format		7x5	7x5				
Change print size							
Change type font							
No. in character set				Viewdata Teletext	96	96	
Headlife (million chrs)							
Descenders							
Underlining							
Ribbon life (million chrs)	normal						
	carbon						
Mobius loop type?							
Graphics							
Bidirectional movement							
Pin feed							
Tractors							
Dual tractor							
Paper widths	Min						
	Max				4	9	
Friction feed							
Sheet feeder							
Paper cutter							
Serial interface							
Max baud rate					600	600	
Buffer	Opt.						
	Fixed						
Parallel interface		Centronics Standard					
Parallel transfer rate (ch/sec)							
Self-test							
VFU							
Switchable forms length							
Punched tape							
8 Channel cartridge							
Electronic + No. channels							
Paper-out sensor							
Measurement in inches	width	20		13			
	depth	18		10			
	height	8		4			
Approx weight (lbs)		45		10			
Cost		£1200	£1370	£500	£350	£188	£7

Key:

DM	Dot Matrix
DW	Daisy Wheel
DR	Drum
SW	Spin Wheel
GB	Golf Ball
CM	Comb
CH	Chain
PH	Print Head
P	Pressure Sensitive
E	Electro Sensitive
TH	Thermal
*	Half Space Facility
	Optional
	Standard

			Data Recording Equipment 0784 61141				Data Type 063-33 65307	Decision Data 01-488 9751
312	410	520	6320	6325	6330	6331	DT 150	6540
DM	E	DM	DM	DM	DM	DM	DM	DM
CR	CR	CR	CR	CR	CR	CR	CR	CR
		66	140	140	150	150	150	120
100	120							
20							136	
			10	10	10	10	10	10
			6/8	6/8	6	6/8	6/8	6
			4	4	4	4	5	
7x5	7x5	7x5	7x7	7x7	7x7	7x7	9x9	9x7
96	64/16	64	64/96	64/96	64/96	64/96		96
			250	250			200	
							6	
			4	4	4	4		3
			15	15	16	15	13	15
		1200		600				1200
								4k
20		48			256	256		
			5	5				
9			25	25	27	27	23	27
9			20	20	20	20	14	19
4			13	13	11	13	8	10
					68	68	22	45
£269	£255	£500	£1000	£1135	£1435	£1435	£895	£1370

	Diablo 04862 791191	Dolphin Walters 0494: 445172: Datac 061-941 2361: Pronto 01-599 3041		DSH 01-952 8471	DTC ISG Wind 57955	
Model		BD 80	BD 136	M50	200	30
Print mechanism type	DW	DM	DM	DW	DM	DV
Line or character	CR	CR	CR	CR	CR	CF
Speed cps Max	45	125	240	50	200	45
Min						
Lines/min Max						
Min						
Characters/line 80						
132						
other			136			
Characters/inch horizontal		10		10/12	10	
Lines/inch vertical		6	6	6/8	6	
Proportional spacing						
Bidirectional printing						
Justification						
Multiple copies	14	2			5	
Ballistic head						
Matrix format		9x7	9x7 or 9		9x5	
Change print size						
Change type font						
No. in character set	96	96	96	96		96
Headlife (million chrs)						
Descenders						
Underlining						
Ribbon life normal						
(million chrs) carbon						
Mobius loop type?						
Graphics						
Bidirectional movement						
Pin feed						
Tractors						
Dual tractor						
Paper widths Min						4
Max						15
Friction feed						
Sheet feeder						
Paper cutter						
Serial interface						
Max baud rate	9600					120
Buffer Opt.	2304	2048				
Fixed	256	400	16000			168
Parallel interface						
Parallel transfer rate (ch/sec)	2000					
Self-test						
VFU						
Switchable forms length						
Punched tape						
8 Channel cartridge						
Electronic + No. channels						
Paper-out sensor						
Measurement in inches width		21			23	
depth		17			18	
height		7			13	
Approx weight (lbs)		25		22	45	
Cost	£2200	£525	£1100	£1400	£1700	£17

Key:

DM	Dot Matrix
DW	Daisy Wheel
DR	Drum
SW	Spin Wheel
GB	Golf Ball
CM	Comb
CH	Chain
PH	Print Head
P	Pressure Sensitive
E	Electro Sensitive
TH	Thermal
*	Half Space Facility
	Optional
	Standard

ıcotel -660 26	Epson 01-439 6288	Facit 0634 401721				Heath 0452 29451	Ipex 0101-213-368 3679	Lear Siegler 0276 34044
ıcotel 3L80	TX80	4506	4530	4555	4520	WH 14	Spin-term	300
	DM	TH	DM	DM	DM	DM	DW	DM
	CR	CR	CR	CR	CR	CR	CR	CR
	125	28	220	60			55	180
			150					
					60			
		14	198			96	136/163	136
	10		10/15			10/16	10/12	10/16
	6		6/8/10	6		6/8	6/8	6/8
			5	3	1		5	5
	7x6 7x5	7x5			7x9	7x5		9x7
			Various	63	96	96	128	96
	100				100			
	2							10
	4							
	10				9		16	16
	9600		4800		9600	4800	1200	9600
						256		2048
	80		500		700		256	
	17		26	19		18		27
	13		21	19		14		17
	8		10	8		5		8
	21		65	55		25		150
	£395	£100	£1680	£640	£640	£510		£1350

Specification as Base 2 (page 120)

		Malibu 0101-805 4961990	MEMEC 084-421 5471	Newbear 0635 30505	OKI Slough 49117		Pa Ti
Model		165	NEC	8300	Microline 80	DP 125	Pa Ti
Print mechanism type		DM	DW	DM	DM	PH	DI
Line or character		CR	CR	CR	CR	L	CI
Speed cps	Max	165	55	125	80		19
	Min	90					57
Lines/min	Max				101	125	27
	Min				21		42
Characters/line	80						
	132						
	other		136/163		40		96
Characters/inch	horizontal		10/12	10	10		10
Lines/inch	vertical			6	6/8		6/
Proportional spacing							
Bidirectional printing							
Justification							
Multiple copies				3		4	
Ballistic head							
Matrix format		9x10			9x7	9x7	7 8
Change print size							
Change type font							
No. in character set			128		96	96	96
Headlife (million chrs)					200	500	
Descenders					No		
Underlining							
Ribbon life (million chrs)	normal						
	carbon						
Mobius loop type?							
Graphics							
Bidirectional movement							
Pin feed							
Tractors							
Dual tractor							
Paper widths	Min	3		5	3	4	2
	Max	16		10	9	16	10
Friction feed							
Sheet feeder							
Paper cutter							
Serial interface							
Max baud rate			1200			9600	
Buffer	Opt.					2k	
	Fixed		256	80		132	20
Parallel interface							
Parallel transfer rate (ch/sec)							
Self-test							
VFU							
Switchable forms length							
Punched tape							
8 Channel cartridge							
Electronic + No. channels						12	
Paper-out sensor							
Measurement in inches	width	28	25	18	14	24	16
	depth	19	16	15	10	33	13
	height	9	9	7	5	10	12
Approx weight (lbs)		48	60	20	13	77	20
Cost		n/a	£1850	£475	£500	£2250	£5

Key:

DM	Dot Matrix
DW	Daisy Wheel
DR	Drum
SW	Spin Wheel
GB	Golf Ball
CM	Comb
CH	Chain
PH	Print Head
P	Pressure Sensitive
E	Electro Sensitive
TH	Thermal
*	Half Space Facility
	Optional
	Standard

Printerm 01-894 5511	Qume (Mill-bank) Compu-ting 01-549 7262)	Racal 0703 843265			Mighty Micro 0923 38923	Tally 0734 580141		Terminet 01-402 4100
879	Sprint 5	1000	2000	4000	Super Print 2	M 80-MC	MT 1602	200
DM	DW	DM	DM	DM		DM	DM	DM
CR	CR	CR	CR	CR		CR	CR	L
180	55	150	200	240		200	160	200
120	45			85		140		
75							200	
							70	
	158							136/224
10		10	10				10	10/16.5
6		6	6	6		6	6	
5		6/7	6/7	7/8		5	5	8
9x7		7x7	7x7	9x7		7x7*	7x7*	9x7
95	96					64	96	
						>100		100
					Specification as Base 2 (Page 120)			
								2
								16½
9600	1200							120
		1k/2k	1k/2k	1k/2k				
256				512				2/256
							2	
							12	
18	24	21/26	21/26	21—35				
22	15	20	20	20				
8	8	9	9	9				
25	44	80	80	80				
£725	£2200	£1600	£1700	£2100		£1000	£1380	£1450

		Transdata 01-240 2713	Texas Bedford 67466			Trend 06285 24977	
Model		313	OMNI 820RO	OMNI 825RO	810	RO 800	Cen
Print mechanism type		TH	DM	DM	DM	DM	DM
Line or character		CR	CR	CR	CR	CR	CR
Speed cps	Max	30	150	75	150	30	112
	Min						
Lines/min	Max				440		
	Min				64		
Characters/line	80						
	132						
	other						96
Characters/inch	horizontal				10	10	
Lines/inch	vertical				6/8		6
Proportional spacing							
Bidirectional printing							
Justification							
Multiple copies			5	3	6	3	
Ballistic head							
Matrix format			9x7	9x7	9x7	7x5	9x7
Change print size							
Change type font							
No. in character set		94	128	128	64		96
Headlife (million chrs)							90
Descenders							
Underlining							
Ribbon life (million chrs)	normal						2
	carbon						
Mobius loop type?							
Graphics							
Bidirectional movement							
Pin feed							
Tractors							
Dual tractor							
Paper widths	Min		3	3	3		
	Max		15	15	15		
Friction feed							
Sheet feeder							
Paper cutter							
Serial interface							
Max baud rate		300	9600	600	9600	300	960
Buffer	Opt.						100
	Fixed	64	1280	256	256		
Parallel interface							
Parallel transfer rate (ch/sec)							
Self-test							
VFU							
Switchable forms length							
Punched tape							
8 Channel cartridge							
Electronic + No. channels							
Paper-out sensor							
Measurement in inches	width	16			25	19	19
	depth	10			20	15	15
	height	5			8	6	6
Approx weight (lbs)		12			55	24	25
Cost		£790	£1450	£1090	£1450	£870	

Key:

DM	Dot Matrix
DW	Daisy Wheel
DR	Drum
SW	Spin Wheel
GB	Golf Ball
CM	Comb
CH	Chain
PH	Print Head
P	Pressure Sensitive
E	Electro Sensitive
TH	Thermal
*	Half Space Facility
	Optional
	Standard

Keypak available from Capital Computer Services, 01-637 5
Logabax LX100 and LX200 from Logabax, 01-965 0061 o
Kingston, 0262-73036.
The following supplied information too late to be included
grid:
Data Dynamics, 01-848 9781.
Tandy, 021-556 6101.
Whymark, 07372 21753.

PROGRAMS

Nightmare Park

by Bob Chappell

Fight your way through the Gorillas and Blabbers of Nightmare Park. A great challenge for those readers with PETs. Listing courtesty Lion House

```
10 REM**AUTHOR-BOB CHAPPELL 14/5/80**
20 W=RND(TI):S$="                                        "
30 PRINT"■■■NIGHTMARE PARK.":PRINT"■■THE SHORTEST ROUTE MAY NOT BE THE BEST."
35 PRINT"■■YOU MAY ONLY MOVE NORTH,SOUTH OR EAST."
40 PRINT"■■STAY ON THE PATH.":PRINT"■■■ABANDON HOPE ALL YE WHO";
45 PRINT" ENTER.....■■":GOSUB9600
50 FORN=1TO5:PRINT"      ■NIGHTMARE PARK":NEXT:GOSUB9600
100 P$="                                                "
110 P1=33291:P=33291:E3=83:Y1=0
270 GOSUB9000
280 P=P1:PRINT"■    N,S,OR E?"
285 GETW$:IFW$=""GOTO285
287 GOSUB9500
290 IFW$="N"THENA=-40:GOTO330
300 IFW$="S"THENA=40:GOTO330
310 IFW$="E"THENA=1:GOTO330
320 GOTO280
330 P1=P+A:IFPEEK(P1)=32GOTO10000
340 IFPEEK(P1)=5THEN12000
350 POKEP,102:POKEP1,E3
352 X=INT(5*RND(TI)+1):J=4
355 IFP1>33297ANDP1<33315THENJ=3
357 IFX<JGOTO280
358 Y1=Y1+1
360 X=INT(15*RND(1)+1)
365 IFX=7ANDY1>10GOTO360
370 ONXGOTO1000,1500,2000,2500,3000,3500,4000,4500,5000,5500,6000,6500
380 X=X-12:ONXGOTO7000,7500,8000
1000 B$="π":W$="UNICORNS!":F=94
1002 PRINT"■■STAMPEDING ";W$:PRINT"■PRESS 'L' TO GO LEFT,'R' FOR RIGHT"
1005 X=80:D=32988
1010 GOSUB9700:PRINT"■":FORN=1TO20:GETA$:PRINT:NEXT:C=32988:POKEC,E3
1020 FORN=1TOX:A=INT(6*RND(TI)+3):POKEC,32:FORB=1TO2:PRINTSPC(A);B$;SPC(A);
1022 NEXT:GETA$:IFA$="L"THEND=C-1
1023 IFA$="R"THEND=C+1
1025 POKEC,32:C=D:POKEC,E3
1027 IFPEEK(C+40)=FTHENPOKEC+40,170:GOTO1080
1030 NEXT:IFX=50GOTO1070
1040 X=50:B$=" ":GOTO1020
1070 GOSUB9600:PRINT"■■■■■SURVIVED!":GOSUB9600:GOSUB9810:GOTO270
1080 GOSUB9600:PRINT"■■■■■TRAMPLED!":GOTO9800
1500 W$="BLABBERS!":F=209
1501 PRINT"■■SURROUNDED BY ";W$:PRINT"■FIND NOS. BETWEEN 0-8 TO VANQUISH
1502 E1=INT(9*RND(TI)):E2=INT(9*RND(TI)):E4=INT(9*RND(TI))
1504 D1=F:D2=F:D3=F
1510 POKE33306,E3:C1=32937:C2=32946:C3=32955:C4=33297:C5=33315:C6=33657
1520 C7=33666:C8=33675:FORN=1TO10:POKEC1,32:C1=C1+41:POKEC1,D1:POKEC2,32
1530 C2=C2+40:POKEC2,D2:POKEC3,32:C3=C3+39:POKEC3,D3:POKEC4,32:C4=C4+1
1540 POKEC4,D1:POKEC5,32:C5=C5-1:POKEC5,D2:POKEC6,32:C6=C6-39:POKEC6,D3
1550 POKEC7,32:C7=C7-40:POKEC7,D2:POKEC8,32:C8=C8-41:POKEC8,D1
1555 IFC1=33306THEN1700
1560 GETA$:IFA$=""GOTO1560
1565 A=VAL(A$):IFA=E1THEND1=32
1570 IFA=E2THEND2=32
1580 IFA=E4THEND3=32
1590 IFD1=32ANDD2=32ANDD3=32THEN1610
1600 NEXT
1610 PRINT"■■■LUCKY!":GOSUB9600:GOTO270
1700 PRINT"■■■N SCROMP!!!":GOTO9800
2000 PRINT"■■■THE MAD MATHEMATICIAN!!":PRINT"■YOU HAVE 10 SECONDS TO ANSWER"
2005 PRINT"■THE FOLLOWING QUESTION CORRECTLY:-■■■"
2010 T=0:GOSUB9600:FORN=1TO6:A=INT(9*RND(TI)+1):T=T+A
2020 PRINTA;"+";:NEXT:PRINT"■= ?":T1=TI:INPUT"■■■WHAT IS YOUR ANSWER";A
2030 IFA<>TTHEN2060
2035 PRINT"■■■CORRECT....";:GOSUB9600
2040 IFTI-T1>600THENPRINT"BUT YOU TOOK TOO LONG!!!":GOTO2070
2050 PRINT"YOU HAVE CHEATED DEATH!":GOSUB9600:GOTO270
2060 PRINT"■■■■RONG!!"
2070 PRINT"■ PREPARE TO DIE!!!":GOTO9800
2500 PRINT"■■■EATH RAYS!! KEEP STILL AND HOPE!":FORN=1TO5:Z(N)=0:NEXT
2510 GOSUB9600:PRINT"■":POKE33268,E3:FORB=1TO5
2512 F=0:A=INT(14*RND(TI)+5):FORA2=1TOB:IFA=Z(A2)THENA2=B:F=1
2515 NEXTA2:IFF=1GOTO2512
2520 Z(B)=A:A1=A+20:FORN=1TO21:PRINTTAB(A);"\"
2522 A=A+1:FORX=1TO50:NEXTX:NEXTN
2525 IFPEEK(33268)<>E3THEN2550
2527 PRINT"■":FORN=1TO21:PRINTTAB(A1);"/":A1=A1-1:FORX=1TO50:NEXTX:NEXTN
2528 IFPEEK(33268)<>E3THEN2550
2540 PRINT"■":NEXTB:GOSUB9600:PRINT"■■A NEAR THING!":GOSUB9600:GOTO270
2550 GOTO9800
3000 W$="LURGI!":F=42
3005 PRINT"■■■MULTIPLYING ";W$:PRINT"■YOU HAVE 1 MINUTE TO REACH THE EXIT"
3010 PRINT"■8=N,2=S,4=W,6=E":GOSUB9700
3020 B=33633:T1=TI:PRINT"■":POKE32768,5:POKEB,E3
3025 FORN=1TO30:A=INT(930*RND(TI))+32776:IFPEEK(A)=E3THEN3025
3028 POKEA,F:NEXT:IFTI-T1>3600THEN3200
3030 FORN=1TO6
3035 GETA$:IFA$=""THEN3035
3040 POKEB,32:IFA$="8"THENB=B-40
3050 IFA$="2"THENB=B+40
3060 IFA$="4"THENB=B-1
3070 IFA$="6"THENB=B+1
3080 IFPEEK(B)=FTHENPOKEB,209:GOTO3200
3085 IFB>33767ORB<32768THENB=33633
3090 IFB=32768THEN3190
3100 POKEB,E3:NEXT:GOSUB9810:GOTO3025
3190 PRINT"■■■ESCAPED!!":GOSUB9600:GOTO270
3200 GOSUB9600:PRINT"■■■MITTEN BY ";W$:GOTO9800
3500 PRINT"■ CRUSHER!!ONLY 1 LETTER WILL STOP IT":POKE33666,E3
3505 X=INT(25*RND(TI)+65)
3510 PRINT:FORN=1TO21
3514 PRINT"  ■";:FORA1=1TO36:PRINT" ";:NEXT:PRINT
```

FUN & GAMES

```
3515 IFN>20THEN3540
3520 GETA$:IFA$=""GOTO3520
3530 IFASC(A$)=XTHEN3590
3540 NEXT:PRINT"■■■■■■SHED!":GOTO9800
3590 PRINT"■■■ESCAPED!!":GOSUB9600:GOTO270
4000 PRINT"■■■CK TO THE START!!!":P1=33291:P=33291:GOSUB9600:GOTO270
4500 PRINT"■■■MANIACAL MEMORY TESTER!!":PRINT"■MEMORISE THIS TO PACIFY HIM"
4510 GOSUB9700:FORN=1TO5:Z(N)=INT(26*RND(TI)+65):NEXT:PRINT"■■■■■■■■■";
4520 FORN=1TO5:PRINTCHR$(Z(N));" ";:NEXT:FORN=1TO500:NEXT:PRINT"■■■"
4530 FORN=1TO5:PRINT"■■HAT WAS LETTER",N;
4535 GETA$:IFA$=""GOTO4535
4537 PRINTA$:IFASC(A$)<>Z(N)THEN4560
4540 NEXT:PRINT"■■■LUKE!!":GOSUB9600:GOTO270
4560 PRINT"■■■RONG!! CURTAINS FOR YOU!":GOTO9800
5000 PRINT"■■■HAIL OF BARBS!":PRINT"■CROSS YOUR FINGERS!"
5010 C=33500:GOSUB9600:PRINT"■";B$="V":POKEC,E3:FORN=1TO15
5040 A=INT(4*RND(TI)+3):FORB=1TO6:PRINTSPC(A);B$;SPC(A);:NEXT
5070 FORN=1TO250:NEXT
5100 NEXT:GOSUB9600:IFPEEK(C)<>E3THEN5120
5110 PRINT"■■■■■MISSED!":GOSUB9600:GOTO270
5120 PRINT"■■■EXTERMINATED!!":GOTO9800
5500 PRINT"■■■THE EGOTISTICAL GORILLA!!":PRINT"■TELL HIM HIS NAME OR BE";
5510 PRINT" DISMANTLED!!":PRINT"■A FLASH OF LIGHTNING REVEALS IT BRIEFLY"
5520 A=INT(4*RND(TI)+1):IFA=1THENA$="CLARENCE"
5530 FORN=1TO6000:NEXT:IFA=2THENA$="PERCIVAL"
5540 IFA=3THENA$="STANLEY"
5550 IFA=4THENA$="WINSTON"
5555 A=INT(15*RND(TI)+3):FORN=1TOA:PRINT"■";:NEXT
5560 PRINTA$:FORN=1TO150:NEXT:PRINT"■■■■■WHAT'S MY NAME?■":INPUTB$
5570 PRINT"■■■DER...UM...ERR.....DAT IS.....■":GOSUB9600:IFB$<>A$GOTO5590
5580 PRINT"GRRR! RIGHT!":GOSUB9600:GOTO270
5590 PRINT"WRONG!! RIP!...CRACK!...SQUASH!.....":GOTO9800
6000 PRINT"■■THE DOORS!!":PRINT"■BEHIND ONE IS A STARVING LION!"
6010 FORN=1TO3:A$(N)="■ ■":NEXT:PRINT"■";TAB(8);"1";TAB(18);"2";
6020 PRINTTAB(28);"3":A1=4:GOSUB6070:FORN=1TO3:A$(N)=" ":NEXT
6030 PRINT"■■CHOOSE";
6035 GETA$:IFA$=""GOTO6035
6037 X=VAL(A$):A1=INT(3*RND(1)+1):E=1000
6040 GOSUB6070:GOTO6150
6070 A=6:FORB=1TO3:PRINT"■■■■■■■":FORN=1TO7:PRINTTAB(A);A$(B)
6080 IFN=3ANDB=A1THENA$(B)="LION!"
6090 IFN=4ANDA1<4THENA$(B)="  "
6100 FORC=1TO200:NEXT:NEXT:A=A+10:NEXT:RETURN
6150 PRINT"■■■":IFA1<>XTHENPRINT"FORTUNE HAS SMILED ON YOU":GOSUB9600:GOTO270
6160 GOTO9800
6500 B$="†":W$="STINGERS!":F=30:GOTO1002
7000 W$="NAJJERS!":F=35:GOTO1501
7500 W$="ZIGZAGGERS!":F=26:GOTO3005
8000 PRINT"■■THE GRUESOME GAMBLER!!":PRINT"■■HE CHALLENGES YOU TO THROW A";
8005 PRINT" HIGHER OR":PRINT"■LOWER DICE ROLL.UNFORTUNATELY,HE WON'T"
8007 PRINT"■SAY WHICH UNTIL AFTER YOU THROW!!":PRINT"■YOUR LIFE IS THE STAKE."
8010 GOSUB9700:GOSUB9600:PRINT"■■■HE THROWS .....":
8020 A=INT(6*RND(1)+1):B=INT(6*RND(1)+1):PRINT"■■■■■■";A;"  AND  ";
8022 GOSUB9600:PRINT"■";B;" D=A+B:PRINT"  =  ";D:GOSUB9600
8025 PRINT"■■■ILL YOU TRY FOR A HIGHER OR":PRINT"■LOWER SCORE (H OR L)"
8030 GETA$:IFA$=""GOTO8040
8040 IFA$="H"THENA=6:B=6:GOTO8050
8042 IFA$<>"L"GOTO8030
8045 A=3:B=3
8050 A=INT(A*RND(1)+1):B=INT(B*RND(1)+1):PRINT"■■■YOU THROW....."
8060 PRINT"■■■■■";A;"  AND  ";
8062 GOSUB9600:PRINT"■";B;:A=A+B:PRINT"  =  ";A:PRINT"■■■":GOSUB9600
8070 GOSUB9600:PRINT"■■■THE BET WAS THAT HE WOULD SCORE ";
8072 B=INT(2*RND(1)+1):IFB=2THENPRINT"LESS!":GOTO8100
8075 PRINT"MORE!":GOSUB9700:IFD>ATHEN8200
8080 GOTO8150
8100 GOSUB9700:IFD<ATHEN8200
8150 PRINT"■■CURSES!! YOU WIN!":GOSUB9600:GOTO270
8200 PRINT"■■HA-HA!! YOU LOSE!":GOTO9800
9000 PRINT"■■■■■■■"
9010 PRINTTAB(10);LEFT$(P$,12)
9020 FORN=1TO2
9030 PRINTTAB(10);"■  ■  ■  ■":NEXT
9040 PRINTTAB(10);LEFT$(P$,12);"  ■■■■"
9050 FORN=1TO2
9060 PRINTTAB(10);"■  ■  ■  ■  ■  ■  ■":NEXT
9070 PRINT"IN ";LEFT$(P$,24);"  ■"
9080 PRINTTAB(10);"■  ■  ■  ■■■■■■■■■■IT"
9090 FORN=1TO3
9100 PRINTTAB(10);"■  ■  ■  ■  ■  ■":NEXT
9110 PRINTTAB(10);"■  ";LEFT$(P$,18)
9120 FORN=1TO2:PRINTTAB(10);"■";TAB(19);"■  ■  ■  ■":NEXT
9130 PRINTTAB(10);LEFT$(P$,21)
9140 POKEP,83
9150 PRINTAB(15);"■NIGHTMARE PARK■"
9160 RETURN
9500 PRINT"■";:FORN=1TO7:PRINT$:NEXT:RETURN
9600 FORN=1TO2000:NEXT:RETURN
9700 FORN=1TO4000:NEXT:RETURN
9800 GOSUB9600:PRINT"■■■■■NIGHTMARE PARK CLAIMS ANOTHER VICTIM!!!"
9802 GOSUB9810:END
9810 FORN=1TO20:GETA$:NEXT:RETURN
10000 PRINT"■■YOU FELL INTO THE ABYSS!!":GOTO9800
12000 PRINT"■■■YOU BEAT THE PARK THIS TIME":PRINT"■BUT NEXT TIME....."
12010 GOTO9802
```

BLUDNERS

Apologies for not mentioning Ian Jones of the Mighty Micro in our Stringy Floppy review — he lent us the machine for the photographs.

In June's case study we erroneously gave Kestrel's phone number as Hitchin — it should have been Hemel Hempstead 69175. (Gulp! — Sorry Kestrel)

Young Computer World Program Cont. from Page 89

```
450 POKEP,65:POKEJ,32:J=P
460 D=D+1:IFD-7=INT(D/40)*40THENPOKEP,32:GOTO1000
470 POKED,43:POKED+1,61:POKED+2,45:POKEL,32:L=D
480 GOTO430
1000 REM MISSILE FIRE
1006 P=P-40
1007 IFP<32768THEN1030
1010 POKEP,65:POKEJ,32:J=P
1020 GOTO1006
1025 F3=F3+1
1030 POKEJ,32:GOTO320
3000 PRINT"■■THE ALIEN FLEET HAS PASSED,OUT OF 9      "
3001 PRINT"ALIENS"9-F3"WERE LEFT TO "
3005 PRINT:PRINT"ATTACK THE BASE"
3010 FORT=1TO10:GETR$:NEXTT
3011 IFF3>F4THENPRINT:PRINT"THIS IS THE HIGHEST SCORE SO FAR":F4=F3:GOTO3018
3012 PRINT:PRINT"TODAYS HIGHEST SCORE IS "F4" HITS":PRINT
3016 IFF3=9THENPRINT:PRINT"THE BASE IS SAVED YOU ARE A HERO!!!!!!!"
3017 IFF3=8THENPRINT:PRINT"THE LAST ALIEN CRAFT WAS DESTROYED ON ITS ATTACK RUN
3018 IFF3<2THENPRINT"THE ALIENS MADE A THOUROGH JOB OF IT,ALL IS LOST!!!"
3019 PRINT:PRINT"■RTO PLAY AGAIN PRESS ANY KEY■_"
3020 GETR$:IFR$=""THEN3020
3030 F3=0:E=0:GOTO01
4000 PRINT"■■YOU USED UP YOUR AMMO,OUT OF 9 ALIEN":PRINT
4010 PRINT"CRAFT,"9-F3" SURVIVED TO RAVAGE THE BASE"
4020 PRINT:PRINT"YOU DESTROYED "F3
```

```
4030 GOTO3010
10000 A=42:GOSUB20000:A=160:GOSUB20000:A=102:GOSUB20000:A=81:GOSUB20000:F=F+1
10015 F3=F3+1
10016 A=87:GOSUB20000:A=46:GOSUB20000:A=32:GOSUB20000
10020 GOTO70
20000 POKEP,A:POKEP+1,A:POKEP-1,A:POKEP+40,A:POKEP-40,A
20010 POKEP+2,A:POKEP-2,A:POKEP+80,A:POKEP-80,A
20020 POKEP+39,A:POKEP+41,A:POKEP-41,A:POKEP-39,A:RETURN
50000 PRINT"G♥"
50010 PRINTTAB(13)"SPACE DEFENCE!"
50040 PRINT:PRINT:PRINT" YOU ARE THE WEAPONRY OFFICER OF THE ":PRINT
50050 PRINT"ASTEROID BASE  AT THE TIME OF THE ALIEN "
50060 PRINT"ATTACK.
50065 PRINT"GRPRESS ANY KEYG-"
50066 GETR$:IFR$=""THEN50066
50067 PRINT"G♥"
50070 PRINT:PRINT"  YOUR SCANNERS TELL YOU THAT 9 ";PRINT
50080 PRINT"ALIEN SHIPS  ARE THUNDERING ACROSS":PRINT
50090 PRINT" THE SURFACE TOWARDS THE COMPLEX!!"
50100 PRINT:PRINT"   YOU HAVE TIME ONLY TO ENGAGE THE ":PRINT
50110 PRINT"WEAPONRY COMPUTERS,BUT NOT THE TARGET ":PRINT
50120 PRINT"COMPUTERS:-YOU WILL HAVE TO TAKE THE ":PRINT
50130 PRINT"ALIENS  ON BY YOURSELF AND ON MANUAL!!!!"
50140 PRINT" YOUR MISSILE SYSTEMS ,NUMBERED FROM ":PRINT
50150 PRINT" FROM 1TO9 ARE ACTIVATED BY KEYING IN ":PRINT
50160 PRINT"THE APPROPRIATE NUMBER ON THE KEYPAD,YOU"
50170 PRINT"HAVE TO SCORE A DIRECT HIT TO DESTROY ":PRINT
50180 PRINT"THE ALIEN CRAFT!!GRPRESS ANY KEY TO BEGING-G♥"
50190 GETR$:IFR$=""THEN50190
50200 GOTO10
60005 W2=W2+40
60015 POKEW3,32
60016 W3=E9
```

Note: G precedes a screen control key.

Getting it Taped Cont. from P. 71

0C60 File Number	(1)
0C61 Record Size	(1)
0C62 Read/Write Ind	(1)
0C63 Unit Number	(1)
0C64 Date	(3)
0C67 Response Code	(1)

Fig 8 OPEN block.

Using TSAM

To open a file the user program loads the file number of the file required into 0C60H. The Read/Write indicator (0C62H) is set to 1 or 2 according to whether an existing file or a new file is to be opened. In the case of a new file, the record size is moved to 0C61H whereas for an existing file, TSAM will set this from the file header block.

Having done this, a call can then be made to OPEN. This will communicate with the operator via the screen, telling him what files to load and on what deck and whether to engage the deck for reading or recording.

Having completed its task, OPEN will set the response code (0C67H) to reflect the result of the operation and return to the calling program at the instruction immediately following the call.

To write a record the file number is loaded in 0C60H and the record is moved to the buffer starting at location 0C78H. A call to WRITE is then made. Using the R/W control block which OPEN created, WRITE will know how much of the buffer to write and onto what deck.

To read a record, a call is made to READ having set 0C60H. READ will place the record in the buffer starting at 0C78H and a response code will be returned in 0C67H. This will indicate the end of the file when this is the case.

To close a file, simply set 0C60H and call CLOSE.

To those venturing into developing their own software — good luck. Should you need to know more do not hesitate to write to me at 229 Derby Road, Beeston, Notts. NG9 3AZ.

Super System cont. from page 73

whether played by the machine or not. Just for fun I allowed System III to have the pleasure of making the mating move this time(!) — (the asterisk before the move indicating that it was played by the computer).

Printout

System III was the first chess machine to observe all the important rules of chess. Long gone (by a year at least!) are the days when one could complain about chess computers which made illegal moves, could not castle or observe the formalities when it came to making 'en passant' captures. However, at the time of writing, System III is still, after almost a year, the only one which recognises the important rules concerning draws by three-fold repetition of position and under the so-called '50-move rule'. According to the latter rule a game is drawn after 50 moves by each side (100 ply) if in that time no pawn is moved and no piece is captured.

System III is also much better than any other machine on the market at solving chess problems. A problem is a composed position, not one which arose in the course of a game. You often see chess problems in newspaper columns and can recognise them by the caption which is always of the type 'White to play and mate in x moves'. System III can solve any problem, up to and including mate in 5 moves (9 ply).

My thanks go to Andrew Page and Michael Hicks-Beach of Action Gable, System III's UK distributors, for the loan of a complete system. Next month I shall be looking at Sargon 2.5. Since you will undoubtedly be going to the PCW show, why not take a look yourself at the programs competing in the First World Microprocessor Championship. I expect to be in attendance every day and look forward to meeting some of you there.

The main System III unit can be bought for about £150 and the entire system, complete with smart carrying case is available for around £400.

*Chess Champion Super System III is used as a trade name on the Continent; in the UK it is known as Chess System III/Chess Master, and in the USA as Chess System III/Grandmaster, hence my uniform reference to System III.

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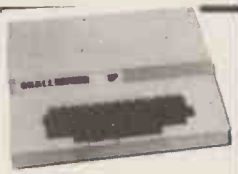

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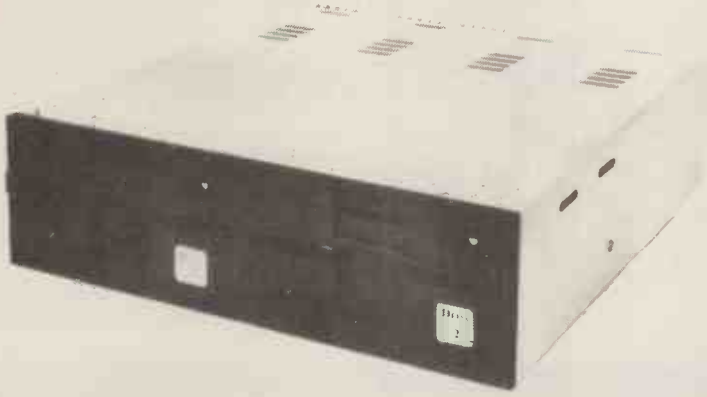

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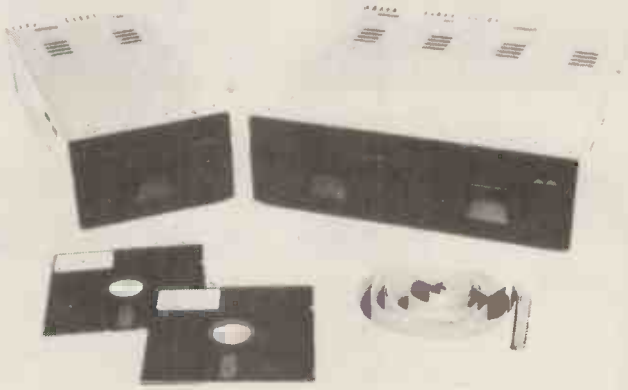

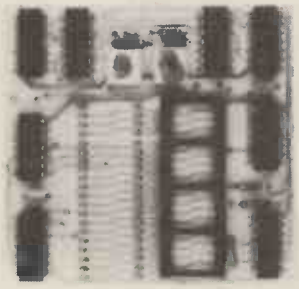

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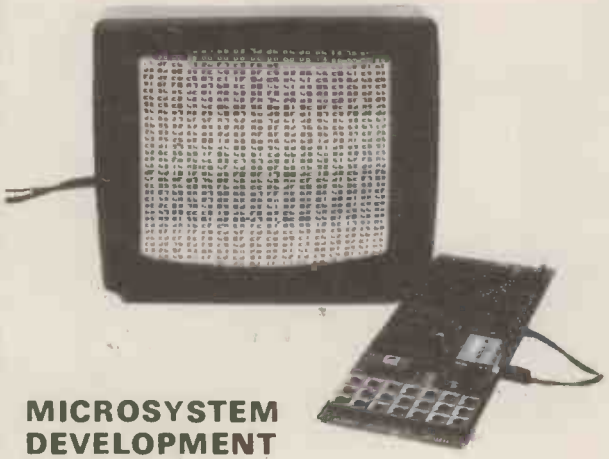

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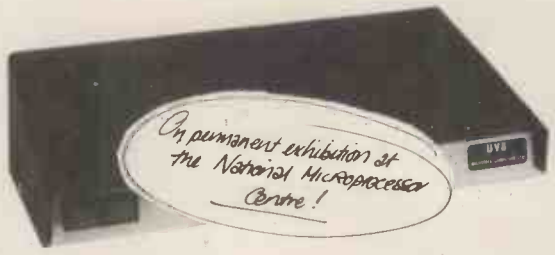

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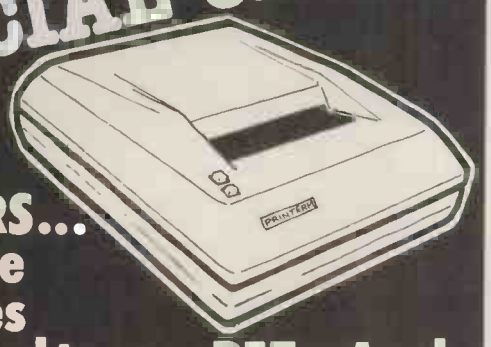

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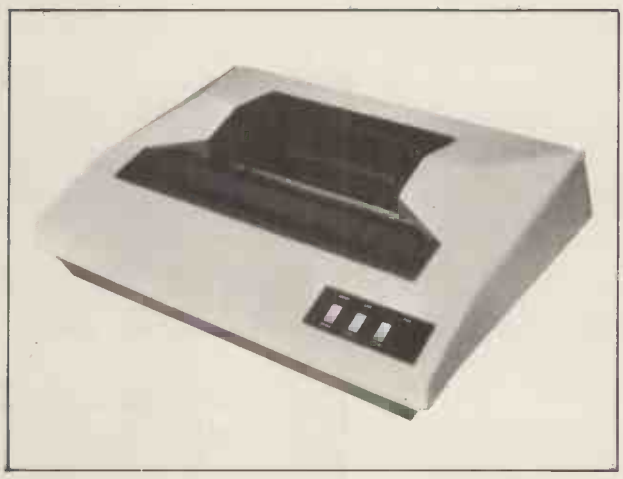

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CREATE KC$="CREATE O:MAILFILE,120,15,1: SYS 24600 This example tells KRAM to create an indexed file called MAILFILE on the disk in drive zero, with a record length of 120 characters and a key length of 20 characters which starts at position 1 of the record. KRAM looks at the RESERVED variable KC$ to identify the function and its parameters; the SYS call tells KRAM to execute the function. The record length can be any value up to 254 characters and the key up to 48 characters, a total of 302. KRAM packs as many records into the 255 character disk block as necessary.

OPEN KC$="OPEN O:MAILFILE": SYS 24579 This tells KRAM that we will want to make accesses to the file called MAILFILE on the disk in drive zero. KRAM returns in location zero (peek (0)) the file number by which this file can be accessed during the rest of the program.

ADD KC$="ADD 1,NA$,AD$": SYS 24591 This tells KRAM to add to file number one the data in variable AD$ whose key is NA$. For example in a mailing list, the key NA$ might be the name 'SMITH A.J.' and AD$ might be the address '120, HIGH STREET, ANYTOWN'. Any normal double character string variable can be used to denote the key and the record.

GET KC$="GET 1,NA$,AD$": SYS 24582 This tells KRAM to get from file number one the data belonging to the key NA$ and put it into variable AD$. In our example, if NA$ was 'SMITH A. J.', KRAM would read the address '120, HIGH STREET, ANYTOWN' from file and put it into variable AD$. If we weren't sure of the exact surname, we could give KRAM the key 'SM' and it would get for us the next alphabetically higher name beginning 'SM', together with its address! Or if we gave KRAM a blank key, it would find the first name and address on file.

READ KC$="READ 1,NA$,AD$": SYS 24585 This tells KRAM to read the data belonging to the next highest key following the name in NA$, and put it into variable AD$. In our example, a complete file of names and addresses could be read in alphabetical order, starting at any name in the file, simply by executing successive READ commands! For instance, having got Mr A. J. Smith from file, executing the READ command as above would get us say 'SMITH M.' in NA$ together with his address in AD$.

READ- KC$="READ-1,NA$,AD$": SYS 24585 This works like READ except BACKWARDS! It tells KRAM to read the data belonging to the next lowest key preceding the name in NA$, and put it into AD$. For instance, having read 'SMITH M.' with the forward read, executing the backward read as above would get us 'SMITH A.J.' in NA$ together with his address in AD$.

PUT KC$="PUT 1,NA$,AD$": SYS 24588 This tells KRAM to rewrite to file number one the data in variable AD$ which belongs to key NA$. For instance, if we wanted to change Mr A.J. Smith's address, we would simply set NA$ equal to 'SMITH A.J.', AD$ equal to his new address, and execute the PUT function.

DELETE KC$="DELETE 1,NA$,AD$": SYS 24594 This tells KRAM to delete from file number one the key contained in NA$ and its associated data contained in AD$. In our example, to delete Mr A. J. Smith from the file, we would simply set NA$ equal to 'SMITH A.J.', AD$ equal to his address, and execute the DELETE function. KRAM will release for further use the disk space made available by the deletion.

CLOSE KC$="CLOSE 1": SYS 24597" This tells KRAM that file one is finished with for now. KRAM updates the BAM on disk, but the file can still be used without another OPEN command.

INITIALIZE SYS 24600 This function is used at the beginning of each program to clear KRAM's work areas and buffers.

The examples above illustrate the use of KRAM in a mailing list application, with disk access times from less than one second. KRAM can of course be used in any application program with the Commodore disk where programmer time, user time and disk space are at a premium.

Each KRAM package includes a ROM which plugs into the middle ROM socket of the 16K/32K Pet, a demonstration disk with a mailing list program and a 40-page User Reference Manual. KRAM is available by post (cash with order) price £115 including VAT, or by credit card phone the KRAM 24 Hour Order Desk on 01-546 7256; or see your nearest dealer. (Quantity discounts available).

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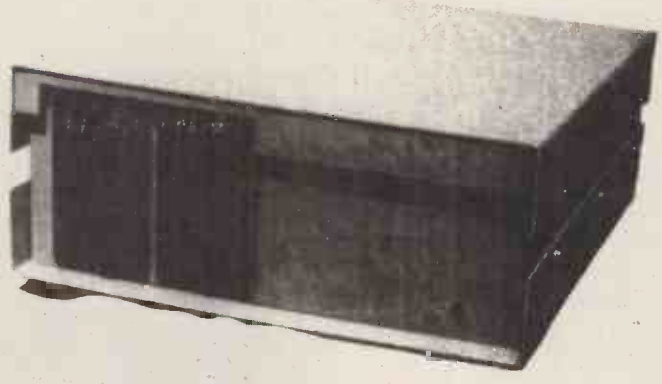

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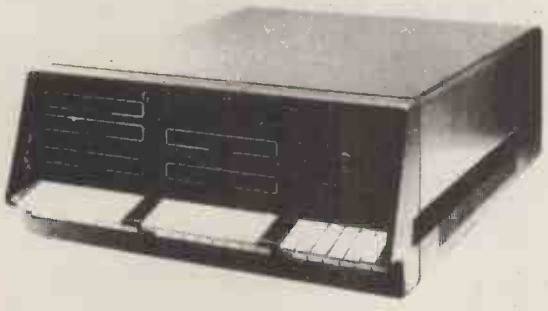

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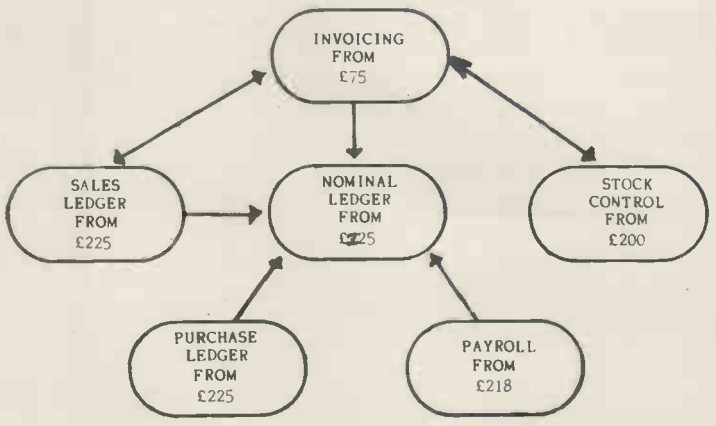

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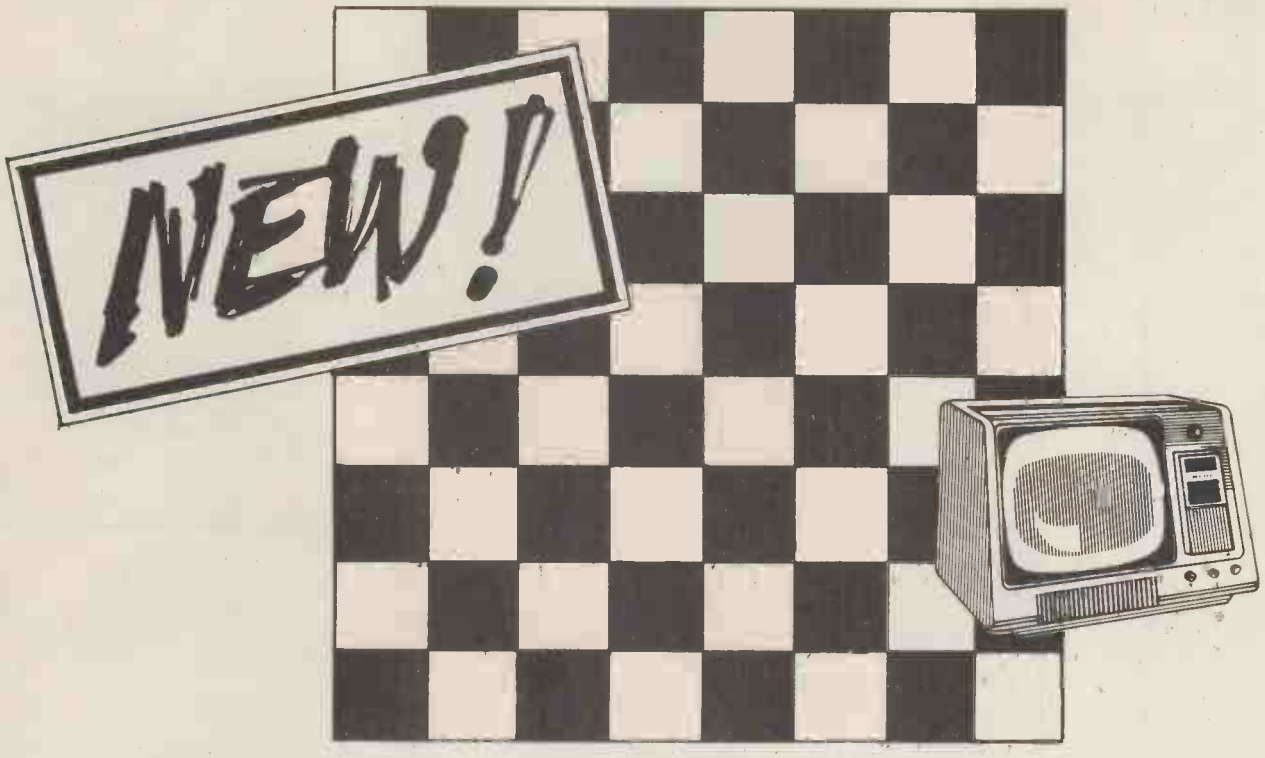

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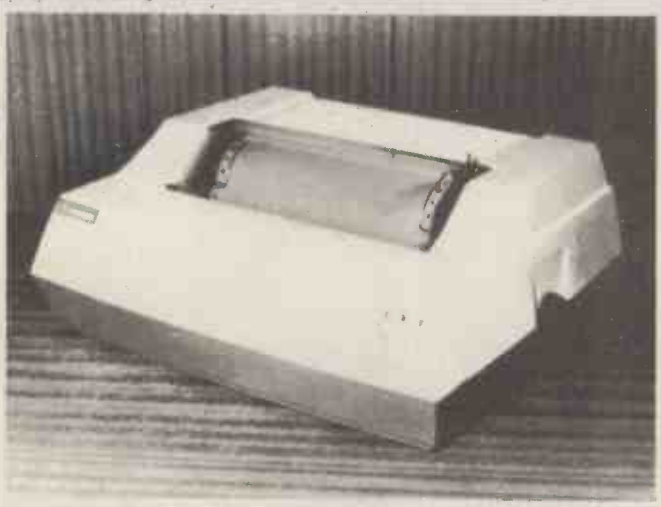

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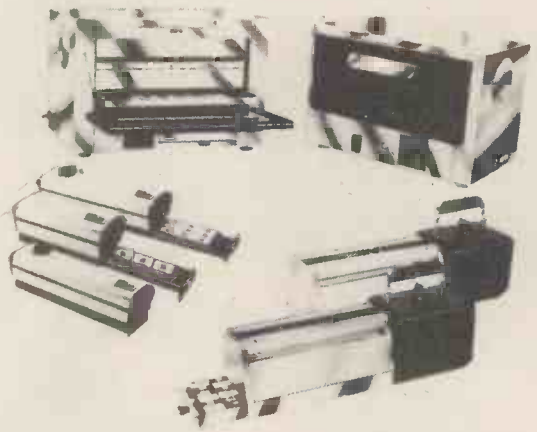

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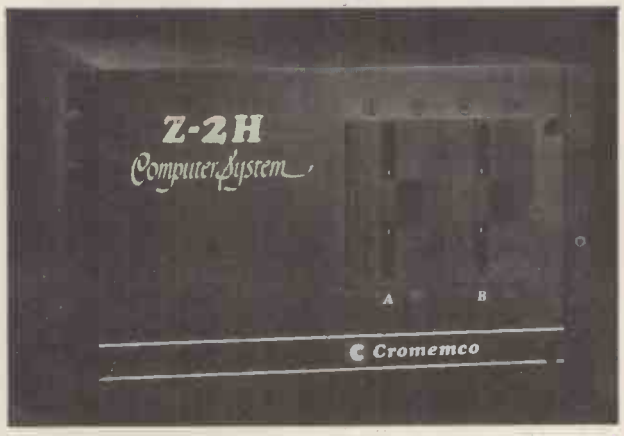

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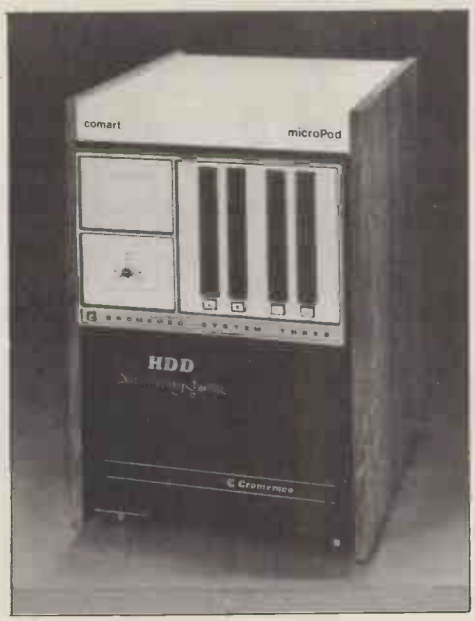

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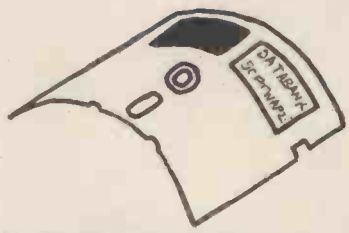

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PCW 162

ADVERTISERS INDEX

CHIP CHAT

Latest Microvictim to byte the dust is Abacus. It seems their backer backed out and the rumoured asking price is between £30,000 and £50,000, if you're interested; of course that doesn't include Derek Rowe's scarf...Newcastle comes to the coal! US magazine *Creative Computing* will be at the PCW show and Micronet, the American interactive personal computer network, is showing strong interest...Seen at the recent PETshow — 'Squire' Allason and 'Bumper' Harris deep in conversation. What can the dynamic duo be plotting now?...Talking of the 'Squire', why has microgossiper 'Inside Trader' of PET-dedicated *Printout* magazine written to ask if he can take over Chip Chat — does he need the money? Don't ring us, as they say...Having dropped the Sorcerer, Comp Shop's 'Spangles' Cary cut his losses by managing to fit the left-over disk drives to (wait for it) the Nascom II...*CPUCN* — the Commodore PET Users Club Newsletter — describes Baroness International (Commodore's PR hacks) as a *Pubic* Relations firm. No comment...Look out for news soon of a spectacular micro from, of all places, Brazil; called the Maleca IV, its preliminary spec looks outstanding, says our spy in the coffee fields...Bad news for those who know Martin Banks — a journalist — as 'Legless'; from now on, he tells us, he wants to be called 'Superstar'. Little does he realise that only those who write for PCW merit this accolade. Incidentally, the PCW random anagram generator calls him BAN ARM STINK. Who's next?... Commodore's latest marketing masterpiece is said to be a prerequisite that dealers must be moving £10,000 worth of PETs a month before they'll be permitted to sell the 80-column SuperPET. Micrononsense seems to be on a similar wavelength as, apparently, Apple dealers must also shift set quantities of Apple IIs before they can sell the Apple III; ITT 2020 vendors needn't apply, we're told...Broadcast over the PA at the PETshow, a reminder to exhibitors to refrain from calling the machine a 'PET' when talking to French visitors as it sounds like their word for 'fart'...*Info World* publisher John Craig now has room for expansion following the dramatic exit of three of his editors, Sam, Tom and Linda; PCW hopes it's business as usual; *Info World* isn't a bad rag...Room-letter Grand-Met extends its GRIP on microcomputing with the purchase of Hi-Tech, makers of S100 colour video boards. Look out for some interesting pub games, maybe...More Micrononsense! That worthy firm of Apple dealers has taken to sending out a booklet entitled *Computers in Education*. Unfortunately the first page illustration shows a classroom full of kids using PETs...We just received pages 49-60 of an update to a reference manual; unfortunately, nowhere, not even in the form of a covering letter, could we find the name and address of the sender. Only a telephone number provided a clue to the sender's identity — Molimerx. Now that's what we call confidence!...Our correspondent Steve Withers writes to ask if 'Gonzo Talbot' is the result of putting 'Guy Kewney' through the IBM data encryption algorithm.

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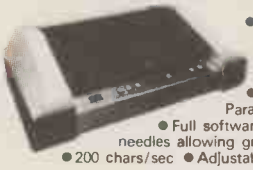

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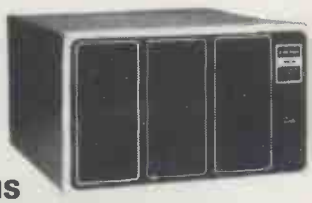

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