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85p February 1984
Volume 7 Issue 2

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Published by Electrical Electronic Press, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500. Telex/grams 892084 BISPRS G.

Distributed by Business Press International Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Subscriptions: U.K. £13 per annum; Overseas £19 per annum; selling price in Eire subject to currency exchange fluctuations and VAT; airmail rates available on application to Subscription Manager, Business Press International Ltd, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. Tel: 0444 459188.

Printed in Great Britain for the proprietors Business Press International Ltd by Eden Fisher (Southend) Ltd, Southend-on-Sea. Typeset by Centrepoint Typesetters, London EC1.

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Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £35 per published page. Submissions should be typed or computer-printed and should include a tape or disc of any program. Handwritten material is liable to delay and error.
Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

Who needs a top 10?

LISTS OF the top 10 records, cars, books and television programmes exercise a curious fascination. It is hardly surprising that a number of micro magazines publish top 10s or 20s of computers or programs.

At best a top 10 can provide three things: first, entertainment; second, an indication of which companies and/or products are selling; third, help in deciding which products might be worth looking at in more detail.

In the first case, it does not matter much if the list is accurate or not. Who cares if the 10 most beautiful words or top 10 tie-wearers really are or are not the top 10?

In the second case, however, accuracy is essential. A top 10 sales chart is worth only as much as the data on which it is based. Even then, a guide to sales is not necessarily a guide to success. For example, Texas Instruments has just dropped out of the home-micro market when, according to Dataquest, it was number 2 in the world after Commodore in the category of micros under $1,000. The company's recent huge quarterly losses show that even these sales were unprofitable.

In the third case, the value of even an accurate list is very much a matter of taste. There is not necessarily a connection between any of the items listed. All that *Coronation Street* and *This is Your Life* have in common, essentially, is that they are popular.

Neither is popularity a guarantee of quality. The *Sun* newspaper sells twice as many copies as *The Times, Guardian, Daily Telegraph* and *Financial Times* put together. This does not make it a more comprehensively reliable guide to world affairs. It is certainly a more accurate indicator of popular taste and is also cheaper, which counts for a lot in the U.K.

Yet in the microcomputer business there is nothing quite as strong as the bandwagon effect. The whole industry is crying out for standards, and quality may take second place to the widespread use which establishes a *de facto* standard.

Few people would claim that CP/M is the best possible micro operating system, or that in hardware terms either the Sinclair Spectrum or IBM PC represent the optimum hardware for games playing or business use. These products do not sell only insofar as they are good or bad: they sell because they sell.

Another factor is that, by and large, most of the people currently buying micros and software do not have the slightest idea what they are doing. It is easy to buy, say, a Commodore 64 without knowing it needs a considerable amount of programming just to draw a straight line. It is easy to order an Electron without considering how joysticks, discs and printers can be plugged into it. That is not to say that these are rotten machines, but it is the case that most of the people who buy them are, in computer terms, innocents. The problem is that a list of best-sellers can be used to avoid thinking about what is being purchased. "Thousands of other people have bought it so it must be good" — if only that were true.

So top 10 lists are important in computing, and we only wish there was one we felt we could rely on. Unfortunately a reliable guide is only likely to come from the independent analysis of confidential sales figures. In the current market, where whopping lies are far from unknown, which companies would be willing to release them, and to whom?

The Computer Retailers Association, as desperate for information as the rest of us, is trying to answer this very question. It is possible the CRA will produce a guide, at least to the best-selling business software.

It would be a start. We live in hope. µ

5 Years ago...

Commodore has reduced the price of its Kim 1 to £99.95. This price puts it well in the range of students, hobbyists and schools, but it remains ideal for control applications and training industry.

Commodore stresses that the Kim 1 is not a kit, but a complete microcomputer with a fully assembled PC board, needing only a power supply to operate. Based on the MOS 6502 microprocessor, it has 2K bytes of ROM, 1K byte of RAM, a keyboard and six-digit LED display. The system can be expanded significantly, starting with the Kim 3 8K RAM memory boards (£193.32 inc VAT). This can be wired in by the user — all the required connectors are built-in — or attached more neatly by using a Kim 4 motherboard (£96.12 Inc VAT).

An ordinary audio cassette unit can be attached to provide auxiliary storage. All interface circuits provided on the Kim 1 board including a Teletype interface are ready for connection. If the Teletype has the facility, Kim can also handle paper-tape input and output.

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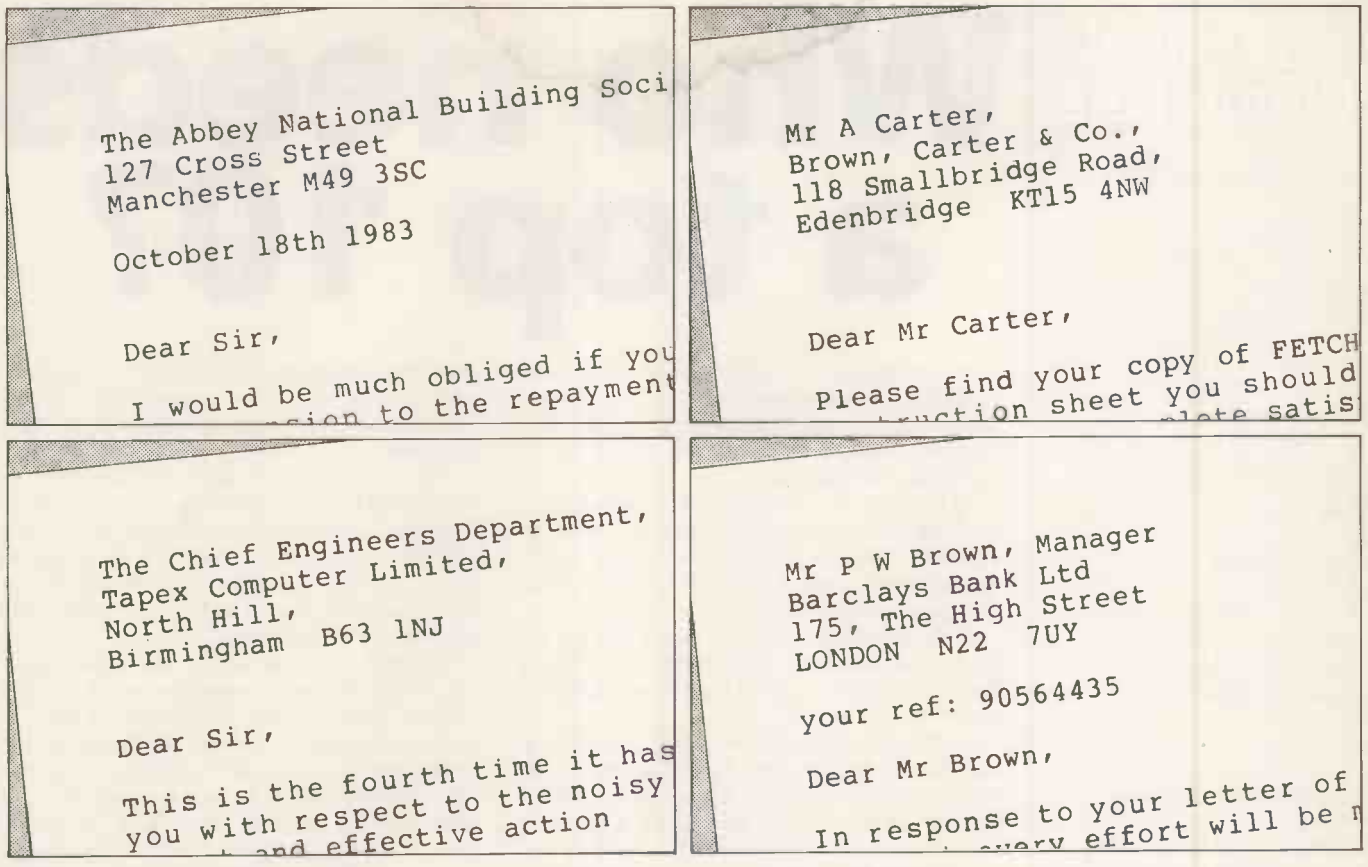

For £46, your word processor can get personal.

The trouble with most CP/M* word processors is that they can't work out who's who.

While they're fine at sending one letter to large lists of people, they're virtually useless for one-off communications.

In fact, getting one name from your name and address file is such hard work that your secretary probably retypes it every time it is needed, wasting time, money and an expensive name and address file that is only used for mailing shots.

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There's no limit to the number of names and addresses that FETCH can handle, even if they are in Datastar format.

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Address _____

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War games

IN THE December issue of *Practical Computing* you reviewed several games, among them Eastern Front. You praise it as a good game with amazing graphics.

Is that all you have to say about it? After all, the object of the game is to plan the death of men most effectively. The player is encouraged to do better than Hitler while sitting in the armchair.

Children might believe that this is what war is like. Adults should know that war is no fun and Hitler is not JR.

Oliver Völckers,
Osnabrück,
West Germany.

● The Editor replies: Does the fact that Eastern Front offers a fairly accurate historical simulation of the Barbarossa campaign make it less acceptable than other war games such as chess, or make it more educational? What do other readers think?

HP Model 16

MANY THANKS for the copy of December's *Practical Computing*, and your review of the HP series 200 Model 16. I thought I had best let you know of a few inaccuracies which have crept in, just to keep the record straight.

HPL is not a version of APL, nor indeed does it resemble it. The nearest one can say is that it looks rather like a cross between Basic and Algol 60.

The Model 16, unlike some other members of the HP Series 200, cannot run Unix. Finally, the Basic manuals described are included in the cost of the system.

All of these are relatively minor matters and in no way spoilt my appreciation of your very good review.

Ron F Weeden,
Hewlett-Packard Ltd,
Wokingham,
Berkshire.

Bad service

I HAVE BEEN trying to use a 48K Spectrum to help in the day-to-day running of my dental practice for the last 12 to 14 months or so. I have written my own software, which I also sell to my professional colleagues in a small way. The system is now proving to be a great help.

However, one thing that has certainly not helped is the unhelpful and ill-mannered attitude of the majority of firms in the British computer hardware / peripheral industry. I no longer expect to receive replies to eight out of 10 letters of enquiry that I write, even though I always send an SAE.

When I eventually do find a firm that will condescend to soil its hands with the sordid business of actually selling me something, I no longer expect the things to function as advertised, if at all.

One of the latest offenders has been Kempston Electronics — a Centronics interface that had the driving software recorded on the leader tape of the cassette, and an interface unit that locked up the computer completely. These were eventually replaced, but two enquiries that I have made to the firm since then have had no reply. One of them was to ask why I cannot use the complete character set supplied with my printer, a Star DF-510, or even the complete character set of my Spectrum. The printer is recommended in Kempston's advertising as being completely compatible.

The other firm that I have had recent contact with is the Spectrum group. I phoned a number of the group's local dealers to enquire about the Viscount disc drives for the Spectrum and was greeted with ignorance, apathy and downright rudeness. One salesman was helpful — I expect he's been sacked by now.

I daresay we shall all soon be treated to the sight of the British computer retail and manufacturing trade wringing its collective hands, and bemoaning the fact that they are going out of business, while the Japanese — or whoever happens to be the latest scapegoat — are flourishing. Will I feel sorry for them? I'll leave you to guess the answer to that one.

I realise that my experiences are far from unusual — indeed, a lot of people will probably feel that I've got off very lightly so far. However, I don't see why we should have to put up with this situation. The money comes from our pockets, after all, and if the bad firms are constantly exposed, then maybe other customers will go elsewhere, until only the decent firms are left. My local Micromanagement dealer was most helpful recently when I was looking for a new printer — needless to say, he got my order.

W H Roberts,
Pencoed,
Mid Glamorgan.

IBM PC XT

PERHAPS you would care to note the following points relating to your review in the October issue of *Practical Computing*.

The use of the word Multiplan is invalid since it is more than eight letters long, so it is thus shortened by DOS to Multipla.

When creating a path, there should not be any spaces after the \ symbol. The current path can be checked simply by typing Path, when at command level. This would have shown up these points. The Path command is only for use in batch or command situations, and is not a default route to a data file if not in the current directory.

When searching for a file not in the current directory, DOS expects the drive letter as part of the file identifier; otherwise it only searches the logged drive. Furthermore, directory searches are carried out on each drive only by the previously set CHDIR pathways for the individual drive, and files that are actually in the volume may be invisible.

By keeping important files, such as utilities, in a specific directory and setting the appropriate path, it may be possible to use them from any current drive or directory position.

To a newcomer, the DOS 2.0 manual is without doubt an intellectual challenge second to none. It makes learning the Highway Code an exercise to be enjoyed in comparison.

Martin Guyer,
London SW6.

What about Tandy?

IN OUR FAMILY we have several systems which we use for the normal home-computing activities, and we often get asked for advice on purchasing computers. Therefore we were interested in Jack Schofield's article "Home Truths" and recognise the validity of his general principles.

Many journalists, including some in *PC*, mention way-out ideas such as the Spectrum and Microdrives for business use. A basic knowledge of business costs would show that a cheap unit and expensive labour are not cost effective. Any competent typist will double their output on a good keyboard, and the error-count on a poor machine will prohibit its use for business.

Where we would disagree with Jack Schofield is that the TRS-80 is, by implication, considered poor. It is a reliable machine that has suffered no significant compatibility problems for years and has a mass of good software at all prices. We consider that LDOS and Newdos 80 are superior to the DOSs available for the Apple and certainly the Commodore 64.

The ROM-based word processor of the BBC is simple to use but lacks the power of Scripsit, let alone Superscripsit; and Enhanced VisiCalc for the TRS-80 seems to have more commands than the Apple

(continued on next page)

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

(continued from previous page)
version. We have never bothered to add the high-resolution peripherals as colour and high resolution gobble up memory.

When our TRS-80 was destroyed by fire we had the opportunity to purchase some new equipment at the insurance company's expense. Sharing Jack Schofield's view that in a few years there will be much better machines, we chose to buy a Model 1 TRS-80 which was available from our local Tandy store, but added a non-Tandy 64K memory which brought the total cost to just over £200. A further £230 added a single disc drive.

During the period when we were without a computer, we were able to walk into any Tandy store and the management were pleased to let us use the demo machine. Despite the fact that Tandy is now using the Model 4, all our Model 1 software can be made to run under LDOS without problems. This, combined with the fact that Tandy actually makes a profit on computer sales and is therefore likely to stay in business, must make them at least a reasonable buy.

W Trayler,
Hornchurch,
Essex.

Calling by name

I WAS very interested to read John Hooper's article in the November *Practical Computing*. Calling subroutines by name certainly aids readability of Basic programs but, as I am sure many readers will have realised, in many dialects of Basic there are better ways of achieiving it.

If the line number in Goto can be an expression, as on the Atari, Spectrum or Oric, then Hooper's switching routine can be eliminated completely. Instead the subroutine names are simply the names of variables, initialised to the appropriate line numbers. For instance, in his example he enters subroutine Answer via

```
5040 SUB$ = "ANSWER":
  GOSUB 100
```

in the main program, and

```
120 IF SUB$ = "ANSWER"
  THEN 1200
```

in his switching routine. We can streamline these by

```
5040 GOSUB ANSWER
```

plus an earlier initialisation statement

```
ANSWER = 1200
```

The result is clearer to read and more efficient.

If this is not permitted, many dialects — Commodore is one — allow the switching to be improved by means of On Goto, which is much more efficient than a string of If statements. The switching routine is now a single statement:

```
100 ON SUB GOTO 100,
  1200...
```

the jumps to the switching routine look like

```
5040 SUB = ANSWER: GOSUB
  100
```

and we still need an earlier initialisation like

```
ANSWER = 2
```

Admittedly, in neither of these methods can we pass arguments by concatenating on to the subroutine name, but surely it is anyway clearer and more efficient to use a separate argument variable? Referring again to John Hooper's example, the line:

```
1260 SUB$ = "DELAY01" :
  GOSUB 100
```

with the associated decoding exercises

```
130 IF LEFT$ (SUB$,5) =
  "DELAY" THEN 1300
1310 DEL$ = RIGHT$ (SUB$,2):
  DEL = VAL (DEL$)
```

would be replaced by

```
1260 ARG = 1: GOSUB DELAY
```

in the first method; or, in the second method, by

```
1260 SUB = DELAY: ARG = 1:
  GOSUB 100
```

and no decoding is required. Furthermore, explicit argument passing is much better when the argument is not a constant, as is nearly always the case. Compare:

```
1260 SUB$ = "DELAY" +
  STR$(X + Y): GOSUB 100
1310 DEL$ = RIGHT$(SUB$,
  LEN(SUB$) – 5):
  DEL = VAL(DEL$)
```

with

```
1260 ARG = X + Y: GOSUB
  DELAY
```

or

```
1260 SUB = DELAY: ARG =
  X + Y: GOSUB 100
```

Tony O'Hagan,
Department of Statistics,
University of Warwick.

Commodore 64 bugs?

I HAVE JUST COMPLETED a writing *Study Guide to the Commodore 64* for Pitman Books and have discovered various bugs in the Commodore 64 and Vic-20 Basic ROM.

Commodore 64 owners should try

```
10 T = 1
20 T = T/2 PRINT T : GOTO 20
```

to produce a long sequence of numbers, becoming smaller. After a time the numbers go to zero:

```
5.87747176E – 39
2.93873588E – 39
0
```

which is what should occur. Altering the value of T in line 10 to –1 while keeping line 20 exactly the same, produces a sequence which ends

```
– 1.17549435E – 38
– 5.87747176E – 39
2.93873588E – 39
0
```

which is in no way correct. There should not be a change from a minus to a plus.

Now try

```
T = 4.25352959E + 37 : PRINT
*2
```

to which the response is

```
?OVERFLOW ERROR
```

Entering Print T + T produces the value 8.50705917E + 37.

For further interesting results try

```
V = 1.70141183E + 38 : PRINT V
V = (V/2) * 2 : PRINT V
```

to gauge the amusing possibilities open to the adventurous user.

Boris Allan,
Stockport,
Cheshire.

Not Julian, but Gregorian

I AM SURPRISED and alarmed to learn from your November 1983 issue, pages 161 and 178, that the present calendar is Julian. During my lifetime so far all calendars and diaries for use in this country have used the Gregorian, not the old-style calendar which was abolished in Britain and Sweden in September 1752.

Perhaps this explains why I am always about a fortnight behind in my work, but more likely someone has confused the Julian calendar with the Julian day used by astronomers. This day runs from noon to noon, not midnight to midnight, and starts on noon Monday –4712, ending noon, Sunday December 31, 3268. The cycle of 7,980 years then repeats, various lunar and solar cycles starting off again in step. Noon on January 1, 1984 is the start of Julian day 2,445,701.

However confused the nomenclature, Mr Wade's program rises above it. I have not tried it out, having neither an Atari nor the time, but line 70 is essentially Gregorian.

R A Fairthorne,
Farnborough,
Hampshire.

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This compute to be desig

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You.

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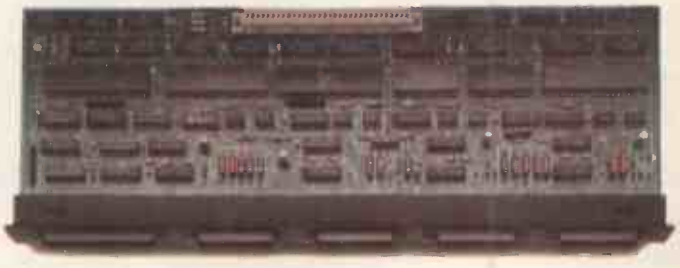
A couple of thousand pounds will buy a fully-fledged business computer system, including two disc drives and a high resolution monitor. And, quite free, over a thousand pounds worth of software: a package called 'Axis.'

It's capable of controlling stock, invoicing and keeping your sales, purchase and nominal ledger, and would almost certainly be the first software package you'd have to buy.

We've had seven years' experience of developing micros and software exclusively for business. (You won't find us in primary schools or amusement arcades.)

The result of which is the most flexible system ever offered – Octopus.



For an appreciably greater investment the ultimate Octopus starter kit offers the extra speed and capacity of a Winchester disc drive, integrated with the central computer.

Keep your options open.

This is where your designing comes in. (And the back of the box is where it goes in.)

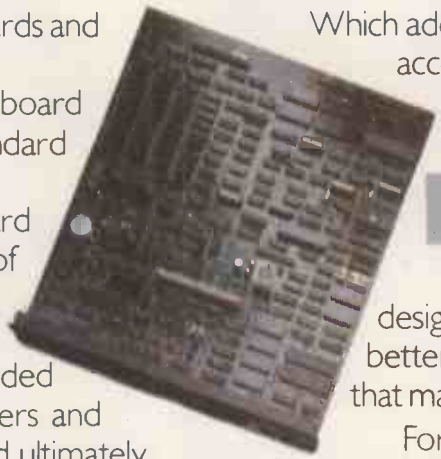
er is designed ned by you.

We've left room for four option boards and are offering, already, a choice of seven.

For example, a telecommunications board facilitates all kinds of links through the standard Telecom network.

A graphics board conjures up all kinds of shapes and sizes.

Others offer colour display, expanded RAM, links for printers and other peripherals and, ultimately, the ability to connect up an entire Octopus network.



And because you'll be able to get up-dated option boards, the Octopus system means you can keep your options open for the foreseeable future.

Better by a Zilog.

With all this inbuilt flexibility, we had to be doubly sure about the abilities of the central processor.

So we included two of them.

Namely the Intel 8088-2 and the Zilog Z80B.

In plain English (well, plainish), this means Octopus can operate both the tried and tested 8-bit programs and the new, faster 16-bit ones; even, if

necessary, switching between the two.

It can also speak five languages or more and work on any of five operating systems.

Which adds up to the fact that Octopus will accept virtually all of the business micro software that's currently on the market.

Hard-nosed software.

Not that we let that stop us from designing our own. And designing it better, with the kind of thoughtful detail that makes for real convenience.

For instance, we provide a mat to lay over the keyboard when its function keys are re-programmed. So you won't have to re-train staff to use a keyboard that says one thing and means another. Or re-train them whenever you up-date or expand the program.

An advantage, we might add, which you could only enjoy with a computer system that doesn't become obsolete or outgrown.

No matter what size of business you've got designs on.

Please send me details of the Octopus computer system.

Name_____

Position_____

Company_____

Address_____

_____ Postcode_____

Telephone_____

LSI OCTOPUS

The growing business computer.

To LSI Computers, Coose Rd., St Johns, Woking, Surrey GU21 1FX Tel: 04862 23411.

PC2/84

● Circle No. 105

Never before has so much been available from so little, to so many.

Never before in the history of modern computers has there been available a totally portable machine with the ability to cope with so many demands, to so many people, in so many different business areas.

Epson, with over 20 years experience in designing and manufacturing high quality printers, have produced the HX-20, a precision machine with its own rechargeable power supply that can be used for just about any task within todays discerning business: from data capture to word processing, from card indexing to sales order entry. Communicating with other machines is no problem and the HX-20 is easily coupled to one of our fine printers. You can even link in another main computer system by using an acoustic coupler.

Don't be fooled by its size, the HX-20 has all the software back-up you'd expect from a much larger machine and incorporates many "bigger computer" features – 16k RAM expandable to 32k with serial interfaces, a full size typewriter keyboard, it's own built in LCD screen and a dot matrix microprinter. A micro-cassette facility is available as an optional extra.

A complete computer that will either stand on its own or could be the obvious extension to your existing system.

More and more people are finding out just how big the small compact HX-20 is. Why don't you find out for yourself – you owe it to your business.

EPSON

Extraordinary product. Exceptional quality.

Epson (UK) Limited, Freepost, Wembley, Middlesex HA9 6BR.
Sales Enquiries: Freefone EPSON.
General Enquiries: 01-902 8892.
Telex: 8814169.

☐ I would like a demonstration of the HX-20 Portable Computer.

☐ Please send me details of my local stockist.

Name _____

Position _____

Company _____

Address _____

_____ Tel: _____

PC2/20

● Circle No. 106

Professional Tandy

TANDY CORPORATION has launched its professional micro Model 16B, with integral 1.25Mbyte 8in. floppy and a 15Mbyte Winchester. The cost is £5,999 including VAT.

The powerful Z-80A/68000 system runs under TRS-Xenix, a multi-user operating system that is said to be supported already by multi-user software. The system can be expanded up to 768K RAM and there is a user-accessible card cage allowing additional RS-232C cards to be slotted in for extra users. The model 16B comes with a 12in. screen, detachable keyboard and two RS-232C ports, as well as a parallel printer interface.

More information from Tandy Corporation, Tameway Tower, Bridge Street, Walsall, West Midlands WS1 1LA. Telephone: (0922) 648181.

TI business portable

TEXAS INSTRUMENTS has joined the portable bandwagon with the Portable Professional Computer. It is fully compatible with the desk-top version, and offers the same high-resolution graphics, colour options, memory-expandability and keyboard, but with a 9in. screen.

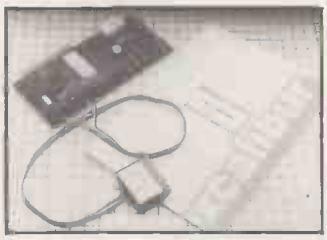
The system has an IBM-type configuration: 8088 processor, up to 768K RAM, with single or dual half-height 320K floppies. A 10Mbyte Winchester will be available shortly.

TI has also announced an 8087 maths co-processor option for both the Professional and Portable systems, and an Ethernet local area network for linking the Professional family with network file servers and printers. A further product, Ethermail, allows the LAN to function as an electronic mailbox, with messages and replies despatched instantly throughout the network. Programs, text or data files may be sent.

The TI Portable will cost from about £2,000. Further information may be obtained from Texas Instruments, Manton Lane, Bedford MK41 7PA. Telephone: (0234) 67466.

Baked Apples

IF YOU EVER thought of connecting a blast-furnace to your Apple, then Xcalibur Computers Ltd has the device



for you. The XTC module allows an Apple to read up to 16 thermocouples functioning over a range of 0°C to 500°C with a typical accuracy of ± 3°C.

The XTC costs about £120, as does the XDA four-channel analogue-to-digital converter which interfaces to an Apple slot. More information from Xcalibur Computers Ltd. Telephone: (0604) 21051.

Manchester fair

TO THE CASUAL VISITOR the Northern Computer Fair provided a daunting prospect: a large number of schoolchildren playing a seemingly endless range of computer games with eye-jolting graphics and mind-numbing sound effects. But as well as the beeping, flashing games there was a more serious side to the show which spelt out good business for the intrepid band of personal-computer suppliers and systems houses participating in the exhibition.

Speaking on the Newton Computer Furniture stand Roger Carrington of Microfactor Computerland said that the response was fantastic. "We have sold about 30 computers off the stand," he claimed, with one customer handing over a £5,000 cheque as a deposit on five hard-disc Wang computers. By the second day of the show orders had also been taken for 14 Portico Miracle computers at £1,800 each and Roger Carrington was a happy man. "It's a very good show. We're going to book for next year before we leave," he said.

Also pleased with the exhibition was Phil Cook of Umbra Software, a systems company specialising in Apple computers and add-ons. "There is genuine business interest and not just from small companies," he asserted. "We've made useful contacts with people from companies such as British Nuclear Fuels and Shell. If we don't pay for the exhibition over the next week, something's wrong," he said.

Some of the largest business micros at the show were being exhibited by LSI Computers North West. As well as demonstrating its older M-Two and M-Four Logical systems, the latter operating with OCR input, LSI was featuring the new Octopus multi-tasking micro, previewed on page 66 of this issue.

LSI dealer manager, Bob Wells-Gaston said that anyone looking for business systems had come to his stand. "There is a tremendous amount of interest in Octopus and we've got a lot of leads to work with," he added.

(More news on page 15)

Hardware flashes

● **Future Computers** has now added to its range of micros with the introduction of the FX-30 range including integral Winchester discs. Options range from 5Mbyte to 50Mbyte, and the entry price is about £3,000. Details from Future Computers Ltd at 01-683 0111.

● **Tandy** has announced its TRS-80 Model 2000 personal computer, powered by the Intel 80186, and running under MS-DOS. The new professional machine will offer Microsoft windows and an integrated applications package called Ovation. Plans for the U.K. launch have not yet been finalised. At the other end of the market, prices of the Color Computer have been cut. The 16K version now sells at £179, while a full £80 has been cut from the 32K price to bring it down to £299.

● **Krypton 400K** is a business machine from Transtec. It costs £995 including bundled software valued at £1,500. Contact Transtec at 01-247 1327.

● **Talking computers** for the blind are now available from John Bradburn Ltd. The machine from Maryland Computers Inc. includes a voice synthesiser and a Braille output device. More information (0604) 55142.

● **Hewlett-Packard** computer owners dying for a passive dongle — that is, one which requires no external power — are now served by Protek Electronics. The cost is about £200. Telephone: 01-834 3602.

● **Thomson-CSF**, the French computer company, has joined the gigabyte club with its read/write laser video disc GD-1001. The specifications are very close to those of the Shugart disc previewed in last month's *Practical Computing*.

● **Hard-disc options** can now be added to the 16-bit Orb machine without spoiling its elegant lines. Both 10Mbyte and 20Mbyte add-ons are available as either integral or external units. Prices start at £2,000. Details from ABS Computers at (0273) 421509.

● **Shugart Corporation**, not content to rest on its copious laurels, has developed a 3.5in. micro-floppy capable of storing 1Mbyte. A hard-shell cartridge with automatic spring-loaded shutter protects the disc.

● **Osborne U.K.** is by no means down and out, whatever its American relative is doing. It has launched a disc upgrade for the Osborne which doubles total capacity from 400K to 800K. Details from Osborne at (0908) 615274.

● **Inmac** has produced a 64K printer buffer suitable for the IBM PC, Apple, TRS-80 in conjunction with many leading printers. It costs £225. Contact Inmac at (09285) 67551.

"This One Decision Saved our Business and Grossed over $1,000,000. in Sales"

So said the chairman of an American manufacturing company. Read what else he had to say. . . .

"In 1979, our recreational manufacturing business was booming. And we had developed a new product that looked like a real winner. The new product was extremely important, in that it appeared to be the answer to a seasonality problem associated with our other product lines.

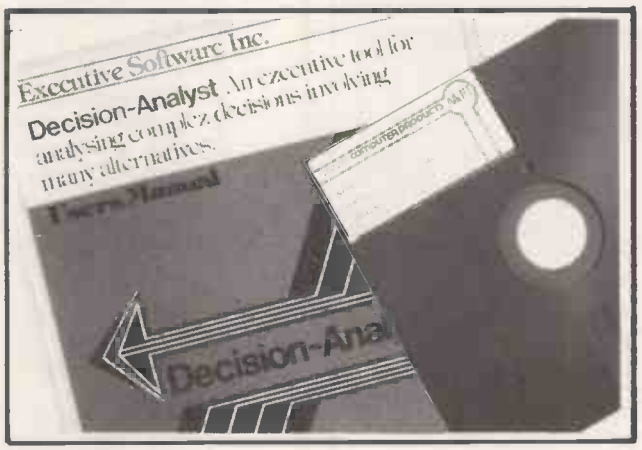
By early summer, our order book was bulging. It really looked as if our off-season sales and production problems were over. Then just as quickly the roof fell in. Gas shortages devastated the recreational vehicle market overnight. And our order book for over two million dollars worth of the new product disintegrated.

Faced with a fall and winter of virtually no sales, many thousands of dollars of unneeded parts and excess production staff, I had no choice but to shut down the production lines. And if a solution to our problem couldn't be found, the business itself was in jeopardy.

A life saving decision

I spent many sleepless nights trying to come up with a solution to this nightmarish situation. Then I remembered a course I had taken in decision analysis. I spent the rest of that night reviewing course material and other books I had bought on the subject. The next day, I called an emergency meeting.

Using the decision making techniques I had learned, we spent the rest of the week searching for and analysing potential solutions. The net result was that not only was the company pulled back from the brink of destruction, but we added over $1,000,000.00 in gross sales during that off-season.



A way of life

From that point on, almost every critical decision (and there were many) regarding new products, marketing channels, pricing, advertising, production equipment, engineering projects, received this same type of analysis.

Although the process was very time consuming and clumsy, because it had to be done by hand, our decisions were much improved. And there were some real benefits that we had not anticipated.

1. Our understanding of each problem was greatly increased.
2. We uncovered opportunities that we would not have thought of in any other way.
3. Our decisions were documented, preventing us from slipping off the selected path or 'rehashing' the same things over and over.
4. Consensus became easier because we were forced to focus and resolve each part of the problem, one piece at a time."

The birth of Decision ~ Analyst ™

Decision ~ Analyst was created because the process of evaluating complex decisions with multiple alternatives and many criteria is very tedious and time-consuming if you do it on paper. And doing it in your head is virtually impossible.

Any complex decision usually requires multiple revisions to criteria, alternatives, weights and values assigned to them. If done manually, the ordeal of rewriting, recalculating and redocumenting tends to discourage revisions, thus producing poor results.

Decision ~ Analyst overcomes these problems by asking for the minimum input possible from you, in the correct sequence. It leads you step by step through the decision making process, then does all the necessary calculations and produces polished reports without any further effort. And all of your input is stored on your disk so that revisions and updates can be made easily at any time.

Comprehensive but easy to use

Decision ~ Analyst is probably the easiest program you'll ever use. You can literally learn to operate the program using only the 'help' screens. But it comes with a thoroughly indexed manual which includes many pages of examples plus a step by step guide to the decision making process.

And Decision ~ Analyst is no fly-weight. It uses over 100,000 bytes of fast compiled code and a 40,000 character help file. The program is extremely 'bullet proof' and does all the work . . . you do the thinking. And there is no danger of missing a critical step because your analysis is guided through each of the eight menu-driven sections.

Endless opportunity for use

If you're saying to yourself that you really don't have any earth shattering applications for Decision ~ Analyst . . . then consider this. If you're in business, chances are that the most important thing you do is make decisions.

Decision ~ Analyst can help you select key personnel, decide on new machinery or equipment, prioritize major projects and allocate resources, choose a new product or a better price strategy, select new offices or plant locations, select the most profitable marketing channel or the best piece of computer hardware or software. Use it to analyse any decision which has more than one viable alternative.

In your personal life, it can help you choose the best job, select the right business, career or franchise, determine the best field of investment or even the right home, boat or car. In fact, improving your decisions is probably the most rewarding thing you can do.

Let us help you make a £120 decision

If there's a chance that Decision ~ Analyst could help you improve even one decision, would it pay for itself? Chances are it would. In fact, it's likely that it could save you the price many times over!

So why not take advantage of this opportunity by calling us today. We know you won't regret it.

Available for virtually every make of micro-computer using CP/M, CP/M-86, MS-DOS or PC-DOS operating systems. Requires an 80 column screen and an 80 column printer for reports.

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Intertec Headstart

INTERTEC'S 16-bit Headstart, successor to the Superbrain, is now distributed by Icarus in the U.K. Combining eight- and 16-bit processors, the machine offers one 0.5Mbyte micro-floppy as standard, together with 512K RAM. Both can be upgraded to 1Mbyte. A key feature is the RAM-disc option whereby the RAM may be partitioned into a virtual-disc area.

The system has been built with networking in mind. Four stations and a 10Mbyte file

server will cost about £10,000. The basic 512K system, complete with 12in. screen and detachable keyboard, costs £2,895 plus VAT.

Further details from Icarus Computer Systems Ltd, Deane House, 27 Greenwood Place, London NW5 1NN. Telephone: 01-485 5574.

Koala graphics

A GRAPHICS PAD for the Commodore 64 has been produced by Audiogenic. The Koala Painter allows colour graphics to be drawn, stored and manipulated using menus of commands. As well as drawing with a stylus on the 4in. by 4in. pressure-sensitive pad, standard routines for lines, circles, etc. can be called, and colours added successively. Individual portions of the

screen can be blown up and worked on in detail.

The system is disc based and costs £89.95 including VAT. The curious name apparently stems from the original American designers. Further details from Audiogenic Ltd, PO Box 88, Reading, Berkshire RG1 2SN. Telephone: (0734) 595647.

Bromley's Superstar

SUPERSTAR 16 is a 16-bit multi-user system from Bromley Computers. It has an interesting dual-processor architecture surrounding a 16-bit master processor. Multi-user units can be added by buying additional eight- or 16-bit processors which plug inside the main Superstar unit. Terminals are then connected and may be run as independent systems. This contrasts with the normal system of distributed processing power in the terminals.

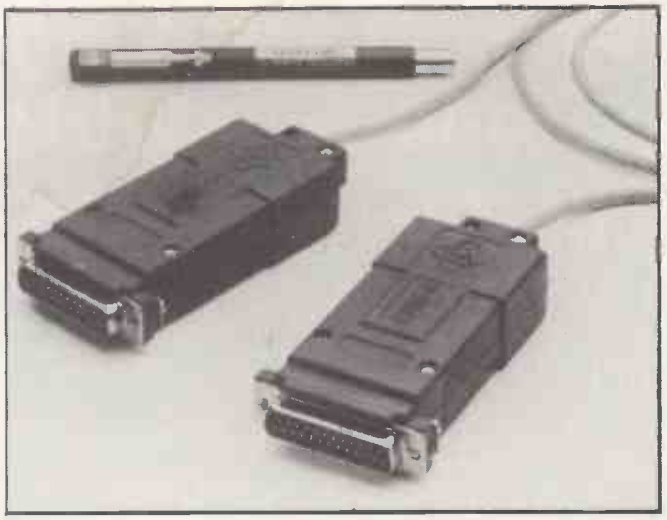
The new machine runs CP/M, MS-DOS and Xenix. Bromley Computers has

produced a range of applications software.

The entry system comes with an eight-bit slave, 10Mbyte Winchester, one 400K floppy, screen and keyboard, and costs £2,450. Up to 16 users can be accommodated sharing a Winchester storage capacity of 160Mbyte. Further information from Bromley Computer Consultancy Ltd, 417-421 Bromley Road, Bromley, Kent. Telephone: 01-697 8933.

Micro modem

A NEW low-cost ultra-miniature modem measuring just 4.5cm.



by 2.2cm. By 10.6cm. has been produced by Tech-Nel. Designed for short-range data transmission up to 25km., the unit requires no power supply or batteries.

The modem plugs directly into the standard RS-232C port and is powered from signals emitted by the host machine. Transmission rates of up to 19,200 baud are possible. A pair of SRM-6 units costs £140. Contact Tech-Nel Data Products Ltd. Telephone: (0295) 65781.

Removable Winchesters

COUNTRY COMPUTERS has extended its range of computers with the C-3010, featuring one fixed Winchester and one removable cartridge version. This particularly lends itself to security-sensitive data and situations. The Z-80A system can be expected to run with 192K RAM using bank switching. A multi-user version is also promised later in the year.

The 5+5Mbyte system costs £4,500 plus VAT; a 10+10Mbyte version is planned.

More details from Country Computers Ltd, Pipers Road, Park Farm Industrial Estate, Redditch, Worcestershire B98 0HU. Telephone: (0527) 29826.

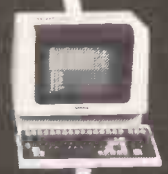
Xmas cheer

AT A SPECIAL ceremony held to celebrate the millionth Spectrum rolling off the production line on December 9, Sir Clive Sinclair was given his Christmas present a little early. Yes, it was a Spectrum.

Oric also obtained a useful Christmas bonus in the form of £4 million raised through its new parent company called Edenspring. The money will fund new developments and a substantial advertising campaign.

A multi-user CP/M compatible system with high performance and reliability.

The Sirton MIDAS-MPS



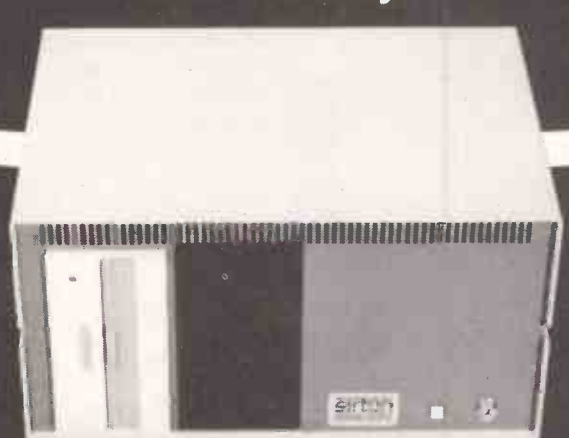
Sirton Computer Systems' new Distributed Processing System; MIDAS-MPS, has been specially designed to be a flexible, multi-user system. Each user terminal added to the system has its own local processor, expanding the computing capacity of the system. The MIDAS-MPS is CP/M compatible,

has sophisticated password protection, it is easily installed and, as with all our systems, reliable.

If you'd like to learn more about MIDAS-MPS why not write or 'phone for our leaflet which includes full specification. We'd be pleased to help you with your enquiry.

Features:

- ★ CP/M Compatible
- ★ Multiple Directories with Hierarchical Access
- ★ Easily Expandable
- ★ High Throughput
- ★ High Speed Communication
- ★ Individual Processors at each Terminal
- ★ Easily Installed
- ★ Reliable
- ★ User Friendly



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Sirton computer systems

Sirton Computer Systems
Unit 14, 29 Willow Lane, Mitcham, Surrey, CR4 4NA. Telephone: 01-640 6931/2/3

● Circle No. 108

If your microcomputer job involves managing information, you'll need a Compsoft Data Management System. It's your guarantee that computerisation will be a success.

Compsoft are world leaders when it comes to easy to use database programs. There is nothing quite so genuinely user friendly, and nothing quite as powerful. And Compsoft were the winners of the 1983 RITA (Recognition of Information Technology Achievement) Awards 'Software Product of the Year'.

We can give your *Computer the power to breeze through the management of any record keeping situation, – effortlessly, efficiently, and more accurately than you ever dreamed possible. From sales ledger to stock control, purchaser ledger to personnel, clubs to customers, and in a thousand other ways, we can lend a helping hand.

You don't have to be a computer expert to use Compsoft's DMS or Delta. Both programs offer fast, accurate and elegant database power for both first time computer users and professional systems designers.

You owe it to yourself to know more. Either return the coupon to us, or simply telephone the office and we'll send you a complete guide to our versatile database programs – today.

* Delta is available for almost any microcomputer with the MSDOS, PCDOS, CP/M, or MP/M operating systems, including IBM, DEC Rainbow, SIRIUS, XEROX, ICL, EPSON and many others.

DMS is also available for Commodore computers.

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Shamley Green
Nr Guildford, Surrey
England GU4 8QZ
Telephone: Guildford (0483) 898545
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SEE OUR COMPLETE RANGE AT THE "WHICH COMPUTER? SHOW" N.E.C. 17-20 JAN 1984

This is Sanyo's new range of normal to high resolution graphic display monitors. Designed for the customer who specifically demands a high quality product at a realistic price.

A complete range in every sense (size, colour capability and input versatility) that has evolved directly from the experience and advanced technology of one of the

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Return to Marketing Department, Sanyo Marubeni (UK) Ltd, Sanyo House, 8 Greycaine Road, Watford, Herts.

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PC2

TIPS, THE KEY TO A GE OF DATA MONITORS.

world's leading colour television and computer product manufacturers.

A range that's available now at your fingertips.

If you're investing in business micros for the first time, or just simply extending your present system, phone STC on 0279 26777 or Micro Peripheral on 0256 3232.

Alternatively, clip the coupon and we'll tell you all about Sanyo, the key to a complete new range of data monitors.

SEE SANYO, THEN DECIDE

SANYO

SOFTWARE AND TECHNOLOGY 4

A disk for every micro. While 8-bit micro-computers may boast a 'standard' operating system, one of its gravest shortcomings has been the lack of a common disk format. It has meant that data created with the same software package but on different computers could not be moved from one machine to another running the same operating system. With 16-bit micros running MS-DOS, this situation has been remedied. MS-DOS uses one data format common across all machines. This means that files from Multiplan or documents from Microsoft Word are completely transferable between any MS-DOS micros.

Enhancing high-level languages. Today's computer hardware offers a staggering array of new facilities, particularly where graphics and sound are concerned. As hardware develops, software writers have a choice between buying a special package just to achieve the most rudimentary on-screen graphics or music, or using a high-level language with built-in graphics and music commands. In fact, it would be foolish to expect proven languages like BASIC not to evolve as hardware becomes more sophisticated. With the latest version of its GW BASIC Interpreter, Microsoft has enhanced BASIC one step further for this new hardware. The language has a large number of graphics and sound extensions supporting new input devices such as joysticks and light pens, with graphics commands that can rotate defined objects at will on the screen, and the ability to open windows and see objects shrink or expand automatically as window sizes alter. The combination of advanced hardware and software like GW BASIC means that programs written in Interpretive BASIC can now run at speeds approaching those of programs written in lower-level languages. Features of this type would have been unheard of two years ago – but just think what sort of facilities may be available in tomorrow's high-level languages.

Europe's leading Financial Planning package. Even though the European Economic Community sometimes finds it hard to agree just who pays how much to whom and for what, it has at least reached a firm decision on one aspect of financial planning. When it comes to spreadsheets there appears to be great accord between France, Germany and the UK. Microsoft's Multiplan, translated to work in the natural languages of those countries has come out as the number one European spreadsheet package. According to a recent European survey in one of the monthly computer journals, Multiplan has emerged as the favourite spreadsheet. Microsoft has brought the same linguistic resources to bear on Word, its text processing package, and hopes that in 1984 Word will achieve the same international success as Multiplan.

How does a standard evolve? The microcomputer industry has traditionally established its standards by two routes. The S-100 bus, MS-DOS and 8-bit CP/M evolved while some manufacturers have consciously attempted to set standards as with the Ethernet network and the 3.5" Winchester disk format, hoping that others will follow in their footsteps. There has, however, recently been a new approach. At the end of 1983, an unprecedented commitment was made by 23 of the industry's leading microcomputer manufacturers to a new product from Microsoft. The product was Microsoft Windows – an enhancement to the MS-DOS operating system. Never before in microcomputing history has such a forceful public committment been made to one product. Companies like DEC, Wang, Tandy, Apple/Rana, Altos, NCR, Compaq, TeleVideo and Eagle will all be offering the product on their MS-DOS based micros in 1984. More recently, the UK's leading 16-bit microcomputer manufacturer, ACT announced that it too, would be supporting Windows on the hugely successful Apricot. By mid-1984 we will be reaping the benefits that such standardisation offers – portable software running in the same manner on different machines; integrated software with different applications running together on the same machines; and software that's a whole lot easier to use.

MICROSOFT

Microsoft Ltd, Piper House,
Hatch Lane, Windsor, Berkshire.

● Circle No. 111

Digital Research's new language strategy

DR FORTRAN 77 is the first of five planned new language compilers from Digital Research. Pascal, C, PL/1 and CBasic compilers will follow shortly. All these languages will use a new compiler writing technique which promises to increase the portability of application programs between systems, and to make new language compilers available more quickly across the range of microcomputers.

A major problem facing a system-software company like Digital Research is the number of different operating systems and processors used on microcomputers. Suppose seven language compilers were to be produced to run under, say, four different operating systems on micros built around the 8086, 8088 and 68000 chips. This means producing, if not quite 84 separate products, still a large number of completely different pieces of code.

Digital Research's new approach is to split each compiler into two, with a front-end syntax processor and a back-end code generator. This way the front-end syntax processor only has to be written once for each language. The Digital Research front-end processors all generate a common intermediate language. This CIL code is then fed into the back-end code generator for each operating-system/processor combination to produce the final optimised machine-code program.

Although this approach is not new — it has been used with mini and mainframe languages for years and is reminiscent of the Pascal p-code system — Digital Research's across-the-board use of the technique represents a further growth of professionalism in the microcomputer software market. The advantage to language users claimed by Digital Research is that source code written in a given language on one system will work across the complete range of micros.

Designed for scientific and engineering programmers, DR Fortran 77 supports 32-bit real numbers and runs programs up to the 1Mbyte addressing capacity of the 8086 and 8088 processor family. On smaller systems large programs can be overlayed in 128K chunks. Digital Research says the new compiler is a full implementation of the ANSI-77 Fortran standard.

Concurrent CP/M and CP/M-86 versions should be available immediately, and MS-DOS and IBM PC versions are promised for March, priced at £385. Further versions will probably follow, with Unix high on the list.

These products will be available through retail channels, but if you require further information Digital Research's telephone number is Newbury (0635) 35304.

Commodore/ Atari program generator

HOME FILEWRITER is a program generator for disc-based Atari and Commodore 64 systems. It will be most useful for database applications. The user types a layout on to the screen and Home Filewriter then generates the necessary code. A typical application would be club membership records.

Home Filewriter costs £39.95. Details from Dynatech Microsoftware, Rue du Commerce, Bouet, St Peter Port, Guernsey, Channel Islands. Tel: (0481) 20255.

Applesoft compiler

THE EINSTEIN compiler is for Apple IIe and Apple II Plus disc-based systems. It is an optimising compiler for translating Applesoft Basic programs into Apple machine code. The £89 utility program supports the full range of Applesoft and DOS 3.3 commands, including high- and low-resolution graphics and shape tables.

Details from Pete and Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 212321.

Version 3 of The Last One

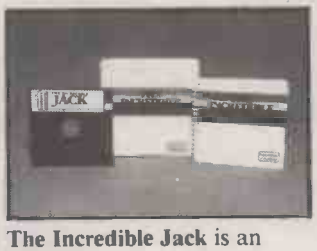
VERSION 3.0 of The Last One — which must surely be a contradiction in terms — is now out. The Last One is a program generator, and one of the most heavily publicised programs of all time. Version 3.0 has several enhancements, including the ability to have final programs in any national language. It costs £330 for the IBM PC, Apricot, Sirius, DEC Rainbow, Orion and most CP/M machines, and £199 for the Apple II Plus and IIe.

Version 2.0 of The Last One is still available for the Commodore 64, with disc drive, for £85. Contact D J Al Systems, Station Road, Ilminster, Somerset TA19 9BQ. Telephone: (04605) 4117.

(More news on page 23)

In brief

Battle 1917 is a World War I strategic simulation game for several players, running on the Spectrum. The price is £6 from Cases Computer Simulations. Telephone: 01-858 0763.

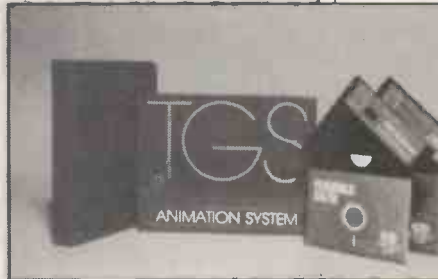


The Incredible Jack is an integrated software package for the Apple IIe. Word processing, calc, filing and mailing are all integrated and run off one disc. The price is £129.50 from Pete and Pam Computers.

Base Invaders is a game with a more modern scenario. You have to dodge policemen and cut down the fence at Greenham Common to get to the cruise-missile bunkers. Running on the Sinclair Spectrum or BBC Micro it costs £8 from Magination. Telephone: Newcastle (0632) 653224.

Total Health for the Commodore 64 helps you plan a balanced diet and exercise program. Tape and disc versions cost £17.95 and £19.95 respectively from Marketing Micro Software Ltd. Telephone: Ipswich (0473) 462721.

Epson has issued a free brochure explaining how to get the best out of its printers when connected to the BBC Micro. Telephone: Freephone Epson.



The Graphics Solution is a graphics editor and animation system for the 64K Apple II Plus or IIe with disc drive. It lets you prepare mixed text and high-resolution charts, three-dimensional graphs and animated sequences. It costs £99 from Pete and Pam Computers.

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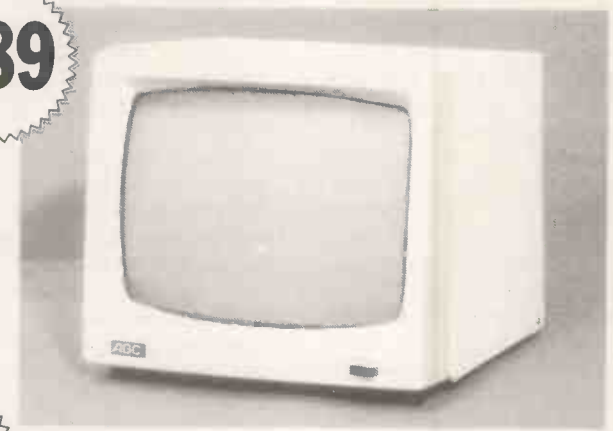

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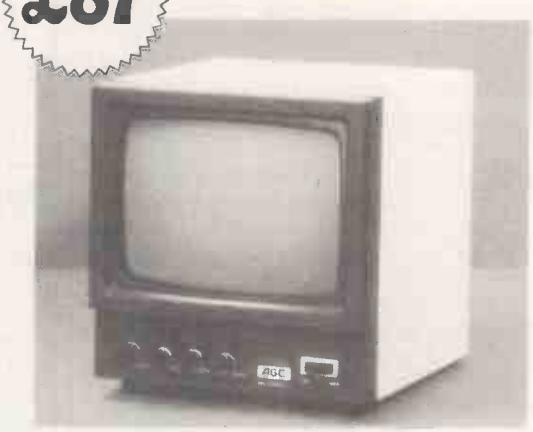

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Compilers for Commodore Basic

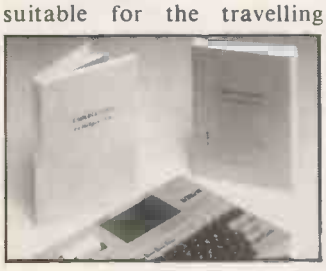
OXFORD COMPUTING SYSTEMS has launched a range of disc-based Basic compilers covering the whole Commodore range. Most interesting is Portspeed, costing £125, a cross-compiler generating Commodore 64 machine-code programs from 8000-series Pet Basic source code.

Petspeed, also costing £125, is a conventional compiler for 4000- and 8000-series Pet Basic. It optimises the output machine code, ensuring that the resulting programs are not prohibitively long, a problem with non-optimising compilers. Oxford Computing Systems also has a £75 Integer Basic Compiler for 3000-, 4000- and 8000-series Pets.

Contact Oxford Computer Systems, Hensington Road, Woodstock, Oxford OX7 1JR. Telephone: Woodstock (0993) 812700.

HX-20 nominal ledger and cash register

PHIPPS ASSOCIATES has produced a nominal-ledger package for the battery-powered portable Epson HX-20. It can analyse accounting data over 100 headings. The audit trail is produced on the Epson's built-in printer. Phipps says the program, which costs £26, is suitable for the travelling



auditor or anyone faced with a complicated multi-column epxense sheet.

Phipps Associates also does a program called Cash Register, which turns the HX-20 into a point-of-sale terminal. Used in conjunction with the Epson bar-code reader package it can be used to read EAN/UPC-coded labels directly from products. Another option is a cash drawer which links to the HX-20 through its remote On/Off socket. Phipps Associates says the program is also likely to appeal to van salesmen.

Further details from Phipps Associates, 172 Kingston Road, Ewell, Surrey KT19 0SD. Telephone: 01-393 0283.

K-tel double-siders

K-TEL, of TV-advertised record fame, is launching a series of TV-advertised Spectrum and Vic-20 games. Under the slogan "twice the fun with two on one"

the programs will come two at a time on a double-A-side cassette for a price of £6.95.

The initial five cassettes include It's only Rock 'n' Roll plus Tomb of Dracula, and Battle of the Toothpaste Tubes plus Castle Colditz, both for the Spectrum, with Supavaders/Bomber Run for the Vic. Commodore 64 programs will follow in a later batch.

The programs should be readily available at the usual retail outlets. Otherwise contact K-tel on 01-992 8055.

Hands-On training packs

HANDS-ON MULTIPLAN and Hands-On dBase II will be the latest additions to the Hands-On range of self-teaching micro-computer-training products. Although prices have not yet been announced, the packages should be available in early 1984.

Hands-On CP/M Plus, Hands-On MS-DOS 2 and Hands-On CP/M 2.2 are already obtainable, price £80, for the majority of computers running these operating systems. Hands-On Basic, based on Microsoft MBasic, and Hands-On Cis Cobol, cost £150.

The Hands-On range all use a split-screen technique. The top half mimics the product in question while the tutorial guide runs in parallel underneath.

Details from Vector International (U.K.), 64A Lower Teddington Road, Kingston-upon-Thames, Surrey KT1 4ER. Telephone: 01-943 1257.

Home word processor

HOMEWORD is Sierra On-Line's new word processor designed especially for the home user. The program has fashionable features like graphic icons and can be used with an optional joystick to achieve a mouse-like effect cheaply.

Homeword is intended to be easy, and it comes with an audio cassette explaining how to use the program. Available now for the Apple II Plus and IIe, price £33.95, versions of Homeword are also promised for the Atari

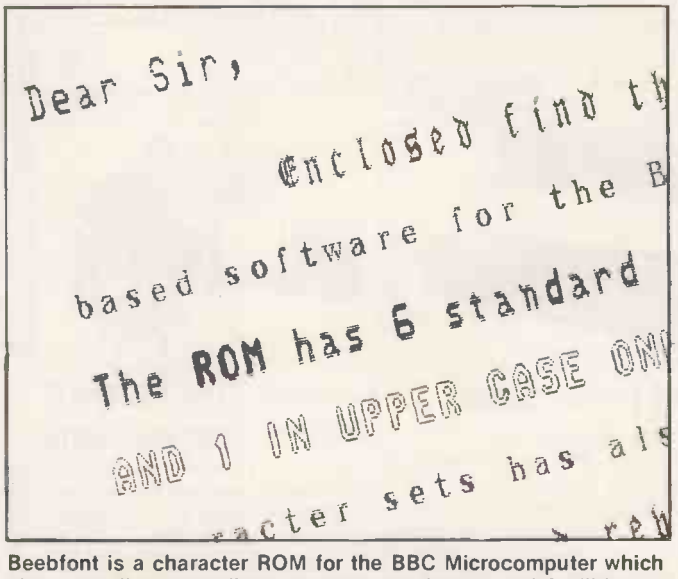
and Commodore 64. Contact Pete and Pam Computers. Telephone: Rossendale (0706) 212321.

Expert systems from Acorn

BRIAN ALDISS on Science Fiction, Sheridan Morley on Theatre, Steve Race on Music, John Julius Norwich on History, Anthony Holden on Royalty and Julian Symonds on Crime: each of Acornsoft's Grandmaster Quiz series each presents 300 questions compiled by one of these experts on their specialist subject area.

The quizzes can be played competitively between two people or alone against the machine. The six programs cost £12.65 each, including VAT, and run on the BBC Model B — or the Acorn Electron, if you can get hold of one.

Details from Acornsoft, 4A Market Hill, Cambridge CB2 3NJ. Telephone: (0223) 31640.



Beebfont is a character ROM for the BBC Microcomputer which gives you five pre-defined 16-by-16 dot founts and facilities to define your own. Founts can be displayed on the screen or printed on an Epson printer, according to the supplier, Watford Electronics. Beebfont costs £45 for the ROM, manual and supporting disc or tape software. Details from Watford Electronics, 33/35 Cardiff Road, Watford, Hertfordshire WD1 8ED. Telephone: (0923) 40588.

Shredders for computer printout

The increasing use of word processors, printers and computer installations means that Business Aids' electronic Scimitar Data Shredders are in greater demand than ever. The Compact Data 1001 is ideal for the smaller computer user; models 2001 and 2002 accept 25 sheets or eight streams of continuous stationery, while the high-security 2002XC converts paper into illegible 2 × 15mm chips. Data 4001 is a wide-throated console model; the heavy duty Data 5000 and 6000 have a 30-sheet capacity and process up to 20 streams of printout simultaneously. Contact me now.

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Telex terminal of tomorrow

Streamline your telex operation with the Trend Telex Terminal, a system marketed by British Telecom as the 'Puma'. Similar in appearance to an electronic typewriter, the Puma supercedes paper tape telex terminals by incorporating a 16,000-character memory and the ability to communicate with WP/Micro computer systems. Messages are edited and dialled from the keyboard and the system can transmit unattended — anywhere in the world, if necessary re-dialling until a busy line is free. Let me put you in touch with the telex trend-setters.

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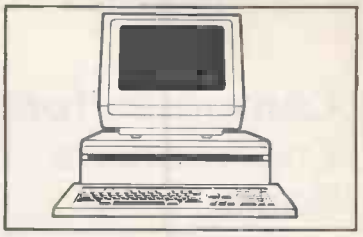

The Xerox 16/8 PC the two-in-one micro

The Rank Xerox 16/8, by offering to you both 8 Bit AND through 16 Bit processing, is the two-in-one micro to meet your business needs now — and in the future. It can utilise all your existing 8 Bit data and programs and all the much faster processing 16 Bit software now becoming more widely available. It comes with three operating systems — CP/M®, MS-DOS™ and CP/M86. It is the micro designed to combat obsolescence so find out more by contacting me now.

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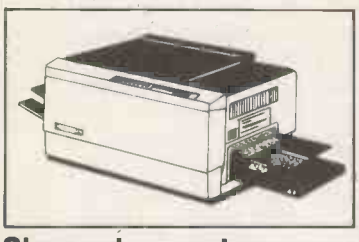

Clear crisp copies

If you require needle sharp, edge to edge copies, clear black and white from virtually any colour, the Roneo 230 Copier from Roneo Alcatel will suit you. It produces 30 copies per minute, has a touch sensitive keyboard to minimise misfeeds and a key control to monitor usage. The 230 will copy standard documents, books, flimsy originals, even three dimensional objects, onto standard bond, address labels, etc. in sizes A3, A4, B4 and B5. An automatic sorter and feeder are also available. Contact me for further details.

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A fast and efficient mailing system

If your computer can produce invoices in a matter of minutes it seems crazy to then spend hours mailing them by hand. The Neopost System Five-2 from Roneo Alcatel is designed to fold, insert, seal and frank in a fraction of the time it takes manually. The 'system' can be controlled by a single operator saving many costly man-hours and its modular construction gives it the flexibility to match your needs exactly. If you're interested in saving time and money circle this number today for more details. **429 on enquiry card**

A cut above the rest . . .

Continuous stationery can create as may problems as it solves, with paper-cutting bottlenecks holding up output. But according to Bell & Howell their Fimafold 1000 provides a low-cost solution for small or medium computer installations. The accent is on ease of use and maximum versatility, with electronic control systems keeping the operator fully informed and in complete control. Interested? Circle the number and I'll be happy to send you full details.

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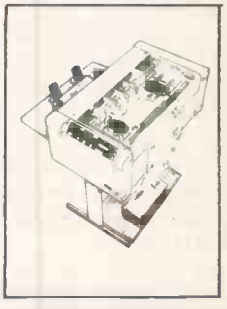

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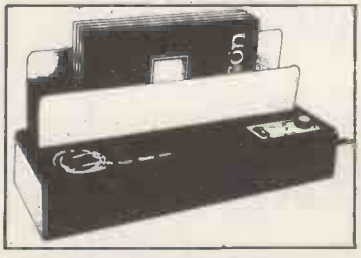

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Twinlock have extended their successful VDU furniture range with the addition of two VDU workcentres. One is designed to accommodate separate VDU screens and keyboards with a height adjustable platform that tilts back and forth to avoid eye-strain or glare. The other is fixed and designed for an adjustable VDU, or an integrated VDU and keyboard system. Both have an extra large work surface which will accommodate a table-top printer. Optional accessories, such as a printout catcher and a 5-tray housing are also available. Just circle this number.

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A free Microwriter course

I'm offering free Microwriter self-teach courses to the first 250 business or professional people to circle the number below. This is your chance to find out for yourself how easily you can touch-type with the Microwiter within minutes. Thousands of business people all over the world are using the Microwriter portable word processor daily for correspondence, reports, notes and any other written work. The remarkably simplified five-finger keyboard can produce the entire alpha/numeric range and other functions.

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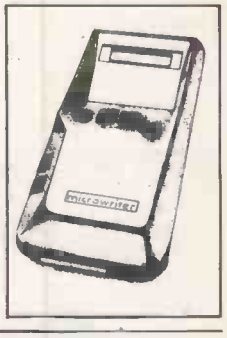

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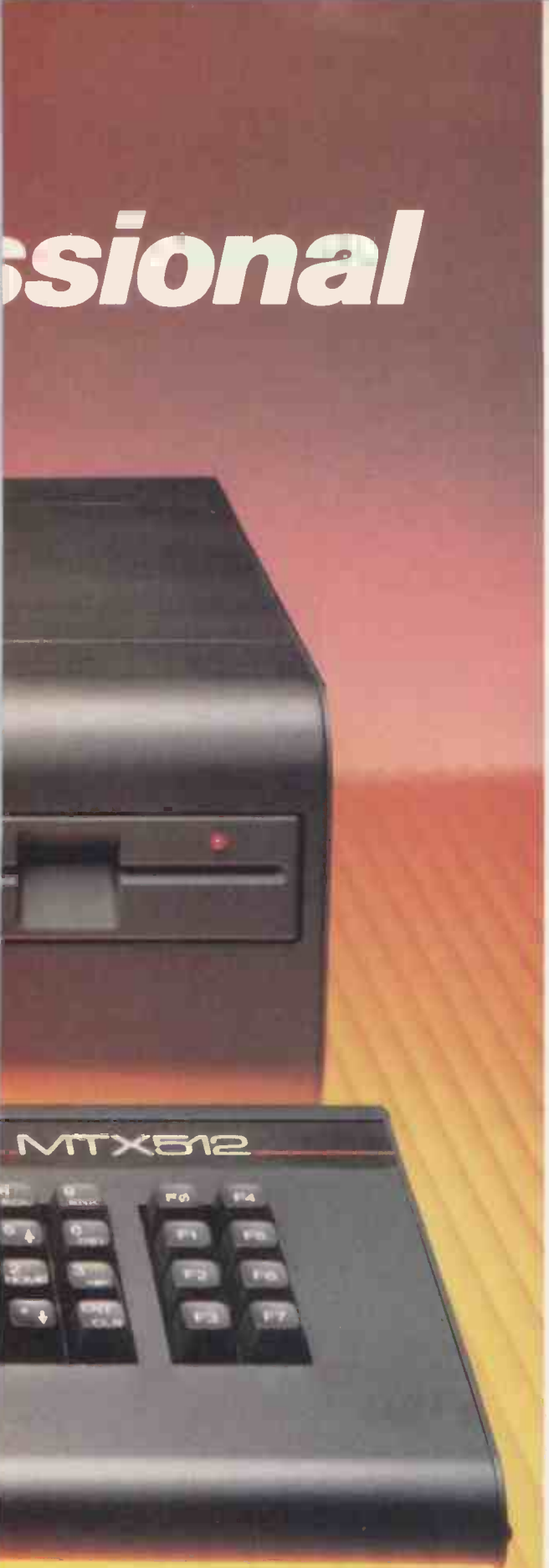

The All-Purpose System

The MTX Series is a new departure in micro-computer technology. Whether your needs as a user are for personal programming, games playing, scientific or process control, educational or business use the MTX Series is already capable or very easily adaptable to almost every application. Glance through the standard features below - you'll see what we mean.

Hardware - 32K RAM on the MTX500, 64K on the MTX512.

The MTX500 has 32K of user RAM as standard (64K on the 512), expandable to 512K plus 16K of video RAM, controlled by a separate Video Processor. Sixteen colours, 40 column text, 256 x 192 high resolution graphics with all sixteen colours available, and 32 easily moveable user defined graphics characters (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are centronics printer port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port, separate TV and Video Monitor ports, 4 channel sound with hifi output plus a dedicated cartridge port. Other standard features include the Z80A processor running at 4MHz, real time clock, full moving key keyboard with 79 keys including eight 2-function keys and separate numeric pad.

Software

The MTX's 24K ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, MTX LOGO commands, NODDY. ROM routines include an ASSSEMBLER/DISASSEMBLER with screen display of the Z80 CPU registers, memory and program,which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to split the screen into a maximum of eight sections to work independently whilst maintaining all full screen facilities. Pascal is available as an add-on ROM pack.

The Disc Based Computers from Memotech

Designed to use the full power of the MTX computers the FDX and HDX make perfect business systems at prices which make perfect business sense. Both feature the CP/M operating system, giving instant access to a wide range of proven application software. Available in October these feature:

- *Full Western Digital floppy disc controller set with SASI interface for 4 drives, CP/M types 0-13.*
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FDX— Floppy Disc System

1 or 2 5 1/4" Qume drives 500K unformatted, 347K formatted,

HDX— Hard Disc System

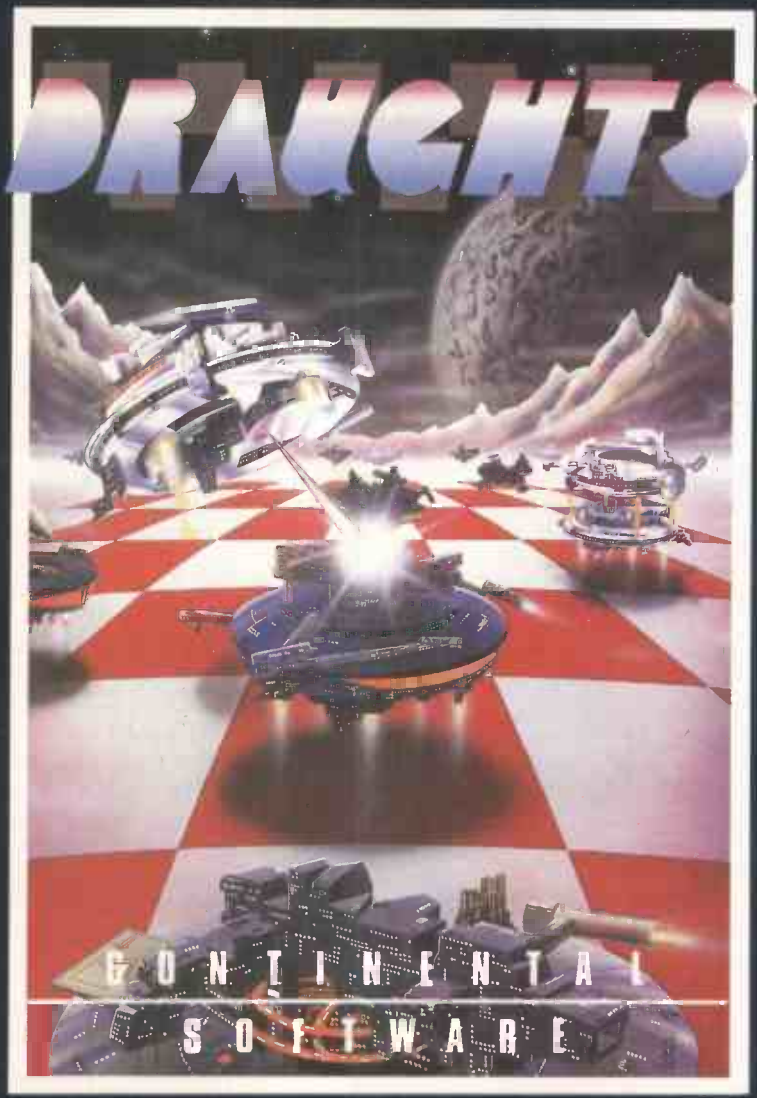
5 1/4" Qume drive, 500K unformatted, 347K formatted, 5 1/4" Winchester which may be 5, 10, or 20 Mb

All Memotech products are designed and manufactured in Oxfordshire, England

CP/M is a trademark of Digital Research Inc.

MEMOTECH MTX SERIES

CONTINENTAL SOFTWARE



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The first two programs in a series of specially written software designed to teach at the pace and level best suited to the user.

Software for the MTX SERIES

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CONTINENTAL SOFTWARE UNIT 24 STATION LANE WITNEY

The shop of things to come

Glyn Moody discovers how a national chain store is planning to deal in business micros.

BY NATURE business people and professionals are a cautious lot, and never more so than when it comes to buying computers. Torn between a fear of being left behind in the micro race on the one hand, and on the other of being taken for an expensive ride, many small businesses have held back from the initial plunge. The activities of a minority of cowboy dealers have threatened to shake people's confidence in buying for business.

Any scheme that aims to provide a total service for the keen but careful business user is to be welcomed, and should help to allay these fears. The Debenhams group hopes to have done just this. Greens Business Systems, a wholly owned subsidiary of the well known chain store, officially launched its micro service to businesses. It is claimed to be unique, and certainly incorporates a number of interesting ideas.

The centres are not independent shops but will be placed in existing Debenhams stores as self-contained sections distinct from the general hurly-burly. Debenhams' market research shows that business users are reluctant to go to conventional dealers, but no such reluctance has been found in the more free-ranging atmosphere of large department stores. Greens hopes to capitalise on this, though acknowledging an initial credibility gap: after all, who would expect extensive business-micro expertise in the store you go to for a pair of tights or a new saucepan.

A key feature of the new project is Debenhams' reputation — according to those market researchers again — for reliability and stability. To reinforce this idea of dependability, Greens offers the following ingredients in its standard micro package:

1. Extensive professional expertise, both in the form of sales advice and free seminars. Using the stores' existing training and catering facilities, Greens provides free evening seminars on such subjects as micros in business, the ACT Apricot and the IBM PC.
2. Authorised dealerships from IBM, Apple and ACT. IBM has scrutinised the scheme and has so far granted dealerships to centres in four stores.
3. A full range of training programmes backing up the machines and software available. There are 28 different courses ranging from introductory micro-appreciation sessions to two-day courses on using dBase II. The cost varies from £75 to £100 per day.
4. Installation with on-site training. The aim is, not unreasonably, to leave the end-user with a fully working system, and with enough knowledge to run it.
5. A 24-hour maintenance service. In addition to running a help-line phone number, Greens guarantees that an engineer will visit within 24 hours of a call being made. Maintenance for a typical Apricot system from Greens will cost about £150, excluding parts; maintenance contracts can be taken out at current rates for up to four years.
6. The Debenham's "price promise" is offered. If a customer can find the same equipment on offer locally at a lower price, he or she may return within seven days and Greens will match it.

Leasing options are also available; a typical Apricot system, for example, would cost around £54 a month. It will be possible to trade in a leased computer for a newer model merely by increasing payments.

Initially seven Debenhams stores operate the business-micro scheme — those at Oxford, Harrow, Romford, Guildford, Southampton, Staines and at Harvey Nichols in Knightsbridge. The Guildford store has been running as a prototype since March 1983; the rest followed six months or so later.

Greens is at pains to emphasise the complete separation from the cheaper games-oriented sector. Through in-store centres and travelling representatives the company sees itself as offering complete professional systems. Only four machines are currently sold: Apple II, ACT Sirius and Apricot, and the IBM PC, a choice which has been largely dictated by the range and availability of software. The software itself is restricted mainly to broad applications systems rather than specialised vertical-market packages.

The frequent reference to the ACT Apricot is no accident. Greens' joint managing director Michael Milman waxes lyrical about the machine, and goes so far as to suggest that it could do for the U.K. business market what the IBM PC did in the U.S. To back this up he points out that the average attendance at Apricot seminars has been running at over 50, and already over 100 machines have been sold by Greens alone.

Whether this prediction turns out to be true or not, Greens is certainly thinking big. The first target turnover is £10 million, and the plan is to have 20 centres open by the end of 1984 with another 40 a year later, eventually taking space in non-Debenham stores. According to Milman, Greens intends to become the biggest dealer in the U.K. So next time you need some business micro equipment it could well be worth looking in your local department store.

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INVOICE <0>£££££££££££

To £<1>£££££££££££ £<2>£££££££££££££££ £<3>£££££££££££££££ £<4>£££££££££££ £<5>£££££££££	From: G.W. Ltd 55 Bedford Court Mans. Bedford Avenue London W.C.1. Tel: 01-636 8210

Date <6>££.£££ Tax point <7>££.££ Agent <8>£££

Quantity	Description	Cost	Tax	Total
<9>£££	<10>£££££££££££££	<11>£££	<12>£££	<13>£££
<14>£££	<15>£££££££££££££	<16>£££	<17>£££	<18>£££

and so on...

Total...<19>£££££ Tax...<20>£££

<??> items <1 >to <5 >internal command to request name input, and then search an address file for details.
<??> items <6 >to <7 >request date input and validate.
<??> item <8 >request agent number and validate range.
<??> <9 >request quantity, validate range.
<??> <10>request description, search file, accept, and calculate fields <11>, <12>, <13>, if finished invoice then calculate fields <19> and <20>

Now comes the more valuable facility, you can provide the 'FORM' with file-related instructions, not only to request a 'console' input for a file search against names, and stock, but after the invoice is finished the fields you have selected may be passed to related files.

EG: Send fields <0 >, <1 >, <6 >, <7 >, <11>, <12>, <13>, <19>, <20> to a sales ledger.
Then send fields <9 >, <10>, <11>, to product analysis file.
Then send fields <0 >, <1 >, <7 >, <19>, <20> to V.A.T. file
Then send fields <10>, <11>, <12>, <13> to Nominal ledger.

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Britain back in front

Ray Coles on the story behind the Inmos Transputer.

THERE CAN BE little doubt that the establishment of the Inmos high-technology semiconductor operation with large chunks of British taxpayers' money was a risky venture. Too often in the past, such government interference in the market place has resulted in the creation of unstable, inefficient industries which are constantly returning for more cash, without ever delivering the profits which were expected from them.

It is too early yet to state definitely that Inmos will break this mould, but all of its activities to date seem to suggest that it will. Already it has performed wonders for Britain's international image by consistently producing innovative products which have put the country back in the forefront of high technology. I for one have all my fingers and toes crossed in the confident hope that this well organised, highly motivated, ingenious — and, damn it all, British — company can pull it off.

The Inmos operation was boldly planned and cleverly executed by a group of expatriate British engineers and scientists who had been forced to work in the United States to develop their talents as chip designers. Iann Barron, now managing director, led the search for funds with the simple but informed message that there was no reason why the American microchip miracle should not be repeated here. All you had to do was to think big and use the best brains and equipment in the business.

New breed

The marketing strategy was simple too: start with the fastest static RAMs in the world; then move into 64K dynamic RAMs; then set the electronics world on its head with a totally new breed of high-performance microprocessor which would be a revolution in itself. How different to the usual ultra-cautious approach so much favoured by other British semiconductor manufacturers: "Let's wait until someone else has done it, then we will have a dabble. But don't spend too much on it, as we probably won't succeed."

Inmos set up its first manufacturing and design centre in Colorado Springs, in the western U.S. Its first static RAM parts designed there, the 1400 series, went on to become world beaters as predicted. A CAD design centre in Bristol followed, and then a second manufacturing facility in Newport, Gwent. By early 1983 the 64K dynamic-RAM family was in production.

One of the main tasks of the Bristol design centre was to work on the microprocessor, and once again no easy options were taken. Inmos wanted a product that the market would be desperate for: not just another 8086 or 68000 clone, but something new which could offer a quantum leap in processing power so that the world would be breaking down the factory doors to get at it.

The new microprocessor, called the T-424 or Transputer, has now been revealed after months of rumour and speculation. What a machine it is! Designed from the outset to change the way we think about computer architecture, the Transputer is a 32-bit processor with a 4Gbyte address range. It can work by itself or as part of a processor array to deliver astonishing performance.

Inside the 1.15in. square, 84-pin Transputer package there is a single CMOS silicon chip containing the equivalent of 250,000 transistors. They are themselves interconnected to form the main functional blocks including a 32-bit CPU, a 32-bit multiplexed data/address bus, a separate eight-bit peripheral bus, four duplex serial communication links and an array of 4Kbyte of 50 nanosecond static RAM.

Used alone, a single Transputer will be a powerful system in its own right. As part of an array of similar processors, the Transputer provides the basic building block for the design of fifth-generation machines which will be able to execute over 10^9 instructions per second.

If there is one word which best describes the Transputer approach, it has to be "concurrency". On the chip itself, the memory interface bus, the peripheral interface bus and the four serial buses all act independently and at high speed. Put an array of Transputers together and each chip can operate alone, communicating with its fellows over the serial links to receive instructions or operands and to transmit intermediate results. With four serial channels available, any one chip in an array can send or receive data in the up, down, left and right directions all at the same time.

Programming

The problems of programming such a highly parallel system have also been tackled by Inmos. As usual it has come up with an ingenious solution in the form of the brand-new Occam language. Occam handles concurrency by the definition of "processes", which are independent computation units complete with their own programs and data, and "channels", which provide the mechanism for communication between processes. The same Occam program can be executed either by a single Transputer or by an array of any size. To make things easy, the Transputer architecture and instruction set directly support the Occam methodology.

Keep it simple

Occam was developed by Inmos in conjunction with Professor C A R Hoare, director of the Programming Research Group at Oxford University. One of Hoare's academic predecessors was the 14th-century philosopher, William of Occam, who first formalised the concept now known as Occam's Razor. Translated from the Latin it states: Entities should not be multiplied beyond necessity — or in other words, keep it simple.

The Occam programming system is already on sale for use on a variety of other machines, including the Apple II and the ACT Sirius, but the real power of the language will not be fully utilised until the first Transputers start to roll off the Inmos production line in late 1984. The basic Transputer instruction set is very simple, with less than 70 instructions. Some of them execute in a single minor cycle of just 50 nanoseconds; others, such as division, take up to 2 microseconds. The on-chip RAM array can be used for data or instructions and gives the great advantage of short access times. Memory accessed outside the chip itself will be slower because of the need to buffer the interconnections to conventional TTL levels. Up to 10,000,000 instructions per second can be achieved by a Transputer operating from internal memory. Following the T-424 32-bit Transputer will be the T-222 16-bit device with the same instrucion set, and after that the G-213 graphics processor and the M-212 disc controller.

Personally, I would like a few shares in Inmos. I wish the company every success with its current quest for extra funding. It deserves to succeed, and so do we.

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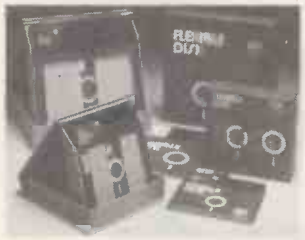

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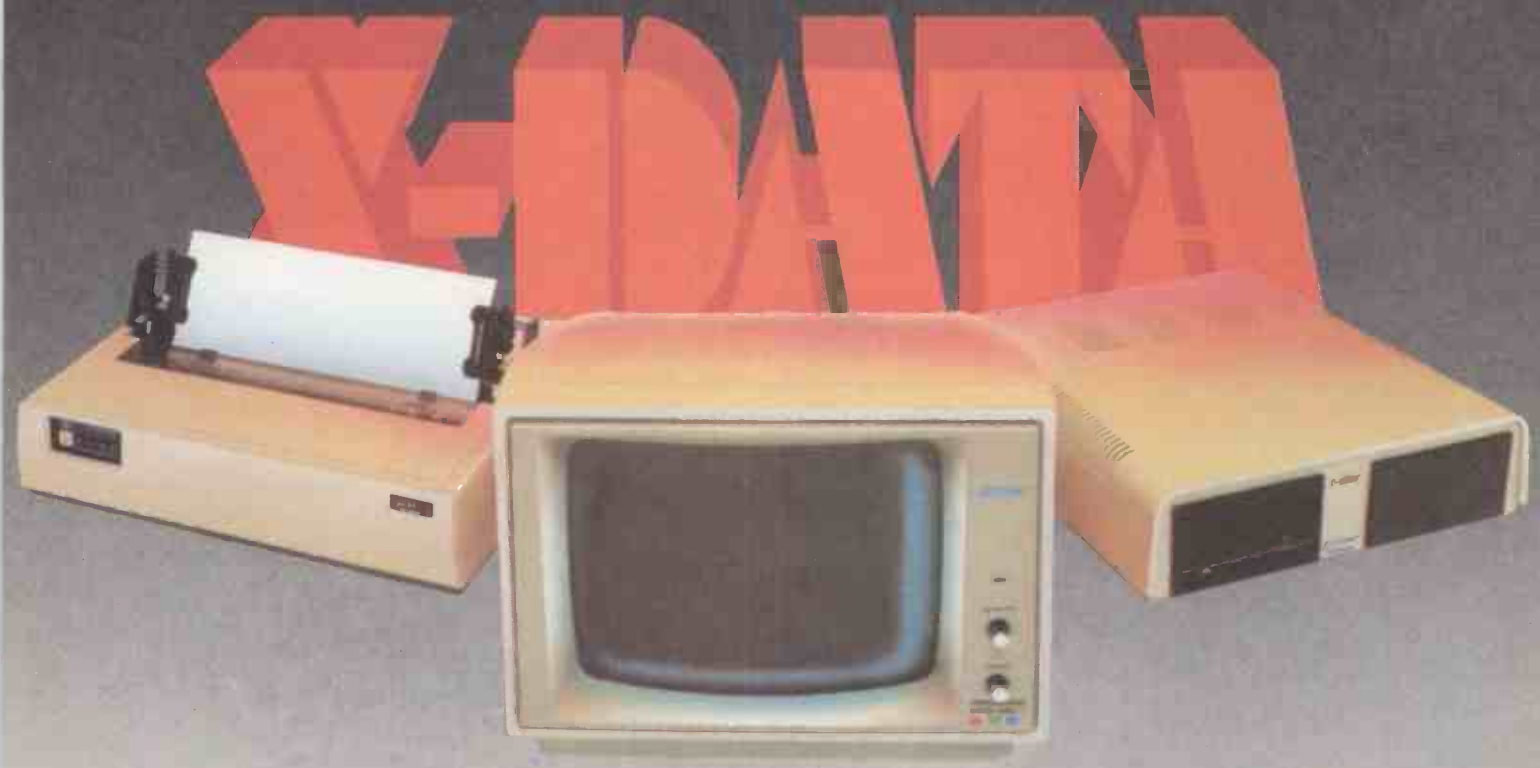

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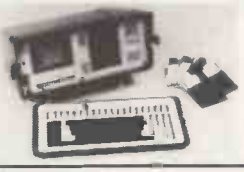

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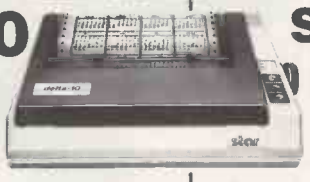

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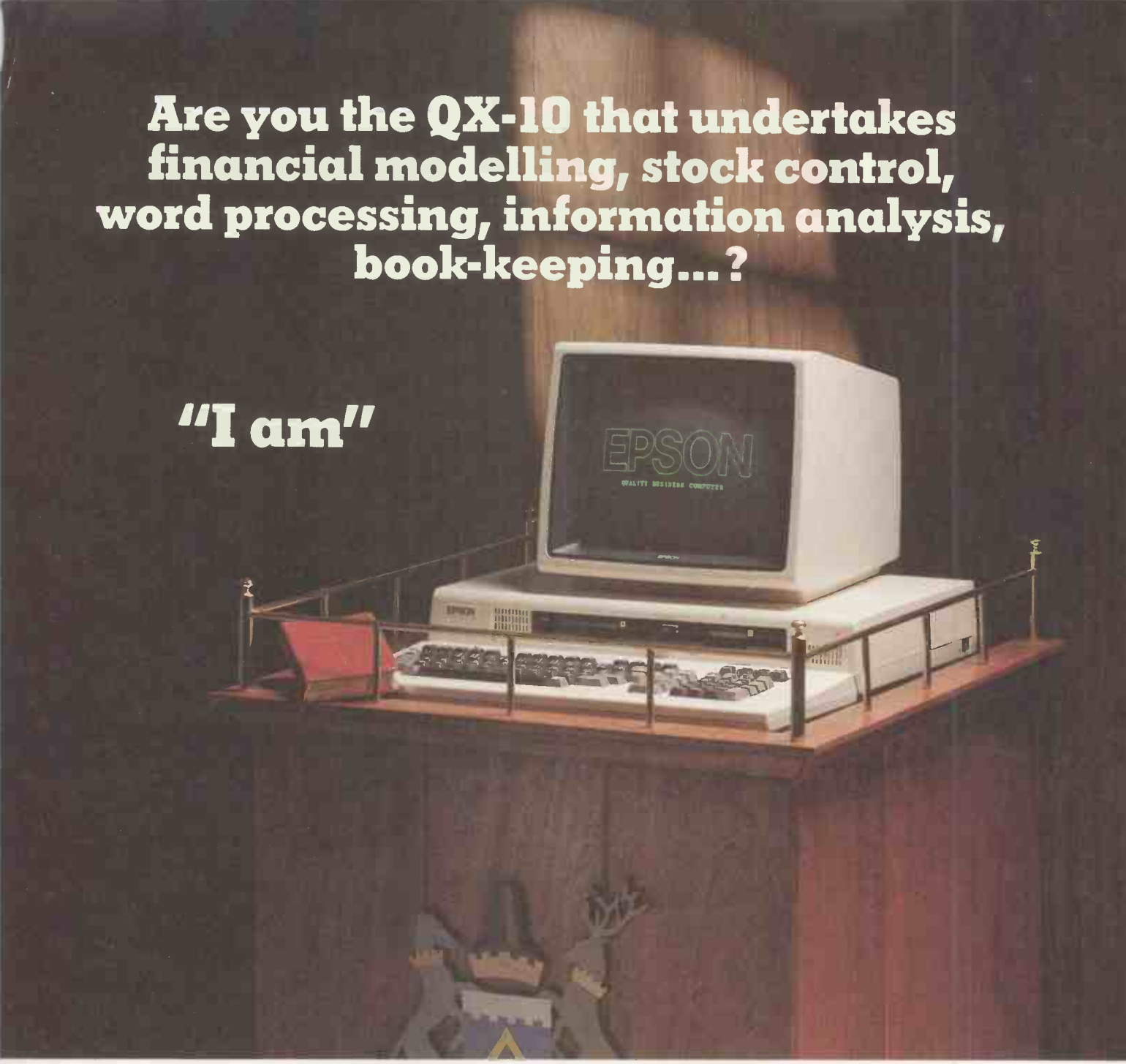

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PC XT/370

THE XT/370 mainframe-on-a-desk version of the IBM PC — see the report in our January issue, page 29 — has been announced by IBM U.K. It offers three modes of operation. First, it is a standard XT Personal Computer with 10Mbyte of hard-disc storage. Second, it emulates an IBM 3277 Model 2 display terminal connected to a mainframe. Third, it runs under the new Virtual Machine/Personal Computer operating system, which enables it to run many programs for the IBM mainframe Virtual Machine/Conversational Monitor System on a desk-top computer.

The XT/370 carries three extra cards which carry a standard Motorola 68000 chip, and two customised IBM chips — one based on the 68000, another on the Intel 8087. The second card carries 512K of extra RAM. The third provides the coaxial communications which are needed for terminal operation.

The XT/370 will be manufactured in Greenock, Scotland, for a September 1984 launch in the U.K. The price is a mere £8,228 plus VAT, plus £919 for a VM/PC software licence. When the IBM 370 mainframe was current it usually cost around £1 million.

Contact IBM United Kingdom Ltd, PO Box 41, North Harbour, Baltic House, Portsmouth PO6 3AU.

IBMulators

MORE computer manufacturers are following the fashion of offering IBM compatibility. Among the latest are ITT, Televideo and Olivetti.

ITT will be launching the Xtra, with an Intel 8088 CPU, 128K of RAM, a 10Mbyte hard disc and one floppy — an IBM PC XT look-alike. Televideo's 1605 will be an IBM PC compatible micro, and is expected to be launched in the U.S. early in 1984.

Olivetti will be making its own version of the Corona PC look-alike for sale outside the U.S. Like Texas Instruments with the Professional, and Tandy with the Model 2000, Olivetti now appreciates that it has no choice but to offer IBM PC emulation. The long-term future of the Z-8000 based M-20 is presumably unaffected, as Olivetti has an 8086 card for it.

Columbia PC relaunch

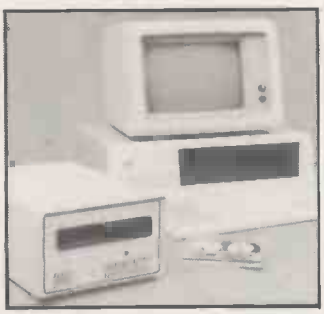
THIS WELL KNOWN IBMulator has been relaunched in the U.K. by Icarus. Its Compaq standard of IBM compatibility has made it the leading look-alike on the U.K. market in the continued absence of the Compaq transportable.

The major change is that it is now supplied with an amber monitor, which is preferred in many European countries. Other new features are the free suite of Perfect software and a graphics package, in all worth £750, plus a little heart logo on the front which features in the new advertising campaign.

Contact Icarus Computer Systems, Deane House, 27 Greewood Place, London NW5 1NN. Telephone: 01-485 5574.

PC back-up

ALLOY has introduced a nine-track magnetic tape sub-system for the IBM PC. The ITS-PC offers 42Mbyte of back-up storage or, more interestingly, allows data to be interchanged



between a PC and a mainframe. For this you also need Alloy's PC-Tip tape-interchange program.

Alloy's other products are PC-Stor, which is a hard disc with built-in tape cartridge for back-up, and PC-Backup, which is a separate tape cartridge for backing up your PC XT.

Contact Alloy at Cotteswold House, Gloucester Street, Cirencester, Gloucestershire GL2 2DQ. Telephone: (0285) 68709.

Perex is also now supplying a tape back-up system for the XT, called the Peridata 4510/IBM. Contact Perex at Arkwright Road, Reading, Berkshire RG2 0EA. Telephone: (0734) 751054.

Fun and games

THE IBM PC is already starting to monopolise the professional/executive software scene with products like Lotus 1-2-3, Multimate, Oz and Expert-Ease. But now about 40 percent of America's best-selling games, as listed by Softsel, already run on the IBM PC. For comparison, over 80 percent run on the Atari micros, over 70 percent on the Apple, while about 60 percent run on the Commodore 64.

The top 20 includes 10 games that run on the IBM PC, including Zork I, II and III, Frogger, Temple of Apshai, Deadline, Planetfall, Miner 2049er, Enchanter, Serpentine and Witness, plus the famous Microsoft Flight Simulator.

With up to 1,000,000 PCjrs to be sold in 1984, the current flood of IBM games will become a torrent. This is particularly good news for a small British company whoose Advance computer is currently being manufactured by Ferranti, and which promises to provide IBM PC compatibility for only £400 — see our October 1983 issue.

Software shorts

● **ACT** has announced its Micromail package, reviewed in the November issue of *Practical Computing*, as Micromail Blue for the IBM PC. Telephone: 021-454 8585.

● **Prospero Software** has a new Pascal compiler for the 8086 family of chips. See our June 1983 issue for a review of Pro Pascal on eight bits, as the 16-bit version is said to be fully compatible. Telephone: 01-785 6848.

● **Sky Software** is not a new company, just a new name for what was Comsoft. Its new range of Blue Sky packages are Skymaster, Skymail, Skycost and Skybuild. They run under the Skymos multi-user operating system on IBM PCs linked using PC-Net. Telephone: (0527) 36299.

● **Inner Loop** software of Los Angeles has launched Scrollmate, which provides up and down scrolling of up to 14 screenfuls of text under MS-DOS. Telephone: (Area code 213) 822-2800.

● **Graphic Communications** of Massachusetts has produced a suite of 24 programs to simplify the design of presentation graphics on the IBM PC and XT. Pete & Pam is importing it. Telephone: 01-677 7631.

● **GCS Communications** has extended its range of products to include P-Cox, a 3270 coaxial interface for the PC and its look-alikes. It costs £900. Telephone: 01-898 2121.

● **Sophco** of Boulder, Colorado, has introduced Protec, a $250 master-menu and security-control program for the PC and XT. It not only shuts out unauthorised users but prevents passing humourists from typing commands like Format C: on the XT. Telephone: (Area Code 303) 444-1542.

IBM PCjr

Jack Schofield takes a hard look at the spec of the "Peanut" and assesses how it will fare against the established home-micro competition.

AFTER INTENSE industry speculation, IBM finally launched the "Peanut" microcomputer — now called the Junior or PCjr — in the U.S. on November 1 last year. One month later some 1,000 machines were delivered to dealers for demonstration purposes. Sales were not scheduled to begin until January — after the Christmas rush on which so many micro companies have come to depend.

The timing of the announcement was presumably to encourage those considering a micro to wait until after Christmas, instead of buying another model in December. The only two surprises were the name, and the infra-red keyboard connection.

Whether you like the name or not, it is accurate, although some Americans are already calling it the "Pee Wee", to distinguish it from the "Pee Cee". The infra-red keyboard connection is a logical part of the design. The deskless home user wants to relax in an armchair, not be cabled to the system box.

The thinking behind the PCjr is interesting. IBM's problems with the PC are twofold. First, it is too successful; second, it is too expensive for Everyman, even in America. Most home buyers of the PC and XT — and there are many — have some business justification for their purchase. People who don't generally cannot afford it. Schools, colleges and even some corporations have also found the price of the PC a disincentive: just think about the cost of buying them by the thousand.

Of course, IBM could not solve the second problem by reducing the price of the PC again. That would merely exacerbate the first problem. It can already sell PCs and XTs faster than it can make them. And, of course, reducing the price of the PC would mean smaller profits.

The PC is over-specified for the home/school market, and the PCjr offered the chance to make a more suitable machine. The easy way would have been to make the new machine largely incompatible with the previous models, like Commodore with the Vic-20. However, this did not mesh with IBM's overall strategy of taking over the entire microcomputer industry with a string of PC products from the top to the bottom of the range.

It was far better, both for IBM and for the user, to make the jr, as far as possible, a PC-compatible machine. The problem then was that while the PCjr had to be good enough to take advantage of the huge software market created by the PC itself, it also had to be not too good, or it would take sales from the more profitable elder brother.

IBM's solution was to retain the Intel 8088 CPU, the PC-DOS operating system and disc format, and fundamentally the same Microsoft Basic, so as to largely retain software compatibility. This enables the PCjr to be offered in large volumes by IBM's corporate sales force, either for use as a cheap work station or for executives to use at home.

To make the system more suitable for the home/education market, IBM added colour graphics as standard, cartridge slots, joystick ports, and expanded the PC's single-tone sound to three channels. These decisions offer an interesting contrast with

Acorn, which deliberately offers less rather than more in all these areas in order to make the Electron a conspicuously inferior machine compared to the BBC Micro.

IBM has ensured that the Junior's weaknesses are in areas where the home/school user does not suffer too much, but where the business buyer is affected. So it has an inferior keyboard and, for now at least, only one disc drive. The PCjr does not have the same internal expansion system as the PC, so business users will not be able to add large quantities of RAM, clock/calendar cards, etc. And while the text display is good, it is not of the exceptionally high quality of the IBM PC.

Not crippled

However, as the keyboard is detached from the main unit, no doubt third parties will offer replacement keyboards and add-on disc drives sooner rather than later, and internal expansion is possible. So though the PCjr may have had one hand tied behind its back, unlike the Electron it has not been deliberately crippled.

The 62-key cordless keyboard is powered by four AA batteries, and weighs 25 ounces. It communicates by infra-red signals with the main unit at distances of up to 20 feet, as long as it is within view. An optional 6ft. adaptor cord is required if more than one PCjr is to be used in the same room.

As the PCjr keyboard has 21 fewer keys than the PC model, something has had to give. For a start, the 10 dedicated function keys are missing, though as on the Electron the functions can still be used by pressing the function key and the number keys. The separate numeric keypad has gone too, though there are now four cursor control keys arranged in a neat cross. The spurious Backslash key — sited between the left Shift key and Z on the PC — has also disappeared, just when we were learning to accept it as the new standard and Elan had carefully added it to its new micro.

For software compatibility, the PCjr keyboard can produce all the codes produced by the standard PC model, though in some cases the key combinations required are less convenient. Still, that is not too bad a limitation. The keyboard has two other distinguishing features: rubber key caps and no labels, as the key labelling is on the keyboard itself. The layout can be customised by reprogramming any of the keys and adding a keyboard overlay.

The rubberised key caps are squishy but apparently not hard to type on for limited periods. In this respect the keyboard is the worst part of the PCjr. It is regrettable that what will be, when it arrives, one of the most expensive home/education micros on the market should have a keyboard that is inferior to cheaper rivals.

The PCjr comes in two models: an entry-level system, and a full-specification model with a built-in disc drive. The system box measures about 14in. long by 11in. deep by 4in. high. Both models have the same detached keyboard, separate power transformer, a *Guide to Operations* manual and *Hands-On Basic* booklet.

The system box has two cartridge slots on the front, plus ports for a cassette recorder, two joysticks, external amplifier and speaker, a keyboard cable, a light-pen and various video displays. There is one spare socket. Unfortunately these ports all seem to be non-standard designs. IBM evidently expects people to pay outrageous prices like $30 for a TV-set connector or cassette-tape adaptor cable. Some schools and corporations will probably shell out, but enthusiasts will rapidly find cheaper alternatives.

Both models have 64K of ROM. It includes self-test diagnostics, as do the Atari XL micros, and a program called Keyboard Adventure which uses graphics and sound to introduce the keyboard. The entry-level model has 64K of RAM and produces a standard 40-column display on a TV set, composite video or RGB colour monitor. In addition to 320-by-200 pixel resolution in four colours, and 640-by-200 pixels in two colours — both of which are offered by the standard IBM PC with colour-graphics card — the entry-level PCjr also offers a 16-colour mode with 160-by-200 pixel resolution.

The other PCjr has 128K or RAM, with no room for more inside, and a 360K half-height 5.25in. floppy-disc drive that uses the same PC-DOS operating system and format as the standard PC. It has better graphics too, and can display 80 characters per line.

OS costs extra

The enhanced model comes with two discs. The first, Exploring the PCjr, is a tutorial which includes system use and simple programming. Your IBM PCjr contains sample programs for home use including a word processor, address file, etc. This model costs $1,269, but you need to spend $65 more for the PC-DOS 2.1 operating system.

There is another catch. With both models the sound, graphics and some peripherals are fully supported only by a plug-in cartridge Basic, for which IBM charges an extra $75. It is tempting to complain about charging extra for a Basic language cartridge, and it did not win Atari friends for the 400. However, the Commodore 64 has proved successful in spite of the fact that the hardware is virtually unsupported by the Basic. At least IBM will probably supply a useful extended Basic, a feat which seems to be beyond Commodore.

The entry-level PCjr can be upgraded by adding a disc drive and a 64K expansion, mainly used for colour graphics. With the PC, video RAM is held on a separate card, but with both models of the PCjr it comes out of main memory. Both models can be upgraded by adding a modem — in the U.S. at least — and serial or parallel printer connections.

The PCjr Basic cartridge is a superset of the original Microsoft Basic. It supports the enhanced graphics and sound capabilities, the light-pens, the three-voice sound and asynchronous communications. As such it is more a necessity than an option.

The IBM PC Compact Printer is a 50cps thermal unit which uses single-sheet, fanfold or rolls of thermal paper. It costs $175. The IBM PC Color Printer prints in up to eight colours. It offers 200cps in draft mode, 110cps in correspondence mode, and 35cps in letter-quality mode. It can use single-sheet, fanfold and rolls of paper up to almost 15in. wide and costs $1,995. Both

(continued on next page)

The PCjr is a downgraded model, and there are 21 fewer keys than on the PC.

(continued from previous page)

printers can be used with all versions of the PC, right up to the XT/370 "desk-top mainframe".

Three groups of programs were launched with the PCjr. There are two new programs intended for all models of the PC. The first of these, the Personal Communications Manager, provides access to other computers via the telephone lines and thus to Dow Jones and The Source, in the U.S. The second is the Fixed Disk Organiser program — not much use with the PCjr.

The second group comprises updated versions of seven programs for all models of the PC. They are Casino Games, Strategy Games, EasyWriter PFS:File, PFS:Report, Basic Program Development System and Time Manager. In all some 30 of the programs in IBM's own PC line-up are said to run on the enhanced PCjr.

The third group comprises new IBM-badge cartridges and disc-based programs for home and educational use. They include Homeword, Home Budget Jr and Turtle Power. Homeword is a simple picture-based word processor from the Apple/Atari software house Sierra On-line. Home Budget Jr is from the Software Publishing Corporation. Turtle Power is a turtle-graphics program from The Learning Company, though IBM already has a Logo. Games on cartridge include Mouser, Mineshaft and Crossfire.

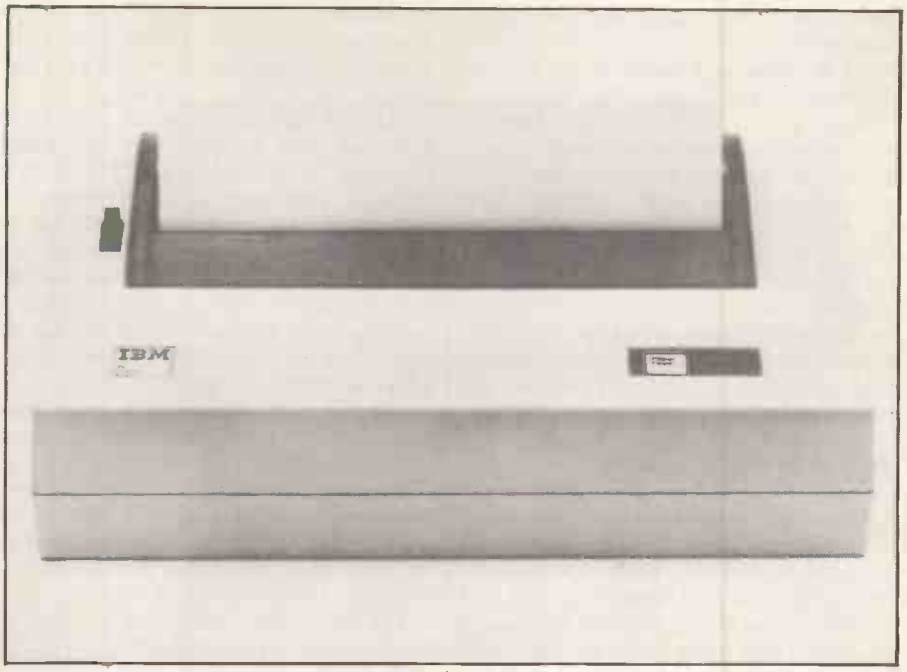
Software flood

Given the vast number of software houses producing programs for the IBM PC, other third-party software will undoubtedly flood the market. There is already a PCjr magazine.

The entry-level system looks a bad buy. In the sound and graphics departments it offers no advance over the Atari 800XL while it is more than twice the price. The keyboard seems grossly inferior, and the entry-level PCjr is at a major disadvantage when it comes to software. The Atari has hundreds of good programs available, while initially this model of the PCjr has only a handful. After the unveiling of the PCjr, Atari announced a price increase — from after Christmas — on its range.

The Commodore 64 has similarly little to fear from the entry-level PCjr. The Commodore is a bit of a seven-stone weakling in terms of its pathetic Basic and cassette-tape software — are there more than three good games? Nonetheless the Commodore 64 hardware looks much more powerful. A PCjr plus Basic costs more than a Commodore 64 plus disc drive: all-in-all the Commodore is a far better buy.

The enhanced PCjr is a different basket of chips. While the price is still not going to worry Commodore, or Atari's 1450XL model with built-in disc drive, it should certainly worry Apple. With 128K of RAM, an 80-column screen and PC-DOS 2.1 the PCjr can rival any small micro on the market thanks to being able to share



software with the IBM PC. The Basic, graphics and sound are all superior to the Apple IIe, and the PCjr price is very competitive.

At its launch, the Apple IIe without disc drive had a list price of $1,400 — just twice as much as the entry-level PCjr, and more than even the disc-based model. While the Apple II still has more software, and more good software, than any other micro, the PC is catching up fast. The PCjr could well tip the balance.

Further, the PCjr offers an upgrade path, which the Apple IIe conspicuously fails to do. The PCjr is simply the bottom rung of a ladder through which the user can progress via the IBM PC and XT right up to the XT/370. Not many individuals will go all the way, but the facility certainly matters to schools, colleges and corporations.

However, a glance at the sparsely-populated Apple IIe board suggests Apple can slash the American price to make it competitive and still make a comfortable profit. In the U.K. the situation is more uncertain. Here the competition is not Apple but the superior Acorn BBC Micro. Apple has basically ignored the home-into-business market well represented among readers of this magazine — just try looking for Apple advertisements in *PC*! — and has left the BBC Micro to capture tens of thousands of sales unopposed.

The BBC Micro has massive support from serious home/educational/small-business users. It also probably has a year's grace before the PCjr finally arrives. By this time the BBC software base will be that much stronger, especially in the area of small-business and executive tools where it is currently weakest. It should continue to prosper, possibly at the same price as today, though with a profit margin for dealers. Apple may be squeezed between the BBC and the PCjr, and the IIe's price might well need to drop to under £500.

Whenever the PCjr arrives, and whatever the price, it looks likely to establish PC compatibility as a major factor at the bottom end of the micro market. This will benefit the Advance and other IBM look-alikes due to appear on the home-micro market. Machines which have a strong user base or can develop one before that happens should be OK. Trying to establish a new standard, like the Japanese manufacturers with the Microsoft MSX eight-bit system, looks like a complete waste of time.

Conclusions

● The main advantage of the PCjr is that it offers compatibility with the IBM PC, and thus both a share of the software base and an upgrade path.

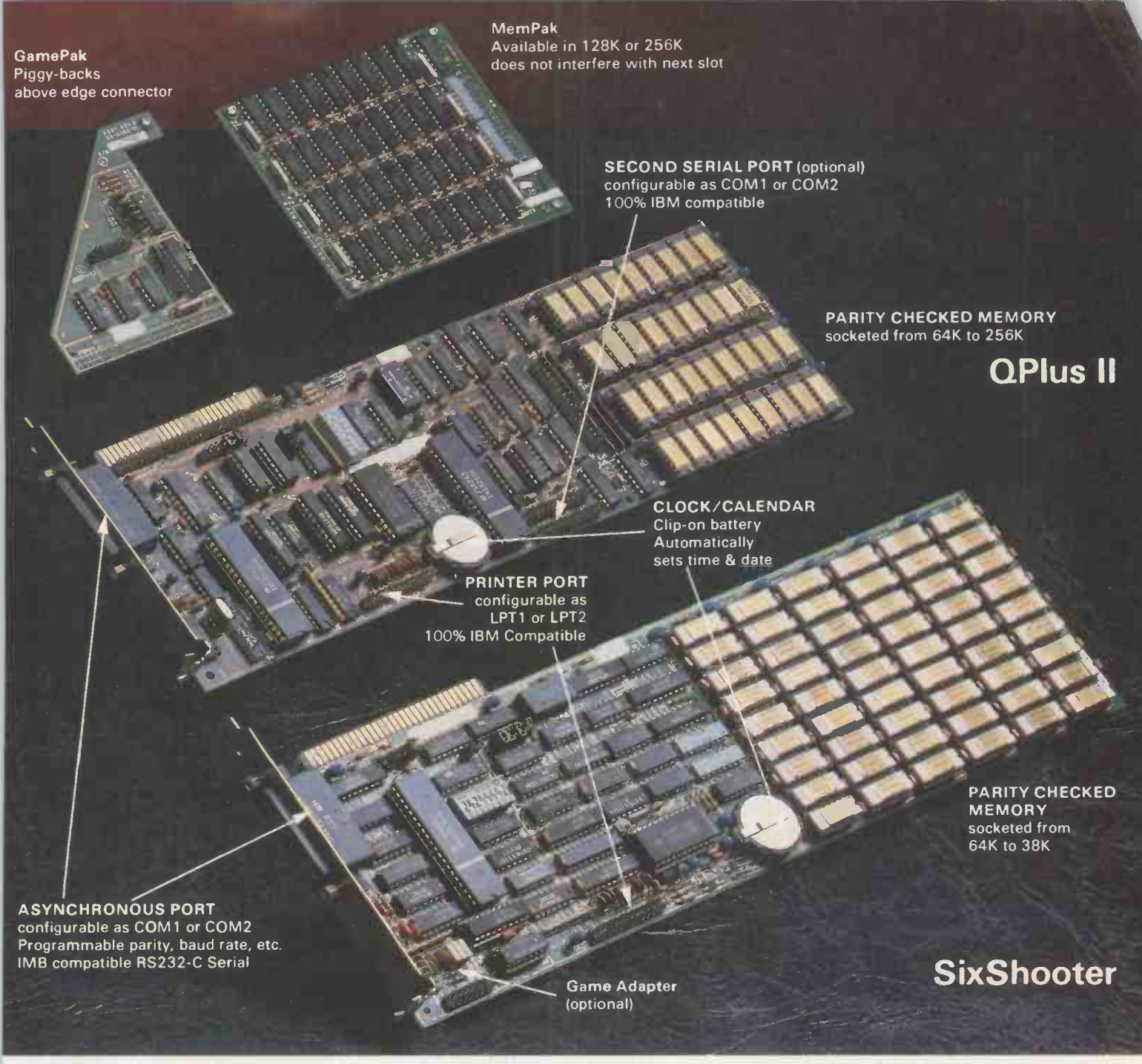
● The main disadvantage is the keyboard. It looks as though its deficiencies are deliberate, in order to protect sales of the IBM PC itself.

● A further disadvantage is that it has non-standard ports and the nominal price does not include numerous extras that will in fact be required — like DOS 2.1 with the enhanced PCjr. The new models are more expensive than they look — but then, this applies to many other machines too.

● The PCjr entry-level system is under-powered and overpriced at $669 plus extras. If it comes to the U.K. at £500 to £550 it should not hurt the BBC Model B, though it might.

● The enhanced PCjr is very competitive at $1,269 including disc drive. If it arrives in the U.K. at around £1,000 it looks likely to hurt Apple.

● The PCjr will be a success thanks to the excellence of IBM's marketing and the strength of the name. PC compatibility could be established as a major force at the bottom end of the micro market, wiping out those firms who do not have a large user base.



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The **Qplus II** comes standard with clock/calendar, asynchronous serial port (RS232C), and your choice of memory from 64K to 256K. Options include: a second asynchronous port, a parallel printer port, a game port on a plug-in "piggy-back" board, and a choice of 128K or 256K MemPaks. The MemPaks give you the ability to add 384K or 512K of memory in one slot.

The **SixShooter** is ideal for the XT model. It offers a battery powered clock/calendar, asynchronous port, parallel printer port, SuperDrive & SuperSpool software, and your choice of memory up to 384K, all standard. Optional is an IBM compatible game port adapter.

Also included with both boards is the SuperDrive™ disk emulation software. It allows you to create up to three "electronic disk drives" in memory which access your programmes at the speed of RAM memory. You also get SuperSpool™, a programme which allows you to assign a portion of memory to act as a print spooler.

Both boards are backed up by a one year parts and labor warranty and 48 hour turnaround on any warranty repairs. Visit your local dealer and pick up a brochure with the full details. If he doesn't have the information have him give us a call. Your PC will really thank you.

Suggested List Prices;
64K £319 128K £389 192K £459 256K £529
Options: Second async port, printer port, game port, and GamePak, each £40. MemPak 128K £199, MemPak 256K £349.

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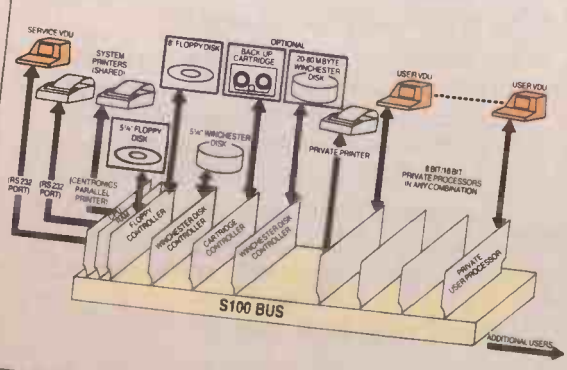

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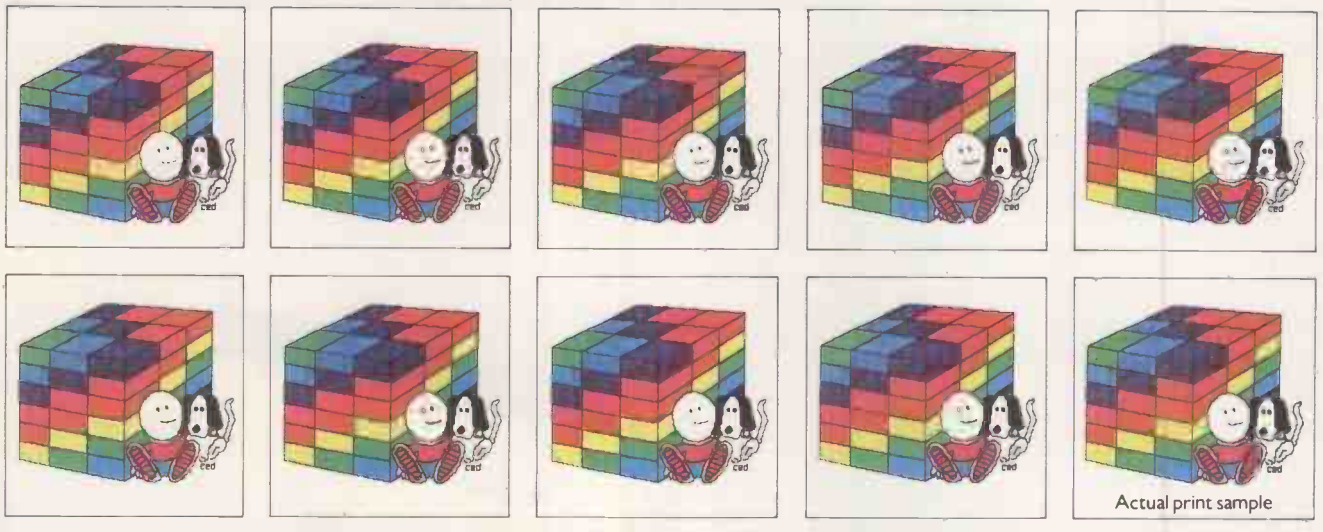

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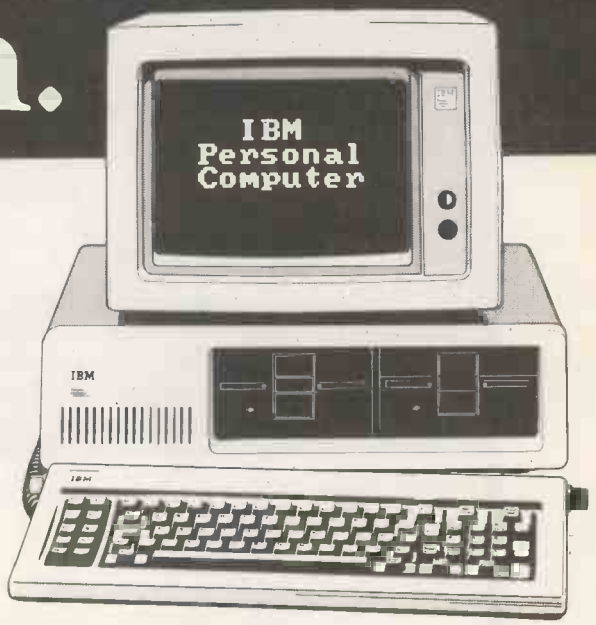

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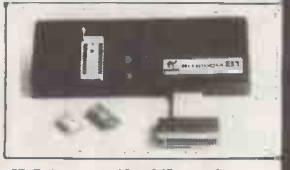

STATUS NO. OF SYSTEM —HEX
EPROM TYPE —27128
RAM START ADDR —4000
EPROM ST. ADDR — 0000
JOB LENGTH — 4000
TASK — CHECK

WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
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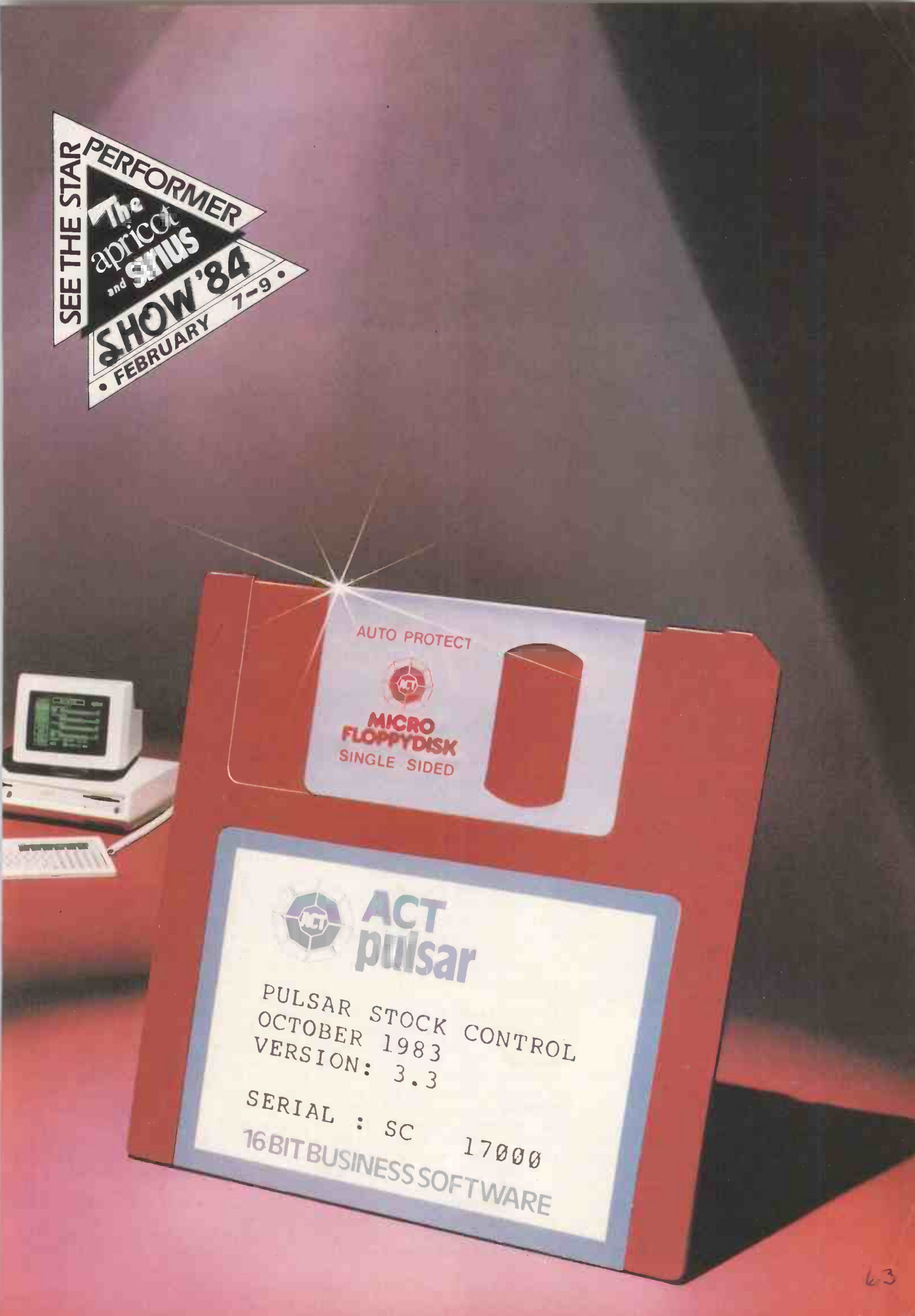
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TANDY COLOR COMPUTER 2

The 64K Color Computer is being launched this month. Jack Schofield sees if at last Tandy can slay the Dragon 32.

THE TANDY Color Computer was launched in late 1981, and represented a significant shift in approach by Tandy Radio Shack. It used the powerful Motorola 6809 chip, rather than the Tandy standard Zilog Z-80, and it offered colour, sound, a cartridge slot and joystick ports. Like the Texas Instruments TI-99/4a and Atari micros, it was aimed at the consumer rather than the enthusiast.

Unfortunately, Tandy had not reckoned on a mythical fire-breathing monster from the Welsh hills, which devoured the U.K. market before the Color Computer really got going. The Dragon 32 offered remarkably similar features to the Color Computer. In addition, it had a better keyboard, twice as much memory, and cost a lot less. In fact, when the 32K Color Computer was born, the Dragon was virtually half the price.

Tandy could not outsell Dragon on the availability of software, because by choosing the 6809 it had cut itself off from its own software base. Neither could it sell on the availability of peripherals: few Dragon 32 buyers realised how long it would take Dragon Data to offer a proper system, and even fewer cared. Nor could Tandy beat Dragon at marketing, because the Dragon 32 was taken up by Boots the Chemist — one of every Briton's favourite stores.

Now Tandy is having another attempt. It has given the Color Computer a face-lift: more memory, a better keyboard and a fresh lick of paint. Also it has cut the price of the existing models fairly dramatically. The 32K Extended Basic model is down from £379.95 to £299.95, and the 16K standard model from £239.95 to £179.95. The cost of a disc drive with controller has dropped too, from £459.95 to £349. In spite of all this, the 64K Color Computer remains an ugly duckling, as will be seen later.

However, Tandy has provided it with the potential to be a swan, by implementing the Unix-like OS-9 operating system on the 64K model. This offers real concurrent operation or multi-tasking. It offers multi-user facilities, so you can hang an extra terminal off the CoCo's serial port, plus login, password protection and tree-structured directories. In several respects the 64K CoCo gives machines like the IBM PC a good run for their money, since the 6809 is as much of a 16-bit chip as the Intel 8088 which powers the IBM.

The new Color Computer makes a good first impression, and sports a smart grey finish instead of Tandy's usual silver. The case is solid and extremely well finished. The Tandy leaves the Dragon slain in overall appearance.

The keyboard also appears to be good. Gone are what the Americans call Chicklet keys, after the popular sugar-coated chewing gum. However, the keys have a stiff touch and very little travel. The typing quality is well below that of the Atari XL range, BBC Model B, Sharp MZ-711, and even the Dragon. Chicklet keys positioned over a membrane worked better than they looked; the new keyboard looks better than it works, but it is an improvement.

Like the 32K CoCo and the Dragon itself, the new model has a limited number of keys and a very limited character set. The 64K CoCo has only 53 keys: no function keys, no numeric keypad, no Escape key, not even a Control key, and the keys still lack auto-repeat. The character set is still more limited. The 53 keys produce only 63 alphanumeric characters and symbols. The rest of the 255 available mainly comprise a weird and wonderful collection of block-graphics characters in a range of unexciting colours.

Thus, like the Dragon, the 64K CoCo lacks a lower-case character set, which even the Apple IIe has. Of course it is possible to use inverse caps in place of lower-case

letters, or you could reconstruct the character set to include true lower case, but in this day and age it should not be necessary. It is not good enough, and that applies for the 64K Dragon too.

Powering-up reveals the familiar CoCo/Dragon hideous green screen with black letters, and only 32 characters by 16 rows of text. The display is not as awful as that of the *Practical Computing* Dragon, but most current machines do better.

Only 24,871 bytes of RAM are free to Basic. It seems that, again like the Dragon 64, the 64K CoCo is a 32K machine that allows you to grab extra memory if you want it. Unfortunately the review machine had no documentation and I never calculated how to do so. Typing Exec did not work and on the 64K Dragon this gives 41,241 bytes free, which is more than the Commodore 64. On the CoCo it crashed the machine.

In its 32K mode, the CoCo has the same good but slightly old-fashioned Microsoft Extended Color Basic as before, and the same rotten Microsoft line editor. Again, this is not adequate by today's standards. Ataris have had full-screen editing since 1979, so Tandy and Dragon should be able to offer it now too.

The Color Computer becomes a more attractive machine when you plug a disc-controller cartridge into the port on the right-hand side, then plug in one or two disc drives. Preferably two, because copying a full disc with one drive involves five insertions of the source disc and five insertions of the destination disc.

With discs connected, the 64K CoCo offers 22,823 bytes free to Basic. The discs take up less RAM than Atari discs, but more than the Commodore 64 ones. Disc operation is simple and straightforward, though the drives are slow and noisy. The regrettable thing is that, without warning, the operating system writes over your old files if you happen to use the same name as an existing file. There is no friendly

Are you sure (Y/N)?

or

Replace existing file?

The 64K CoCo comes into its own after booting the OS-9 disc-operating system, which I had never used before. It was written by Microware Systems Corporation in America especially for the 6809 chip, and was modelled on the Bell Labs Unix operating system.

Anyone who is familiar with Unix, or the Unix-like MS-DOS/PC-DOS version 2 from the IBM PC, will find OS-9 even easier to use. Tandy's excellent documentation comes in a slip case and consists of one booklet *Getting Started with OS-9* plus three spiral-bound manuals.

Disc feature

OS-9 is on a single disc and the whole package costs £69.95. It has many sophisticated features normally found only on very expensive machines of, say, £5,000 to £50,000. It has a kernel, a shell and a hierarchical file structure, so you can organise material in directories, sub-directories and so on. It has device-independent input and output, with Pipes so that the output of one program can become the input of another.

In Unix you can run several programs simultaneously if you have enough memory, by adding & to the command. Similarly with OS-9 you can have multi-user operation and hang an extra terminal from the back of your Color Computer. Pretty amazing for a toy home micro.

OS-9 allows Unix-like commands such as

```
dir ! sort >/P&
```

which does a file directory, sorts it and sends it to the printer but hands the prompt back straightaway so that you can do something else at the same time. Or, for example,

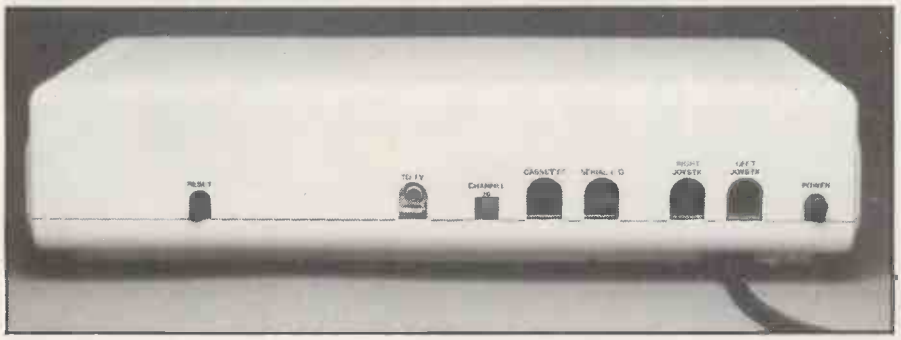
```
dir >/P& list myfile& copy oldfile newfile;
  del yourfile
```

sends a directory to the printer at the same time as typing Myfile on the screen and, concurrently, copying from the old file to the new file. When that's done it deletes your file. It is all done by one command line.

OS-9 comes with a good assembler, a text editor and an interactive debugger, so the assembler programmer will be very happy with it. There's an OS-9 Basic too, not supplied for review. The OS-9 prompt is tedious, reading "OS-9" all the time. However, you only have to type -P to kill it, then remove the echo, and the environment is so convincing that in a few minutes you believe you are using Unix on a DEC mini — except that you cannot browse through Usenet, the anarchic message network.

The 64K CoCo is not perfect. Screen width is a problem because of the way copious directory information is wrapped around. Also, Unix commands are traditionally all lower case, so the CoCo's insistence on capitals only, mixed with inverse capitals pretending to be lower case, is a pain. Finally, the software-driven real-time clock which OS-9 provides is hopelessly inaccurate, being configured for the American mains. Still, short of spending £5,000 on an IBM PC XT or Fortune 32:16, a 64K Color Computer with OS-9 provides the most fun you can have in computing other than playing Defender.

Incidentally, OS-9 has a serious purpose: to make available a substantial amount of business software which runs under this operating system. However, none was available for review, and it is probably all American anyway.



From the back it looks like a toy, but with discs it becomes something special.

Benchmarks

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av
BBC Model B—6502	1.0	3.1	8.3	8.7	9.2	13.9	21.9	52.0	14.8
Commodore 64*—6510	1.4	10.5	19.2	20.0	21.0	32.2	51.6	116.0	34.0
Tandy 64K CoCo—6809	1.4	10.5	20.4	22.3	24.0	34.7	51.1	132.6	37.1
Sinclair Spectrum—Z-80	4.8	8.7	21.1	20.4	24.0	55.3	80.7	253.0	58.5

*portable version

The 64K Color Computer is fast at writing to the screen, but the standard Benchmarks show the Microsoft Basic running at its usual leisurely pace.

Conclusions

● On its own, the 64K Tandy Color Computer is a moderately good home micro with a number of serious limitations, particularly in the screen display and lack of lower-case letters.

● With the OS-9 operating system, the 64K Color Computer becomes a powerful and interesting machine which potentially offers the serious user facilities far above its price level.

● If OS-9 software becomes available, and the Color Computer proves big enough to take it, this could give it serious business applications.

● In any event, the wealth of error messages, excellent assembler facilities and Unix-like power make OS-9 far superior to CP/M, and a valuable learning tool for anyone interested in current developments in operating systems.

● The 64K Color Computer will be available from Tandy stores and computer centres at a price to be announced. Contact Tandy, Tameway Tower, Bridge Street, Walsall, West Midlands. Telephone: (0922) 648181.

LSI OCTOPUS

A new image and a massive promotion budget are to accompany the launch of LSI's business micro. Glyn Moody has been finding out what the fuss is about.

A LITTLE OVER a year ago, LSI computers launched its M-Four, which combined eight-bit and 16-bit CP/M operating systems on one machine, implemented via dual processors. At the time there was plenty of tried and tested software for the ageing CP/M-80 but too little for the up-and-coming CP/M-86 to justify a leap of faith in that direction. During this last year things have moved on, and practical 16-bit software is starting to come through. Any system that can offer the best of both worlds is clearly attractive.

LSI has now extended the M-Four to include a wide-ranging expandability while adding CP/M Plus and Concurrent CP/M in dual 86/80 form and MS-DOS. Since the obvious name for the new product has been pre-empted by Sord, the new machine has been duly christened Octopus.

Hitherto LSI's marketing people have been content to maintain a fairly low profile, and sales have grown quite respectably on their own. However, the Octopus is being launched with the full treatment — Channel 4, no less — and an overall publicity budget of over half a million pounds.

It is big money for a firm that had sales of £3.5 million in the year to June 1983. But LSI forms part of the CPU group, which has over five times the turnover and is quoted on the Unlisted Securities Market. The LSI range is sold through an interesting mixture of 12 franchises and a dealer network.

Three-box format

The Octopus adapts the standard three-box format: the monitor and keyboard are separate and there is a low, squarish main unit in off-white polyurethane. On a desk top it is a rather more manageable than its predecessor.

The entry-level system includes one 400K floppy disc and 128K RAM but no monitor. It costs £1,530 plus VAT. The first real usable option offers two 400K floppies and a monitor, together with bundled accounting software for £2,090. Winchester options start at £3,290 for one 5Mbyte floppy.

Two hexagonal screws secure the back of the main unit. A neat modular layout with tidy wiring is to be found inside. Everything possible is earthed, a feature which is indicative of LSI's long-term plans. After the British and European launches the company intends to start marketing the Octopus in the U.S., where stringent safety regulations prevail.

The power supply occupies the left-hand side of the unit, viewed from the front, positioned next to a small fan and loudspeaker. Two half-height Shugart 5.25in. floppies, or one floppy plus a

Benchmarks

The Octopus will be released with Digital Research's Personal Basic as standard. It was not available on the preview machine, so Microsoft Basic-80 Version 5.2 running under Concurrent CP/M-86/80 was used. It requires about 24K of RAM. The full 16-bit PBasic, when it comes, is unlikely to perform Benchmarks very much better. All timings are in seconds.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av
HP Series 200 Model 16— 68000	0.2	0.6	1.4	1.6	1.7	2.8	4.3	15	3.4
Orion—8086	0.6	2.1	4.8	4.9	5.8	10.5	16.7	13	7.3
Octopus Z-80/8088	0.8	2.5	7.5	7.4	7.9	13.6	21.9	38.5	12.5
IBM PC—8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30	16.9

The twin-floppy business system costs just over £2,000; other disc options range from a single 400K floppy to a 40Mbyte Winchester.

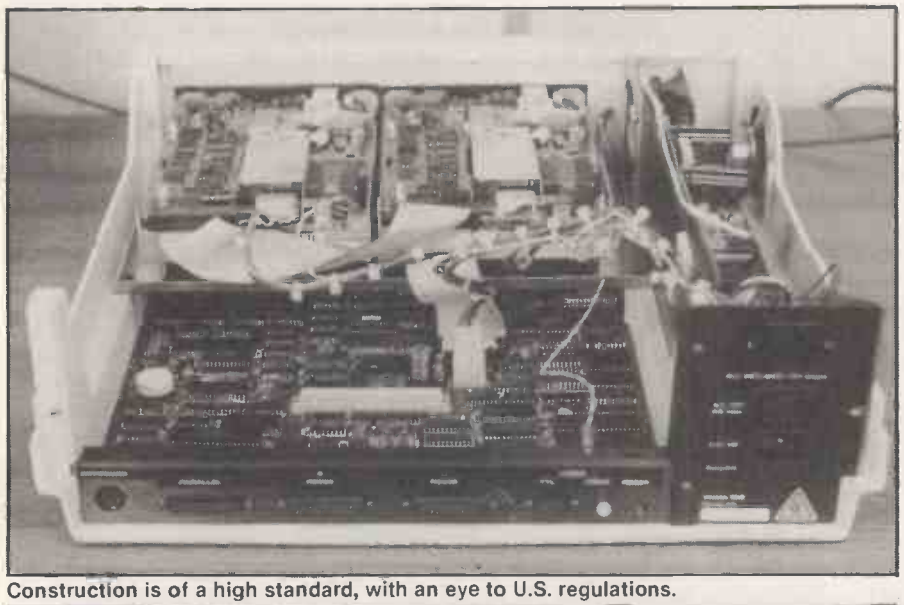
Winchester, are mounted in the front. Along the back of the unit you find: a socket for the serial keyboard input; a parallel I/O, which is a superset of the Centronics port; two RS-232C ports; a TTL output that connects to an RGB monitor or TV set VHF input; and a composite-video monochrome plug. There is a tiny Reset button — no danger of accidentally pressing it. Finally there is the mains input, along with a socket to allow the monitor to be powered from the Octopus itself.

Inside, the motherboard nestles partly under the disc units at the front, and is mounted so as to slide out as a single unit. The PCB itself is of an advanced multi-layer construction which allows very neat and compact board layout, and reduces circuit noise. It is populated in Scotland. The few wires and piggybacks visible would, I was assured, be incorporated on to the main board for the production models.

The two processors are an Intel 8088-2 running at 8MHz and a Zilog Z-80B at 6MHz. The standard model comes with 128K plus parity. A 32K EPROM contains the system firmware, and there is room for another. An 8087 maths co-processor chip cay be piggybacked into the 8088 slot as an extra. There is a real-time clock powered by a rechargeable battery. It lasts about 3½ weeks when the Octopus is switched off.

One striking feature of the board is the large expansion slot towards the back, next to the I/O ports and circuitry. It is perhaps the key element of the Octopus and its philosophy. A superset of the Multibus system is used, and up to four expansion boards can be progressively stacked on top of each other. One card mates via a bridging piece with the bus slot beneath and provides a similar slot for further expansion. The bus effectively flows through the additional boards.

Options include a communications board with four RS-232C and one RS-422 ports. Extra RAM up to 512K and an Arcnet-type LAN will also be available. A graphics board allowing a 325-by-800 resolution and a BT-approved internal modem are also promised. LSI is encouraging third-party suppliers to add to this range.



Construction is of a high standard, with an eye to U.S. regulations.

Buyers have a choice of keyboards, including an IBM PC look-alike.

The keyboard is connected via a 14ft. coiled cord which plugs into the rear of the Octopus. LSI offers a straight IBM look-alike keyboard — even down to the tedious Backslash key where Shift should be. Alternatively, you can have a slimmed-down version of the popular M-Four word-processing keyboard which has no fewer than 32 programmable function keys. This may sound like overkill but it can be put to good use.

The LSI-supplied monochrome monitor is a 12in. Panasonic which uses a P-34 green phosphor. A colour option is fitted as standard on the Octopus, so colour monitors of varying resolution are also available. Other features include a sound channel installed as firmware, and provision for a cartridge tape back-up. A mouse will be available later.

On powering-up, the machine goes into a self-diagnostic routine. The screen shows the following in succession:

```
Testing . . .

Main Processor
PROM
DMA Controllers
RAM
Interrupt Controllers
Floppy discs
```

Any intelligent option boards present on the expansion bus show up in a similar way.

The system may be reset at any time by pressing Control, Shift and Delete simultaneously — the same three-key system as the IBM. After the diagnostic routine the Octopus gives a choice of booting up the Winchester or the floppy. Four operating systems are available: CP/M, MP/M, MS-DOS and the company's proprietary system Elsie. After you select a disc the system searches for all bootable systems and then presents a menu of options.

Since CP/M-86/80 and MP/M-86/80 have been available for some time on the M-Four, the most interesting developments on the Octopus are the LSI versions of CP/M Plus and Concurrent CP/M for the dual-processor architecture. The CP/M Plus running on the preview machine was only the beta-test version, though evidently Digital Research has assured LSI that the final release is to be available "real soon now". It will then form the basic operating system offered as standard on the Octopus.

Loading CP/M Plus produces the following screen output:

```
Available Drives

A:W
B:W
C:LH drive 48 tpi automatic
M:128K memory
P:patchable format
```

This shows a floppy and Winchester system where the hard disc has been partitioned by system software into two

(continued on next page)

(continued from previous page)
drives A: and B:. Drive C: is the 400K floppy drive to the left of the Winchester unit.

Drive M: represents the virtual disc storage allocated in RAM by CP/M Plus, and the 128K its total extent. With a 256K system, 128K is normally allocated as a RAM disc, and the remaining 128K then serves as normal RAM.

The P: drive refers to a patchable format option. The physical drive C: is set up to read IBM PC and LSI disc formats automatically. Using the configurable P: drive, practically any other disc format — except the Sirius — can be read by specifying the relevant parameters using the Parmgen command.

This is a standard routine supplied as part of the 370K of system utilities. The version that I saw also allowed scroll speed to be varied from a gentle flow to a hiccoughing line-jump. Various display-width and colour options may also be set. The final version will have the command structure for matching the P: drive's parameters to other disc formats, either via menus or directly.

Two other useful utilities are included with the Octopus. Keygen allows the 32 function keys to be programmed via a series of menus. The program detects automatically whether the keyboard is of IBM or LSI type and adjusts the options accordingly. An obvious choice is the set of standard WordStar commands, and booting CP/M Plus sets them as default. LSI produces a keyboard overlay for people using the function keys in this way.

The Fontgen command allows whole character sets to be set up and modified. The Octopus comes with two standard files of founts, for 80-character screen width, and a narrower one for 132-character display. Up to 256 characters can be defined in two blocks of 128. Using simple menus of instructions, new characters can be defined or old ones modified.

Specification

CPU: Intel 8088-2 and Z-80B
RAM: 128K, expandable to 768K
Portability: typical main unit weighs 15lb.; a carrying case is available
Size: main unit is 15.7in. deep by 17.7in. wide by 5.7in. high
Display: monochrome 12in. allowing 80 columns × 25 lines or 132 columns × 29 lines, characters are formed on 12 × nine and 11 × six matrices respectively
Keyboard: detachable; choice of IBM-type or LSI word-processing model
Interfaces: Centronics-type parallel port; two RS-232Cs
Discs: one or two 5.25in. Shugart half-height floppies, formatted capacity 400K per drive; 800K optional; Winchester discs of 4, 10, 20 and 40Mbyte available
Software in price: CP/M Plus 86/80 and Personal Basic from Digital Research; Axis accounting package with business system
Hardware options: expansion boards for RAM, communications, internal modem, and networking; also 8087 maths co-processor
Manufacturer: LSI Ltd, St John's, Woking, Surrey. Telephone: (04862) 23411
U.K. prices: £2,090 for 128K system comprising screen, keyboard, twin disc drives plus Axis software

Attractive

In 80-column format the character is displayed as a blown-up 13-by-nine pixel representation. Moving around this grid with the cursor-control pad, individual pixels can then be added or expunged. Working with the 132-column fount the character is formed on an 11-by-six pixel grid. The founts can then be stored and loaded at any time. This whole feature is very attractive and well implemented.

Similar options are available on the Concurrent CP/M-86/80 system. It is fully operational now, but because it requires about 128K of RAM Concurrent CP/M is not supported on machines with less than 256K RAM; the recommended level is 512K. CP/M Plus, by contrast, takes only 40K including buffer and command interpreter, most of which is separate from the 64K directly addressable by the Z-80 under CP/M.

The Octopus uses the 8088 as a slave to the Z-80. All I/O is handled by the 16-bit processor and so is coded exclusively in 8088 instructions. Only about 2K of the Z-80's precious 64K address space is therefore taken up by systems software. This arrangement also enhances response times — so much so that LSI says well tested eight-bit implementations of applications software are often still preferred to bug-ridden 16-bit upgrades. WordStar is a case in point.

Concurrent CP/M is signalled by an A> prompt for User 0, and 1A> for User 1 — up to 3A> for user 3. A status line appears at the bottom of the screen. One of the neat uses of concurrency is to allow different levels of operation at the same time. For example, while modifying one fount using Fontgen, quick reference can be made to another, simply at the touch of a key. CP/M listings of a directory can be checked for the presence or otherwise of files while a WordStar file is read or modified. Eight-bit and 16-bit programs can be run concurrently on the different virtual screens.

MP/M-86/80 supports the same operations with the addition of multi-user capability. Up to six intelligent terminals can be hooked up to the system via the RS-232Cs, though quite what the response would be is another matter. The system showed no obvious degradation with two users and, like Concurrent CP/M, allowed eight-bit and 16-bit software to be mixed. A multi-user concurrent version is also promised.

As in the case of CP/M Plus, LSI is still rather waiting on Digital Research for the networking option. The promised DR Net — a system like Arcnet that uses token-passing to give priority for transmission to each machine in turn — will apparently look like a distributed MP/M system with concurrency. The speed is about 2.5Mbit/second.

The basic system includes CP/M Plus 86/80 and Digital Research's Personal Basic. The £2,090 business system comes with an accounting, invoicing and stock-control package called Axis. For an extra £295 you can buy the Octosoft range of software. It consists of Plannercalc, a fairly cheap and rather idiosyncratic spreadsheet system; Lexicom, a menu-driven word-processor; and Rescue a well thought of database package. Clearly LSI felt the need to offer the canonical three applications, but this seems rather a motley bunch. The manuals for each are reasonably full if unexcitingly produced.

Unfortunately the same cannot be said of the manual for the Octopus itself. One slim A5-size ring-bound volume introduces the machine, CP/M-80/86 Plus and Personal Basic. There is no index. Too much is assumed for it to be much use to a beginner, and it is too skimpy for the practised user. When the basic product is so well thought-out it seems a shame to spoil the ship with such flimsy documentation.

Conclusions

● The Octopus is a well designed machine. It is soundly based in established technology but also incorporates some original features.

● The dual-processor architecture is a real gain, in terms of both present performance and future upgrading.

● Perhaps the most significant feature of the Octopus is its versatile expansion bus. A small business could safely buy the machine secure in the knowledge that upgrade paths will be readily available.

● With its wide range of operating systems, the Octopus is well placed to benefit from new software as it comes through. The systems software includes useful extra utilities like Parmgen and Fontgen.

● The bundled accounting software is a poor choice for a system which is otherwise well suited to the business user. It would be far better to make the price even more competitive, and allow end-users to choose their own application software. Businesses are no longer content to accept any old system. The Octosoft package is also unexciting.

● The Octopus user manual is a disappointment, though LSI has promised a revision. Manuals represent potentially the most important link with the user and should be as full and easy to understand as possible. When LSI produces a worthy companion to its machine, the Octopus will represent a good buy.

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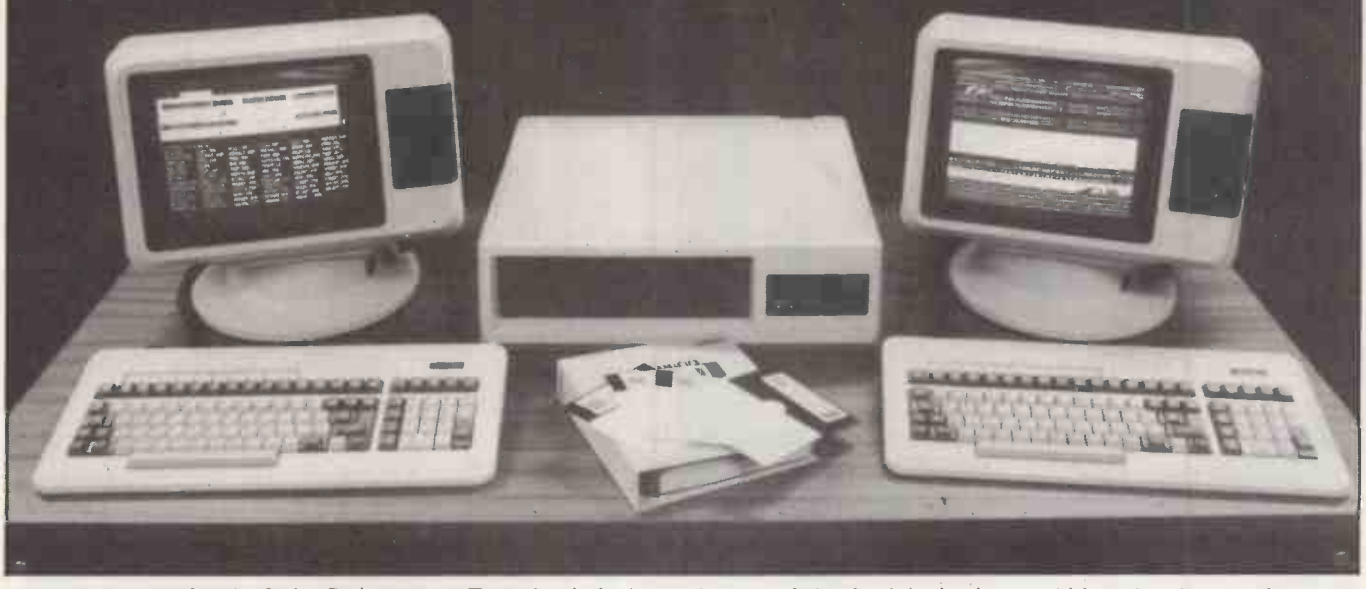
SEIKO 8600

Multi-user systems seem attractive — as long as software is there to run them. We put the Seiko to the test and Glyn Moody discovered it to be a practical proposition for business use.



THE ENTRY PRICE for the Seiko Series 8600 micro is £3,587 plus VAT for a 16-bit machine with 128K RAM and one 655K floppy. So it is hardly cheap, but then neither is it really representative. The Series 8600 is designed as a multi-user system for small professional offices and businesses.

A more realistic starting price would be £5,270 for two users. That includes one floppy and one 10Mbyte Winchester with 256K RAM, in addition to the two terminals with keyboards. Three-user options start from £8,256.

The hardware for the 8600 is produced in Japan. The systems software in America, from a company called Seicom which is jointly owned by Seiko and Science Management Corporation. Sole distribution rights in the U.K. are held by Intelligence Distribution Ltd. The plan is to sell the 8600 through a network of 80 dealers.

We reviewed here a two-user system with 20Mbyte Winchester. Physically, it is arranged as the natural progression from the IBM three-box configuration: one central processing unit connected to two terminals, each with a separate keyboard and VDU.

The squat rectangular box of the central unit has two convenient recesses in its base for easy lifting. At the front, to the left, is the floppy and next to that the Winchester. At the back you find the mains input socket and On/Off switch, printer port, four RS-232Cs and a recessed Reset button. Two simple locks at the top of this back panel release the upper lid.

The interior layout is almost spartan, chiefly because of the total invisibility of the motherboard with its 8086 processor. The board is tucked away safely in a separate compartment underneath; access is difficult, though not explicitly forbidden. By contrast, the disc-drive units are a model of easy installation and removal. The excellent blow-by-blow account in the manual gives full details — with illustrations — of which wire to put where. Good design means that it is practically impossible to hook anything up incorrectly.

Three extra 128K RAM cartridges take the total RAM to 512K and are similarly easy to load. A fourth slot is for communications. Although the hardware is available now, the software that will allow direct mainframe interfacing and terminal emulation — all at a cool 300Kbaud — has not yet been produced. The power unit is sealed off in a further separate compartment, with a small, fan opening on to the main recess containing the discs.

The 12in. monitor with standard P-31 green phosphor is set in a swivel unit that can be locked in various tilted positions. At the back there is a printer port, an RS-232C interface connecting it to the main unit, some Dip switches setting baud rates, and the keyboard port.

The keyboard is equipped with standard QWERTY-layout keys, a numeric pad with separate Enter key and cursor controls, and

Benchmarks

Timings are in seconds. Those for the Seiko were produced from the eight standard routines — see last month's issue — written in Basic-86 running under MP/M. It is perhaps not surprising that running the Benchmarks simultaneously on two terminals took about twice as long as running one terminal only. What is surprising is that running the Benchmarks while the second terminal supported Basic, but ran no program, produces almost identical figures. This is a result of Basic's constant keyboard interrogation, which uses the central processor.

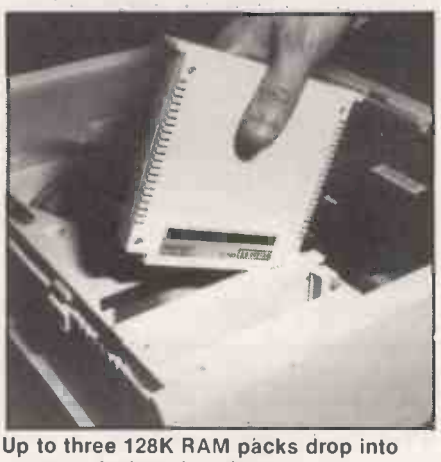
	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av
OEM Orion — 8086	0.6	2.1	4.8	4.9	5.8	10.5	16.7	13.0	7.3
Seiko 8600 — 8086									
single user	1.2	4.0	8.7	8.6	10.3	19.1	29.7	23.7	13.2
two users	2.4	8.4	17.6	18.0	20.7	39.0	60.5	47.8	26.8
IBM PC — 8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30.0	16.8

a host of defined and definable functions. Common keys like Esc and Ctrl are joined by others such as Tpwr and G1/G0. Tpwr switches on Typewriter mode: pressing any ken then produces lower case, and pressing a key with Shift held down gives the upper case or typewriter equivalent. Its setting is signalled by a built-in LED. The G1/G0 key then produces lower case, and pressing character sets available on the terminal, also has an LED warning. The default option G0 is the standard American ASCII set. When G1 is pressed each key produces a graphics symbol which closely resembles Sumerian cuneiform. Perhaps this forms part of some far-sighted marketing plan. Apart from the 10 function keys, there is also a range of edit function keys, used for on-screen editing.

The monitors with their keyboards are no mere dumb terminals. Each set comes complete with an 8085 processor and a large 64K memory used for buffering, and for local activity independent of the main processor. The overall feel of the keyboard is slightly shallow, but generally acceptable. That this is a high-quality unit is reflected in the price of £1,493 for a complete user upgrade — though this also includes a plug-in 128K RAM expansion for the main unit.

Modular construction permits easy replacement of major components.

Terminals are connected via RS-232 links; a Centronics interface is also provided.



Up to three 128K RAM packs drop into purpose-designed sockets.

Diagnostic checks

On powering-up, the user 0 terminal identifies itself as part of the Seiko 8600 computer system, and then goes into a hardware diagnostic routine. The machine then normally requests specification of a disc drive from which it could boot the operating system. On the review machine, part of the partitioned Winchester had been set as the default.

When using the 8600 machine, one of the first things you notice is that keystrokes beep, which is rather trying for those of us who have been conditioned over the years to regard beeps as tantamount to input errors. Happily, the Seiko's rich set of control sequences allows, among other things, the keyboard to be silenced.

Control sequences are entered as a string of characters following the Esc key. Although they can in theory be entered at any point in a computation, you run the risk of them being misinterpreted by the central processor which could then lock itself into something nasty. Seiko has devised a clever system of isolating the terminals for such set-up sequences, so you should be able to stay out of trouble.

Pressing the Shift and Set-up keys simultaneously calls up a 25th line to the screen display, which is normally 80 columns by 24 lines. The extra line is the status line, and is divided into 16 sections. By using the cursor controls it is possible to change the option for the terminal by pressing the Set-up key until the desired function appears. Thus smooth scroll may be replaced by jump scroll, auto repeat set on or off, baud rates may be adjusted and, most relevantly for the Esc command sequences, the relationship of the terminal with the main processor can be altered.

Apart from full-duplex and half-duplex modes, the terminal can be made purely local. Then any characters generated at the keyboard are sent to the screen but not the main processor. There is also a blocking option which allows an entire screenful of input to be built up at a terminal, and then sent all in one go to the 8086 processor when you press the Send key.

You should choose Local mode when using the Esc set-up codes. They are entered without any echo on the screen — something the manual omits to mention. You press Shift and Set-up once more to remove the status line and return to the current program. Using this very powerful facility practically every aspect of the terminal can be modified: screen mode may be set to blinking or double width; windows can be created, the keyboard disabled, and so on. The manual is commendably clear in this generous facility.

The manual is generally well produced and clearly written with plenty of diagrams and examples. It includes two glossaries and a list of Do's and Don'ts. Although it could have been slightly less technical, and so less offputting for the first-time user, its main fault is the lack of an index.

(continued on next page)

Multi-user MP/M-86

Judging by the flood of new machines, 1983 was the year of the 16-bits. Signs are that "multi-user" will be one of the catch phrases of 1984. This is partly a natural consequence of the new processors: for example, multi-tasking is an automatic option for the Motorola 68000 running under Xenix. But now, even the humble CP/M is offered in its Concurrent form — a kind of poor man's multi-user system.

MP/M is Digital Research's full multi-tasking operating system. As such it shares many of the features and infelicities of CP/M. Apart from standard utilities such as Dir, Era, Pip and Type there are a number of new features specific to the multi-user environment.

The first distinction to be made is between user and console. Each physical terminal is allocated a number from 0 to 15. The system console is designated 0, and it is here that the main bootstrap messages appear. The physical console number plays no visible role during use; it is merely used by the computer for housekeeping purposes.

Independently of the console number, each terminal may be assigned a user number from 0 to 15. The maximum number of users, as opposed to consoles, under MP/M is 16. The user number refers to the space allocated on all the disc drives, whether floppies or partitioned Winchesters. Each file is stored with an attached user number and only those pertaining to the user at the terminal may be accessed.

On booting up, the user number on each console is set by convention to the physical console number: user 0 on console 0, user 1 on console 1 and so on. The user number may be changed at any time by means of the User command: keying User 6, for example, sets the current user to 6. Unlike physical console numbers, which are unique, user numbers may be shared between different consoles. Thus two consoles may be logged into user 1 for example, and they may both access user 1's files on any drive.

Certain files from other users' disc drives can also be tapped. Any file can be stored with one of two attributes: Dir and Sys. Dir locks the file into the particular user's area on the disc: only the specified user may access it. If the file is stored with the Sys attribute by user 0 — but not other users — then other users may also gain access. Files which are generally available are systems files, hence the name, and provide general utilities like Dir and Era which are needed by all users.

Information on the attributes of a file can be obtained from an extended Dir command, calld SDir. This detailed directory gives the number of bytes and records taken up by the file and the attributes of the file such as Dir / Sys, Read / Write.

Although users may only access files in their own user area, it is easy to switch user number. So in real environments password protection is vital if access to sensitive files is to be limited. Entire discs or individual files, including command files, can be protected and at three levels: read-, write- or delete- protected. To set a local password, a global password for the entire system must first be entered. This may sound labyrinthine, but in fact is only logical. If the password-setting command structure were accessible to all users, the password option on all files could then be turned off.

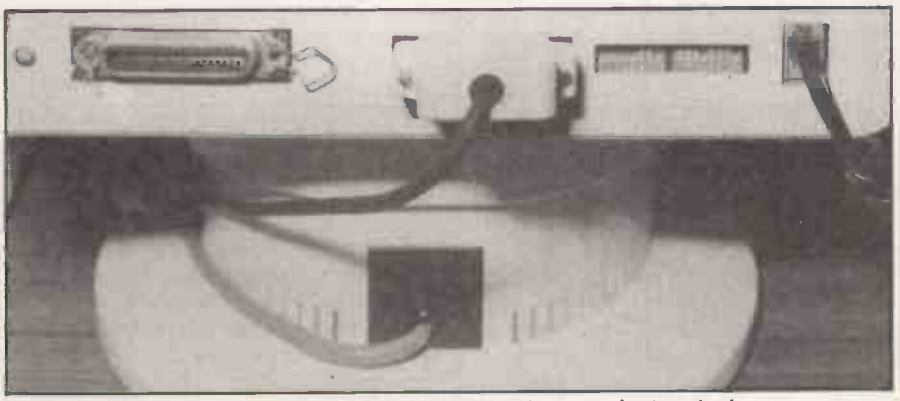
Booting-up MP/M on the review machine produced a main boot message on console 0 and user 0, and a subsidiary signal on console 1 and user 1. The prompts for the two terminals are respectively 0A> and 1A>, which signals the user numbers and drive, A being one of two partitions on the Winchester. The prompt P: is obtained when using the floppy drive. Drives are changed, as in CP/M, by entering the appropriate letter followed by a colon.

(continued from previous page)

Seiko's prices do not include any bundled software. Since the 8600 runs MP/M, CP/M-86 and MS-DOS, with the new Oasis-16 operating system promised, there should be no shortage of software. Cis-Cobol is also supported, allowing access to a wide range of business programs. The main problem is the lack of true multi-user products.

Conclusions

● The Seiko 8600 represents a well thought-out and well produced system.
● As a one-user option, it is not cheap. The full benefits are only obtained with two or three users.
● Naturally, with more users, the response time begins to falter. The Seiko is not suited to solid multi-user processing, but is ideal for professional or business use where two or three terminals are accessed frequently.
● The user-definable characteristics of the terminals are very impressive, if slightly superfluous for the intended end-market.
● There is no bundled software, so a working system will cost more than the prices quoted. For example MP/M costs £475 plus VAT.
● An otherwise excellent manual is flawed by its lack of an index, making it unnecessarily hard to use.



Each user can have a separate printer, connected direct to the terminal.

Specification

CPU: Intel 8086, 16-bit running at 5MHz
RAM: 128K, expandable at 512K
Dimensions: main unit is 19in. wide by 6in. high by 16.5in. deep
Display: 12in., 25-line by 80-character CRT; character matrix 10 by 14; two character sets supplied including ASCII, various cursor modes
Keyboards: Detached 100-key QWERTY, 10 programmable function keys, 18-key auxiliary pad, five special function keys
Interfaces: four RS-232Cs, Centronics-type printer interface, each terminal has one RS-232C and printer interface
Discs: one or two 5.25in. double-sided double-density 655K formatted; 10Mbyte and 20Mbyte hard discs optional
Software: CP/M-86, MP/M, MS-DOS, main languages and applications available but not included in price
Hardware options: communications interface, but without operating software
Manufacturer: Seiko, Japan
U.K. distributor: Intelligence Distribution Limited, Nelson House, 271 Kingston Road, London SW19 3NW. Telephone: 01-543 3711
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73

NEC PC-8201

Chris Bidmead looks at the latest lap portable in the Kyocera family.

TOWARDS THE END of 1982 the Epson HX-20 blazed a trail into a new market for briefcase-size computers. An ambitious machine, it is in many ways still the most interesting of what have become known as lap portables. However, it has suffered in comparison with newcomers such as the Tandy Model 100, the Olivetti M-10 and the NEC PC-8201A which offer a screen of 40 characters by eight lines, instead of the Epson's poky 20-character by four-line LED display.

Regular readers of *Practical Computing* will notice that we are tracking the development of these machines closely, with reviews of the Tandy 100 in the August issue, and the Olivetti M-10 in December. I suspect this is because lap portables, with their emphasis on word processing on the move, hold particular interest for journalists.

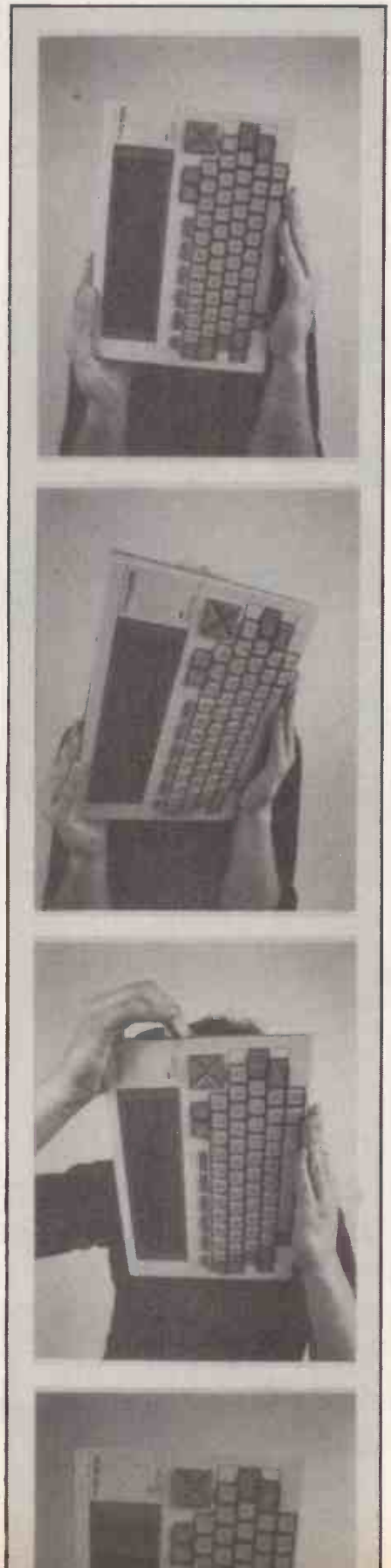
Their price of around £500 for a 16K model and their inability to hook up to a colour TV distinguish them sharply from home computers like the Vic-20 that they resemble physically. Nevertheless, they do represent a class of machine that is going to be mass produced in such quantities that prices will fall quickly.

Differences

The striking similarity between the three successors to the HX-20 is not accidental. They are all versions of the same design from the Japanese firm of Kyocera, which built the original and sold it to NEC. But although they are all based on the same kernel hardware, and run similar software from Microsoft, the machines are certainly distinct from one another. Negotiations between Tandy, NEC and Kyocera have resulted in complex trading agreements, with the outcome that NEC is permitted to market its own version, the NEC 8201, in the U.K.

Comparisons with the more widely available Tandy Model 100 are inevitable. The wedge-shape of the NEC makes it significantly bigger. The increase in physical size does two things for the NEC: it allows for a comprehensive collection of I/O ports at the rear; and it makes room for a large cartridge socket on the left-hand side which is closed by a spring-loaded flap when out of use.

Another noticeable feature is the cluster of sizeable and geographically oriented cursor keys instead of the miniature in-line keys of the Tandy. Otherwise, the basic QWERTY arrangement is identical, with changes being confined to the function keys and more esoteric computer keys. On the NEC the function keys are larger and fewer, from eight down to five, although they operate as 10 keys since, with the help of Shift, each one does double duty.



The Tandy has a ghost numeric keypad that allows the three rows of keys immediately below the 7, 8 and 9 on the top row to serve for numeric entry with the Num key locked down. On the NEC this arrangement has been omitted, and so has the Code key that permits access to foreign characters.

As in the other Kyocera machines, 32K of the address space is occupied now by ROM, with a further 16K of RAM — 8K on the Tandy — being sold as standard. Also like them, the memory size can be upgraded. The Kyocera CPU is an 80C85, the CMOS low-power version of the 8085 and a close relative of the ubiquitous Z-80. RAM enhancement ought to stop at 32K since 32K RAM plus 32K ROM makes 64K. But the NEC allows bank-switching of the RAM segment, which allows you to go on adding RAM internally up to a maximum of 64K.

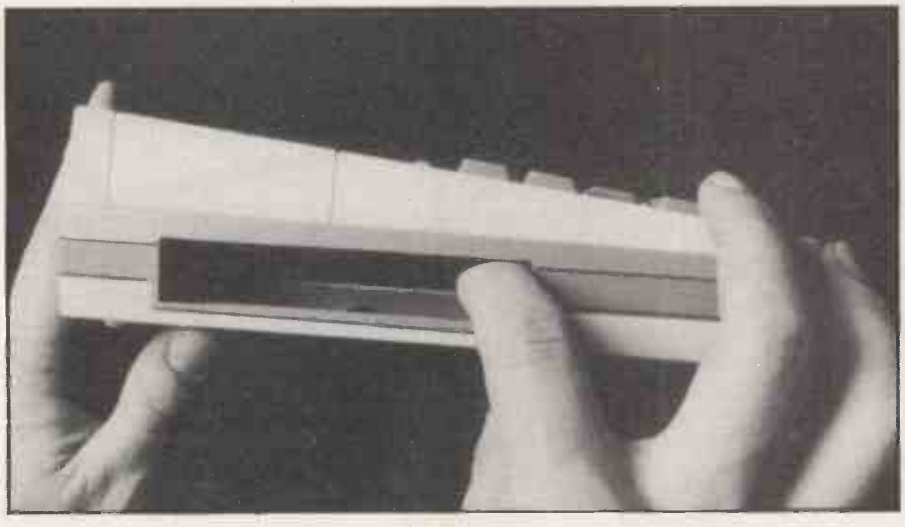
The flap-covered cartridge socket is designed to take a further 32K in the form of a CMOS RAM pack with its own batteries, which appears to the system as a third banked-out segment. This is one of the exciting aspects of the NEC, allowing you to create text or collect data in the

Specification

CPU: OKI 80C85 running at 2.4MHz
ROM: 32K Microsoft Basic with Telcom and Text
RAM: 16K standard, expandable to 96K
Size: 300mm. by 215mm. by 61mm.
Weight: 1.7kg. approx
Power: four AA batteries in interchangeable battery pack or optional NiCad rechargeable pack and recharger; additional built-in NiCads for back-up
Display: 40 characters × eight lines LCD; 64 × 240 dot addressable graphics
Keyboard: full-size QWERTY; five dual programmable function keys, operating as 10 geographically oriented cursor keys
Interfaces: eight-pin DIN cassette; RS-232, programmable for 75-19,200 baud; Centronics printer; HP-compatible bar-code reader; S-101 and S-102 reserved for future use, system slot for RAM cartridge
Software: 25-program cassettes supplied as standard in addition to ROM-based software
Manufacturer: Kyocera, Japan for NEC
U.K. distributor: NEC (U.K.) Ltd

The striking cursor-control keys instantly distinguish the NEC from its cousins.

Communications are well catered for with a variable baud-rate RS-232 interface.



ROM-based software plugs into a socket on the side, as does up to 32K of RAM.

RAM pack, detach it and despatch it back to base. One obstacle is that the RAM pack is not available yet; a further obstacle is the price. The pocket-size RAM packs each cost as much as a cheap dot-matrix printer, so you will probably settle for downloading data to a cassette machine.

All three new lap portables offer variations on the same suite of built-in software from Microsoft. Microsoft Basic is supplied burnt in to the ROM, but surprisingly it is not the same Basic across all the machines. NEC has said goodbye to the SCHDL and ADDRSS programs that on the Tandy and Olivetti are integral with the machine. The additional space is used to offer more comprehensive Basic, closer to GWBasic now appearing on all the new 16-bit hardware.

The word processor Text was covered in detail in the August 1983 issue of *Practical Computing*. SCHDL and ADDRSS are elementary database programs that act as diary plus name-and-address book respectively. They offer nothing that you could not knock up for yourself using the Find facility in Text, but NEC provides them in Basic in the Personal Application Kit — a cassette of 25 programs of varying utility.

Be warned that applications programs are not necessarily transportable across these superficially similar machines. Transfer rate and coding differences in the cassette interfaces make it impossible to get data from a Tandy cassette on to an NEC machine, and vice versa.

A machine of this sort can be expected to make heavy use of the RS-232 interface in communication with non-portables. All the Kyoceras come with a terminal emulating program that allows you to configure the baud rate and transfer files. Unfortunately, the XOn/XOff handshaking did not work convincingly, and I had difficulty matching baud rates.

One advantage of the NEC is the way it lets you carry out file housekeeping at the level of the menu presented at start-up. All you have to do is push a few function keys, using the cursor to identify files you want to delete or rename. Saving to and from cassette can be done interactively at this level. This is more convenient than the way the Tandy requires you to go into Basic and write out the Basic commands in full.

Conclusions

● The NEC is functionally very similar to the Olivetti M-10 and the Tandy Model 100, being from the same manufacturer Kyocera.

● It is significantly cheaper than the Tandy. The basic 16K NEC costs £475 and the 8K Tandy costs £499.

● Unique in its class, it can be enhanced up to 96K, equivalent to 12,000 words of text.

● The doubt hanging over the serial comms line is unfortunate. Like others who have mentioned this problem, I cannot swear it was useless because of the complexities of the RS-232 standard.

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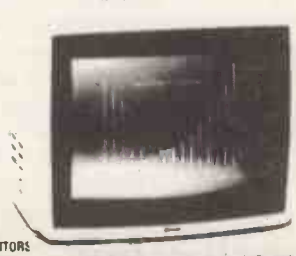

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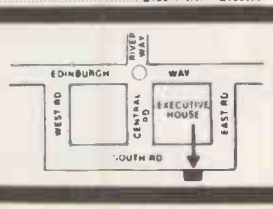


● Circle No. 146

The memory lingers on

Neville Maude makes a date with a combined diary, real-time clock and non-volatile add-on RAM for the BBC Micro.

ONE OF the annoying things about computers is that when the current is switched off everything held in memory is lost. Files can be saved to tape or disc, of course, but they then have to be fed back in on each occasion. The idea behind the Acacia non-volatile real-time clock and RAM system for the BBC Micro is to store diary information in RAM which has its own back-up battery.

The Acacia unit is housed in a substantial case which measures 8in. by 5.5in. by 3in. A ribbon cable links it to the micro's 1MHz bus connector, and a four-strand connector goes to the auxiliary power socket.

The all-important back-up power is supplied by a Tadrian TL-5104P lithium battery. Acacia quotes a rather conservative three-year battery life, after which a replacement will cost around £5. New batteries can be inserted by anyone who can handle a soldering iron without damaging CMOS components, and Acacia will do the job for those who lack the courage to do it themselves.

Sideways ROM

Interfacing software comes on a ROM which should be placed in the first socket from the right. It is formatted as sideways ROM so only 256 bytes of workspace are needed. The current version is compatible with Torch, second processors and so on.

The RAM filing system is very swift indeed — three times faster than disc for Load and Save. It is also very reliable since there are no moving parts, and operation is completely silent. Time and date can be automatically included into files.

Setting up

Only 4K of memory is available, but that is enough to be useful for small things such as setting-up data. For example, if using the Wordwise word-processor chip it is useful to let the non-volatile RAM feed in things like *TV255,0 and *FX6,0. Other useful instructions might set the second values for the user-definable keys to provide single-key controls, standard page settings, and any commands required to ensure that the printer produces a £ sign instead of a #.

The idea of instantaneously switching in Snapper, Planetoids or more serious long programs must wait until more RAM is available. Acacia can provide a 26K upgrade with no change in base software, though this costs about £150 extra. When 8K chips become cheap enough to replace the present chips, full expansion will be possible up to 64K.

The diary system is based on a real-time clock which can provide readings of the year, month, date, hour and minute. Reminder messages are available if required; they could be yearly for birthdays or an approaching MOT test, or monthly, like cheque-card repayments. Temporary messages for things like switching off the cooker can be programmed in. An alarm can be made to sound even if you are in the middle of another program. The current version holds dates up to the year 2014.

You can search the diary for particular entries. Suppose you were a keen golf player, entering

*DIAK GOLF

would select and display all entries showing this keyword. If you wanted to know when you met Mr Brown the computer would pick the relevant entry or entries. Useful refinements are that upper and lower case can be used. There is a wild-card facility so if you are not sure whether the name is spelt with an e or not, typing

Brown*

would cover both contingencies.

Apple Diary

The Oasis Diary Card provides a clock/calendar for the Apple II computer. The software, in ROM, provides commands to create, review, search and exit from the diary information, which is held in battery-backed RAM. Data retention is stated to be a minimum of five years. The 16K of RAM allows about 240 diary entries, but a factory upgrade to 64K of RAM is possible. The diary card can be installed in any slot except slot 0, and the diary can be accessed without disturbing any program in RAM. Contact Oasis Electronics Ltd, University Village, Norwich NR4 7TJ. Telephone: Norwich (0603) 503275.

*DIAA—add a reminder to diary
*DIAD—display and/or delete all reminders for specific or subsequent dates
*DIAK—display and/or delete items containing keyword
*DIAR—read and/or delete items that activated alarm
*TIME—enable continuous date and time display
*DATD—display non-continuous time and date
*TIMD—disable continuous time and date display
*TIMS—set the time
*DATS—set the date

Table 1. Diary system commands.

*ACCESS—locks or unlocks file
*INFO—determines load address, length, and execution address file
*OPT 4n—controls autoboot, 1 Load, 2 Run, 3 Execute
*EXEC—treats file as if typed in
*SPOOL—directs output to screen, printer, RS-423 etc
*RAM—access to Acacia filing system

Table 2. Filing system commands.

Conclusions

● The diary and RAM filing system are a very clever piece of programming, with well thought-out commands.

● A commendably clear 36-page A5 manual is supplied.

● The instant loading offered by non-volatile RAM storage is attractive, but the standard 4K is large enough only for frequently used set-up routines rather than full programs.

● Good old-fashioned desk diaries and real-time clocks with built-in alarms can both be had for a few pounds: whether a micro-based version of the same things is worth 10 times as much must be a matter of personal priorities.

● The Acacia Diary and RAM filing system is supplied by Acacia Computers Ltd, 5 Coombe Lea, Bickley, Bromley, Kent BR1 2HQ. It costs £147 including VAT; the 26K RAM upgrade costs about £150.

VISI ON

Ian Stobie looks at Visicorp's long-awaited mouse-controlled integrated software system: how it compares to the Lisa and to competing products promised by Digital Research and Microsoft.

A YEAR AFTER the Apple Lisa pioneered a new approach to software the first of the major imitators has arrived. Visi On from Visicorp has, like Lisa, a friendly mouse-controlled user interface. Also like Lisa, Visi On lets you run several applications concurrently, displaying them in separate windows on the screen, and it lets you pass data between them.

Unlike Lisa, Visi On does not require special dedicated hardware — it will run on a range of machines. But it is not an operating system, but an "operating environment". You load it on top of your operating system, which is one reason why it is machine independent. The initial version, available immediately, is for the IBM PC XT.

Visi On comes in two parts. The Visi On Applications Manager sits immediately on top of the OS, which in the initial release is MS-DOS. The VAM seizes control of all interaction between the machine and the user, doing things like displaying the output from application programs in user-defined windows on the screen and accepting commands entered using the mouse or keyboard. Visi On application programs then sit on top of the Applications Manager.

Initially Visicorp is releasing three application programs for Visi On: a spreadsheet, a word processor and a graphics package. They are called Visi On Calc, Visi On Word and Visi On Graph, names which are sure to lead to confusion with Visicorp's older series of programs, the VisiCalc/VisiWord/VisiPlot range. The company intends to bring out other Visi On applications, with a database called Visi On Query to be followed by mainframe-to-micro communications.

Data transfer

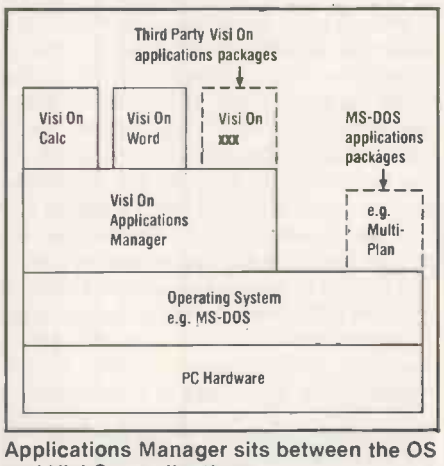
Data from the Visi On programs can be transferred from one program to another, from Calc to Graph to produce a bar chart for instance, and then from Graph to Word to incorporate the bar chart in a report. At least that is the intention. In fact the initial release, Version 1.0, that I saw running on the IBM could not manage to move charts across into a Word document.

It took Apple some time to get similar functions working on the Lisa, but with a year's start the Lisa provides a more completely data-integrated invironment. On the other hand Visi On's response time seems good compared to the sluggish standard set by the Apple Lisa, especially when opening up an additional window for a new application program.

The mouse supplied by Visicorp has two buttons and is of novel design. Instead of having a large ball-bearing in the base like the Lisa and Microsoft mice, underneath it has a light emitter and a light detector. You move the mouse about on a 9in.-by-6in. flat mirror with a grid marked on it. This optical system seems to work reasonably well and is claimed to be more reliable. Visicorp says later versions of Visi On will support other manufacturers' mice.

The general approach embodied in both Visi On and Lisa is to simulate the familiar desk-top paper environment on the computer screen. I personally find this makes unfamiliar packages easier to use. The consistency between applications makes it easier to remember what to do when you return to a package after not using it for several weeks.

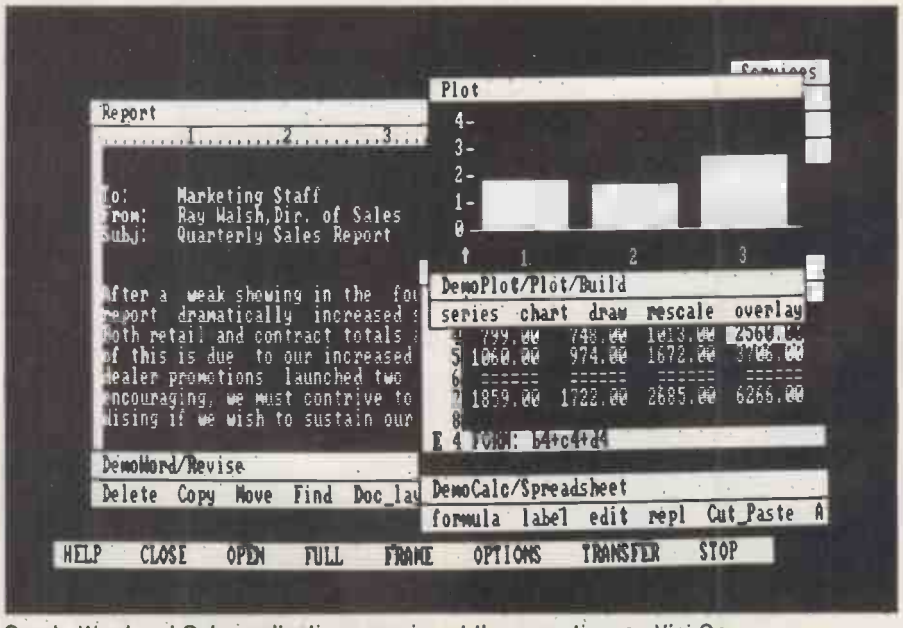
All the same, I find it difficult to be very excited by Visi On, perhaps because it is so very like the Lisa. Where Visi On differs from the Lisa it is generally less ambitious. It does not make such extensive use of graphic symbols on the screen for instance, being content with displaying keywords.



Applications Manager sits between the OS and Visi On applications.

As with Lisa, the problem most people find with Visi On is the price. Before you can do anything you need the Visi On Applications Manager costing £375 and the mouse at £185. The Visi On applications themselves cost an additional £295 for Visi On Calc, £285 for Visi On Word and £195 for Visi On Graph. When you add on the cost of an IBM PC XT you are not far off the price of Lisa, which is £6,500 with all six integrated Lisa applications.

Visi On will be launched for several other machines including the Texas Professional, the Wang PC and the standard IBM PC, but the overall cost is unlikely to be much lower because Visi On requires a hard disc. The VAP code alone takes up 1.5Mbyte. It is crucial to the success of Visicorp's strategy for Visi On to get third-party suppliers writing independent application packages for Visi On. Above all, Visicorp has to achieve a large installed base quickly. So the all-in end-user system price matters a great deal.



Graph, Word and Calc applications running at the same time on Visi On.

To encourage third-party suppliers to develop Visi On application programs Visicorp is releasing full details of the VAP's program-level interface. This is not as useful as it sounds, as Visi On applications will have to be written in C and you will need the Visi On toolkit to build mouse control and windows into your application package.

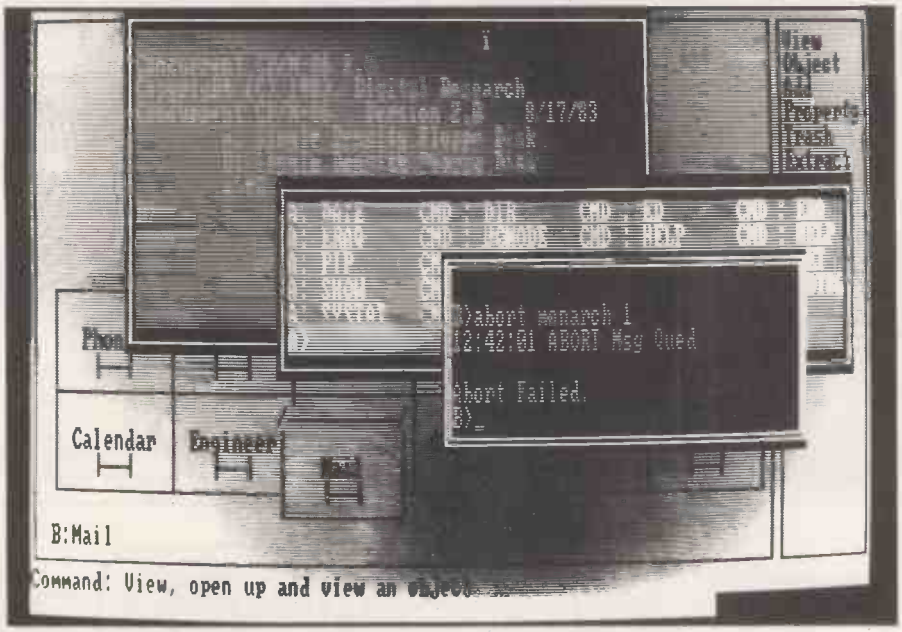
The toolkit will run only in a Unix environment at the moment, which means that whatever your target machine is you will need a Vax or a good 68000-based machine to develop your software on. Further, the Visi On toolkit is expensive: the Vax version costs £7,500, and the 68000 version £5,000. A version of the toolkit to run on the IBM PC, which presumably will be cheaper, is promised for early 1984.

Since Visi On sits on top of a standard operating system running on a standard machine, the key question for any commercial software developer is why not simply write directly for the OS. Immediately this would open up the huge potential market of possibly one million MS-DOS systems already out there, compared to an installed user base for Visi On, at the time of writing, of zero.

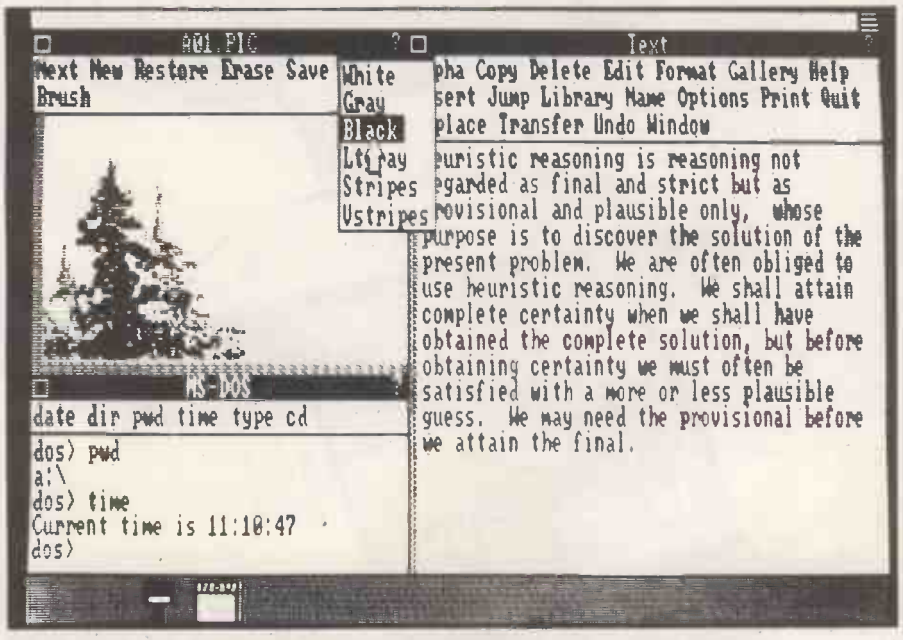
It could be argued that it might make better commercial sense to write your own set of routines and put them in with the application code, like in Lotus 1-2-3 or Multiplan for example, or to forget about such frills altogether. This assumes that the standard operating systems are going to remain simple, with a fairly spartan user interface. What is happening is that both Microsoft and Digital Research are putting elaborate user-friendly features into their OSs, and are bringing out powerful software tools to help with system development. Now both have announced concurrent windowing for future products.

At a press conference timed to the hour to match Visi On's launch, Microsoft showed Windows, or rather an early mock-up version. The real product will, it is claimed, be available in April 1984. A year ago Visicorp pre-announced Visi On to journalists at the height of the excitement over the Lisa. It is ironic that in this instance Visicorp is having its thunder stolen in the same way.

Windows is really part of MS-DOS 2, the latest release of Microsoft's 16-bit OS. Windows is still a provisional product, but the demo I saw running on a DEC Rainbow 100+, the new hard-disc Rainbow, looked very good. It has better-resolution graphics than Visi On and made full use of Lisa-style icons. However, the response time of the eventual product was impossible to judge given the artificiality of the demonstration.



Concurrent CP/M, with four windows, is due for release in March.



MS-DOS with Windows showing Word simultaneously with another program.

Less ambitious

Microsoft's MS-DOS 2 with Windows is a less ambitious product than Visi On in that it looks as though it will not have virtual-memory management. this suggests that the number of tasks you can do concurrently may be more limited, or the response time may suffer in some circumstances. Nonetheless I would judge it to be a real threat to Visi On in the market place. Already Microsoft has signed deals with 23 computer manufacturers to put MS-DOS with Windows on their machines. As an OEM product MS-DOS with Windows will sell in volume to system suppliers. To the end-user it will appear to be come free with the system. Visi On, on the other hand, has to be bought like any other application product, and it is not cheap.

Microsoft's activities will have the most immediate impact on Visicorp because all the early versions of Visi On will be for MS-DOS machines. But Visicorp intends to release Visi On for Digital Research operating systems at some stage. Again, Digital Research has rapidly followed the Visi On launch with an announcement of its own. Version 3.1 of Concurrent CP/M-86, due for release in March, is to have windows. DR's windowing facilities are limited to four windows active at one time, but there will be support for data transfer between windows, which is probably more important.

Between them, Digital Research and Microsoft have not left Visicorp much time to start an unstoppable Visi On bandwagon rolling. And then there is Apple, pioneer of the mouse/windows/integrated-software approach. Is it content to let things rest with the Lisa? In next month's *Practical Computing* we reveal the shape of Apple's answer.

Visi On's U.K. distributor is Rapid Terminals, Rapid House, Denmark Street, High Wycombe, Buckinghamshire HP11 2ER. Telephone: (0494) 26271.

The best policy

Ian Hopkins details the crucial clauses to look out for when you are insuring a micro

THE MAGIC of the micro is great to begin with. It obediently displays the latest profit figures, the answers to homework or the latest state of your single-handed battle to save the world from extra-terrestrial invasion. However, as with the TV and the hi-fi, at some point things are liable to go wrong.

It may be that a fault develops in the mysterious little box, or the keyboard refuses to function. Maybe your Dragon ends up in a burglar's swag-bag while you are at Butlins, or the ZX-81 loses an argument with the vacuum cleaner. As with most of the little tragedies of life, however, some solace can be found if you plan in advance — and take out insurance.

It is possible to insure practically anything in which you have a financial interest, but the insurance companies have been slow to adapt to computers, compared with their obsession for cars, houses and lives. At first they were happy to insure micros, and even larger machines, as an item in a business-contents contract, or to add the personal micro to the list of other electrical gadgets among the personal effects covered by a house-contents policy.

Embarassment

It has taken some time for the companies to realise the special problems relating to computers and to see that these are risks of a different nature than those applicable to the washing machine. It is still normal to go to a broker or the local branch office of a major company and be met with an embarrassed stare when you enquire about micro insurance.

There are three ways of approaching the insurance of your micro, and each has advantages and disadvantages. The simplest is to add it to the appropriate section of an office or house-contents policy, usually on an "all risks" basis. For home computers this involves simply contacting your insurers and asking them to add the machine to your policy and informing them of its value. The annual premium is then likely to be adjusted to take it into account.

Premiums are usually calculated as so many pence per £100 insured. Rates vary not only from company to company but from area to area. Norwich Union, for example, would ask 35p per £100 in low-risk country areas but as much as 90p per £100 in the burglar-infested wastes of inner London. Provincial's asking rate is £1 per £100. However, the cheapest policy is not alway the best since exclusions and excess — the sum you remain liable for, such as the first £100 of each claim — vary from company to company.

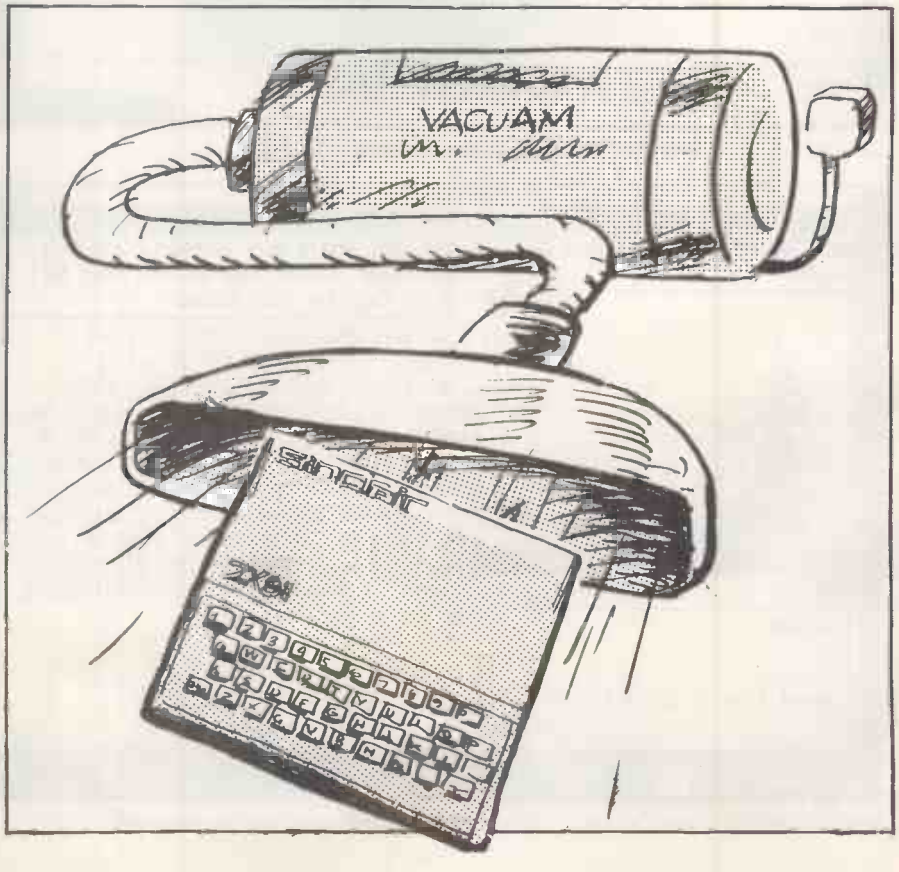
The problem with this type of insurance for a micro is that while it is cheap it only covers normal risks such as fire, theft and, to quote the Provincial, "loss or damage by any accident or misfortune". It does not cope with cooked chips or head crashes, still less with any financial loss which you incur because the machine is out of action. It may, however, be the economical choice for casual home users or smaller businesses.

A growing number of companies now produce computer policies that will cover the specific needs of small machines. For example, in addition to fire, theft and accident cover they will give protection for data media, costs of replacing data on tape or disc and similar expenses. Some of these companies are small engineering subsidiaries of the larger ones. For example, British Engine belongs to the Royal Insurance Group, National Vulcan is associated with Sun Alliance, and Scottish Boiler is part of General Accident. They tend to concentrate on commercial installations, especially mainframe computers, but will also cover micros. British Engine has a special Mini and Micro policy. Other companies catering specially for computers include household names such as Cornhill, Commercial Union and Eagle Star, while Prudential and Norwich Union have still to wake up to the potential in computer insurance.

Dr Ian Hopkins is a Director of Kosmos Computing

What these companies offer varies in detail but there are a large number of similarities. The significant differences are often simply the cost of premiums and the excess imposed. In the event of theft or total loss by fire or damage, most companies will replace the machine with a new one of the same specification. This new-for-old approach is important for computers because of the poor state of the second-hand market.

In motor insurance it is normal to indemnify the customer. In other words, if



your four-year-old Cortina is hit by a runaway lamp post you get the value of a four-year-old Cortina — no more, no less. You could then go out and buy one if you wanted to replace like with like. However, it is not so easy to get an Acorn Atom or Pet of a particular vintage. By and large the insurance companies recognise this, though there are a few exceptions, such as Guardian Royal Exchange. Many companies limit new-for-old to fairly recent models.

Along with the loss of the machine, loss of tapes and discs is an important risk, especially if they are carried about or lent to other people. Most of the specialist policies make some attempt to finance the resurrection of software. Some do not compensate for loss of the actual media, and the degree to which they will support data recovery also varies. Commercial Union is more generous on this than many others but it is important to get a clear understanding of the extent of compensation before you go ahead and sign the agreement.

Consequential loss

A third important area of cover is what is known as consequential loss. It covers loss of income and other costs resulting from computer breakdown or loss of access to the machine. British Engine summarises this cover as "additional expenditure up to the limit of the sum insured, incurred in order to continue the work normally done on the computer for up to six months . . .".

It is in the area of consequential loss that the traditional home-contents policies fall down because they will not offer any compensation for this type of loss. Office policies tend to include some cover of this nature often designated "interruption of work", although it may not be adequate for the potential loss of a database or large software system. The average home-computer owner, of course, may suffer little or no real loss of earnings if the micro is used solely for entertainment or pleasure. An identical machine used as the heart of a business-accounts or customer-record system could lead to financial problems in the event of theft or damage.

All risks?

If you are considering a so-called all-risks policy it is important to remember that it does not in fact cover literally all risks. There are a number of exclusions, which vary from company to company, but again they show a fair amount of common ground. Most policies exclude problems resulting from wear and tear and especially "derangement", by which is meant breakdown resulting from loose connections rather than a faulty part. Nearly all policies exclude loss or damage following "war, riots and civil commotion" and there are particular limitations in Northern Ireland. The effects

of nuclear radiation and changes in atmospheric pressure changes, such as sonic booms, are also excluded from nearly all policies. If your micro is insured on the basis of home use only you may have difficulties with a claim arising from business use. Domestic and General is especially keen on this point.

Failure of the electricity supply is often excluded, except for long periods, and this is a vital element in computer stoppage. For example, British Engine only insures against failure of supply for more than four hours and excludes "deliberate acts of the supply authority or drought". Eagle Star has a more complicated power-failure clause, but Commercial does not exclude this problem.

As with all insurance policies, there are excess clauses. You are expected to pay the first £10 per claim with Commercial Union and Cornhill, up to £50 per claim with Scottish Boiler.

Special policies

Finally, there are special contracts for certain models. Domestic & General produces policies geared to the Genie, Vic-20 and Commodore 64, and also insures the computer trade. Another type of special policy is the computer-fraud contract of Legal and General, but this is more likely to interest larger financial businesses than the owners of micro systems.

The cost of specialist computer policies varies from about £8 upwards, and depends on the value of the equipment covered and the potential loss of business. The average home or small-business user always needs to consider carefully the cost of a special policy compared with an extension to a home/office-contents contract. The decision really hinges on whether serious problems would emerge if the machine were to be out of action for more than a few days.

A final type of cover deals with the exclusions of wear and tear and derangement found in most regular policies. Many micro users, especially those with business interests, find the insurance companies' exclusions irritating. As far as they are concerned, if the machine is down they want it put right as quickly and as economically as possible, whatever the cause. The traditional answer to this problem has always been a maintenance agreement of a similar nature to that which many of us have to look after our central heating. For an annual fee, an engineering company will agree to service the equipment free of labour and we just have to pay for the parts.

Datacover

However, computer users now have an alternative which is growing rapidly in popularity. It is known as Datacover and is organised by the Bristol firm of insurance brokers, Halsey and Company. Its distinctive feature is breakdown cover. The Datacover policy includes parts as well as labour on an all-risks basis, and expenses of recompiling data, hiring alternative equipment and normal loss or damage are included. The idea is that the average computer user needs a policy which really covers all insurable risks and is simple to claim on. Datacover is cheaper than a maintenance agreement, and the user has the freedom to contact any engineer and then present the bill to the insurers.

Critics of Datacover argue that maintenance agreements ensure that the engineer places the contracted customer high on the priority list. In other words if you ring XYZ Engineers Ltd when your machine is down someone will come today if you have a maintenance contract but you will have to wait till next week if you use Datacover. There is some doubt, however, whether things are really quite as bad as this. Surely, where there is competition between engineering firms there is ample incentive to deal with all customers promptly. The Datacover concept looks like catching on and represents a very good deal.

There are few professional advisers who can offer help in choosing a policy to insure a micro. On the whole, if a machine is being used for personal use then an extension to a home-contents all-risks policy may be adequate unless a lot of software is being produced. If the micro is being used regularly for personal or business purposes and any breakdown would be costly or inconvenient, then Datacover may well be the answer. For firms which can do their own maintenance or the individual who enjoys soldering PCBs a normal special computer policy may be enough.

As with all insurance policies it pays to get what advice you can and to read the small print. What are the exclusions? Does it cover transit? How much consequential loss is covered? The day when the micro can be insured as easily as the car may be some way off, but a little shopping around should produce a suitable policy for home and business users.

Home heating

John Smith's program takes the hard labour out of calculating radiator sizes and the boiler rating for a domestic central-heating system.

A WELL THUMBED book of tables is an indispensable part of most central-heating engineers' equipment. The vital information it contains includes data on the heat output of radiators of a given size, water flow in the pipes, boiler sizing and plenty more besides. A rough-and-ready convertor specifying what size of radiator is required for a room of a particular size is likely to be particularly well used.

However, an efficient system calls for some extensive calculations to make sure that fuel is not wasted in overheating some rooms while others remain chilly. In the first place you need to work out precisely how much heat is required in each room. The inside and outside temperatures, the volume of the room and how often the air in the room is changed are the most crucial factors. The area of glass in the room, the temperature of the house next door and the insulating properties of various building materials also need to be taken into account. It all amounts to quite an involved series of calculations which must be repeated for each room in the house.

If you have ever done the exercise for yourself the thought is bound to have dawned that this is work more suited to a computer than a human. With this program you can repeat the calculations for a series of external temperatures and compare the results. A bonus is that any errors in your raw data can easily be corrected without having to spend hours checking the knock-on effect in other rooms: you just run the program again.

Making changes

The program makes it particularly easy to change the target temperature in any room. Other parameters can be altered by changing the appropriate program line. Likely candidates are: number of rooms, variable name Nrooms% at line 120; external temperature, variable name Outside at line 100; and the temperature in adjoining building: variable name Ndoor at line 110.

The data itself is placed in Data statements. It is not worth using a data file if you just want to run the program a few times. If you need to run the program regularly you can modify it to read from such a Data file; the data is simply loaded into anarray for analysis in lines 180 to 220.

The program assumes that each room has six rectangular surfaces, so lighthouse-keepers will have to make approximations. Only one window is allowed for in each wall, but you can aggregate the areas of several windows. No allowance is made for internal doors; errors arising from this assumption are negligible as it is bad practice to design for large temperature differences across internal walls. External doors present a slightly different problem, which can best be dealt with by adding a few tens of watts to the heating requirements of the room in question.

The program calculates the heat loss and ventilation loss for each room. The heat-loss calculation uses the general formula:

Heat loss = area of surface × U value of surface × temperature difference across surface

where area is in square metres, the temperature in °C and the heat loss is in watts. In each surface a separate calculation is done for the window area and non-window area.

Ventilation loss is calculated from the formula:

Ventilation loss per room = number of air

```
>L.
   10MODE6
   20PRINT"CENTRAL HEATING PROGRAM 'HEAT'"
   30PRINT"   BY John Smith. (C) 1983"
   40TIME=0:REPEAT UNTIL TIME>250
   50VDU3:CLOSE#0:REM ensure printer is off and any files from other programs cl
osed
   60@%=&10
   70VDU 23,240,24,24,0,0,0,0,195,195
   80REM DEFINE SOME CONSTANTS
   90shfactor=0.37:REM INCLUDES SPECIFIC HEAT OF AIR
  100outside= -1:REM OUTSIDE TEMPERATURE
  110ndoor= 12:REM NEXTDOOR TEMP
  120nrooms%= 9:REM NUMBER OF ROOMS
  130valuesperroom%=48
  140maxdata%=valuesperroom%*nrooms%
  150i%=0:REM a search pointer
  160DIM data(maxdata%)
  170REM fill the array
  180FORi%=1 TO maxdata%
  190READ data(i%)
  200NEXT
  210READeof%
  220IFeof%<>10000 PRINT"missed end marker":STOP
  230CLS:PRINT'"Process entire data ? (P)":"Change a room temp  ? (C) "
  240PRINT"Choose option -> ";
  250opt$=GET$
  260PRINTopt$
  270 IF (opt$="P") OR (opt$="p") GOTO 470
  280 IF (opt$<>"C") AND (opt$<>"c") GOTO 230
  290PRINT''"ROOM / CODE"'"-----------"
  300FORi%=1 TO nrooms%
  310PROCroom(i%*-1)
  320PRINTroom$," ("|i%|")"
  330NEXT
  340INPUT'"Enter code of room to  be changed  ";r%
  350INPUT"What is the desired temp   "|t%
  360PRINT
  370REM find the room
  380FOR i%=1 TO maxdata%
  390IF data(i%)=r% *-1 GOTO 410
  400NEXT
  410data(i%+1)=t% :REM change to new temp
  420REM Tell user what's been changed"
  430PROCroom(r%*-1)
  440PRINT"Temp in the "|room$;" is now ";t%
  450PRINT"Press SPACE to continue":A=GET
  460GOTO 230
  470 REM
  480REM START PROCESSING
  490PRINT'"Output to printer ? (Y/N) ";
  500opt$=GET$
  510PRINTopt$
  520IF(opt$<>"Y") AND (opt$<>"y")AND (opt$<>"N")AND (opt$<>"n")GOTO500
  530CLS:PRINTTAB(0,23);"------------------------------------"
  540PRINT"|Press SPACE for next page of results|"
  550PRINT"------------------------------------"
  560IF(opt$="Y") OR (opt$="y")VDU2:REM printer on
  570VDU30:REM Cursor home
  580PRINT"------------------------------------"
  590PRINT"|   Lowest outside temp assumed = "|outside|" |"
  600PRINT"|   Temp   next door is assumed = "|ndoor|" |"
  610PRINT"------------------------------------"
  620VDU28,0,19,39,6:REM Define text window
  630total%=0
  640FORp%=1 TO maxdata% STEP 48 :REM for each room
  650q%=p%
  660roomid%=data(q%):q%=q%+1:REM which room
```

changes per hour × volume of room × specific heat capacity of air × temperature different to outside.

The boiler losses are simply estimated as being 10 percent of the total losses so far. An additional 3kW is then added for domestic hot-water requirements to arrive at a total figure for the minimum boiler capacity needed. A conversion factor is applied to give results in BTU per hour, as manufacturers still quote radiator and boiler outputs in these units.

Before entering the data, draw a rough plan of each floor of the building. Label each room with a unique identification number, starting at −1 and going on to −2, −3, etc.; this number corresponds to program variable RoomID. Mark the desired temperature in each room in °C. Then draw up a table with the dimensions in metres of each room and, where appropriate, the size of the windows. Assume one wall to be north and then work round east, south and west, which is a help when checking the data afterwards.

The program expects data in the following order: RoomID; temperature; x_{surf}, y_{surf}, U_{surf}, $xglass_{surf}$, $yglass_{surf}$, $Uglass_{surf}$, Tag — repeated for each of the six surfaces; x,y,z — dimensions of room in metres; number of air changes per hour. This makes a total of 48 items of data, which you repeat for each room followed by the value 10000 as the last data item as an end-of-file marker. There is considerable redundancy in the data, but the format is convenient and quick to enter, and simplifies the program as each room is represented by a record of fixed length. The Tag variable must be one of the following:

—the absolute value of the RoomID of the room adjoining this surface;
—999 if the surface is an outside wall;
—1000 if surface adjoins other building.

The Tag is the key to the operation of the program. The temperature difference across each surface is required to calculate the losses, and the program picks up a Tag and scans the entire data looking for a RoomID corresponding to it. RoomIDs are negative and so can be easily extracted from

(continued on next page)

Surface	U value
Cavity wall	1.9
Cavity wall with foam infill	0.5
Brick internal wall	2.1-2.5
Breeze-block internal wall	2.4
Tile/slate roof on battens with felt	2.0
Tile/slate roof, insulated with glass-fibre	0.5
Wood floor, uncovered	1.8
Wood floor, carpeted	1.1
Solid floor	1.1
Intermediate floor	1.6
Intermediate floor	1.2
Single-glazed windows	5.6
Double-glazed windows, sealed	2.7
Double-glazed windows, non-sealed	4.0

Table 1. U values.

Sitting room	2
Bedroom	1.5
Bathroom	2
Kitchen	3
Hall	1.5

Table 2. Air changes per hour.

```
  670destemp=data(q%):q%=q%+1:REM what temp for this room
  680Totalroomloss=0
  690PROCroom(roomid%)
  700PRINT'$room$;": Desired temp = "$destemp
  710FORk%=1 TO 6:REM for each surface of the room
  720adjroomid%=data(q%+6)* -1
  730 IF ABS(adjroomid%)=999 adjroomtemp=outside:GOTO780:REM it's an external wa
ll
  740 IF ABS(adjroomid%)=1000 adjroomtemp=ndoor:GOTO780:REM this wall is 'shared
' with nextdoor
  750FOR l%=1 TO maxdata%:REM find out which ROOM is adjacent to this wall.
  760IF data(l%)=adjroomid% adjroomtemp=data(l%+1)
  770NEXT
  780IFl%>maxdata%+1 PRINT"Oops - can't find room ";adjroomid%:STOP
  790tempdiff=destemp-adjroomtemp
  800btuloss=(((data(q%)*data(q%+1)-data(q%+3)*data(q%+4))*data(q%+2)+data(q%+3)
*data(q%+4)*data(q%+5))*tempdiff)*3.4121
  810total=total+btuloss
  820Totalroomloss=Totalroomloss+btuloss
  830PRINT"Surface "$k%;" Loss = "INT(btuloss)$" Btu/hr"
  840q%=q%+7:REM on to the next surface
  850NEXT
  860vol=data(q%)*data(q%+1)*data(q%+2)
  870airch=data(q%+3)
  880ventfactor=(vol*airch*(destemp-outside)*shfactor)*3.4121
  890PRINT'"Ventilation loss = "$INT(ventfactor);" Btu/hr"
  900Totalroomloss=Totalroomloss+ventfactor
  910total=total+ventfactor
  920IFopt$="Y"PRINT'"Radiator needed = "INT(Totalroomloss);" Btu/hr" ELSE PRINT
'CHR$240;" Radiator needed = "INT(Totalroomloss)$" Btu/hr"
  930PRINT'"****"
  940IF(opt$<>"Y") OR (opt$="y") A=GET:CLS
  950NEXT
  960PRINT'"Sum of losses so far = "$INT(total);" Btu/hr"
  970PRINT'"Add 10% for the boiler losses:"
  980total=total+total*0.1
  990PRINT'"this makes the losses up to "$INT(total)$" Btu/hr"
 1000PRINT'"Now allowing 10000 Btu/hr for domestic  hot water,"
 1010total=total+10000
 1020PRINT'"boiler capacity must be at least = "INT(total)$" Btu/hr ("$INT(total
*.293)$" Watts)"
 1030VDU3,26
 1040PRINTTAB(0,22)$"            PROGRAM COMPLETE            "
 1050END
 1060DEFPROCroom(roomid%)
 1070IFroomid%=-1 room$="Living room":ENDPROC
 1080IFroomid%=-2 room$="Lounge":ENDPROC
 1090IFroomid%=-3 room$="Kitchen":ENDPROC
 1100IFroomid%=-4 room$="Lower hall":ENDPROC
 1110IFroomid%=-5 room$="Rear bedroom":ENDPROC
 1120IFroomid%=-6 room$="Front bedroom":ENDPROC
 1130IFroomid%=-7 room$="Small bedroom":ENDPROC
 1140IFroomid%=-8 room$="Upper hall":ENDPROC
 1150IFroomid%=-9 room$="Bathroom":ENDPROC
 1160ENDPROC
 1170DATA -1,22
 1180DATA 3.56,2.3,1.9,1.68,1.49,5.6,999
 1190DATA 3.7,2.3,2.5,0,0,0,3
 1200DATA 3.56,2.3,2.5,0,0,0,2
 1210DATA 3.7,2.3,2.5,0,0,0,1000
 1220DATA 3.7,3.56,1.1,0,0,0,999
 1230DATA 3.7,3.56,1.6,0,0,0,5
 1240DATA 3.7,3.56,2.3,2
 1250REM
 1260DATA -2,20
 1270DATA 3.56,2.3,2.5,0,0,0,1
 1280DATA 3.85,2.3,2.5,0,0,0,4
 1290DATA 3.56,2.3,1.9,2.92,1.47,5.6,999
 1300DATA 3.85,2.3,2.5,0,0,0,1000
 1310DATA 3.85,3.56,1.1,0,0,0,999
 1320DATA 3.85,3.56,1.6,0,0,0,6
 1330DATA 3.85,3.56,2.3,2
 1340REM
 1350DATA -3,16
 1360DATA 2.11,2.3,1.9,1.78,1.17,5.6,999
 1370DATA 4,2.3,1.9,1.14,1.15,5.6,999
 1380DATA 2.11,2.3,2.5,0,0,0,4
 1390DATA 4,2.3,2.5,0,0,0,1
 1400DATA 2.11,4,1.1,0,0,0,999
 1410DATA 2.11,4,1.6,0,0,0,9
 1420DATA 2.11,4,2.3,3
 1430REM
 1440DATA -4,16
 1450DATA 2.11,2.3,2.5,0,0,0,3
 1460DATA 4.15,2.3,1.9,0,0,0,999
 1470DATA 2.11,2.3,1.9,2.11,2.3,5.6,999
 1480DATA 4.15,2.3,2.5,0,0,0,2
 1490DATA 4.15,2.11,1.1,0,0,0,999
 1500DATA 4.15,2.11,1.6,0,0,0,8
 1510DATA 4.15,2.11,2.3,1.5
 1520REM
 1530DATA -5,21
 1540 DATA 3.56,2.36,1.9,1.68,1.33,5.6,999
 1550DATA 3.7,2.36,2.5,0,0,0,9
 1560DATA 3.56,2.36,2.5,0,0,0,6
 1570DATA 3.7,2.36,2.5,0,0,0,1000
 1580DATA 3.7,3.56,1.2,0,0,0,1
 1590DATA 3.7,3.56,0.5,0,0,0,999
 1600DATA 3.7,3.56,2.36,1.5
 1610REM
 1620DATA -6,20
 1630DATA 3.56,2.36,2.5,0,0,0,5
 1640DATA 3.85,2.36,2.5,0,0,0,7
 1650DATA 3.56,2.36,1.9,2.92,1.47,5.6,999
 1660DATA 3.85,2.36,2.5,0,0,0,1000
 1670DATA 3.85,3.56,1.2,0,0,0,2
 1680DATA 3.85,3.56,0.5,0,0,0,999
 1690DATA 3.85,3.56,2.36,1.5
 1700REM
 1710 DATA -7,21
 1720DATA 2.11,2.36,2.5,0,0,0,8
 1730DATA 1.95,2.36,1.9,0,0,0,999
 1740DATA 2.11,2.36,1.9,1,1,5.6,999
 1750DATA 1.95,2.36,2.5,0,0,0,6
 1760DATA 2.11,1.95,1.2,0,0,0,4
 1770DATA 2.11,1.95,0.5,0,0,0,999
 1780DATA 2.11,1.95,2.36,1.5
 1790REM
 1800DATA -8,16
 1810DATA 2.11,2.36,2.5,0,0,0,9
 1820DATA 2.54,2.36,1.9,1.4,1.9,5.6,999
 1830DATA 2.11,2.36,2.5,0,0,0,7
 1840DATA 2.54,2.36,2.5,0,0,0,6
 1850DATA 2.11,2.54,1.2,0,0,0,4
 1860DATA 2.11,2.54,0.5,0,0,0,999
 1870DATA 2.11,2.54,2.36,1.5
 1880REM
 1890DATA -9,19
 1900DATA 2.11,2.36,1.9,1.12,1.16,3.9,999
 1910DATA 3.15,2.36,1.9,0,0,0,999
 1920DATA 2.11,2.36,2.5,0,0,0,8
 1930DATA 3.15,2.36,2.5,0,0,0,5
 1940DATA 2.11,3.15,1.2,0,0,0,3
 1950DATA 2.11,3.15,0.5,0,0,0,999
 1960DATA 2.11,3.15,2.36,2
 1970DATA 10000
```

```
>RUN
CENTRAL HEATING PROGRAM 'HEAT'
   BY John Smith. (C) 1983
----------------------------------------
|   Lowest outside temp assumed = -1   |
|   Temp   next door is assumed = 12   |
----------------------------------------

Living room: Desired temp = 22
Surface 1 Loss = 1947 Btu/hr
Surface 2 Loss = 435 Btu/hr
Surface 3 Loss = 139 Btu/hr
Surface 4 Loss = 725 Btu/hr
Surface 5 Loss = 1137 Btu/hr
Surface 6 Loss = 71 Btu/hr

Ventilation loss = 1759 Btu/hr

Radiator needed =              6217 Btu/hr

****

Lounge: Desired temp = 20
Surface 1 Loss = -140 Btu/hr
Surface 2 Loss = 302 Btu/hr
Surface 3 Loss = 2252 Btu/hr
Surface 4 Loss = 604 Btu/hr
Surface 5 Loss = 1080 Btu/hr
Surface 6 Loss = 0 Btu/hr

Ventilation loss = 1671 Btu/hr

Radiator needed =              5771 Btu/hr

****

Kitchen: Desired temp = 16
Surface 1 Loss = 981 Btu/hr
Surface 2 Loss = 1295 Btu/hr
Surface 3 Loss = 0 Btu/hr
Surface 4 Loss = -471 Btu/hr
Surface 5 Loss = 538 Btu/hr
Surface 6 Loss = -139 Btu/hr

Ventilation loss = 1249 Btu/hr

Radiator needed =              3456 Btu/hr

****

Lower hall: Desired temp = 16
Surface 1 Loss = 0 Btu/hr
Surface 2 Loss = 1051 Btu/hr
Surface 3 Loss = 1576 Btu/hr
Surface 4 Loss = -326 Btu/hr
Surface 5 Loss = 558 Btu/hr
Surface 6 Loss = 0 Btu/hr

Ventilation loss = 648 Btu/hr

Radiator needed =              3509 Btu/hr

****

Rear bedroom: Desired temp = 21
Surface 1 Loss = 1818 Btu/hr
Surface 2 Loss = 148 Btu/hr
Surface 3 Loss = 71 Btu/hr
Surface 4 Loss = 670 Btu/hr
Surface 5 Loss = -54 Btu/hr
Surface 6 Loss = 494 Btu/hr


Ventilation loss = 1295 Btu/hr

Radiator needed =              4445 Btu/hr

****

Front bedroom: Desired temp = 20
Surface 1 Loss = -72 Btu/hr
Surface 2 Loss = -78 Btu/hr
Surface 3 Loss = 2281 Btu/hr
Surface 4 Loss = 620 Btu/hr
Surface 5 Loss = 0 Btu/hr
Surface 6 Loss = 491 Btu/hr

Ventilation loss = 1286 Btu/hr

Radiator needed =              4530 Btu/hr

****

Small bedroom: Desired temp = 21
Surface 1 Loss = 212 Btu/hr
Surface 2 Loss = 656 Btu/hr
Surface 3 Loss = 987 Btu/hr
Surface 4 Loss = 39 Btu/hr
Surface 5 Loss = 84 Btu/hr
Surface 6 Loss = 154 Btu/hr

Ventilation loss = 404 Btu/hr

Radiator needed =              2539 Btu/hr

****

Upper hall: Desired temp = 16
Surface 1 Loss = -128 Btu/hr
Surface 2 Loss = 1231 Btu/hr
Surface 3 Loss = -213 Btu/hr
Surface 4 Loss = -205 Btu/hr
Surface 5 Loss = 0 Btu/hr
Surface 6 Loss = 155 Btu/hr

Ventilation loss = 407 Btu/hr

Radiator needed =              1249 Btu/hr

****

Bathroom: Desired temp = 19
Surface 1 Loss = 822 Btu/hr
Surface 2 Loss = 963 Btu/hr
Surface 3 Loss = 127 Btu/hr
Surface 4 Loss = -127 Btu/hr
Surface 5 Loss = 81 Btu/hr
Surface 6 Loss = 226 Btu/hr

Ventilation loss = 792 Btu/hr

Radiator needed =              2888 Btu/hr

****


Sum of losses so far = 34607 Btu/hr

Add 10% for the boiler losses:

this makes the losses up to 38068 Btu/hr

Now allowing 10000 Btu/hr for domestic  hot water,

boiler capacity must be at least =            48068 Btu/hr (14083 Watts)
```

(continued from previous page)

the data; the program just multiplies the Tag by −1 before beginning its search for a RoomID. When the program finds a RoomID which corresponds to the Tag, the temperature in that room is simply the entry following that RoomID in the array.

In the example for which data is given, the hall was treated as two rooms, as the geometry of the building lent itself to that approach; remember to add one to Nrooms% if you do this. Changes should be made to the procedure in lines 1070 to 1150 to associate the RoomID with the name of the room for your application.

The program runs on the BBC Microcomputer Model B in Mode 6; change line 10 to read Mode 7 to run on a Model A. It takes about a minute to compute the results for a whole house and output can be sent to a printer as one of the options. Page mode is engaged when output goes only to the screen, and is disengaged for printer output.

LOVE STORY

"Gordon Baker had often thought about buying a computer, but his courage always failed him at the vital moment. "I'm not a technical man", he explained. "I need patience and understanding and when I saw Columbia in a recent issue of a computer magazine, it looked so attractive and uncomplicated that I just had to send for more details."

A package arrived from Icarus the following Monday. With trembling hands Gordon opened it and read through the letter and introductory brochure. It seemed too good to be true: Columbia embodied all that had been missing from his previous relationships.

A meeting was arranged.

Gordon passed that afternoon with his local Icarus dealer in a state of near ecstasy! Columbia was not only attractive to look at, but, as the dealer explained and demonstrated, proved extremely competent without being overly complicated.

Soon after that initial contact Gordon had to fly North on business and it was a fortnight before he could contact the dealer to fix another meeting. It was decided to bring Columbia round to Gordon's office to be introduced to the staff. It was vital to establish as soon as possible whether Columbia could operate efficiently in his own business environment.

Things could not have gone better. Columbia was a big hit with everybody; Accounts, Stock Control, Sales, Research and Forecasting were all of one accord: Columbia was terrific.

They enthused over the high resolution amber screen, were effusive about the choice of CP/M 86 and MS-DOS operating systems and IBM PC compatibility, and then became quite emotional over Columbia's floppy and Winchester disc configurations, its expandability up to 896K RAM and the access it gave to hundreds of 16 BIT 'off the shelf' software packages.

The dealer asked Gordon if he would like to see Columbia again. "Oh, please", said Gordon, "could it stay for just a couple more days?"

Within a week Columbia had moved in permanently, and Gordon was on top of the world.

"I'd just about given up hope of ever finding my perfect partner", he said, "until Columbia came along and changed my life!"

In the background, the warm glow from the amber screen seemed to indicate that Columbia too was well pleased with the situation . . ."

If you think the Columbia PC could be your perfect partner too, we'll be pleased to send you more intimate details in complete confidence.

The Columbia 16 BIT Personal Computer

Columbia
Your perfect partner

ICARUS
Computer Systems Ltd

ICARUS COMPUTER SYSTEMS LTD, Deane House, 27 Greenwood Place, London NW5 1NN. Tel: 01-485 5574. Telex: 264209

● Circle No. 143

Apple operations

Peter and Owen Benson set up the Apple II as a process controller.

THE GATEWAY between your Apple II and the big, wide world outside is that little socket which has so far been monopolised by the game paddle and joystick. An A/D converter is built into the Apple, so analogue signals received through the games port can be converted into digital form. They can then be stored or manipulated by the computer.

The essential component of a games paddle is a variable resistor or potentiometer, the value of which depends on the position of the paddle knob. When reading the games port the Apple checks the current value of the potentiometer by measuring how long it takes to charge an internal capacitor through it. The value produced is a number between 0 and 255, corresponding to resistances in the range zero to 150kΩ.

Suppose games paddle 0 is in the middle of its travel, and you enter the instruction

```
PRINT PDL (0)
```

The number 127 appears on the screen. If you were playing a game, the value of the paddle setting would not be printed, but would be used to provide instructions as to how to move something on the screen.

The Apple obviously has no means of knowing what kind of resistor is connected to the Game I/O socket so any resistive devices can be used instead of a paddle. There are a huge variety available, but one of the simplest is a thermistor, which is just a resistor that changes its value according to its temperature. Thermistors can be bought for a few pence from electronics stores, Tandy shops, etc.

Clearly a thermistor can be used to enable the Apple to measure temperatures, then graph them, manipulate them or store them. These values can even be used as triggers to instruct the computer to switch heaters, fans or warning devices on and off.

Listing 1 shows a program to take temperature readings each minute and graph the results.

As written, the program produces results in arbitrary units. To give temperatures in conventional units such as °C or °F you have to calibrate the thermistor. The first problem is that thermistors come in a variety of types. For example, some increase in resistance as the temperature rises, while others decrease. Either type will do. The next variable is the thermistor's resistance. It is probably best to choose one with a resistance between 60kΩ and 100kΩ, since this is near the middle point of the Apple's measuring capacity.

To calibrate the thermistor, place it in crushed, melting ice to find its resistance at 0°C, and then next to a household thermometer under a lamp or other heat source. Allow a few minutes for the temperature to stabilise in each case.

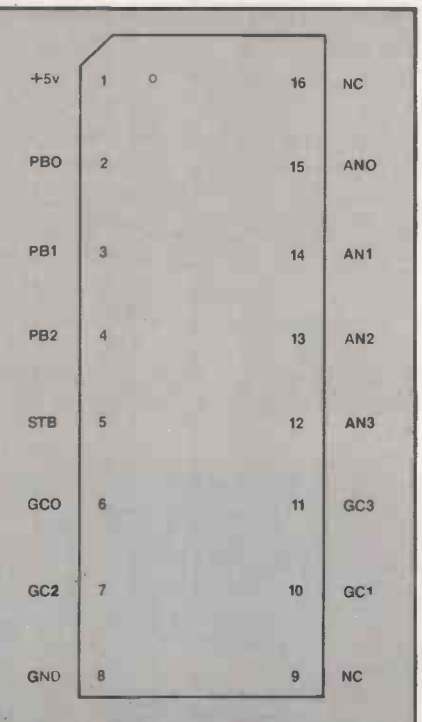
The Apple has provision for four games paddles, so it can handle up to four separate thermistors at once, which are read by PDL (0), (1), (2) and (3). Data from two sensors could be used to monitor outside and inside temperatures, or two chemical baths in a dark-room, and control heaters accordingly.

You can do a similar sort of thing with other resistive devices. A light-dependent resistor, LDR, can be bought from Tandy for about £1. As the name implies, the value of the resistor depends on the amount of light striking it, so you could use it to monitor light levels, compare the output of supposedly similar light bulbs, or control operations in the dark-room.

An LDR can be used to count the number of times a light beam is interrupted, since the resistance suddenly changes when the light is blocked. A limiting factor here is that the LDR does not respond instantly, so it can only be used for events happening less frequently than about 100 times per minute.

You can use a set-up of this kind in the physics lab to measure the speed of a moving cart. The computer starts counting when the beam is first interrupted, and stops when the beam is reinstated. By converting the count value into seconds and dividing the length of the vehicle by the calculated time you obtain a very useful value for its speed. Only one LDR is needed, and the light source can be daylight from a window. If possible, choose an LDR with a resistance of about 80kΩ, so that it normally lies near the middle of the Apple's measuring range.

The LDR is also the key to measuring other factors, which are not in themselves variable resistances. For instance, a voltage



Pin 1 — +5V at up to 100mA
Pins 2 to 4 — used for the push buttons
Pins 6, 7, 10, 11 — used for the paddles
Pin 8 — electrical earth
Pins 12 to 15 — annunciator outputs, up to 10mA

The connector plugs in with pin 1 towards the front of the Apple.

Figure 3. Game I/O connector.

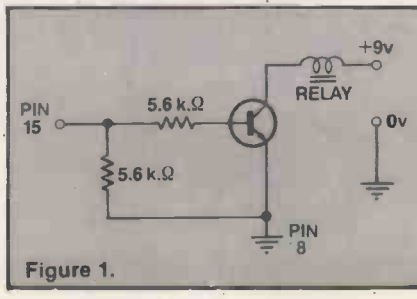


Figure 1.

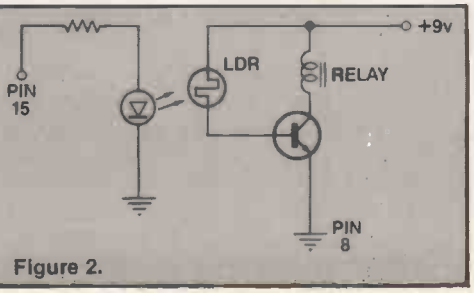


Figure 2.

Peter Benson is director of studies at Aiglon College, Switzerland.

or current to be monitored can be used to operate a light bulb or LED which shines directly on to the LDR. If screened from the ambient light — you can use a plastic 35mm. film canister — the resistance of the LDR will vary with the changing voltage or current, allowing the computer to track it. The values will not be known directly, but this is often not necessary.

It is almost as easy for the Apple to control external electrical devices as it is for it to receive data. By arranging for it to do both, the computer can be used to run a sophisticated control system.

The Game I/O socket includes four outputs, known as annunciators, which can be turned on or off by software. They are labelled AN(0) - (3). The voltage level at these outputs is normally close to zero, but when they are turned on the voltage is set to +5V. Suitably buffered for the safety of your computer, this change can be used to turn on or off an electrical device.

The command to turn on annunciator (0) is Poke −16295,0. Pin 15 then remains at +5V until turned off by the command Poke −16296,0. The only complication arises from the fact that the Apple can only provide a few millilamps of current, so some degree of amplification is called for.

In figure 1, the annunciator output is taken to the base of an NPN transistor such as a 2N-2222, with a relay placed in the collector circuit of the transistor. When the +5V signal arrives at the transistor base, the transistor allows current to flow through the relay coil, which in turn switches on whatever appliance is connected to the relay contacts. The power to operate the relay coil is best derived from an external source, such as a 9V battery.

In figure 2, complete electrical isolation is achieved by having the annunciator output turn on an LED which shines on an LDR in the control circuit of a similar transistor. The LED will not draw more current than the Apple can safely provide. The optical coupling to the LDR prevents any expensive surprises which might result from accidental connections between the computer and the apparatus being controlled.

The program in listing 3 could be used to switch on a fan and give a warning beep if the temperature rises too high. The value 200 in line 110 should be adjusted to suit the characteristics of your thermistor and the switch-on temperature required.

The Game I/O connector is shown in figure 3. In most cases, only four or five wires will be needed. Since the connector is small, it is best to keep down the number of wires and use very thin, stranded wire. The connection is made using a 16-pin Dip header obtainable from Tandy, for example. Carefully solder the wire in place, using a soldering iron with a very small bit. If you are a novice with the soldering iron, be very careful that no solder bridges are formed which might connect one pin with another inside the header plug.

A lead length between 18in. and 24in. should be adequate. You can start by experimenting with just two wires, connected to the +5V on pin 1 and GC(0), pin 6. The other ends of these wires can be terminated with insulated alligator clips, or soldered directly to the thermistor or LDR leads. Take great care that the bare wires do not touch each other, or any part of the Apple, otherwise expensive damage could occur.

Listing 1.

```
100  REM: PLOT THE GRAPH AXES
110  HOME
120  FOR I = 1 TO 20
130  IF I = 10 THEN PRINT "TEMP": GOTO 150
140  PRINT " I"
150  NEXT I
160  PRINT " ";
170  FOR I = 2 TO 15
180  PRINT "-";
190  NEXT I
200  PRINT "TIME (MINS)";
210  FOR I = 26 TO 39
220  PRINT "-";
230  NEXT I

400  REM: RECORD DATA & DISPLAY
410  FOR TIME = 1 TO 30
420  X = PDL (0)
430  TEMP = X*(40/255)

440  REM:  CONVERSION FACTOR DEPENDS ON THERMISTOR
450  VTAB TEMP: HTAB TIME: PRINT "+"
460  FOR DELAY = 1 TO 46800: NEXT DELAY

470  REM:  1 MINUTE DELAY
480  NEXT TIME
490  VTAB 23
```

Listing 2.

```
100  INPUT "LENGTH OF OBJECT (CMS) ";L
110  REM:  CONVERT TO METRES
120  L=L/100
130  X=0
140  REM:  P = BASE LEVEL OF LIGHT
150  P= PDL(0)
160  REM:  MONITOR LDR FOR INCREASED RESISTANCE
170  R=PDL(0)
180  IF R < 1.1*P GOTO 170
190  X=X+1
200  R=POL(0)
210  IF R > 1.1*P GOTO 190
220  REM:  CONVERT TO SECONOS
230  X=X/67
240  PRINT X" SECS"
250  REM:  CALCULATE SPEED & ROUND OFF
260  S=INT(100*L/X+0.5)/100
270  PRINT "SPEED = "S" M/SEC"
280  END
```

Listing 3.

```
100  X = PDL(0)
110  IF X< 200 GOTO 100
120  POKE -16295,0
130  FOR BEEP = 1 TO 50
140  S = PEEK(-16336)
150  NEXT BEEP
```

Table manners

Call it an array, matrix, vector or what you will, the humble table is one of the programmer's best friends. Mike Lewis explains how to use it properly.

NOT SURPRISINGLY, there are well established techniques for sorting, searching and manipulating tables. Since this column is dedicated to helping you get the best out of your programming I will be discussing some of these techniques, as well as other programming topics, in this and future issues.

One of the problems that good table handling can solve is direct access to disc files by means of a symbolic key. Suppose you want to access the membership file of your local tennis club. If each member can be identified by means of a simple, consecutive serial number there is no problem. The Get command in Microsoft Basic, allows you to read data from disc by means of a record number, and most other programming languages allow you to do the same. So to get member number 5 you simply read record number 5.

But it would be much more convenient if you could reach your members' records with an alphanumeric key such as their initials or their names, rather than by an impersonal, easy-to-forget number. Some languages include the means to access files in this way: the Find command in dBase and the symbolic key option in Cobol are examples. But most micro languages do not, which is where the table comes in.

The first step is to build a table holding the keys in the same sequence as the records in the file. Your program must look at every record in turn, extract the key — which obviously must have been stored in the file in the first place — and add it to the table. The sequence of the records within the file is immaterial, and the keys do not all have to be the same length. Then, when you want to access a specified member's record, you search the table for the key. The position of the key within the table specifies the member's record number.

Crude search

The program in listing 1 shows a crude way of doing a linear search. It is the simplest possible table search and it requires no further explanation. You look at each table entry in turn until either you find the one you want or, if the key is not in the table, you drop off the end.

I have used Basic for this and other examples because it is still the most widely known language. It is the technique that I

This column is dedicated to helping you get the best out of your programming. Even if you are one of those sensible micro users who normally tries to avoid programming at all costs, please stay with us as every month Mike Lewis will be passing on tips for using popular packages like WordStar, dBase II, Supercalc and the like.

How to sort the table

Exchange sort. Far and away the easiest sort to code, and also the least efficient. You compare each pair of adjacent table entries, swapping them if they are out of sequence. Keep repeating until you have done an entire pass of the table without any swaps.

Binary insertion. For each entry in turn except the first, look to see where it fits in the sequence of the entries before it. Move all the entries below this insertion point down one place, then place the current entry in the gap thus created. The method is similar to the one you would use to sort a hand of cards. It can be very fast, especially if a binary search is used to find the insertion point.

Counting sort. Here the aim is not to put the entries in sequence, but to determine the ranking of entries within the table. You end up with a second array, which follows the same sequence as the main table and which contains an integer to indicate the rank — 1 = first, 2 = second, etc. — of the corresponding entry. Compare each entry in the main table with each of the subsequent entries. For each comparison, increment the count in the second table that corresponds to the lower of the two entries being compared.

Heap sort. Put each adjacent pair of entries in sequence. Then merge each pair with the next pair, creating a run of four. Merge these four with the next four to create a run of eight; and so on. This is the most practical method for very large sorts where the intermediate groupings must be held on disc files.

Shell sort. Similar to the exchange sort, except that you start by comparing far-apart elements. It is reasonably fast.

Merge sort. This is another method that comes into its own for large sorts. Start by loading a small section of the file into a table, and sort it using any of the previous methods. Write the sorted table to a work file on disc. Then sort the next section of the original file, but this time merge it with the work file. Repeat, merging each sorted section with an ever-increasing work file. After the final pass, the work file will have become a sorted version of the original file.

Listing 1.

```
2000 REM --     SIZE% is the number of items in the list; ARRAY$(SIZE%) is the
                list; ITEM$ contains the item which we are searching for.
2010 FOR J%=1 TO SIZE%
2020    IF ITEM$=ARRAY$(J%) THEN GOTO 2100
2030 NEXT J%
2040 REM --     Come here if required item not found
                ...     ...     ...
                ...     ...     ...
2100 REM --     Come here if found; J% is the required record number
```

wish to illustrate; the logic can be coded just as easily in other languages, such as Pascal and C.

The simple linear search is extremely easy to program, but it suffers from being very slow. On average, a successful search must test half the entries in the table, while an unsuccessful one must test them all. Most of the methods of improving the search depend on the table being pre-sorted so that the keys are in ascending sequence, but it is only worth doing if you are likely to be performing many searches in the same session. In fact there are dozens of ways of sorting a table. Andrew Featherstone described several of them in a series of articles "Know Your Sort" published in the March and April 1983 issues of *Practical Computing*, and they are summarised in the box on the opposite page.

The trouble with sorting the table is that you can no longer rely on the position of the key within the table to indicate the record number. To get round this, you must keep a separate list of record numbers which you sort in parallel with the main table.

Time halved

Once your table is in sequence you can improve the performance of the search by branching out as soon as a table entry is greater than the specified key. This will not speed up a successful search but it will, on average, halve the time needed to discover if a key is absent.

If you are going to the trouble of sorting the table, you might as well go further and do a binary search. This is the classic way of searching a table, and while it is a little trickier to code it will greatly improve the speed of the search.

In the binary search program shown in listing 2 you start by testing the searched-for item against the middle entry in the table. If your key is below this value, you confine the next stage to the lower half of the table; if it is above, you confine it to the upper half. You then test the middle entry in the chosen half, thus confining the next stage to one-quarter of the table.

Homing in

You repeat the same process, halving the search area each time. As you can see, you very rapidly home in on the required item. Whatever the size of the table, the number of comparisons is kept to a minimum, giving a very fast search.

Another approach to table searching is the percolated search, which does not require the table to be sorted. Instead it takes advantage of the fact that some entries are accessed more frequently than others. The percolated search is just like the simple linear search, except that each time that you find a hit, you swap the entry with the one immediately before it. So the more frequently used elements will gradually percolate through to the start of the table, making each subsequent search a little faster.

This technique really comes into its own if you can arrange to write the table back to disc at the end of each session, thus accumulating the benefit. An idea similar to percolation forms the basis of the least used/first discarded algorithm, which has many uses in programming and will be dealt with in a later article in this series.

Listing 2.

```
2000 REM --      SIZE%, ARRAY$ and ITEM$ as in
                 previous examples; a separate
                 list RECNO% (SIZE%) contains
                 the record numbers, and is in
                 the same sequence as ARRAY$.
2010 LOW%=0: HIGH%=SIZE%
2020 WHILE LOW%<=HIGH%
2030     J%=(LOW%+HIGH%)/2
2040     IF ITEM$<ARRAY$(J%) THEN
                 HIGH%=J%-1
         ELSE
                 IF ITEM$>ARRAY$(J%) THEN
                         LOW%=J%+1
                 ELSE
                         GOTO 2100
2050 WEND
2060 REM --      Come here if requ ired item not found
                 ...      ...      ...
                 ...      ...      ...
2100 REM --      Come here if found; the record number is in RECNO%(J%)
```

When things crash

I PICKED UP a useful trick from a group of enthusiasts who revel in the name CPMUGUK, which stands for CP/M Users Group United Kingdom. The idea is to have a quick way of getting back into a CP/M program when it crashes — that is, when a BDOS error or similar tragedy causes a return to CP/M command level.

Before you can use this dodge your disc directory must contain a COM file of length zero. This is easily achieved by typing, at command level:

SAVE 0 RESTART.COM

Of course, Restart is just an example. Any valid name will do.

Next time your program crashes, just type Restart. The effect is to pass control back to the program that was running when the crash took place, without disturbing the transient program area, TPA.

With a bit of luck, everything in the TPA will be just as it was before. For example, in MBasic your source file and variables will be preserved. I cannot guarantee that this will work every time, but think how much aggravation it could save you when it does.

WordStar wisdom

I HAVE BEEN USING Micropro's WordStar word-processing package regularly for the last four years. Yet I am still discovering new tricks and techniques.

Take, for example, the dummy Find and Replace, which is useful if you wish to type a particular word or phrase many times in the same text. You might perhaps be writing a thesis on logical positivism. It would be nice to have a quick way to type these two words over and over.

You do it as follows. Enter Control-QA. WordStar asks

"FIND?"

Press Return, and WordStar asks

"REPLACE WITH?"

Type "logical positivism", or whatever, and WordStar asks

"OPTIONS?"

then press Return.

From now on, every time you want to type "logical positivism", just enter Control-LY. WordStar interprets the Control-L as a dummy Find, and it duly finds whatever is at present under the cursor. It then asks if you want to replace it, and interprets the Y as "yes", so the required word or phrase appears at the current cursor position.

Sounds familiar

David Clarke programs the Soundex algorithm, which will find a set of similar-sounding entries.

IN MANY computer applications it is necessary to keep a list of names. Common examples include customers and suppliers for businesses, passengers for travel agencies, clients for the professions, and patients for hospitals. This telephone directory program illustrates some of the techniques that can be used in managing and searching such lists.

The program is written for the 40-column Commodore Pet but uses no machine-specific features of Basic other than the screen-formatting characters, which are described in the text. The program will run in 8K but with a restricted directory.

One of the problems encountered when searching name lists is that the name being sought may not be known precisely. For instance, my own name is frequently spelt "Clarke" or "Clark" and sometimes even "Clerk or "Clerke". Clearly when searching the index it is useful to show all the entries that are phonetically similar.

The Soundex code has been devised for this purpose. As implemented in the program the steps in coding a name into its Soundex equivalent are as follows:

1. The first letter of the code is the first letter of the name.
2. Subsequent letters of the name are replaced as follows:
   B, F, P or V — replaced by P
   C, G, J, K, Q, S, X or Z — replaced by S
   M or N — replaced by M
   L or R — coded without change
   A, E, I, O, U, W, H or Y — not coded
   All consonants with similar pronunciation are grouped together.
3. A sequence of uninterrupted letters of the same coded value is replaced by a single code letter, though this does not include the first letter of the name. It can be included by changing line 2000 to read
   SD$ = LEFT$(NM$,1):L$ = SD$:N = 0
4. The code is forced to be exactly four characters long, either by truncating or by padding at the right with the letter A.

The routine to perform the coding is at lines 2000 to 2160. In the examples shown in figure 1 phonetically similar names code identically, though the quirks of English spelling and pronunciation mean that this will not always be the case. "Belvoir" codes to BLPR, whereas it may be pronounced "Beaver", which codes to BPRA. Similarly "Bough" codes to BSAA but can be pronounced "Boff" or "Bow", which have Soundex codes of BPAA and BAAA respectively.

The Soundex code is sufficient to find entries in a small personal telephone directory, but it would only form part of a search algorithm for a larger index. Typically such lists are searched in stages, with the search critieria becoming less restrictive at each stage.

Thus the first stage could be to look for an exact match on surname, initials, sex

```
200 GOSUB400
210 GOSUB600
220 GETIP$:IFIP$="I"THEN210
230 IFIP$="L"THENGOSUB800:GOTO300
240 IFIP$="A"THENGOSUB1000:GOTO300
250 IFIP$="F"THENGOSUB1200:GOTO300
260 IFIP$="S"THENGOSUB1400:GOTO300
270 IFIP$="N"THENGOSUB1600:GOTO300
280 IFIP$="D"THENGOSUB2800:GOTO300
290 IFIP$="E"THENGOSUB1800:END
295 GOTO220
300 PRINT"■■ENTER CODE FOR NEXT FUNCTION,"
310 PRINT"OR 'I' FOR INSTRUCTIONS":GOTO220
400 SE$="■":CD$="■■■
```

and date of birth. If this failed to produce the required match, the second stage could be to search on Soundex, sex, and year of birth. The particular search method employed depends on the application and the importance being attached to finding exact and close matches.

Figure 1.

WATT
WITHE
WAITE
WHITE
WYATT
} all code to WTAA

GURNEY
GRIM
GOREN
GREEN
} all code to GRMA

Various data structures could be used to create the index. The simplest would be a serial array or file. Additions would always follow the last-used record in the array, the array having been declared large enough for anticipated expansions. Deletions require the index to be searched for the entry to be deleted, and this set to a special value such as Deleted or "", the null string. If there are a lot deletions there will need to be a procedure to recover the deleted records. Searching the index for all matches requires every record to be examined.

A more useful structure is the linked list. It is used in the program and is a structure widely employed within more comprehensive data structures and data-base-management systems. A pointer is added to each record, indicating the location of the next record in sequence; the pointer corresponds to the value of the subscript of the appropriate record. Because Basic does not allow you to mix string and numeric variable types the pointers are held in a sparate array, PT%, which is maintained in parallel with the main data array, TP$.

Initially all the elements of the array are assigned to a free list. The pointer to the first element in this list is held in FF and each element of PT% is set to point to the next, so:

PT%(1) = 2
PT%(2) = 3

the last element in PT% is set to zero, indicating the end of the list. Another pointer, FU, gives the subscript of the first used record. The structure is shown diagramatically in figure 2.

Any new record is assigned to the location given by FF, the first record in the unused record list; it is subscript 7 in the example. The free-list pointer is then reset to the value of the pointer corresponding to this record, 18 in this case.

The new record is linked into the used list so that records are kept in sequence. Therefore the pointer for the record of key GHK is set to the subscript of the new record 7 and the pointer of this record set to point to the record 4, formerly pointed to by GHK.

Deletion of records is simpler. The free-list pointer FF is set to the subscript of the record being deleted, while the pointer for this record is set to the former value of FF, thus linking the deleted record to the head of the free list. The record that previously pointed to the deleted record is set to point to the record formerly pointed to by the deleted record. Both these procedures require additional coding to deal with addition/deletion to or from the start and end of the list.

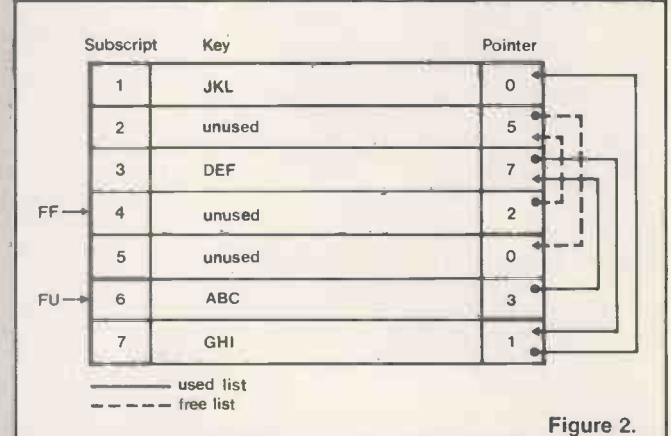


Figure 2.

Searching is carried out sequentially following the pointers. This ensures that keys are scanned in ascending sequence and the search is complete when the key of the record being compared exceeds the key being sought.

The linked-list structure is quite suitable

(continued on next page)

```
1605 INPUT#1,N$:NN=VAL(N$):PRINT
1610 IFNN<200RNN>250THENPRINT"20-250 IS THE LIMIT. RE-ENTER ";:GOTO1605
1620 DIMTP$(NN),PT%(NN)
1630 FU=0:FF=1
1640 FORI=1TONN-1:PT%(I)=I+1:NEXT
1650 PT%(NN)=0:RETURN
1800 IFUD<>1THEN1850
1810 PRINT"YOU HAVE CHANGED THE FILE. DO YOU"
1820 PRINT"WISH TO SAVE IT?"
1830 GETA$:IFA$="N"THEN1850
1840 IFA$<>"Y"THEN1830
1845 GOSUB1400
1850 CLOSE1:RETURN
2000 SD$=LEFT$(NM$,1):L$="":N=0
2010 FORI=2TOLEN(NM$):A$=MID$(NM$,I,1)
2020 IFA$="B"ORA$="F"ORA$="P"ORA$="V"THENC$="P":GOTO2090
2030 IFA$="C"ORA$="G"ORA$="J"ORA$="K"THENC$="S":GOTO2090
2035 IFA$="T"ORA$="D"THENC$="T":GOTO2090
2040 IFA$="Q"ORA$="S"ORA$="X"ORA$="Z"THENC$="S":GOTO2090
2050 IFA$="M"ORA$="N"THENC$="M":GOTO2090
2060 IFA$="L"ORA$="R"THENC$=A$:GOTO2090
2070 IFA$=" "THENI=99:GOTO2110
2080 L$=A$:GOTO2110
2090 IFC$=L$THEN2110
2100 SD$=SD$+C$:N=N+1:L$=C$
2110 NEXT
2120 IFN=3THEN2150
2130 IFN<3THENSD$=SD$+LEFT$("AAA",3-N):GOTO2150
2140 SD$=LEFT$(SD$,4)
2150 SD$=SD$+SX$
2160 RETURN
2200 ER=0:IFFF=0THENER=1:RETURN
2210 NP=FU:IP=0:CP=0:TP$(FF)=RC$
2220 IFNP=0THEN2280
2230 GOSUB2400:A$=LEFT$(TP$(CP),5)
2240 IFSD$>A$THEN2220
2250 IFIP=0THENFU=FF:GOTO2270
2260 PT%(IP)=FF
2270 N=PT%(FF):PT%(FF)=CP:FF=N:GOTO2350
2280 IFCP=0THENFU=FF:GOTO2300
2290 PT%(CP)=FF
2300 N=PT%(FF):PT%(FF)=NP:FF=N:GOTO2350
2350 RETURN
2400 IP=CP:CP=NP:NP=PT%(CP):RETURN
2600 RC$=TP$(CP):L=LEN(RC$):J=0:K=0
2610 FORI=6TOL
2620 IFMID$(RC$,I,1)<>"@"THEN2650
2630 IFJ=0THENJ=I:GOTO2650
2640 K=I
2650 NEXT
2660 NM$=MID$(RC$,6,J-6):AD$=MID$(RC$,J+1,K-J-1)
2670 TL$=RIGHT$(RC$,L-K)
2680 PRINT"@";NM$;TAB(20);TL$:PRINTAD$
2690 ND=ND+1:RETURN
2800 GOSUB3000:IFER<>0THENRETURN
2810 GOSUB2400
2820 IFSD$=LEFT$(TP$(CP),5)THEN2850
2830 IFNP<>0ANDSD$>=LEFT$(TP$(CP),5)THEN2810
2840 PRINT"NO MORE MATCHES":RETURN
2850 PRINT"@@@@":GOSUB2600
2860 PRINT"DELETE THIS RECORD? ('Y' OR 'N')
2870 GETA$:IFA$="N"THEN2830
2880 IFA$<>"Y"THEN2870
2890 IFIP=0THENFU=PT%(CP):GOTO2910
2900 PT%(IP)=PT%(CP)
2910 PT%(CP)=FF:FF=CP:TP$(CP)="":UD=1:RETURN
3000 ER=0:IFNN=0THENPRINT"USE 'N' OR 'L' TO CREATE/LOAD A FILE":ER=1:RETURN
3010 IFFU=0THENPRINT"NO RECORDS ON FILE":ER=1:RETURN
3020 PRINT"ENTER NAME, SURNAME FIRST. DO NOT USE":PRINT"COMMAS":PRINT
3030 INPUT#1,NM$:PRINT
3040 PRINT"ENTER SEX ('M' OR 'F' OR 'O' FOR":PRINT"BUSINESSES ETC) ";
3050 INPUT#1,SX$:PRINT
3060 IFSX$="M"ORSX$="F"ORSX$="O"THEN3080
3070 PRINT"'M' OR 'F' OR 'O' PLEASE. REPEAT":GOTO3050
3080 GOSUB2000:IP=0:CP=0:NP=FU
3090 PRINT"@":RETURN
```

(continued from previous page)

for records held entirely in RAM but requires the addition of one or more index when extended to use backing store. It may still form the basis of such a system, having the particular virtue of allowing additions and deletions without major file restructuring.

The program to implement these procedures has been constructed in a modular fashion, as modular programming simplifies coding, testing and subsequent enhancements. The art of coding is in solving the problem and designing the solution. The first step is to define the problem; coding should be left as late in the programming cycle as possible. If the program has been well planned and designed from the outset, coding becomes a largely mechanical process.

The next step is to reduce the solution to a set of modules. At this stage you may prefer to use a structured pseudo-language or a flowchart. The main requirement is that modules should be functionally well defined and small enough for their purpose to be clear. It should also be possible to code each one in a reasonable number of lines. I always assign routines to line numbers advancing by 200 and expect to code the module within the 200 lines with line numbers advancing by 10, allowing space for 20 lines of code.

In Basic, each model except the controlling module should be coded as a subroutine. Because the purpose of the modules can be clearly stated, and they are not too large, they should present no coding difficulties. Furthermore they can be implemented top-down.

Each subroutine is initially coded as a stub, which may simply be a Return or more usefully a line of code to print the subroutine name and then Return. As each subroutine is coded it replaces its stub, and so the program is gradually built up. Where necessary the stub may set values in variables to simulate its actual function, the routines being added and tested one at a time. As the process continues the common routines will be frequently used and you will become increasingly confident in their correctness.

Variables.

NN — number of records assigned to Index
TP$(NN) — telephone index
PT%(NN) — record links
RC$ — index entry
NM$ — name
SX$ — sex
AD$ — address
TL$ — telephone number
SD$ — Soundex code
NP — pointer to next record
IP — pointer to previous record
CP — pointer to current record
FU — pointer to first record of index
FF — pointer to first unused record
IP$ — input action key
LF$ — name of file to be loaded
SF$ — name of file to be saved
UD — update flag, set to 1 if file is created/amended
ER — error flag
ND — number of records being displayed
SE$ — separator character, ","
CD$ — cursor-movement string
A$, N, I, N$, L$, C$, J, K, L — general-purpose variables

Routines.

Cursor-movement characters peculiar to the Pet are shown by codes inside square brackets. The codes used are: CD, cursor down, HOM, cursor home; and CLS, clear screen.

Master Routine, lines 200-310. Calls the initialisation and instruction routines. Accepts input of action key and calls the corresponding routine.

Initialisation, lines 400-410. Sets up constants and initialises UD to zero, showing that initially the Index does not require saving. Open 1,0 in line 410 opens the keyboard as an input device. Data can then be accepted from the keyboard by Input#1. The advantage of this is that pressing the Return key on its own does not cause the Ready display, but is ignored. The disadvantage is that a literal prompt may not be used with Input#1 and the Return which completes entry does not produce a new line on the screen. These disadvantages are easily overcome and are a small price to pay for a program that does not leave the user wondering what Ready means.

Instructions, lines 600-665. Straightforward display.

Load routine, lines 800-890. NN is initially zero; if it is not, an index has already been created/loaded and the user is told of this. The named file is opened and read and the user may extend the file if desired. The additional records are linked into the existing ones by lines 860-870.

Add control routine, lines 1000-1170. Line 1000 ensures records cannot be added until the file has been loaded or created. Details of record to be added are provided for, with error checking, in lines 1010-1100. Commas cannot be used in the input strings as Basic treats a comma as a separator. Subroutine 2000, called in lines 1110, creates the Soundex code. Line 1120 creates the record by concatenating its separate parts. Subroutine 2200, called in line 1130, adds the new record into the index. Lines 1140-1170 cope with the File Full condition detected by subroutine 2200. The user is asked to save the file and then rerun the program and expand the file when it is loaded.

Search routine, lines 1200-1290. Lines 1200-1210 accept the search key. Lines 1220-1240 search through the index one record at a time. The subroutine at 2400 returns CP with the pointer to the next sequential record. Line 1250 detects if there have been no matches, and displays an appropriate message showing that the search was unsuccessful and all matches have been found. Line 1270 prints the matching record and checks that the screen is not full. If it is, lines 1280 and 1290 allow the user to examine the matches before displaying the remainder. The Wait 59410,4,4 in line 1290 is specific to the Pet; it waits for the space bar to be pressed. If this instruction is not entered exactly the Pet is liable to hang on the Wait statement in an uniterruptible state. Some safer alternative code is:

```
1290 GET A$: IF A$<>" "THEN 1290
1300 PRINT"[CLS]": GOTO 1240
```

Save Index, lines 1400-1430. The index is saved to a named cassette-tape file. The comma separator between variables must be forced on to the tape by including it specifically in the Print#2 statements.

New Index, lines 1600-1650. Details of the new file are requested, and the corresponding arrays are set up. Lines 1640-1650 link all the elements of the array into the unused list.

End routine, lines 1800-1850. The keyboard file is closed. If the Index has been changed the user is given an opportunity to save it.

Soundex, lines 2000-2160. This follows the description given in the text.

Add New Entry, lines 2200-2350. If FF=0, line 2200, there are no unused records and the new record therefore cannot be added. Line 2210 places the record in TP$(FF) and sets up a loop to scan for the correct place at which to add the record; lines 2220-2240 form the body of the scan. The scan is left either when the correct point has been found or all the used records have been examined and NP=0. Line 2250 caters for addition at the start of the index. Lines 2260-2270 add the new record into the index. Line 2280 caters for an addition to an empty index. Lines 2290-2300 cater for an addition at the end of the index.

Next Record, line 2400. Resets IP, CP and NP.

Record Display, lines 2600-2690. The main part of the routine, lines 2610-2670, separates RC$ into name, address and telephone number. The actual display is at line 2680. Line 2690 increments a counter of the records displayed.

Delete, line 2800-2910. The key of the record to be deleted is entered in line 2800, and the index scanned to find it in lines 2810-2840. Lines 2850-2880 give the user an opportunity to abandon the delete. Lines 2890-2910 delete the record as described in the text.

Key Entry, 3000-3090. The name and sex are accepted as input by lines 3020-3070, and the Soundex code is created by line 3080.

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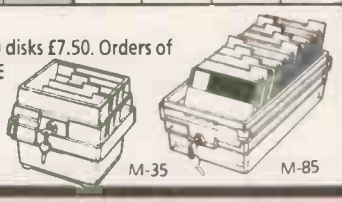

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Tomorrow's world

DE CRECY watched Madame Zsa-Zsa's ample bosom heaving after their exertions. Only a true patriot could make *l'amour* so passionately; she could not be an English spy.

Suddenly the door burst open and the macho Don Sebastian, Ambassador to King Philip of Spain, strode in holding his weapon.

"French whore," the Spaniard declared. "This is how you keep faith with me."

His rapier rested upon De Crecy's nipple.

"Prepare to die, you cur."

Fearlessly, the brave De Crecy awaited the final thrust.

INSPIRATION EXHAUSTION
ABORT

"Oh shit," said Lord Seymore.

A monocle fell from his eye.

"Ouch," said the gold-rimmed monocle as it hit the floor.

The trappings of his ancient peerage surrounded him in the library of the family's medieval mansion: bookshelves piled high with fusty books; deathwatch beetle tap, tap, tapping overhead; dust collecting on the disc drives, keyboard, and VDU, even on Seymore himself. Dirty sunbeams oozed through dirty window panes, staining the floor with anaemic light.

Seymore had struggled all day dictating another best-seller into his word processor, but the story had gone. His second Nobel prize would have to wait: he could not afford to buy another one at the moment.

He glanced outside at the police storming the gates.

"Shit," he repeated. He slammed the microphone on to the desk.

"Ouch," said the microphone.

"Oooh," squealed the masochistic desk with pleasure.

Seymore muttered something under his

by Andrew Walker

breath about "goddamn intelligent machines".

"Curtains," he commanded, and the curtains drew across the window just as one of the policemen mounted the fence and was fried in a laser beam.

"Three-D TV," Seymore commanded, swivelling in his chair to face the screen.

The picture was fuzzy. He had had to repair it himself, because the rental company was reluctant to lose any more staff. They were still suing him over the last five repair men, who had been disintegrated by his over-zealous bodyguards.

The President was speaking.

"Furthermore," she said, projecting her voice across the country, "it is my view — and the view of the American people — that this man should not escape punishment lightly, that his advantaged position should not afford him the slightest clemency. Therefore, in accordance with the powers vested in me, I decree that he should spend no less than 25 years in the state penitentiary for the crime of attempting to pervert the course of justice." She paused to allow her audience to stand and cheer and clap and pick each other's pockets.

It was election year and the man she was sentencing was a senator on her own staff. He was the vote-saving sacrificial goat. He had originally been convicted of underbribing a public official and sentenced to 50 lashes. Being 93 years old he had died of exposure the moment his shirt was ripped from his back.

The public cry of outrage had shaken the foundations of the White House. A presidential aide had gone unpunished: had his money tipped the scales of justice? Had the President bent the law to suit her own ends? Had his lawyers found a new loophole in the penal system? Rumour abounded.

Defeat had previously been inconceivable. She had risen to power with a landslide victory: Mount Rushmore had mysteriously crumbled and her opponent was crushed in the rubble of Washington's left nostril. She was the idol of the American minorities. Her biograpy showed her to be black, Roman Catholic and of Chinese and Puerto Rican descent, which gave her the backing of 75 percent of the people.

Despite this, her position had been threatened by the moral indignation surrounding the senator's indiscretions.

The senator was also disliked by her biographer, the influential chief programmer for Robo-of-America, who had designed and still maintained her.

Mad Dan the gardener walked rudely between Seymore and the television carrying his blood-stained axe. Tall and gaunt, he spoke to no one but carried out his duties while whistling a tune.

He swiped at a fly as he left the room. The fly dodged.

"Missed me you old . . ." Its curse was cut short as it flew into the wall.

It picked itself up, dusted itself off, and followed Dan from the room into the large cobweb-ridden hallway. There it ignored Dan and made for the nearest of the mousetraps that littered the floor. The cheese looked good but a mouse beat him to it and pounced. The trap snapped shut.

"Ouch," cried the mousetrap.

"Aaaagh," screamed the mouse, which otherwise kept its trap shut.

The cook rushed from the kitchen, her heart set on the fresh ex-rodent.

"Mouseburger and chips for His Lordship's lunch," she chortled, licking her lips enviously.

The fly, grateful to her for opening the door, flew into the kitchen. A slab of steaming red meat lay on the window sill, playground for a gang of bluebottles and a million bacteria.

"Lord Seymore — enemy of the people!" An instinct that had been burned into his memory flashed before him. His mission: to assassinate Lord Seymore by contaminating his food.

The American Nationalist Army of liberation had plotted the mass murder of all imperialist oppressors for 10 years. They had designed the super bluebottle at a cost of several billions, and each one was individually programmed for a specific target.

The creature's eyes lit up when he glanced into the corner where the potatoes lay in a pile. A soft, warm pile of doggy-droppings. As he made the approach run his senses were raised to new heights. The excrement's aroma grew, his lust became insatiable, a tidal wave of desire washed over him.

INTERRUPT
"COME-INTO-MY-PARLOUR" WARNING

With a swipe of contempt he brushed aside his logic chips and landed.

He could not move. With all his might he tried to lift his feet but not one of them would budge. Panic seized him, a subconscious awareness of danger. He looked around to cry for help . . . his friends on the sill. He called out. They did not hear.

A fast-rising horizon blotted them from view. This mass that once promised heaven now threatened hell. It swelled before him, putrefying as it did so.

And then it was a mountain, towering above him, engulfing him, burying him in an insecticidal tomb.

"My god, these fiendish humans," was his final thought.

"And now a word from our sponsors," the TV blasted.

Ted Teeth, smiling adman, was earning another million plugging the latest micro-products.

"Yes folks, take it from me — it really fools all known insects. Remember the name: Crap-a-Fly, the world's first fly-catching dog turd. Made by Turdomatic Inc., a subsidiary of tonight's sponsors, Robo-of-America."

So now what? Should he return to De Crecy's predicament? He shook his head: not in the mood. What about the children's story he was dabbling with? What was it called? He searched his memory, drumming his fingers on the desk top, sending its insatiable sensors into electro-orgasm.

"Susan the Dragon and the Robot Gang-bang," he recalled aloud. It had a certain ring to it.

Queen Henry was executing orphans for not writing games programs on their micro-computers. Prince Peregrine was playing Dungeons and Dragons with the real thing, while King Twit III was molesting sheep on the croquet lawn.

It was rubbish, Seymore knew, but that was what the kids wanted. He just could not conjure up any enthusiasm for it though. Perhaps tomorrow.

"I'm not waiting all day," thought the microphone, and switched itself off.

He considered setting the machine on auto. His agent had insisted that he had his brain profile saved on disc.

Brain profiles were all the rage. Every cell was copied — the sum total of his thoughts for the rest of his life. The computer could use the disc to generate new ideas, working in parallel on up to four novels, writing in hours what would have taken Seymore a lifetime.

Many rejected the whole thing as inhuman, claiming that literature was the last bastion of natural creativity and that it should be defended against the invading automaton hordes. Most writers set them to work and retired to live off the 10 best-sellers a year that they produced. Unscrupulous publishers killed their authors, taking the profit from the obedient, prolific emulators.

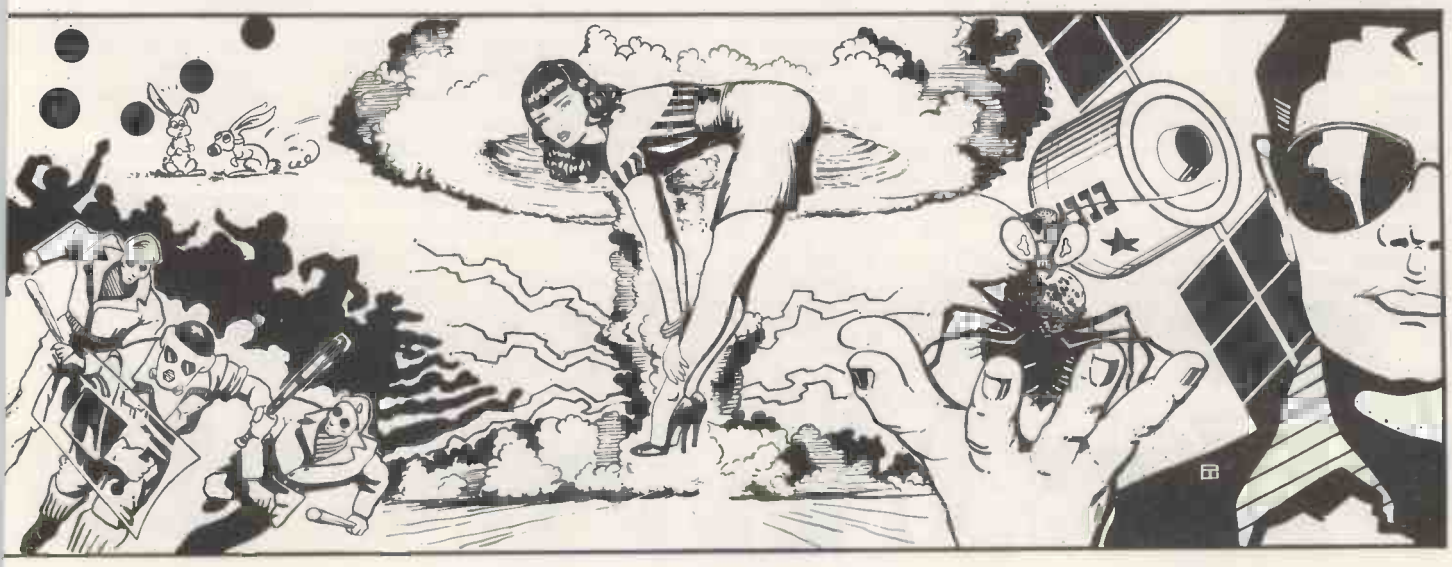
"It'll guarantee this year's Nobel," Seymore pointed out. But he shook his head. It was too impersonal. He preferred the human touch.

"Curtains."

Daylight flooded the room, and before Seymore's admiring eyes lay the scenery of Death Valley. It was all there: the Tower of London, Buckingham Palace, Ben Nevis, Blackpool's Golden Mile: most of Britain had been shipped to the States, leaving only Scunthorpe and bits of Manchester behind.

Mad Dan walked across the garden cutting the grass, short and black as it was. All the time he looked to the sky. The flowers were in midsummer bloom with charred petals on withered stems. The goldfish were sunbathing, or so Seymore thought. Actually they had died from radiation poisoning, which caused them to glow in the dark, a phenomenon that had always puzzled him.

(continued on next page)



Tomorrow's world

(continued from previous page)

Albert was watching the fish: he had nothing better to do. Being Lord Seymore's favourite gnome was no fun; being his only gnome made it unbearable. The others had run off because of the conditions and poor wages. They had gone to work on the Paris Underground, getting jobs as Metro-gnomes.

Albert rolled his trousers down and began defecating on the flowers. A duck-billed-chicken-rabbit hopped across the garden, its fluffy feathers ruffled by the hot nuclear breeze. It was one of the few Nubreeds still permitted to roam wild.

Amateur Genetic Engineering had taken off in a big way until the world's governments had banned the disastrous experiments of the less ethically minded participants. The last straw was the nesting of the elephant-sparrows, and the terror of the red-admiral-piranha still lived in the memories of the survivors.

Seymore himself had built up a large safari park of these quirks of science. His rhinocerhorse, resembling the unicorn of legend, had been a great crowd-puller, while around thanksgiving the delicious octopus-turkey sold well to large families who all wanted a leg.

"Quack," said the lion-giraffe-duck. Despite government orders, Seymore refused to destroy all his creatures. It bit Albert's head off.

"Ouch," cried Albert's head, the cry echoing down the long throat as he slid slowly along. His body squatted above the flowers, nonplussed, wondering where his head had gone.

A laser flash caught Seymore's eye. The security team was defending his freedom again. Police Commissioner Macdonald had been converted to a heap of cinders as he dropped over the fence, shot-gun in hand.

Seymore tut-tutted. All that money in bribes and this was how the likes of Macdonald repaid him.

"Damned unemployed scroungers," he cursed.

Ever since he had been replaced by Commissioner Macrobot, Macdonald and his men had lain seige to the Seymore estate.

Seymore had never understood people's rejection of phased leisure progression. Why work when the government was willing to let you retire and have a machine to do your job? He shook his head in wonder.

The police no longer had to face day-to-day dangers: no more homicidal maniacs, no more shootouts with liquor-store robbers. Anyway, most of the big-time crooks had robots of their own built to do the jobs for them.

Who else was out there? Seymore panned the camera. It was hard to recognise anyone, charred and bloodied as they were from the pounding they were taking from the Cybercops.

The media were there in force with their autofocus, remote-control cameras, relaying live television picutres and their image-translators that turned the pictures into the written word for the newspapers. Vultures gorged on the carrion of the day's crises. The auto-reporters paid particular attention to the old journalists, who with the ex-cops and others were trying to tear down the fences.

Le Blanc was there, the physicist famous for perfecting hand-held laser weapons. Wilson and Tate, the science-fiction writers, had reached the inner perimeter but had fallen into the clutches of the voracious doberman-cockroaches and were quickly being devoured by the seven-feet-wide genetic abominations. The members of the Computer Programmers Union had long since perished in the same way.

The defences were gradually being overwhelmed as more of the rioters climbed over the wires, pushing the Cybercops back step by step, drowning them in numbers.

The drone of engines caught everyone's attention. The fighting stopped, all eyes cast to the sky. Mad Dan burst into aimless, rabid action.

The aeroplane came out of the sun, unmarked and mysterious. As it passed overhead, a single parachute began to descend. A deathly silence fell over the Valley. Rioter and Cybercop stood side by side. The chilling thought ran through all minds: "Was it the enemy's super-bacteria? Was this the end of the world?"

Lives flashed before eyes. Who would remember them when tomorrow had come? The insignificance of their existence hit them like a slap in the face. How could they start again, afresh? Images of what could have been, what still could be, reflected in the tear-stained mirrors of their eyes, shining through the dim myopia of reality. But it was too late.

The package cradled beneath the parachute landed with a thud. Mad Dan ran forward through the concentrated gaze of the onlookers, ripping it open to reveal the coffin-like box within. He prised the lid up and stopped, wide-eyed.

She was beautiful: an Amazon. He pulled her from the container and stood her up to admire her full glory. "I'm gonna turn you on, baby," he promised learfully. His hand strayed nervously to her left breast, and with a hasty jab of his finger he flicked the bright red switch on the nipple.

She simmered into life, stretching felinely, displaying every elegant sensuous curve. "Hello Big Boy," she oozed, letting rip with a slow, deliberate wink. "Robo-of-America made me yesterday. You can make me today." She was barely able to keep her feet as Dan dragged her home.

A wave of relief washed over the rioters. It had not been the super-bacteria after all. When tomorrow came they would still be there. They could build a new tomorrow.

Le Blanc started it. He lashed out at the nearest robot with a length of broken gatepost. The victim crumbled to the ground and pandemonium broke out all around. As the blood poured from the shattered skull Le Blanc realised that he had made a mistake.

"Ouch," cried the fence as it fell down under the weight of the Artists Against Robots society. Le Blanc's head skimmed across the grass, severed from its shoulders by the slash of a razor-sharp laser, and landed at the feet of a guard-roach.

"Gulp. Yummy," said the Doberman cockroach as it licked its lips.

The Nuke Warning light suddenly flashed red. Lightning instincts crashed Seymore's fist on to the Alert button.

"Ouch," screamed the button.

Sirens wailed, blast-proof shutters clamped down on doors and windows. The Cybercops stopped beating the invaders and retreated to the safety of the fallout shelters. The guard-roaches withdrew into the woodwork. The rioters simply stopped, puzzled, looking for something to fight.

Seymore was livid: this was an unscheduled attack and a blatant infringement of the right to riot.

Silence fell on the rioters, then death.

Through heavily filtered screens Seymore watched the flash of the bomb. Then the crowd outside melted away.

"Unemployment Down," cried the headlines.

Albert ran blindly for his own shelter, but without a head he bumped into trees, ricocheting like a pinball until at last he fell into the pond. Seymore sadly watched his last gnome turning to jelly in the intense heat.

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Shrinking the computer

Ian Stobie discusses squeezing the computer into a calculator's shell in an examination of 10 pocket-sized battery-powered machines with Basic.

POCKET COMPUTERS do not seem to have caught the popular imagination in the way home micros, office personal computers and even the larger-sized portable computers have done. It sems that there has to be a certain necessary power crammed into the package before you have a computer worth anyone's while. Until recently the bottom limit has been machines like the Epson HX-20 and Tandy Model 100, which have full-sized keyboards and reasonable sized displays. Their main advantage is that you can also run practical software on such machines without having to write it yourself.

But a new wave of technical advance is beginning to transform prospects for the very small computer. The notebook-sized Husky Hunter packs CP/M into its small 2.5lb. bulk, and is capable of running WordStar or Supercalc just as fast as the desk-top Sirius I am using now. VisiCalc, the genuine article from Visicorp, can be run on the lighter weight Hewlett-Packard 75C. Admittedly these two machines are the most expensive in this survey, but now is a convenient time to take a look at what is available over the whole range of pocket computers, from super-calculator to super-compressed office system.

Battery powered

For the survey we are defining the pocket computer category to include all machines which offer a version of the Basic programming language, which are battery-powered with at least one working day's battery life, but which are too small to have a full-sized keyboard. Rather than quibble about the size of the standard pocket computer we will include anything with a keyboard smaller than the standard typewriter — calculators are excluded because they lack Basic.

The machines in this survey find at least two distinct kinds of use. Commercial organisations and even the military are using the two successful Sharp machines and the Hunter for data collection, as well as calculation "in the field". Here a prime requirement is to have some means of storing the data collected — micro-cassettes in the case of the Sharps and battery-backed RAM in the case of the Hunter. The other major use for pocket computers is as super-calculators, which are used predominantly on the desk top, but can be moved around.

Machines like the smaller Casios are adequate in the super-calculator role. But some people are tempted to buy such machines as a cheap introduction to programming, and it must be said that the mains-powered home computers from the ZX-81 upwards offer a preferable buy, with their better display, sound facilities, vast range of entertainment software and heavy support from specialist magazines.

Battery-powered portability is not worth paying for if you do not want it, since at present the low power consumption CMOS technology used in battery-powered computers is slower and more expensive than conventional NMOS. Major investment has been going into CMOS, and it is now producing results in the form of cheaper and faster circuits.

Portable flat-screen display technology is also improving fast, with larger LCD arrays coming in further up the market on machines like the Gavilan, Tandy Model 100, Olivetti M-10 and NEC PC-8201. Already Hitachi has a flat-screen TV at the experimental stage.

Finally, various technologies are being explored to get rid of conventional cabling. This offers great advantages for portable computing. The Canon X-07 we have in the office is connected to its mains-powered printer by an infra-red link.

Seiko is introducing a product in Japan in early 1984 which takes matters a step further. Using the induction loop principle, Seiko designers have built a pocket computer split into three components, just like a miniature conventional office computer but without the cables. The processor and 2K of user RAM fit in a box measuring 5.5in. by 8in. which goes on the desk, or into a briefcase or pocket; a completely detached mini-keyboard fits into a shirt pocket, while the display can be worn, watch-like, on the wrist.

The Seiko "wrist computer" is programmable in Microsoft Basic and features a tiny printer built into the system box. The Japanese price works out at around £160. At the moment Seiko in the U.K. pleads ignorance about any wider marketing plans, but if the idea proves successful in Japan we can expect other multi-pocket computer systems.

Details of our top 10 pocketables can be found overleaf. All prices are for unexpanded systems: for the Husky Hunter and HP-75C they do not include VAT; prices for Casio and Sharp machines are VAT inclusive.

Suppliers

Canon X-07 Canon (U.K.) Ltd, Waddon House, Stafford Road, Croydon CR9 4DD. Telephone: 01-680 7700.

Casio Casio Electronics Co Ltd, Unit 6, 1,000 North Circular Road, London NW2 7DJ. Telephone: 01-450 9131.

HP-75C Hewlett-Packard Ltd, PC Group, King Street Lane, Winnersh, Wokingham, Berkshire RG11 5AR. Telephone: (0734) 784774.

Husky Hunter Husky Computers Ltd, PO Box 135, Foleshill Road, Coventry CV6 5RW. Telephone: (0203) 668181.

Sharp PC-1251, PC-1500 Sharp Electronics (U.K.) Ltd, Sharp House, Thorp Road, Manchester M10 9BE. Telephone: 061-205 2333.

Texas CC-40 Texas Instruments Ltd, Manton Lane, Bedford MK41 7PA. Telephone: (0234) 67466.

CANON X-07 around £200

If you have room in your pocket for a hardback novel then you could carry an X-07 around instead. The LCD screen shows four lines of 20 characters, and it is just possible to touch-type on its 10mm.-wide button keys. The standard machine has 6.6K of RAM free to an enhanced Microsoft/Canon Basic. Battery-backed memory-expansion modules — the size of credit cards, but thicker — slot in the back. The X-07 is well set up as a system machine via its cassette port, serial port, parallel printer port and expansion port. It can communicate with its own peripherals, including four-colour mains-powered printer/plotter, via an optional infra-red module. Unfortunately, no U.K. version has been produced, but we live in hope.

For. Expandable system. Novel features such as RAM cards and infra-red communications.

Against. Not available. Canon (U.K.) may decide not to import it.

CASIO PB-100 £49.95

A straightforward machine, the PB-100 is aimed at the beginner. It is the size of a largish calculator at 6.5in. by 2.75in., there is a small QWERTY keyboard with separate numeric keypad and a 12-character LCD display. The PB-100 comes with the simple Casio Basic in ROM, and 1K of RAM, expandable to 2K by adding a £14 module. The user manual is particularly good. Up to 10 programs can be held in memory while the machine is switched off. Numeric results are displayed to 10 significant digits but string handling is limited. A cassette interface costs £26; the printer is £60.

For. Low cost. Good manual. Better than a calculator.

Against. Limited memory expansion. No string handling in Basic.

CASIO FX-700P £59.95

This is the same machine as the PB-100 with a similar Basic, but more technically biased. For the extra money you get single-key entry of scientific functions and 2K of RAM, which is not expandable. The FX-700P is good for numerical work — much simpler to program than a calculator — but the Casio Basic is limited. You are only allowed one string variable, limited to 30 characters, and there are no sub-string manipulation functions. You can use string constants in Print and Input statements. The FX-700P will accept the same peripherals as the PB-100, including cassette interface. No commercial software is available, but a book of useful program listings is supplied with the machine.

For. Scientific functions. 2K of RAM.

Against. No further memory expansion. No third-party software.

CASIO PB-300 £99.95

Similar to the PB-100 but with a slightly larger QWERTY keyboard and numeric keypad, a built-in printer and more memory. The 20-column printer uses 38mm. rolls of thermal paper. Basic and display are the same as the PB-100. Standard RAM is 2K, but is not expandable. An optional interface costing £26 lets you save and store programs and data on a standard audio cassette recorder. The PB-802P is a scientific version of the PB-300.

For. Good manual. Built-in printer.

Against. Limited string handling.

CASIO PB-700 £139

Top of the small-key Casio range, with a larger display, more memory and a wider range of peripherals. The LCD panel shows four lines of 20 characters or 32-by-160 dot graphics. Standard memory is 4K, expandable to 16K internally. The Basic includes plotting commands and string functions like Left$, Mid$, Right$ and Inkey$. An optional battery-powered slip-on four-colour printer/plotter costing £179 also provides an interface to a domestic audio cassette, or for £70 you can fit the Casio micro-cassette deck to form a single battery-powered unit. Other options include Centronics-type parallel printer port.

For. Better Basic. Larger screen. Good peripherals.

Against. Small keys. Little third-party software. No RS-232 option.

Pocketables: top 10

HEWLETT-PACKARD 75C £763

Luxury machine with wide range of battery-powered add-ons; it measures 10in. by 5in. The HP-75C has calculator-style keys with almost typewriter spacing, and a single-line 32-character LCD display. Standard 16K of RAM is expandable to 24K. The 48K of ROM contains a very powerful Basic with 12-digit numeric precision and good diary/alarm and address-list programs. Genuine VisiCalc is available on ROM for £154. The built-in card reader lets you store 1.3K per thin magnetic card. Wide range of mainly technical software available on cards or on ROM chips. The HP-75C comes fitted with an HP-IL socket which connects it to a wide range of HP plotters, printers, measuring instruments, a full-size display and larger HP computers.

For. Excellent Basic. Optional VisiCalc. Versatile HP-IL interface.

Against. Expensive. Software and peripherals are expensive too.

HUSKY HUNTER £997

The smallest battery-powered machine to offer CP/M. It measures 8.5in. by 6in. and is housed in a rugged cast-aluminium case with a sealed, waterproof keyboard. The eight-line by 40-character LCD display can also show 64-by-240 dot graphics. Standard RAM is 80K, expandable to 208K, some of it configured as a silicon disc. CP/M 2.2 and Microsoft Basic are supplied in the machine's 48K ROM. The NSC800-4 CMOS CPU runs at 4MHz, so it is no slower than an eight-bit mains-powered micro. RS-232 interface included as standard for linking to printers and other computers. Options include modem and mains-powered disc drive.

For. Fast. Very tough, Vast CP/M software base.

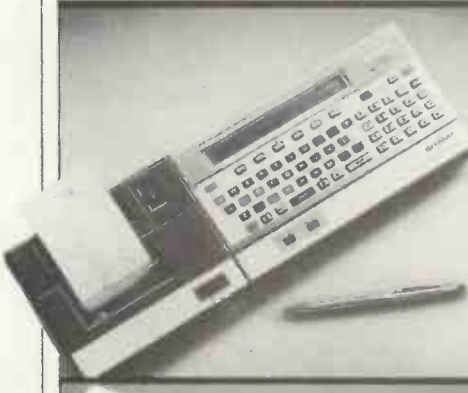
Against. Price.

SHARP PC-125 £79.95

Compact enough to fit in a jacket breast pocket this smaller companion to the successful PC-1500 also has good expansion options. It measures 5.25in. by 2.75 in. The standard machine has a 24-character LCD and comes with 4.2K of RAM. A powerful Basic comes in 24K of ROM, offering two-dimensional arrays, scientific functions and a full range of string operations. An optional battery-powered clip-on unit costing £99.95 adds a 24-character thermal printer and a micro-cassette drive. This expanded system has been taken up by commercial users particularly in the financial and engineering fields. A number of third-party programs are available on micro-cassette.

For. Good Basic. Neat printer/cassette option. Commercially available software.

Against. Limited maximum memory.

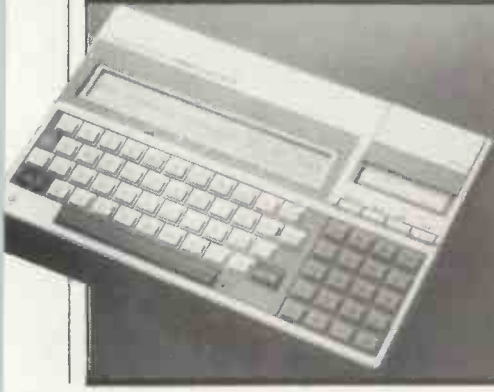


SHARP PC-1500 £169.95

Longer established than the PC-1251 and offering a wider range of peripherals, greater memory expansion and a larger base of independent software. It measures 8in. by 3.5in. and has a 26-character LCD display. The standard 3.5K RAM is expandable to 11.5K; the 16K ROM contains a powerful Basic with full string handling, arrays and scientific functions. A range of scientific, engineering and financial programs are available on plug-in ROMs. The £149.95 printer/plotter unit uses a four-colour ball-point pen carousel mechanism and also provides a cassette interface. Other battery-powered options include a combined RS-232 and parallel interface suitable for connecting larger computers or modems. Tandy sells the same machine for £159 as the Tandy PC-2.

For. Good Basic. Printer/plotter and RS-232 options. Software.

Against. Small keys. Micro-cassette would be an asset.



TEXAS CC-40 aorund £170

Long-delayed machine first announced in February 1983; should be available in 1984 according to Texas Instruments. It runs an eight-bit CMOS CPU with 6K of RAM, expandable to 16K; the 34K of ROM contains a very comprehensive Basic. ROM software cartridges of up to 128K can be slotted in to the right of the 31-character LCD. The CC-40 weighs 1.3lb. and measures 9.5in. by 5.75in. and is designed to have a large family of battery-powered peripherals including a 36-character four-colour printer/plotter, a stringy-floppy drive similar to the Sinclair Microdrive, and a combined RS-232 and parallel printer interface. We were allowed to examine a sample machine last year, so the CC-40 is not a complete myth.

For. Excellent Basic. Range of peripherals.

Against. Not yet here, a year after announcement.

Many-legged beasties

Ray Coles reveals what goes on inside those little black rectangular packages sitting on the circuit board of your micro.

THE TALE of the chip began back in 1948 when the first transistor was made in the U.S. Researchers in both the U.K. and abroad soon realised the potential of this new solid-state component as a switch to replace the bulky and unreliable electromagnetic relays and thermionic valves then used in the digital computers of the day. It was this breakthrough more than any other which turned laboratory curiosities into the powerful data-processing machines which have become so indispensible.

Transistors may have made the digital computer a practical proposition, but the machines they were used in were by no means easy to live with. They were so enormously expensive that only large government or industrial concerns could even dream of tapping their problem-solving potential. Before long, however, semiconductor manufacturers packaged several transistors together on a single sliver of silicon. There they formed a complete functional circuit such as a logic gate, the basic building block of the computer.

These integrated circuits revolutionised the design and manufacture of computers. This eventually led to the introduction of minicomputers in the mid 1960s which, for the first time, brought data processing into smaller companies and scientific laboratories. The great benefits of these miniature circuits with such low price tags created a tremendous pressure to squeeze more and more transistors on to a single chip. The so called small-scale integration, SSI, of the logic gate soon led to the medium-scale integration of the counter or register, and beyond.

At this point the semiconductor manufacturers began to turn away from the conventional bipolar transistor. The new breed of field-effect transistors were simpler and smaller, which allowed even more functions to be sqeezed on to silicon chips now containing over 1,000 transistors each. Thus large-scale integration, LSI, was born. With several thousand transistors to play with, complete functional systems such as the innards of an electronic calculator could be built with only one integrated circuit. It was not long before Intel realised that a calculator could be transformed into a general-purpose computer.

The first device which was actually given the name "microprocessor" was the Intel 4004. This four-bit general-purpose digital processor was first designed for a calculator manufacturer which wanted to be able to reprogram its calculator chip to produce variations on the theme. Along with a few other pioneers who bought the new device for use in non-calculator applications, Intel soon realised the potential of this new general-purpose digital component.

By the mid 1970s Intel had introduced its eight-bit 8080A microprocessor. It had many features in common with the minicomputers of the day, including a 64K address range, a unified data and instruction memory space and an extensive repertoire of 78 different instructions. Although some diehards still felt that such a puny computer would never catch on, others saw the writing on the wall and began to dream up new applications for the microprocessor.

The concept of a microprocessor-based personal computer appeared around this time. The precedents set by existing computers were still a powerful influence and early designs looked just like their larger cousins. They used separate teletypewriter terminals, alongside paper-tape readers and square CPU cabinets containing rows of individual plug-in circuit boards. It was not the sort of thing for the average living room or office.

Seeing the success of the 8080A, many other semiconductor manufacturers were hard at work to do better, and Motorola had some early success with its 6800, which needed less peripheral circuitry than the Intel device. The two microprocessors which had the greatest effect were the Zilog Z-80 and the MOS Technology 6502.

The Z-80 caused quite a stir when it was introduced in 1977. Its advanced features included a very powerful instruction set, extra registers and a sophisticated interrupt structure. Its compatibility with the 8080A provided it with a ready-made market as a replacement for the Intel device. The CP/M disc-operating system software, designed originally for the 8080A, could be used unmodified with the Zilog processor. Z-80 sales took off like a rocket.

In the same way that the Z-80 was designed as an improved 8080A, the 6502 was produced as a competitor to the 6800. It is to this processor that the honour must go of sparking off the concept of personal computers as we now know them. The simple but powerful architecture of the 6502, optimised for use with high-level languages such as Basic, proved to be just the thing for Commodore Business Machines to use in its now famous Pet.

The separate functional units typical of the big computers were replaced by an integrated system with built-in keyboard, VDU screen and cassette-tape unit. Instead

CPU chips

INTEL 8080A, page 106
Used in: S-100 micros

ZILOG Z-80, page 107
Used in: Computers Lynx, Cifer Club, Gemini, Galaxy, Osborne, Rair Black Box, Research Machines 380Z, Sinclair ZX-80/81 and Spectrum, Sord M-23, Superbrain, Tandy Models I, II, III and IV, Video Genie

MOS TECHNOLOGY 6502, page 108
Used in: Acorn Atom, Acorn Electron, Aim 65, Apple models I, II and III, Atari, BBC Micro, Commodore Pet, Commodore Vic-20, Oric

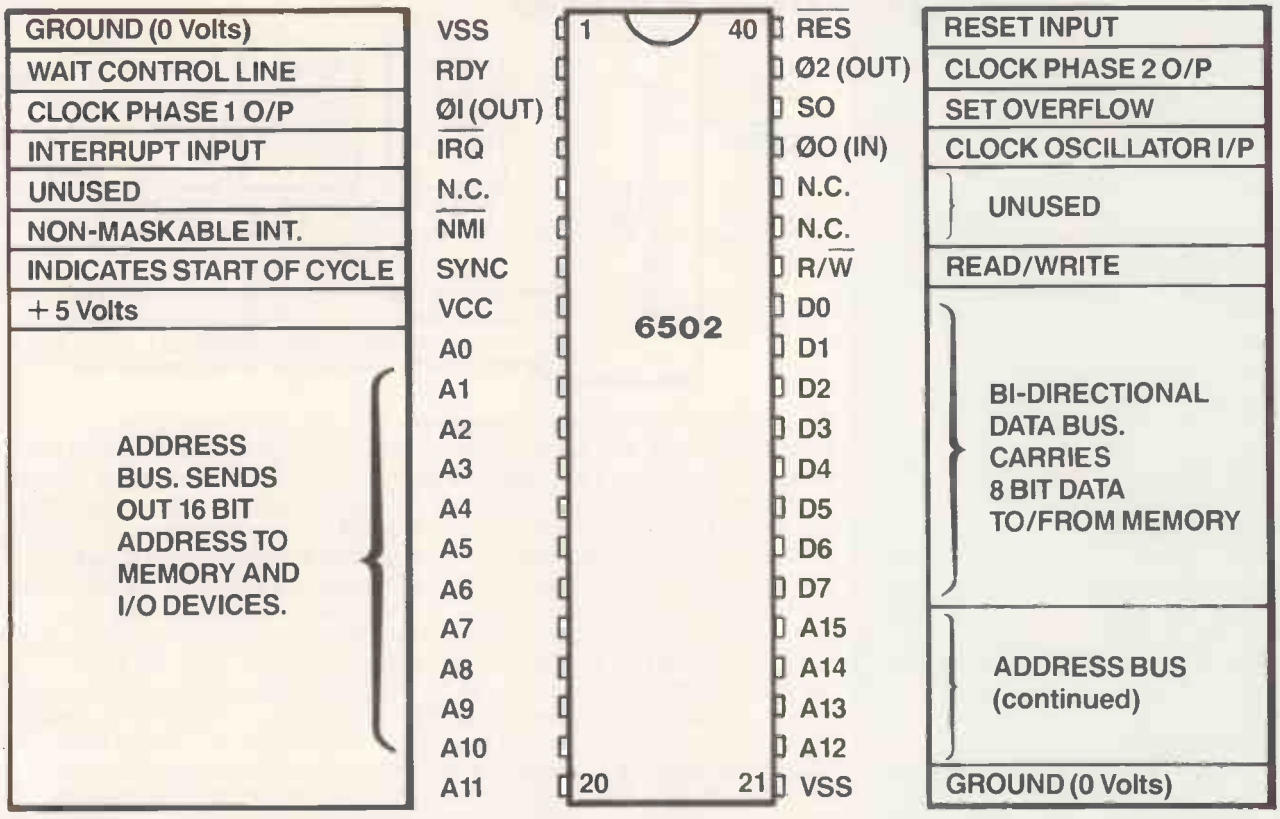
MOTOROLA 6809, page 109
Used in: Dragon, Tandy Color Computer

TEXAS 9900, page 110
Texas Home Computer

INTEL 8088, page 111
Used in: ACT Sirius, DEC Rainbow, IBM Personal Computer, Sharp PC 5000, Texas Professional

MOTOROLA 68000, page 112
Apple Lisa, Bleasdale BDC 680, Britannia Baby, Torch 700, Hewlett-Packard 9826 and 9836

ZILOG Z-8000, page 113
Used in: forthcoming Commodore system



The 6502, like many other microprocessors, is housed in a 40-pin plastic dual-in-line package measuring 2in. by 0.6in. The semiconductor chip itself is in the centre of the package and measures typically 0.3in. square; most of the package volume consists of just plastic or metal frame. Much smaller packages are therefore possible, and are available for high-density applications. Some 16-bit microprocessors may need more than 40 pins, and this has triggered the development of much larger packages. One trick commonly employed to reduce the number of pins is to multiplex or time-share the data- and address-bus pins. This demands additional circuitry to de-multiplex the information outside the microprocessor package.

of loading the Basic interpreter into RAM from a paper tape or cassette the operating system and a Basic were inside the machine, stored in permanent ROM. Best of all, the concept of separate plug-in circuit boards for CPU, memory and I/O functions had gone. Although this reduced flexibility it cut costs dramatically. For the first time, the smallest business budget could withstand a computer, and schools and some lucky households could afford them too. Alongside the Pet, Tandy's TRS-80 with its Z-80 processor and the 6502-based Apple led an American personal-computer boom.

Home users

In Britain Sinclair Research introduced a computer aimed for the first time at High Street stores and the ordinary consumer. The educationally sophisticated but relatively impecunious British home market helped Sinclair create a brand-new low-cost computer formula, turning the tables on the Americans and the Japanese. Where Sinclair led, other British brand names in the computer stores, like Oric, Dragon and Lynx, have followed into the burgeoning computer departments of the country's chain stores.

Meanwhile there was brisk business back at the semiconductor manufacturers, and the resulting profits led to massive investment in the development of new and more exotic microprocessor chips. Eight-bit designs like the Z-80 and the 6502 are now cheap and easy to make, and semiconductor technology has moved on to provide smaller geometries and more transistors per chip. The 8080A and its contemporaries had from 5,000 to 10,000 transistors on a chip. Today 50,000 to 100,000 is routine, and by the end of the decade, microprocessors with 1,000,000 transistors will be commonplace.

There is always a time lag before a new device appears inside a commercially available microcomputer, but 16-bit microprocessors have already provided another quantum jump in processing power since the advent of the first personal computers.

Eight-bit data words can represent a single ASCII character or provide a numeric resolution of one in 256. They are about the smallest units that can usefully be employed in a practical data processor. But eight-bit resolution is not adequate for most numeric applications, so even in eight-bit machines multiple operations are necessary to achieve the more usable arithmetic precision of 16 or 32 bits. So for every simple calculation made by the Basic interpreter, several eight-bit operations have to be performed one after the other, which slows things up considerably.

Extra goodies

Though improved computational performance is the main driving force behind the move to 16- or 32-bit microprocessor chips, many other benefits are provided too. With 16 bits to play with, more instruction codes become possible and lots of new features can be added to the instruction set. As the data bus becomes wider so does the address bus, and the 64K maximum memory map exands to a megabyte or more.

The technology which manages to squeeze a 16-bit processor on to a chip also allows features such as extra registers and hardware multiply/divide units to be incorporated. As a result, the 16-bit microprocessor is much more than twice as powerful as its eight-bit predecessor.

The first 16-bit processor to see wide use was the Texas 9900. It appeared early

(continued on next page)

Many-legged beasties

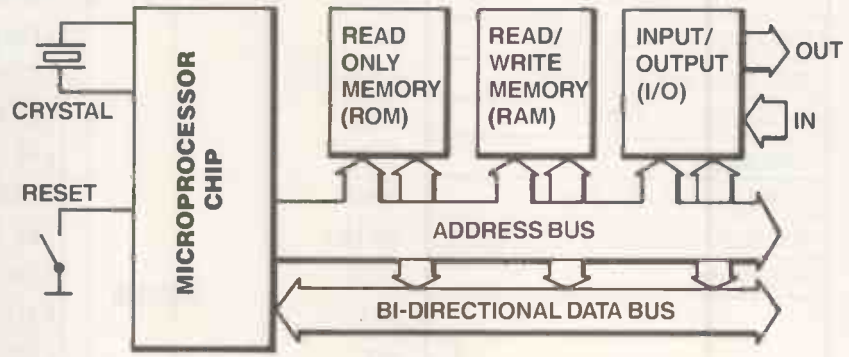
(continued from previous page)

because Texas decided to miss the eight-bit evolutionary step altogether. This proved popular in embedded computers for avionics and the like, and was built into a home computer by Texas itself. It never really caught on, perhaps because of its unusual architecture based on the Texas 990 family of minicomputers.

The first 16-bit device to achieve real prominence was the 8088/8086 family from Intel. This company is still a market leader, after the success of the 8080A and its successor the 8085. The 8086 provides the power of a mid-range minicomputer from a single 40-pin plastic package with a 16-bit time-multiplexed data and address bus. Though the 8086 package is no bigger than that used for earlier eight-bit devices, 20 address bits are available to provide access to 1Mbyte of memory. Its only major limitation is that its internal addressing techniques restrict access to four 64K segments at a time.

The cost-sensitive personal-computer market was not really ready for the 8086 when it first appeared, so Intel launched the cut-down 8088 at almost the same time. The 8088 is cut-down in only one sense: it uses an eight-bit data bus in place of the 16 bits of the basic 8086. Inside the 8088 is a complete 8086 16-bit processor with a full-

How it works



When the microprocessor is powered-up or reset it wakes up in a predefined state and begins to fetch instructions from memory and to execute them. The rate at which it does this is determined by the crystal-controlled clock oscillator which is used to synchronise all activity. The processor fetches an instruction from ROM or RAM memory by issuing an address on the address bus and then reading the instruction it has addressed into its internal instruction register via the data bus. What the processor does next depends on the instruction to be executed, but instructions may involve internal arithmetic and logical operations, or further external bus activity in transferring data to or from the RAM memory or input/output ports. Since the address bus is always driven by the processor it is uni-directional, but data may be transferred in either direction on the bi-directional data bus. The amount of memory which can be accessed by the processor is determined by the address-bus width, which is usually 16 bits for eight-bit processors. The "eight-bit" label actually refers to the width of the data bus which determines the precision of the data which can be handled in one transaction. The main reason that the newer 16-bit machines are more powerful is that they can transfer data twice as fast. In most cases they also have an address but which is more than 16 bits wide, so that they can reach more than 64K.

Memory and peripheral chips

For every processor sold, at least eight memory devices are sold too. Not suprisingly, therefore, this market is even more important to the manufacturers than that for microprocessor chips. Advances in technology have been very rapid. The 4Kbit chips which were available in the heyday of the 8080A became 16Kbit devices for the Z-80; now 64Kbits is the norm for new machines. Just around the corner are the 256Kbit chips able to exploit the addressing range of 16-bit processors like the 68000. Costs per bit are dropping dramatically to make large memory arrays an affordable proposition.

As the density of RAM memory chips increases, personal-computer manufacturers are able to offer higher-resolution graphics and more advanced software. In some cases the software need not be read in from floppy discs but can be resident in the machine, stored in ROM. The density of ROM devices is even higher than that of RAM. Even now 256Kbit chips are the norm, with 1Mbit not far off. Just think what you could do with 128K of software available as soon as you hit the On switch. As well as a fancy operating system like Unix, there would be room for a word-processing program, a spreadsheet and no doubt a few games too. It's quite an improvement over the 4K Basics of just a few years ago.

Also needed to build a complete system are the specialised peripheral devices. They are often just as dense and sophisticated as the microprocessors they serve. One of the most commonly used peripheral chips is the universal asynchronous receiver transmitter or Uart, which interfaces with RS-232 serial links for VDUs, modems and other external facilities. Devices of this type are available from the various manufacturers.

Graphics-controller chips are widely used to unload the tedious chore of screen refresh from the processor. Devices are now available which offer not only high-resolution bit-mapped colour graphics but the ability to draw lines and shapes without processor intervention. Add to these the extensive array of parallel interfaces, floppy-disc controllers, text processors, floating-point arithmetic units and memory managers, and you can see why there are often so many little black rectangles inside your office computer.

Each of these specialist chips is likely to cost as much as the CPU itself. At the lower end of the market lots of peripheral chips like these would soon have the price rocketing out of control. The designers of high-volume personal computers therefore turn to custom logic arrays. They are programmed at the manufacturing stage to form a peripheral chip tailored specifically for a particular machine and its needs.

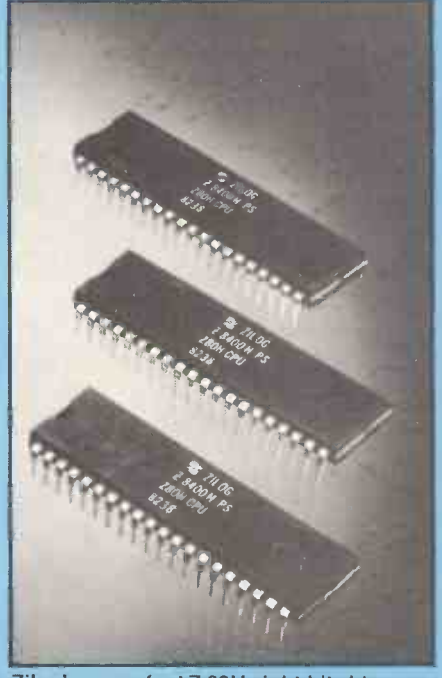
These cost-cutting devices provide only a subset of the general-purpose facilities offered by the conventional peripheral chips. But by clever design and compromise customised arrays can often be made to provide multiple functions such as dynamic-RAM refresh, graphics control and printer interface all from one package at a fraction of the cost of three separate chips. The use of these custom logic arrays means that there are relatively few components in mass-market home micros like the Sinclair Spectrum or Oric.

width internal bus. The memory addressing range is still 1Mbyte, but instructions and data are fetched from memory eight bits at a time. This slows down the processor of course, but it also allows it to be used with external memory and peripheral devices organised on a byte-wide basis, which in turn reduces the overall system costs.

The success of this ploy is plain to see. More 8088 processors have been sold than 8086s, and nearly all the first-generation 16-bit machines like the IBM PC and the ACT Sirius have used it. Better still, 8088 software is absolutely identical to 8086 software. System builders have a no-hassle upgrade path when they need it, which Intel has extended further to the 80186 and 80286 processors now available. In contrast, the more powerful Zilog Z-8000 processor family does not include an eight-bit bus version, which is one of the reasons why this otherwise attractive device has not caught on so well.

For the ultimate in 16-bit power, though, take a look at the Motorola 68000. This beautiful processor is designed with 32-bit architecture on the inside but uses a 16 bit bus to the outside world. If offers an elegant, regular instruction set and a 16Mbyte address range. The 68000 looks a natural for the second generation of 16-bit personal computers and has already been employed in advanced new machines like the Apple Lisa and others. An eight-bit bus version, the 68008, is available and the 68020 with a full 32-bit bus will be along soon.

On the following eight pages you will find details of the eight major families of CPU chip. They range from Intel's pioneering 8080A to the Motorola 68000 whose intricacies are giving the designers something to work on for micros that will be appearing in the second half of the decade.



Zilog's super-fast Z-80H eight-bit chips run at 8MHz.

Preparing silicon waters at Ferranti for ULA chips, key elements in cheap home micros.

Does it matter?

A few years ago, when personal computers were a brand-new phenomenon, any prospective buyer was made immediately aware of which microprocessor had been used to animate his or her new-found friend. Today the picture is changing, and in some cases one can comb the glowing text of the advertisements without finding so much as a hint of what the microprocessor chip is among the "128K" and "16-bit" superlatives. So should it really matter to today's prospective buyer what lurks within the oh-so-sexy box? The answer, as so often, is yes and no.

Any particular microprocessor chip can be compared with its contemporaries and a judgment made about its relative power or performance. Regrettably, the potential of that device may not be fully realised in the personal computers in which it is used, so it is better to compare personal computers on the basis of memory, word size, graphics capabilities, available software, and similar overall system parameters than to choose on the basis of the CPU chip used. Regular readers of this magazine have heard often enough about proud owners of new 16-bit machines who discover to their horror that programs actually run faster on their old eight-bit systems. Software is the great leveller, and bad 16-bit software is worse than good eight-bit code, no matter how big the price tag on the system.

But the choice of processor does matter because, by and large, different processor chips cannot run each other's software. If you choose a machine which uses an obscure processor you will find that software is difficult to come by, and expensive too. Happiness is definitely more assured if you go for the Ford Escort processor, rather than for that alluring Porsche with such great potential but so little support.

It also matters if the potential user intends to write any assembly-language software, since in this case the power and instruction set of the processor itself will be more important and more easily exploited. Finally, even if some of today's available software for 16-bit machines is mediocre, it is a fair bet that the situation will improve dramatically. The 16-bit machines do have much more untapped potential in terms of memory expansion and raw processor power, which will ensure that they remain useful for many years to come.

8080A The one that started it all

In 1972, when Intel introduced the first microprocessors, the 4004 and the 8008, the world had little idea of the revolution it was about to witness. They were puny devices with limited capabilities and instruction sets, and were fabricated in the difficult PMOS technology. These newcomers gave no hint of posing any threat to real computers, so most system designers looked briefly at the data sheets and passed on.

Within Intel itself, however, the possibilities opened up by a complete central processor on a single chip of silicon were soon recognised. Development of a more powerful successor using the new NMOS technology was vigorously pursued. The result was the 8080A, launched only 10 years ago as the leader of a revolution which was soon to affect us all.

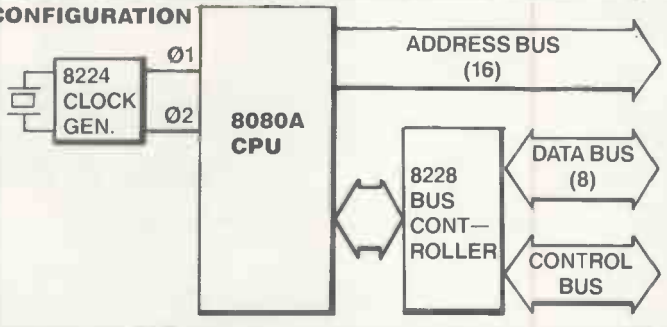
The 8080A was a real computer in miniature, with a 64K addressing range, a useful set of 78 instructions, plenty of registers, and binary or BCD arithmetic capability. Initially produced in small numbers and with a high price tag, the 8080A went on to sales exceeding two million units per year and made Intel almost a household name.

Right from the start visionaries foresaw its potential for use in small personal computers. The first real example, the Altair 880B, became so successful that its S-100 back-plane bus went on to become an industry standard. CP/M too, was designed for the 8080A, and is still the most popular operating system, offering access to a vast range of software. Intel's chosen successor to the 8080A, the 8085, was a damp squib by comparison, and attention soon switched to the Z-80 device from the competing Zilog corporation.

8080A

Manufacturers: Intel, NEC, AMD, National, Siemens, Signetics, Hitachi
Used on: Altair 880 and numerous other S-100 bus microcomputers
Technology: NMOS
Memory address range: 64K
Clock frequency: 2MHz
Power supply: +5V, +12V, −5V

BUS CONFIGURATION

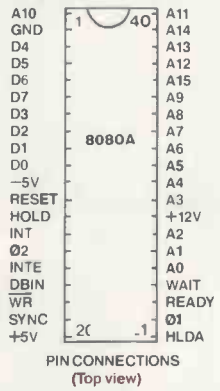


ACCUM	8	Flags	8	PSW
B	8	C	8	BC
D	8	E	8	DE
H	8	L	8	HL
STACK POINTER			16	SP
PROGRAM COUNTER			16	PC

Register set
The 8080 has a single accumulator which acts as the implied focus of most instructions. In addition there are six eight-bit general-purpose registers which can be used as three 16-bit pairs, a stack pointer, a program counter, and a flag register. There are no true index registers.

Family members
Basic 8080A also needs 8224 clock generator or 8228 bus controller. Very wide range of peripheral circuits including serial Uart, parallel I/O, DHA, interrupt controller, keyboard encoder, etc. The 8085 CPU has same instruction set but improved bus and I/O.

Software and instruction set
The 8080A looks rather primitive today, but any system using CP/M runs code written for this processor since CP/M was originally developed for the 8080A. Thus a huge software base is available, including all popular languages and a host of special application programs. The instruction set is register orientated and contains 78 basic instructions including some BCD and 16-bit arithmetic types. A separate I/O address space is available using in and out instructions.



PIN CONNECTIONS
(Top view)

Data types
Byte, eight bits
Word, 16 bits

Addressing modes
Implied
Immediate
Register
Register indirect
Direct

Z-80 Zilog's challenge

Shortly after the introduction of the 8080A, a group of engineers who had worked for Intel on that project broke away and formed the competing Zilog corporation. They had ambitious plans for a more powerful processor, and it was launched in 1977 as the Z-80.

The Z-80 is impressive even by today's enlightened standards; in 1977 it was a blockbuster. With two complete sets of 8080A-style general registers, two new index registers, on-chip dynamic-RAM refresh logic, three interrupt modes, and no less than 158 instructions including block operations, bit addressing, and BCD shifts, the Zilog Z-80 posed a real and sustained challenge to Intel.

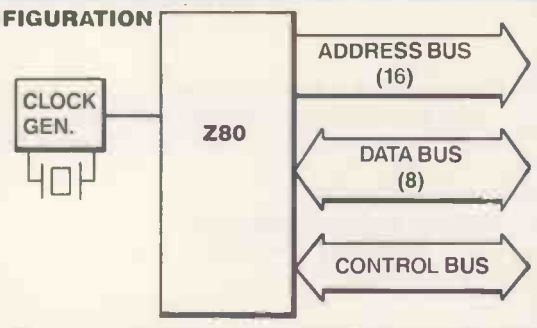
To cash in on the blooming 8080A market, Zilog made its processor upwards compatible at the object-code level. This endowed the Z-80 with a messy and confusing instruction set, but also ensured ready industry acceptance and access to the gigantic CP/M software base. To provide room for all the new instructions, Zilog took advantage of the 12 unused op codes in the 8080A set. Some were used directly, and others were trap doors to additional op-code tables, each with 256 new op code possibilities. This technique made it necessary to use two op code bytes to reach the new tables, and resulted in instructions up to four bytes long, but the wisdom of the Zilog approach to compatibility has been amply demonstrated by the sales figures.

Also introduced were a family of very powerful peripheral devices which used the sophisticated Z-80 interrupt structure; they are still considered the best devices of their type available. Used in many personal computers including all the Sinclair family, the Z-80 will be with us for many years to come.

Z-80

Manufacturers: Zilog, Mostek, NEC, Sharo, SGS
Used on: Sinclair ZX-80, 81 and Spectrum; Lynx; Tandy; Video Genie; Nascom; etc.
Technology: NMOS
Memory address range: 64K
Clock frequency: 2.5MHz or 4MHz
Power supply: +5V

BUS CONFIGURATION



A 8	F 8	A' 8	F' 8
B	C	B'	C'
D	E	D'	E'
H	L	H'	L'
I	R		

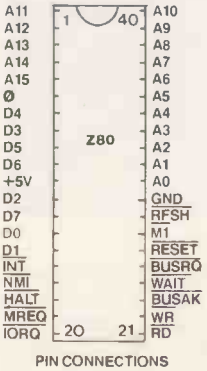
INDEX REG	IX 16
INDEX REG	IY 16
STACK POINTER	SP 16
PROGRAM CNTR.	PC 16

Alternative register set
Either main set or alternative set can be used. Bank switch is achieved with EX and EXX instructions.

Register set
The Z-80 register set is very generous and has two banks of 8080-style general registers plus two 16-bit index registers. Also included is an interrupt page address register I and a dynamic-RAM refresh counter register R.

Family members
The Z-80 requires an external clock generator but does not need a bus controller. Zilog has a powerful family of peripheral chips including a PIO, CTC and dual Uart/SIO, each of which includes vectored interrupt logic; 8080 peripherals can also be used.

Software and instruction set
This processor is probably better endowed with available software than any other, thanks to upward 8080 compatibility and the CP/M operating system — and Clive Sinclair. The instruction set is much improved over that of the 8080 and includes extended 16-bit compatibility, relative jumps, indexed addressing, bit set, test, and reset, block operations, and BCD shift operations. There are 158 basic instructions.



PIN CONNECTIONS
(Top view)

Data types
Bit
Nibble, four bits
Byte, eight bits
Word, 16 bits
Block, up to 64K bytes

Addressing modes
Implied
Immediate
Register
Register indirect
Extended, Direct
Relative
Indexed
Bit

6502 Commodore's Pet chip

Shortly after the introduction of the 8080A, Motorola introduced the MC-6800, a pretty chip with some nice features like single-supply 5V operation and an easy-to-use instruction set. Due in part to a lack of on-chip registers, the 6800 was never as popular as the 8080A and was not very good at running high-level languages like Basic.

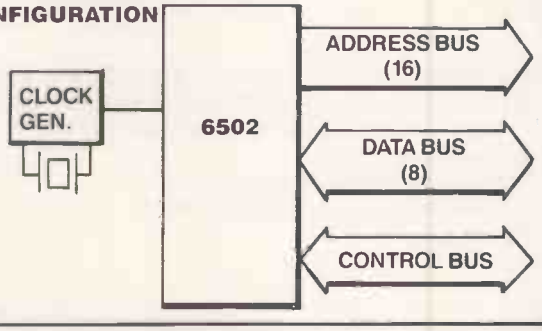
Once again, a small competing firm, in this case MOS Technology, decided it could do better, and the 6502 was born. It was optimised for data-processing applications and had the advantage of two index registers and a comprehensive set of addressing modes which, rather surprisingly, allowed it to run certain benchmarks even faster than the Z-80. The chip was simple and cheap, and right from the start it attracted the attention of budding personal-computer manufacturers.

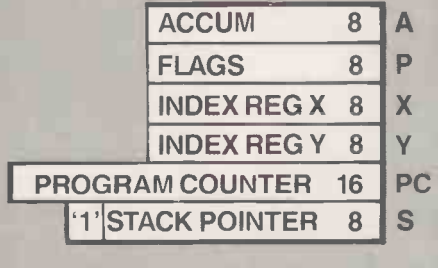
The very first single-box personal computer, the Commodore Pet, was designed around the 6502. It was hotly pursued by the Apple, and when MOS Technology ran into trouble Commodore took over and is now a fully fledged semiconductor manufacturer in its own right. Two aggressive second sources, Rockwell and Synertek, back up the field. The 6502 is actually only one device in a whole family of processors with the same basic architecture, including single-chip processors with RAM, ROM and I/O all in the same package.

6502

Manufacturers: MOS Technology, now Commodore Semicon Group; Rockwell, Sybertek
Used on: Atom, Apple, BBC, Commodore Pet, Vic-20, Oric, etc.
Technology: NMOS
Memory address range: 64K
Clock frequency: 1MHz or 2MHz
Power supply: +5V

BUS CONFIGURATION

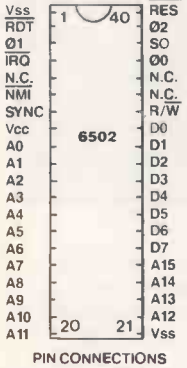




Register set
The 6502 register set appears odd but it has been designed to provide maximum facilities from the minimum of silicon. Apart from the single accumulator there are no general-purpose data registers, but the whole of memory page 0 can be used for this purpose. The short index registers are enlarged by clever addressing modes but the short stack pointer mandates the use of page 1 for the stack.

Family members
The 6502 is just one member of a large family of closely related microprocessors which offer various features and address ranges. There is a large family of 6502 peripheral devices including Uarts, PIOs, CRT controllers and combination chips.

Software and instruction set
The 6502 has been chosen for many personal computers, which guarantees a broad software base. The Achilles heel of the 6502 is its incompatibility with CP/M and the lack of a universal 6502 orientated alternative OS. The instruction set is well thought-out and squeezes a lot of performance from a short set of 56 basic types, thanks to a large repertoire of addressing modes. The 6502 performs very well when running high-level languages — often better, than the Z-80.



PIN CONNECTIONS
(Top view)

Data types
Byte, eight bits
Word, 16 bits

Addressing modes
Implied
Immediate
Zero page, eight-bit direct
Absolute, 16-bit direct
Relative
Indexed absolute
Indexed page 0
Indexed indirect
Indirect indexed

6809 Best of the eight-bitters

When the 6502 stole most of the Motorola 6800 thunder, there was only one thing for Motorola to do and that was to build a new processor that was better in every respect. So dedicated were the Motorola designers to building the very best eight-bit device, that the resulting 6809 chip has just about everything that anyone could want from an eight-bit processor, except one thing: it was not around when it was really needed.

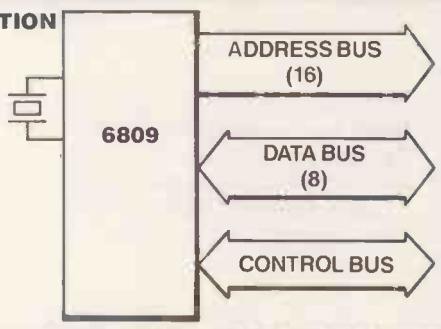
This elegant paragon of a microprocessor arrived on the scene too late to grab much of a share of the thriving eight-bit personal-computer market, and most designers had already opted for the Z-80 or the 6502 for their shiny new machines. The classic lines of the 6809 were enough, however, to ensure that some manufacturers would adopt it, and it has appeared in the Dragon, the Tandy Color Computer and a few others you may be lucky enough to own.

Like the 6502, the 6809 does not enjoy the undoubted benefits of CP/M compatibility, and so software availability is a problem. What software there is runs very fast on the sleek architecture of this powerful processor. With two accumulators, two index registers, two stack pointers, a host of addressing modes and a hardware multiplier, the 6809 does well in high-level language applications. It can be expected to Benchmark ahead of the Z-80 or the 6502 on most data-processing tasks. It will be interesting to see whether this chip manages to carve out its own niche in the microprocessor hall of fame before the coming deluge of 16-bit machines swamps the market.

6809

Manufacturers: Motorola, AMI, Fairchild, Hitachi
Used on: Dragon, Tandy Color Computer
Technology: NMOS
Memory address range: 64K
Clock frequency: 1.0MHz, 1.5MHz, 2MHz
Power supply: +5V

BUS CONFIGURATION

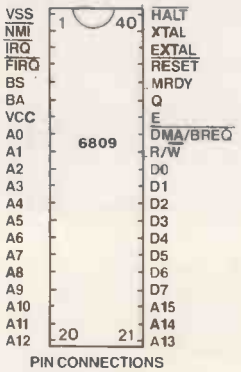


ACCUM A 8	ACCUM B 8		D
DIRECT PAGE	FLAGS		
INDEX REGISTER X		16	X
INDEX REGISTER Y		16	Y
USER STACK POINTER		16	LL
SYSTEM STACK POINTER		16	S
PROGRAM COUNTER		16	PC

Register set
The 6809 puts right the shortcomings of the 6800 and 6502 register set and is optimised for data-processing and high-level language applications. There are two stack points, two index registers and two eight-bit accumulators which can be concentrated to form the 16-bit D register. The direct page register allows the register page to be positioned anywhere in memory.

Family members
The 6809 has a companion device, the 6809E, which is optimised for multi-processor tasks. Since the 6809 bus structure is compatible with the 6800 and 6502, peripheral chips from those families are used for expansion: the special 6829 memory-management unit is also available.

Software and instruction set
The 6809 is ideal for personal-computer applications since it is optimised for data-processing tables. Unfortunately it has not been widely used due to its late arrival on the market, and the available software base is consequently restricted. The instruction set is regular, elegant, and powerful with lots of nice features such as the eight-by-eight multiply and extensive 16-bit operations. The additional stack pointer is useful for RPN maths and high-level language interpreters.



PIN CONNECTIONS
(Top view)

Data types
Byte, eight bits
Word, 16 bits

Addressing modes
Inherent, implied
Immediate
Register
Direct, eight-bit
Extended, 16-bit
Indexed, five sub-modes
Indexed indirect
Relative
Program counter relative

9900 First to 16-bits

The 9900 represented a bold move by Texas Instruments, one of the largest of the semiconductor manufacturers. In 1976, Texas announced that the 16-bit 9900 represented the "end of the two-bit eight-bit", but things are never that clear cut or predictable in the fickle microprocessor market. Despite plenty of early interest from scientific and military designers who needed the high throughput and 16-bit precision the 9900 offered, this unique device was too costly and too different to be used in the volume applications so essential for success. With separate 16-bit data and address buses, the Texas chip needed an expensive 64-pin package, but could only address 32K.

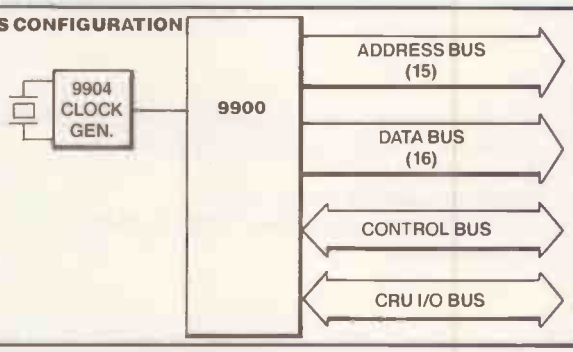
The architecture is based on that of the Texas 990 family of minicomputers and has many novel features, including the use of blocks of workspace registers in RAM memory rather than the more usual on-chip register sets of conventional processors. I/O arrangements are unusual too in using a serial communications register unit which can address up to 4,096 individual bit I/O lines. It is therefore possible for Texas to produce a family of peripheral devices using smaller packages than those used by the competition. But programming the 9900 requires a special approach since there are no stack operations and no JSR instruction.

To the initiated, however, the 9900 chip is powerful and flexible. To show what could be done, Texas introduced its own personal computer which used it, the TI-99/4. Unfortunately it has not proved a great success in the market place and is now being discontinued in favour of an 8088-based machine. More up-to-date versions of the 9900 are now available, including the 9995 with a multiplexed bus, and the 99000 which is intended to compete with the 8086 and 68000.

9900

Manufacturers: Texas Instruments, AMI, ITT
Used on: Texas home computer
Technology: NMOS
Memory address range: 32K
Clock frequency: 3MHz or 4MHz
Power supply: +5V, +12V, −5V

BUS CONFIGURATION

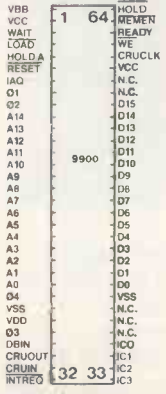


PROGRAM COUNTER	16	PC
WORKSPACE POINTER	16	WP
STATUS (FLAG) REGISTER	16	ST

Register set
The 9900 has a unique architecture which relies on multiple banks of workspace registers in RAM and therefore has few on-chip registers. The only on-chip registers are the program-counter flag register and the register which points to the current workspace. Multiple accumulators and index registers can be provided in the workspace, but there is no true stack pointer on the chip or in the workspace.

Software and instruction set
The 9900 is compatible with the Texas 990 family of minicomputers and can solve software with them, but there is no popular user base and no access to the huge variety of software offered by CP/M. The Texas home computer does, however, have a reasonable following and reasonable software. The instruction set is quite unique and does not include stack operations or subroutine jumps. I/O operations are also different from other CPUs and use the special serial CRU bus.

Family members
Several more recent variations of the basic 9900 architecture have been produced, including the 9940 single-chip device and the 9995 with a 40-pin package and multiplexed data bus. There is a useful family of dedicated peripheral devices.



Data types
Bit
Byte, eight bits
Word, 16 bits

Addressing modes
Immediate
Workspace register addressing
Workspace register indirect
Workspace register, indirect auto inc.
Symbolic, direct
Indexed
PC relative
CRU relative

8088 Minicomputer on a desk

Intel waited until large cheap memories were available and the market was ready before launching its own 16-bit processor, the 8086. Once again its timing was excellent. Designers liked the 1Mbyte address range and the powerful new instruction set. A memory system organised for a 16-bit data bus can be expensive however — too expensive for the personal-computer market to begin with — so Intel also produced the companion 8088 which uses an eight-bit data bus.

The 8088 is identical to the 8086 on the inside, and can run the same software; the only difference is the width of the external data bus. This slows things down, but has the more important effect of lowering system costs. The 8088 has been a big success in the personal-computer field, being used in the IBM PC and several other machines where it gives minicomputer performance in a low-cost desk-top system.

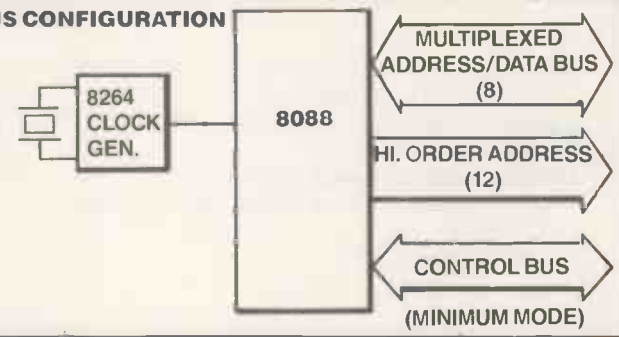
In a repeat of its earlier success with the 8080A, Intel has managed to gain a firm foothold in the 16-bit market with the 8088. Manufacturers are therefore likely to choose another Intel device, such as the 8086 or the newer 80186 or 80286, when the time comes to add increased performance to their products. The 8088/8086 family also has the two popular disc-operating systems CP/M-86 and MS-DOS to its credit.

Despite its success, the 8088 is not a very elegant chip. It has an untidy architecture and instruction set, and needs three separate chips for the CPU group alone. It is only the economics of its early popularity which keeps it ahead.

8088

Manufacturers: Intel, AMD, NEC, Siemens, Fujitsu
Used on: IBM PC, Sirius, DEC Rainbow, Texas Professional
Technology: HMOS
Memory address range: 1Mbyte
Clock frequency: 5MHz, 8MHz and 10MHz
Power supply: + 5V

BUS CONFIGURATION



POINTER & INDEX REGS

STACK POINTER 16	SP
BASE POINTER 16	BP
SOURCE INDEX 16	SI
DEST. INDEX 16	DI

GENERAL REGS

AH	AL	AX
BH	BL	BX
CH	CL	CX
DH	DL	DX

SEGMENT REGS

CODE SEGT. 16	CS
DATA SEG. 16	DS
STACK SEG 16	SS
EXTRA SEG. 16	ES

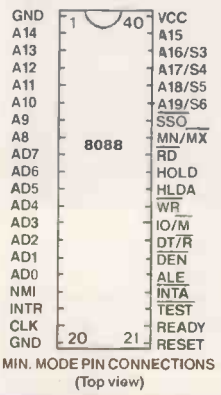
PROGRAM COUNTER/FLAGS

INSTRUCTION POINTER	IP
FLAGS 16	

Register set
The 8088 registers and architecture are identical to that of the 8086 and contain as a subset a group of 8080 types. A 20-bit address is generated by combining a pointer and a segment register, four segments being simultaneously available. There are eight eight-bit general registers which can be used as four 16-bit pairs.

Family members
In Min mode 8088 just needs an 8264 clock generator, but in Max mode an 8288 bus controller is also required. The 8088 is an eight-bit bus version of the 8086 16-bit processor. Few-chip versions 80188 and 80186 are now available as is the 80286 virtual-memory version.

Software and instruction set
Its selection for the popular IBM PC and Sirius machines has meant there is more software available for the 8088/86 than for any other 16-bit CPU. Operating systems include CP/M-80, MS-DOS and Unix. There are no software differences between the 8088 and 8086, and both are upwards compatible with the 8080 at the object-code level. The instruction set is aimed at minicomputer-style applications in high-level languages and contains multiply/divide, bit operations and Z-80 style block operations.



MIN. MODE PIN CONNECTIONS
(Top view)

Data types
Bit
Byte, eight bits
Word, 16 bits
Double word, 32 bits
Bytestring, N bytes
Wordstring, N words

Addressing modes
Implied
Immediate
Register
Register indirect
Direct
Based
Indexed
Based indexed
String

68000 Beauty . . .

Motorola has always produced elegant processors. Its 6800, despite coming second to the 8080A, was much easier to understand and to program, and the 6809 is the best of all the eight-bit chips. With the 68000, though, Motorola has surpassed itself with a processor that is not only prettier to look at than the competition but is also a lot more powerful into the bargain.

While others use fancy extras and clever tricks to squeeze extra performance out of their chips, the secret of the 68000 lies in the sheer scale of its internal 32-bit architecture. With 17 32-bit registers, a 16-bit data bus and a 24-bit address bus, the 68000 does not need tricks to get performance. The programmer is faced with a simple set of only 56 basic instructions which can be expanded by data-type and address-mode options to provide over 1,000 combinations.

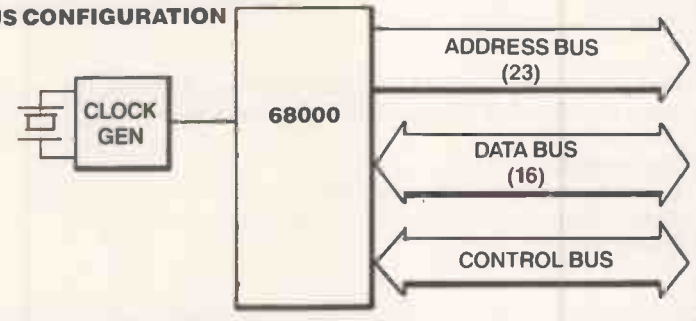
The 68000 is powerful enough to take advantage of the much favoured Unix operating system from Bell Labs, which is fast becoming a standard for 68000 users. Unix offers the same advantages that were ultimately achieved by CP/M on the 8080 and its derivatives — a common software base.

While the 8086 needs lots of awkward add-ons to squeeze more performance from it, as in the new 80286, the 68000 is really a more powerful machine struggling to escape, and so upgrades are simple. Next to appear will be the 68010, still with a 16-bit data bus but offering virtual-memory support. After that we are promised the 68020, which reveals for the first time the full glory of that 32-bit architecture.

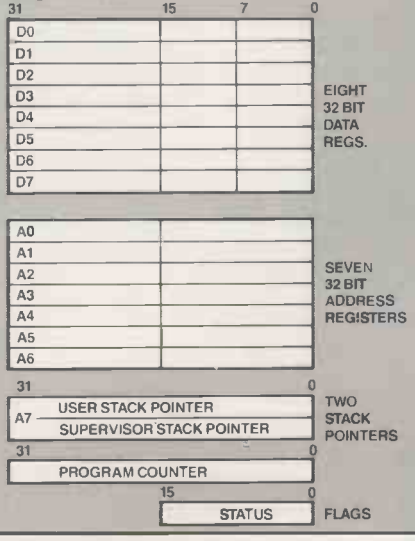
68000

Manufacturers: Motorola, Mostek, Rockwell, Signetics, Thompson CSF
Used on: Apple Lisa, Torch 700, HP 9826
Technology: HMOS
Memory address range: 16Mbyte
Clock frequency: 4MHz, 6MHz, 8MHz, 10MHz, 12.5MHz
Power supply: +5V

BUS CONFIGURATION

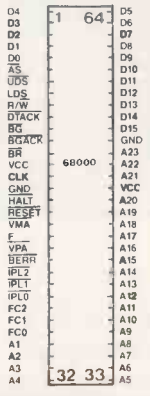


Register set



Family members
At the moment there is a shortage of 68000 peripheral devices and no maths processor but 6800/6502 peripherals can be used. Other processors available or planned are the 68008 eight-bit data bus, the 68010 with virtual-memory support and the 68020 with full 32-bit data bus.

Software and instruction set
The 68000 is a very powerful processor and will probably become very popular as new systems are introduced. The most popular operating system at the moment is Unix in several versions. Available software is fairly limited at the moment but the situation will quickly change as support grows. The instruction set is powerful, simple and elegant, being based on just 56 basic mnemonics. Surprisingly, the 68000 can perform floating-point arithmetic almost as fast as the 8086 with 8087 co-processor.



Data types
Bit
Nibble, four bits
Byte, eight bits
Word, 16 bits
Long word, 32 bits

Addressing modes
Implied
Immediate
Register
Register indirect
Absolute, direct
Relative
— plus many more sub-modes, including indexing

Z-8000 . . . and the beast

The Z-8000 appeared after the 8086 and before the 68000 and has unfortunately turned out to be neither first nor best. A processor very much from the Zilog mould, the architecture is designed for raw processing power with no concessions to the seekers of elegance or simplicity. The Zilog motto seems to be: if it's any use, stick it in. As a result, this admittedly powerful device is the most complex 16-bit processor around, having 110 basic instruction mnemonics and an extensive but tangled register set. But despite the complexity, it actually uses fewer transistors on the chip than the 8086 because it uses logic for instruction decoding rather than the simpler but more wasteful microcode of its competitors.

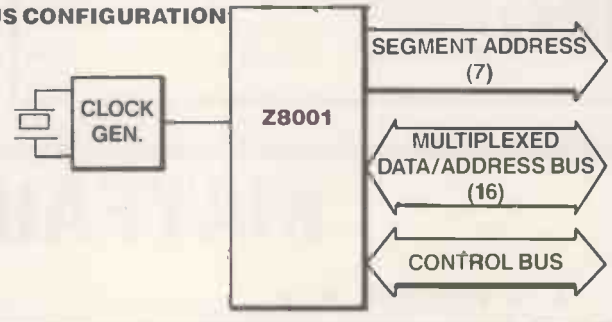
One of the Z-8000's features, inherited and expanded from the similar Z-80 facility, is an extensive set of 20 block or string macro instructions able to move, compare and translate whole blocks of memory in one go. One of its biggest disadvantages, on the other hand, is the fact that no eight-bit bus version has been produced, effectively keeping the door firmly closed to use in pioneering 16-bit personal computers. Up to now, the Z-8000 has been most successful in military applications, but Commodore has recently announced its intention of using it in a new machine, so perhaps it is not too late. The label Z-8000 is a family name for the Z-8001, with 8Mbyte addressing, and the Z-8002 which addresses 64K. There is no Z-8000 chip as such.

Zilog itself seems to be having second thoughts, because it has launched an entirely separate 16-bit processor, the Z-800. It has the great advantage of being upwards compatible with the Z-80, which the Z-8000 is not.

Z-8000

Manufacturers: Zilog, AMD, SGS, Sharp, Toshiba
Used on: Zilog System 8000, newly announced Commodore system
Technology: NMOS
Memory address range: 8Mbyte
Clock frequency: 4MHz, 6MHz, 10MHz
Power supply: +5V

BUS CONFIGURATION



GENERAL REGISTERS

7 RH0 0	7 RL0 0			
RH1	RL1	R0	R80	RQ0
RH2	RL2	R1		
RH3	RL3	R2	R82	
RH4	RL4	R3		
RH5	RL5	R4	R84	RQ4
RH6	RL6	R5		
RH7	RL7	R6	R86	
		R7		

SPECIAL REGISTERS

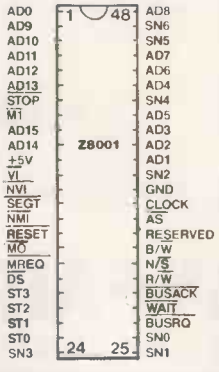
RESERVED WORD
FLAGS
PC SEGMENT
PROG. COUNTER
SP SEGMENT
STATUS POINTER
REFRESH COUNTER

15 0			
	R8	R88	RQ8
	R9		
	R10	R810	
	R11		
	R12	R812	
	R13		
NORMAL STACK SEG	R14		RQ12
SYS. STACK SEG.	R14	R814	
NORMAL SP	R15		
SYSTEM SP	R15		

Register set
The Z-8000 has plenty of general and special-purpose registers, but the programmer has a lot to remember. Register combinations of eight, 16, 32 and 64 bits are available.

Software and instruction set
The Z-8000 has not caught on in the personal-computer market despite its power and availability so software support is limited. A version of CP/M called CP/M-8000 is available; as yet there is little software to run under it but this may change when Commodore introduces its promised machine using the Zilog chip. The instruction set has 110 basic mnemonics and many advanced features, including comprehensive string and block functions. Unfortunately, it is also rather messy.

Family members
The Z-8000 family includes: the Z-8001, 48-pin, 8Mbyte; Z-8002, 40-pin; 64K; and the Z-8003 and Z-8004 with virtual-memory support. There is an extensive family of peripheral chips including a maths unit, memory manager, and a universal peripheral controller.



Data types	Addressing modes
Bit	Implied
Nibble	Immediate
Byte	Register
Word	Indirect register
Double word	Direct
Byte strings	Relative
Word strings	Index
	Base
	Base index

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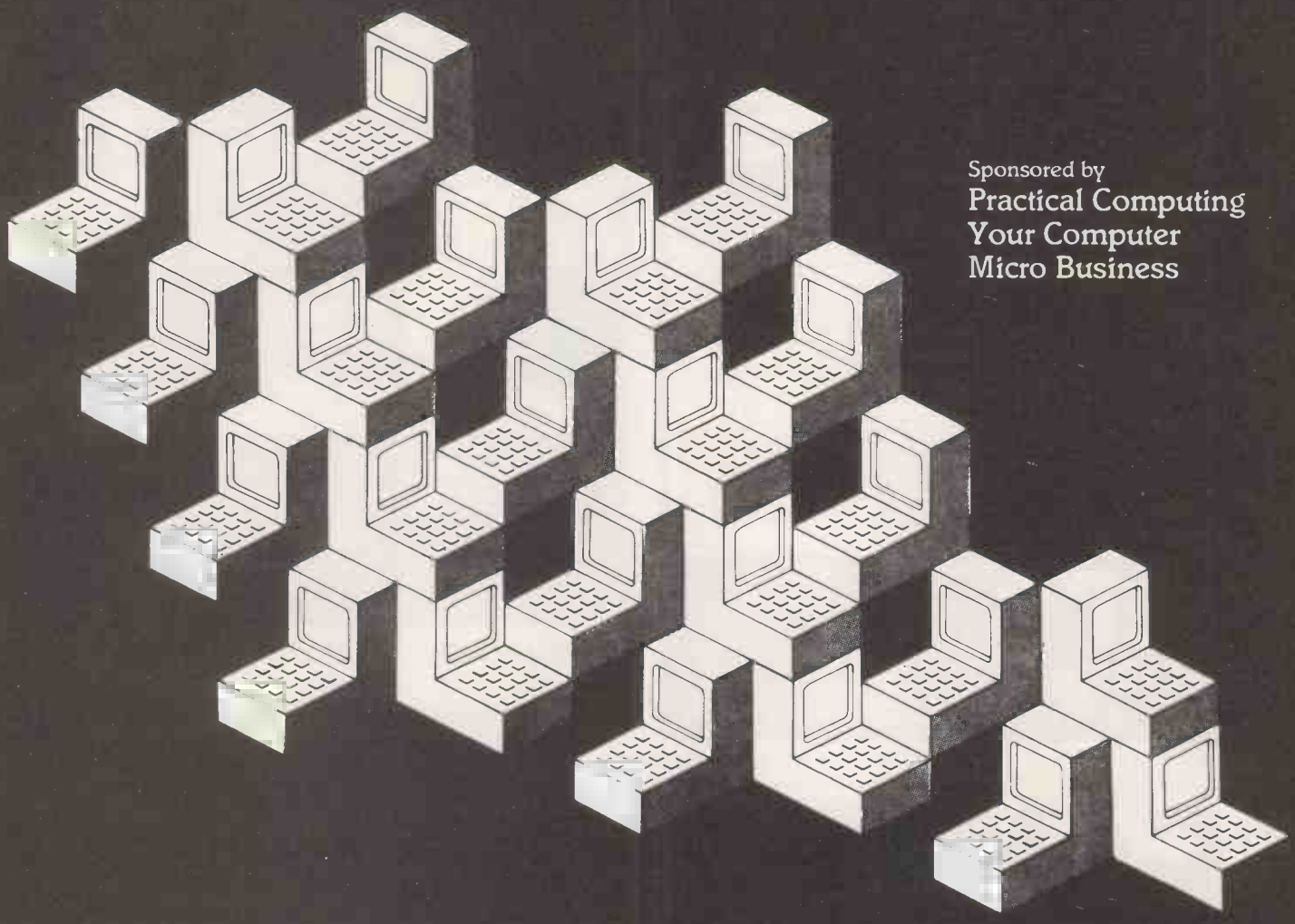

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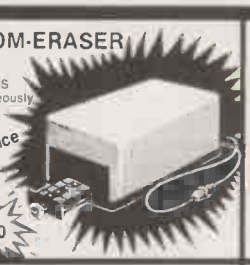

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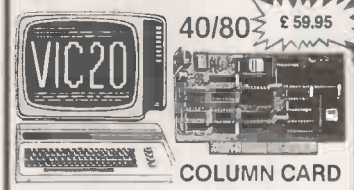

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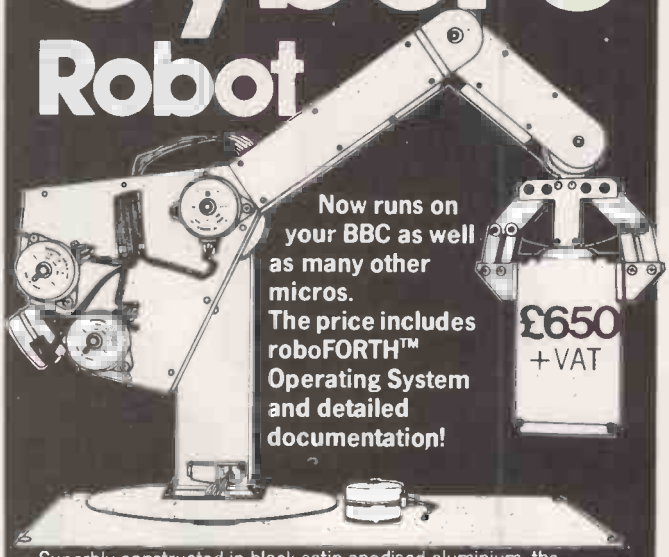

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How to score with the 64

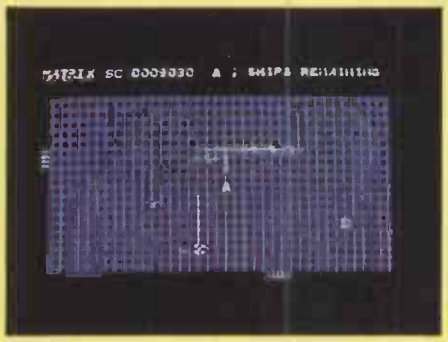
Games on the Commodore 64 are noisy and colourful, but its capabilities are only just beginning to be exploited, as Paul Bond discovered.

Outstanding graphics are a feature of Commodore's forthcoming Soccer.

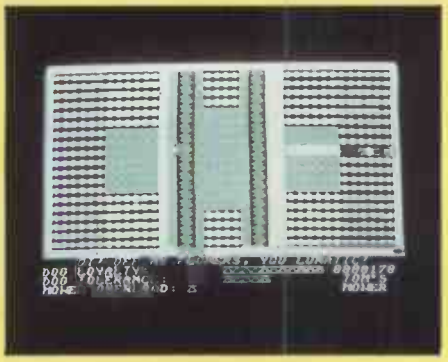
Mirrorsoft's Caesar aims to keep the larder mouse-free.

WITH ITS elephantine 64K of memory, nearly 38K of which is available for Basic programs, and a choice of 16 colours, together with the impressive sound capability of the Sid chip, the Commodore 64 is ideal for home use. On the minus side, its Basic is slow. The machine's potential may be further extended by the adition of the new Simons Basic, but this may be a pricey privilege.

Radar Rat — Pacman with windows.



Jeff Minter's Matrix from Llamasoft.



Garden aggro in Hovver Bovver.

Blue Moon

Like the song *Blue Moon* , the Merlin Software game of the same name is an old standard: you shoot at things coming down the screen. Nevertheless, the game has some originality in its interpretation.

You take the part of the pilot of an intergalactic spacecraft, and have to rescue another spacecraft then return to the safety of the Blue Moon. But before you can get any ground elapsed time under your belt you have to dock with the other half of your ship. There is nothing so infuriating as having to carry out this kind of delicate operation before you can get down to laying waste vast regions of the cosmos. But it is intensely satisfying, seconds later and docking achieved, when you are catapulted straight into a comet storm. You have to dodge them if you want to have any future in the Space Corps, and it won't do your score any harm if you put a few ergs into these irritating ice blocks.

Presently the blue bouncers appear and bounce around the screen firing plasma bombs. They can mutate into pods and fall to the bottom of the screen. Occasionally the Tecom Man drifts across the screen dropping droids and large yellow eggs containing bell birds. They are pretty handy with the old plasma bombs too.

You have to zap the whole sorry crew before you delta-vee down to the lunar surface, where you have a choice of difficult and easy landing sites.

Blue Moon is a good example of how traditional games are implemented on the 64 — not original in concept but visually appealing and addictive if you like shoot-em-up games. It is certainly fast.

Matrix

Still in space, and travelling faster than before, we approach the fine-mesh tracery of the Power Grid surrounding planet Earth. Llamasoft's Matrix, implemented by Jeff Minter for the Commodore 64, is the true son of Gridrunner. Minter's original game is claimed to be number 7 in the American popularity stakes. The follow-up is set 10 years after the infamous Grid Wars when space pilots with nerves of steel battled to free the Power Grid of alien infestation.

In Gridrunner the evil droids traversed the grid horizontally; now they come in diagonal waves too. In the original game the X,Y zappers running along two sides of the grid formed pods at the nodes of their crossfire. If you were not caught in the crossfire, the pods would probably obliterate you by hurling a bolt of energy down the grid. It's the same in Matrix, but there is a treacherous humanoid, the Snitch, who runs along the top of the grid pointing you out to the enemy. Camels appear and run down the grid, reducing your score, and force fields hurl your fire back at you. On the plus side, ship control — achieved by joystick — no longer limits you to the lower regions of the grid; you can move anywhere other than the top four lines.

There are 20 skill levels. The first six are selectable before play and after that you must fight. Action is incredibly fast and furious throughout, and the interminable sounds of cosmic weaponry are well reproduced by the Sid chip. This is essential, if only to drown out the demented screams which people playing this game inevitably emit.

Hovver Bovver

Back to the green hills of Earth. Since most surviving grid pilots are good for little other than mowing the lawn, it is fitting that we should move on to another Minter extravaganza, Llamasoft's Hovver Bovver.

It is summer-time in England. Gordon Bennet presumes too much and borrows his neighbour Jim's Air-Mo. But Jim decides he wants his mower back.

The scene is set for a horticultural holocuast in which, using the joystick to manoeuvre Gordon and his mower, you run away from Jim at the same time as your dog Rover fights a rearguard action, snapping at Jim's heels. However, Rover is frightened of the Air-Mo, so monitor Dog Tolerance and Dog Loyalty readouts carefully. If you slice through a flower bed, an angry gardener will join in the chase. The game has 16 different lawns, including one shaped like a llama. As with Matrix, the graphics are good but the sound-track is particularly telling. Mowing, screaming, snapping and barking are well reproduced and a non-stop rendition of *In an English Country Garden* churns on and on.

Caesar the Cat

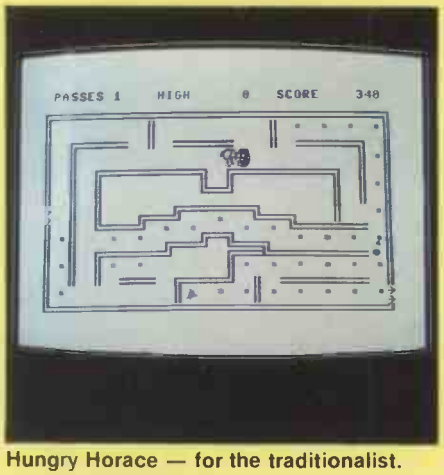
From Rover the dog to Caesar the Cat, Mirrorsoft's cute game for the Commodore 64. Mirrorsoft is part of Mirror Group Newspapers and you can buy the software via MGN publications or from newsagents, plus the usual commercial outlets. If Caesar is anything to go by, MGN has avoided the mistakes made by some other big companies seeking to break into the home-computing software market.

Caesar is a cheeky young cat on duty in a well stocked larder. There is a joystick/keyboard control option, which you use to guide the furry feline along crowded shelves to pounce on the mice and take them away from the larder through a door which appears at random.

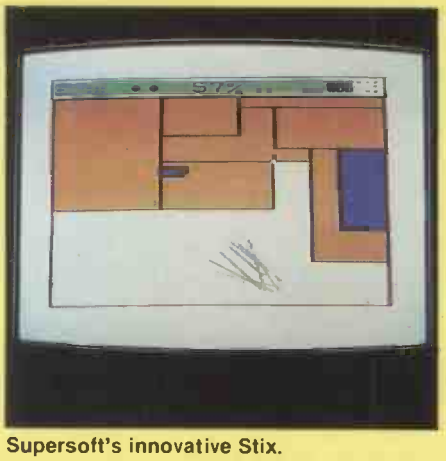
With its Disneyesque graphics and

(continued on page 121)

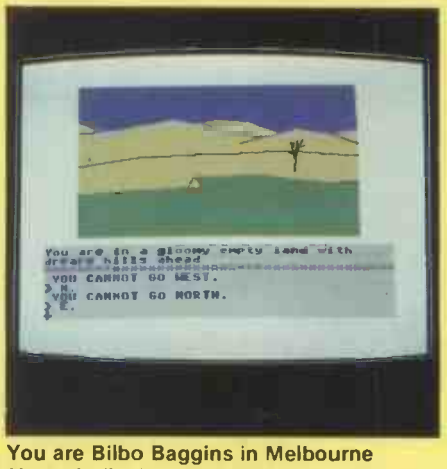
Grandmaster — the strongest yet?



Hungry Horace — for the traditionalist.



Supersoft's innovative Stix.



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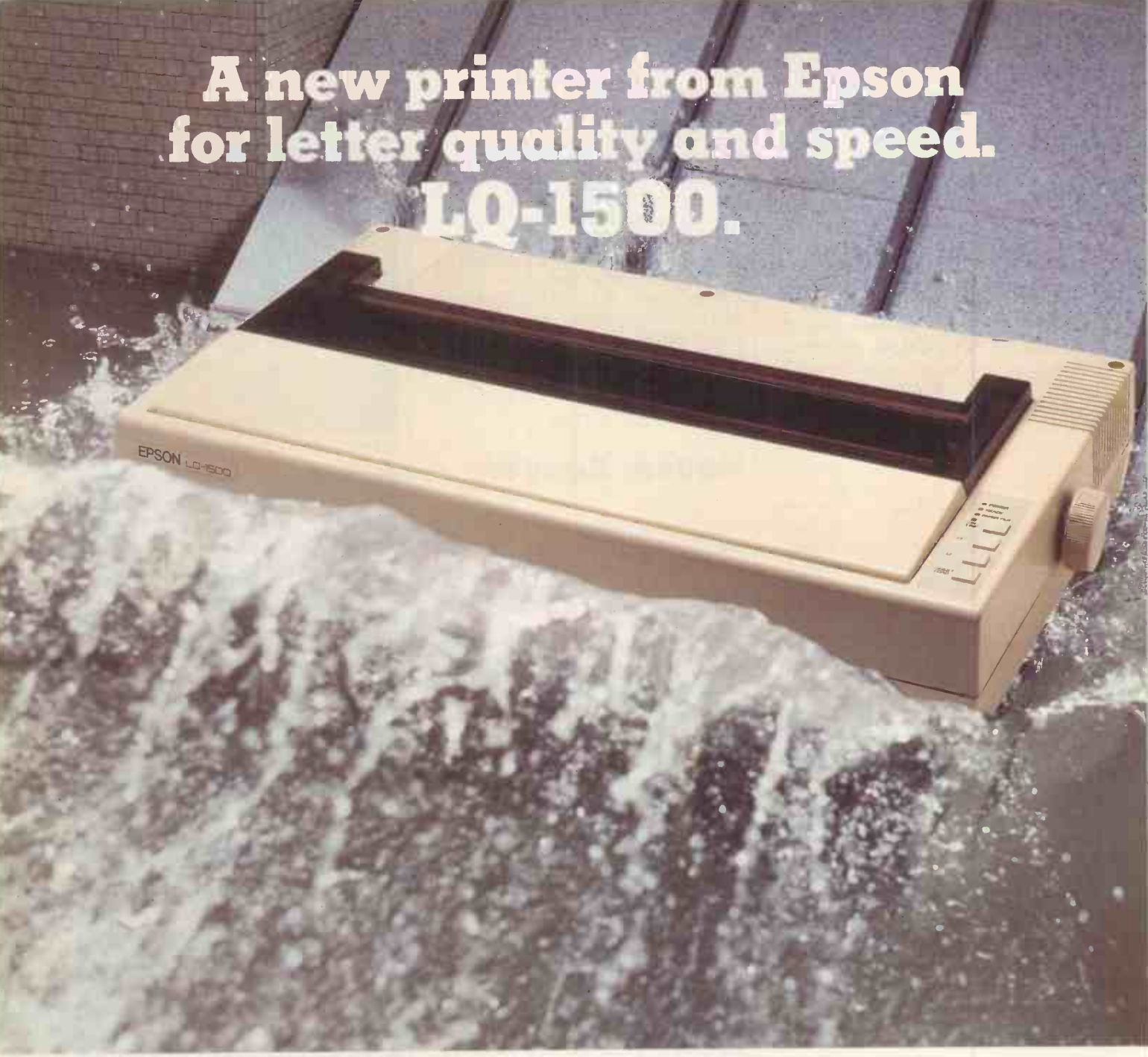

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You now have at your fingertips all the advantages of a daisy-wheel machine, in terms of quality, together with the added benefits of condensed or enlarged characters and proportional spacing, plus a very high speed when set to operate in draft mode.

Having superb graphics capabilities and optional 8 bit parallel (centronics) RS-232 and IEEE interfaces, the LQ-1500 has joined the Epson family of very fine printers.

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(continued from page 119)
catchy backing music, the game should appeal to youngsters, but it is also challenging for high-scoring arcade adepts. The concept of keeping the larder free of mice, especially when portrayed so well, seems healthier than murdering encroaching hordes of presumably sentient alien beings. The game is a really excellent use of the Commodore's graphic facilities.

Radar Rat Race

Now from cats to rats. This cartridge-based program seemed the most promising of the bunch. Cartridges cost more than cassettes, and a lot of the games tested did not seem to merit the extra expenditure for the sake of quick loading.

Radar Rat Race, from Commodore, is like a speedy Pacman with windows. As a rat, you race through a continually scrolling maze, pursued by red rats and trying not to bump into cats sitting about in the passageways. If a rat is hot on your trail you can create a false scent by pressing the S key. On the right-hand side of the screen is a small plan of the entire maze, from which you glean where the cheese is hidden. There are 10 cheeses placed throughout the maze. The first is worth 100 points, the second 200 and so on.

There is a joystick/keyboard option and scoring more than 20,000 gives you an extra life. Radar Rat Race was not one of my all-time personal favourites, but it will appeal to maze addicts.

Hungry Horace

Remaining with mazes, we find the voracious Horace — Melbourne House's variation on an Atari theme — still in the park eating flowers and stealing the guards' lunch. The game also scrolls: the park is divided into four sections, each with an exit. Horace exits when he likes, and doesn't have to clear the screen. Each area of the park is tougher than the last. On leaving the last section, you re-enter the first with the action becoming faster and the guards meaner.

This implementation is fine if you are a traditionalist, but hopes remain high that games like this will have more life injected into them in future. Most software houses have so far failed to utilise the extra memory of the 64 to its full extent.

Stix

Atari-like insofar as it bears a passing resemblance to a game called Qix, Stix from Supersoft has a scenario in which a bundle of energy roams the universe, destroying all in its path. It becomes trapped in a cosmic storm, giving you the chance to harness its evil power for the good of mankind. To control the energy you must restrict its movement by constructing force fields.

This you do by moving four field synthesisers around the screen using your joystick plugged into control port 1. A field can be completed by joining to the boundary of the screen or to another completed force field. If you keep the Fire button depressed, it takes longer to finish a border, but you do score more. When more than 75 percent of the hyperspace has been surrounded by force fields you move into a new dimension and each percent scored above 75 percent scores more points.

A game of strategy, Stix is one of the more original computer games around and its implementation for the 64 has not done it any harm. Mondrian would have loved it.

The Hobbit

Originally implemented by Melbourne House for the Spectrum, this is a computerised Adventure game. It is based on Professor Tolkien's famous yarn about a hairy-footed little creature in conflict with a nasty dragon. Your role is that of the feisty Bilbo Baggins — to discover the evil dragon Smaug and recover the treasure. The delinquent orcs and poor Smeagol cause as much trouble as possible. Help is sometimes available from Gandalf Greyhame, but don't rely on it.

Each different scene in the adventure is colourfully depicted on the screen. Commands can be entered with a great deal of flexibility since the program has a large vocabulary. It recognises over 500 words, and can perform over 50 different actions made up by over 30 verbs, combined with about a dozen prepositions.

Flexibility combined with excellent graphics account for the success of the Spectrum Hobbit. It should be as popular in the Commodore 64 version.

Grand Master

Supposedly the world's strongest chess program yet for home computers, Grand Master was developed by Kingsoft and is distributed by Audiogenic. To begin with you see a chess board with your white pieces, nearer the bottom of the screen. Moves are entered by locating the square from which you wish to move, followed by the square you want to move to, then pressing Return.

The Grand Master displays its thoughts in the form of plys. A ply is one move for one side. If you look to the letter P, you can see how many plys deep the analysis is. So P3 means that the program has analysed one move from itself, one from you, and its own again.

If you key in an illegal move, the computer will not accept it, so the program is a useful chess tutor too. You can have response times from five seconds up to several days, the latter for postal chess. Since the original version of this game will run happily on a Vic-20, perhaps we can look forward to an even stronger program in the future.

Soccer

Leaving the rarified intellectual atmosphere of the chess competition I donned my Pierre Cardin football-terrace-chic pullover and had a quick kick around with the Commodore three-dimensional football game.

The game stands alone as an example of what can be done with the 64. Brilliant graphics show the players from a BBC camera angle. You can select the colours you wish to play in. Two people can play using a pair of joysticks. At any time the man nearest the ball is under joystick control. There is an option enabling you to play against the computer but, as usual, it cheats.

There are some nice touches, such as the way the players troop off at half-time. The ball even casts a shadow, and makes a realistic boinking noise as it bounces around. But as any footballer will tell you, it's the roar of the crowd that makes it all worthwhile.

Game	Publisher	Price	Rating
Blue Moon	Merlin Software	£6.50	14/20
Matrix	Llamasoft	£7.50	15/20
Hovver Bovver	Llamasoft	£7.50	16/20
Caesar the Cat	Mirrorsoft	£8.95	17/20
Radar Rat Race*	Commodore	£9.99	12/20
Grand Master	Kingsoft/Audiogenics	£17.95	16/20
Soccer	Commodore	TBA	18/20
Hobbit	Melbourne House	£14.95	16/20
Hungry Horace	Melbourne House	£5.95	13/20
Stix	Supersoft	£7.78	14/20

*Radar Rat Race is supplied on cartridge

Why all other spread

In the early days of micros, the first spreadsheets appeared, using complicated cell co-ordinate references to define plans.

This made the most of limited computing power but plans were tricky to write, and difficult to read later.

Today's micros are much more sophisticated but all the spreadsheets are more or less the same as they always were. All that is, except PlannerCalc and MasterPlanner. Described in a recent university report as "... the best spreadsheet package currently on the Market," PlannerCalc and MasterPlanner are true business aids.

Dyed in the wool calc freaks won't like them but businessmen will.

NEW USERS START HERE

PlannerCalc at £85.00* is now accepted as the first choice for people new to financial planning.

Designed for 8-bit micros, it boasts the kind of features that you'd expect to pay twice as much for. (Buy PlannerCalc's nearest rival and you'll have to.)

Unlike all other 'calc' products it allows you to enter calculations in a language you understand. Plain English.

For example:

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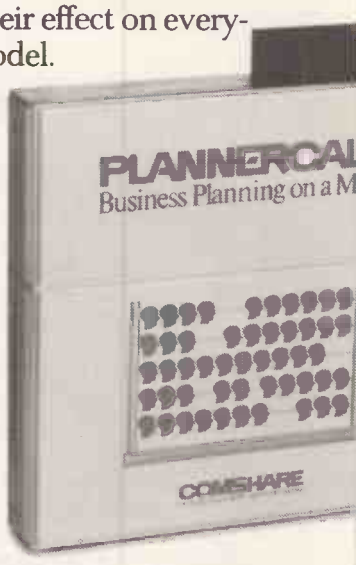
LINE 1  SALES=100, 150, 175, 210
LINE 2  EXPENSES=GROW 70 BY 15% FOR 4
LINE 3  NET=SALES-EXPENSES
LINE 4  CSALES=CUM SALES
COLUMN 5 YEAR=SUM OF COL 1 THRU COL 4
```

So it's much easier to use.

It uses the popular "spreadsheet" approach with a window that can be rolled in all directions.

Which means you can enter new figures and rules and immediately see their effect on everything else in the model.



It comes with the best manual on the market and it's suitable for most micros with a ™CP/M 2.2 operating system, 64K of memory, giving at least 900 cells, minimum screen width of 80 characters and 2 floppy disc drives.

MUCH MORE POWER, NOT MUCH MORE MONEY

MasterPlanner is the most powerful spreadsheet system currently available with its increased matrix size, 2000-3000 cells on most 64K micros. (But at £245* it certainly isn't the most expensive.)

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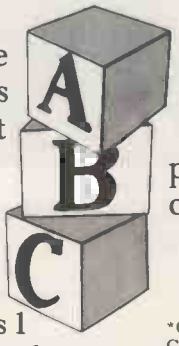

It works on exactly the same system as PlannerCalc and models written on PlannerCalc run without modification on MasterPlanner.

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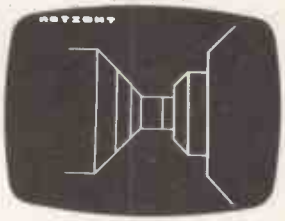
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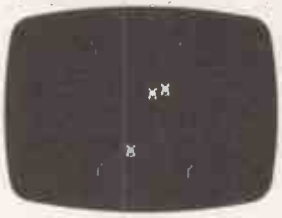
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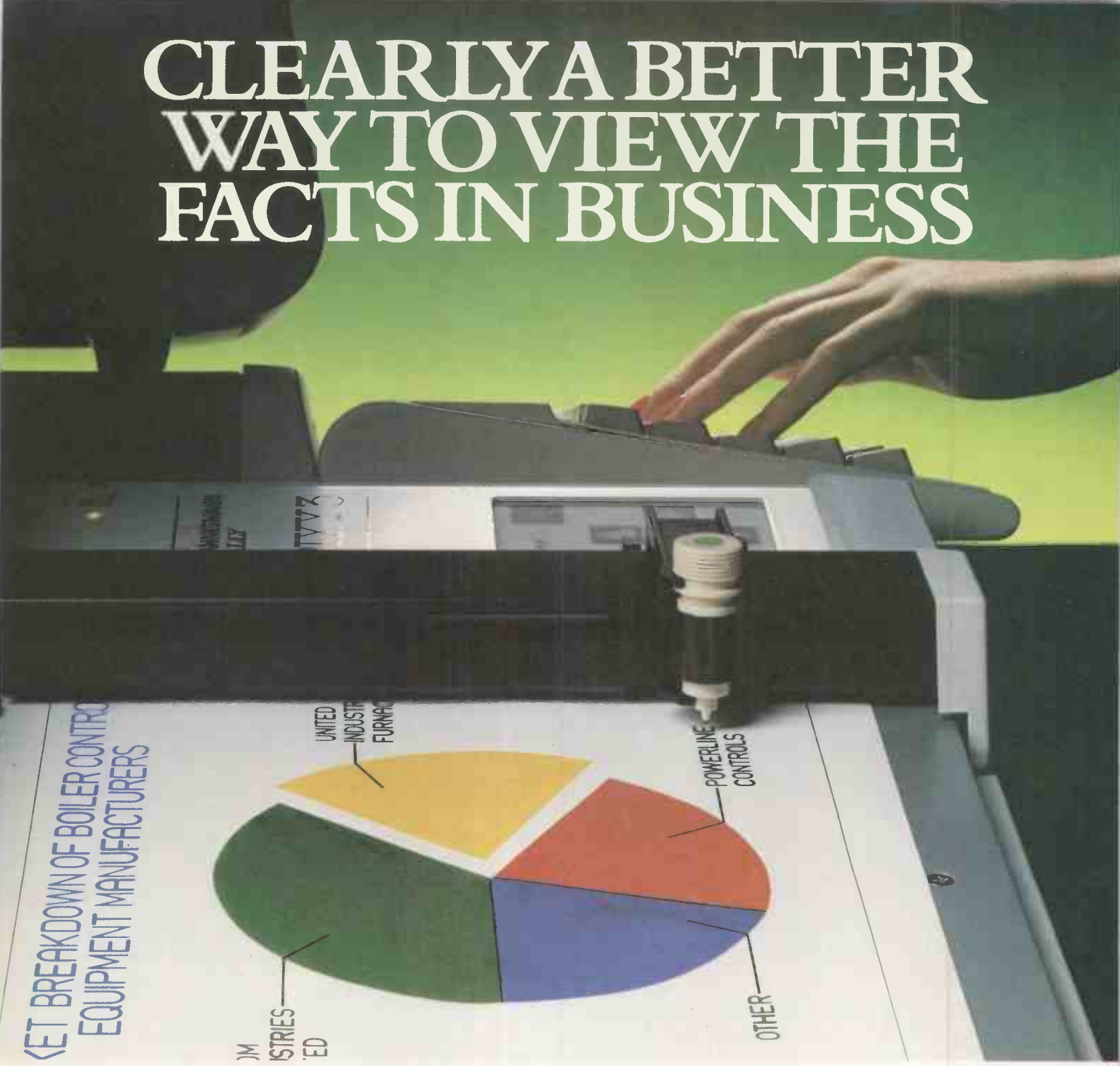

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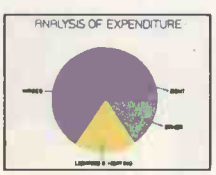

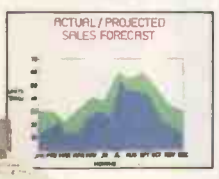

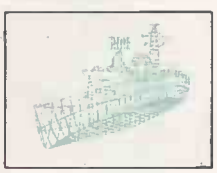

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128

>OPEN FILE

PRACTICAL COMPUTING FEBRUARY 1984

Open File monitors

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Open File is the part of the magazine written by the readers of *Practical Computing*. All aspects of microcomputing are covered, from games to serious business software and utilities. Fully-debugged programs can be submitted for any micro, and for standard CP/M machines such as the Osborne and Superbrain. Programs can be in machine code or any language, including Forth and Pascal.

Submissions should include a brief description which explains what your program does, and how it does it. If possible it should be typed, with lines double-spaced. We need a printed program listing. Hand-written listings cannot be accepted. A tape or disc of the program helps if it is in a standard format.

When printing listings, please remember to use a new ribbon or double-intensity printing — faint listings reproduce badly. Use plain paper only, and try to list the program across either a 35-character or a 70-character width. Also, make sure all special graphics or inverse-video characters are either listed correctly or else include Rem statements to explain them fully.

Each program listing, tape or disc must have your name and address on it, or we cannot promise its safe return. A stamped addressed envelope is appreciated.

If you write in with a comment, correction or enquiry please remember to state the machine and the program title.

We pay at least £10 for any programs used, or £35 per page and pro rata for part pages.

>BBC

130 SENSATIONAL SIMON An implementation of the well known memory game.

130 CALCULATOR In John Humphreys' arithmetical puzzle the computer provides the numbers while you guess which operators link them together.

>COMMODORE

137 TRANSFERRING PROGRAMS Mike Todd's programming guidelines and Basic patches will help you convert Pet software for use on the Commodore 64.

137 CATALOGUING DISCS L V Turner's compact utilities, suitable for both Basic 4 and Basic 2, catalogue your disc files.

138 BOMBING MONSTER This arcade game illustrates Vic-20 graphics-programming techniques which help add that touch of excitement.

>NEWBRAIN

139 SCREEN DUMP A Atkins' routine demonstrates how to address memory for the currently open screen.

139 CARD INDEX Search through a set of electronic record cards and print the result.

139 RENUMBER The absence of this useful function can be remedied with A R Armitstead's routine.

140 BRAIN-MAN A fast and furious combination of maze, monster and power pills.

>SHARP

145 HIDDEN LINES How program lines may disappear from a listed program, but be implemented by the interpreter when the program is run.

145 THE NULL-INPUT PROBLEM Pressing Return in response to the Input prompt can make a nasty mess of carefully formatted screen output; this routine keeps things tidy.

>TANDY

146 GRAPH PLOTTER This Basic program will plot from Data statements or tape or disc files.

146 CODE BREAKER A logic puzzle after the classic Mastermind game.

>APPLE

149 SHOOT-OUT Dodge the approaching invaders in D Turnbull's game.

150 SCREEN FORMATTER Save instructions or text as binary files to be formatted for display.

>ATARI

152 DISC SAVER With H M Hoffman's routine you can recover a deleted file.

152 PAINTER Chris Simon's maze game requires 16K of RAM and a joystick.

>SINCLAIR

155 SCRUBBER How to reserve space and load machine code.

155 VOCABULARY Test your knowledge of a foreign language.

Send your contribution to:

Open File, Practical Computing,
Quadrant House, The Quadrant,
Sutton, Surrey SM2 5AS

Sensational Simon

```
  10  REM @@@@@@@@@@@@@@@@@@
  20  REM @@@@@@ SIMON @@@@@
  30  REM @ by D.Whitworth @
  40  REM @ 23rd JULY 1983 @
  50  REM @@@@@@@@@@@@@@@@@@
  60
  70  high%=0
  80  DIM A%(100)
  90  DIM B%(4)
 100  FOR L=1 TO 4
 110  B%(L)=L*20
 120  NEXT L
 130  ON ERROR GOTO 9000
 140  *FX4,1
 150  *TV255
 160  MODE 7
 170  PROCCOFF
 180  PROCINSTR
 190  MODE 2
 200  PROCCOFF
 210  PROCDRAWSCRN
 220  REPEAT
 230  PROCDLY(30)
 240  PROCGAME
 250  UNTIL again$="n" OR again$="N"
 260  MODE 7
 270  *FX4
 280  END
 290
 300
1000  DEF PROCINSTR
1010  F$=CHR$141+CHR$131+CHR$157+CHR$
132
1020  TT$=F$+"SIMON  "+CHR$156
1030  PRINT TAB(13,0);TT$;TAB(13,1);T
T$
1040  PRINT TAB(5,4);"Simon is a game
 of memory."'''"The computer repeats a
sequence by"'''"playing notes and flash
ing boxes on the"'''"screen and you mus
t try to copy this by"'''"pressing the
cursor keys in the correct"'''"order."
1050  PRINT'''"Each time you get it rig
ht the computer"'''"will add one more n
ote and repeat the"'''"sequence.    GOO
D LUCK"
1060  PRINT''TAB(6)"PRESS THE SPACE B
AR TO START"
1070  REPEAT UNTIL GET=32
1080  ENDPROC
1090
1100
2000  DEF PROCDRAWSCRN
2010  CLS
2020  PROCSQUARE(7,50,50,850)
2030  PROCSQUARE(4,100,100,350)
2040  PROCSQUARE(3,500,100,350)
2050  PROCSQUARE(1,100,500,350)
2060  PROCSQUARE(2,500,500,350)
2070  PRINT TAB(15,5)"SCORE"
2080  PRINT TAB(16,14)"HIGH"
2090  PRINT TAB(15,15)"SCORE"
2100  ENDPROC
2110
2120
3000  DEF PROCGAME
3010  PRINT TAB(0,31);STRING$(19," ")
;
3020  PRINT TAB(17,7);"0  "
3030  PRINT TAB(17,17);high%
3040  C%=0
3050  C%=C%+1
3060  A%(C%)=RND(4)
3070  FOR G=1 TO C%
3080  PROCSOUNDS(A%(G))
3090  NEXT G
3100  *FX15,1
3110  player%=0
3120  REPEAT player%=player%+1
3130  REPEAT
3140  A=GET
3150  UNTIL A>135 AND A<140
3160  PROCSOUNDS(A-135)
3170  UNTIL player%=C% OR A-135<>A%(p
layer%)
3180  IF A-135<>A%(player%) THEN PROC
ERROR:ENDPROC
3190  PRINT TAB(17,7);C%;" "
3200  IF C%>high% THEN COLOUR 9:PRINT
TAB(17,17);C%:high%=C%:COLOUR 7
3210  PROCDLY(10)
3220  GOTO 3050
3230
3240
4000  DEF PROCSOUNDS(F%)
4010  VDU 19,F%,0,0,0,0
4020  SOUND 1,-10,B%(F%),2
4030  PROCDLY(3)
4040  VDU 19,F%,F%,0,0,0
4050  PROCDLY(5)
4060  ENDPROC
4070
4080
5000  DEF PROCERROR
5010  SOUND 1,-15,0,30
5020  SOUND 2,-15,0,30
5030  SOUND 3,-15,0,30
5040  PRINT TAB(0,31);"ANOTHER GAME (
Y/N)?";
5050  REPEAT
5060  again$=GET$
5070  UNTIL again$="n" OR again$="y"
OR again$="N" OR again$="Y"
5080  ENDPROC
5090
5100
6000  DEF PROCDLY(dy)
6010  FOR wait%=1 TO dy*100
6020  NEXT wait%
6030  ENDPROC
6040
6050
7000  DEF PROCCOFF
7010  VDU 23;11,0;0;0;0
7020  ENDPROC
7030
7040
8000  DEF PROCSQUARE(col%,xstart%,yst
art%,side%)
8010  GCOL 0,col%
8020  MOVE xstart%,ystart%
8030  PLOT 80,side%,0
8040  PLOT 81,-side%,side%
8050  PLOT 81,side%,0
8060  ENDPROC
8070
8080
9000  *FX4
9010  IF ERR=17 THEN 140
9020  MODE7
9030  REPORT
9040  PRINT" at line ";ERL
```

THE COMMERCIAL memory game Simon has been capturing young people's attention. The idea is to repeat a sequence in which the computer plays a series of notes while lights flash in four coloured boxes, each of which corresonds to a particular note. The player uses the cursor keys to simulate the pattern.

Each time the sequence is completed correctly one note is added to the length. If you can get as far as 20 notes then you are doing pretty well — though I do know someone who has got as far as 33 notes.

Calculator

So-called calculator programs can either be calculator simulators or fun programs where you have to guess the correct answer to a number of questions. J Humphreys' program is of the latter type.

The only restriction on how many questions you may be asked is the number that will fit on a screen, in this case 20. You have all the usual options of addition, subtraction, multiplication and division. When you have guessed all that you feel able to, you are presented with a score as a percentage, and a congratulatory word.

On the whole this is quite an enjoyable little program. Its screen presentation is let down only by the white on yellow prompts.

```
  10  REM ********************
  20  REM **** CALCULATOR ****
  30  REM ** By J.Humphreys **
  35  REM **** (C) 5/7/83 ****
  40  REM ********************
  50  REM INTRODUCTION PAGE

  55  ON ERROR RUN
  60 MODE 7
  70  VDU 23;11;0;0;0;0
  80 FOR A=1 TO 25
  90 PRINTCHR$(134);CHR$(157)
 100 NEXT A
 110 PRINT TAB(14,4);CHR$(129);CHR$(1
41);"CALCULATOR"
 120 PRINT TAB(14,5);CHR$(129);CHR$(1
41);"CALCULATOR"
 130 PRINT TAB(13,6);CHR$(132);"=====
=========="
 140 PRINT TAB(11,8);CHR$(133);"THIS
PROGRAM ASKS"
 150 PRINT TAB(10,11);CHR$(133);"YOU
WHICH SUMS YOU"
 160 PRINT TAB(12,14);CHR$(133);"REQU
IRE AND HOW"
 170 PRINT TAB(13,17);CHR$(133);"MANY
 OF EACH"
 180 PRINT TAB(2,2);CHR$(130);"******
****************************"
 190   PRINT TAB(2,22);CHR$(130);"***
********************************"
 200    PRINT TAB(6,23);CHR$(135);"PR
ESS"
 210  PRINT TAB(12,23);CHR$(132);"SPA
CE"
 220  PRINT TAB(18,23);CHR$(135);"BAR
TO CONTINUE"
 230  B=GET
 240  IF B<>&20 THEN 230 ELSE 260

 250  REM SELECTION PAGE

 260 MODE 7
 270 VDU 23;8202;0;0;0;
 280 FOR C=1 TO 25
 290 PRINTCHR$(131);CHR$(157)
 300 NEXT C
 310 PRINT TAB(12,7);CHR$(132);"WHICH
SUMS DO"
 320 PRINT TAB(8,8);CHR$(132);"YOU WA
NT (1,2,3 or 4) ?"
 330 PRINT TAB(32,9);CHR$(134);CHR$(1
36);" "
 340 PRINT TAB(2,2);CHR$(129);"******
****************************"
 350  PRINT TAB(2,22);CHR$(129);"****
********************************"
 360 FOR T=1 TO 1000:NEXT T
 370 PRINT TAB(12,12);CHR$(129);"1"
 380 PRINT TAB(14,12);CHR$(130);"ADDI
TION"
 390  FOR T=1 TO 1000:NEXT T
 400 PRINT TAB(12,14);CHR$(129);"2"
 410 PRINT TAB(14,14);CHR$(133);"SUBT
RACTION"
 420 FOR T=1 TO 1000:NEXT T
 430 PRINT TAB(12,16);CHR$(129);"3"
 440 PRINT TAB(14,16);CHR$(134);"DIVI
```

```
SION"
  450 FOR T=1 TO 1000:NEXT T
  460 PRINT TAB(12,18);CHR$(129);"4"
  470 PRINT TAB(14,18);CHR$(135);"MULT
IPLICATION"
  480 VDU 31,34,8
  490  VDU 23;8202;0;0;0
  500 INPUT D
  510 IF D=1 THEN 830
  520 IF D=2 THEN 1610
  530 IF D=3 THEN 2410
  540 IF D=4 THEN 3230
  550  GOTO 260



  560  REM NUMBER OF SUMS REMINDER

  570  MODE 7
  580  VDU 23;11;0;0;0;0
  590  FOR G=1 TO 25
  600  PRINTCHR$(131);CHR$(157)
  610  NEXT G
  620  PRINT TAB(2,2);CHR$(129);"*****
****************************"
  630  PRINT TAB(2,22);CHR$(129);"****
****************************"
  640  PRINT TAB(13,6);CHR$(130);CHR$(
141);"THE MAXIMUM"
  650  PRINT TAB(13,7);CHR$(130);CHR$(
141);"THE MAXIMUM"
  660 PRINT TAB(14,10);CHR$(130);CHR$(
141);"NUMBER OF"
  670 PRINT TAB(14,11);CHR$(130);CHR$(
141);"NUMBER OF"
  680 PRINT TAB(14,14);CHR$(130);CHR$(
141);"SUMS ARE"
  690 PRINT TAB(14,15);CHR$(130);CHR$(
141);"SUMS ARE"
  700 PRINT TAB(16,18);CHR$(133);CHR$(
136);CHR$(141);"20"
  710 PRINT TAB(16,19);CHR$(133);CHR$(
136);CHR$(141);"20"
  720 FOR T=1 TO 1000:NEXT T
  730 PRINT TAB(6,23);CHR$(132);"PRESS
"
  740 PRINT TAB(12,23);CHR$(134);"SPAC
E"
  750 PRINT TAB(18,23);CHR$(132);"BAR
TO CONTINUE"
  760 H=GET
  770 IF H<>&20 THEN 760 ELSE 780
  780 IF D=1 THEN 830
  790 IF D=2 THEN 1610
  800 IF D=3 THEN 2410
  810 IF D=4 THEN 3230



  820  REM NUMBER OF ADDITION SUMS

  830 MODE 7
  840  VDU 23;8202;0;0;0;
  850 FOR E=1 TO 25
  860 PRINTCHR$(134);CHR$(157)
  870 NEXT E
  880 PRINTTAB(15,4);CHR$(132);CHR$(14
1);"ADDITION"
  890 PRINTTAB(15,5);CHR$(132);CHR$(14
1);"ADDITION"
  900 PRINTTAB(14,6);CHR$(135);"======
======"
  910 PRINTTAB(16,8);CHR$(129);"HOW MA
NY"
  920 PRINTTAB(16,10);CHR$(129);"ADDIT
ION"
  930 PRINTTAB(16,12);CHR$(129);"SUMS
DO"
  940 PRINTTAB(14,14);CHR$(129);"YOU R
EQUIRE ?"
  950 PRINTTAB(27,15);CHR$(131);CHR$(1
36);"_"
  960 PRINTTAB(2,2);CHR$(130);"*******
**************************"
  970 PRINTTAB(2,22);CHR$(130);"******
**************************"
  980 FOR T=1 TO 1000:NEXT T
  990 PRINTTAB(13,16);CHR$(133);CHR$(1
36);"REMEMBER NO"
 1000 PRINTTAB(14,18);CHR$(133);CHR$(1
36);"MORE THAN"
 1010 PRINTTAB(15,20);CHR$(133);CHR$(1
36);"20 SUMS"
 1020 VDU 31,29,14
 1030  VDU 23;8202;0;0;0
 1040 INPUT F
 1050 IF F<1 OR F>20 THEN 570 ELSE 107
0



 1060  REM ADDITION SUMS

 1070  MODE 7
 1080 VDU 23;8202;0;0;0;
 1090  FOR I=1 TO 25
 1100  PRINTCHR$(131);CHR$(157)
 1110  NEXT I
 1120  PRINTTAB(2,2);CHR$(129);"******
**************************"
 1130 PRINTTAB(2,22);CHR$(129);"******
**************************"
 1140 PRINTTAB(15,4);CHR$(130);CHR$(14
1);"ADDITION"
 1150 PRINTTAB(15,5);CHR$(130);CHR$(14
1);"ADDITION"
 1160 PRINTTAB(14,6);CHR$(134);"======
======"
 1170 LET J=-1
 1180 LET K=0
 1190 LET J=J+1
 1200  IF J=10 THEN 1390
 1210 IF J=F THEN 4010
 1220 LET L=RND(99)
 1230 LET M=RND(99)
 1240 LET N=L+M
 1250 PRINTTAB(3,J+9);CHR$(133);L
 1260 PRINTTAB(6,J+9);CHR$(133);"+"
 1270 PRINTTAB(8,J+9);CHR$(133);M
 1280 PRINTTAB(11,J+9);CHR$(133);"="
 1290 VDU 31,14,J+9
 1300 VDU 23;8202;0;0;0
 1310 INPUT O
 1320 IF O=N THEN 1360
 1330 PRINTTAB(17,J+9);CHR$(129);"X"
 1340 SOUND1,-15,0,10
 1350 GOTO 1190
 1360 LET K=K+1
 1370 SOUND1,-15,150,10
 1380 GOTO 1190
 1390 LET J=-1
 1400 LET F=F-10
 1410 LET J=J+1
 1420 IF J=F THEN LET F=F+10:GOTO 4010
 1430 LET P=RND(99)
 1440 LET Q=RND(99)
 1450 LET R=P+Q
 1460 PRINTTAB(21,J+9);CHR$(132);P
 1470 PRINTTAB(24,J+9);CHR$(132);"+"
 1480 PRINTTAB(26,J+9);CHR$(132);Q
 1490 PRINTTAB(29,J+9);CHR$(132);"="
 1500 VDU 31,32,J+9
 1510 VDU 23;8202;0;0;0
 1520 INPUT S
 1530 IF S=R THEN 1570
 1540 PRINTTAB(35,J+9);CHR$(129);"X"
 1550 SOUND 1,-15,0,10
 1560 GOTO 1410
 1570 LET K=K+1
 1580 SOUND 1,-15,150,10
 1590 GOTO 1410



 1600  REM NUMBER OF SUBTRACTION SUMS

 1610 MODE 7
 1620 VDU 23;8202;0;0;0;
 1630 FOR E=1 TO 25
 1640 PRINTCHR$(134);CHR$(157)
 1650  NEXT E
 1660 PRINTTAB(13,4);CHR$(132);CHR$(14
1);"SUBTRACTION"
 1670 PRINTTAB(13,5);CHR$(132);CHR$(14
1);"SUBTRACTION"
 1680 PRINTTAB(12,6);CHR$(135);"======
========="
 1690 PRINTTAB(16,8);CHR$(129);"HOW MA
NY"
 1700 PRINTTAB(14,10);CHR$(129);"SUBTR
ACTION"
 1710 PRINTTAB(16,12);CHR$(129);"SUMS
DO"
 1720 PRINTTAB(14,14);CHR$(129);"YOU R
EQUIRE ?"
 1730 PRINTTAB(27,15);CHR$(131);CHR$(1
36);"_"
 1740 PRINTTAB(2,2);CHR$(130);"*******
**************************"
 1750 PRINTTAB(2,22);CHR$(130);"******
**************************"
 1760 FOR T=1 TO 1000:NEXT T
 1770 PRINTTAB(13,16);CHR$(133);CHR$(1
36);"REMEMBER NO"
 1780 PRINTTAB(14,18);CHR$(133);CHR$(1
36);"MORE THAN"
 1790  PRINTTAB(15,20);CHR$(133);CHR$(
136);"20 SUMS"
 1800  VDU 31,29,14
 1810  VDU 23;8202;0;0;0
 1820  INPUT F
 1830  IF F<1 OR F>20 THEN 570 ELSE 18
50



 1840  REM SUBTRACTION SUMS

 1850 MODE 7
 1860 VDU 23;8202;0;0;0;
 1870  FOR I=1 TO 25
 1880 PRINTCHR$(131);CHR$(157)
 1890 NEXT I
 1900 PRINTTAB(2,2);CHR$(129);"*******
**************************"
 1910 PRINTTAB(2,22);CHR$(129);"******
**************************"
 1920 PRINTTAB(13,4);CHR$(130);CHR$(14
1);"SUBTRACTION"
 1930 PRINTTAB(13,5);CHR$(130);CHR$(14
1);"SUBTRACTION"
 1940 PRINTTAB(12,6);CHR$(134);"======
========="
 1950 LET J=-1
 1960 LET K=0
 1970  LET J=J+1
 1980  IF J=10 THEN 2180
 1990  IF J=F THEN 4010
 2000  LET L=RND(99)
 2010  LET M=RND(99)
 2020  IF M>L THEN 2000
 2030  LET N=L-M
 2040  PRINTTAB(3,J+9);CHR$(133);L
 2050  PRINTTAB(6,J+9);CHR$(133);"-"
 2060 PRINTTAB(8,J+9);CHR$(133);M
 2070 PRINTTAB(11,J+9);CHR$(133);"="
 2080 VDU 31,14,J+9
 2090 VDU 23;8202;0;0;0
 2100 INPUT O
 2110 IF O=N THEN 2150
 2120 PRINTTAB(17,J+9);CHR$(129);"X"
 2130 SOUND 1,-15,0,10
 2140 GOTO 1970
 2150 LET K=K+1
 2160 SOUND 1,-15,150,10
 2170 GOTO 1970
 2180 LET J=-1
 2190 LET F=F-10
 2200 LET J=J+1
 2210 IF J=F THEN LET F=F+10:GOTO 4010

 2220 LET P=RND(99)
 2230 LET Q=RND(99)
 2240 IF Q>P THEN 2220
 2250 LET R=P-Q
 2260 PRINTTAB(21,J+9);CHR$(132);P
 2270 PRINTTAB(24,J+9);CHR$(132);"-"
 2280 PRINTTAB(26,J+9);CHR$(132);Q
 2290 PRINTTAB(29,J+9);CHR$(132);"="
 2300 VDU 31,32,J+9
 2310 VDU 23;8202;0;0;0
 2320 INPUT S
 2330 IF S=R THEN 2370
 2340 PRINTTAB(35,J+9);CHR$(129);"X"
 2350 SOUND 1,-15,0,10
 2360 GOTO 2200
 2370 LET K=K+1
 2380 SOUND 1,-15,150,10
 2390 GOTO 2200



 2400  REM NUMBER OF DIVISION SUMS
```

(continued on next page)

(continued from previous page)

```
  2410  MODE 7
  2420 VDU 23;8202;0;0;0;
  2430 FOR E=1 TO 25
  2440 PRINTCHR$(134);CHR$(157)
  2450 NEXT E
  2460 PRINT TAB(15,4);CHR$(132);CHR$(1
41);"DIVISION"
  2470 PRINT TAB(15,5);CHR$(132);CHR$(1
41);"DIVISION"
  2480 PRINT TAB(14,6);CHR$(135);"=====
======="
  2490 PRINT TAB(16,8);CHR$(129);"HOW M
ANY"
  2500 PRINT TAB(16,10);CHR$(129);"DIVI
SION"
  2510 PRINT TAB(16,12);CHR$(129);"SUMS
 DO"
  2520 PRINT TAB(14,14);CHR$(129);"YOU
REQUIRE ?"
  2530 PRINT TAB(27,15);CHR$(131);CHR$(
136);"  "
  2540 PRINT TAB(2,2);CHR$(130);"******
**************************"
  2550 PRINT TAB(2,22);CHR$(130);"*****
*****************************"
  2560 FOR T=1 TO 1000: NEXT T
  2570 PRINT TAB(13,16);CHR$(133);CHR$(
136);"REMEMBER NO"
  2580 PRINT TAB(14,18);CHR$(133);CHR$(
136);"MORE THAN"
  2590 PRINT TAB(15,20);CHR$(133);CHR$(
136);"20 SUMS"
  2600 VDU 31,29,14
  2610 VDU 23;8202;0;0;0
  2620 INPUT F
  2630 IF F<1 OR F>20 THEN 570 ELSE 265
0



  2640  REM DIVISION SUMS

  2650  MODE 7
  2660  VDU 23;8202;0;0;0;
  2670  FOR I=1 TO 25
  2680  PRINT CHR$(131);CHR$(157)
  2690  NEXT I
  2700  PRINT TAB(2,2);CHR$(129);"*****
**************************"
  2710  PRINT TAB(2,22);CHR$(129);"****
*****************************"
  2720 PRINT TAB(15,4);CHR$(130);CHR$(1
41);"DIVISION"
  2730 PRINT TAB(15,5);CHR$(130);CHR$(1
41);"DIVISION"
  2740 PRINT TAB(14,6);CHR$(134);"=====
======="
  2750 LET J=-1
  2760 LET K=0
  2770 LET J=J+1
  2780 IF J=10 THEN 2990
  2790 IF J=F THEN 4010
  2800 LET L=RND(500)
  2810 LET M=RND(500)
  2820 LET N=L/M
  2830  IF L<M THEN 2800
  2840 IF N<>INT(N) THEN 2800
  2850  PRINT TAB(3,J+9);CHR$(133);L
  2860 PRINT TAB(7,J+9);CHR$(133);CHR$(
254)
  2870 PRINT TAB(9,J+9);CHR$(133);M
  2880 PRINT TAB(13,J+9);CHR$(133);"="
  2890  VDU 31,15,J+9
  2900 VDU 23;8202;0;0;0
  2910 INPUT O
  2920 IF O=N THEN 2960
  2930 PRINT TAB(18,J+9);CHR$(129);"X"
  2940 SOUND 1,-15,0,10
  2950 GOTO 2770
  2960 LET K=K+1
  2970 SOUND 1,-15,150,10
  2980 GOTO 2770
  2990 LET J=-1
  3000 LET F=F-10
  3010 LET J=J+1
  3020 IF J=F THEN LET F=F+10:GOTO 4010

  3030 LET L=RND(500)
  3040 LET M=RND(500)
  3050 LET N=L/M
  3060  IF L<M THEN 3030
  3070 IF N<>INT(N) THEN 3030
  3080 PRINT TAB(21,J+9);CHR$(132);L
  3090 PRINT TAB(25,J+9);CHR$(132);CHR$
(254)
  3100 PRINT TAB(27,J+9);CHR$(132);M
  3110 PRINT TAB(31,J+9);CHR$(132);"="
  3120 VDU 31,34,J+9
  3130 VDU 23;8202;0;0;0
  3140 INPUT S
  3150 IF S=N THEN 3190
  3160 PRINT TAB(37,J+9);CHR$(129);"X"
  3170 SOUND 1,-15,0,10
  3180 GOTO 3010
  3190 LET K=K+1
  3200 SOUND 1,-15,150,10
  3210  GOTO 3010



  3220  REM NUMBER OF MULTIPLICATION SU
MS
  3230 MODE 7
  3240 VDU 23;8202;0;0;0;
  3250 FOR E=1 TO 25
  3260 PRINT CHR$(134);CHR$(157)
  3270 NEXT E
  3280 PRINT TAB(12,4);CHR$(132);CHR$(1
41);"MULTIPLICATION"
  3290 PRINT TAB(12,5);CHR$(132);CHR$(1
41);"MULTIPLICATION"
  3300 PRINT TAB(11,6);CHR$(135);"=====
============="
  3310 PRINT TAB(16,8);CHR$(129);"HOW M
ANY"
  3320 PRINT TAB(12,10);CHR$(129);"MULT
IPLICATION"
  3330 PRINT TAB(16,12);CHR$(129);"SUMS
 DO"
  3340 PRINT TAB(14,14);CHR$(129);"YOU
REQUIRE ?"
  3350 PRINT TAB(27,15);CHR$(131);CHR$(
136);"  "
  3360 PRINT TAB(2,2);CHR$(130);"******
**************************"
  3370 PRINT TAB(2,22);CHR$(130);"*****
*****************************"
  3380 FOR T=1 TO 1000:NEXT T
  3390 PRINT TAB(13,16);CHR$(133);CHR$(
136);"REMEMBER NO"
  3400 PRINT TAB(14,18);CHR$(133);CHR$(
136);"MORE THAN"
  3410 PRINT TAB(15,20);CHR$(133);CHR$(
136);"20 SUMS"
  3420 VDU 31,29,14
  3430 VDU 23;8202;0;0;0
  3440 INPUT F
  3450 IF F<1 OR F>20 THEN 570 ELSE 347
0



  3460  REM MULTIPLICATION SUMS

  3470 MODE 7
  3480 VDU 23;8202;0;0;0;
  3490 FOR I=1 TO 25
  3500 PRINT CHR$(131);CHR$(157)
  3510 NEXT I
  3520 PRINT TAB(2,2);CHR$(129);"******
**************************"
  3530 PRINT TAB(2,22);CHR$(129);"*****
*****************************"
  3540 PRINT TAB(12,4);CHR$(130);CHR$(1
41);"MULTIPLICATION"
  3550 PRINT TAB(12,5);CHR$(130);CHR$(1
41);"MULTIPLICATION"
  3560 PRINT TAB(11,6);CHR$(134);"=====
============="
  3570 LET J=-1
  3580 LET K=0
  3590 LET J=J+1
  3600 IF J=10 THEN 3790
  3610 IF J=F THEN 4010
  3620 LET L=RND(12)
  3630 LET M=RND(12)
  3640 LET N=L*M
  3650 PRINT TAB(3,J+9);CHR$(133);L
  3660 PRINT TAB(6,J+9);CHR$(133);"x"
  3670 PRINT TAB(8,J+9);CHR$(133);M
  3680 PRINT TAB(11,J+9);CHR$(133);"="
  3690 VDU 31,14,J+9
  3700 VDU 23;8202;0;0;0
  3710 INPUT O
  3720 IF O=N THEN 3760
  3730 PRINT TAB(17,J+9);CHR$(129);"X"
  3740 SOUND 1,-15,0,10
  3750 GOTO 3590
  3760 LET K=K+1
  3770 SOUND 1,-15,150,10
  3780 GOTO 3590
  3790 LET J=-1
  3800 LET F=F-10
  3810 LET J=J+1
  3820 IF J=F THEN LET F=F+10:GOTO 4010

  3830 LET P=RND(12)
  3840 LET Q=RND(12)
  3850 LET R=P*Q
  3860 PRINT TAB(21,J+9);CHR$(132);P
  3870 PRINT TAB(24,J+9);CHR$(132);"x"
  3880 PRINT TAB(26,J+9);CHR$(132);Q
  3890 PRINT TAB(29,J+9);CHR$(132);"="
  3900 VDU 31,32,J+9
  3910 VDU 23;8202;0;0;0
  3920 INPUT S
  3930 IF S=R THEN 3970
  3940 PRINT TAB(35,J+9);CHR$(129);"X"
  3950 SOUND 1,-15,0,10
  3960 GOTO 3810
  3970 LET K=K+1
  3980 SOUND 1,-15,150,10
  3990 GOTO 3810



  4000  REM SCORE AND PERCENTAGE MARK

  4010 MODE 7
  4020 VDU 23;8202;0;0;0;
  4030 FOR X=1 TO 25
  4040 PRINT CHR$(134);CHR$(157)
  4050 NEXT X
  4060  PRINT TAB(2,2);CHR$(130);"*****
**************************"
  4070  PRINT TAB(2,22);CHR$(130);"****
*****************************"
  4080  IF F=1 THEN 4140 ELSE 4100
  4090  IF K=1 THEN 4180 ELSE 4210
  4100 PRINT TAB(8,4);CHR$(133);"YOU AT
TEMPTED"
  4110 PRINT TAB(22,4);CHR$(129);F
  4120 PRINT TAB(25,4);CHR$(133);"SUMS
 "
  4130 GOTO 4090
  4140 PRINT TAB(9,4);CHR$(133);"YOU AT
TEMPTED"
  4150 PRINT TAB(23,4);CHR$(129);"1"
  4160 PRINT TAB(25,4);CHR$(133);"SUM ,
"
  4170 GOTO 4090
  4180 PRINT TAB(12,6);CHR$(129);"1"
  4190 PRINT TAB(14,6);CHR$(133);"WAS C
ORRECT ."
  4200 GOTO 4240
  4210 PRINT TAB(11,6);CHR$(129);K
  4220 PRINT TAB(14,6);CHR$(133);"WERE
CORRECT ."
  4230 GOTO 4240
  4240 LET Z=INT(K*(100/F))
  4250 PRINT TAB(7,10);CHR$(133);"YOUR
PERCENTAGE SCORE IS"
  4260 FOR Y=-15 TO 0 STEP 2
  4270 SOUND 1,Y,50,5
  4280 SOUND 1,Y,120,2
  4290 SOUND 1,Y,150,2
  4300 SOUND 1,Y,100,5
  4310 SOUND 1,Y,150,10
  4320 PRINT TAB(16,12);CHR$(132);CHR$(
141);CHR$(136);Z"%"
  4330 PRINT TAB(16,13);CHR$(132);CHR$(
141);CHR$(136);Z"%"
  4340  IF Z>=80 THEN PRINT TAB(15,15);
CHR$(129);CHR$(136);"EXCELLENT"
  4350 IF Z<80 AND Z>=60 THEN PRINT TAB
(15,15);CHR$(129);CHR$(136);"VERY GOOD
"
  4360 IF Z<60 AND Z>=40 THEN PRINT TAB
(17,15);CHR$(129);CHR$(136);"GOOD"
  4370 IF Z<40 AND Z>=20 THEN PRINT TAB
(14,15);CHR$(129);CHR$(136);"QUITE GOO
D"
  4380  IF Z<20 THEN PRINT TAB(17,15);C
HR$(129);CHR$(136);"POOR"
  4390 NEXT Y
  4400 PRINT TAB(2,20);CHR$(132);"Do yo
u want another go(Y or N) ?"
  4410 VDU 31,35,20
  4420  VDU 23;8202;0;0;0
  4430 INPUT U$
  4440 IF U$="Y" THEN 60
  4450 CLS
  4460 END
>
```

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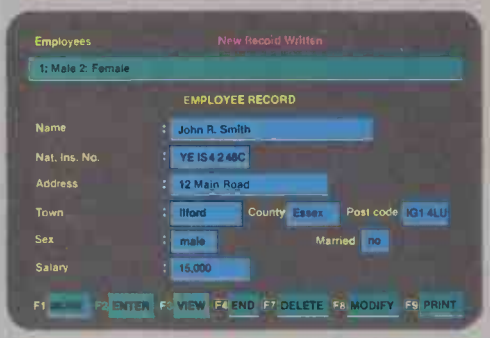

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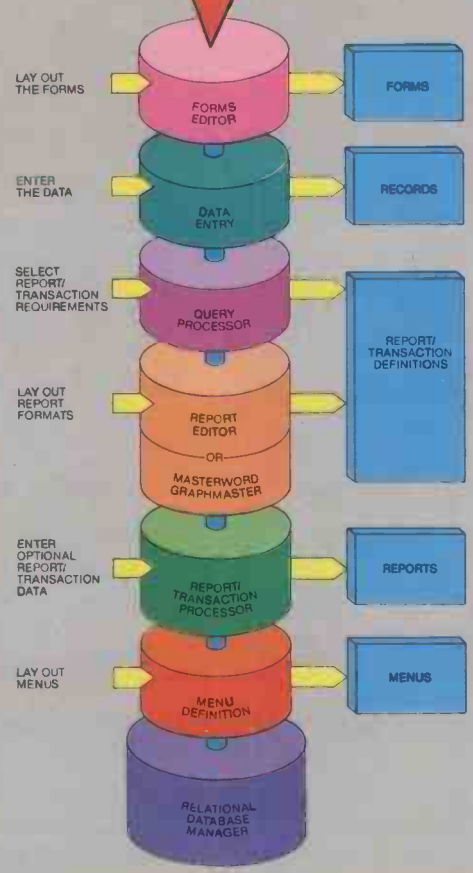

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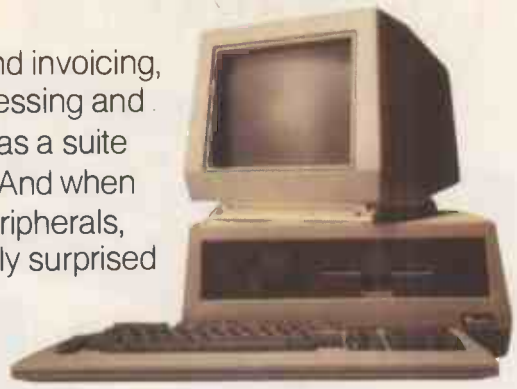

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Transferring programs

SINCE THE Commodore 64 has 40 characters on a line, and uses the same character set as the Pet and the same Basic, there should be ample scope for using Pet programs directly on the Commodore with little or no modification. As long as the programs contain no Peek, Poke, Sys or Wait commands, they should be completely portable.

In reality few programs are that simple. The commonest Peeks and Pokes are to the screen; on the Commodore 64 screen memory starts at location 1024 whereas on the Pet it starts at 32768. Fortunately, the 64 is flexible enough to move things around so that the screen memory can be moved to start at 32768.

The sequence of commands in listing 1 sets up the necessary parameters to make the Commodore 64 look like a Pet. The first line moves the screen itself, the second tells the Basic interpreter what has happened and the last two simply clear out any rubbish that is left over.

Any Pet program can now be loaded and examined, although it is possible that when the program is listed the first line may be badly corrupted. This is a result of the way some Basic programs are saved, especially on older-model Pets. If this does occur, it is very simple to recover the situation by the sequence of Pokes in listing 2.

Once the program has been converted to your satisfaction, the necessary reconfiguration can be achieved by adding the three lines of listing 3 to the start of the program and saving it again. In the future, loading the program will not put it at the same place in the 64 as it was in the Pet, but this should not be a problem unless the program is extremely long.

Despite all this, straight Pokes to the screen will still not work. Whenever the 64 screen is cleared, the colour memory is reset to the same colour as the background, which means that any characters Poked on to the screen will not be seen.

One way of solving the problem is to Poke a colour into colour memory whenever a screen Poke occurs. This can most easily be done by simply adding 22528 to the screen Poke location and putting the correct colour code there. Another way is to fill the colour memory with a different colour every time the screen is cleared. A simple For-Next loop would do the trick, but would be unbearably slow.

A neater solution is provided in the subroutine of listing 4, which actually makes use of the fact that the colour memory is set to the background colour. The first line changes the background colour to the same colour as the current character printing colour, in location 646, first preserving the background colour.

The screen is then cleared, so setting the colour memory, and then the background colour is restored. By removing all Clear Screen characters in the program, and inserting Gosub 63400 just before each Print statement containing a Clear Screen character, the Poke problems on the screen will be solved. It is, of course, possible that there are other Peeks and Pokes in the program which are rather trickier to deal with, but they will have to wait until a later date.

Finally, there is a bug on the Commodore 64 which affects the Input command when the prompt continues over the end of a line. The Pet is quite happy with this, but the 64 will not read the input correctly, so some Input statements and their associated Prints may have to be changed to avoid printing beyond the end of a line.

I must thank Bob Merry of Stockport for providing many of the ideas for using Pet programs on the Commodore 64.

Listing 1.

```
POKE 53272,4: POKE 56576,5: POKE 648,128
POKE 56,128: POKE 44,4: POKE 1024,0
clear the screen
NEW
```

Listing 2.

```
POKE 1027,PEEK(1026): POKE 1026,PEEK(1025)
POKE 1025,0: POKE 43,2
```

Listing 3.

```
1 POKE 648,128: POKE 56576,5: POKE 53272,4
2 PRINT "[CLEAR]"
3 POKE 56,128: CLR
```

Listing 4.

```
63400 ZZ=PEEK(53281): POKE 53281,PEEK(646)
63401 PRINT "[CLEAR]";
63402 POKE 53281,ZZ
63403 RETURN
```

Cataloguing discs

There are many ways of getting at the file names on a disc, all of which involve opening special files and a lot of Get # commands. These methods certainly work, but they require careful counting of the characters received. The result is often a complicated and rather inelegant program.

Now L V Turner of Colchester has produced an extremely simple and rather elegant approach to the problem. It involves reading the directory and generating a sequential disc file containing all the directory information. His program relies on the Directory command in Basic 4, which normally prints the directory on to the screen, and the method is simple.

Listing 1 shows the program which, first of all, opens a suitable sequential file on the disc in line 200. There is no reason why this should not be an Append command so that a complete file of all disc directories is built up. Just before the Directory command is issued, the output which would normally

(continued on next page)

Cataloguing discs.
Listing 1.

```
100 REM ************************
110 REM *                      *
120 REM * DISK CATALOGER -     *
130 REM *                      *
140 REM *   BASIC 4 + DOS 2    *
150 REM *                      *
160 REM *           L V TURNER *
170 REM *                      *
180 REM ************************

200 DOPEN#2,"CATALOG",D0,W
210 CMD2
220 DIRECTORY
230 PRINT#2
240 DCLOSE#2

300 REM ************************
310 REM *                      *
320 REM *    READ CATALOGUE    *
330 REM *                      *
340 REM ************************

400 DOPEN#2,"CATALOG",D0
410 INPUT#2,A$
420 PRINT A$

430 INPUT#2,A$
440 IF ST=64 OR A$="" THEN 470
450 PRINT A$
460 GOTO 430

470 DCLOSE#2
```

Listing 2.

```
************************
*                      *
* DISK CATALOGER -     *
*                      *
*   BASIC 2 + DOS 2    *
*                      *
*           L V TURNER *
*                      *
************************

LOAD "$",8

OPEN 2,8,2,"0:CATALOG,S,W"
CMD2 : LIST
PRINT#2
CLOSE2

300 REM ************************
310 REM *                      *
320 REM *    READ CATALOGUE    *
330 REM *                      *
340 REM ************************

400 OPEN 2,8,2,"0:CATALOG,S,R"
410 INPUT#2,A$
420 PRINT A$

430 INPUT#2,A$
440 IF ST=64 OR A$="" THEN 470
450 PRINT A$
460 GOTO 430

470 CLOSE2
```

(continued from previous page)

go to the screen is redirected to the disc file with the CMD2 in line 220.

As the directory is read, it is no longer printed on the screen but is redirected to the disc file. Lines 230 and 240 do the necessary closing out routine when the directory is complete. Now the file exists as a series of individual sequential file entries, each separated by a Carriage Return. They can be read back again using the Input# command.

An example of how this could be done is also included in the program. Line 410 reads the directory heading, and then lines 430 to 460 read the rest of the directory and print it to the screen. Of course, there is no reason why line 450 should not be replaced with a routine to put the file information into an array or to extract any information required simply using the Mid$ command.

Those who have worked with computers for more than a few weeks will not be surprised to learn that there are problems with the technique. The file Catalog will be shown as though it has not been closed. This is to be expected, as the file was open while the directory was being read.

The disc drive handles directories rather differently to normal files, and there are problems when it comes to do the Blocks Free total at the end of the directory. In fact it will not make much sense, so it should not be used to work out how much space is left. The final problem is that, for some reason, trying to read the directory of only one of the drives does not work. This again is probably a quirk of the way that the disc operating system generates the directory listing.

A version for Basic 2 users is given in listing 2. The main problem is that Basic 2 has no facility for listing the directory directly on to the screen. You have to execute a few commands directly from the keyboard; they are given at the start of the listing. The principle is exactly the same, but the directory must first be loaded into the computer, and then listed to the disc drive.

With this technique, the problems of having files open while reading the directory no longer exist, and the directory loading can be for one or both drives and can follow the usual conventions of a selective directory listing. For instance, to read only the program files from drive 1, replace the Load command with:

LOAD "$1:*=P",8

The number of blocks free should be correct.

So, where is the problem? The last line to be listed will actually be the "Ready." message that would normally have been printed on the screen. However, as long as you know it is there it should not cause any difficulties.

The read-back operation is almost identical to the Basic 4 version, except that the file is opened in the Basic 2 way, as in line 400. There is no doubt that this is a case of "Why didn't I think of it before?"

Bombing Monster.

```
10 POKE 5184,0
30 GOSUB 5000

98 POKE 36879,24
99 PRINT"[CLEAR]"
100 POKE 56,26:POKE 52,26:CLR
105 AA=RND(-TI):M=4
107 A(1)=5:A(2)=4:A(3)=2:A(4)=7
110 POKE 36866,23
115 POKE 36878,10
120 POKE 36867,58
130 POKE 36864,11
140 POKE 36865,27
150 POKE 36869,253



160 FOR I=0 TO 7:POKE 5120+I,0:NEXT
170 FOR I=0 TO 7:READ A:POKE 5120+I,A
    :NEXT
180 DATA 60,118,231,247,247,247,126,60
190 FOR I=0 TO 7:READ A:POKE 5136+I,A
    :NEXT
200 DATA 60,102,219,247,239,195,126,60
210 FOR I=0 TO 7:READ A:POKE 5144+I,A
    :NEXT
220 DATA 60,102,219,247,219,102,126,60
230 FOR I=0 TO 7:READ A:POKE 5152+I,A
    :NEXT
240 DATA 60,110,235,227,251,251,126,60
250 FOR I=0 TO 7:READ A:POKE 5160+I,A
    :NEXT
260 DATA 24,60,126,90,126,231,255,219
270 FOR I=0 TO 7:READ A:POKE 5168+I,A
    :NEXT
280 DATA 127,62,62,62,62,62,28,8
290 FOR I=0 TO 7:POKE 5176+I,255:NEXT

490 FOR I=37888 TO 38554:POKE I,6:NEXT
495 FOR I=7168 TO 7834:POKE I,0:NEXT

500 FOR I=1 TO 7:READ A,B
510 FOR J=A TO B:POKE J+7168,7
    :POKE J+37888,0:NEXT:NEXT

520 DATA 506,508,526,532,548,556,570,
    580,592,604,614,628,636,666
530 POKE 7294,4
550 FOR I=509 TO 635 STEP 2
560 J=INT(RND(TI)*4+1)
570 IF PEEK(7168+I)<>7 THEN POKE 3788
    8+I,A(J):POKE 7168+I,J:S2=S2+J
580 NEXT
600 A=INT(RND(TI)*10)+11:B=0


610 POKE 7168+A*23+B,5
    :POKE 7167+A*23+B,0
620 B=B+1:IF B=23 THEN POKE 7167+A*23
    +B,0:GOTO 600
630 IF PEEK(197)<>64 AND C<>1 THEN C=1
    :D=B:E=A:POKE 36877,128
    :POKE 36876,250:POKE 36877,0
    :POKE 36876,0
640 IF C<>1 THEN 770
650 FOR F=1 TO 2
660 D1=D:E1=E:D=D+.5:E=E+1
670 IF PEEK(7168+E*23+D)=7 THEN GOSUB
     2000:GOTO 750
680 IF PEEK(7168+E*23+D)<>0 THEN GOSU
    B 1000:GOTO 750
690 POKE 7168+E*23+D,6
    :POKE 7168+E1*23+D1,0
750 NEXT F:GOTO 800
770 FOR F=1 TO 50:NEXT F
800 GOTO 610



1000 POKE 36877,200
1010 S=S+PEEK(7168+E*23+D)
1020 POKE 7168+E*23+D,0
     :POKE 7168+E1*23+D1,0
1030 C=0:E=0:D=0:F=2
1040 POKE 36877,0
1050 IF S=S2 THEN GOTO 3000


1060 RETURN
2000 POKE 7168+E1*23+D1,0
2010 FOR I=230 TO 200 STEP-1
     :POKE 36876,I:NEXT:POKE 36876,0
2020 M=M-1:POKE 7294,M
     :IF M=0 THEN 3000
2030 C=0:D=0:E=0:F=2
2040 RETURN


3000 POKE 36864,12:POKE 36865,38
     :POKE 36866,150:POKE 36867,174
     :POKE 36869,240


3010 PRINT"[CLEAR,BLUE]"
3015 IF WE=1 THEN 3025
3020 PRINT"~THAT~WAS~YOUR~LAST~~~~MIS
     S!!!"
3025 PRINT"[DOWN]~YOUR~SCORE~WAS"S
3027 PRINT"~THAT~IS"INT(S/S2*1000+.5)
     /10"[LEFT]%~OF~MAX!"
3031 IF S>PEEK(5184)THEN PRINT"~WOW,
     ~YOU'VE~BEATEN~~~~THE~HI-SCORE"
     :POKE 5184,S:GOTO 3035
3032 PRINT"[DOWN]~HI-SCORE:"PEEK(5184)
3035 POKE 198,0:REM CLEAR INPUT BUFFER
3040 PRINT"[DOWN]~DO~YOU~WANT~ANOTHER"
3050 INPUT"~GO";A$
3060 IF LEN(A$)=0 OR LEFT$(A$,
     1)="Y"THEN RUN 50
3070 PRINT"[DOWN]~OKAY,~CHICKEN!!"
3080 END
5000 POKE 36879,25
5010 PRINT"[CLEAR,BLUE]
     ~~BOMBING~MONSTER~~~~~~[CYAN]
     ----------------"
5020 PRINT"[BLACK,DOWN]
     YOU~RELEASE~THE~BOMBS~BY~HITTING
     ~ANY~KEY."
5030 PRINT"[RED,DOWN]THE~TARGETS~ARE~
     WORTH~THE~AMOUNT~THAT~IS~~~~PRIN
     TED~ON~THEM."
5040 PRINT"[BLACK,DOWN]
     IF~YOU~MISS~YOU~WILL~~LOSE~ONE~M
     ONSTER."
5050 PRINT"[RED,DOWN]THE~AMOUNT~OF~MO
     NSTERSLEFT,~IS~THE~NUMBER~~~IN~T
     HE~MIDDLE~OF~THE~~SCREEN."
5060 PRINT"[GREEN,DOWN2,RIGHT4]
     LET'S~START!"
5070 PRINT"[RVS,RIGHT4]HIT~ANY~KEY!
     [RVOFF]"
5080 GET A$:IF A$=""THEN 5080
5090 RETURN
```

Bombing Monster

Games are often a useful way of learning programming techniques, especially when they include the complexities of high-resolution graphics or user-defined characters. Thomas and Kim Gustafsson have written a fairly simple bombing game for the Vic-20, in which a craft flies across the screen and drops a bomb when a key is pressed. The object is to destroy as many of the round objects at the bottom of the screen as possible.

Each target object is actually a user-defined character containing a number which represents the score achieved when it is hit. Only four misses are allowed before the game stops and you are given the score.

The distinguishing feature of this game is that the bomb does not drop straight down. Instead, it continues travelling from left to right with an element of intertia, which makes the task of targeting that much more difficult.

The program is in several distinct sections. Initial setting up, including the setting of the Vic control registers, is done in lines 98 to 150, and the character definitions are set up is lines 160 to 290. Each character is set up individually, with the first being a space, all 0s, and the last a solid block, 1s. Lines 490 to 580 set up the screen itself. The game proper continues from line 600 onwards, the instructions being held in a subroutine at line 5000.

The techniques used show how straightforward it can be to set up a simple sequence of user-defined characters to make a simple game look just that bit more exciting.

Screen dump

ONE OF the first responses to my request last July for a text-editing program to complement Letter Writer came from Mr A Atkins of Coventry. Although not quite what I had in min, it is interesting in itself and demonstrates how to address the memory for the currently open screen. The program will work with either 40 or 80 character lines, and you can select the lines you wish to print.

Bytes 92 and 93 hold the address of the current screen's data area, calculated at line 60030. Line 60070 calculates the location of the first byte of the display buffer; the first byte of the screen data area contains an offset from which it can be worked out. The questions appear on the VF display of a model AD. If you have a model A delete line 60010 and remove all references to stream £3 for the prompts to be displayed on the video screen.

To use the program, open stream 0 with a suitable line width and number of lines. To print a letter, just type it in using the cursor-control keys to go to a new line. To print a portion of a program, or a display created by a program, load the program using Merge; the program must not use line numbers above 60000. Then run Screen Dump by typing Goto 60005.

```
60005  REM "SCREEN DUMP" BY A.A.ATKINS
60010 CLOSE£3:OPEN£3,3
60020 CLOSE£8:OPEN£8,8,"1200"
60030 TV=PEEK(92)+256*PEEK(93): REM  ADD
RESS OF CURRENT VIDEO OWN MEMORY
60040 ML=PEEK(TV+4): REM  NO. OF DISPLAY
 LINES HELD IN BUFFER
60050 CH=PEEK(TV+5): REM  NO. OF DISPLAY
 CHARACTERS PER LINE
60060 GL=PEEK(TV+6): REM  TOTAL BYTES PE
R LINE
60070 TV=TV+PEEK(TV)+5: REM  DISPLAY BUF
FER FIRST LOCATION
60080 PRINT£3,"FIRST LINE NO.?"
60090 INPUT£3,FL
60100 FL=INT(FL)
60110 IFFL<0 OR FL>ML THEN PRINT£3,"WRON
G ENTRY":GOTO 90
60120 PRINT£3,"LAST LINE NO.?"
60130 INPUT £3,EN
60140 EN=INT(EN)
60150 IF EN<FL OR EN>ML THEN PRINT£3,"WR
ONG ENTRY":GOTO 130
60170 FOR I=FL TO EN
60180     FOR J=0 TO CH-1
60190         PRINT £8,CHR$(PEEK(TV+GL*(I-
1)+J));
60200     NEXT J
60210     PRINT£8
60220 NEXT I
60230 CLOSE£3:CLOSE£8:END
```

Card Index.

```
10 FORI=1TO255 CLOSE#1 NEXTI OPEN#0,0,OPEN#1 0,1 OPEN#6,6
20 OPTIONBASE1:DIMA$(100):DIMP(30,5) DIMT$(30
100 PUT22,5,10 ?"DO YOU WISH TO LOAD INDEX CARDS" PUT22,11,12 ?"FROM CASSETTE'
110 PUT22,24,12:?" (Y/N)?" GET#6,P IFP<>110ANDP<>121THEN110
120 PUT31 IFP=110THENGOSUB1100 GOTO200
130 GET#6,Q:PUT22,6,10:?"PRESS PLAY ON THE TAPE RECORDER"
140 PUT22,7,12:?"THEN ANY KEY ON THE KEYBOARD"
150 GET#6,Q:IFQ<9THEN150
160 PUT31,22,11,12:?"LOADING ":TAB(25);"CARDS" PUT22,19,12
170 OPENIN#99,1,"INDEX":FORA=1TO100 LINPUT#99,A$(A):NEXTA:FORA=1TO30
180 LINPUT#99,T$(A) FORB=1TO5 INPUT#99,P(A,B):NEXTB:NEXTA:CLOSE#99:GOTO300
200 PUT#1,22,4,6 ?#1,"Card":GOSUB 1200:PUT31,22,9,11:?"IS THIS CORRECT (Y/N)?'
210 GET#6,Q:IFQ<>110ANDQ<>121THEN210
220 IFQ=110THEN1900
230 LI=1 GOSUB2700 FORC=1TO100
240 GOSUB1600 GOSUB1300:PUT31,22,6,11:?"IS THIS CARD CORRECT  (Y/N)?"
250 PUT22,2,12:?"PRESS ESCAPE TO FINISH MAKING ENTRIES"
260 GET#6,Q:IFQ<>110ANDQ<>121ANDQ<>27THEN260
270 IFQ=110THEN240
280 IFQ=27THEN300
290 NEXTC
300 REM READING AND INDEXING CARDS
310 PUT#1,31:GOSUB1400:GOSUB1100
340 PUT31:PUT22,4,6:?"PAGE 1  SPECIFIC TITLES REQUIRED":LI=1
350 PUT22,4,8 ?"PAGE 2  SPECIFIC CARD NUMBERS"
360 PUT22,4,10 ?"PAGE 3  SEQUENTIAL CARD PAGING"
400 PUT22,4,20:?"PAGE REQUIRED ? ":GET#6,Q:IFQ>51ORQ<49THEN400
420 IFQ=49THENGOSUB2100
430 IFQ=50THENGOSUB2200
440 IFQ=51THENGOSUB2400
500 GOTO340
1000 REM USER INPUT
1010 PUT#1,22,X,Y,20:GET#1,A:PUT#1,22,X,Y,CHR$(127)
1020 GET#6,B:IFB=27ANDLI=0THEN1900
1030 IFB<>26ANDB<>17ANDB<>27ANDB<32THENGOSUB1700
1040 IFB>96ANDB<123THENB=B-32
1050 IFB=26THENB=A
1060 IFB=17THENB=95
1070 PUT#1,22,X,Y,CHR$(B)
1080 IFB=0THENB=32
1090 RETURN
1100 REM CARD BORDER
1110 FORX=3TO38:PUT#1,22,X,5,129,22,X,20,129:NEXTX
1120 FORY=6TO19:PUT#1,22,2,Y,130,22,39,Y,130:NEXTY
1130 PUT#1,22,2,5,139,22,39,5,138,22,2,20,137,22,39,20,136
1140 RETURN
1200 REM STANDARD CARD INDEX
1210 PUT#1,22,3,21:?#1,"INSERT for reply space,  ";CHR$(197);" to leave"
1211 PUT#1,22,3,22:?#1,"text alone,or ESCAPE to start again."
1220 I=0:GOSUB1600:FORY=6TO19:FORX=4TO38:IFX=38THENQ=0:GOTO1290
1230 GOSUB1000:IFQ=1ANDB=95THENB=0
1240 IFQ=2ANDB<>95THENQ=0
1250 IFB<>95ANDQ=0THENT=T+1:P(T,4)=X:P(T,5)=Y:Q=1
1260 IFB=95ANDQ=0THENI=I+1:P(I,1)=X:P(I,2)=Y:Q=2
1270 IFQ=1THENT$(T)=T$(T)+CHR$(B)
1280 IFQ=2THENP(I,3)=P(I,3)+1
1290 NEXTX:NEXTY:RETURN
1300 REM INDIVIDUAL CARD INPUT
1310 PUT#1,22,3,21:?#1,"There """";CHR$(95);""" will not be printed,"
1320 PUT#1,22,3,22:?#1,"use the  ";CHR$(197);" to leave the text alone."
1329 IFFREE(1500THEN2500
1330 A$(C)="":FORR=1TO30:Z=P(R,1):Y=P(R,2):L=P(R,3)
1340 IFR>30THEN:IFP(R+1,3)=0THENRETURN
1350 FORX=Z TO Z+L-1:GOSUB1000:IFB=95THENB=32
1360 A$(C)=A$(C)+CHR$(B):NEXTX:NEXTR:RETURN
1400 REM PRINTS STANDARD CARD
1410 FORR=1TO30:IFP(R,4)<30RP(R,4)>37THENRETURN
1420 PUT#1,22,P(R,4),P(R,5):?#1,T$(R):NEXTR:RETURN
1500 REM SAVE INDEX CARDS
1510 PUT31,22,2,10:?"PRESS RECORD ON THE TAPE RECORDER THEN":PUT22,9,12
1520 ?"ANY KEY ON THE KEYBOARD"
1530 GET#6,Q:IFQ<9THEN1530
1540 PUT31,22,12,12:?"SAVING INDEX CARDS"
1550 CLOSE#99:OPENOUT#99,1,"INDEX":FORA=1TO100:?#99,A$(A)
1560 NEXTA:FORA=1TO30:?#99,T$(A):FORB=1TO5:?#99,P(A,B):NEXTB:NEXTA:CLOSE#99
1570 RETURN
1600 REM PRINTS INDIVIDUAL CARD
1610 PUT#1,22,9,6:?#1,"  ":PUT#1,22,8,6:?#1,C:IFC=0THENRETURN
1620 IFA$(C)=""THENGOSUB1800
1630 P=1:FORR=1TO30:X=P(R,1):Y=P(R,2):L=P(R,3)
1640 IFX<3ORY<3THENRETURN
1650 PUT#1,22,X,Y:?#1,MID$(A$(C),P,L)
1660 P=P+L:NEXTR:RETURN
1700 REM DELAY
1710 PUT#1,22,X,Y,CHR$(A)
1720 FORD=1TO30:GET#6,B:IFB>31ORB=26ORB=17THENRETURN
1730 IFB=27ANDLI=0THEN1900
1740 NEXTD:PUT#1,22,X,Y,CHR$(127)
1750 FORD=1TO20:GET#6,B:IFB>31ORB=26ORB=17THENRETURN
1760 IFB=27ANDLI=0THEN1900
1770 NEXTD:GOTO1700
1800 REM PRINTS EMPTY CARD
1810 P=1:FORR=1TO30:XX=P(R,1):Y=P(R,2):L=P(R,3)
1820 IFXX<3ORY<3THENRETURN
1830 FORX=XXTOXX+L-1
1840 PUT#1,22,X,Y:?#1,CHR$(95):NEXTX:NEXTR:RETURN
1900 REM LEAVES TEXT ON STREAM ONE
1910 CLEAR:OPTIONBASE1:DIMA$(100)
1920 DIMP(30,5):DIMT$(30):GOTO200
2100 REM TITLE REQUIRED
2110 PUT31,22,10,11:?"WHAT TITLE IS REQUIRED":PUT22,15,13:LINPUT(""):E$:B$=""
2120 FORA=1TOLEN(E$):T=ASC(MID$(E$,A,1)):R$=MID$(E$,A,1)
2130 IFT>96ANDT<123THENR$=CHR$(ASC(MID$(E$,A,1))-32)
2140 B$=B$+R$:NEXTA:Q=0:FORC=1TO100:IFASC(A$(C))=0THEN2160
2150 IFINSTR(A$(C),B$)>0THENGOSUB1600:GOSUB2600:GOSUB2800
2160 NEXTC
2170 GOTO2100
2200 REM CARD NUMBER
2210 PUT31,22,10,10:INPUT("CARD NUMBER REQUIRED ")C:IFC>1000RC<1THEN2210
2220 GOSUB1600:GOSUB2600:GOSUB2800:GOSUB2700:GOTO2200
2300 CLOSE#8:REM PRINTS CARD ON GP-250X
2310 OPEN#8,8,"2400":LF$=CHR$(10)
2320 FORM=6TO20:K$=""  ":FORN=4TO37:PUT#1,22,N,M,20:GET#1,Q:IFQ<32THENQ=32
2330 K$=K$+CHR$(Q):NEXTN:FORN=1TO(LEN(K$)):?#8,MID$(K$,N,1);:NEXTN
2340 ?#8,LF$:NEXTM:RETURN
2400 REM SEQUENTIAL CARDS
2410 PUT31,22,12,12:INPUT("STARTING CARD? ")K:Q=0:IFK>980RK<1THEN2410
2420 FORC=KTO100:IFASC(A$(C))>0THEN2440
2430 GOSUB1600:GOSUB2600:GOSUB2800
2440 NEXTC:IFQ=9THENGOSUB2700
2450 RETURN
2500 PUT31,22,3,10 ?"SORRY INSUFFICIENT MEMORY AVAILABLE":PUT22,2,12
2590 FORD=1TO999:NEXTD:PUT31:GOTO340
2600 REM ONLY IF TITLE PRESENT
2610 PUT#1,22,3,21 ?#1,"S to save, P to print, A to alter,"
2620 PUT#1 22,3,22 ?#1,"ESCAPE for options or SPACE BAR." RETURN
2700 PUT#1,22,1,21,30 PUT#1,22,1,22,30 RETURN
2800 REM OPTIONS
2810 GET#6,Q IFQ<9THEN2810
2820 IFQ=27THENGOSUB2700:GOTO340
2830 IFQ=37THENGOSUB2700:GOSUB1300
2840 IFQ=12THENGOSUB2300
2850 IFQ=13THENGOSUB1500
2860 RETURN
```

Screen Dump program for listing of main program.

```
60000 FORI=1TO255:CLOSE#1:NEXTI:OPEN#0,0,"L170":LIST-59999:OPEN#8,8,"2400":LF$=C
HR$(10):FORY=1TO170:FORX=1TO80:PUT22,X,1,20:GETQX:JD$=JD$+CHR$(QX):NEXTX:FORX=1T
O80:?#8,MID$(JD$,X,1);:NEXTX:?#8,LF$:FORD=1TO20:NEXTD:PUT2:JD$="":NEXTY:END
```

Card index

This program by Stephen Hall of Horndean, Hampshire allows users with no programming experience to format their own index cards. You can search through them for any word or value, and print the results of the search on a Seikosha GP-250X printer, if available.

Amendments are easily made by pressing A when the card to be altered is shown on the screen. The cursor then appears and can be moved to the area to be altered by using the Right Cursor control. Any card shown can be printed by pressing P, and the 100 index cards can be saved on cassette by pressing S. Concise instructions are given on the screen.

Renumber

This useful routine to renumber the lines of your Basic programs has been sent in by Mr A R Armitstead of Blackpool. It will not alter your Gotos and Gosubs, so you will have to trace them yourself. Programs to be renumbered should not contain any lines numbered 60000 or greater.

To use the routine merge it into the program to be renumbered, set the starting line number and step size at lines 60140 and 60150, then type Goto 60000. The routine does not renumber itself, so it can be used again.

The Newbrain stores program lines in an unusual way, using three distinct areas of memory to hold all the information needed to execute a statement. The line-number

(continued on next page)

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table, LNT, contains an entry for each Basic statement, consisting of:

- The statement line number as two bytes, low then high.
- A pointer to the compressed Basic statements as two bytes; this is the second area, the source code area.
- A pointer to the compiled version as two bytes. If the statement has not been compiled, it contains 0. This is the object code area.

The LNT is pointed to by locations IY + 30 and IY + 31, where the address of IY is stored at locations 22 and 23.

Lines 60260 to 60360 contain a routine to display the first 18 entries of the line-number table. They are not part of the renumber program and may be deleted if not required.

Renumber.

```
60000 REM Renumbers the line numbers ONL
Y- not the goto's etc.
60010 DEF FN ln(n)=PEEK(n)+256*PEEK(n+1)
60020 REM iy:=IY Z80 register.
60030 iy=FN ln(22)
60040 REM bs gives the base of the line-
number table.
60050 bs=FN ln(iy+30)
60060 REM find end of user program:-it e
nds when this renumber program is found
 at line no. 60000.
60070 i=bs+6
60080 j=0
60090 IF FN ln(i)=60000 THEN GOTO 60140
60100 j=j+1
60110 REM j holds number of lines.
60120 i=i+6
60130 GOTO 60090
60140 s=100      :REM s:=starting line no
.
60150 st=10      :REM st:=stepsize
60160 REM renumber table
60170 FOR k=1 TO j
60180 sa=FALSE   :REM sa:=samelinenumber
60190 i=bs+6*k
60200 IF FN ln(i)=FN ln(i+6) THEN sa=TRUE
        :REM catch multiple statement
 lines.
60210 POKE i,s-256*INT(s/256)
60220 POKE i+1,INT(s/256)
60230 IF NOT(sa) THEN s=s+st :REM Only a
dd st if different line number.
60240 NEXT k
60250 END
60260 REM prints out some table entries
to show structure.
60270 bs=FN ln(FN ln(22)+30)
60280 PRINT "   line no.  source code  o
bject code"
60290 PRINT TAB(16);"pointer      pointe
r"
60295 FOR i=1 TO 40:PRINT CHR$(129);:NEX
T i: PRINT
60300 FOR i=bs TO bs+18*6 STEP 6
60310 FOR j=i TO i+5
60320 PRINT PEEK(j)[4];
60330 NEXT j
60340 PRINT
60350 NEXT i
60360 END
```

Brain Man.

```
1 REM  **
2 REM  **
3 REM  ** BY RORY STAFFORD
4 REM  ** 7,1983
5 REM  **
14 REM ** SET UP FOR GAME
15 PUT31,23,72,22,3,15: PRINT "DO YOU WA
NT INSTRUCTIONS ?":CLOSE £10: OPEN £10,
6
16 GET £10,A$: IF A$="y" GOSUB 2000:GOTO
 20
17 IF ASC(A$)=0 OR A$<>"n" GOTO 16
18 GOSUB 2210
20 PUT 31: SC=0: SF=10: E(1)=1106: E(2)=
1496
30 E(3)=1112: E(4)=1490: FR=1:CH=98: RAN
DOMIZE
49 REM ** START GAME
50 GOSUB 600
56 IF R<>2 THEN PUT 22,6,19: PRINT SC+SF
60 GOSUB 100
80 GOTO 56
99 REM ** PLAYER MOVEMENT GET
100 GET £10,M$: IF ASC(M$)=0 THEN 160
120 IF M$="n" THEN D=-1
130 IF M$="m" THEN D=1
140 IF M$="a" THEN D=-64
150 IF M$="z" THEN D=64
159 REM ** PLAYER MOVEMENT CONTROL
160 FG=PP+D: IF PEEK(FG)=128 THEN D=0
170 IF PEEK(FG)=109 THEN SF=SF+10
180 IF PEEK(FG)=110 THEN SF=SF+10: CALL
62383
190 IF PEEK(FG)=115 THEN 1000
195 IF CH=98 THEN CH=106: GOTO 200
196 CH=98
200 IF PEEK(PP+D)=243 GOSUB 760: GOTO 10
0
210 POKE PP,32: PP=PP+D: POKE PP,CH
220 IF PP=1295 THEN POKE PP,32: PP=1306:
 IF PEEK(PP)=109 THEN SF=SF+10: GOTO 23
0
225 IF PP=1307 THEN POKE PP,32: PP=1296:
 IF PEEK(PP)=109 THEN SF=SF+10
230 IF SF>=800 AND PP=1296 OR SF>=800 AN
D PP=1306 THEN FR=FR+1: SC=SC+SF: SF=10
:GOSUB 600
239 REM ** MONSTER MOVEMENT
240 CALL 62399,M: IF M<5*50 THEN 369
249 REM ** NOT ENERGIZED
250 PC=115: MM=DM
260 IF PP<PM-8 THEN DM=-64: GOTO 300
270 IF PP>PM+8 THEN DM=64: GOTO 300
280 IF PP<PM THEN DM=-1
290 IF PP>PM THEN DM=1
300 IF PEEK(DM+PM)<>128 THEN 350
310 IF PEEK(MM+PM)<>128 THEN DM=MM: GOTO
 350
320 IF ABS(DM)=64 THEN DM=SGN(RND-.5): G
OTO 340
330 IF ABS(DM)=1 THEN DM=SGN(RND-.5)*64
340 MM=DM: GOTO 300
349 REM ** MOVE MONSTER
350 IF PEEK(PM+DM)=CH THEN 1000
360 GOTO 580
369 REM ** ENERGIZED
370 PC=243: IF GG<>1 THEN MM=DM*-1: GG=1
375 MM=DM
380 IF PP<PM-8 THEN DM=64: GOTO 420
390 IF PP>PM+8 THEN DM=-64: GOTO 420
400 IF PP<PM THEN DM=1
410 IF PP>PM THEN DM=-1
420 IF PEEK(DM+PM)<>128 THEN 450
430 IF PEEK(MM+PM)<>128 THEN DM=MM: GOTO
 450
440 IF ABS(DM)=64 THEN DM=SGN(RND-.5): G
OTO 446
445 IF ABS(DM)=1 THEN DM=SGN(RND-.5)*64
446 MM=DM: GOTO 420
449 REM ** MOVE MONSTER
450 IF PEEK(PM+DM)=CH GOSUB 750: GOTO 10
0
580 IF PM+DM=1295 THEN POKE PM,DW: GOTO
590
585 IF PM+DM=1307 THEN POKE PM,DW:PM=129
5
590 POKE PM,DW: PM=PM+DM: DW=PEEK(PM): P
OKE PM,PC
595 RETURN
597 REM ** DRAW MAZE ROUTINE
598 REM ** WHEN TYPING IN USE AN INVERSE
599 REM ** SPACE INSTEAD OF EACH S.
600 IF FR>1 THEN GOSUB 2300
603 IF FR=5 THEN 800
605 PUT 31,22,1,5
610 PRINT TAB(14); "SSSSSSSSSSSS"
620 PRINT TAB(14); "SmmmmmmmmmS"
630 PRINT TAB(14); "SmSSSSmSSSSmS"
640 PRINT TAB(14); "SmSmmmmmmmSmS"
650 PRINT TAB(14); "SmSmSSmSSmSmS"
660 PRINT TAB(14); "SmSmSmmmSmSmS"
670 PRINT TAB(14); " mmmmmSmmmm "
675 PRINT TAB(14); "SmSmSmmmSmSmS"
680 PRINT TAB(14); "SmSmSSmSSmSmS"
685 PRINT TAB(14); "SmSmmmmmmmSmS"
690 PRINT TAB(14); "SmSSSSmSSSSmS"
693 PRINT TAB(14); "SmmmmmmmmmmS"
695 PRINT TAB(14); "SSSSSSSSSSSS"
700 D=0: PP=1621: PM=1301: DW=128: POKE
PM,115: POKE PP,CH: MK=0
710 FOR T=0 TO 5-FR
720 POKE E(T),110
730 NEXT T
735 PUT 22,1,19: PRINT "SCORE";SC+SF;TAB
(12);"FRAME";FR;"HI-SCORE";HS:PRINT "PR
ESS ANY KEY"
736 GET £10,L: IF L=0 THEN 736
740 PUT 22,1,20: PRINT "                ";
 RETURN
749 REM ** CATCH MONSTER
750 POKE PM,DW: H=PM+DM: IF DW=109 THEN
SF=SF+10
755 POKE H,170: GOTO 770
760 H=PP+D: POKE PP,32: IF PEEK(H)=109 T
HEN SF=SF+10
765 POKE H,170
770 FOR T=1 TO 75: NEXT T: POKE H,32
775 SC=SC+100
780 PP=PP+D: PW=128: PM=1301: MK=MK+1: D
M=64: RETURN
799 REM ** WIN
800 FOR T=1 TO 200: NEXT T
810 PUT 31,22,1,14
820 PRINT "YOU HAVE CLEARED ALL THE FRAM
ES"
830 PRINT "YOU SCORED ";SC
840 GOTO 1040
1000 POKE PM,32: FOR T=136 TO 141: POKE
PP,T: FOR TT=1 TO 70: NEXT TT: NEXT T:
POKE PP,32: FOR T=1 TO 200: NEXT T
1010 PUT 31,22,1,14
1020 PRINT "YOU HAVE BEEN KILLED,"
1030 PRINT "YOU SCORED ";SC+SF
1040 IF SC+SF>HS THEN PRINT: PRINT "YOU
GOT THE HIGH SCORE!!": HS=SC+SF
1050 PRINT: PRINT "PLAY AGAIN?": GET £10
,U
1055 GET £10,A$: IF ASC(A$)=0 THEN 1055
1060 IF A$="n" THEN 1070
1065 IF A$="y" THEN 20
1066 GOTO 1055
1070 PUT 31,22,1,14: PRINT"          GOOD-
BYE"
1080 CLOSE £10: END
```

Brain-Man

A version of the popular Pacman game is provided by Rory Stafford. The maze has been simplified, and only one monster is used, but the game is very fast.

The program uses character set 3. Line 15 sets it with the statement

PUT 31,23,72

The Call at line 180 resets the system clock to zero if a power pill is eaten, and line 240 reads the value of the clock so the monster runs away during the following five seconds. This line could be changed to make the game easier to play. Lines 610 to 695 print the maze. The character listed as S should be typed as an inverse space, ASCII 128, by pressing Graphics-=.

```
1999 REM ** INSTRUCTIONS
2000 PUT 31
2010 PRINT "            NEWBRAIN PAC-MAN"
2020 PRINT "            BY RORY STAFFORD"
2030 PRINT
2040 PRINT "YOU MUST MOVE THROUGH THE MA
ZE EATING"
2050 PRINT "THEM 'm'S WHILE AVOIDING THE
 MAN-EATING"
2060 PRINT "MONSTER.HE IS REPRESENTED BY
 AN 's' WHEN"
2070 PRINT "YOU EAT AN 'n' YOU HAVE THE
POWER TO EAT"
2080 PRINT "THE MONSTER FOR A SHORT WHIL
E."
2100 PRINT "YOUR CHARACTER IS A FOUR-LEG
GED BEING"
2110 PRINT "WHO YOU CONTROL BY THE FOLLO
WING KEYS,"
2120 PRINT: PRINT "N         FOR LEFT,"
2130 PRINT "M         FOR RIGHT,"
2140 PRINT "Z         FOR DOWN,"
2150 PRINT "A         FOR UP."
2160 PRINT
2170 PRINT "YOU HAVE A CHOICE OF TWO LEV
ELS OF PLAY."
2180 PRINT "2 BEING VERY HECTIC"
2190 PRINT "WHEN YOU HAVE EATEN ALL THE
DOUGHNUTS"
2200 PRINT "YOU MUST GET TO AN EXIT. YOU
 THEN GET A"
2201 PRINT "BONUS FOR EVERY MONSTER YOU
CAUGHT."
2210 PRINT: PRINT "NOW CHOOSE YOUR LEVEL
 1/2 "
2220 GET £10,R$: IF R$<> "1" AND R$<> "2
" GOTO 2220
2230 R = VAL(R$): RETURN
2299 REM ** CLEAR FRAME BONUS
2300 PUT 31,22,1,16: PRINT "
          ": CB=1602
2350 FOR T=CB TO CB+10+MK: POKE T,CH:FOR
 TT=1 TO 70: NEXT TT
2360 IF CH=98 THEN CH=106: GOTO 2380
2370 CH=98
2380 POKE T,32: NEXT T
2390 PUT 22,1,17: PRINT "BONUS";MK*100:
SC=SC+MK*100
2400 FOR T=1 TO 300: NEXT T: RETURN
```

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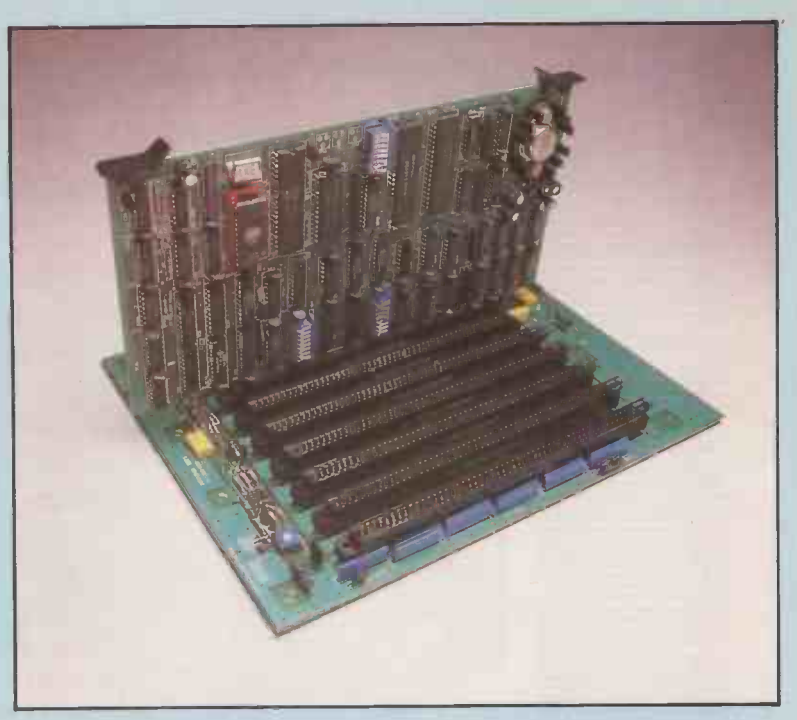

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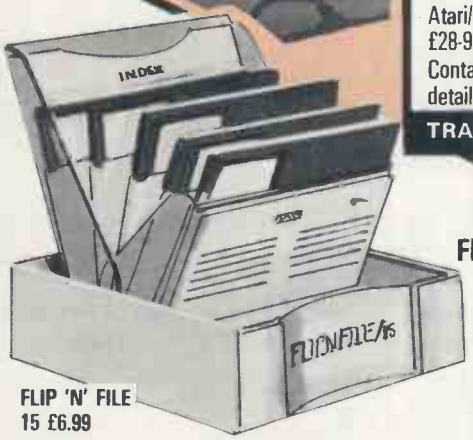

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Hidden lines

Short and Sharp

For too long the Sharps seem to have existed in the shadow of other machines. First it was the Pets, Apples and Tandys; now it is the BBC and Sinclair machines. But perhaps the blame lies with us, the owners and users. Rather than pester the computer press with queries, articles, hints, tips and programs we have resigned ourselves to a second-rate existence in which we tell each other what wonderful micros the Sharps are, and how foolish the rest of the world is not to realise what it is missing. So now is your chance — let the contributions roll.

I have just one plea to make, and that is for brevity. Each Open File section will be at most two magazine pages long. It is very difficult to accept any contribution of more than three pages of double-spaced A4 typescript or 120 lines of listing. Material for Open File should be short and snappy. For tips and hints listings can be open and easy to follow, but for games and other programs where the result is more important than the ideas and techniques illustrated they should be as densely packed as possible.

The null-input problem

It is perhaps best to employ input routines using the Get command, and best of all to do it in machine code. There is still a place for the humble Input, the trouble is that it is difficult to cope with a null input. If some careless and heavy-fingered user presses Return without entering anything else first, Basic kindly starts a new line with a question mark and waits for a fresh input, which makes an awful mess of a neatly formatted screen.

What is required is something the Input routine will pick up even if nothing but Return has been pressed. Moreover, if that something is unusual and distinctive, then the rest of the program can check for its existence and take whatever remedial action may be necessary.

How is this to be done? The first idea that comes to mind is to Print a special character immediately after the input prompt, then cursor left, and then to use Input "" to suppress the question mark and leave the cursor sitting on the character. For example:

```
PRINT "PROMPT:-*(cursor-left)";
  :INPUT"";A$
```

but unfortunately this does not work; the Input routine is not fooled.

IN MOST MICROS, including the MZ-80 series, each line is stored in memory in a four-part format. It begins wih a link identifying the next line's start, and is followed by the line number, the content of the line itself and the end-of-line marker, which is 0Dhex for the Sharps.

For the Sharp PC-1500 hand-held computer the format is slightly different. Each line starts with the line number, which occupies two bytes, followed by a single-bye relative link giving the length of the line's content, including the end-of-line marker. Then there is the line content and the end-of-line marker itself.

During editing the relative link tells the editor how many of the next few bytes belong to the current line, and should be prepared for display. During operation it tells the interpreter where to jump to find the next line when executing a Goto or Gosub if the current line has the wrong label or line number.

What is of interest about this is that the editor and interpreter work in rather different ways when actually reading a line. The interpreter scans and executes each line up to the end-of-line marker, Gotos, and so on excepted, and then automatically carries on, assuming the next byte is the start of the next line.

The editor, however, displays the line up to the end-of-line marker, beyond which the cursor cannot be moved, and uses the link to find the start of the subsequent line. One or more lines can be hidden from the editor, and thus from anyone Listing the program, even though it will run quite happily. This can be arranged by the simple expedient of Poking into memory a value for the previous line's link that points not to the line's own end-of-line marker but to that of the line to be hidden.

The listing shows a simple look-at-memory program before it has been nobbled in this way. Assuming no other program is in memory, line 10 starts at locations 16581/2 with the high/low byte of the line number, and 16583 holds 31, the number of bytes up to and including the end-of-line marker, which is at 16614. Line 15 begins at 16615, and 16617 holds 15, the number of bytes up to its end-of-line marker at 16632. The total number of bytes from the line 10 link at 16583 up to the line 15 end-of-line marker at 16632 is 49. If 49 is Poked into 15583, line 15 apparently disappears. If some unscruplous person deletes line 10, then line 15 actually dissappears and the program does not run properly any more.

"Look-at-memory" program.

```
10:REM  MYPROG <C
   > FRED BLOGGS
   1983
15:MS=16851:WAIT
   :TEXT
20:FOR A=0TO 1000
   :ML=MS+A:P=
   PEEK ML
30:PRINT P;"  ";M
   L;"  ";CHR$ P;
   "  ";:CURSOR 0
40:NEXT A
50:PRINT "THE END
   ":END
```

The next idea involves Printing a new line of cursor-rights over the input prompt, ending up on the character:

```
PRINT "PROMPT:-*":PRINT"(cursor-up;
  nine cursor-rights)";: INPUT "";A$
```

which does work, but is rather laborious in a general input routine designed to handle any input anywhere on the screen. And maybe the user will not want confusing characters at the start of each input field.

But these two objections can be dealt with. First, the X,Y co-ordinates of the position on the screen of the beginning of the input field can be found by Peeking 4465 and 4466 just before the Input statement. The top line and the left-most column are zero. These co-ordinates enable the special character to be Printed — or, preferabley, Poked — into that position. Rather oddly the character with the display code 240, which appears to be a space, is not a space at all so far as the input routine is concerned. Instead, it is ASCII character 197 — the left-most line character with the display code 113. So, if it is Poked into place at the start of the input field, and not overwritten by any key press, it is picked up as the input. The form is:

```
PRINT "PROMPT:- ";:POKE
  53248+PEEK(4465)+40*PEEK(4466),
  240:INPUT "";A$
```

where 53248 is the start of the screen memory. This provides both a user-invisible first line of defence against the careless key presser and the means, via a check for the input having the ASCII Code 197, to initiate remedial action. Do not forget to Poke 10167,1 to remove the Peek protect.

Graph plotter

```
1 'THIS IS JONGRAF/001 V4  STARTED
17.12.81 AS A MOBILE GRAPH, I.E. TO
SHOW GRAPH OF UNLIMITED NUMBERS OF
DATA
4
DATA1,2,3,4,5,6,8,9,12,15,19,23,20,19,2
0,21,22,23,26,28,30,35,36,37,37,37,36,3
5,34,32,30,28,27,26,25,24,23,21,19,17,1
5,14,14,15,16,17,19,21,24,27,31,35,40,4
4
5
DATA43,43,42,42,42,41,41,41,41,40,40,39
,39,38,38,37,36,35,35,34,34,34,34,33,33
,33,33,32,31,30,31,32,33,35,37,40,41,42
,44,43,42,40,41,39,40,41
6
DATA41,42,41,43,42,41,40,39,39,38,37,37
,37,37,36,35,35,34,33,33,32,32,31,31,30
,29,29,28,27,26,25,25,24,23,22,22,23,22
,22,23,23,24,24,26,25,26,24
7
DATA24,23,22,21,19,18,17,16,15,14,13,12
,11,11,10,10,10,9,9,9,9,8,8,8,8,8,7,7,7
,7,7,7,6,6,6,6,6,6,6,6,5,5,5,5,5,5,5,5,6,
7,8,9,10,11,12,13,14,12,13,11,11,11,11,
11,11,11,12,13,14,15,16,16,17,17,17,17,
17,17,18,18,18,19
8
DATA19,19,18,18,18,17,17,17,16,17,17,17
,18,18,19,19,20,20,20,20,20,21,21,21,21
,21,21,22,22,22,22,22,22,22,22,22,22,22
,23,23,23,0


10 CLS:CLEAR 500:DIMD(500)
30
GR$=CHR$(176):G2$=CHR$(184):G3$=GR$+GR$
+GR$+G2$:
50
G4$=GR$+GR$+GR$+GR$+G2$:G5$=G4$+G4$+G4$
+G4$+G4$:
70 '**********   LINES 50 TO 90 DRAW
THE VERTICAL AXIS
90
PRINT@960,CHR$(181);:PRINT@896,CHR$(149
);:PRINT@832,CHR$(149);:PRINT@768,CHR$(
157);:PRINT@704,CHR$(149);:PRINT@640,CH
R$(149);:PRINT@576,CHR$(151);:


110
PRINT@512,CHR$(149);:PRINT@448,CHR$(149
);:PRINT@384,CHR$(149);:PRINT@320,CHR$(
181);:PRINT@256,CHR$(149);:PRINT@192,CH
R$(149);:PRINT@128,CHR$(157);:


130
PRINT@64,CHR$(149);:PRINT@0,CHR$(149);:

150 '**********  LINES 130 TO 170
PRINT THE NUMBERS ON VERTICAL AND
HORIZONTAL AXES
170
PRINT@769,"10";:PRINT@577,"20";:PRINT@3
85,"30";:PRINT@129,"40";:


190
PRINT@900,"10";:PRINT@905,"20";:PRINT@9
10,"30";:PRINT@915,"40";:PRINT@920,"50"
;:PRINT@925,"60";:PRINT@930,"70";:PRINT
@935,"80";:
210
PRINT@940,"90";:PRINT@944,"100";:PRINT@
949,"110";:PRINT@954,"120";:
230 ' ***********  LINES 50 TO 52
PRINT THE HORIZONTAL AXIS


250 PRINT@961,G3$+G5$+G5$+G3$;
270 READ D(X):IF D(X)=0 THEN 290 ELSE
D(X)=D(X)+3:X=X+1:GOTO 270'
d(x)-d(x)+3 - this is to get the 'dot'
into the correct position on the graph
290 X=0:Z=0
310 IF X=128 THEN X1=X1+1:GOTO 370
330 SET(X,(51-D(Z)))
350 X=X+1:Z=Z+1: IF D(Z)=0 THEN 510
ELSE 310
370 I$=INKEY$:IF I$="" THEN 370:
390 X=0
430 RESET (X,51-D(Z-128)):IF D(Z)=0
THEN 530 ELSE SET(X,51-D(Z)):Z=Z+1
470 X=X+1:IF X)127 THEN 490  ELSE 430
490 X1=X1+1:GOTO 370
530 Z=Z-1:FOR A=X-1 TO
127:RESET(A,51-D(Z-128)):Z=Z+1:NEXT
550 FOR X=1 TO 4:FOR Y=1 TO 100
570 PRINT@31,"End";
590 NEXT Y
610 PRINT@31,STRING$(3,32);:NEXT X
630 PRINT@31,"End";
650 GOTO 650
60023 CLOSE:CLS:PRINT@470,"G O O D    B
Y E ":SAVE"JONGRAF/001:1":END
```

AN ALMOST unlimited number of points can be plotted as a simple line graph using this program. The data can be filed on either tape or disc or in Data program lines, and the number of items of data can be almost unlimited. When the program is run it first draws the X and Y axes with appropriate markers followed by the first 128 items of data. When you press the space bar, the next 128 items of data are drawn and the previous line is erased. Successive sections of the graph will thus be drawn until all the items of data are exhausted. The end of the data in the program is indicated by a zero.

Lines 4 to 8 contain a specimen set of data and have no other significance. Your own data is entered here or elsewhere if you are using Data program lines. The data is actually read in line 270 as a variable D(X). If necessary you could insert a file opening and reading routine.

Code Breaker

Keith Blount of Northampton has sent in a program which he calls Code Breaker. It is a logical puzzle very much after the style of the well known Mastermind game. Mr Blount tells us very little about the rules as instructions are included in the program. Part of the puzzle is to decide how the rules work: don't be put off, just use your head to work it out.

```
1 '**********..CODE BREAKER BY KEITH
BLOUNT 15/08/83
2 '*****...INITIALIZE
3
CLS:CLEAR100:RANDOM:DEFSTRA-F:DEFINTG-Z
:V=207
4 '
5 '*************.....,SET UP SCREEN
6 '
7
PRINTSTRING$(64,143);:PRINTTAB(45)"CODE
 BREAKER":PRINTTAB(6)"ROUND
";:FORX=0TO3:PRINTCHR$(143)"
";:NEXT:PRINT"
RESULT"CHR$(201)"Select 4
digits":PRINTTAB(42)CHR$(34)CHR$(93)"
"CHR$(94)CHR$(34)"Moves cursor
8 PRINTTAB(42)CHR$(34)"ENTER"CHR$(34)"
for result":PRINT@429,"RESULT
CODE":PRINTTAB(42)"* = Correct
digit":PRINTTAB(46)"correct
position":PRINTTAB(42)"£ = Correct
digit":PRINTTAB(46)"Wrong
position":PRINTTAB(42)". = Wrong digit
9
PRINTSTRING$(64,143):PRINTSTRING$(64,18
8);:Y=199:FORX=1TO9:PRINT@Y,X;:Y=Y+64:
NEXT:FORY=0TO42:SET(0,Y):SET(127,Y):IFY
(36:SET(80,Y)
10 '


11 '****...SELECT 4 RANDOM NOS.
12 '
13
NEXT:FORX=0TO3:F(X)=RIGHT$(STR$((RND(10
)-1)),1):NEXT
14 '


15 '****...SET VARS.FOR MAIN ROUTINE
16 '.
17 FORX=0TO3:E(X)=F(X):D(X)="
":U(X)=V:V=V+2:NEXT:Z=0:V=V+4
18 '


19 '****...SCAN KEYS AND FLASH CURSOR
20 '
21
A=INKEY$:IFA="":Y=Y+1:IFY(87THEN21ELSEPR
INT@U(Z),D(Z);
22
IFA="":A=INKEY$:Y=Y+1:IFY(327THEN22ELSEP
RINT@U(Z),CHR$(140);
23 '


24 '***.... SET PROMPT MESSAGE AND
TEST FOR "ENTER"
25 '
26 Y=0:FORX=0TO3:Y=Y-(D(X)="
"):NEXT:IFY=0:PRINT@842,"Press
"CHR$(34)"ENTER"CHR$(34)" to have this
round
decoded";:IFA=CHR$(13)GOSUB44:GOTO35
27 '


28 '****....TEST FOR AND ACTION INPUT
29 '
30
IFA=""THEN21ELSEIFASC(A)=9ANDZ=(2:GOSUB
44:Z=Z+1ELSEIFASC(A)=8ANDZ)=1THENGOSUB4
4:Z=Z-1ELSEIFA("0"ORA)"9"THEN21ELSED(Z)
=A:PRINT@U(Z),A;:IFZ=(2THENZ=Z+1
31 GOTO21
32 '


33 '****....DECODE AND TEST FOR SUCESS
OR FAILURE
34 '
35
F=0:FORX=0TO3:IFD(X)=E(X)THENF=F+1"*
":D(X)=" ":E(X)=0
36
NEXTX:FORY=0TO3:FORX=0TO3:IFD(Y)=E(X)TH
ENF=F+1"£ ":D(Y)=" ":E(X)=0
37 NEXTX:NEXTY:PRINT@V,LEFT$(F+". . .
.",8);:V=V+52:PRINT@842,STRING$(40,32);
:T=T+1:IFMID$(F$,7,1)="*"THEN41ELSEIFT=
9THEN43ELSE17
38 '


39 '****....DISPLAY SUCESS OR FAILURE
- WAIT TO RESTART GAME
40 '
41 PRINT@834,"*** YOU WIN WELL DONE
***   * Press any key to start again
*";
42 A=INKEY$:IFA=""THEN42ELSE4
43 PRINT@834,"The code was  "F(0)"
"F(1)" "F(2)" "F(3)"   ** (Press any
key to restart)";:GOTO42
44 PRINT@U(Z),D(Z);:RETURN
```

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Shoot-out

A SMALL joystick-controlled aiming game with dodging targets approaching over a scrolled mountain terrain has been submitted by Mr D Turnbull of Vaud in Switzerland. He displays his sense of humour not least in placing the movement and firing controls on different joysticks; some of its other aspects become apparent later in the game. There is a curious symbolism in denoting the good guy by a > character and the victims as <, which rather indicates from the start who is likely to get the better of the scrap.

On line 8 a literal \ is coded. It is entered by typing:

8 DS$ = "Ctrl-x

at which point the line is terminated by pressing Return. To get the final quote, Esc-I, copy to the end of line and add the last character. A simpler alternative is to code:

8 DS$ = CHR$(92)

instead. I have been puzzling for far longer than is reasonable about what causes the first option to work at all.

The sound routine in lines 4 and 5 is a standard Poke pitch, Poke duration, Call format, the addresses being held as Pi, Du and No.

```
1  GOSUB 86
2  TEXT : SPEED= 255
3 SJ$ = "
                    "
4  FOR I = 768 TO 781: READ J: POKE
     I,J: NEXT I:NO = 768:PI = 77
     1:DU = 769
5  DATA  160,255,162,160,202,208,
     253,173,48,192,136,208,245,9
     6
6  POKE  - 16368,0
7  PRINT
8 DS$ = "\"
9 A$ = "            /" + DS$ + "
                      /" + DS$ +
     "      "
10 B$ = "   /" + DS$ + "     /  " +
     DS$ + "           /" + DS$ +
     "    /  " + DS$ + "      "
11 C$ = "  /   " + DS$ + "/" + DS$
     + "/    /" + DS$ + " /" + D
     S$ + "      /  " + DS$ + "/"
     + DS$ + "/     " + DS$ + "
     "
12 D$ = " /     " + DS$ + " " + DS
     $ + "   /  " + DS$ + "  " +
     DS$ + "   /" + DS$ + "    / /
     " + DS$ + "    "
13  HOME : VTAB 2: HTAB 5: PRINT
     " @@@@ @   @  @@@   @@@  @@@
     @@          @      @   @ @
     @ @   @   @                @@
     @@ @@@@@ @   @ @   @   @
                @ @   @ @   @ @
        @   @              @@@@@ @
        @  @@@@  @@@@   @ "
14  PRINT : HTAB 11: PRINT " @@@
     @   @ @@@@@
           @   @ @   @   @
                     @   @ @
     @   @
       @   @ @   @   @
                   @@@@  @@@@
     @"
15  PRINT : HTAB 10: PRINT "DAVID
     TURNBULL - 1983"
16  PRINT : HTAB 15: PRINT "PRESS
     A KEY"
17  VTAB 18: PRINT A$;B$;C$;D$
18 ZE = ZE + 1: IF ZE = 52 THEN Z
     E = 1: RESTORE : FOR J = 1 TO
     14: READ D: NEXT
19  READ J: IF J = 200 THEN  FOR
     I = 1 TO 500: NEXT : GOTO 21

20 J = J * 2.95: POKE PI,J: POKE
     DU,255: CALL NO
21  IF  PEEK (-16384) < 128 THEN
     18
22  POKE  - 16368,0
23  HOME :SH$ = "----------------
     ----------------------"
24  VTAB 1: PRINT "
                SCORE:00000"
25  VTAB 3: PRINT SH$: VTAB 22: PRINT
     SH$
26  VTAB 23: PRINT "  SHOOT-OUT
          D.TURNBULL - 1983"
27 X = 12:OX = 12
28  IF SO < 6 AND  RND (1) * 10 >
     = 8 THEN  GOSUB 49
29  IF SO = 0 THEN 37
30  FOR I = 1 TO SO:OX(I) = NX(I)
     :OY(I) = NY(I): NEXT
31  FOR I = 1 TO SO:NY(I) = NY(I)
     - 2: IF NY(I) < 3 THEN  GOSUB
     51
32  NEXT
33  FOR I = 1 TO SO
34 NX(I) = NX(I) +  INT ( RND (1)
     * 3 - 1)
35  IF  SCRN( NY(I),2 * (NX(I) -
     1)) + 16 *  SCRN( NY(I) - 1,
     2 * (NX(I) - 1) + 1) <  > 16
     0 THEN NX(I) = OX(I): GOTO 3
     4
36  NEXT
37  VTAB 18: PRINT A$;B$;C$;D$
38  IF SO > 0 THEN  FOR I = 1 TO
     SO: VTAB OX(I): HTAB OY(I): PRINT

     "  ": VTAB NX(I): HTAB NY(I)
     : INVERSE : PRINT "<": NORMAL
     : NEXT
39  IF N$ = "K" THEN  GOSUB 106
40  IF N$ = "J" THEN  GOSUB 114
41 A$ =  MID$ (A$,2) +  LEFT$ (A$
     ,1)
42 B$ =  MID$ (B$,2) +  LEFT$ (B$
     ,1)
43 C$ =  MID$ (C$,2) +  LEFT$ (C$
     ,1)
44 D$ =  MID$ (D$,2) +  LEFT$ (D$
     ,1)
45  IF SC < 0 THEN SC = 0
46  VTAB 1: HTAB 38: PRINT "  "
47  VTAB 1: HTAB 37 - (SC > 10) -
     (SC > 100) - (SC > 1000) - (
     SC > 10000): PRINT SC
48  GOTO 28
49 SO = SO + 1:NX(SO) =  INT ( RND
     (1) * 14 + 4):NY(SO) = 35
50  RETURN
51  VTAB OX(1): HTAB OY(1): PRINT
     " "
52  IF NX(1) = X THEN 69
53 SC = SC - 50
54  FOR T = 1 TO SO - 1:NX(T) = N
     X(T + 1):NY(T) = NY(T + 1):O
     X(T) = OX(T + 1):OY(T) = OY(
     T + 1): NEXT :SO = SO - 1: RETURN


55  FOR I = 1 TO 100 STEP 5: POKE
     PI,I: POKE DU,3: CALL NO: NEXT

56 SC = SC - 10
57  IF SO = 0 THEN  RETURN
58  FOR I = 1 TO SO: IF NX(I) = X
     THEN 62
59  NEXT
60  VTAB X: HTAB 2: PRINT  MID$ (
     SH$,1,38): VTAB X: HTAB 2: PRINT
     MID$ (SJ$,1,38)
61  RETURN
62  VTAB X: HTAB 2: PRINT  MID$ (
     SH$,1,NY(I) - 2): VTAB X: HTAB
     2: PRINT  MID$ (SJ$,1,NY(I) -
     2)
63  FOR J = 1 TO 25: POKE PI, RND
     (1) * 43: POKE DU,3: CALL NO
     : NEXT
64  VTAB NX(I): HTAB NY(I): PRINT
     "  "
65  FOR J = I TO SO - 1:NX(J) = N
     X(J + 1):NY(J) = NY(J + 1):O
     X(J) = OX(J + 1):OY(J) = OY(
     J + 1): NEXT J
66 SC = SC + 100
67 SO = SO - 1
68  RETURN
69  HOME : GOSUB 80
70  PRINT "          @@@    @   @
       @ @@@@@              @
       @  @ @  @@ @@ @
                @     @@@@@ @ @ @
     @@@@                 @ @@@
     @   @ @   @ @
           @@@  @   @ @   @ @@@@
     @"
71  PRINT : PRINT "          @@@
     @   @ @@@@@ @@@@
           @   @ @   @ @     @
     @                 @   @ @
     @ @@@@  @@@@
       @   @  @ @  @     @ @
                   @@@    @   @@
     @@@ @   @"
72  FOR I = 250 TO 1 STEP  - 5: POKE
     PI,I: POKE DU,10: CALL NO: NEXT
73  PRINT : PRINT : PRINT "  WE R
     EGRET THE SLIGHT ACCIDENT YO
     U                EXPERIENCED
     ..."
74  FOR I = 250 TO 1 STEP  - 5: POKE
     PI,I: POKE DU,20: CALL NO: NEXT

75  PRINT : PRINT "  CONSOLATIONS
      WILL BE SENT TO YOUR
              FAMILY."
76  FOR I = 250 TO 1 STEP  - 5: POKE
     PI,I: POKE DU,30: CALL NO: NEXT

77  PRINT : PRINT "   YOUR SCORE
     MIGHT HAVE BEEN "( INT ( RND
     (1) * 10000) + 1): PRINT "
              IT WAS   "SC
78  FOR I = 250 TO 1 STEP  - 5: POKE
     PI,I: POKE DU,40: CALL NO: NEXT

79  RESTORE : GOTO 2
80  POKE PI,240: POKE DU,255: FOR
     I = 1 TO 4: CALL NO: FOR J =
     1 TO 100: NEXT J,I
81  POKE PI,204: POKE DU,255: CALL
     NO: FOR J = 1 TO 100: NEXT :
      POKE PI,216: POKE DU,255: FOR
     I = 1 TO 2: CALL NO: FOR J =
     1 TO 100: NEXT J,I
82  POKE DU,255: POKE PI,240: FOR
     I = 1 TO 2: CALL NO: FOR J =
     1 TO 100: NEXT J,I
83  POKE DU,255: POKE PI,255: CALL
     NO: FOR J = 1 TO 100: NEXT :
      POKE PI,240: POKE DU,255: CALL
     NO
84  RETURN
85  DATA   54,54,54,200,54,57,64,
     57,54,48,72,43,43,43,200,43,
     48,54,48,43,40,43,40,36,43,4
     8,54,32,36,40,43,40,43,48,54
     ,48,54,57,64,57,64,72,80,86,
     80,76,72,200,72,64,57
86  TEXT : HOME : VTAB 1: HTAB 15
     : PRINT "SHOOT - OUT"
87  PRINT : PRINT "   YOU ARE THE
      PILOT OF A SMALL"
88  PRINT : PRINT "RECONAISSANCE
     CRAFT FLYING OVER THE
89  PRINT : PRINT "MOUNTAINOUS MO
     ON OF LUF IN THE OBSCURE
90  PRINT : PRINT "KULY GALAXY.SU
     DDENLY,HOSILE ORKANS FLY
91  PRINT : PRINT "ONTO THE SCENE
      AND ADOPT A HYPNOTIC
92  PRINT : PRINT "DANCE TO TRY T
     O HYPNOTISE YOU.YOUR ONLY
93  PRINT : PRINT "CHANCE IS TO S
     HOOT THEM BEFORE THEY
94  PRINT : PRINT "REACH THE OTHE
     R SIDE OF THE SCREEN.THIS
95  PRINT : PRINT "COSTS YOU 50 P
     OINTS,A SHOT TEN.IF YOU
96  PRINT : PRINT "SCORE A DIRECT
      HIT ON ONE OF THE SHIPS.."
97  PRINT : PRINT "              PL
     EASE HIT A KEY";: GET A$
98  PRINT : PRINT
99  PRINT : PRINT "YOU SCORE 100
     POINTS.USE <- AND -> TO
100  PRINT : PRINT "MOVE YOUR SHI
     P UP AND DOWN AND SPACE
101  PRINT : PRINT "BAR TO FIRE A
      PROTON TORPEDO.
102  PRINT : PRINT "
          GOOD LUCK!"
103  PRINT : PRINT "   PRESS K FO
     R KEYBOARD CONTROL AND
              J FOR JOYSTICKS ";: GET
     N$
104  IF N$ <  > "J" AND N$ <  > "
     K" THEN 86
105  RETURN
106  IF  PEEK ( - 16384) = 136 THEN
     X = X - 1
107  IF  PEEK ( - 16384) = 149 THEN
     X = X + 1
108  IF  SCRN( 0,2 * (X - 1)) + 1
     6 *  SCRN( 0,2 * (X - 1) + 1
     ) <  > 160 AND  SCRN( 0,2 *
     (X - 1)) + 16 *  SCRN( 0,2 *
     (X - 1) + 1) <  > 190 THEN 6
     9
109  HTAB 1: VTAB OX: PRINT " "
110  VTAB X: HTAB 1: PRINT ">"
111 OX = X
112  IF  PEEK ( - 16384) = 160 THEN
      GOSUB 55
113  RETURN
114  HTAB 1: VTAB X: PRINT " "
115  IF  PDL (1) < 20 THEN X = X -
```

(continued on next page)

(continued from previous page)

```
      1
 116  IF  PDL (1) > 235 THEN X = X
       + 1
 117  HTAB 1: VTAB 0X: PRINT " "
 118  IF  SCRN( 0,2 * (X - 1)) + 1
      6 *  SCRN( 0,2 * (X - 1) + 1
      ) <  > 160 AND  SCRN( 0,2 *
      (X - 1)) + 16 *  SCRN( 0,2 *
      (X - 1) + 1) <  > 190 THEN 6
      9
 119  VTAB X: HTAB 1: PRINT ">"
 120 0X = X
 121  IF  PEEK ( - 16287) > 127 THEN
       GOSUB 55
 122  RETURN
 123  REM
 124  REM   ****
 125  REM  *       HOOT
 126  REM   ***
 127  REM    ***
 128  REM  **** * UT
 129  REM   *   *
 130  REM   *   *
 131  REM    ***
```

Low-resolution screen formatter

Basic programs frequently carry screen-loads of instructions about with them as embedded code, using up memory while the program is resident and requiring effort to code up in the first place. A screen formatter from John Cayley of Durham lets you prepare and amend binary files containing the text in a format suitable for display when brought into memory through a corresponding assembler module. The assembler is prepared through a small Basic program which Pokes the routine into memory and BSaves it. Text is saved in a condensed rather than display format, which saves some disc space.

When running the formatting program, Encode.Obj must be on disc. When running the user program, Decode.Obj must be in memory; it is put there by entering:

```
PRINT CHR$ (4) ; "BLOAD DECODE.OBJ"
```

When you want to load the screen itself, put its name into a string variable and Gosub to a routine with the following lines:

```
  PUT = PEEK (110) + 1
  POKE 8 , 0 : POKE 9 , PUT
  PUT = PUT * 256
PRINT CHR$ (4) ; "BLOAD" SCREEN$
",A" PUT
  CALL 768
```

Screen formatter.

```
 100  REM  ** LO-RES SCREEN FORMAT
      TER **
 110  REM  **     AND BINARY SAVER
           **
 120  REM  ** BY JOHN CAYLEY, 1983
           **
 130  REM
 140  HOME :A1 = 1:Z = 0:V = A1:H =
      A1:D$ =  CHR$ (13) +  CHR$ (
      4)
 150  HTAB 3: PRINT "SCREEN FORMAT
      TER & BINARY SAVER": HTAB 3:
       PRINT "----------------------
      ----------"
 160  HTAB 20: VTAB 4: PRINT "BY J
      OHN CAYLEY, 1983"
 170  PRINT : PRINT "  THIS PROGRA
      M WILL HELP YOU SET UP      D
      ISPLAY SCREENS AND SAVE THEM
       IN AN"
 180  PRINT "ECONOMICAL BINARY FOR
      M. THE SCREENS ARE ACCESSIBL
      E TO YOUR BASIC PROGRAMS BUT
      "
 190  PRINT "DON'T USE UP VALUABLE
       PROGRAM SPACE."
 200  PRINT : PRINT "  PRESSING 'E
      SC' ALLOWS THE FOLLOWING
       COMMANDS:"
 210  PRINT : PRINT  TAB( 5)"I,J,K
      ,M - MOVE THE CURSOR"
 220  PRINT  TAB( 7)"V,F,N - INVER
      SE, FLASH, NORMAL"
 230  PRINT  TAB( 9)"C,D - CLEAR S
      CREEN OR LINE"
 240  PRINT  TAB( 11)"/ - FINISH &
       SAVE"
 250  PRINT "  SPACE BAR - RETURN
      TO TYPING"
 260  VTAB 23: HTAB 1: INPUT "DO Y
      OU WANT TO LOAD A PREVIOUSLY
       CREATEDSCREEN? ";A$: GOSUB
      710
 270  HOME : IF Y THEN  GOSUB 740
 280  GOSUB 800
 290  GET A$:A =  ASC (A$)
 300  IF A = 8 THEN  GOSUB 370
 310  IF A = 13 THEN  GOSUB 410
 320  IF A = 27 THEN  GOSUB 450
 330  IF A < 32 THEN 290
 340  PRINT A$;
 350 H = H + A1: IF H > 40 THEN H =
      A1:V = V + A1: IF V > 20 THEN
      H = A1:V = 20: HTAB H: VTAB
      V
 360  GOTO 290
 370  REM  ** BACKSPACE **
 380  PRINT A$;
 390 H = H - A1: IF H < A1 THEN H =
      40:V = V - A1: IF V < A1 THEN
      H = A1:V = A1
 400  HTAB H: VTAB V: RETURN
 410  REM  ** RETURNS **
 420  PRINT A$;
 430 H = A1:V = V + A1: IF V > 20 THEN
      V = 20
 440  HTAB H: VTAB V: RETURN
 450  REM  ** ESC MODE **
 460  GOSUB 860
 470  GET A$:A =  ASC (A$)
 480  IF A = 32 THEN  GOSUB 800: RETURN


 490  IF A = 73 THEN V = V - A1: IF
      V < A1 THEN V = A1
 500  IF A = 74 THEN H = H - A1: IF
      H < A1 THEN H = A1
 510  IF A = 75 THEN H = H + A1: IF
      H > 40 THEN H = 40
 520  IF A = 77 THEN V = V + A1: IF
      V > 20 THEN V = 20
 530  IF A = 67 THEN  HOME :V = A1
      :H = A1: GOTO 460
 540  IF A = 68 THEN  HTAB A1: PRINT
       SPC( 40)
 550  IF A = 78 THEN  NORMAL :F =
      Z:I = Z: GOSUB 880
 560  IF A = 86 THEN  INVERSE :I =
      A1: GOSUB 890
 570  IF A = 70 THEN  FLASH :F = A
      1: GOSUB 900
 580  IF A = 47 THEN  POP : GOTO 6
      00
 590  VTAB V: HTAB H: GOTO 470
 600  REM  ** SAVE SCREEN **
 610  HTAB A1: VTAB 23: INPUT "DO
      YOU WANT TO SAVE THIS SCREEN
      ? ";A$: GOSUB 910
 620  GOSUB 710: IF  NOT Y THEN 68
      0
 630  HTAB A1: VTAB 23: INPUT "UND
      ER WHAT NAME? ";S$: GOSUB 91
      0
 640  HTAB A1: VTAB 23: INPUT "DRI
      VE NUMBER? ";DR$: GOSUB 910
 650  HTAB A1: VTAB 22: PRINT D$"B
      LOAD ENCODE.OBJ,D1"
 660  POKE 10,76: POKE 11,Z: POKE
      12,3:L =  USR (Z)
 670  HTAB A1: VTAB 22: PRINT D$"B
      SAVE "S$",A$4000,L"L",D"DR$
 680  HTAB A1: VTAB 23: INPUT "DO
      YOU WISH TO CONTINUE? ";A$
 690  GOSUB 710: IF Y THEN  GOTO 1
      40
 700  END
 710  REM  ** YES/NO **
 720  IF  LEFT$ (A$,A1) = "Y" THEN
      Y = A1: RETURN
 730 Y = Z: RETURN
 740  REM  ** LOAD SCREEN **
 750  PRINT D$"BLOAD DECODE.OBJ"
 760  PRINT "WHAT IS THE NAME OF T
      HE SCREEN?": PRINT : INPUT "
      > ";S$
 770  PRINT : INPUT "DRIVE NUMBER?
       ";DR$
 780 PUT =  PEEK (110) + A1: POKE
      8,Z: POKE 9,PUT:PUT = PUT *
      256
 790  PRINT D$"BLOAD "S$",D"DR$",A
      "PUT: CALL 768: RETURN
 800  REM  ** TYPING MODE **
 810  NORMAL : HTAB 14: VTAB 23: PRINT
      "TYPING MODE";
 820  HTAB H: VTAB V
 830  IF F THEN  FLASH
 840  IF I THEN  INVERSE
 850  RETURN
 860  REM  ** ENTER ESC MODE **
 870  NORMAL : HTAB 14: VTAB 23: PRINT
      "  ESC MODE ";: GOTO 820
 880  VTAB 23: HTAB 2: PRINT "
         ";: VTAB 23: HTAB 35: PRINT
      "      ";: VTAB V: HTAB H: RETURN

 890  VTAB 23: HTAB 2: PRINT "INVE
      RSE";: VTAB V: HTAB H: RETURN

 900  VTAB 23: HTAB 35: PRINT "FLA
      SH"$: VTAB V: HTAB H: RETURN

 910  REM  ** CLEAR LOWER LINES **

 920  HTAB A1: VTAB 23: PRINT  SPC(
      79): RETURN
```

Basic loader.

```
 100  REM  ** PROGRAM TO CREATE AN
      D SAVE OBJECT FILES FOR SCRE
      EN MAKER **
 110 D$ =  CHR$ (4): HOME
 120  GOSUB 1000
 130  PRINT D$"BSAVE ENCODE.OBJ,A$
      300,L188"
 140  PRINT "SCREEN ENCODER CREATE
      D AS ";: INVERSE : PRINT "EN
      CODE.OBJ": NORMAL
 150  GOSUB 2000
 160  PRINT D$"BSAVE DECODE.OBJ,A$
      300,L112"
 170  PRINT : PRINT "SCREEN DECODE
      R (AS USED IN PROGRAMS)    S
      AVED AS ";: INVERSE : PRINT
      "DECODE.OBJ": NORMAL
 180  END



1000  REM  ** MACHINE CODE FOR SC
      REEN COMPRESSOR **
1010  DATA  169,0,133,6,133,8,141
      ,185,3,141,186,3,141,187,3,1
      69,4,133,7,169,64,133,9,160,
      0,162,0,177,6,201,160,208,74
      ,32,145,3,165,7,201,8,208
1020  DATA  5,169,160,76,85,3,177
      ,6,201,160,240,8,32,165,3,17
      7,6,76,107,3,169,153,32,122,
      3,232,240,29,177,6,201,160,2
      08,23,32,145,3,165,7,201,8
1030  DATA  208,238,138,32,122,3,
      173,187,3,172,186,3,32,242,2
      26,96,138,32,122,3,162,0,76,
      27,3,32,122,3,32,145,3,165,7
      ,201,8,208,164,76,85,3,140
1040  DATA  185,3,172,186,3,145,8
      ,200,208,5,230,9,238,187,3,1
      40,186,3,172,185,3,96,200,19
      2,248,208,5,230,7,76,159,3,1
      92,120,208,5,152,24,105,8,16
      8
1050  DATA  96,136,192,255,208,5,
      198,7,76,179,3,192,127,208,5
      ,152,24,233,8,168,96,0,0,0,0

1060  FOR X = 0 TO 188: READ CD: POKE
      768 + X,CD: NEXT
1070  RETURN



2000  REM  ** MACHINE CODE TO LOA
      D COMPRESSED SCREEN INTO LOW
       RES AREA **
2010  DATA  169,0,133,6,141,110,3
      ,141,111,3,169,4,133,7,162,0
      ,160,0,177,8,201,153,208,24,
      32,104,3,177,8,32,104,3,170,
      169,160,32,64,3,201,255,240
2020  DATA  16,202,208,244,76,18,
      3,32,64,3,32,104,3,201,255,2
      08,216,169,160,141,247,7,96,
      140,111,3,172,110,3,145,6,20
      0,192,248,208,11,230,7,165,7
      ,201
2030  DATA  8,208,7,169,255,96,19
      2,120,208,5,152,24,105,8,168
      ,140,110,3,172,111,3,96,200,
      208,2,230,9,96,0,0,0
2040  FOR X = 0 TO 112: READ CD: POKE
      768 + X,CD: NEXT
2050  RETURN
```

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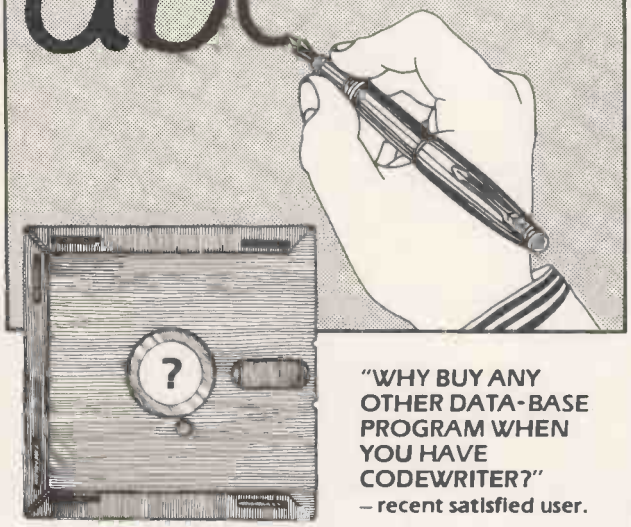

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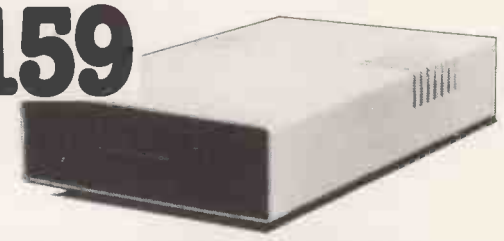

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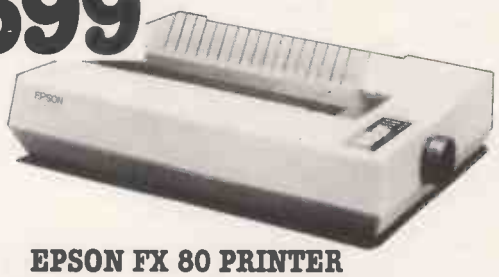

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Disc saver

A COMMODORE LISTING for a disc file restore on page 163 of the September issue inspired H M Hoffman to devise a way of restoring deleted Atari disc files. Mr Hoffman says if a file is deleted from DOS 2 or Basic, the first byte in the directory entry is set to $80 or 128 decimal. Whenever the directory is searched, any entry associated with this flag value is ignored. However, after booting DOS, it is possible to issue a command from Basic so that files will no longer be checked for a deleted status. The command is

POKE 3926,234:POKE 3927,234

Listing the disc directory will then reveal the deleted files so that they can be loaded and run. Undeleted files should be loaded and then saved with a different file name so that they can be read normally under DOS.

Obviously, if you write to a disc after deleting a file, the deleted file may be overwritten and thus be unrecoverable. The command Poke 3926,48 : Poke 3927,27 restores DOS to normal.

Painter

At last here's an Atari game. Painter, written by Chris Simon of Clwyd, North Wales, requires 16K and a joystick. Use the joystick to move the painter to cover all the lines, while avoiding the chaser. Pressing the Fire button creates a gap the chaser cannot jump.

Three complete mazes are included, but you can easily add your own. For an interesting variation, add the line

190 GOTO 100

so that whenever the painter stops moving the chaser will start, and vice versa. It speeds the game up, and is not as easy at it sounds. Another enhancement would be to add a routine to fill boxes with colour when they are completed.

Even if you do not type in the whole program it is worth experimenting with the sound subroutine, which is done with Pokes instead of sound statements.

```
10 GOSUB 9000
20 GOSUB MAZE$1000:IF SCORE THEN 80
25 REM Titles
30 FOR A=1 TO 3:POSITION 0,0:? TITLE$(1,39):FOR
I=1 TO 100:SOUND 0,100,10,8:NEXT I:SOUND 0,0,0,0
:POKE 77,0
40 POSITION 0,0:? BL$:FOR I=1 TO 100:NEXT I:NEXT
 A
50 FOR I=39 TO LEN(TITLE$):POSITION 0,0:? TITLE$
(I-38,I):SOUND 0,0,5,15:FOR A=1 TO 15
60 IF STRIG(0)=0 THEN POP :POP :GOTO 80
70 NEXT A:SOUND 0,0,0,0:NEXT I:GOTO 30
80 GOSUB MAZE$1000:FOR A=0 TO 9:FOR I=100-A$5 TO
 60-A$5 STEP -4:SOUND 0,I,10,8:NEXT I:NEXT A:SOU
ND 0,0,0,0
90 GOSUB 400:POKE 77,0:RB=0:ST=RB
99 REM Main loop
100 S=S+1:IF S=50 THEN POKE 53766,1
110 IF S=80 THEN S=0:POKE 53766,49
114 REM Move Painter
115 IF STRIG(0)=0 THEN PP=PP$RB:RB=1
120 IF ST(STICK(0)) THEN A=ST(STICK(0)):IF PEEK(
P+A) THEN ST=A
125 IF ST=0 THEN 200
130 A=P+ST:IF PEEK(A)=0 OR PEEK(A)=128 OR A>MAX
OR A<MIN THEN 200
140 POKE P,PP:IF PP<128 THEN SCORE=SCORE+1:POKE
P,PP+128:POSITION 9,0:? SCORE:COUNT=COUNT+1:IF C
OUNT=DONE THEN 600
150 P=A:PP=PEEK(P):IF PP=CH THEN 500
160 POKE P,PA
199 REM Move Chaser
200 IF CH=3 THEN CH=2:GOTO 220
210 CH=3
220 A=PC$IF A>127 THEN A=A-128
230 IF A=0 THEN IN=-IN:GOTO 290
240 IF A<8 THEN B=(ABS(IN)=1)+2$(ABS(IN)=40):IN=
A(A-3,B):GOTO 290
250 IF A<10 OR A>13 THEN 290
260 ON A-9 GOTO 800,850,900,950
290 B=C+IN:IF PEEK(B)=PA THEN POKE C,PC:GOTO 500
300 POKE C,PC:PC=PEEK(B):C=B:POKE C,CH:GOTO 100
399 REM Sound subroutine
400 SOUND 0,0,0,0:POKE 53768,24:POKE 53761,168:P
OKE 53763,168:POKE 53765,168:POKE 53767,168
410 POKE 53760,240:POKE 53764,252:POKE 53762,28:
POKE 53766,49:S=0:RETURN
499 REM Crash
500 FOR I=0 TO 3:SOUND I,0,0,0:NEXT I
510 POKE P-1,71:POKE P,14:POKE P+1,70
520 FOR I=14 TO 0 STEP -0.1:SOUND 0,100,8,I:POKE
 712,I$18:NEXT I:SOUND 0,0,0,0:POKE 712,0
530 LIVES=LIVES-1:IF LIVES THEN 80
540 LIVES=3:MAZE=1:FRAME=1:IF HIGH>SCORE THEN 58
0
550 HIGH=SCORE:POSITION 0,0:? BL$
560 POSITION 12,0:? "A NEW HIGH SCORE":FOR I=255
 TO 0 STEP -2.5:SOUND 0,I,8,10
563 IF I/20=INT(I/20) THEN POSITION 0,0:? BL$:GO
TO 570
567 IF I/10=INT(I/10) THEN POSITION 12,0:? "A NE
W HIGH SCORE"
570 NEXT I:SOUND 0,0,0,0
580 POSITION 0,0:? BL$:SCORE=0:GOTO 20
599 REM Frame complete
600 FOR A=1 TO 10:FOR I=100 TO 60 STEP -5:SOUND
0,I,10,8:POKE 711,I:NEXT I:NEXT A:POKE 711,134:S
OUND 0,0,0,0
620 MAZE=MAZE+(MAZE<3):FRAME=FRAME+1:SCORE=SCORE
+100:GOTO 80
799 REM Routines for choosing new            cha
ser direction when there                is a choi
ce of two
800 ST(0)=IN:ST(1)=-40:IF IN=40 THEN ST(0)=1:ST(
1)=-1
810 IN=ST(INT(RND(0)$2)):GOTO 290
850 ST(0)=IN:ST(1)=40:IF IN=-40 THEN ST(0)=1:ST(
1)=-1
860 IN=ST(INT(RND(0)$2)):GOTO 290
900 ST(0)=IN:ST(1)=1:IF IN=-1 THEN ST(0)=40:ST(1
)=-40
910 IN=ST(INT(RND(0)$2)):GOTO 290
950 ST(0)=IN:ST(1)=-1:IF IN=1 THEN ST(0)=40:ST(1
)=-40
960 IN=ST(INT(RND(0)$2)):GOTO 290
999 REM Maze #1
1000 POKE 559,0:? CHR$(125):POKE 82,6:POSITION 1
,0:? "Score :       Frame : 1   High : ":POSITIO
N 9,0:? SCORE
1010 POSITION 34,0:? HIGH:? :?
1020 ? "          $)))))))%"
1030 ? "          (        ("
1040 ? "          (        ("
1050 ? "$)))))))-          ,)))))))%"
1060 ? "(         (        (         ("
1070 ? "(         (        (         ("
1080 ? "(         ,)))))))-          ("
1090 ? "(                  (         ("
1100 ? "(         (        (         ("
1110 ? ",)))))))-          ,)))))))-"
1120 ? "(         (        (         ("
1130 ? "(         (        (         ("
1140 ? "(         ,)))))))-          ("
1150 ? "(         (        (         ("
1160 ? "(         (        (         ("
1170 ? "&)))))))-          ,)))))))'"
1180 ? "          (        ("
1190 ? "          (        ("
1200 ? "          &)))))))'"
1210 DONE=144:P=RAM+620:C=RAM+247:PP=9:PC=9:COUN
T=0:POKE P,PA:POKE C,CH:IN=1:IF RND(0)>0.5 THEN
IN=-IN
1220 POSITION 1,1:FOR I=1 TO LIVES:? "! ";:NEXT
I:REM ! in inverse video
1230 POKE 559,34:RETURN
1999 REM Maze #2
2000 POKE 559,0:? CHR$(125):POKE 82,8:POSITION 1
,0:? "Score :       Frame : 2   High : ":POSITIO
N 9,0:? SCORE
2010 POSITION 34,0:? HIGH
2020 ? "        $)))))))%"
2030 ? "        (       ("
2040 ? "        (       ("
2050 ? "        (       ("
2060 ? "        &))% $))'"
2070 ? "          ( ("
2080 ? "      $)))$)$)))%"
2090 ? "        (         ("
2100 ? "$)))))-           ,)))))%"
2110 ? "(       (         (       ("
2120 ? "&)))))-           ,)))))'"
2130 ? "        (         ("
2140 ? "        ,)))))))-"
2150 ? "        (         ("
2160 ? "   $))-           ,))%"
2170 ? "  ( (   (       ( (  ("
2180 ? "   ( &)+)))))+)'  ("
2190 ? "$))-     (       (     ,))%"
2200 ? "( (   (       (     (   ("
2210 ? "(  &)+))'      &))+)'  ("
2220 ? "(     (                (   ("
2230 ? "(     (                (   ("
2240 ? "&))))'                 &))))'";
2250 DONE=160:P=RAM+539:C=RAM+56:PP=9:PC=9:COUNT
=0:IN=1:POKE P,PA:POKE C,CH:IF RND(0)>0.5 THEN I
N=-IN
2260 POSITION 1,1:FOR I=1 TO LIVES:? "! ";:NEXT
I:REM ! in inverse video
2270 POKE 559,34:RETURN
2999 REM Maze #3
3000 POKE 559,0:? CHR$(125):POKE 82,6:POSITION 1
,0:? "Score :       Frame : 3   High : ":POSITIO
N 9,0:? SCORE
3010 POSITION 23,0:? FRAME:POSITION 34,0:? HIGH
3020 ? "    $)))))))))% $)))))))))%"
3030 ? "   (          ( (          ("
3040 ? "   (          ( (          ("
3050 ? "$))$)+)+)))))$)$)))))+)+)$))%"
3060 ? "(     ( (                ( (     ("
3070 ? "(     ( (                ( (     ("
3080 ? "&))))- &)))%      $)))' ,))))'"
3090 ? "      (      (      (      ("
3100 ? "      (      (      (      ("
3110 ? "      (      (      (      ("
3120 ? "      (      &))+))'       ("
3130 ? "      (             (      ("
3140 ? "      (             (      ("
3150 ? "      (             (      ("
3160 ? "$))))$)+)))))+$+)))))+)$))))%"
3170 ? "(         (      ( (      (       ("
3180 ? "(         (      ( (      (       ("
3190 ? "&))%    ,)+)))$)$)))+)-    $))'"
3200 ? "    (    (  ( (           ( (   ("
3210 ? "$))$)))' &)))% $)))' &)))$))%"
3220 ? "(                 ( (             ("
3230 ? "(                 ( (             ("
3240 ? "&)))))))))))))$)$)))))))))))))'";
3250 DONE=256:P=RAM+617:C=RAM+50:PP=9:PC=9:COUNT
=0:IN=1:POKE P,PA:POKE C,CH:IF RND(0)>0.5 THEN I
N=-IN
3260 POSITION 1,1:FOR I=1 TO LIVES:? "! ";:NEXT
I:REM ! in inverse video
3270 POKE 559,34:RETURN
8999 REM Initialise
9000 DIM ST(15),TITLE$(160),BL$(39),A(4,2):POKE
106,PEEK(106)-5:GRAPHICS 0:POKE 752,1
9010 CHBASE=(PEEK(106)+1)$256:POSITION 2,0:? "PI
ease wait a moment.....":IF PEEK(16)<128 THEN 9
020
9015 POKE 16,PEEK(16)-128:POKE 53774,PEEK(16):RE
M Disable BREAK
9020 POKE 708,184:POKE 709,12:POKE 710,36:POKE 7
11,134
9030 DL=PEEK(560)+256$PEEK(561):FOR I=DL+6 TO DL
+28:POKE I,4:NEXT I
9040 FOR I=0 TO 7:POKE CHBASE+I,0:NEXT I:FOR I=1
12 TO 1023:POKE CHBASE+I,PEEK(57344+I):NEXT I
9050 POKE 756,CHBASE/256:FOR I=CHBASE+8 TO CHBAS
E+111:READ A:POKE I,A:NEXT I
9060 DATA 0,130,20,20,255,20,20,130
9070 DATA 20,20,166,166,154,154,20,20
9080 DATA 40,40,89,89,101,101,40,40
9090 DATA 0,0,0,63,63,60,60,60
9100 DATA 0,0,0,252,252,60,60,60
9110 DATA 60,60,60,63,63,0,0,0
9120 DATA 60,60,60,252,252,0,0,0
9130 DATA 60,60,60,60,60,60,60,60
9140 DATA 0,0,0,255,255,0,0,0
9150 DATA 60,60,60,255,255,0,0,0
9160 DATA 0,0,0,255,255,60,60,60
9170 DATA 60,60,60,63,63,60,60,60
9180 DATA 60,60,60,252,252,60,60,60
9200 RAM=DL+32:MIN=RAM+40:MAX=RAM+960:PA=129:CH=
3:SCORE=0:HIGH=SCORE:LIVES=3:MAZE=1:FRAME=1
9210 BL$="
 ":REM 39 spaces
9220 TITLE$="                    PAINTER
    .........Program by Chris Simon.............
......."
9230 TITLE$(LEN(TITLE$)+1)="Press trigger to beg
in.....":TITLE$(LEN(TITLE$)+1)=BL$
9240 FOR I=5 TO 15:READ A:ST(I)=A:NEXT I
9250 DATA 0,0,1,0,0,0,-1,0,40,-40,0
9260 FOR I=1 TO 4:FOR A=1 TO 2:READ B:A(I,A)=B:N
EXT A:NEXT I:RETURN
9270 DATA 40,1,40,-1,-40,1,-40,-1
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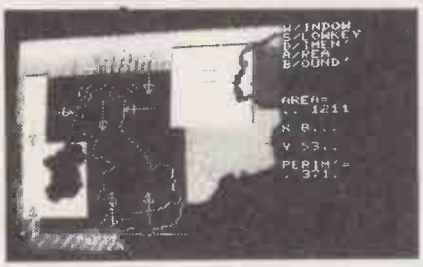

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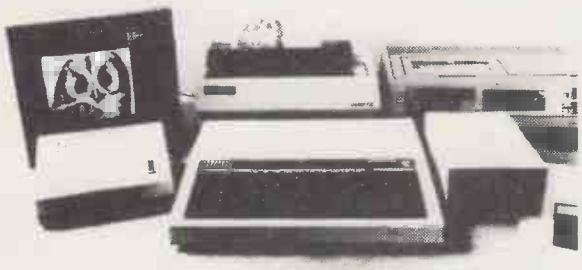

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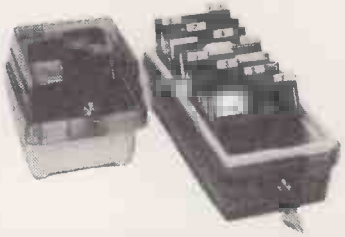

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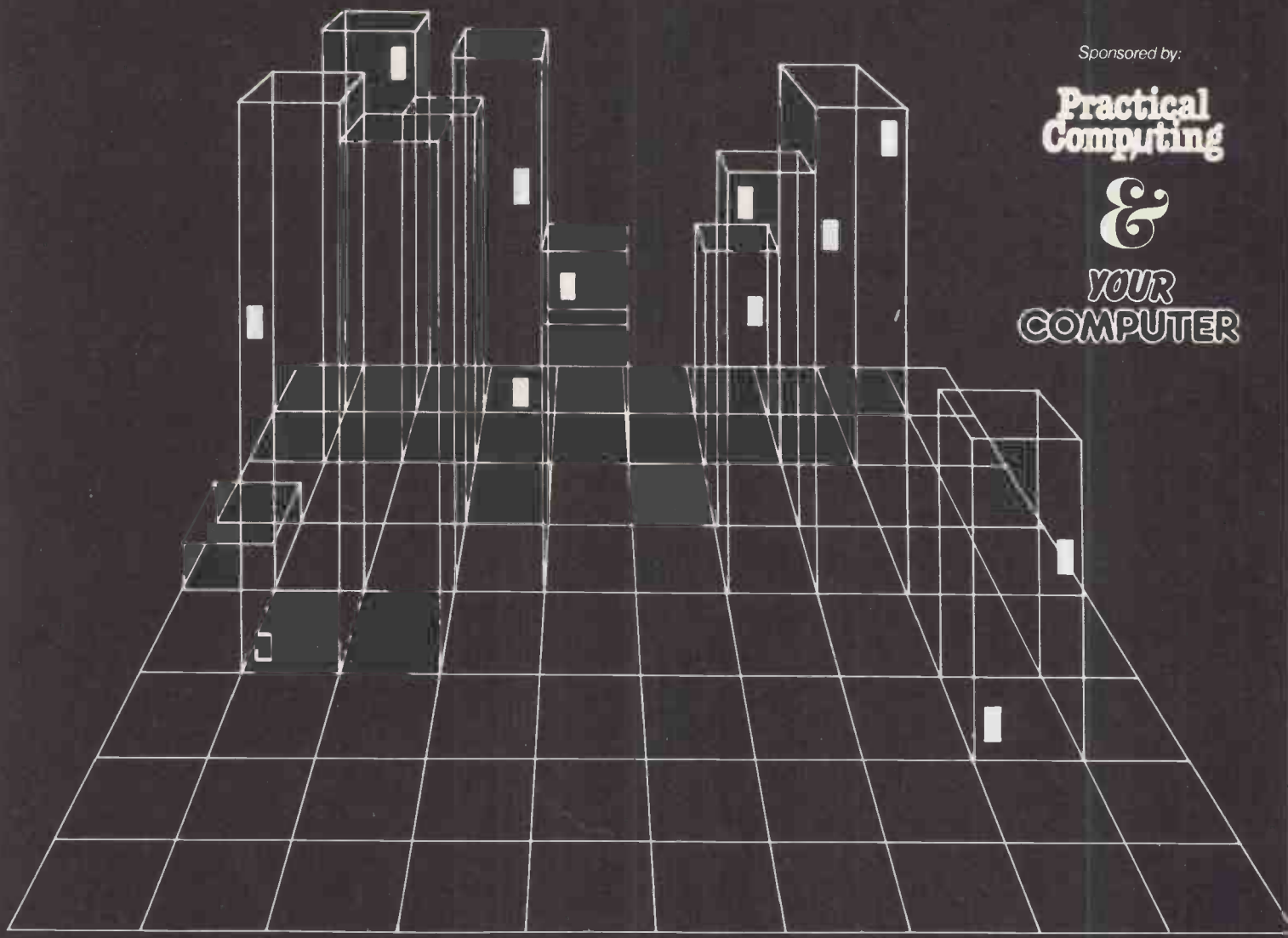

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Scrubber

A PAIR of programs from Bill Leigh of Varese, Italy make up a useful program-development utility for 16K and 48K Spectrums. Scrubber itself consists of two lines only; the Rem statement in the second line reserves space for the machine-code program of which the hex listing is found in the consecutive Data statements of the second program, Makescrub.

Makescrub is more or less a hex loader written to construct Scrubber. The Rems in lines with numbers ending in 9 are essentially cosmetic and may be omitted. Makescrub loads hex-coded bytes in the Data statements of lines 109 to 170. It also contains some elementary partial trapping of keying errors in lines 500 to 550. It executes Scrubber after hex loading, thereby simply generating Scrubber itself. If the two lines that compose the Scrubber are allocated consecutive line numbers anywhere in a Basic program, then when the program control reaches these lines all previous lines of the program (but nothing in the variables area) are eliminated, while the variable area remains intact.

Scrubber can be used to save space by eliminating part of a program once it has done its work — setting up a screen, for example, the space saved can be used for data input to, or generated by, the rest of the program.

It can also be used when you have a large dummy main program that has been used to set up and test a subroutine. These all have to be eliminated before the subroutine is available for use. Scrubber can also be used to Scrub hex loaders, of course.

The programs also demonstrate how, by Peeking the system variable NxtLin, you can get away from the restrictions inherent in the normal practice of putting machine code into Rem statements at the top of the program listing. Apart from the inflexibility of the normal approach, a listing of such a program cannot conveniently include header lines such as I have given Makescrub.

I find myself making good use of Scrubber, merging it into longer programs, moving it about by changing the line numbers, and then Scrubbing unwanted program lines.

Scrubber.

```
  1 LET scrub=15+256*(PEEK 23638)+PEEK 23637
  2 RANDOMIZE USR (scrub): REM <>12345678901234567890123456789012345678901234567890123456
```

Makescrub.

```
 19 REM ************************
 29 REM * Bill Leigh, Sept 83 *
 39 REM ************************
 49 REM ****** MAKESCRUB ******
 59 REM ************************
 69 REM
100 RESTORE : GO SUB 1000
109 REM save registers
110 DATA "F5,C5,D5,E5"
119 REM change line nos
120 DATA "2A,45,5C,CD,6E,19,06,00,70,EB,70,23,04,70,04,EB,23,70"
129 REM relocate lines
130 DATA "2A,55,5C,E5,1B,CD,DD,19,ED,5B,53,5C,D5,ED,B0"
139 REM transfer control
140 DATA "E1,D5,06,78,48,06,00,A7,09,E9"
149 REM reclaim space
150 DATA "D1,E1,CD,E5,19"
159 REM restore registers
160 DATA "E1,D1,C1,F1"
169 REM return
170 DATA "C9"
179 REM correct line length
180 POKE scrub-13,69
189 REM save start address
190 LET scrub0=scrub
200 FOR x=1 TO 2 STEP 0
210 READ m$
220 FOR y=1 TO (1+LEN m$)/3
230 LET z=3*y-2: GO SUB 500
240 LET n=m*16
250 LET z=z+1: GO SUB 500
260 LET n=n+m
270 POKE scrub,n
280 LET scrub=scrub+1
290 NEXT y
300 IF m$="C9" THEN  LET x=3
310 NEXT x
320 RUN 1000
499 REM hex digit conversion
500 IF "0"<=m$(z) AND m$(z)<="9" THEN  LET m=VAL m$(z): RETURN
510 IF "A"<=m$(z) AND m$(z)<="F" THEN  LET m=CODE m$(z)-55: RETURN
520 PRINT "Error in statement:": PRINT
530 PRINT TAB 5;"DATA """;m$;""""": PRINT : PRINT
540 POKE scrub0-13,63: POKE scrub0,201
550 LIST 109: STOP
1000 LET scrub=15+256*(PEEK 23638)+PEEK 23637
1001 RANDOMIZE USR (scrub): REM <>12345678901234567890123456789012345678901234567890
1002 RETURN
```

Vocabulary.

```
    10 REM LANGUAGE TUTOR

            by M.Coombes (8/83)

   20 POKE 23658,8: LET hs=0: LET
 n$=""
   30 BORDER 7: PAPER 7: CLS : IN
K 0: POKE USR "a",255: FOR f=1 T
O 6: POKE USR "a"+f,129: NEXT f:
 POKE USR "a"+f,255
   40 PRINT AT 2,9; INK 0; PAPER
5;"LANGUAGE TUTOR"
   45 LET g$="□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□"
   50 INK 1: PRINT AT 0,8;g$(1 TO
 16);AT 4,0;g$: FOR f=5 TO 19: P
RINT AT f,0;"□";AT f,31;"□": NEX
T f: PRINT AT 20,0;g$: LET g=7:
```

(continued on next page)

Vocabulary

If you need help memorising foreign-language vocabularies Michael Coombes has come up with just the program for you. It is suitable for both 16K and 48K Spectrums.

When the program is run, an introduction page is first displayed, followed by a menu. Your first task is to enter the vocabulary, and you can then select the Test option. The program will ask for 10 translations, either English to foreign or vice versa. The program then tells you your score and returns you to the menu. There is also a Save option so that the program can be stored and retrieved for a later test.

(continued from previous page)

```
LET h=24: FOR f=1 TO 3: PRINT AT
 f,g;"□";AT f,h;"□": LET g=g-1:
LET h=h+1: NEXT f
  52 GO SUB 9500
  55 INK 0
  58 GO SUB 2000
  60 PRINT AT 6,2; INK 2;"PLEASE
 SELECT:"
  70 PRINT AT 9,2;"Press A to en
ter words.";AT 11,2;"Press B to
 start test.";AT 13,2;"Press C to
 save the program";AT 15,10;"and
 the vocabulary.";AT 17,2;"Press
 X to exit."
  80 PRINT AT 9,8; PAPER 2; INK
6; FLASH 1;"A";AT 11,8;"B";AT 13
,8;"C";AT 17,8;"X"
  85 LET i$=INKEY$: IF i$="A" OR
 i$="B" OR i$="C" OR i$="X" THEN
 BEEP .1,10: GO SUB 2000
  90 IF i$="A" THEN GO TO 9000
 100 IF i$="B" THEN GO SUB 500
 110 IF i$="C" THEN GO TO 6000
 120 IF i$="X" THEN PRINT AT 12,
6; INK 2;"THANK YOU FOR USING";A
T 13,7;"'LANGUAGE TUTOR'!": BEEP
 2,10: NEW
 130 GO TO 85
 510 LET sc=0
 520 GO SUB 2000: PRINT AT 12,3;
 INK 2;"HERE ARE YOUR QUESTIONS.
..": FOR f=0 TO 20: BEEP .01,f:
BEEP .01,f+3: NEXT f
 530 FOR q=1 TO 10: GO SUB 2000
 540 PRINT AT 6,2; INK 1;"QUESTI
ON NUMBER:"; PAPER 6; FLASH 1;q;
 FOR f=1 TO 60: NEXT f: PRINT AT
 6,18; INK 2;q
 550 LET a=INT (RND*100): IF a<5
0 THEN GO TO 800
 560 GO TO 900
 630 INPUT LINE s$: BEEP .1,10
 632 IF a<50 THEN LET m$=a$(h)(1
 TO m(h))
 634 IF a>49 THEN LET m$=b$(h)(1
 TO n(h))
 650 IF s$<>m$ THEN GO TO 700
 655 LET sc=sc+1: GO SUB 2000: P
RINT AT 8,2; INK 2; FLASH 1;"WEL
L DONE!";AT 10,2; FLASH 0; INK 1
;"That is correct"
 657 FOR f=1 TO 30 STEP 3: BEEP
 .03,f: BEEP .03,f+10: BEEP .03,f
: NEXT f: PRINT AT 13,2; BRIGHT
1;"SCORE SO FAR:";sc;" out of ";
q: FOR f=1 TO 5: BEEP .05,30: BE
EP .05,20: NEXT f: FOR f=1 TO 30
: NEXT f
 660 GO TO 750
 700 GO SUB 2000: PRINT AT 8,2;
PAPER 2; INK 7; BRIGHT 1; FLASH
1;"NO!": FOR f=0 TO -20 STEP -1:
 BEEP .1,f: NEXT f: PRINT AT 10,
2; INK 2;"That is incorrect.": B
EEP 2,-20: PRINT AT 12,2; INK 1;
"The correct answer was";AT 13,2
;m$;"."
 710 PRINT AT 16,2; BRIGHT 1;"SC
ORE SO FAR:";sc;" out of ";q: FO
R f=1 TO 50: NEXT f
 720 FOR f=1 TO 200: NEXT f
 750 NEXT q
 760 GO TO 1000
 800 LET h=((RND*(w-1)+1))
 805 LET z$=b$(h)(1 TO n(h))
 810 PRINT AT 11,2; INK 1;"What
 is the English word";AT 12,2;"fo
r ";z$;"?"
 820 GO TO 630
 900 LET h=((RND*(w-1)+1))
 905 LET z$=a$(h)(1 TO m(h))
 910 PRINT AT 11,2; INK 1;"What
 is the ";x$;AT 12,2;"word for ";
z$;"?"
 920 GO TO 630
1020 GO SUB 2000
1030 PRINT AT 6,2; INK 1; PAPER
5;"THAT IS THE END OF THE TEST":
 FOR f=1 TO 4 STEP .1: BEEP .01,
10: BEEP .01,20: BEEP .01,30: NE
XT f
1040 PRINT AT 8,5; INK 1;"YOUR F
INAL SCORE WAS ";sc: IF sc<=hs T
HEN GO TO 3000
1050 LET hs=sc: PRINT AT 12,1; P
APER 2; INK 7; BRIGHT 1; FLASH 1
;"**************************
**";AT 18,1; INVERSE 1;"********
**********************
**********"
1060 PRINT AT 14,11; INK 1;"WELL
 DONE!";AT 15,5; INK 2;"YOU HAVE
 REACHED A NEW";AT 16,11;"HIGH S
CORE"
1070 FOR f=1 TO 30: BEEP .01,f:
NEXT f: FOR g=1 TO 20: BEEP .01,
f-5: BEEP .01,f: NEXT g
1080 INPUT INK 1; PAPER 6;"   PL
EASE ENTER YOUR NAME...   "; PAP
ER 7;"      "; LINE n$
1090 FOR f=1 TO 10: BEEP .01,f:
BEEP .01,f+4: NEXT f: GO TO 57
2010 FOR f=5 TO 19: PRINT AT f,1
;"
": NEXT f
2020 RETURN
3000 PRINT AT 11,1; INK 1;"The h
ighest score so far is ";hs;AT 1
3,1; INK 2;"This score was reach
ed by";AT 14,1;n$;"."
3010 FOR f=10 TO 7 STEP -1: BEEP
 .1,f: BEEP .1,f+3: NEXT f
3020 FOR f=1 TO 300: NEXT f: GO
TO 57
6010 GO SUB 2000: SAVE "LANGUAGE
" LINE 20
6020 GO TO 57
9010 PRINT AT 12,1; INK 2;"WHAT
IS THE FOREIGN LANGUAGE?": INPU
T "■ "; LINE x$: BEEP .3,20
9030 PRINT AT 12,1; INK 2;"
    HOW MANY WORDS?          ": INPU
T "■ ";w: BEEP .3,20
9035 DIM a$(w,10): DIM b$(w,10):
 DIM m(w): DIM n(w)
9040 PRINT AT 12,1;"PLEASE ENTER
 THE VOCABULARY..."
9045 FOR f=1 TO w
9050 INPUT "English word?"'"■ ";
 LINE e$: BEEP .3,20
9055 PRINT AT 14,2;"                ";
AT 16,2;"
9060 IF LEN e$>10 OR e$="" THEN
BEEP .4,-20: GO TO 9050
9070 LET m(f)=LEN e$: LET a$(f)=
e$
9075 PRINT AT 14,2; INK 0;e$:
9080 INPUT (x$);" translation?"'
"■ "; LINE e$: BEEP .3,20
9090 IF LEN e$>10 OR e$="" THEN
BEEP .4,-20: GO TO 9080
9100 LET n(f)=LEN e$: LET b$(f)=
e$
9110 PRINT AT 16,2;e$
9120 NEXT f
9130 GO SUB 2000
9140 PRINT AT 12,8; INK 2; FLASH
 1;"ALL DATA ENTERED"
9150 BEEP 2,20
9160 GO TO 57
9510 PRINT AT 6,2; INK 1;"The ai
m of this program is";AT 7,2;"to
 help you to learn the";AT 8,2;"
vocabulary of a foreign";AT 9,2;
"language."
9520 PRINT AT 11,2; INK 2;"You c
an enter words of up";AT 12,2;"t
o ten letters in length";AT 13,2
;"and the computer will then";AT
 14,2;"test you on your knowledg
e";AT 15,2;"of that vocabulary."
9530 PRINT AT 17,10; PAPER 6; IN
K 2; FLASH 1;"PRESS ANY KEY": PA
USE 1: PAUSE 1: PAUSE 0: RETURN
```

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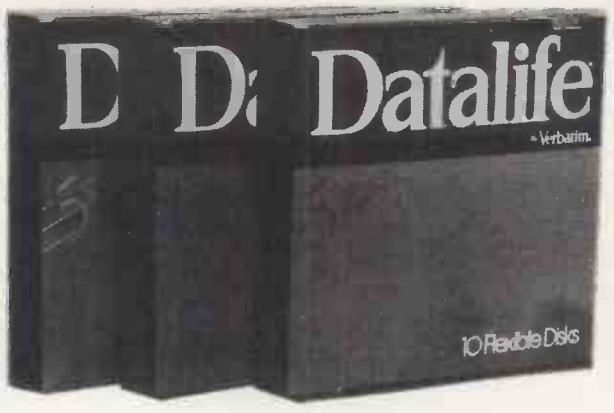

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Assembler for the IBM PC

Paul Myerscough looks at the guides available for those preparing to delve below the surface of the PC's operating software.

AT THE HEART of the IBM PC is an Intel 8088 microprocessor. It is this chip that provides the instruction set and hence lays the ground rules for assembler programming. The 8086/88 family of processors has been available for five years now, and several books have been published that describe their programming and hardware features. Two new books are specific to the IBM PC and more are on the way, no doubt inspired by the news that the PC started outselling Apple in the U.S. last summer.

The iAPX-88 Book is produced by Intel, the company that designed the 8088. Not surprisingly, it provides an excellent and readable description of the chip architecture and instruction set. This book has been available for some time and is presented as a publication designed to sell the 8088 as well as inform potential users. The initials iAPX stand for Intel Advanced Processor System, and the iAPX-88 is a real or hypothetical computer based on the Intel 8088 CPU.

In their introduction the authors outline the architecture of the 8088 and describe what makes it superior to eight-bit microprocessors. This clear and concise discussion is comprehensible to anyone with a little basic knowledge on the subject. For those without it there is a supplement towards the back entitled "What is a Microcomputer?".

Intel assembler

For the programmer, the chapter "Architecture and Instructions" describes the concepts of segmented memory, the register structure, addressing modes, and the 8088 instructions grouped by function. A further 24 pages are devoted to assembly-language programming. Although the information is applicable to all 8088 assemblers, specific reference is made to ASM-86 which is Intel's own assembler. The text in this section is largely reproduced from *The 8086 Primer* by Stephen Morse, published by Hayden Book Co.

A short program is given by way of introduction to many of the concepts and terms employed in 8088 programming. The style is at once authoritative and concise, and the authors define their terms carefully and analytically as they are introduced. An assembler statement is built from different kinds of tokens, a token being an identifier, a reserved word, a constant, an operator, and so on.

Each category of token is discussed before the authors deal with statements, which they divide into instructions and directives. Instructions have their equivalent 8088 function; directives control the way the assembler generates the 8088 program from the instructions.

The directives described correspond with a subset of the psuedo-ops available with the IBM Macro Assembler and allow the definition of symbols, data storage, segments and procedures. The discussion that follows is clear but very condensed, covering general and 8088-specific programming techniques in a few pages with four short example programs to provide an idea of how real routines might look.

Some 110 pages, over one-third of the book, are devoted to an alphabetic table of instructions with one or two pages per instruction. Here you will find a description, details of the operation in pseudo-code format, the flags affected, the binary encoding, the required operands, clock times, instruction length and a coding example. This information is complete but lacks the illuminating explanations provided by Rector and Alexy in their book.

Osborne/McGraw-Hill books seem to be becoming the standard texts for assembler programming on microcomputers. *The 8086 Book* by Russell Rector and George Alexy was published in 1980 and is on the shelves once more after being unavailable for some months. Whereas Intel's book provides a readable and concise introduction to the 8088 microprocessor and 8088 programming, this one is much more of a reference work. The scope here is slightly more comprehensive.

Stock text

It is always a little strange when such specialised books should take the time to answer the question "What is programming?" One suspects that this publisher's word-processing software automatically pulls in the standard paragraphs on these subjects, which are admittedly concise and well presented. After this short general introduction two programming problems are presented and the reader is walked through the design process.

By page 20 the 8086 is introduced; from a programming point of view the 8086 and 8088 are identical, the only noticeable difference being run times. The description begins with the registers and the flags, and reference is made to the equivalent 8080 implementation. A discussion of the 8086 address modes follows. About 150 pages are used to describe the instruction set.

The concepts surrounding Intel's Multibus system are introduced, and some

(continued on next page)

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notes are provided on multi-processor configurations. The book ends with a set of appendices. They give a table summarising all the 8086 instruction in alphabetic mnemonic sequence and in object code numeric sequence; electrical and timing data sheets for the 8086/88 and related series of clock and bus controller; and notes on the differences between the 8086 and the 8088. These hardware differences effect some of the pin signals and the bus timing for the data/address cycles.

The two remaining books, as their titles indicate, are IBM PC oriented and give themselves a wider brief. They refer not only to the 8088 and its programming, but also to the PC-DOS operating system, the ROM BIOS and some of the additional hardware that is found in the PC. Both refer specifically to the IBM Macro Assembler, though it cannot function very differently from any other assembler for the 8088 CPU.

New breed

Scanlon's *IBM PC Assembler Language* is one of the new breed. A floppy disc prepared for use in conjuction with the book contains the example programs referred to in the text. It cannot be denied that this is a good idea. However, in this instance the publisher seems to be motivated by dollars: the programs cannot be described as useful outside of the context of this already expensive book, yet you have to pay an extra $34 for the diskette. By adding its real cost of two or three dollars on to the book and packaging them together successful sales would be assured.

The approach taken by Scanlon is that of a cataloguer. He brings together fairly comprehensively relevant information from all the IBM PC manuals, lists it, tabulates it, describes it, and provides some useful if unexciting example programs. By contrast, David Willen and Jeffrey Krantz in their *8088 Assembly Language Programming: the IBM PC* provide a clearer and more readable discussion of much the same subject matter, with original programming examples and excellent diagrams. They also manage to cover more topics more thoroughly in fewer pages. While Willen and Krantz have a style that is easy and authoritative, Scanlon's is more uneven and in places awkwardly verbose.

Both books launch into binary arithmetic and numbering systems and in a few pages seek to embrace bytes, nybbles, twos-complement form, and some discussion of the 8088 architecture. Such a short and general introduction is difficult to organise in a few pages and Scanlon is less successful here.

Under the label of "8088 Architecture" Willen and Krantz provide a well organised summary of the internal functions of the CPU and its instruction set by functional group, again with good explanatory diagrams. Then they quickly add all that is necessary to create a simple program: describing how it sits in memory, how it relates to DOS, and the BIOS. Some specifics about the IBM Macro Assembler are supplied, particularly the essential pseudo-op instructions to the assembler for reserving storage and defining procedures and segments. They take about 60 pages to describe this material.

Scanlon requires 120 pages to cover less ground — he does not even mention DOS and BIOS. Some of the more esoteric pseudo-ops provided by the IBM Macro Assembler are rather difficult to understand from the manual and here Scanlon's detailed explanation provides a welcome insight. However, even he is stumped when it comes to Record and Struc.

After these introductory chapters the two books diverge on to different paths. Scanlon takes a couple of chapters to cover higher-precision mathematics and data structure operations. Though the material he provides is useful for orienting the inexperienced programmer, it can be found in virtually any text on the subject. He approaches the keyboard, video display, cassette and the like from the point of view of a program looking outwards. The interrupts are catalogued and described, and a few simple programming examples are given.

Willen and Krantz follow their introduction to the CPU and the Macro Assembler with a thorough and interesting breakdown of the IBM PC hardware and its control. Starting with the system board they provide descriptions of the 8259 interrupt controller, the 8253 timer, and the 8255 programmable peripheral interface, which are all configured in the PC as I/O devices. They go on to discuss the other devices that are not on the system board. The chapter referring to the display and printer adaptors describes their operation at length and provides programs for both monochrome and colour/graphics use.

A typical application where Basic programming is often just not fast or versatile enough is that involving communications. For this reason, although it is an optional extra, the RS-232-C serial communication adaptor is of particular interest to the assembler programmer. The authors provide a good chapter on this device, describing asynchronous protocol, hos a Uart functions, and how it interfaces through an RS-232 interface to a modem. Programming of the Intel 8250 used by the IBM PC for controlling asychronous communication is described, and a simple terminal-emulation program is provided as an example.

Unlike Scanlon, Willen and Krantz do not shy away from disc I/O. Their chapter on the subject starts at basics with the anatomy of a diskette and takes you through file access using DOS to access at the track/sector level using BIOS routines.

The books discussed so far fall into one or more of the categories 8088 reference work, assembler programming text and IBM PC assembler-level guide. *Programming the 8086/8088* by James W Coffron falls between all three stools. He covers the 8086/88 in sufficient depth to provide a good introduction but the book is not comprehensive enough to be considered as a reference work.

On assembler programming Coffron discusses some important topics but others are omitted, and his program examples could be more frequent and more illuminating. A 20-page chapter on the IBM PC is dropped in almost as an afterthought and deals with only a few of the machine's features.

Numbers

Following the mould of the two PC-oriented books, Coffron starts by introducing number representation, binary arithmetic and associated processor-flag usage, and follows up with a summary review of the CPU archiecture and a detailed discussion of the 8086/88 address modes and their encoding.

Next comes a substantial chapter of 105 pages cataloguing the 8088 instruction-set mnemonics. Unlike Rector and Alexy, Coffron does not choose to expand on the information provided by Intel and leaves out some of the details available.

Programming techniques are introduced with some very basic arithmetic and a discussion of subroutines. This is followed by a useful review of external and internal CPU interrupts and a chapter on I/O ports and instructions In and Out. His program examples here are short and curious — to generate a delay, and to scan a four-by-four keyboard. Although the 8255 PIO and the 8253 timer chips are mentioned he does not convey their functions and uses as clearly as Willen and Krantz do.

The iAPX 88 Book, by the Intel Corporation. Published by Reston Publishing Company, Inc., 315 pages, £11

The 8086 Book by Russell Rector and George Alexy. Published by Osborne/McGraw-Hill, 595 pages, £13.95

IBM PC Assembly Language — A Guide for Programmers by Leo J Scanlon. Published by R J Brady/Prentice-Hall Publishing. 311 pages, £16.95

8088 Assembler Language Programming: The IBM PC by David C Willen and Jeffrey I Krantz. Published by Howard W Sams & Co. Inc., 235 pages, £13.55

Programming the 8086/8088, by James W Coffron. Published by Sybex Inc., 309 pages, $14.95

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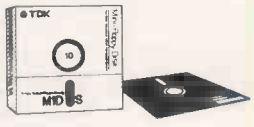

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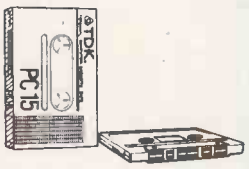

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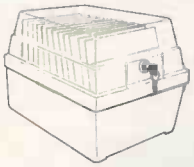

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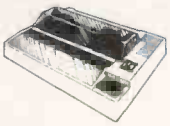

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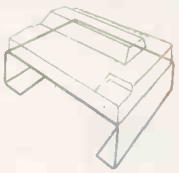

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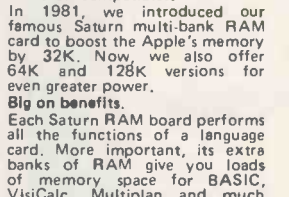

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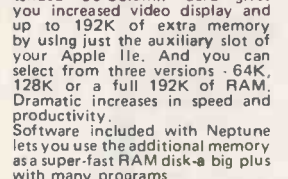

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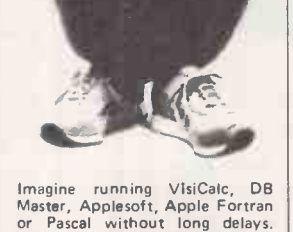

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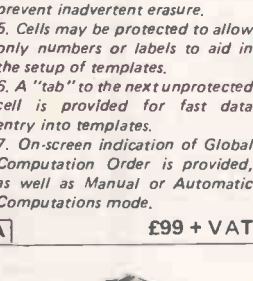

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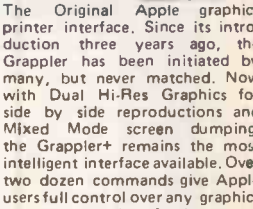

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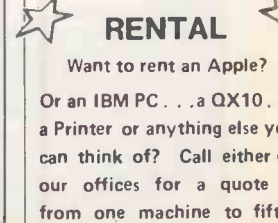

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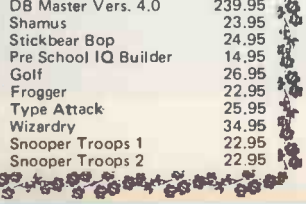

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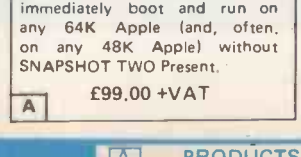

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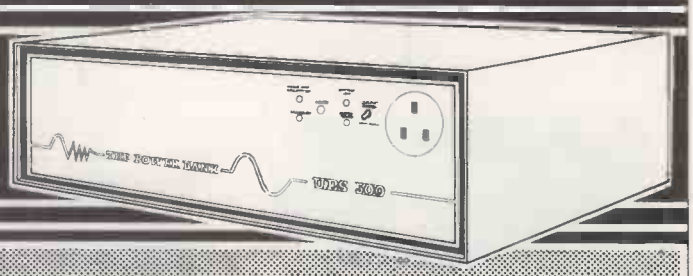

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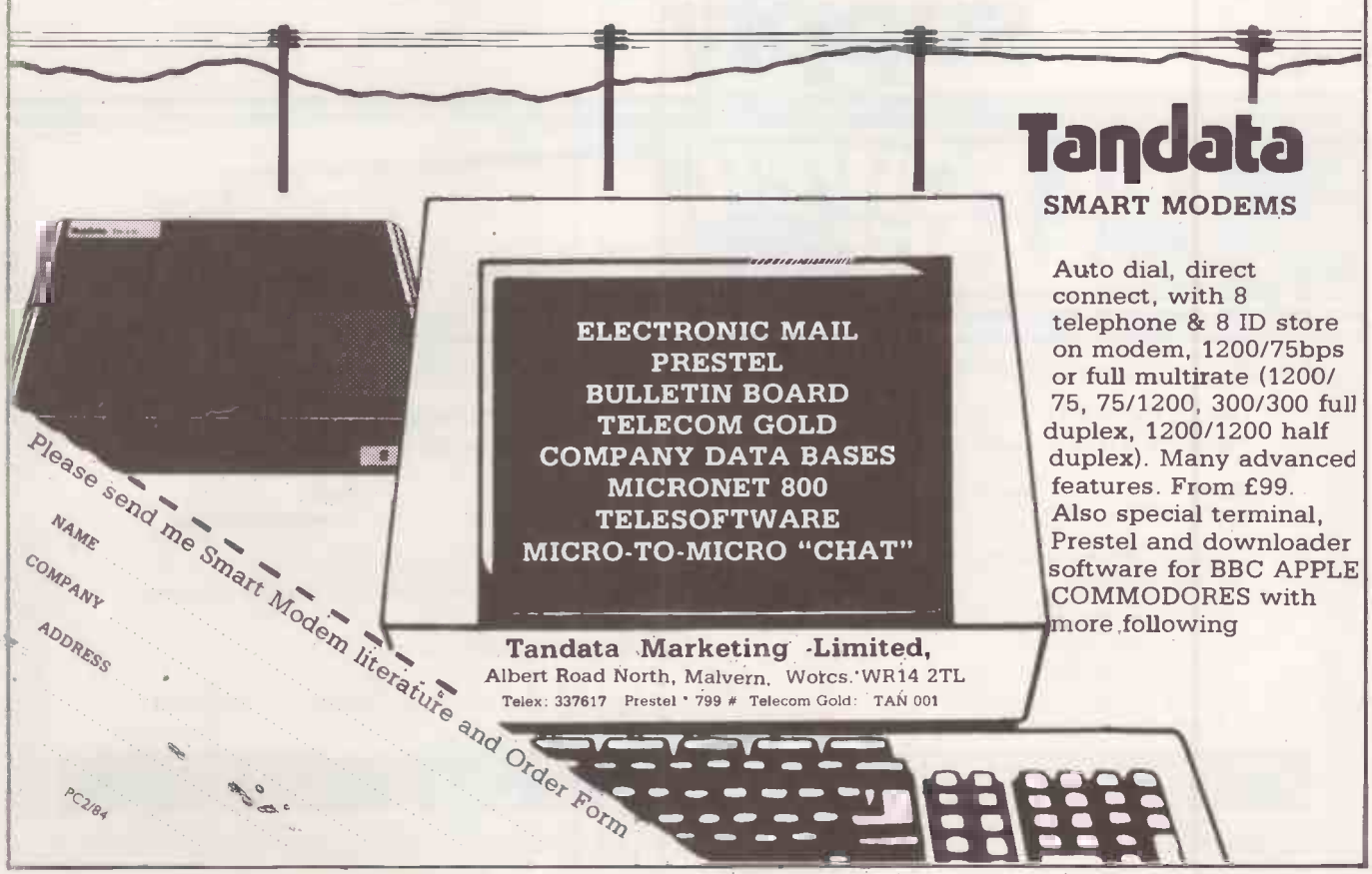

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>NEXT MONTH

>WORD PROCESSING

Almost everyone can benefit from word processing, and almost every micro now offers a word processor, so in the March issue Special Section we offer a guide to the field. We will be examining a range of packages, from the easiest to use, like the Bank Street Writer, to the famous WordStar.

>COMPETITION

The Research Machines 480Z system is on the test bench for next month, along with its disc drives and a bundle of software including WordStar. An outfit worth £1,000 will be offered as a prize in an accompanying competition that anyone can enter.

>REVIEWS

One of the world's leading micro companies, named after a fruit, will be launching a user-friendly computer, named after a raincoat . . . but we aren't allowed to mention it. Full details in the next issue. We will also be looking at battery-powered portable computers, including hands-on experience with the new Sharp PC-5000. Software under investigation includes Oz, Expert-Ease and Atari games.

>AND MUCH MORE!

Features for March include a visit to Xerox's Parc where Smalltalk and Lisa-like environments originated. Commodore 64 owners should order their copy now: Boris Allan will be helping out with colour-graphics routines for this machine. Mike Lewis presents the second of his columns for programmers; plus there will be all the regulars, including News, Chip-Chat, and pages and pages of free software in Open File.

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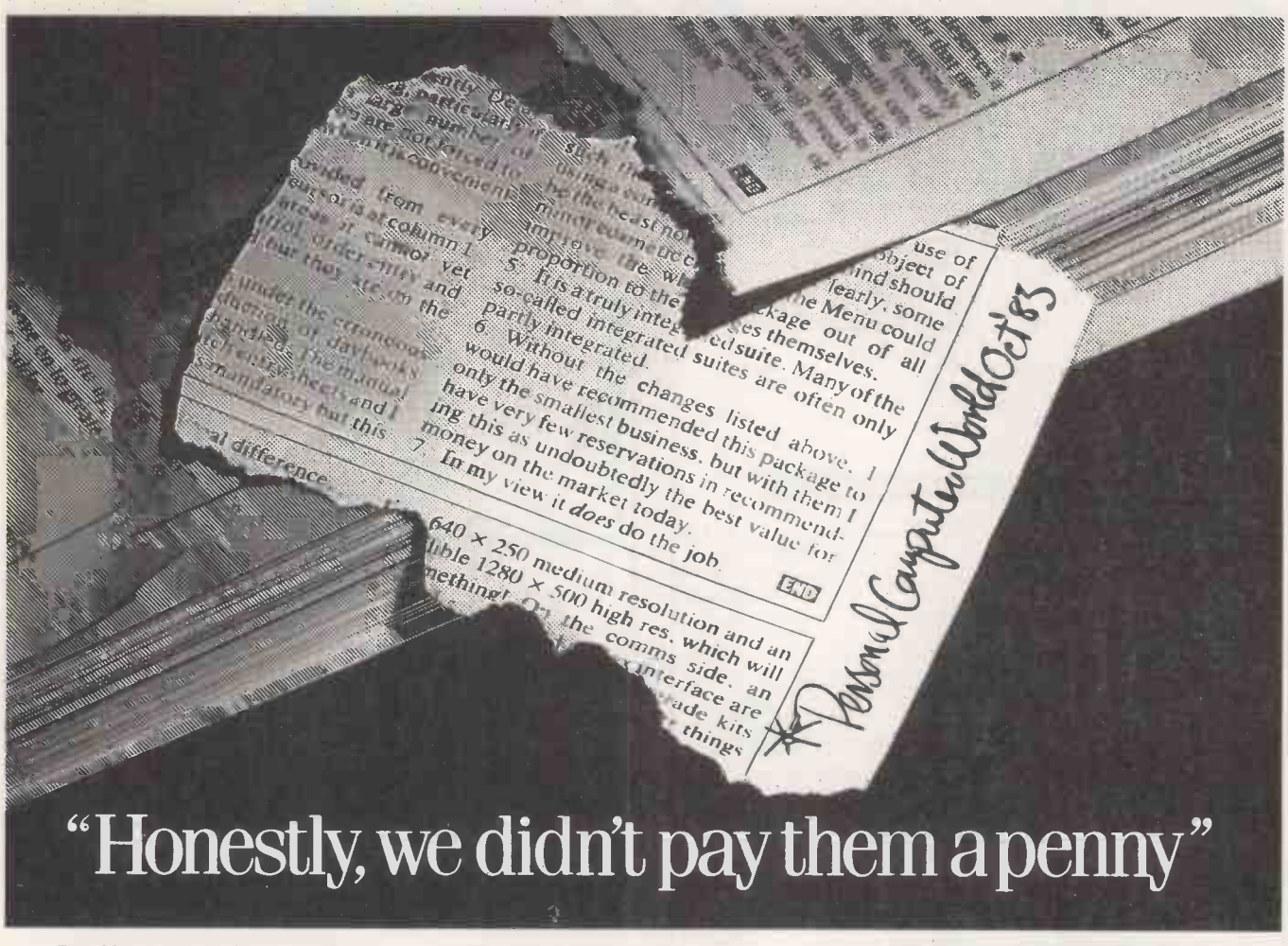

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Return of the electronic brain

Chris Naylor sets his grey matter working on itself and comes up with some unexpected predictions of what can be done with a few hundred megabytes.

"OF COURSE," the man is saying, "you can do anything you want with a computer." He smiles and waves an expansive hand over his shelves of shiny machines while, before him, an uncertain customer nervously fingers a cheque book. "Anything," continues the salesman. "Absolutely anything at all. It's entirely up to you what you make it do."

And, at this point, one ceases to eavesdrop and shuffles away out of earshot so that this particular naive end-user may be fleeced in private. Too much, one thinks to oneself, to be both fleeced and to have an audience at the said fleecing.

Pausing to think for a moment about what the salesman said: is it actually incorrect. Can a computer, actually and really, do anything? To us experts, of course, the answer is No. So what, actually, would a do-anything machine look like?

Rough workings

Now the human brain is, surely the most do-anything machine in the entire known world. While admitting that there are certain difficulties in explaining exactly how it works, it is still possible to give a rough idea. The many thousands of neurons that make up our thinking engine are sufficiently similar for an idealised neuron to be taken as a pretty accurate representation of the whole lot.

Each neuron consists of a cell body out of which appear lots of little branches called dendrites and one big branch called an axon. At the end of the axon there are a lot more branches sticking out which are called terminals. These terminals come very close to the little dendrites sticking out of the cell bodies of other neurons, and sometimes come close to the actual cell bodies themselves. The junction between a terminal and a dendrite is called a synopse.

What happens is this. For some reason one of the cell bodies acquires an electrical charge. When it does so it sends a signal down the long axon to all the terminals at its end. When the signal reaches the terminals they fire the synapses and induce a corresponding signal in the nearby dendrites of other cells. As the cell potential passes a certain threshold it too sends its own signal down its own axon to other neurons. And so the process goes on. Once started it turns into an avalanche of signals until the whole brain is humming away nicely.

You can get a computer to do the same sort of thing. One bit can represent each cell body firing or not firing according to whether it is 0 or 1. A simple address takes the place of an axon with terminals out to the dendrites on other cells. Allow six terminals to each axon and give one-byte addressing for each terminal. So, connected with the bit for the cell body are six bytes for the terminal address, for other bits representing other cell bodies.

Pass it on

Now write a short piece of code to allow for the fact that the electronic neurons are not self-acting in the same way that real neurons are. All you need is a loop which scans through each of the cell-body bits, reads it, and if it is set to 1 goes on to read the terminal addresses associated with it and sets the cell bits in those addresses to 1 before passing on to read the next cell body in line.

So far the end result will be that the system jams solid with every bit set to 1 and staying there. This is because all of the electronic synapses are excitatory synapses — that is, they trigger a cell into action. Real brains also have inhibitory synapses which inhibit a cell from triggering. What your electronic analogue needs is another bit to go with each of the terminal addresses to show whether or not it is excitatory or inhibitory. Now the level of firing varies, but the whole thing should neither jam solid nor switch off altogether.

Time slice

Real axons are surrounded by something called myelin, which insulates it but also alters the speed of transmission of each nerve impulse. In a real brain, the cells can fire or stop firing as soon as they receive the appropriate signals. In the computer they have to be read and fired by a scanning process, which rather upsets the time picture by introducing an order into the events which really should not be there. Each scan should produce an instant slice of time, and if some synapses are triggered at different times due to transmission delays then you want to be able to represent this somehow or everything will get out of step. So introduce another bit to go with each cell bit, which can be either 0 or 1 depending on whether or not transmission down the axon to the terminals is to be fast or slow.

For the sake of yet more verisimiltude, add in another bit for each cell to represent the threshold level which must be provided to start each cell firing down its axon. As a final touch of accuracy the threshold bit and transmission time bit can be changed to bytes to give more variability.

Each neuron then takes up about $2n+3$ bytes, where n is the number of terminals addressed. That assumes one byte is enough to hold the terminal address — in practice two bytes per address might be better — and with, say, six terminals that gives us 21 bytes per neuron. The control program will not take up much room, so 48K of memory will give you around 2,340 neurons in the machine.

Now the human brain contains around 10^9 neurons, so machine memory size is going to be a problem. Even adding a 200K floppy gives you not much more than 10,000 neurons.

Clever snail

Still, all is not lost. A snail or a locust has between 10,000 and 100,000 in its little head and, say what you like, but the locust can fly and even the snail can get about.

So there you have the makings of an intelligent computer which can do anything that, say, a snail can do. The real problem as always, lies in the software — in particular specifying all those terminal addreses and whether they should be excitatory or inhibitory. Somehow the human brain already has it all built-in, and it can alter its own threshold values over a period so that different connections come into play at appropriate times.

If you worked out one address for each of those 10^9 neurons every five seconds and put it in the machine you'd be through the lot in less than 160 years. Or maybe you could write a program to do it all for you. It is an attractive thought certainly, and there do not seem to be any theoretical problems. Maybe if 160 programmers worked for a year without sleep . . .

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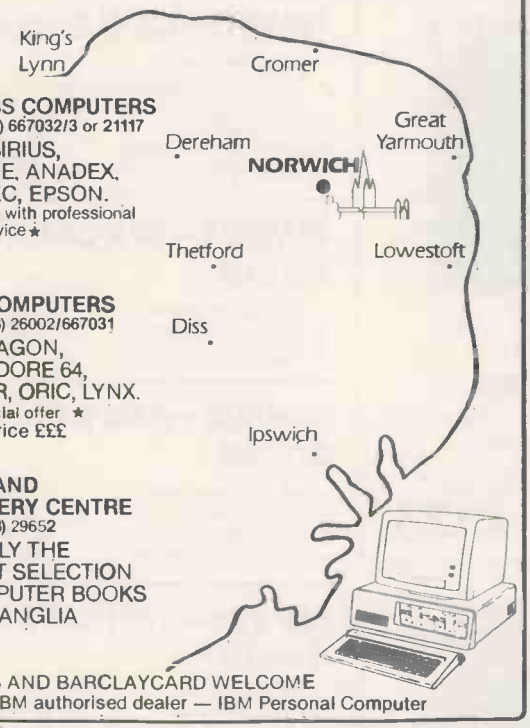

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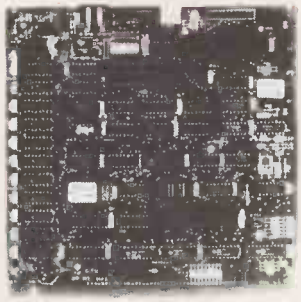
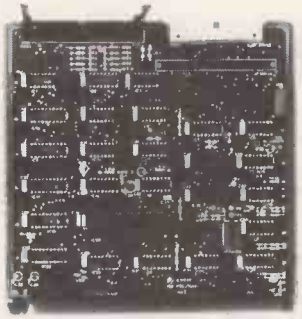
MicroValue 80-BUS MULTIBOARDS



GM813—CPU/64K RAM Board

- 4MHz Z80A C.P.U.
- 64K Dynamic RAM
- RS232 Interface
- Two 8-Bit I/O Ports
- Cassette Interface
- Extended & Page Addressing Modes
- CP/M Compatible Monitor

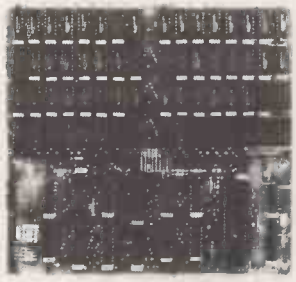
£225



GM829—Disk Controller Board

- Up To 4 Mixed 5.25 & 8" Drives
- SASI Hard Disk Interface
- Single & Double Density Operation
- Single & Double Sided Drive Support
- Supports 48 and 96 TPI Drives

£145



GM833—RAM-DISK Board

- Virtual Disk Operation
- 512K Dynamic RAM
- Port Mapped For Easy Interface Software
- Over 10 Times Faster Than a Floppy Disk

£450

Please note: This board cannot be used as a conventional RAM board

GM812—Video Controller Board

- 80 Characters×25 Line Display Format
- On-board Z80A Microprocessor
- Buffered Keyboard Input
- Programmable Character Generator
- 160×75 Pixel Graphics
- Light Pen Input

£125

GM816—Multi I/O Board

- 6 I/O Ports
- 4 Counter/Timer Channels
- On-Board Real Time Clock
- Battery Backup
- Further Expansion Capability

£125

PLUTO—Colour Graphics Board

- On-Board 16 Bit Microprocessor
- 640×576 Bit Mapped Display
- 192K Of Dual Ported RAM
- Comprehensive On-Board Software

£499

CLIMAX—Colour Graphics Board

- 256×256 Pixel Display
- 16 Colours
- Ultra-fast Vector & Character Generation
- Light Pen Input
- UHF or RGB Outputs

UHF Version **£199**

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GM811—CPU Board

- 4MHz Z80A CPU
- 4 'Bytewide' Memory Sockets
- 2×8-Bit Input/Output Ports
- 8 Bit Input Port
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£125

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- Up to 40K of Firmware
- 2708 or 2716 EPROMS
- Page Mode Operations

£65

GM802—64K RAM Board

- 64K Dynamic RAM
- 4MHz Operation
- RAM Disable Function
- Page Mode Operation

£125

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- 32K Static RAM
- Battery Backup
- Page Mode Operation

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EV814—IEEE488 (GPIB) Controller

- Cost Effective Controller
- Comprehensive Software Supplied
- Full Implementation
- Easy To Use

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GM827—87 Key Keyboard

- User Definable Function Keys
- Numeric Keypad
- Cursor Control Keys

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GM839—Prototyping Board

- Fibreglass P.C.B.
- 80-BUS Signal Identification
- High Density IC Capability

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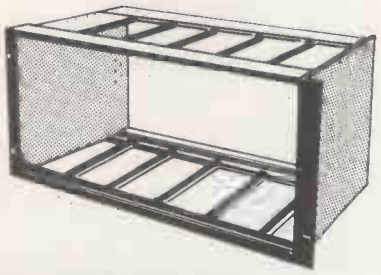
MULTIBOARD COMPUTERS

Gemini Microcomputers

All the boards and components in the 80-BUS range are fully compatible and offer a very flexible and cost effective solution to your computer needs. For further information about the 80-BUS range contact your nearest MICROVALUE dealer.

MicroValue · MicroValue



Power Supplies, Mother Boards & Frames

* GM807 3A Power Supply	£40.00
* GM817 6A Switch Mode P.S.U.	£75.00
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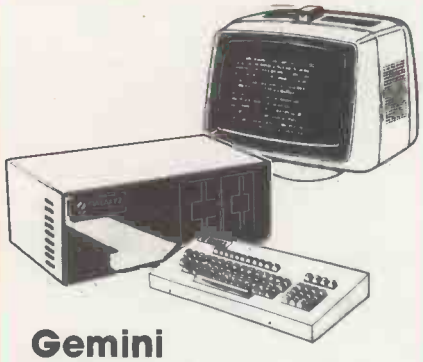
* GM656 3 Slot Motherboard	£5.00
* GM654 5 Slot Motherboard	£6.00
* GM655 8 Slot Motherboard	£10.00
* MP840 14 Slot Motherboard	£47.00
* GM662 5 Board Frame	£50.00
* GM610 19" Frame	£37.50



Gemini Galaxy 2

"I would place the Galaxy at the top of my list" (Computing Today, April 1983)

* Twin Z80A Processors
* CP/M 2.2 Operating System
* 80x25 Video Display
* 64K Dynamic Ram
* Light Pen Interface
* Up to 1.6Mhz Disk Capacity
* Serial RS232 Interface
* Parallel Interface
* Numeric Keypad
* Definable Function Keys
* Cassette Interface
* 12" Monitor Included

from £1495

Quantum System 2000

Computerise Without Compromise

* 80-BUS Construction
* Serial & Parallel Interface
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* Up To 2.4Mhz Disk Capacity
* Up To Three 5.25" Drives
* Fully Expandable
* Twin Z80A Processors
* CP/M Operating System
* 64K Dynamic Ram
* Definable Function Keys

Two-Drive Quantum £1910

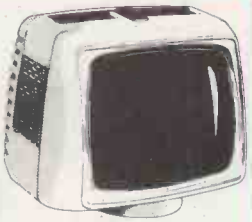
Gemini Multinet

The Gemini Multinet enables as many people as possible to have access to their own microcomputer with mass storage and printer facilities for the lowest possible cost. This is achieved by providing a central 'fileserver' fitted with a Winchester hard disk unit and printer interfaces, in conjunction with a method of interconnecting up to thirty-one workstations to the fileserver. The fileserver and each station are fitted with the Gemini GM836 network interface board. A Micropolis 800K floppy disk drive is incorporated in the fileserver providing backup for the hard disk.

GM910 Galaxy 4 Multinet 5.4 M/byte fileserver	£2600
GM912 Galaxy 4 Multinet 10.8 M/byte fileserver	£2850
GM909 Galaxy 4 Multinet workstation	£650

Both fileservers and workstations are supplied complete with VDU's; the operating software is supplied with the fileserver.

Phoenix P12 Monitor



A high quality 12" data display monitor, ideal for Gemini systems. The P12 is available in both green and amber phosphor versions and has a resolution of 20Mhz.

£95

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FLOPPY DISKS FAST

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The complete DISKING DATA PROCESSING package

1 - SEE 10 LIBRARY BOX

Value £2.50

** PLUS **

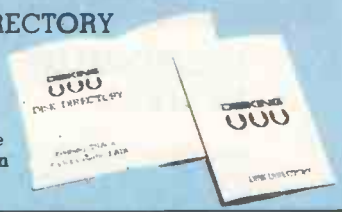
2. DISKWRITER

Value 20p
You may purchase these separately at £9.90 for 50 (specify blue or black ink)

** PLUS **

3 - DISK DIRECTORY

Value 99p



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LORUS are part of the SEIKO group of companies

Order FOUR Ten-packs of any brand of diskettes (5¼" or 8") using the coupon opposite, or if telephoning credit card orders mention this ad. At these prices you will receive a FREE Quartz Watch. Order EIGHT Ten-packs and you will recieve TWO Quartz Watches and so on. Please specify when ordering whether you require Gents or Ladies models. Offer ends 28th February 1984.

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MEMORY EXCELLENT

With their NEW FIVE YEAR WARRANTY MEMOREX prove once again their reputation for high quality media. Specify MEMOREX diskettes and you can be sure of reliable products with specifications far exceeding those stated on the label.

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A FREE MEMOREX C-90 CASSETTE TAPE will be packed with every ten-pack of any MEMOREX diskettes purchased at these prices. This offer does not affect any other promotions and is in addition to them. Offer ends June 30th 1984.

5.25" DISKETTES
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	10-40	50-90	100+
3481 S/S 48 tpi Soft Sect	21.90	20.90	19.90
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48 tpi suitable for 35 or 40 track operation
96 tpi suitable for 77 or 80 track operation
10 & 16 Hard Sector available at same prices

DISKING stock around 80,000 of the world's finest diskettes and normally ship within FOUR working hours! Whether you want 1 or 100 ten-packs we are waiting.
Call Joan or Roger on 0428 722563 anytime. ACCESS, VISA or DINERS cards welcome.

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Datalife by Verbatim - With Five Year Warranty

VERBATIM have not become the World's favourite floppy disks by accident. Perfect magnetic media is their stock in trade, and to prove it they now offer an unconditional FIVE YEAR warranty on all DATALIFE products.

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Certified for single OR double density and with hub ring reinforcement.

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96 tpi suitable for 77 or 80 track operation
10 & 16 Hard Sector available at same prices

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PRICES EXC VAT	10-40	50-90	100+
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32 Hard Sector available at same prices

Verex

THE VERBATIM PROMISE AT POPULAR PRICES

5¼" DISKETTES
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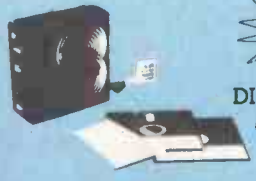
DD34-1501 D/S D/Dens. Soft Sect	29.90	28.90	27.90

DISKETTE CARE AND MAILING



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We're fed up with being asked whether our disk drive head cleaning kit actually works. So here's the proof:-

BEFORE. AFTER

Can you really risk that breakdown?

CK5 for 5¼" disk drives	14.90
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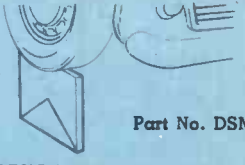
(5¼" only)



Part No. DSM

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* CAVERNOUS CAPACITY - will take, one, two, three or even four diskettes WITH envelopes.

* FULL INSTRUCTIONS - Each DISKING 'SUPERMAILER' is printed with full instructions

*PACKED IN 100'S - For convenience

1 PACK	2 PACKS	3+ PACKS
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48 tpi suitable for 35 or 40 track operation
96 tpi suitable for 77 or 80 track operation
10 & 16 Hard Sector available at same prices

8" DISKETTES

PRICES EXC VAT	10-40	50-90	100+
3740/1 S/S S/Dens Soft Sect	30.90	29.90	28.90
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32 Hard Sector available at same prices

SONY.

3½" MICRODISK

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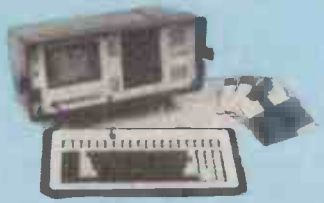
OM-D3320 S/Sided Auto Shutter	42.90	41.90	40.90

(There is no free library box with these yet)

ZORBA Portable Microcomputer



Whether Businessman, Programmer or beginner THIS Portable Business Micro is for YOU. We defy ANYBODY to match it's value ANYWHERE!
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MORE STORAGE - 800 KBytes on twin 5.25" floppy disks plus 64 KBytes User Memory.
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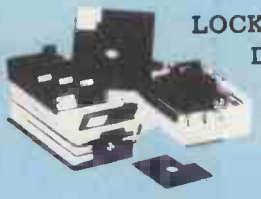
More handbooks including:- CP/M, Zorba, WordStar, Mailmerge, Calcstar AND Beginners Manuals.

DISKETTE STORAGE



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These anti-static, ABS plastic diskette storage boxes come in four sizes, two for mini disks and two for 8" disks.
They have a white base with a transparent smoked lockable lid, and hold 40 or 80 diskettes.
They come complete with keys and dividers.

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LIBRARY BOXES

PRICES EXC VAT	1-49	50+
SEE 10 for minidisks only	2.50	2.20
	1-47	48+
8" LIBRARY BOX (NOT SEE 10 Design)	2.50	2.20

The new SEE 10 is probably the best 5¼" library box around.
(FREE with every ten disks ordered).

5, 10, 15 & 20MB Hard Disks for YOUR Micro.

We just bought a 20MB sub-system for our micro., to service the ever increasing number of you lovely people who keep ordering diskettes, adn were so impressed with the performance, service and price, that we decided you'd all like one of these magic boxes. So we now sell them.
They come in four sizes, and there's one for YOUR machine:-

Part No:	5MB DS505	10MB DS510	15MB DS515	20MB DS520
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IBM-PC	1290.00	1390.00	1490.00	1590.00
SIRIUS/VICT.	1190.00	1290.00	1390.00	1490.00
EPSON QX10	1190.00	1290.00	1390.00	1490.00
DEC LSI 11	1390.00	1490.00	1590.00	1690.00
Z80 System	1190.00	1290.00	1390.00	1490.00
S100 System	1290.00	1390.00	1490.00	1590.00
ONE slave may be added at these lower prices				
Slaves	990.00	1090.00	1190.00	1290.00

Complete with intelligent controller, host adaptor power supply unit, fan, cabling, software and User Manual.
Free delivery in the UK.

UK SHIPPING RATES EXC VAT

5¼" DISKETTES
1-2 Packs each pack @ 95p
3-5 Packs each pack @ 75p
6-9 Packs each pack @ 60p
10+ Packs @ POST FREE @

8" DISKETTES
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5¼" CLEANING KITS
Same postal rate as packs of 5¼" diskettes, 10+ POST FREE

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DISKING SUPERMAILERS (5¼" ONLY)
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DISKING DISKWRITERS
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LOCKABLE DISKETTE STORAGE
All versions £2.00 each for one, £1.30 each for 2-7, 8+ postfree.

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We are now happy to accept any official orders with a minimum value of £30.00 from Government Departments, Ministries and Local Authorities. We do this on the understanding that invoices will be settled within thirty days or preferably less please.
Alternately, you may send your remittance with your order if you so wish.
All other non Government bodies, cheques with order please payable to DISKING. If you are a large establishment, and cannot raise cheques without an invoice please post or telephone us your order, and we will send a pro-forma invoice by return, for your accounts department to pay against.
Also bear in mind, that you do have to pay VAT, which will be added to these prices.
If you are in any doubt, please see the order form on this brochure to help you with your calculations, or telephone us for assistance.

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We welcome Access (Mastercharge), Barclaycard (VISA) & Diners Club International, & there is NO credit card surcharge. You may write your c/card No. on your order or telephone the order day or night, 365 days a year. You may speak for as long as you like, (but don't leave long gaps otherwise our machine thinks you've gone home) and don't forget to give the following details:
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2. Delivery Address if different
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If you're posting your order, omit the word FREEPOST from our address, and use our normal postcode GU30 7EJ and do not forget to stamp it FIRST CLASS. If you are a Government body as defined under 'NORMAL ORDERS' and are telephoning your official order OR are an individual or company using your credit card No., please make it clear that you wish to pay for your goods to be sent to you by FIRST CLASS POST.

FIRST CLASS RATES EXC VAT	MINIDISKS	8" DISKETTES
First TEN-PACK	2.00	2.50
Second and subsequent TEN-PACK	1.50	2.00

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Your options are: DATAPOST Which will deliver the goods within the United Kingdom over night (usually before 10 am the next day) provided they are ordered and paid for from DISKING by 3.00 pm or EXPRESSPOST Which will deliver the goods the SAME DAY provided they are ordered and paid for from DISKING by 10.30 am, and provided you are no further north than Manchester.
These services put great stress on our sales order processing and packaging departments. Please therefore, spare a thought for our girls, and make sure that:-
-) The required goods are in stock and
-) A full complement of manpower and vehicles are available at DISKING

TRADE CORNER

Write or call for our 1984 Trade pack, including our FREE sample unlabelled diskette.

A Seasonal Message to all our Customers

You'll find our prices good, and our service even better. Cheaper products you may find, but anyone can advertise anything at a silly price. Just try buying it — it's always next week! Like car salesman with the new £1000.00 cars, he had plenty of orders, but he just couldn't get the stock! surprise surprise.

Our thanks this month go to Alistair who always leaves his order for 1000 diskettes until 6.15pm and then wants delivery in London next morning — A Happy New Year to him from DISKING, and from our local taxi driver who's getting to know the route quite well. To ALL our customers both Trade AND End User, without whom we wouldn't be here:-

*** * * A HAPPY AND PROSPEROUS NEW YEAR * * ***

STOP PRESS * STOP PRESS * STOP PRESS *

400 Brand New, Unlabelled Grey Superluxe Disk Libraries (20 minidisk capacity) at half price to Clear. Minimum order quantity 10 pieces.
Only . . . 4.90 each. (3.00 P&P per 10, 30+ FREE)
This offer is open to the trade OR end users. First come, first served.

Order any 4 Ten-packs of diskettes use this coupon and you will receive a FREE Quartz watch, specify

Gents Qty . . . . . .
or
Ladies Qty . . . . . .

QTY	PART NO.	DESCRIPTION	PRICE EXC VAT
			£
			£
			£

TOTAL GOODS VALUE EXC VAT	£
TOTAL DELIVERY AND INSURANCE	£
SUB TOTAL EXC VAT	£
VAT	£
VALUE OF CHEQUE PAYABLE TO DISKING	£

Name: _____ Tel No: _____
Address: _____
Please charge my credit card No: _____
ACCESS, VISA AND DINERS cards welcome.

DINERS CLUB

179

● Circle No. 204

This man can use...

46 Microcomputers 6 Word Processors 16 Printers 2 Mini Computers

...all without leaving his seat!

Clearway

is a low cost Networking device allowing *ALL* minis, micros, printers, mainframes etc. to communicate with each other.

- From £150 per connection (node)
- No controller needed.
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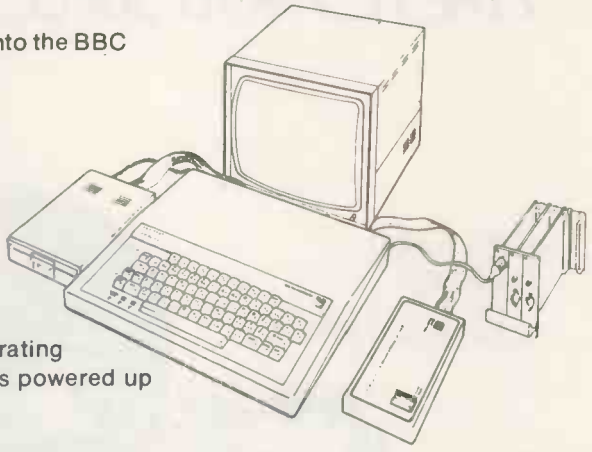

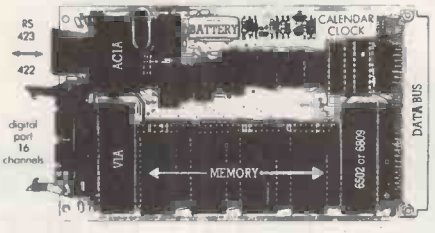

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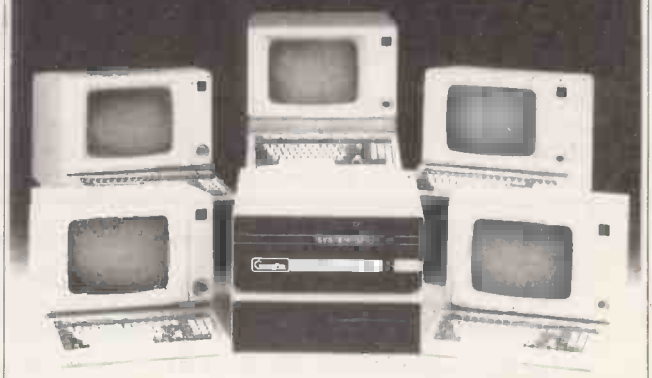

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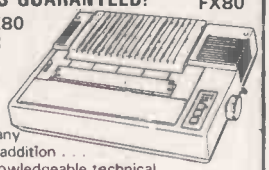

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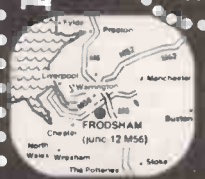

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