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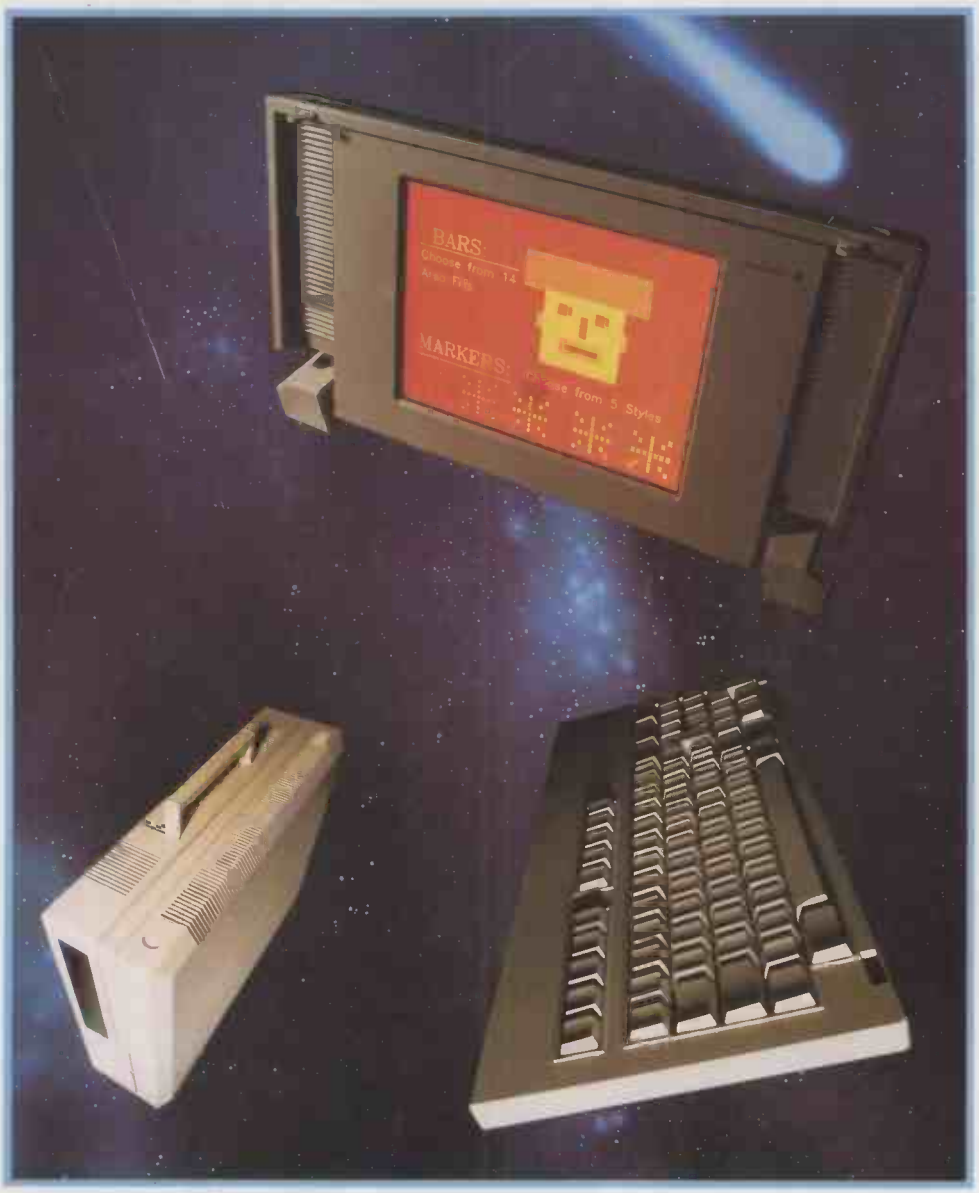

NETWORKS: TIME TO CONNECT?

HARDWARE Epson QX-16 • Headstart • 128K Atari

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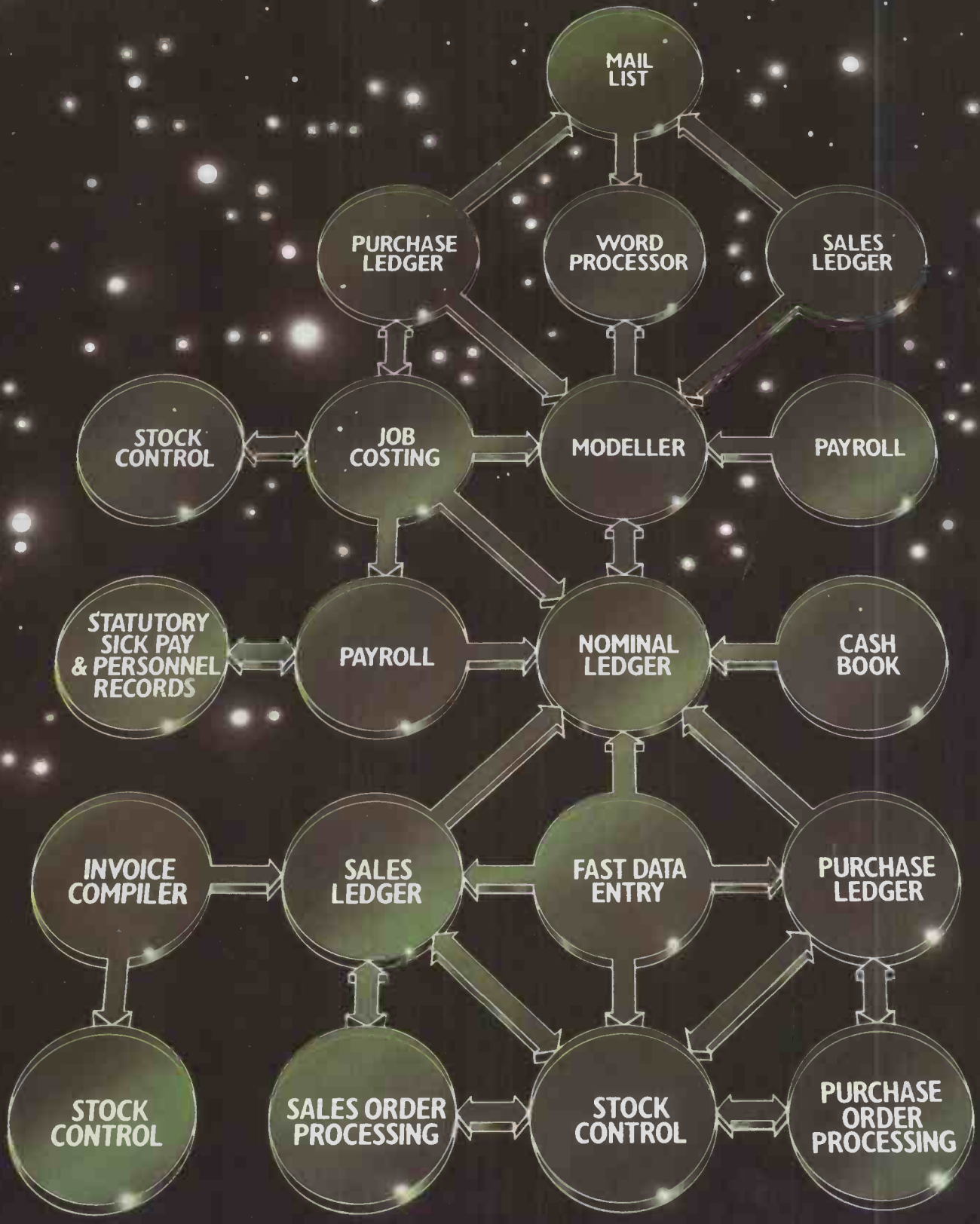

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PRACTICAL COMPUTING

JULY 1985 **CONTENTS**

FEATURE

NETWORKS

This month's special section covers networking, which for some time has been seen as the solution to all the problems of stand-alone computing. But actually choosing and implementing a network is not easy. To help, *Kathryn Custance* surveys the market, and provides a list of possible suppliers. Then you have to lay the cables, and on page 94 *Della Bradshaw* looks at how it's done. Finally, on page 96 *Mike Lewis* discusses the pros and cons of networked PCs as compared with multi-user systems **88**

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ACT's private viewdata system for up to 16 simultaneous users.

OPEN FILE

REGULARS

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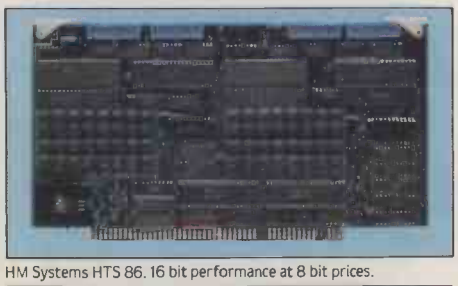
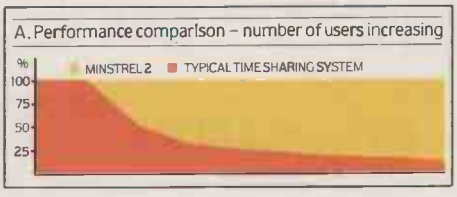
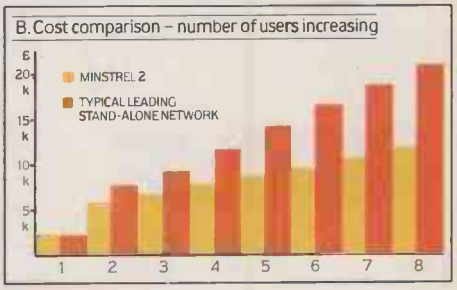


HM Systems HTS 86. 16 bit performance at 8 bit prices.





Costs rise and performance suffers when a number of terminals share a common processor. Graph B shows a network of leading stand-alone computers when compared with Minstrel 2. Graph A shows the effect on performance of timesharing compared with Minstrel 2.

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4

DECISIONS, DECISIONS

MICROS have to earn their keep. If you look at the real growth in computing — as opposed to the craze element — each leap forward has been stimulated by the micro's ability to tackle more useful tasks in the real world.

The process began with word processing, continued with database applications and then the appearance of the spreadsheet in 1979. Since then we have added business graphics and, more recently, communications.

This year we have seen a huge growth in communications, with low-cost modems becoming widely available along with easy-to-use software. There is a wide and ever-growing range of electronic mail services, on-line databases and useful bulletin-board systems. Continued progress is reflected in our own Comms column, written by Ben Knox.

Now people are starting to look around and wonder what will be next. And for a change, no clear message is being received from America. Usually, it has been easy to predict the short-term future of computing in Britain, because all the major packages have originated in the U.S. Thus the movements of the British market have simply followed those of the American one, but a year or so behind. Look at America today, however, and there seems to be no clear road ahead.

Some people suggest the future lies in what has been called psyche-ware — software that concerns feelings and psychology, rather than ordinary data. There are programs that help you to be a better manager, learn to sell, find out what your girlfriend or boyfriend is really thinking, and so on.

Alternatively, perhaps what you need to know is what you are really thinking, which you can perhaps do with another new type of software, the thought processor. Programs like Brainstorm and Thinktank claim to help you organise and clarify your ideas, and thus plan reports and projects.

A more prosaic and familiar implementation of a similar idea is project-management software. There are already some 35 to 40 programs on the market, with others on the way. Clearly most serious computer users are managers, and most managers have to run projects, so the idea that everyone should buy a project-management package has a certain appeal.

A fourth possibility is what are known as expert systems. The term covers a multitude of sins, and this is another area that has seen rapid growth. Expert Ease and Hulk have been followed by programs such as Trigger and Lightyear. Here the Japanese fifth-generation project and our own Alvey programme are encouraging research into artificial intelligence, some of which feeds through into the expert systems field.

With so many contenders, it is far from clear what the next VisiCalc will be. But take a wider view, and the situation looks less confusing. In fact the next software explosion could well be in decision making, of which all the areas so far described are merely part. Psyche-ware programs, project managers, ideas processors and expert systems all have a common aim in view, which is helping people to organise their thoughts so as to make decisions. More fully, these programs enable people to express, analyse and justify decisions, according to the criteria involved. These may by psychological, technical, financial or whatever, it does not really matter as long as the criteria themselves are clear.

If there has to be a candidate, it could well be something like Lightyear, reviewed in this issue. Yes, you may say, but what does it actually do? That is a hard question to answer without reaching for the standard get-out of "anything you like". It enables you to set priorities, consider and compare alternatives, and make and justify decisions. Like the description of a spreadsheet, "you can use it to manipulate rows and columns of numbers", the straight answer is not the answer at all. The true worth of software emerges not from what it does, in the ordinary sense, but from the problems it enables users to solve.

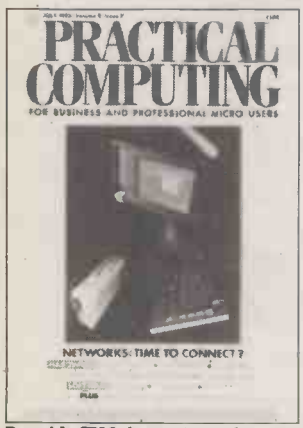
Whatever the next software motor proves to be, there is one further point worth making about the decision-making field. That is, the program need not necessarily be American in origin. British software seems to be at least as far advanced. While the Americans have produced Super Project, Microsoft Project and the Harvard Project Manager, we have rivals in Micro Planner, Hornet and others. Against Thinktank we can put BrainStorm and Tea, while Lightyear and Trigger have been preceded by British programs such as Expert Ease, ESP/Advisor and Hulk.

There is hope for the British software industry yet.

5 YEARS AGO...

The problems of surviving in the rapidly-growing microcomputer business have been well highlighted by *Practical Computing* in the past and it is a well-known danger that the company you buy from today may have gone out of business tomorrow leaving you stranded for parts and technical support. It is, however, particularly sad to have to report that one of our best known and successful manufacturers, Nascom, has called in a receiver. Several weeks ago John Marshal of Nascom announced that he was looking for a buyer to help support his investment plans after his backers, Grovewood Securities declined to inject any more capital into the company.

In June last year, Grovewood invested £500,000 in Nascom, shortly after the launch of the Nascom 2 which cost more than £250,000 to develop. Problems in securing supplies of EPROMs for the first Nascom 2 delayed the return on the investment.



Portable IBMulators: page 62.
Photo: Tony Hutchings.

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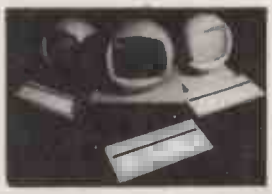

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Quadrant House, The Quadrant,
Sutton, Surrey SM2 5AS

OLIC

THANKS for the mention of our on-line information centre in your March article on networks. Unfortunately, the facts got twisted somehow: OLIC is not about to become an independent consultancy firm — it's only just become part of Aslib, as from 1 March.

For six years, it was funded by grants from the British Library and the DTI, plus members' subscriptions. In February this year, the grants ran out, and, rather than close down such a useful office, Aslib agreed to take it over. It now forms part of our information resources group, along with the on-line searching service and the information centre.

We're hoping to get some sponsorship to keep the service going, so if anyone's interested, write to me for details of the sponsorship scheme. New members are always welcome too.

FEONA J HAMILTON,
Aslib,
Information House,
26-27 Boswell Street,
London WC1N 3JZ.

File lister

I READ with interest the article by John and Tim Lee entitled "File lister" in April 1985's edition. While appreciating the object of the program, the days when such programs are written in assembler should be behind us by now. On reading the article I sat down and produced a similar program in C. The source code is much shorter and easier to understand.

While I appreciate the advantages of assembler, having produced my own CP/M BIOS and pieces of time-critical code, I find that the use of assembler for such tasks rather outdated when languages such as C are becoming more widespread. There are now C systems available running under most of the popular disc operating systems; I use BDS C under CP/M. I look forward to seeing more C programs in your magazine in the future.

P J ONION,
Loughborough,
Leicestershire.

THE EDITOR REPLIES: The main reason we have not published programs written in C is that no one sends us any. However, it is also worth noting that C code tends not to be very readable. One of C's virtues is that it encourages brevity, but it does require a vast amount of documentation to explain satisfactorily what the programmer is trying to do.

TOUCHÉ

MAY I HELP solve a little puzzle? On page 106 of the May issue under the entry for the Advance 86B you state "it is hard to understand why this machine has not taken off in a big way". If you look on page 74 of the same issue you will see why. The Canon A-200 has a spec broadly similar to the Advance, both run a true 16-bit processor at 4.77MHz and offer IBM compatibility. The Canon price includes a monochrome monitor, say £100, and a further 128K worth £80 at High Street prices. The Advance in turn offers a year's free maintenance and a bundled software package, the word processor of which alone must be worth that.

The main difference between these two machines is that the Canon is in a pretty box and costs £1,875 and the Advance isn't and costs £1,086. And your conclusion? You think that the Canon pricing is "very competitive".

The point of this is: if a British magazine doesn't point out when a home-grown machine offers a similar performance for nearly £800 less, who on earth will? Noboby expects you to give endless free plugs to companies just because they are British, but in this instance it would be perfectly reasonable to compare the two machines in a review as they do offer a very similar performance.

I can't help thinking that the British desire for fair play sometimes gives the other chap the advantage.

RAY DANIELS,
London W13.

DBS Pay

MAY I comment on certain points made by Chris Bidmead in his review of DBS Pay for the Macintosh in your May issue.

- The size of text boxes are dependent on the fact that characters are proportionally spaced and hence boxes have to cater for entry of characters in the largest width.
- The Wastebasket is the U.K. version of the Finder by Apple and all the features relating to this are part of the standard Macintosh Finder desk top.
- DBS Pay keeps a separate track of all folders created and allows folders to be held on separate discs. Therefore it is designed to detect the missing folders and allow other discs to be inserted.
- The printing of cheques and any other payroll forms to a special design can be accomplished with our DBS Form application.

We welcome and encourage valid suggestions and criticisms of our products as these enable us to keep in tune with user requirements and effectively carry out our policy of continual product review and improvement.

DARYL A WALMSLEY,
Deverill Business Systems,
Poole,
Dorset.

Mainframe quirks

I AM collecting source material for a book I am drafting about mainframe systems. The information I am seeking concerns the oddities and quirks of large systems — those events that occur seemingly at random, causing hiccups in the tightest run system.

One such example I have is a line printer that occasionally printed the text buffer backwards. That one still remains a complete mystery to all involved. Another is an operating system that managed to disable all its terminals without a single user or job on the system, but the problem was rectified.

I would be grateful for any such material from all aspects of computing. All information will be treated confidentially and, if requested, nothing will be submitted for publication without the originator's approval.

GRAHAM R ING,
11 Hawk Close,
Stubbington,
Hampshire PO14 3SW.

Scientific and foreign text WP

I READ with interest the word-processing feature in the April 1985 issue of *Practical Computing*, and having a vested interest in the word-processing package — we are a word-processing software house — I felt I must point out some facts about scientific and foreign text, etc.

We market a product in this country exclusively through Sperry Limited on the Sperry PC, which allows the display of almost any character you require. This has been difficult to achieve before as the graphics display of IBM clones in often unreadable, but Sperry Limited have produced an IBM-compatible personal computer with a high-resolution monitor, and using this medium we can soft load five complete character sets to the PC. All these character sets are available via the function keys on a touch of a button. Included in the software is a screen fount editor, therefore the software can be simply configured for any character or character sets required.

As for printing, it is our proud boast that what you see on the screen is what you get on the printer. We show on the screen the justifed line as it will be printed, including true line spacing, therefore at print time you know exactly what you are going to get. To achieve the printing of these characters we make use of the new high-quality downloadable dot-matrix printers. We are printing in the ASCII mode and produce extended ASCII text files. We also support full micro justification; included in the package is a print fount editor so the user can match his or her screen files to the printer.

D F MANNING,
Scientex Ltd,
Stevenage,
Hertfordshire.

IN SUSAN CURRAN'S article on word processing in the April 1985 issue she gives the impression that on the BBC computer only Wordwise with Languagewise can handle foreign text. In fact, View

(continued on next page)

(continued from previous page)
with Watford's FX-80 printer driver can handle French, German, Danish, Swedish, Italian, Spanish and the Japanese yen sign, as well as sub- and superscripts and a variety of type styles. This makes View into a very powerful word processor.

K M SHAW,
Sevenoaks,
Kent.

WP for professionals

SUSAN CURRAN'S article — April issue — shines as a beacon of clarity and solid information on a subject on which an inordinate amount of flannel tends to be written. Those of your readers whose interest lie in the professional field — scientists, engineers, authors, journalists, home typists — rather than in business applications, might be interested in my particular experience, based on having processed some half million words, and studied manuals for systems other than those I have used.

For professional use, I am convinced that the best of the cheap systems, based on home computers, are actually more suitable than business-type programs costing 10 times as much, and bristling with features which will never get used, and only make learning laborious. My experience is mainly with two programs for the Dragon, which is now back on the market: Telewriter, tape or disc, and Super Writer II, cartridge. Compared with Amsword, these allow more text in memory, even on the 32K Dragon, have better provision for code sequences and give a word count, which is essential for many professional users but which Amsword lacks. The Amsword page-break indication is virtually useless, as it does not alter with editing.

Super Writer II allows a screen preview of the text exactly as it will be formatted in print, and has all sorts of features Susan Curran quotes as desirable, including such refinements as the option of printing headers and footers on alternate pages, etc. I am not sure about reliability, having suffered quite a few crashes, possibly attributable to a fault in my hardware. The manual could be better.

Telewriter has nearly all the desirable features, except page-break indication, and has proved absolutely reliable. Early versions had very bad keyboard response, now cured. The manual is very good.

I would guess Susan Curran hasn't tried these two programs, or she wouldn't condemn all cheap programs except Amsword. The Amstrad's 80-column display is of course excellent for word processing, and while Amsword is quite good, the machine deserves a still better program.

The Author program for the now defunct Oric Atmos is, in my experience, also quite good, though marred by an atrocious manual.

The kind of users I have in mind do not need vast memories. Telewriter, for instance, allows the Dragon 32 to hold 2,800 words — Super Writer II and Author allow more. As this represents the best part of a day's work for an author or a translator, little is gained by demanding more. Also, the more text you hold in memory the greater the disaster if there is a power failure, or if the machine gets switched off accidentally. This does happen sooner or later, and it is good practice to store anything much over 2,000 words on tape or disc, before going further.

Likewise, though disc is nicer, cassette storage is in my view perfectly adequate, since it may take as little as three minutes to store the result of hours of work. I have found tape perfectly reliable.

Amsword, Telewriter and Super Writer II allow ASCII codes to be sent to the printer, and hence there is no problem in achieving such things as one-and-a-half spacing, which Susan Curran says some presumably more expensive programs do not allow. All you need do is embody the right code sequence in the text — 27 65 18 for the Epson RX-80 printer. Similar remarks apply to foreign variants of the Latin alphabet, as long as the printer allows them.

On the subject of printers, daisywheels are not only less versatile than dot-matrix machines, but painfully slow unless you pay the earth. Good but still quite cheap dot-matrix printers — like my Epson RX-80FT — give print that is by no means displeasing, and is gaining increasing acceptance.

RUBEN HADEKEL,
London SW6.

THE EDITOR ADDS: We reviewed Dragon word-processing programs in our July 1983 issue and found Telewriter to be good. Other very good cheap word processors for small micros include Wordwise Plus, for the BBC, Atariwriter, for the Atari, and Vizawrite, for the CBM 64. Homeword and Bank Street Writer are also available for the Apple, Atari, Commodore 64 and IBM PC with discs.

Snowflake

THANK YOU for printing my short program Snowflake in March's BBC Open File. The appearance of the last dozen lines defining a procedure Screendumo — lines 440 to 560 — may have puzzled some people as this procedure is never used in the program. It is in fact a screen-dump routine taken from a previous BBC Open File that I used when developing the program and which I must have inadvertently copied on to the tape I submitted. It makes no difference to the running of the program and may be used to good effect simply by inserting a line ProcScreendumo at the appropriate point, say line 255.

S P J DENNINGTON,
Sarpsborg,
Norway.

Benchmarks

I AGREE ENTIRELY with the remarks of Peter Finch in your May issue on the subject of BM8. In the course of a great deal of experience in scientific computing I have never met a problem which needed so high a proportion of its time for calculating mathematical functions. On the wider aspects of the subject, I think that BM1 to BM7 are fairly useless as a realistic means of measuring computing power. For that reason I have recently been using the accompanying program which I run, as opportunity offers, in one or other of the machines with which I hope to replace my present Commodore 3032.

It is a simple bubble sort which first generates and stores the integers from M – 1 to 0 and then sorts them into ascending order. It is written in a very simple way with no attempt to save time, since I want it to consume some. In the Commodore it takes 198 seconds; the running time for other sets is roughly proportional

(continued on page 13)

BENCHMARKS

```
1 M=100:F=0:N=0:X=0:DI
M U(M):T=TI
2 FOR N=1 TO M
3 U(N)=M-N:PRINT N,U(N
):NEXT
4 F=0:FOR N=1 TO M-1
5 IF U(N+1)<U(N) THEN
X=U(N):U(N)=U(N+1):U(N
+1)=X:F=1
6 NEXT: IF F>0 THEN 4
7 FOR N=1 TO M:PRINT N
,U(N):NEXT
8 T=(TI-T)/60:PRINT "T
IME = ";T;" SECS"
```

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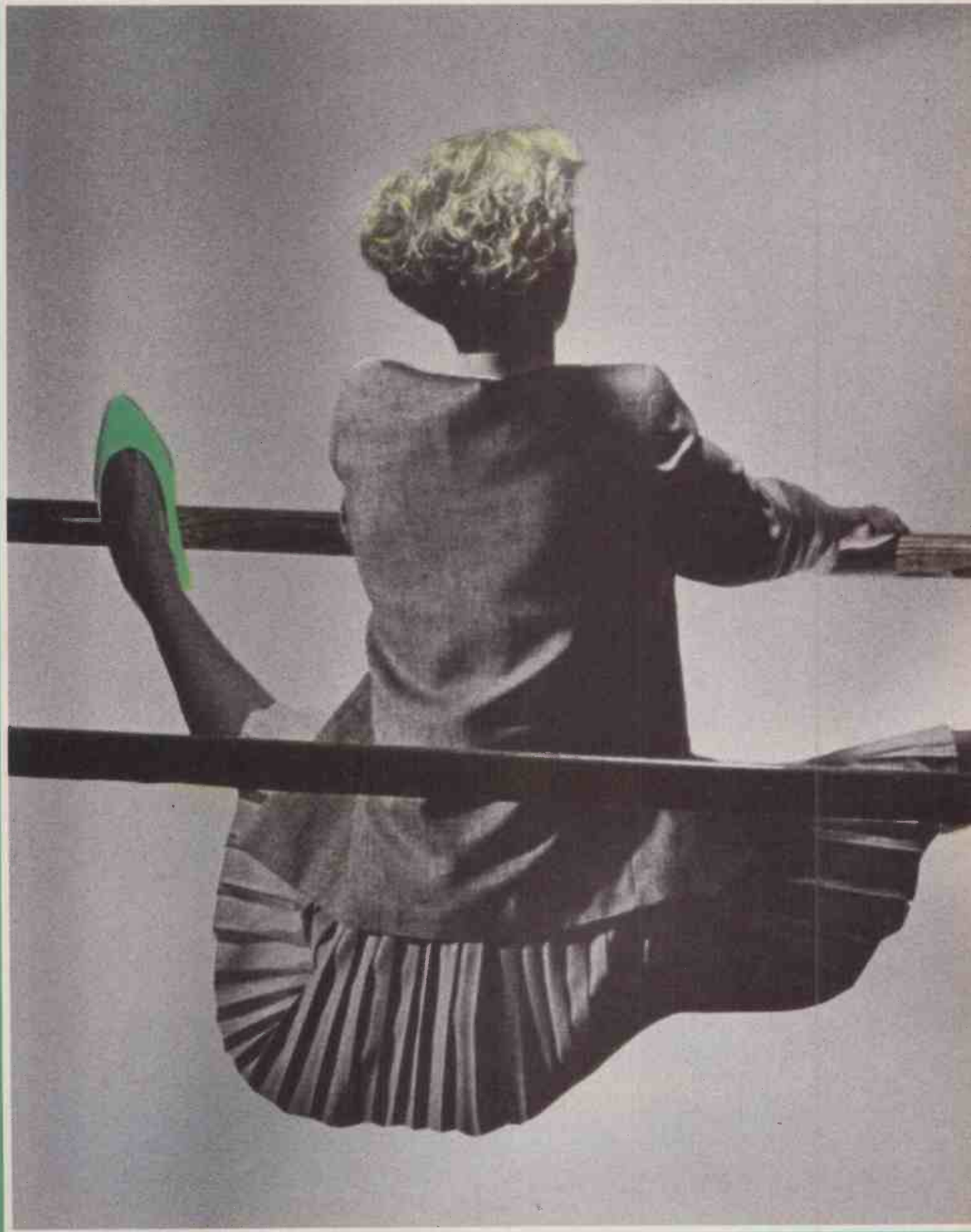

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*Case studies of their installations are available on request.

SuperStar is a trade mark of Bromley Computer Consultancy. CP/M is a trade mark of Digital Research. MS-DOS is a trade mark of MICROSOFT.

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SuperStar-16 has a 16-bit Master Processor which runs IMPOS (BROMCOM designed true 16-bit controlling operating system). IMPOS supports CP/M, MS-DOS and shortly Xenix in slave processors in any combination and it is fully upward compatable with ACTION DPC/OS, Televideo MmmOST and TurboDOS.

● Circle No. 123

(continued from page 8)

to the square of M. The time for writing to the screen can be deduced by omitting the Print command in line 3. The reason for using this test is that it is hardly possible to write a large program without fairly extensive use of arrays; and it also uses most of the operations tested by the standard Benchmarks except for BM8.

H J GAWLIK,
Muir of Ord,
Ross-shire.

Highlighting codes for SList program

I HAVE the Slist CP/M utility published in *PC* April 85 working on my BBC and Z-80 second processor. Initially the program would not work so I removed all references to Highlight and Unhighlight, and then all worked OK. Obviously the statements Hi EQU 01 and Unhi EQU 02 are not suitable for the BBC/Z-80. Can you advise?

B DANDRIDGE,
Hassocks,
West Sussex.

JOHN AND TIMOTHY LEE REPLY: The highlighting codes in the printed program are for a North Star Advantage, and will need changing for other types of computer. We do not know the control codes for the BBC/Z-80 combination, but it is likely they are the same as for BBC. On the BBC you can generate inverse video by outputting the sequence of characters 17 then 0 then 17 then 135. This could be done from Basic by

```
10 PRINT
CHR$(17)+CHR$(0)+CHR$(17)+
CHR$(135)
```

Similarly normal video can be restored using the sequence 17 7 17 128

```
10 PRINT
CHR$(17)+CHR$(7)+CHR$(17)+
CHR$(128)
```

As printed SList only allows for a single character to start highlighting, and a single character to stop it. These characters are defined at the start of the program by Hi and Unhi. Since you need four-character sequences you should make two changes. First replace the definitions of Hi and Unhi by the values in the table above.

Every time Hi appears in the program replace it with Hi1,Hi2, Hi3,Hi4 and whenever Unhi appears replace it with Unhi1,Unhi2,Unhi3,Unhi4. If necessary to avoid a long line, you could break it into pieces. For example

```
EROPEN: DB  HI, 'Error whilst
opening file', UNHI
```

could become

```
EROPEN: DB HIT,H12,H13,
H14,'Error whilst
opening file'
DB UNHI1,UNHI2,UNHI3,UNHI4
```

SLIST CODES

```
HI10    EQU   17   Define the 4 character
HI2     EQU   0    ;sequence to produce
HI3     EQU   17   ;INVERSE video
HI4     EQU   135
UNHI1   EQU   17   ;Define the 4 character
UNHI2   EQU   0    ;sequence to produce
UNHI3   EQU   17   ;NORMAL video
UNHI4   EQU   135
```

Typewrit. Asm

THERE IS an error in the printer version of the Typewrit.Asm program printed in the May 1985 edition of *PC*. The program will not work correctly because the label Stack is used but never defined. To make the program work correctly the line

```
STACK:
```

should be added to the end of the program.

It may be of interest to those who use the CP/M program Asm to know that the Stack: line appears in our original .Asm file, but not in the .Prn file generated by Asm which was in fact the file printed! It is possible that this was caused by not having a Carriage Return/Linefeed at the end of the .Asm file.

Kaypro moves

THE TELEPHONE NUMBER given for Kaypro in our May issue, page 23, is no longer correct. The new number is (06286) 67547. Calls are automatically transferred from there to the head office in Holland, at no extra cost.

More on accuracy

I READ with special interest the article "A question of accuracy" in the April edition of *Practical Computing*. I agree with the contents. The whole matter of single/double precision can be summed up by the statement that if the first operation is carried out between two single-precision numbers then the result will be in single precision, and no amount of subsequent double-precision work is going to restore the lost digits.

The point is emphasised even more if the lines of arithmetic multiply two numbers then perform two divisions, since the result should then be unity provided no rounding or truncation has occurred.

P A DUVAL,
Theydon Bois,
Essex. PC

ACCURACY

```
10  DEFDBL A,B
20  B=9999
30  X=9999
40  A=B*B/B/B: PRINT "B*B/B/B"; A
50  A=B*B/B/X: PRINT "B*B/B/X"; A
60  A=B*B/X/B: PRINT "B*B/X/B"; A
70  A=B*B/X/X: PRINT "B*B/X/X"; A
80  A=B*X/B/B: PRINT "B*X/B/B"; A
90  A=B*X/B/X: PRINT "B*X/B/X"; A
100 A=B*X/X/B: PRINT "B*X/X/B"; A
110 A=B*X/X/X: PRINT "B*X/X/X"; A
120 A=X*B/B/B: PRINT "X*B/B/B"; A
130 A=X*B/B/X: PRINT "X*B/B/X"; A
140 A=X*B/X/B: PRINT "X*B/X/B"; A
150 A=X*B/X/X: PRINT "X*B/X/X"; A
160 PRINT "LINES BELOW ALL HAVE SINGLE PRECISION STEP"
170 A=X*X/B/B: PRINT "X*X/B/B"; A
180 A=X*X/B/X: PRINT "X*X/B/X"; A
190 A=X*X/X/B: PRINT "X*X/X/B"; A
200 A=X*X/X/X: PRINT "X*X/X/X"; A
```

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There's also a built-in 3½" microfloppy disk drive with a 360K formatted capacity. So you get maximum software flexibility without the limitations of built-in ROM programs on most portables.

And because the Bondwell 2 has a CP/M 2.2 operating system you have access to a huge library of business programs.

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ACT v. BBC

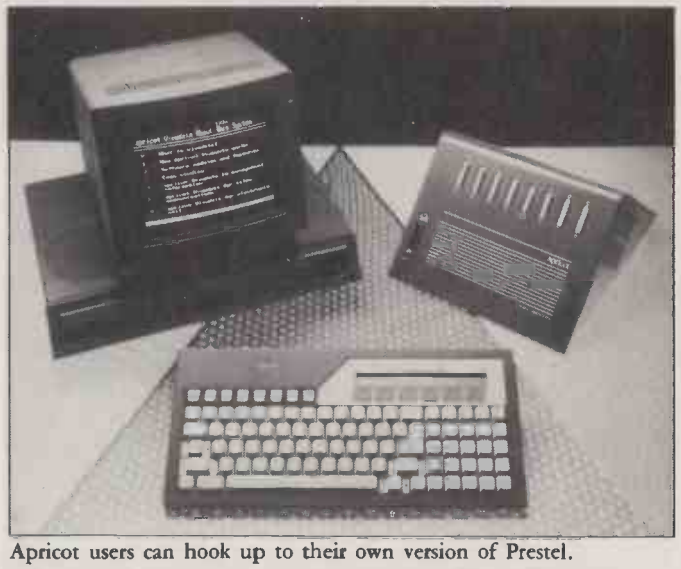
ACT has announced reductions in the prices of its F series; the F1 now costs £895 and the F1E £595. The latter price is only £100 more than the BBC B+ , which costs £499 for the 64K machine. In addition, the ACT micro has 256K RAM, a built-in 3.5in. 315K disc, and comes with MS-DOS.

To add insult to injury, ACT has produced a program called B-Tran which it claims enables the F series to run virtually all programs written in BBC Basic. For some time now, ACT has been arguing for a review of the BBC Micro contract awarded to Acorn. The latest moves are clearly designed to give the screw another turn.

ACT has also announced that the Portable, now called the FP, will cost £995 for the 256K version, and £1,395 for the 512K. This includes the innovative, if slightly unproven, voice-recognition facility.

At the other end of the spectrum, the Apricot 32-80 has been launched. This is a LAN file server with 80Mbyte of storage. It costs £5,995. The MX-80 is a dumb 80Mbyte Winchester disc unit designed as an add-on upgrade to the earlier 32-10 and 32-20 file servers. The price is £3,495.

All prices exclude VAT. More information on 021-501 2284.



Apricot users can hook up to their own version of Prestel.

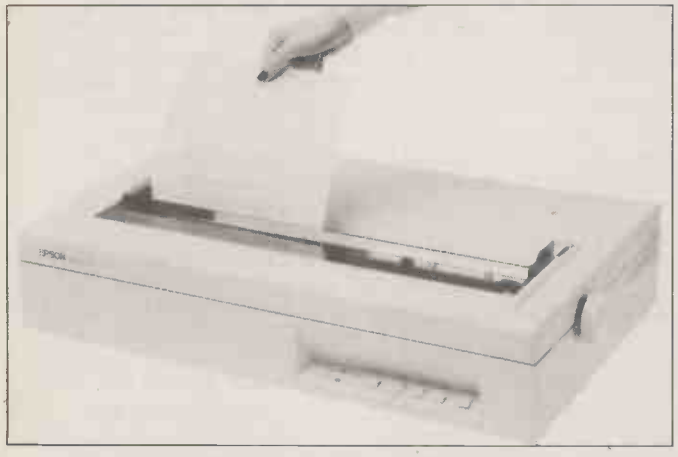
Apricot viewdata

A PRIVATE viewdata system is available based on the new Apricot XI-10S, described in May's *Practical Computing*. A system will support up to 16 simultaneous users, and costs £9,930 for hardware and software.

The XI-10S can store up to 8,000 frames on its Winchester disc. There is a two-tier password structure, and it is also possible to restrict access to parts of the database by placing users in a closed user group.

Apricot Viewdata includes Apricot Editor, a local viewdata editor. This can be used to edit large amounts of text, for example from word processing, to fit the preset 40-column viewdata frame.

As well as using other Apricots, a viewdata terminal is available for £250, and it is possible to use modified colour TVs. Communication is via the public telephone network, PSS or an internal telephone exchange. The system is compatible with Prestel, and has the same database structure. Details on (0454) 617617.



Epson joins the inkjet set

EPSON has launched its first inkjet printers. The SQ-2000 offers 176cps in draft mode, and 105cps for letter-quality printing.

It uses a special ink in a replaceable, hermetically sealed container holding enough for over three million characters. When not in use, the printing head homes on to a sealing cap.

Print styles include Pica, Elite and Roman founts in expanded, condensed, italic, underlined, emphasised and proportional variants. RS-232, IEEE-488 and Centronics interfaces are available.

The SQ-2000 costs £1,825. The HS-80, which offers 160cps, will cost around £400. More information on 01-902 8892.

Epson has also announced interface boards for its matrix printers which convert them from draft quality to NLQ. Versions are available for most models, and cost £139.09 for serial, and £130.34 for parallel interface. More on 01-902 8892.

The Husky – Apricot link.

Husky Apricots

HUSKY COMPUTERS has produced a communications package which allows a Husky Hunter hand-held micro to be hooked up to an Apricot. This follows on from similar packages for the IBM PC and the Sirius.

Text- or object-file records can be transferred between the two machines. The package costs £98 plus VAT. More information from (0203) 668181.

Thoroughly modern modems

NOT ONLY are more modems coming through these days and more cheaply, but they are getting smarter.

Tandata's TM-512 offers all the normal facilities like autodial and auto-answer, and a range of transmission and reception rates. But the inclusion of a microprocessor together with its own operating system means that a number of other facilities are available.

For example, there are three autodial modes available. One is the directory mode which enables you to draw on a list of telephone numbers stored in the modem's own permanent memory. Another is the command mode which allow modem operation under direct program control.

It will discriminate between the traditional pulse dial and the newer tone-dial systems which can often render modems unusable. The TM-512 costs £295 plus VAT, and is available from (06845) 68421.

Interlekt has announced two more modems. The Portman 66 is specially designed for applications where resistance to moisture and dust is important. As well as being in sealed units, the PCBs are sprayed with a special fungicidal varnish. The Portman 66 costs £220 plus VAT.

Another modem from Interlekt is the Prospect which offers 300, 1,200 and 1,200/75 baud. It costs £125 plus VAT. More details on both modems on (0734) 589551.

Colour graphics camera system

WORKING FROM standard RGB output, the Sintrom's Polaroid Model 48 can produce high-resolution hard copy in various formats including 10in. by 8in., 5in. by 4in. and 35mm. transparencies. The graphics camera costs about £9,000. Details on (0734) 875464.

(More news on next page)

An 80286 chip is the driving force inside TI's new machine.

TI Business Pro

TEXAS INSTRUMENTS has launched its Business Pro micro as the top machine in its Professional range, and designed particularly for network applications. It can function as a work station while serving up to 50 personal computers sharing up to 144Mbyte of discs storage and three printers.

The system offers an 80286 with an optional 80287 maths co-processor. Standard RAM is 512K expandable to 3.5Mbyte initially, and to 15Mbyte using additional memory slots. Also available are 360K or 1.2Mbyte floppies, with 21Mbyte or 40Mbyte Winchester.

Initially the system will run under MS-DOS; later, Xenix will offer multi-user and multi-tasking capabilities. An extra board is available designed to provide compatibility with the IBM PC/AT.

The entry-level system, which includes keyboard, serial/parallel interface, 512K RAM and 1.2Mbyte drive costs £5,295. Details on (0234) 67466.

BBC boxes

RACEAMBLE, which sounds like an anagram, has produced two carrying units for BBC Micros. A version which can accommodate a small screen and printer costs £60, while the basic model for the BBC and disc drives costs £40. All prices plus VAT. More information on (0271) 62801.

Comcen multi-users

THE U.K. FIRM Comcen Technology has announced a family of dual-processor multi-user micros, based on the S-100 bus and Compupro boards. The entry-level system costs £6,990, and gives you three users running under MP/M-86, and comes with dBase II and Supercalc 86. There is a 21Mbyte Winchester as well as 320K RAM and a slightly old-fashioned 8in. 1.2Mbyte floppy. Details on (0792) 796000.

Expanding Enterprise

ENTERPRISE has launched the 128K version of its machine; the price is £249.95 Peripherals have also been announced. The EP-80+ dot-matrix printer costs £239.95; the colour monitor £349.95; and the joystick interface £9.95. All prices include VAT. More on 01-739 4282.

Micro video

AN ADAPTED Sony VPH-722Q large screen video projector to work with the IBM PC, BBC Micro and DEC Rainbow, is available from Reflex Limited. No modification is required to the computers.

Screens may be either flat or curved, and the picture size can range from 72in. to 100in. The throw distance from projector to screen can be between 98in. and 133in. Units cost £4,695 plus VAT. Details on (0734) 884611.

HARDWARE SHORTS

- The Data General One 128K lap-portable IBMulator now costs £2,241, down from £2,490. More on 01-572 7455.
- Apple's Lisa, aka the Macintosh XL, has joined the great network in the sky after long drawn-out death throes. Apple is launching a 20Mbyte Winchester as a replacement. More on (0442) 60244.
- An Olivetti 100K disc drive for the BBC costing £60 is available from Leeway Data Products on 01-844 1333.
- A bi-directional serial to parallel convertor is available from Interlink Communications on (0206) 384610. The cost is £89.
- While stocks last, Dean Electronics is selling the Alphacom 81 80-column printer for £74.95, and the 40-column version for £49.95. More on (0344) 885661.
- U-Microcomputers has launched an interface system for the Apple II and IBM PC markets. It has eight- or 16-channel A/D and four-channel D/A. The cost is £500. More on (0925) 54117.
- Cumana's 5.25in. disc drives are now switchable from 80 to 40 tracks. Details on (0483) 503121.
- Le QL est arrivé. For FFr.6,950, you too can have a QL complete with AZERTY keyboard and French error messages. PC

Umi-2B for Midi and BBC

THE UMI-2B from U-Music is a sophisticated Midi interface unit that works with the BBC Micro. As well as acting as a real-time and step-time sequencer — taking in music from a piano or ordinary keyboard — and offering numerous trigger and synchronising facilities, it has a powerful dump facility for saving Yamaha DX-7 sounds to disc at a fraction of the cost of previous systems.

For the price of £495 you get the Midi interface and a sideways ROM. For more details contact the London Rock Shop on 01-267 5381.

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e.	Polaroid 'All Seasons' Sports Sunglasses Red/White	£ 6.95	3
f.	Polaroid 'All Seasons' Sports Sunglasses Blue/White	£ 6.95	3
g.	DISKING 15" x 11" gussetted Burgundy Document case	£ 5.00	3
h.	DISKING 15" x 11" gussetted Gold Document case	£ 5.00	3
j.	LCD Credit card Memory calculator with wallet	£ 5.00	3
k.	LCD Travelling Alarm or Car clock, with hourly chime	£ 4.00	2
m.	Silky smooth 'Satin gold' ballpoint pen	£ 3.00	2
n.	DISKING leather & gold/blue key fob	£ 2.50	1
p.	DISKING playing cards 2-pack set red & blue	£ 2.00	1
q.	Satin chrome 'Political' ballpen, writes red or blue	£ 2.00	1
r.	DISKING Ladies gold/blue stick pin	£ 1.00	0.5
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NEW DISKING DISKETTES – Astonishing value made for us by one of the world's largest manufacturers. They offer the best value money can buy and naturally come with a lifetime warranty. (Please telephone to check delivery on thes e diskettes, as they are not really due in until early July).
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104/2D D/S 48 tpi	29.90	27.90	26.90	25.90	24.90
204/1D S/S 96 tpi	29.90	27.90	26.90	25.90	24.90
204/2D D/S 96 tpi	34.90	32.90	31.90	30.90	29.90

Certified for single OR double density
48 tpi suitable for 35 or 40 track operation
96 tpi suitable for 77 or 80 track operation

8" Diskettes

Prices and quantities relate to Ten-Packs

Prices Exc Vat	1	2-4	5-9	10-19	20+
3740/1D S/S D/Dens	33.90	31.90	30.90	29.90	28.90
3740/2D D/S D/Dens	39.90	37.90	36.90	35.90	34.90

32 hard sector available at the same prices.

The World's No: 1 Diskette

5¼" Diskettes

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
MD 525-01 S/S 48 tpi	20.90	18.90	17.90	16.90	15.90
MD 550-01 D/S 48 tpi	23.90	21.90	20.90	19.90	18.90
MD 577-01 S/S 96 tpi	23.90	21.90	20.90	19.90	18.90
MD 557-01 D/S 96 tpi	28.90	26.90	25.90	24.90	23.90

5¼" Diskettes High Density (IBM PC AT)

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
MOH0 D/S 1.6 MByte	46.90	44.90	43.90	42.90	41.90

3½" Microdisks

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
MF350 S/Sided 0.5Mb	40.90	38.90	37.90	36.90	35.90
MF360 D/Sided 1.0Mb	50.90	48.90	47.90	46.90	45.90

Unlabelled

UL350 S/Sided 0.5Mb	34.90	32.90	31.90	30.90	29.90
UL360 D/Sided 1.0Mb	44.90	42.90	41.90	40.90	39.90

8" Diskettes

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
FD 34-9000 S/S S/D	26.90	24.90	23.90	22.90	21.90
FD 34-8000 S/S D/D	26.90	24.90	23.90	22.90	21.90
DD 34-4001 D/S D/D	30.90	28.90	27.90	26.90	25.90

Introductory Rainbow Pack offer:-

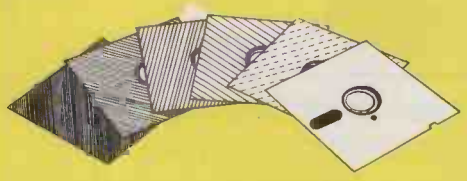
To prove how superb these coloured disk are, we are offering twelve disks for the price of ten. Two of each colour at the single pack price below – just specify 1D, 2D, 1DD or 2DD Rainbow Pack.

For Normal one colour Ten-Packs our new lower prices are as below.
Prices and quantities relate to Ten-Packs

5¼"

Prices Exc VAT	1	2-4	5-9	10-19	20+
1D S/S 48 tpi	20.90	18.90	17.90	16.90	15.90
2D D/S 48 tpi	23.90	21.90	20.90	19.90	18.90
1DD S/S 96 tpi	23.90	21.90	20.90	19.90	18.90
2DD D/S 96 tpi	28.90	26.90	25.90	24.90	23.90

To order the colour of your choice, just precede the type number with the appropriate letter, (R)RED, (O) DRANGE, (Y) YELLOW, (G) GREEN, (B) BLUE & (P) PALE BLUE.



coloured diskettes

Professional diskettes – Lifetime warranty
Prices and quantities related to Ten-Packs

5¼"

Prices Exc VAT	1	2-4	5-9	10-19	20+
O1D S/S 48 tpi	15.90	13.90	13.40	12.90	12.40
O2D D/S 48 tpi	17.90	15.90	15.40	14.90	14.40
O1Q S/S 96 tpi	17.90	15.90	15.40	14.90	14.40
O2Q D/S 96 tpi	22.90	20.90	19.90	19.40	18.90

Memory Excellence

5¼" Diskettes

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
3481 S/S 48 tpi	20.90	18.90	17.90	16.90	15.90
3491 D/S 48 tpi	23.90	21.90	20.90	19.90	18.90
3504 S/S 96 tpi	24.90	22.90	21.90	20.90	19.90
3501 D/S 96 tpi	28.90	26.90	25.90	24.90	23.90

5¼" Diskettes High Density (IBM PC AT)

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
5500 D/S 1.6 MByte	46.90	44.90	43.90	42.90	41.90

3½" Microdisks

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
MF350 S/Sided 0.5Mb	40.90	38.90	37.90	36.90	35.90
MF360 D/Sided 1.0Mb	50.90	48.90	47.90	46.90	45.90

The Gold Standard

5¼" Diskettes

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
MD1-D S/S 48 tpi	22.90	20.90	19.90	17.90	
MD2-D D/S 48 tpi	29.90	27.90	26.90	25.90	24.90
MD1-0D S/S 96 tpi	29.90	27.90	24.90		
MD2-0D D/S 96 tpi	34.90	32.90	31.90	30.90	29.90

Certified for single OR double density
48 tpi suitable for 35 or 40 track operation
96 tpi suitable for 77 or 80 track operation

3½" Microdisks

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
MF1-DD S/Sided 0.5Mb	40.90	38.90	37.90	36.90	35.90
MF2-0D D/Sided 1.0Mb	53.90	51.90	50.90	49.90	48.90

3" Microdisks**

Prices and quantities relate to Ten-Packs

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CF2 Compact D/S Floppy	39.90	38.90	37.90	36.90	35.90

**FREE Memorex YDU Cleaning Kit with every pack.

8" Diskettes

Prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
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FD2-XD D/S D/Dens	39.90	37.90	35.90		34.90

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5¼" Diskettes

Prices and quantities relate to Ten-Packs

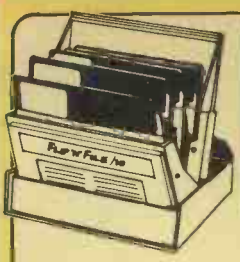
Prices Exc VAT	1	2-4	5-9	10-19	20+
MD 150-01 S/S S/Dens	14.90	12.90	12.40	11.90	11.40
MD 200-01 S/S D/Dens	15.90	13.90	13.40	12.90	12.40
MD 250-01 D/S D/Dens	20.90	18.90	17.90	17.40	16.90

All 48 tpi suitable for 35 or 40 track operation

8" Diskettes

prices and quantities relate to Ten-Packs

Prices Exc VAT	1	2-4	5-9	10-19	20+
FD34-1500 S/S S/Dens	19.90	17.90	16.90	15.90	14.90
DD34-1501 D/S D/Dens	25.90	23.90	22.90	21.90	20.90



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With every ten-pack of diskettes, now comes the NEW Flip'n'File 10 value £3.90.

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At last, a Microdrive head cleaning kit, for 3.5" drives.

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If you are posting your order, leave out the word FREEPOST from our address, and use our normal post code GU30 7EJ and do not forget to stamp it First Class. If you are telephoning your order, please make it clear thawt you wish to pay for your goods to be sent to you by First Class Post.

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First Ten-Pack	2.00
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Just call and discuss your problem, and we will do whatever we can to help. If you are not too far we can probably organise a taxi or courier.

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MKEY	Case/keyboard cleaning kit	4.90
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All clever copyright design, these immensly strong Supermailers offer full protection for up to 4 diskettes complete with envelopes. Packed in 100's for convenience.

Part No:	Description	Price exc VAT
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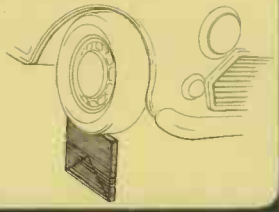

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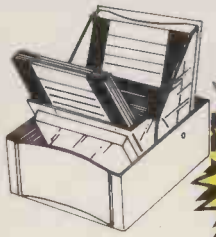
3½"



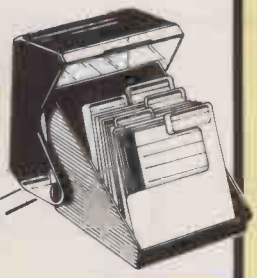
only 4.90

MICRO 10

For a maximum of ten 3½" microdisks which are displayed by the clever easel design when open.

STANDARD MICRO 25

With five dividers which hinge forward for easy disk selection, this box holds twenty-five 3½" microdisks, and look 'twee' on any desk.



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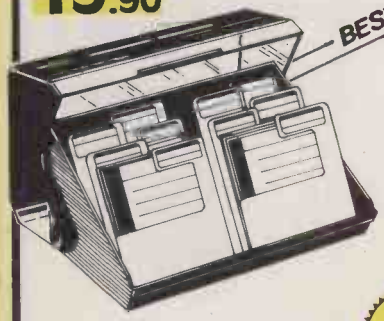


STANDARD MICRO 50

Two banks of twenty-five gives this box a large capacity, without taking up too much desk space.

TOP OF THE RANGE

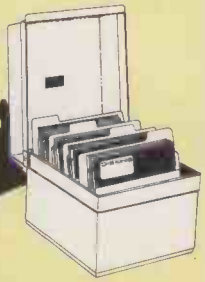
MICRO 40

The ultimate in 3½" storage. This box holds up to 40 and comes complete with a lock, dividers and incorporates the famous Flip'n'File mechanism.

31.90

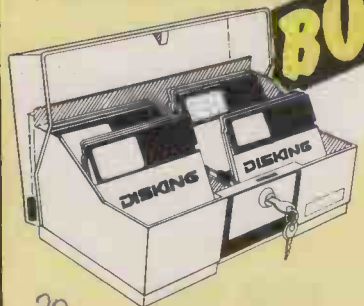
BUDGET 50

Our most popular storage box for fifty disks, precision made with dividers and non-scratch rubber feet.



18.90 Great Value!

BUDGET



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JUMBO SWINGER

The famous box with everything:- enormous capacity, lock, swinging lid which slides almost out of sight, and even a carrying handle as well!

5¼"

3.90

Just 5.90

FLIP'n'FILE 10

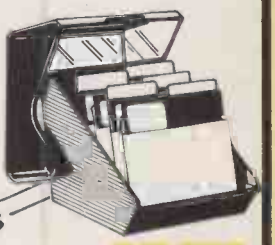
With index and spine labels, a compact economical storage box for up to tenm 5¼" disks.

FLIP'n'FILE 15

A really super box for up to fifteen disks, which when opened allows the unit to double as a work station, due to it's unique easel style Flip'n'File design. Has a massive labelling area.

STANDARD MINI 50

Desk storage for up to fifty 5¼" disks. With tabbed dividers and Index labels for easy filing and retrieval.



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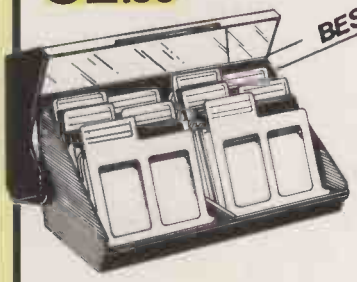
BEST SELLERS

16.90

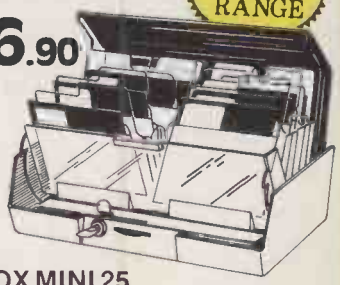


STANDARD MINI 100

Two banks of 50 give this box a massive capacity without taking up too much desk space.

TOP OF THE RANGE

36.90

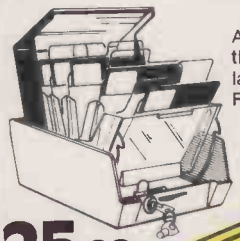


KEYBOX MINI 50

The ultimate in 5¼" storage units. Holds up to fifty disks, with built-in tabbed dividers, index labels, and a non-metallic lock and key. Featuring the famous Flip'n'File mechanism to keep disks horizontal for safer storage.

KEYBOX MINI 25

A twenty-five disk capacity version of the Keybox 50 with dividers and index labels. Also featuring the famous Flip'n'File mechanism.



25.90

How to Order: see coupon on previous page

VISA

THE AT CLONES DELUGE

SIX MORE companies have announced new micros compatible with the next computer standard, the IBM PC/AT. Zenith, Televideo, ITT, NCR, Corona and Texas Instruments all announced their machines in the U.S. Compaq announced two AT-alikes, being desk-top and transportable models; it announced the launch simultaneously in Texas and Europe, via a satellite link.

All the machines use the Intel 80286 chip, like the PC/AT, Kaypro 286i, Headstart ATS and Tomcat launched previously.

Further AT-alikes are expected shortly from Mitsubishi, Fujitsu, Philips, ACT and probably every other company you can think of — except Apple and Atari — and several you can't.

COMPAQ

COMPAQ'S two AT-alikes are the Portable 286 and the Deskpro 286, which means that, yet again, Compaq has beaten IBM to the punch with a transportable.

The Portable 286 features an 80286 which can be run at 6MHz, like the PC/AT, or 8MHz for faster processing. It has a 1.2Mbyte floppy-disc drive, 256K of RAM and a 9in. dual-mode monitor for monochrome and graphics displays. Other features include printer and RS232C ports, RGB and composite video ports, and a clock/calendar. All this still leaves three free expansion slots. RAM can be upgraded to 640K on the main board, and to 2.6Mbyte with one expansion card.

An enhanced model features a 20Mbyte hard disc with security lock, 640K of RAM and two free slots. Hard disc storage can be expanded to 70Mbyte, and a 10Mbyte cartridge tape backup can also be installed.

The Deskpro 286 has the same specification as the basic portable version, except for the 12in. monitor and greater expandability through having five free slots. RAM can be expanded to 8.2Mbyte.

The enhanced Deskpro has a 30Mbyte hard disc, 512K of RAM and security lock. The cartridge backup system is an optional extra.

NCR

THE SPECIFICATION of the new 80286-based NCR PC-8 is almost identical to the IBM PC/AT, enhanced by the addition of a battery-backed clock/calendar. The basic model has 256K of RAM and one 1.2Mbyte floppy for $3,795. The enhanced version has 512K of RAM and a 20Mbyte hard disc for $5,505. The operating system is NCR DOS 3.1, better known as MS-DOS 3.1.

Where the PC/AT is designed to support a maximum of three users under a multi-user operating system such as Xenix, Microsoft's version of Unix, the NCR PC-8 is claimed to handle 16 users. And as long as you are not one of them, why should you care?

The new PC-6 is an enhanced version of the current PC-4i IBMulator. It uses an Intel 80882-chip which can be switched up from 4.77MHz for faster processing — but NCR does not know the higher clock rate. The PC-6 has the system box and monitor separate, unlike the PC-4i, where they are combined in one big box.

TELEVIDEO

THE TELEVIDEO AT has only 256K of RAM and one 1.2Mbyte floppy, but it has eight expansion slots and the price is low at $3,400. An enhanced version costs $4,995.

As with other AT-alikes, the 80286 is run at 8MHz instead of the AT's 6MHz, but a switch is provided to slow it down, for software where the timing is critical.

ITT

THE ITT XTRA XP is an upgraded version of the current Xtra. It features an 80286 chip running at 6MHz, like the AT. However, ITT says the new machine is a PC-compatible, not an AT-compatible micro. The XP has 512K of RAM and either a 10Mbyte hard disc, for $3,995, or a 20Mbyte disc for $4,595.

The ITT machine is claimed to run quicker than either the PC or AT because wait states have been eliminated. Wait states are clock cycles when the CPU does not do anything useful, but simply waits for data to arrive. The IBM PC/AT has one wait state every three cycles.

TEXAS

THE TEXAS INSTRUMENTS Business-Pro features an 80286 but the AT compatibility is not stressed. TI plans to pursue the Xenix market, but says it "will also, as an option, support IBM PC/AT software". The system will be offered with memory up to 15Mbyte, hard discs from 20Mbyte to 70Mbyte and Netware to support a LAN. In fact, the Business-Pro is actually a small minicomputer, rather than a micro.

ZENITH

THE ZENITH Z-200 has 512K of RAM, one 1.2Mbyte floppy-disc drive, and six AT-compatible expansion slots. The starting price is $3,999. Memory can be expanded to 16Mbyte. A 20Mbyte hard-disc version is available for $5,599. Both have six free expansion slots.

Zenith has also launched three more IBM PC compatible micros. These are the Z-138 24lb. transportable with 7in. screen, Z-148 low-price desk-top model, and Z-171 transportable with LCD screen. The Z-171 is based on the Morrow Pivot, which is sold as an Osborne in the U.K. All three micros use the Intel 8088 chip.

Once again, Compaq has beaten IBM to the punch.

CORONA

CORONA DATA SYSTEMS' offering is the ATP-6-QD, a transportable with built-in 9in. green screen. It has 512K of RAM, one 1.2Mbyte and one 360K floppy, and costs $4,500. Features include serial and parallel ports and up to 640-by 400-pixel monochrome/colour graphics.

An enhanced version, the ATP-6-Q20, has a 20Mbyte hard disc, weighs 38lb. and costs $5,500.

CONTACTS

Compaq Computer Ltd, Ambassador House, Paradise Road, Richmond, Surrey TW9 1SQ. Telephone: 01-940 8860.
Intertec Ltd, 12-125 Gloucester Place, London W1H 3PJ. Telephone: 01-930 7738.
ITT, STC Business Systems, Maidstone Road, Sidcup, Kent DA14 5HT. Telephone: 01-300 7788.
Kaypro U.K. Ltd, PO Box 59, Ilford, Essex IG4 5NG. Telephone: (06286) 67547.
NCR Ltd, 206 Marylebone Road, London NW1 6LY. Telephone: 01-723 7070.
Televideo, Thorn EMI Computeraid, 40 Invincible Road, Farnborough, Hampshire GU14 7QU. Telephone: (0252) 521444.
Texas Instruments, Manton Lane, Bedford MK41 7PA. Telephone: (0234) 67466.
Zenith Data Systems Ltd, Bristol Road, Gloucester GL2 6EE. Telephone: (0452) 294151.

● There are samples of the Compaq models in the U.K., and the Kaypro should be on sale, but other companies are unlikely to know much about AT-alikes launched in the U.S. PC

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64K PC.....1207
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IBM still expanding

IBM is still expanding the PC market in all directions. The most interesting new version is a PC/XT hard-disc model without the hard-disc. The XT-DD has two floppies instead. The key point is the use of the XT motherboard, on which the Portable PC is also based. The XT-DD has eight expansion slots, 256K of RAM and comes with an RS-232C interface and heavy-duty power supply. At £1,957 this is more attractive to potential up-graders than the standard PC, which adds to speculation that the PC is about to be discontinued in favour of the PC II.

Another new version of the PC/XT is the Series 1 4950. This is a PC-type version of IBM's Series 1 veteran minicomputer. A Series 1 5170 version based on the PC/AT is also to be offered. The two systems will support up to four IBM 3101 terminals and two printers, running standard software under the EDX and RPS Series 1 operating systems. They also work as PC-DOS personal computers after rebooting. Existing PCs cannot be upgraded to the Series 1 level.

However, if you own a bank, you can convert a PC or PC/XT into a work station on the IBM 4700 system. This means adding three expansion cards and software.

INTEL BUSTS 1-2-3 MEMORY BARRIER

AN IBM PC can now handle up to 8Mbyte of RAM using Intel's memory expansion card, Above Board, which has been developed jointly with Lotus to run 1-2-3. This is the first time a PC-DOS program has got round the 640K memory limit imposed by the design of PC-DOS.

The bank-switching technique employed, called the Lotus/Intel Expanded Memory Specification, has been placed in the public domain, to make it freely available to other software companies. Ashton-Tate and Sorcim/IUS are to adopt it, and the hope is that it will become an industry standard.

The only obvious drawback is that on power up the PC takes a long time to check all its RAM. However, the development is only likely to prove a short-term solution. The rewrite that should finally remove the 640K memory limit and provide multi-tasking, MS-DOS version 6, should arrive by the end of 1986.

Above Board/PC comes in two forms, with 64K or 256K of RAM. The 64K version is expandable to 512K, and the 256K board to 2Mbyte. Above Board/AT also comes in two forms, starting with 128K or 512K, and ending with the 8Mbyte total.

U.K. distribution has not yet been arranged. For informaion contact Lotus Developments (U.K.) Ltd, Consort House, Victoria Street, Windsor SL4 1EX. Telephone: (0753) 840281.

PC for schools?

THE ALPHATRONIC PC-16 looks like a home/school micro, but can be expanded into a full-specification system.

The PC-16 has an Intel 8088 CPU, 64K of RAM and 64K of ROM. The RAM can be expanded to 128K, and the ROM includes 32K of Microsoft Basic. The PC-16 has a cassette port, and can also be used with MS-DOS and one or two 400K 5.25in. disc drives. Graphics resolution is up to 512 by 256 pixels. The precise level of IBM PC compatibility is unknown.

The PC-16 is being sold at reduced prices to German schools, and indeed it looks very much like being Germany's BBC B. There are plans to import it into the U.K., but prices have still to be decided. It would be unwise to underrate Triumph Adler, probably Europe's third-largest microcomputer company after IBM and Olivetti, but it will have trouble gaining a foothold in the British education system.

AT&T bridges the gap

THE MIGHTY AT&T phone company, which owns Unix, makes a 3B2 mini which runs System V. It also sells the AT&T 6300, which is really the IBM-compatible M-24 made by Olivetti, in which AT&T has a large stake. It has therefore produced PC Interface software to link the two machines together. Unix files appear to the PC just like MS-DOS files, etc.

If you spend lots of money on stand-alone PCs and gather masses of data but then decide to switch to Unix, normally you would be stuck. With PC Interface you can shove in a 3B2 and move all the data across to the hard disc. A terminal-emulator program then converts the M-24 to a 3B2 work station.

The M-24 now runs Revelation, the Pick-like operating system/relational database/applications generator. It can access MS-DOS files. Also, Olivetti can now supply 256Kbit chips to upgrade the M-24's RAM to 640K on the motherboard.

Olivetti and AT&T are not the only companies selling the M-24. Control Data Ltd, part of the giant mainframe company, has signed up as a dealer.

Another giant corporation, Xerox, has decided to sell a badge-engineered version of the M-24 to replace its slow, ill-fated 820 micro. The terrible irony is that the main operating environment will probably be Digital Research's Gem. This windows-and-icons interface owes its ultimate inspiration to Xerox's Palo Alto Research Centre, Parc, and the Star. Xerox is the company that thought it all up in the first place.

Contact British Olivetti Ltd, PO Box 89, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.

Pivot II transportable

GEORGE MORROW has launched an improved version of the Pivot transportable, sold in the U.K. under the Osborne label. This features an 80-character by 25-line Lumicon LCD screen — claimed to be more legible than the previous 16-line one.

The Pivot II sports an 80C88 chip with 256K of RAM, one or two IBM-compatible 5.25in. disc drives plus RGB and composite video ports. The machine measures 13in. by 6in. by 9.5in., and the weight with two drives is 13lb.

Software built into the ROM includes a scheduler, calculator, clock/calendar, phone list and autodialler.

The Pivot I is sold in the U.K. by Future Management as the Osborne Encore. At the time of writing, the company did not know about the Pivot II but may well import and sell it.

Contact Future Management (Portable Computers) Ltd, 38 Tanners Drive, Blakelands, Milton Keynes MK14 5LL. Telephone: (0908) 615274.

IBM SHORTS

- The Houston PC Pad is a small high-resolution digitiser which can also be used as a mouse pointer for data entry. It costs £483 from Perimicro. Phone: (0734) 875464.
- APL can now be learned from a tutorial package which is claimed to be fun to use. Microspan/PC costs £250 from APL experts Micro APL. Phone: 01-622 0395.
- Matchcode is a program which enables you to dial up and search a database of 22 million addresses and match post codes, instead of working with the Post Office's own blue books. Phone: 01-828 2355.
- An IBM PC micro can map surfaces down to one micron, and produce an isometric plot with hidden-line removal. The system is an enhancement to existing equipment such as Talysurfaces. Phone 3D on 01-387 7388.

PC

Multimate™? Out of the question Miss Snodgrass.

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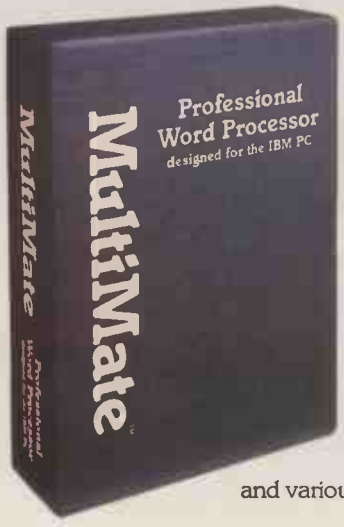
A PLUG FOR MULTIMATE

But Miss Snodgrass explained to her illustrious employer that the newest Multimate, V.3.3, is one of the most sophisticated and powerful wordprocessing software packages available for the IBM™ PC.



It can perform over 130 functions, most requiring just one or two taps on the keyboard, making it simplicity itself to use.

Multimate has support for proportional spacing, micro justification and extended character sets.

Not to mention advanced printing capabilities; including boldface, underline, subscripts and various print fonts.

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There's also provision for customized screen display, a back-up file option (before editing) and a multiple directory feature. So you can divide hard or crowded disks into smaller workspaces. Which makes flushing out the required memo, for example, simplicity itself.

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MICROSOFT GUNS FOR LOTUS

EXCEL is Microsoft's answer to Lotus Developments' Jazz. Running initially on the 512K Mac but with an IBM version under development, Excel integrates spreadsheet, database and business graphics. Rather than trying to do everything well, Excel concentrates on the spreadsheet and graphics functions, offering large worksheet size, the ability to consolidate multiple worksheets, and the choice of 42 different chart types. Excel supports a wide range of different number formats and Mac typefaces, and has a macro facility which lets you automate a number of commonly-used command sequences.

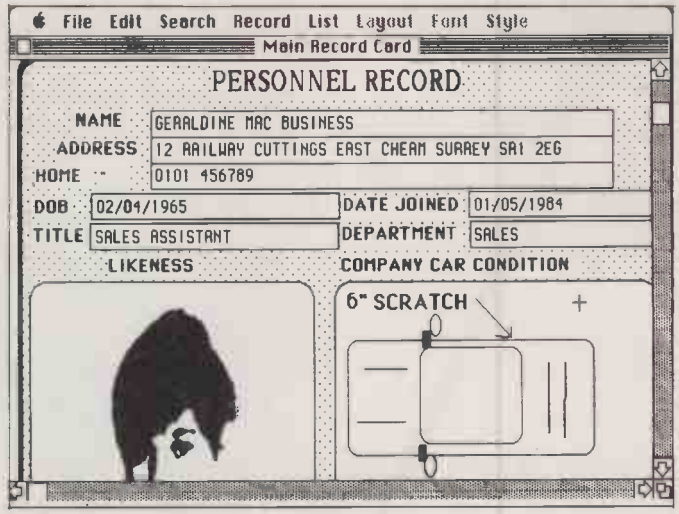
Microsoft plans to release the package in the U.K. in the third quarter of this year; U.K. pricing has not been finalised but the American price is $395. According to the company, Excel is compatible with Multiplan and Jazz files, and is designed to work with data from popular packages running on the IBM PC, including Lotus 1-2-3.

Details from: Microsoft Ltd, Piper House, Hatch Lane, Windsor, Berkshire SL4 3QJ. Telephone: (0753) 559951.

New version of Word

LATEST VERSION of Microsoft Word for the IBM PC and other MS-DOS machines offers an 80,000-word Anglicised built-in spelling checker. Other enhancements include improved support for common IBM graphics cards and the latest printers such as Hewlett-Packard's Laserjet. The new version of Word retains all the features which distinguished the original package, such as the ability to show different documents on-screen at the same time and display different typefaces.

Word 2.0 costs £400 plus VAT, or £495 together with the optional mouse. Existing users can upgrade for £45. Contact Microsoft Ltd, Piper House, Hatch Lane, Windsor, Berkshire SL4 3QJ. Telephone: (0753) 559951.



Macbusiness records add a visual dimension.

Mac database for pictures and text

SYSTEMATICS has launched a new Mac database which lets you combine pictures, numbers and text within the same record. Applications suggested by the company for this breakthrough include storing digitised pictures of employees along with their personnel records, and diagrams of teeth alongside dental data. Each record can contain Macpaint-format pictures and up to 8,000 characters of information in up to 510 different fields.

The package, called Macbusiness, will cost approximately £250 and should be available by mid-June. It runs on either the 512K or 128K Mac. More details from Systematics International Microsystems Ltd, Cleves' House, 14 Hamlet Road, Haverhill, Suffolk CB9 8EE. Telephone: (0440) 61121.

Mac applications generator

INTO the crowded Macintosh database market comes Omnis III. However, this product is different, in that Apple itself is making a great fuss about it — Apple U.K.'s managing director David Hancock described it as "a cornerstone of our future strategy" at the launch. The reason is that Omnis III is really an applications generating tool like dBase II; with it Apple expects end-users or software houses to develop packages for a range of different specialised vertical markets.

Omnis III comes with several example applications which you can modify to start you off — time and cost recording, inventory control and sales ledger. The package requires a 512K Mac and second external floppy or hard disc to run, and costs £445 plus VAT.

More details from Blyth Software Ltd, Mitford House, Benhall, Saxmundham, Suffolk IP17 1JS. Telephone: (0728) 3011.

Pegasus database

PEGASUS has added a database/applications generator to its best-selling range of accounting software. Called Information Manager, the new module is actually an adapted version of Tomorrow's Office from Sosoft. In its Pegasus form it allows you to take data straight from existing ledger files for database use.

Pegasus does not generally quote prices, leaving dealers free to charge the punter what they like, but Tomorrow's Office itself normally costs £495 plus VAT. More details from Pegasus Software Ltd, Brikat House, 35-41 Montagu Street, Kettering, Northamptonshire NN16 8XG. Telephone: (0536) 522822.

Integrated software with time management from Grafox.

Fourth dimension

GRAFOX'S Logistix adds an extra twist to the Lotus 1-2-3 type of integrated package — it adds time management to the usual list of spreadsheet, database and business graphics functions. In practice this allows you to create a kind of computerised wall planner for allocating people and resources to various tasks over specific periods of time.

Logistix costs £395 and runs on the Apricot, IBM and other MS-DOS machines. It is also available bundled with the Epson QX-16, which is reviewed on page 60 of this issue. More details from Grafox, 65 Banbury Road, Oxford OX2 6PE. Telephone: (0865) 516281.

BBC SHORTS

Comal, a programming language popular in educational circles abroad and resembling a cross between Basic and Pascal, is now available from Acornsoft for the BBC computer. The language comes on ROM, together with a 440-page manual; the price is £49.85 including VAT. Contact Acornsoft Ltd. Telephone: (0223) 316039.

ROM Spell is a spelling checker for the BBC computer which works with both View and Wordwise. The program itself is supplied on ROM and is accompanied by a data disc containing a dictionary of 30,000 words. ROM Spell costs £25 including VAT from Watford Electronics Ltd. Telephone: (0923) 37774.

Practicalc II, a spreadsheet package with integrated word-processing and database functions, is now available for the BBC Micro. Previously available only on the Apple II series and Commodore 64, the new version costs £69.95 including VAT and is supplied on disc. Details from Practicorp Ltd. Telephone: (0473) 462721. PC

Top row KX1203, K12SV3, KX1201. Bottom row K12R3, K12R2. Optional 'tilt and swivel' stand shown with certain models.

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THE NEW FORCE IN DISTRIBUTION

Q The use of word processors has greatly changed both the habits and the quality of people's writing. I wonder if Ask PC can tell me of the names and prices of commercially available programs that will find pseudonyms for words, and act as an electronic thesaurus, since this would be a great aid to creative writing.

S WEATHERHEAD

A A thesaurus is an important writers' tool, since it provides a choice of words with a similar meaning. It makes sense if you use a word processor to have the thesaurus online. Thus you can check the meaning of a word and/or the spelling, or find replacement words, without having to take your hands off the keyboard or your eyes off the screen.

We know of two such programs. Dictronic's Electronic Thesaurus can be used with WordStar and many other WP packages on a 64K CP/M-80 system. It has been around for some time, and was formerly known as the Random House Thesaurus. It provides access to about 60,000 synonyms for 5,000 of the most commonly used English words. It is used from within the word processor by simple keystrokes. Like a dictionary, you can check the spelling, check the meaning of words like "insure" and "ensure", or display alternative words without disrupting the normal word processing. It costs £95 from Software Ltd, 2 Alice Owen Technology Centre, 251 Goswell Road, London EC1N 7JO.

The second program is The Synonym Finder, and is sold by Writing Consultants, 11 Creek Bend Drive, Fairport, NY 14450, U.S.A. It works with WordStar, Multimate and other word processors. It too operates from within the word processor: you put the cursor on the word, enter two keystrokes and are given a selection of synonyms. This is rather clever, since the alternatives are displayed in a window which is positioned so that you can select the alternative word while viewing the original section of text.

The database contains the equivalent of a 90,000-word dictionary, and there are over 9,000 keywords with an average of 10 synonyms each; some have as many as 50. This database is cleverly designed, and contains more words than the Dictronic program, yet it occupies less space and works very fast. The program is available for machines running CP/M-80, PC-DOS and MS-DOS. It costs $125.

INCREASING DISC CAPACITY

Q I have noticed how over three or four years floppy discs have been made to store increasing amounts of data. Is there any way of making the North Star Horizon store any more data? Also, is it possible to upgrade an IBM PC so that it stores as much on a disc as the PC/AT?

P McMAHON

A The North Star Horizon started with a single-density disc board and Shugart SA-400 disc drives which stored 80K of data on one side of the disc. Replacing the disc board by a double-density controller increased this to 160K. Changing the disc drives to Tandon TM 100-2 increased this to 340K, If you are using CP/M, the most commonly used version is the one from Lifeboat, which stores 35 tracks on each side of the disc.

There are other versions. For example, the Xitan version from the Byte Shop or Computerland chain stores 40 tracks on each side, thus increasing the storage to 400K. Fairly recently we discovered SAIL Software's implementation of CP/M version 2.2, with a rewritten BIOS. It costs $165. Apart from greatly improved documentation, the main improvement is that it can write 80 tracks on each side of the disc, giving 820K storage on each disc. It also allows you to specify a disc as 40 or 35 tracks per side, so you can still read or write the earlier formats when required. It does not support single-density discs.

Very early versions of the IBM PC wrote on only one side of a 5.25in. disc and stored 160K. More recent versions are double-sided, and store 320K on a disc if you use PC-DOS version 1.2, or 360K with versions 2.X. In contrast to this, the IBM PC/AT stores a massive 1.2Mbyte on a disc — nearly four times as much data. Many users will want to upgrade their PCs so that the discs store more, because this will reduce the number of floppy discs needed, make it easier to find things, and will simplify the backing-up of hard discs.

So far we know of only one firm selling a kit to do this, but before long there will be several. The kit costs $499, and comprises a 1.2Mbyte drive, a 360K drive, a disc controller, cables and software. For further information contact Tall Tree Systems, Suite 124, 1032 Elwell Court, Palo Alto, Ca 94303, U.S.A. We would be pleased to hear of a supplier in the U.K.

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Q I would like to hear if you have any advice on writing structured programs in Basic. I would like some help in tracing a version called PBasic that is supposed to be available in the U.S., and which helps to make structured programming more possible.

RICHARD MORGAN

A Though some people regard Basic as an unstructured language you can introduce some structure into Basic programs without much difficulty. For a start, programs are more structured and easier to follow if you use subroutines, and if you use the If-Then-Else construction if it is available. Avoid using Goto statements as far as possible, since they produce spaghetti-like code which is difficult to follow. Indenting the lines in a loop also helps understandability. Many people speak highly of CBasic, which certainly allows some structure, but we think it a little slow and overrated.

PBasic is available from TNT Software Inc., 34069 Hainesville Road, Round Lake, Il 60073, U.S.A. for CP/M machines and for the IBM PC, at the very modest cost of $39.95 plus postage. It is also available from Roland J Saam, Micros for Managers, 149 Gloucester Road, London SW7 4TH for £38.45 including VAT. However, PBasic is not a stand-alone language, it is neither a Basic interpreter nor a compiler. Instead of writing your program in Basic, you write it in a pseudo-language which is highly structured. In the pseudo-language you can omit line numbers, branch to labels rather than line numbers, indent blocks of code, leave blank lines, put plenty of Rem statements without making the program run slowly, pass parameters to a subroutine as if it were a multi-line function. Altogether it offers about 50 other extensions to Basic. PBasic converts this pseudo-language into standard Microsoft Basic at a speed of 200 to 500 lines a minute.

The Basic program produced by PBasic is good, fast code that will run on a CP/M machine using Microsoft's MBasic interpreter version 5.2 or later, or with the Microsoft Basic compiler. The PC-DOS or MS-DOS version works with Basica. More details of PBasic are given in a review by Jerry Pournelle in April 1983 issue of *Byte* magazine.

Q I have an Epson QX-10 computer which has a NEC UPD-7220 graphics control processor in it. I know that this is a very powerful chip, but I do not have the technical knowledge to decipher the technical specifications. I am looking for a simple explanation of how to draw lines, set/reset points, manipulate symbols and characters, use large windows with smooth scrolling and panning, and how to draw arcs, circles and boxes — using Pascal, Basic or Z-80 code.

GRAHAM FOSTER

A The NEC UPD-7220 graphics-control processor chip is one of the new generation of highly sophisticated graphics-control devices. It is capable of drawing lines, arcs, circles, rectangles and characters without requiring a significant amount of time from the main CPU, and so graphics run at a high speed.

The co-ordinate system used for its advanced features is difficult for the first-time user since to reference a pixel you must specify a row, a word within a row, and a bit within a 16-bit word, rather than simply an (x,y) co-ordinate. Communication with the UPD-7220 is achieved through two ports, one for commands and one for data, and you must read the status port to determine whether the device is ready to accept commands. Write to NEC for the UPD-7220 GDC Design Manual.

Epson has also drawn our attention to the Epson CP/M User Group, which has approximately 100 discs available at £4 per volume. Contact D Fordred, 72 Mill Road, Hawley, Dartford, Kent DA2 7RZ. In addition there is the Epson International User Group, 25 Sawyers Lane, Drayton Bridge Road, London W13 0JP.

Epson says that the graphic display facilities on the UPD-7220 have not been very fully exploited other than by MFBasic. You may find another member of the user group who is trying to use the features of the UPD-7220 from Pascal or machine code. PC

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INTERVIEW

FRED LAMOND — IBM-watcher

INTERVIEWED BY GLYN MOODY

Fred Lamond is one of the leading professional IBM-watchers. He is a graduate of Cambridge and Chicago Universities. Before joining the data-processing industry he worked in market research at the Economist Intelligence Unit. Companies he has worked for in the computing industry include Univac, English Electric Computers, Leasco Systems and Research, and Auerbach. Since 1975 he has been an independent consultant specialising in computers and communications. He has presented many seminars, in the U.K. mostly under the aegis of the CGS Institute.

Why do you think the PC has been so successful?

THEY TRIED with an earlier generation of desk-top computers, the 5100s in the mid-seventies. They failed miserably. So it's not true to say that IBM have just got to stick its three letters on any product and it will just sell automatically. Having failed miserably with the 5100 series, they studied very carefully what made Apple succeed in the first generation of personal computers, and what made the CP/M-80 system succeed, and decided — right, we'll produce a second generation of 16-bit systems that combines the best features of the Apple II and the CP/M-80 systems. The CP/M-80 feature was the independent operating system, and the best feature of the Apple II was its great user-friendliness to independent extension cards.

You then got into what might be called a virtuous circle from IBM's point of view when the distributors, having decided this is going to be the 16-bit standard, made their prediction come true. The manufacturers of extension cards started manufacturing extension cards primarily for the IBM bus, the independent software vendors started writing primarily for the IBM interface.

Who do you think will survive to be IBM's competitors in that market?

THE COMPETITORS who are going to survive are going to be the very big companies and the very small companies — it's the medium-sized companies who are going to be in trouble. If you're a big company with lots of resources like Wang, or DEC, or Ericsson, you can spend the money you need to buy a share of the market.

Side by side with these big companies which are going to go for maximum IBM PC compatibility, you have small companies with a bright idea. Apple has built on the system resources earned with the Apple II by establishing the rival Macintosh standard, and in this they seem to be succeeding. Though it is big in personal computing, Apple is still a small company.

What have been the problems with the AT?

IBM ORDERED the hard discs for the AT from an independent computer manufacturer, Computer Consoles. The entry-system division people at Boca Raton very unwisely did not ensure a second source, and so they were utterly dependent on the Computer Consoles product, and nine out of 10 of the hard-disc drives delivered have not passed IBM quality-control tests. So IBM has had to send them back.

How does the AT fit in with the PC?

THE PC/AT is really going to be the file server for small local area networks. People are beginning to recognise that giving every user his own hard disc is a bit wasteful. As file server controlling those hard discs, you need a somewhat more powerful processor so that it can multi-task the messages coming from other PCs via the local area network and pass them directly on to the discs while its user is working on his own application system. So for that the PC/AT is ideally suited.

Will IBM start pushing LANs when ATs come through in volume?

WELL, they've got their knickers in a bit of a twist there. They had their token ring passing architecture developed, and they've got this common-cabling system with a shielded twisted pair running from each work station to the wine closet at the end of the corridor.

Then they were let down by Texas Instruments who hasn't been able to produce the chips with IBM's token passing protocol in time; they are about two years late. Instead of going to one of the many manufacturers who have low-level local area networks which rely on twisted wire technology and baseband, they go and rush to Sytek — a local area network system which is analogue instead of digital; coaxial cable instead of shielded twisted pair. So now they have PC Net which is fully incompatible with what they are going to offer in two or three years' time.

How will the PCII fit in?

AT THE MOMENT they are offering the portable PC, PC/XT and PC/AT out of Boca Raton and the 3270 PC from the team who designed the 3270 terminals. So it's really cascading down: the PCjr and PCI have been dropped; the PC/XT has come down into the price slot of the PCI, the PC/AT has come into the price slot of the PC/XT. Now in due course when PC/AT is running swimmingly, and they can get all the Intel 80286s they want, they will then presumably be ready to drop the 8088-based PC/XT and announce PCII, which would be a diskette-based single-user system with either the 80186 or the 80286 chip, and quite possibly Sony 3.5in. diskettes instead of the 5.25in.

How do you think the PC family will develop?

IT'S GOING to stay very much Intel-faithful. The first family lasted from '81 until this year, so you are just about ready for a change of hardware. The next generation, which is going to take us from '85 to '88 or '89 is going to be Intel 80286 and possibly 80186-based, and then in '88 or '89, we shall see. So they may say do we offer yet more power with the 32-bit compatible chip, the 80386, or do we go perhaps to a cheaper, later version of the 80286 which Intel may be offering at that time? PC

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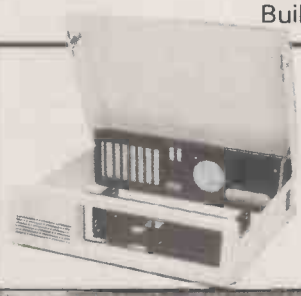

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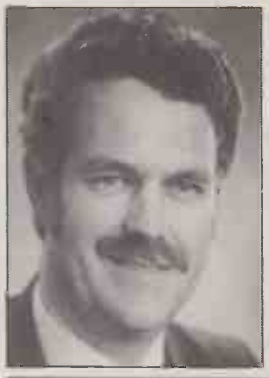


BY RAY COLES

PORTABLE PC POWER

Compatibility with both the 8086 and the 8080 promises an unprecedented degree of ready-written software for NEC's new CMOS CPU chips.

Just two months ago I covered the Hitachi HD-64180 microprocessor and commented upon the latest Japanese strategy of introducing greatly improved versions of popular microprocessors such as the Z-80. I now feel compelled to repeat the performance, following a closer look at the data sheets for two new devices from NEC, the V-20 and V-30.

In "The imitation game" I mentioned in passing that Intel had taken legal action against NEC. Intel is claiming infringement of copyright on the microcode embodied in the new V-20 and V-30 designs, which are unashamed souped-up clones of the Intel 8088 and 8086.

At the time I wrote those words I knew little about the two NEC chips, but now that I have seen the data I can quite understand why Intel is feeling a bit miffed! The specifications show that the V-20 and V-30 offer many advanced new features while competing head-on with Intel and its licensed second sources by offering direct compatibility with the 8086 family.

BIGGER AND BETTER

Perhaps there is a lesson here for Intel and the other major semiconductor houses in the U.S. Following the resounding success of the 8088 and 8086, in the IBM PC and all the look-alikes, Intel moved on to bigger and better technology with the 80186 and 80286. These are marvellous microprocessors, but they are pricey and are still waiting for a mass market to develop.

There is of course a tremendous market conservatism and inertia, even in the trendy microcomputer business. Designers are happy to stick with tried and trusted technology for as long as they possibly can. Anyone who develops a product which allows customers to increase system performance without redesigning the system with fancy new technology has got to be on the right track, and that is just what the Japanese are doing.

The V-20 and V-30 have been designed to tackle a mass market from day 1 of their launch, and in particular the market for portable personal computers of the type which provide the power of an IBM PC in a lap-sized package. Using one of the two new low-power CMOS microprocessors for NEC, designers can now put together lap computers of unprecedented power. They will outperform the full-sized machine for most applications, while retaining full software compatibility.

Compatibility is the watchword of the V-20 and V-30 design. NEC has extended the concept to include even direct software compatibility with the 8080 eight-bit microprocessor, which Intel buried years ago and for which it provided only token compatibility on its own 8086 and 8088 16-bitters.

The significance of the 8080 is that CP/M was written around it, and a future lap computer based on the NEC chips could utilise not only the extensive range of MS-DOS 16-bit software, but also the even bigger range of CP/M applications when required. This represents the linking together of two software generations, a feat which has hitherto been impossible on a single machine unless two separate microprocessors were employed in the design.

The V-20 and V-30, like their Intel counterparts, use internal 16-bit data paths and a 20-bit external address bus. Also like their Intel cousins, they differ in their external data bus widths: eight bits for the V-20 and 16 bits for the V-30. Apart from that fundamental difference, the two NEC devices are identical and will run the same software without modification. They will also drop straight into sockets normally occupied by corresponding Intel-type microprocessors and will bestow some useful advantages even in that restricting setting.

For a start they have an expanded set of basic instructions and many enhanced versions of original instructions. Together they will substantially increase the performance of any new software written to take advantage of them. Even when old software written for the 8086 family is run, improvements in execution time of between 5 percent and 50 percent can be expected thanks to a redesign of the internal architecture and the replacement of many functions previously implemented in microcode with dedicated hardware.

A microcode implementation is fine when a microprocessor is first introduced because it simplifies the chip-design task and provides a means by which any initial problems can be rectified. Design bugs can usually be cured simply by changing the microcode ROM data, a much less expensive process than that needed to change the intrinsic chip layout and interconnections.

Unfortunately the microcode approach sometimes gives flexibility and simplicity at the expense of operating speed, a factor which has already been demonstrated by the relatively slow pace of the microcoded 8086 and 68000 designs when compared with the high-speed random-logic Z-8000 from Zilog.

NEC has not dispensed with microcode entirely, however; if it had, it would not now face a lawsuit from Intel. Instead NEC has simply replaced speed-critical functions previously performed in microcode with a direct hardware implementation. A prime target for the designers was a reduction in the number of clock cycles needed for key instructions. One way this has been achieved is by the incorporation of a second internal 16-bit data bus.

New temporary data and address registers have also been selectively incorporated to reduce the time wasted in data shuffling with earlier designs. One result of this is a much faster response to Call and Branch instructions.

EXECUTION

To speed up the time-critical multiplication and division instructions, a dedicated hardware shifter and loop counter has been provided so that an addition, shift, decrement and carry check, can all be performed within one clock cycle. Further execution advantages are provided by a hardware effective-address generator which will carry out summation of the various address components in a maximum of two clock cycles, regardless of the addressing mode.

Quite apart from the enhancements achieved by architectural improvements, the V-20 and V-30 also have an array of new and modified instructions available which should prove attractive to all software buffs. A comprehensive new range of bit set, test, clear and complement instructions makes the manipulation of bit variables much easier. This is a particularly useful feature for graphics applications, for which the tedious use of logic masking used to be the norm.

Everyone knows about the hilarious rounding errors often introduced by software that relies on binary arithmetic internally, with a swift conversion to decimal before output. The best cure for this sort of nonsense is to perform all arithmetic using the binary-coded decimal (BCD) notation of four bits per decimal digit. To encourage this approach the NEC family considerably extends the limited 8086 set of BCD operations to include two new BCD Rotate instructions and the ability to add, subtract and compare BCD strings up to 254 digits long using a single instruction.

Other new instructions provide some very useful facilities for the support of high-level languages, including an array index bounds check and the Prepare and Dispose instructions, which allocate and retrieve nested stack levels for global variable referencing. There are even a pair of instructions which will cause repetition of the following instructions until the Carry flag is either set or cleared.

Finally, the V-20 and V-30 can operate in the different modes: native mode, 8080 mode, and standby mode in which power consumption is reduced by 90 percent. With one of these and a megabit of CMOS RAM on your lap, who needs the office computer? PC

Today's desk-top power — soon available in a lap-top package?

BY MIKE LEWIS

BREAK IT UP

How modular programming methods prevent large jobs becoming a tangled mess of code.

Even the most experienced programmers have, at some point in their career, managed to make a gooey mess out of what should have been a fairly simple program. Sometimes a program starts life as a straightforward piece of code, but gradually gets amended and enhanced until it becomes such a tangle that further changes are impossible. If you have ever faced this situation, you might be wondering how it is that very complex software packages are successfully written and maintained by large teams of programmers working over many years.

One answer is a technique called modular programing. It is not a wonder new system that claims to change your life. It is simply a method of breaking a large job into manageable chunks. If you are a reasonably tidy and well-organised programmer, the chances are that you already apply at least some of the principles of modular programming without realising they had a name.

The basic idea is to divide a program into a number of self-contained functional units. These units, or modules, form a hierarchy, getting progressively more detailed. For example, a payroll program might have a module for calculating tax, which in turn calls a module to determine the tax rate, which in turn calls a table look-up routine. Each module can hide details of its operation from the rest of the program, thereby making the whole thing clearer and easier to modify later.

What a module looks like will depend on the language. It might be a procedure in Pascal, a function in C, a subroutine in Basic, or a section in Cobol. But modular programming is far more than a way of organising your code. To be used properly, every aspect of the program, from basic design to final testing, must be geared to its modular structure.

There are two ways of achieving this, often called the top-down and bottom-up approaches. In spite of the apparent contradiction in their names, these two approaches have a lot in common, and many devotees of modular programming end up using a combination of the two.

With top-down programming, you start with the big picture. You design, code and test the overall logic of the program, postponing detailed decisions until later. You then tackle each level down in turn. Every test run is a test of the main program plus all lower-level routines written so far. Where a module does not yet exist, you insert a dummy routine which simply returns a constant value or prints a message so that you can satisfy yourself that the program has reached the correct point.

Bottom-up programming, on the other hand, starts at the lowest level. You first write the modules that perform the basic functions, like editing dates or checking for valid file names. To test these routines, you have to construct a test rig of a simple one-time program which passes parameters to the module and displays the result. The tested modules are then slotted together to build higher-level routines, ending with the complete program.

The bottom-up approach comes into its own with languages that allow separate compilation of procedures or subroutines. Common functions can then be held in a library and pressed into service by any program that needs them. Provided that their calling sequence is straightforward and not specific to one application, such modules become virtually an extension of the language. However, while highly desirable, separate compilation is not a prerequisite of modular programming.

For example, suppose that you are asked to write a program for printing address labels from a file which is in regional sequence. At each change of region, you must output a header label showing the name of the following region. Another label must be printed at the very end to show the total number of labels in the run. The user also wants to be able to select names for printing according to various criteria. Finally, the labels must be printed four-up.

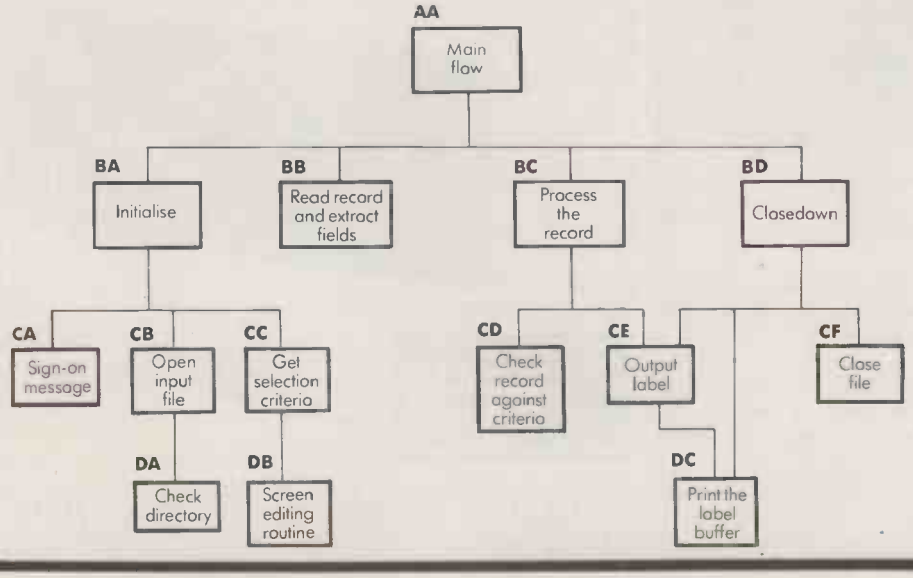
A few points need watching. Because of the need to hold four addresses in a buffer before they can be printed, the flow of the program is different according to whether or not a change of region causes the buffer to be full. The same applies to the end-of-run label. You must also allow for the case where the first label of a new region, or even an entire region, is not processed because it fails to

(continued on next page)

Figure 1. Partial pseudo-code for the label-printing program.

```
MAIN FLOW
        Initialise
        While the input file is not at end-of-file
                Read the next record and extract the required fields
                If not end-of-file
                        Process the record
        Closedown
INITIALISE
        Sign-on message
        Initialise variables
        Open input file
        Get selection criteria from user
        Set previous region to impossible value (to force a region
          change on the first record)
PROCESS THE RECORD
        Check record against criteria
        If record agrees with criteria
                If change of region
                        Set up header label
                        Output the label
                Set up address label
                Output the label
                Update label count
CLOSEDOWN
        Set up end-of-run label
        Output the label
        Print the label buffer
        Close file
OUTPUT THE LABEL
        If already four labels in the buffer
                Print the label buffer
        Add current label to the buffer
```

Figure 2. Module dependency chart.



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meet the user's criteria. Without modular programming, this apparently straightfoward program could end up being quite tricky.

Using the top-down method, you can easily arrive at the main flow of control. This is described in pseudo-code in figure 1. The terse phrase "process the record" covers the testing of selection criteria, the handling of changes of region, and the actual output of the labels, these tasks all being candidates for lower-level routines.

When you are designing the program, a module dependency chart like the one in figure 2 might be useful. Unlike a flowchart, its aim is to document the relationship between modules, rather than the flow of the program. Cross-reference tables, as in figure 3, also come in handy. If you subsequently need to make a fundamental change to the module, the table provides a quick way of finding all the routines which interact with it.

Another useful item of documentation is the module specification sheet. This is a short write-up describing the module's function and its interface with higher-level code. It would list such details as the calling sequence, parameters, returned values, use of global variables, hardware-dependent features, and the effect of the module on the computer's screen. A document like this is especially important when more than one person is working on the same program.

Figure 3. Module cross-reference table.

Caller	AA	BA	BC	BD	CB	CC	CE
Called:							
BA	✓						
BB	✓						
BC	✓						
BD	✓						
CA		✓					
CB		✓					
CC		✓					
CD			✓				
CE			✓	✓			
CF				✓			
DA					✓		
DB						✓	
DC				✓			✓

The beauty of the modular approach is that modules do not need to know anything about the workings of other modules. In the label program, the details of the selection criteria dialogue — the screen layout, use of control keys for editing, validation of the user's entries, etc. — are of concern only to one module. You could postpone writing this and continue with the rest of the program, or you could give this one routine to a colleague to code and test independently.

In the same way, modules that print the various types of labels can ignore the details of the four-up buffer. They simply despatch their data to the output label procedure, which does not know or care what type of label it is being asked to deal with. If the user later changed to two-up labels, only one module would need altering.

Note that although the Print Label Buffer routine is mainly invoked by Output Label, it is also called by Closedown to flush the buffer. Some programmers do not like to see the tree-like structure of a program spoilt by allowing calls to skip a level, but you could always insert an extra module at the intermediate level that does nothing but pass control to the next level down.

That said, a module should not be allowed to make calls to others on the same level or on higher ones, and it should always return control to the calling module, at the statement immediately following the call. There are a few occasions when this rule could be relaxed, such as for calling a routine which processes a fatal error and returns control to the operating systems.

Ideally, every module should have just one entry point and one exit point, these being the first and last physical lines of code respectively. The same should be true of the program as a whole. The interface between modules should be as simple as possible, with all parameters clearly defined and documented.

Above all, a module should be self-contained. It should concentrate on one job only, and when it has finished its work it should leave data areas, screen, etc., in a known state. There should be no side-effects in other parts of the program. PC

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BY BEN KNOX

HAZCHEM –DANGER!

Information on dangerous chemicals is available on-line from Exis-1. It could save lives.

Every week there are up to 120 incidents in Britain involving hazardous chemicals. Though many of them are minor they all present difficulties to the police, fire brigade and other authorities that have to deal with them.

A database which came on-line at the end of last year will undoubtedly help in many situations where chemicals and other hazardous goods are involved. Developed by Expert Information Systems (Exis) in conjunction with Whessoe Technical and Computing Services, the database was set up to fill a gap in the chemical industry.

The database, called Exis 1, provides information and help on many chemicals and their products to carriers of the substances. New applications for the database soon presented themselves after it became operational. It is split into six modules.

Materials Information provides up-to-date, fully cross-referenced information on regulated substances — that is, those which have been given classifications by the British Government, the European Communities or the United Nations. The module named IMDG Code (AMDT. 21), Medical First-Aid Guide, Emergency Schedules contains the International Maritime Dangerous Goods Code, detailing first-aid procedures for treatment of casualties and action which should be taken in case of emergency.

Chemdata is linked to the U.K. National Chemical Emergency Centre database at Harwell for first-strike land-based chemical incident response. Hazardous Cargo Contacts is an International listing of addresses and telephone numbers for National Competent Authorities, port authorities, training establishments, trade associations and inspection establishments. The Air Transport module details international air-transport regulations, with relevant information for the ICAO/IATA transition period. Finally, ADR Codes provides European road regulations.

With all these resources available, a user can find extremely detailed information on almost any chemical. I did a search for fuming sulphuric acid, sometimes called oleum. The printout shows part of the results Exis-1 produced from its various modules. Already, some police forces are experimenting with the service. Valuable time will be saved when they can get information direct from Exis, rather than having to wait for a chemical expert to arrive at the scene of an incident.

Further details are available from Exis Limited, 38 Tavistock Street, London WC2E 7PB. Telephone: 01-240 0837. Exis has a minimum annual charge of £250.

The hourly charge of all modules, except for Materials Information, is £40, the Material Information module costs £75 per hour. High-use discounts are available.

● I can be contacted via Snail Mail c/o *Practical Computing*, or electronically on Telecom Gold 84:TCC051, or Prestel mailbox 919993567. *Practical Computing* is on Telecom Gold 81:JET727; the Editor is on 83:JNL020. PC

MATERIALS INFORMATION

```
# ENTER CHEMICAL OR SUBSTANCE NAME  > SULPHURIC ACID
SULPHURIC ACID

SULPHURIC ACID is listed thus:
1   Sulphuric acid, fuming.  UN No: 1831
2   Sulphuric acid, more than 85%.  UN No: 1830
3   Sulphuric acid, more than 75% but not more than 85%.
    UN No: 1830
4   Sulphuric acid, not less than 40% but not more than 75%.
    UN No: 1830
5   Sulphuric acid, less than 40%.  UN No: 1830
6   Sulphuric acid, spent.  UN No: 1832

Key option number to continue.

> 1

EXIS Name: SULPHURIC ACID, FUMING

TRANSPORT CLASSIFICATION INFORMATION:    UN No: 1831  UN Class: 8
UN Name: SULPHURIC ACID, FUMING
UN Label: CORROSIVE                      UN Sub Risk: 6.1
EC Class:                                US Class:
CEFIC TREMCARD No: TEC(R)-10C            US DOT Resp Guide No: 39
UK EAC: 4WE        Haz Id No: 886        US NFPA 704 Symbol:
UN Packing Group: I                      USCG Cargo Compat Gp: (note)
REGS  CLASS          PROPER SHIPPING NAME
IMDG  8              SULPHURIC ACID, FUMING
ADR   8 lt 1(a)      OLEUM
RID   8 lt 1(a)      OLEUM
ADN   8 lt 1(a)      OLEUM
ICAO  8              SULPHURIC ACID, FUMING
UK NATIONAL REGS     CLASS
DTp "BLUE BOOK"        (as IMDG)
HSE "APPR LIST"      CORROSIVE SUBSTANCE
BR "LDG"             8
BWB "GREEN BOOK"     8 GROUP 2

Key 1 for PROPERTY DATA.

> 1

EXIS NAME: SULPHURIC ACID
FORMULA: H2SO4                           REL MOL MASS: 98.1
DESC AT AMBIENT: Colourless, oily liquid. Corrosive. Odourless.

DENSITY: (20°C) 1.84 kg/l                VAP DENS (Air=1): 3.40
M.P.: 10.4°C                             B.P.: 338°C
FLASH PT: Non-flammable                  CRITICAL TEMP:
AUTOIGNITION TEMP: Non-flammable         FLAM LIMIT: Non-flammable
VAP PRES:
  (mbar)
VISCOSITY: (20 °C)
  (cP)        257
  (cSt)
THERM COND:                              SP HEAT:
COEFF OF EXP: 0.00056/°C
BEHAVIOUR IN WATER: Sinks and mixes violently! No reaction.
T.L.V. TWA:                              STEL:
TOXICITY:                                ODOUR THRESHOLD:
```

MEDICAL FIRST AID GUIDE

```
1    General information on health hazards of substance and
     secondary MFAG data where relevant.
2    Signs and symptoms.
(Treatment recommendations are printed in the MFAG).
```

EMERGENCY SCHEDULE 8-06

```
Special Emergency Equipment to be carried:
   Protective clothing (boots, gloves, coveralls, headgear).
   Self-contained breathing apparatus.
   Inert absorbent material (e.g. diatomaceous earth).
   Spray nozzles.
Emergency Procedures:
   Wear protective clothing and self-contained breathing apparatus
   when dealing with SPILLAGE or FIRE.
Emergency Action: On deck:
   Spillage: Wash overboard with copious quantities of water from as
   far away as practicable.
   Fire: If possible remove receptacles likely to be involved or
   keep them cool with water.
Emergency Action: Under deck:
   Spillage: Collect spillage, where practicable, (using inert
   absorbent material for liquids) for safe disposal.
   Fire: Adopt action as for 'on deck'.
Key 1 for a list of those substances in this schedule for which it
is recommended to TURN SHIP OFF WIND.
```

CHEMDATA

```
# ENTER CHEMICAL OR SUBSTANCE NAME  > OLEUM

SULPHURIC ACID, FUMING

UK EAC : 4WE      UN NO: 1831      UN CLASS: 8.0     TREMCARD: 10C

ADR/RID:
-X886 HIGHLY CORROSIVE SUBSTANCE, TOXIC, REACTS DANGEROUSLY WITH
 WATER

PROTECTION:
-CHEMICAL PROTECTION SUIT, INCLUDING B.A.
-SUBSTANCE ATTACKS PROTECTIVE CLOTHING AND EXPOSURE TO HIGH
 CONCENTRATIONS SHOULD BE LIMITED TO DURATION OF ONE BA CYL
-WEAR POSITIVE PRESSURE BREATHING APPARATUS BECAUSE OF HIGHLY
 TOXIC PROPERTIES OF GASES OR VAPOURS
-ADDITIONAL PERSONAL PROTECTION - CODES A & C

HAZARDS:
-EXTREMELY CORROSIVE
-REACTS VIOLENTLY WITH WATER
-CONTACT WITH LIQUID CAUSES SKIN BURNS & SEVERE DAMAGE
 TO EYES
-CAN REACT WITH ORGANIC SUBSTANCES
-CAN IGNITE COMBUSTIBLE SUBSTANCES

FORM:
-LIQUID

PRECAUTIONS:
-AVOID ANY PERSONAL CONTACT
-KEEP UPWIND
-ABSORB IN EARTH OR SAND
-NEVER SPRAY WITH WATER

FIRE:
-NON-FLAMMABLE

DECONTAMINATION:
-NEUTRALISE WITH SODA ASH, THEN WASH WITH PLENTY OF WATER

Key '1' for company emergency information service.

> 1

SULPHURIC ACID, FUMING
(contd.)

Telephone numbers of company emergency information service:
-STAVELEY CHEMS LTD
 CHESTERFIELD(0246)77251
-LEATHERS CHEMS ST HELENS(0744)811703
-ISC CHEMS AVONMOUTH(0272)823631
-BDH CHEMS PARKSTONE(0202)745520
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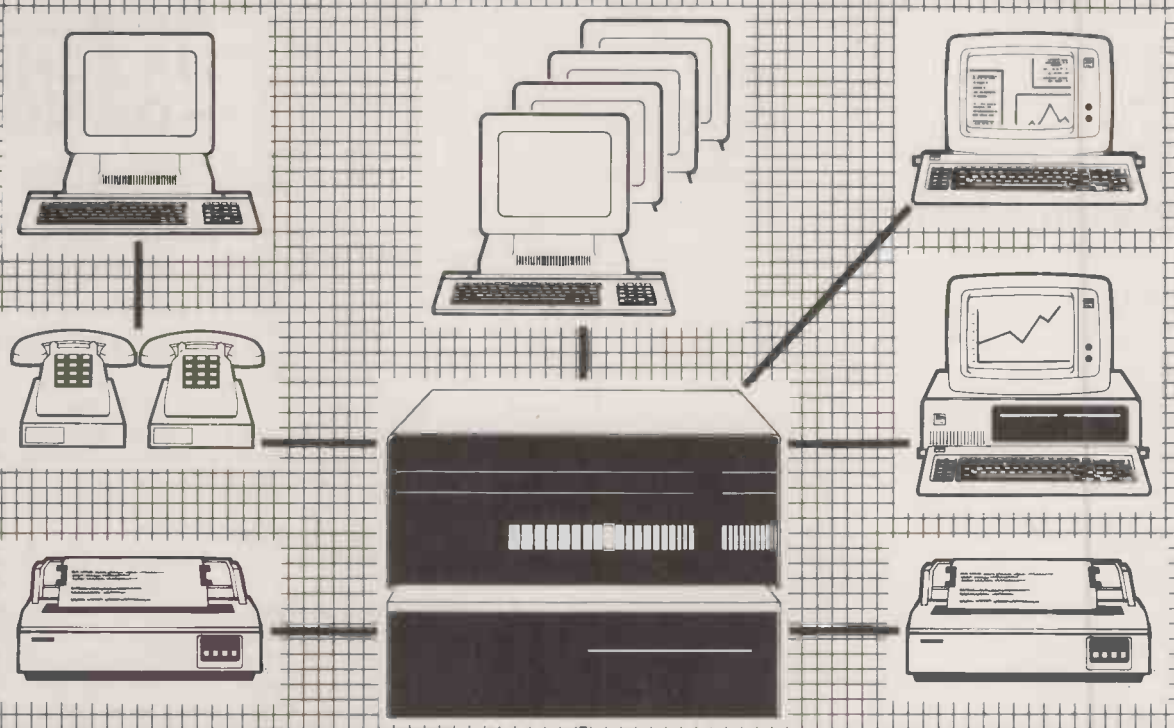

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BY DAVID LEVY

ADVICE

Priests, lawyers and psychiatrists all have a part to play in this amalgam of draughts and halma.

Advice is a delightful game invented just over a decade ago by Alick Elithorn, an experimental psychologist. The game combines the strategic elements of Halma with the exciting tactics of draughts.

The game is played on a nine-by-nine board. Each side has a number of pieces of its own colour: one citizen, four priests, four lawyers and four psychiatrists. At the start of the game the pieces are arranged as indicated in the diagram, where Black's pieces are ringed. A player's move may consist of a single step, a hop or series of hops. In a single step a player may move any one of his pieces one square horizontally, vertically or diagonally in the direction towards his top right-hand corner. For example, in the initial position Black could move his lawyer from e1 to f1, e2 or f2.

The hopping move is only slightly more complicated. A player may make one or more hops with a piece over pieces of his own or his opponent's colour, landing on an adjacent square to the one jumped. When the player hops over an opposing piece, depending on the types of piece involved he may be able to capture the opposing piece and remove it from the board. This happens when a psychiatrist hops over a priest, when a priest hops over a lawyer and when a lawyer hops over a psychiatrist. In addition, any of these pieces can capture the enemy citizen, and when that happens the game is won. The citizen cannot capture anything.

It is possible for a chain of hops to be made in one move, and for more than one enemy piece to be captured as part of this chain. At all times the moving piece must end up nearer to its goal square, in terms of the Manhattan distance, than it was at the start of the move. The Manhattan distance is the vertical plus the horizontal distance. While en route a piece may temporarily make a backward hop so long as its eventual destination represents an advance on its starting square.

To win the game a player must capture his opponent's citizen, get his own citizen to his goal square, or leave his opponent without a legal move. Since every move is a forward play in one or more directions, the game must have a decisive result and there can never be a draw.

The inventor's favourite strategy commences with the manoeuvre of his citizen to the f1 square — d9 if playing White — protected by a piece on e1. The citizen is now immune from capture. From here it creeps round the edge of the board via i1 and on up to i9. In order to stop the advance White will need to keep one piece on i8 and possibly another on i7.

Another strategy is to attack up the middle, surrounding your citizen with at least four of your own pieces on adjacent squares. It is worth writing your program to play both strategies, just to give some variety to the type of game that you experience when playing against it.

Your program should rely on a full-width tree search, and every variation in the tree should be examined to the same depth to ensure that valid comparisons are made between terminal positions. Furthermore, all trees should have even depth, so that the value of the right to move next does not distort comparisons between an even-depth search and an odd-depth search. There are a number of basic principles to help the aspiring Advice player, most of which can readily be incorporated into your evaluation function.

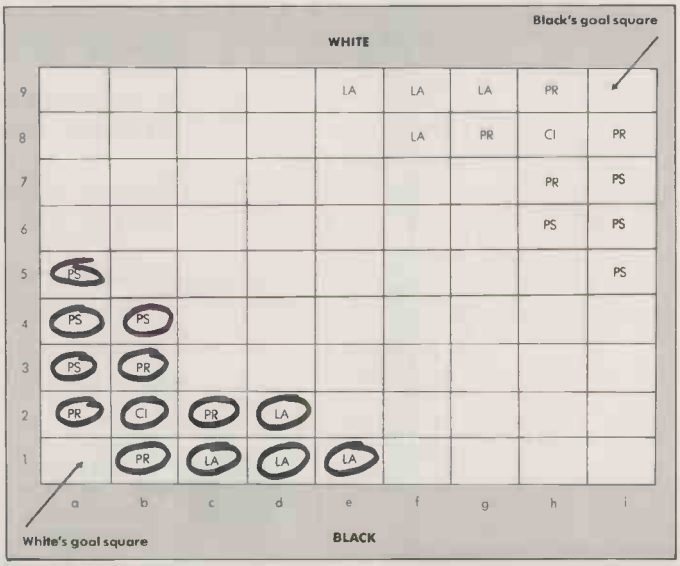
Material is possibly the most important feature of all, and although the lawyer, priest and psychologist all start the game as equals, their value can change according to how many of each type are still on the board. Since only lawyers may capture psychologists, if you lose all of your lawyers then your opponent's remaining psychologists will be invulnerable throughout the rest of the game. They may then wander over the board in whatever way your opponent chooses, wreaking havoc in your camp. So a player should also try to keep a balance of piece types, and try not to lose all the pieces of one particular type.

Try to combine these two aspects of material into one measure, and instead of simply adding the number of pieces of each type on the boad, subtract the squares of the numbers of each type that have been captured. Using this scheme, the program would give a higher score for having two lawyers, two priests and two psychologists, than for having four of one type and one of each of the others. The material feature in the evaluation function simply compares the amount of material currently held by each player.

Mobility is also important. When counting the number of legal moves at a player's disposal, remember that a piece may sometimes move to the same destination square via more than one route, and each route must be counted as a separate move. Also, a player may stop hopping at a moment when he could continue to hop, and this counts as a separate move.

Just as king safety is important in chess, so citizen protection is crucial in Advice. A citizen may only be lost by a hopping move of the opponent, so protection is needed only against those directions from which a hopping piece may come. You can consider the citizen to be potentially vulnerable from eight different directions: up, down, left, right, up and right, up and left, down and right, down and left. It is sufficient to be protected in only one direction out of each pair: the presence of a protector in the up direction means that one is not needed in the down direction and vice versa.

A citizen on an edge square is already protected in three of the four pairs of directions by the edge of the board itself, whereas a citizen that is not on an edge square requires protection in all four pairs. You could measure the safety of your citizen by counting the number of direction pairs in which it is protected: 0, 1, 2, 3 or 4. Squaring these numbers emphasises the value of total protection.



The citizen plays a doubly important role in determining the outcome of the game. A player may win by advancing his citizen to his goal square, or he may lose the game by allowing his citizen to be captured. Therefore it is important to keep the location of your citizen flexible, so that it can be switched quickly from one side of the board to the other. In this sense the sides of the board are the two halves separated by the diagonal running from the bottom left-hand corner to the top right. Parallel to this a1-i9 diagonal there are 16 other diagonals, eight on either side: b1-i8, c1-i7, d1-i6, . . . etc. on one side, and a2-h9, a3-g9, a4-f9, . . . etc. on the other side. You can consider each of these 16 diagonals to be a certain distance from the a1-9i line. A suitable measure of flexibility for the citizen might be the sum of the two greatest distances from a1-9i that the citizen can go on its next move. For example, if the citizen could go as far to the right as f1, which is five diagonals to the right of a1-i9, and as far to the left as b4, which is two diagonals to the left of a1-i9, then its flexibility measure would be 7. The bigger this number, the easier it is for the citizen to dash from one side of the board to the other.

A computer Advice tournament is being planned, details of which will be given in a future issue of the Advice newsletter, but I can tell you now that a four-figure sum will be offered as the first prize. The Advice newsletter and the game can be obtained from Game Advice, 1 Holmes Road, London NW5. The game itself costs around £5 and can also be found in most good games shops. PC

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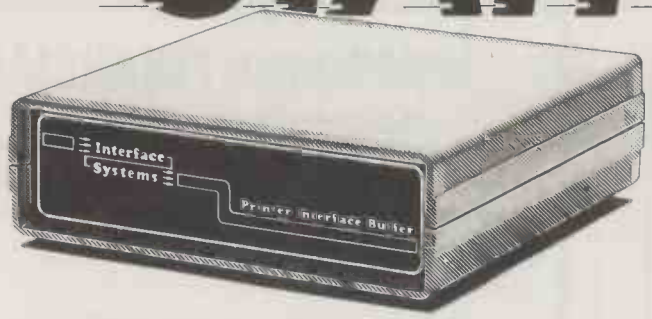

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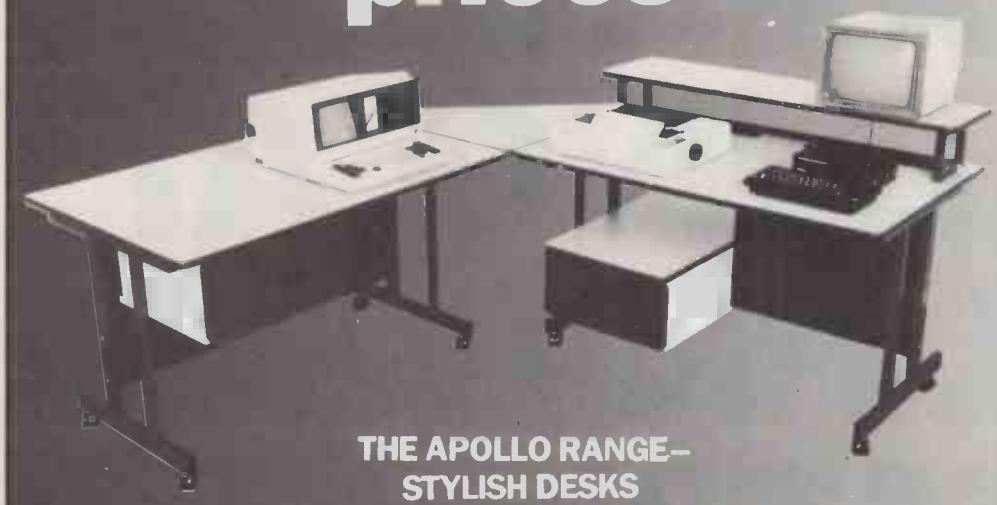

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NEXT MONTH

SPECIAL SECTION

PRINTERS

Is this the year of the laser? We look at the printer market, to see how the dot-matrix and daisywheel models stand up against the advance guard of new technology systems like laser printers.

HARDWARE

AT-ATTACK!

Two more AT-alikes are due next month, with samples from Compaq and Kaypro scheduled for benchtests. We report on how the "future standard" is shaping up.

SOFTWARE

WORD PERFECT

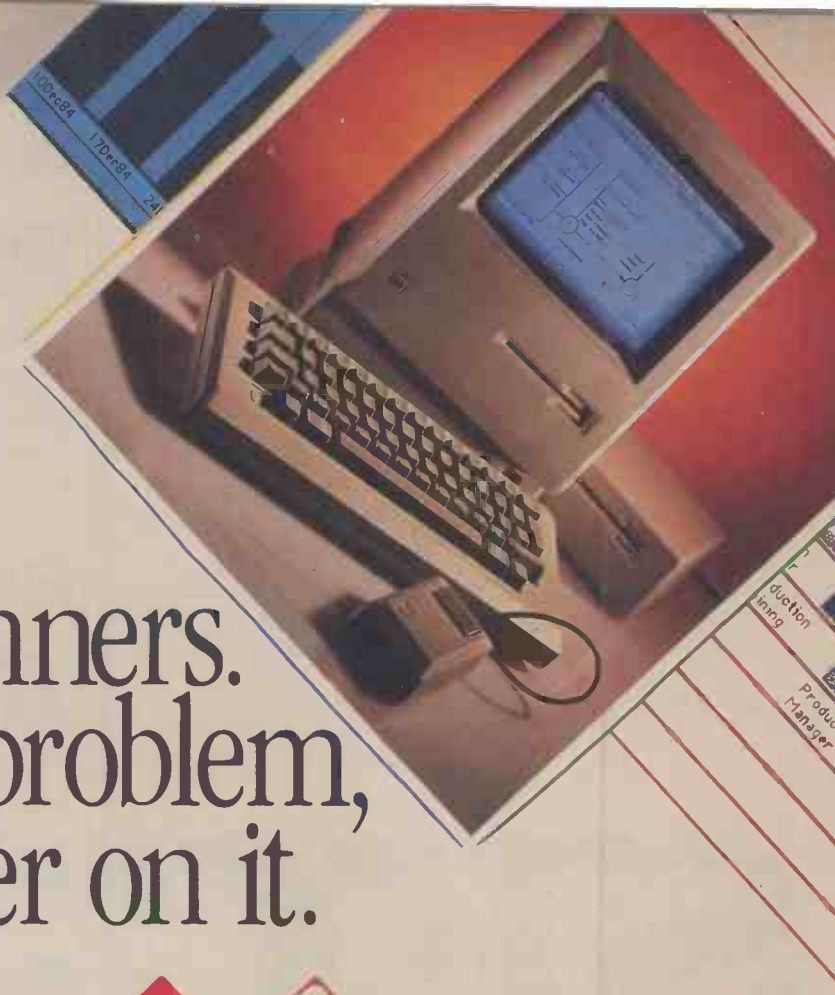
We don't want to write about yet another word processor, and you don't want to read about one but . . . everyone who tries Word Perfect 4.0 from Satellite Systems throws out WordStar and shouts "This is it!". Susan Curran reports on the latest version.

Don't miss the August issue of

PRACTICAL COMPUTING

On sale at W H Smith and all good newsagents after July 10.

Contents may vary due to circumstances beyond our control and are subject to change without notice.



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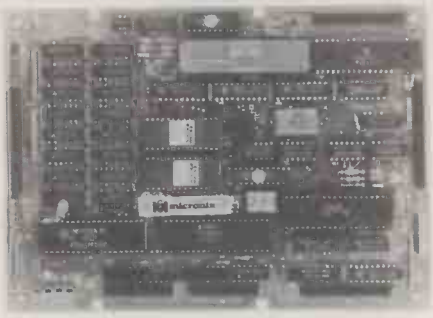

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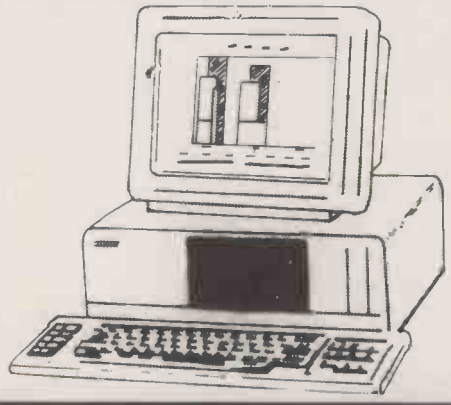

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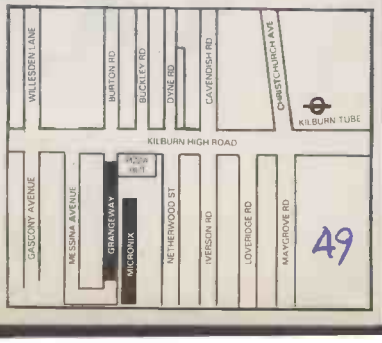

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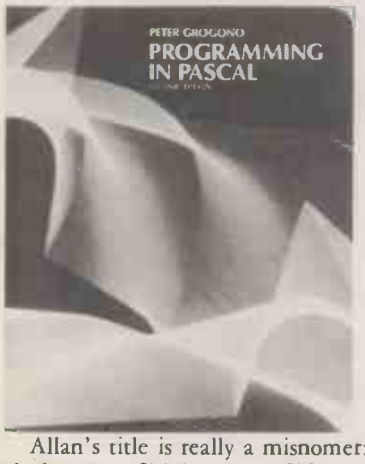
PLENTY FOR PASCAL

Chris Bidmead finds that few of the current books on Pascal come to grips with their subject.

THE LAST three years have seen a boom in books on Pascal, now that schools and universities are turning to the language to teach structured programming. Yet far too few books on Pascal practise the top-down approach they preach: they get bogged down in detail before offering a proper overview. So says Boris Allan in the opening pages of *Introducing Pascal*. But the paradox of the top-down structuring Allan attempts to apply in his book is that, as with programming, it takes skill and judgement to choose the scope and structure of the top layers. The trick is knowing when to stop laying down the philosophical outline and get down to the nitty-gritty. It is quite as easy — as Allan demonstrates — to get bogged down in generalities as in detail.

Thus from a very readable initial chapter on the history of Pascal and related languages, Allan broadens the issue to discuss such matters as the problems of compiler writing, the influence of Pascal on QLBasic, how the outer command layer of UCSD Pascal works, and why it is possible to write Basic programs that run on a Spectrum but not on other machines.



Allan's title is really a misnomer: to get the best out of his bran tub of ideas you need to know the language already, or have access to a better-structured introduction like Peter Grogono's classic *Programming In Pascal*. This book, now in a handsome second edition with added diagrams and an expanded text, puts philosophy aside to get stuck straight in with some simple programming examples, before developing through 400 large-sized pages to cover all the features of the language in strictly practical terms.

Grogono's copious examples can be usefully plundered in your own programs. More important, there are definitive sections on the central features of the language. Grogono's investigation of recursion, for example, recognises the key point that Pascal — unlike some recursive version of Basic — supports recursion in data structures as well as in programs.

Considering the importance of recursion in Pascal, it's surprising how some books skate over the subject. *Getting Started in Pascal Programming* by J Camara and F Puccetti gives reasonable if unexciting coverage of the main points of the language, but dismisses recursion in a page, with the inevitable Tower of Hanoi example. Their explanation of recursion is at once too perfunctory and too detailed; they drag in the concept of the stack frame and discuss the subject in terms of processor mechanics rather than problem-solving.

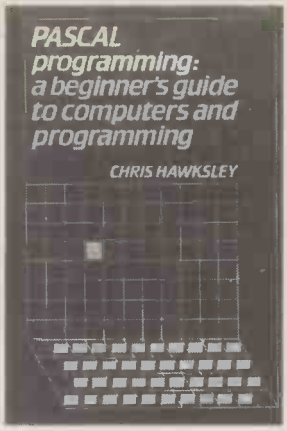
Recursive data structures are not mentioned. You cannot get the best out of Pascal unless you have some grasp of intriguing constructs like

```
type link   = ^object;
     object = record
                next : link;
                data: datatype
              end;
```

Grogono's book explains this as thoroughly as I have found necessary for my own programming, although I come nowhere near the academic grasp of recursion demonstrated by J S Rohl. "We cannot really leave this subject [of Sierpinski space-filling curves] without considering Ackermann's function," says Rohl halfway through *Recursion via Pascal*. I felt we could, and at that point did. Once put down, the book proved to be unpickupable.

One day I will go back to it and push on through "Double recursion", and "Recursion with n-ary trees and graphs" to chapter 8, intriguingly called "The Elimination of Recursion". The point is that on the sort of micros most of us use, recursion is often time and space wasting. Understanding recursion thoroughly must include knowing how to eliminate it where desirable.

Also out of the Cambridge University Press, comes Chris Hawksley's *Pascal*



Programming: A Beginner's Guide to Computers and Programming. It is laid out like the school textbooks I remember from my youth with exercises at the end of each chapter — but no answers at the back.

Aimed at students taking subsidiary level computer programming courses of the kind Hawksley teaches himself, the book is built on the premise that the level of background knowledge most textbooks assume is unrealistically high. Hawksley fills the breach by starting with the fundamentals of computing in general. Not until chapter 5 do we get to "The Fundamentals of Pascal Programming", having earned our way there via a discussion of the relationship between symbols and data, and on through algorithms to a general investigation of the nature of programming languages.

This may sound like the glittering mariner's eye of Boris Allan again, but it isn't. Hawksley's top-down approach is nicely disciplined and concisely argued in concrete images. And where Allan decks every chapter heading with quotes from the famous, Hawksley is more sparing and apt, with a few nice thoughts from Blaise Pascal himself. No mention, though, in the whole book of Wirth. Will this produce a generation of students who think Blaise Pascal invented the language?

Rodnay Zaks' *Introduction to Pascal, Including UCSD Pascal* does have the answers in the back of the book, though it is otherwise nothing like the school textbooks I grew up with. The layout artist has been given his head, and has come up with a riot of design that makes the pages fun to browse through but tough to read.

(continued on next page)

(continued from previous page)

Good layout can serve readibility. *Pascal: an Introduction to the Science and Art of Programming* by Walter J Savitch, is a similar though far more legible, fat American textbook for post high-school computing courses. Here the black print is set off by umber headings, with the same colour being used for diagrams and as discreet highlight in text and examples.

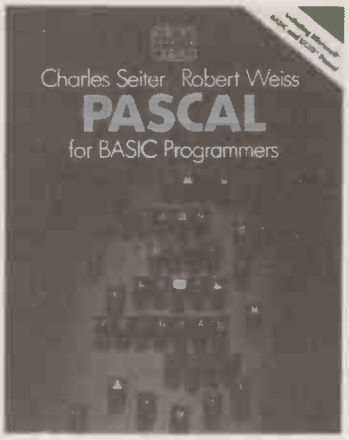
This is almost an encyclopedia of programming; it's packed with good sense. I particularly liked his very clear 14-page chapter on recursion, and the decision to banish the Goto statement to an appendix, where, however, it gets very thorough treatment.

There's no such discretion in the Zaks book. Everywhere the text is broken up with program fragments, tables, charts and diagrams. Zaks offers some useful practical examples, but perhaps tries to tackle too much by giving equal weight to Standard and UCSD Pascal. Two more appropriate books if the latter is your chief interest are *Personal Computing with the UCSD p-System* by Overgaard and Stringfellow, and *Using the UCSD p-System* by K Buckner et al.

UCSD Pascal — the initials stand for University of California at San Diego — is more than just a variant of the language, as it appears in Zaks' book. Buckner and colleagues remind us that it is a fully fledged program development environment, as well as a processor-independent operating system in its own right, with its own large repertoire of commercial and public-domain software packages.

The Overgaard book is poorly produced: 400 pages of patchy daisywheel type. The authors are employees of Softech Microsystems, the company that markets the UCSD p-System, and what they offer is mostly a manual of the UCSD p-System considered as an operating system; there is no treatment of Pascal the language.

Buckner, in the better of these two books,



claims somewhat misleadingly that "The UCSD p-System is rapidly becoming one of the most widespread operating systems for microcomputers". Possibly, if you are counting processor types. In absolute numbers of computers, MS-DOS must take the prize, just as Basic scores heavily over Pascal as the passe-partout microcomputer language.

Three books that recognise this last point, and aim to ease the programmer from the Basic to Pascal, are *Pascal for Basic Programmers* by Seiter and Weiss, *Learn Pascal on your Basic Micro* by Jeremy Ruston, and P J Brown's *Pascal from Basic*. Brown helps Basic programmers adapt to Pascal with wit and detailed knowledge. By contrast, Ruston's book is a rather poor affair. My objection is not so much to its utilitarian presentation — daisywheel printout rather than proper typesetting — as to the misunderstanding it propagates. Seiter and Weiss's book provides a more mature assessment.

Few of the books covered so far make any mention of conformant arrays. This subject, which forms the sole distinction between Pascal Level 0 and Level 1, sounds of only theoretical interesting when sketched out in cold print, as in Huggins's *Mastering Pascal Programming*, where we learn that the admission of conformant array parameters "allows the actual parameter to be an array whose index range is a subrange of that of the formal parameter to be an array whose index range is a subrange of that of the formal parameter array . . .". We are referred to the three relevant clauses in the ISO Standard for the rest of the story, and are left with only the teasing thought that one of Huggins's previously quoted program examples could have been considerably shortened by the use of conformant arrays.

To find out more we need to turn from this rather dry handbook to the more richly detailed *Pascal for Programmers* by a pair of French academics, Olivier Lecarme and Jean-Louis Nebut. Lecarme is an OK figure in the Pascal community who even gets a mention in the preface to Wirth's own User Manual and Report, the scripture on which the language was founded. Perhaps this is why the book embraces Standard Pascal so rigorously, with never a mention of UCSD and those evil American string extensions.

The danger of ignoring Standard Pascal altogether is exemplified in *Pascal for the IBM PC* by Bowyer and Tomboulian, which deals exclusively with UCSD Pascal and IBM's own DOS Pascal Compiler, including such machine-dependent features as graphics and sound. Software outlives hardware, and a book that so thoroughly mixes up the two is a poor way to learn Pascal.

Bowyer's choice of IBM DOS Pascal as the most popular on the IBM PC is already outdated by the arrival of Turbo Pascal, but at least coverage of the alternative UCSD system guarantees the book some longevity. Not so *Personal Pascal*, a similarly PC-orientated book by Cortesi and Cherry, which partners IBM DOS Pascal with Pascal MT+. Neither MT+ nor IBM Pascal seem to be the best choice for teaching the language. But at least Cortesi and Cherry acknowledge Standard Pascal, and ghetto the peculiarities of DOS Pascal and Pascal MT+ into special chapters. PC

PLENTY FOR PASCAL

Introducing Pascal by Boris Allan. Published by Collins, 149 pages, £6.95. ISBN 0 246 12322 2

Programming In Pascal by Peter Grogono. Published by Addison-Wesley, 420 pages, £8.95. ISBN 0 201 12070 4

Getting Started in Pascal Programming by J Camara and F Puccetti. Published by John Wiley, 196 pages, £13.30. ISBN 0 8306 0588 6

Recursion via Pascal by J S Rohl. Published by Cambridge University Press, 191 pages, £7.50. ISBN 0 521 26934 2

Pascal Programming: A Beginner's Guide to Computers and Programming by Chris Hawksley. Published by Cambridge University Press, 188 pages, £15 hardback, £5.95 paperback. ISBN 0 521 25302 0

Introduction to Pascal, including UCSD Pascal by Rodnay Zaks. Published by Sybex, 421 pages; £16.50. ISBN 0 89588 050 4

Pascal: an Introduction to the Science and Art of Programming by Walter J Savitch. Published by Addison-Wesley, 550 pages, £11.95. ISBN 0 8053 8370 0

Personal Computing with the UCSD p-System by Mark Overgaard and Stan Stringfellow. Published by Prentice-Hall, 448 pages, £14.40. ISBN 0 13 658070 X

Using the UCSD p-System by K Buckner et al. Published by Addison-Wesley, 248 pages, £11.95. ISBN 0 201 14641 X

Pascal for Basic Programmers by Charles Seiter and Robert Weiss. Published by Addison-Wesley, 242 pages, £9.95. ISBN 0 201 06577 0

Learn Pascal on your Basic Micro by Jeremy Ruston. Published by 104 pages, £5.95. ISBN 0 907563 27 9

Pascal from Basic by P J Brown. Supplied free by Acornsoft with ISO Pascal ROM, price £69

Mastering Pascal Programming by E Huggins. Published by Macmillan, 269 pages, £2.95. ISBN 0 333 32293 2

Pascal for Programmers by O Lecarme and J-L Nebut. Published by McGraw-Hill, 256 pages, £22.50. ISBN 0 070 369 585

Pascal for the IBM PC by K Bowyer and S J Tomboulian. Published by Prentice-Hall, 326 pages, £15.25. ISBN 0 89303 280 8

Personal Pascal by D Cortesi and G Cherry. Published by Prentice-Hall, 420 pages, £15.25. ISBN 0359 5522 2

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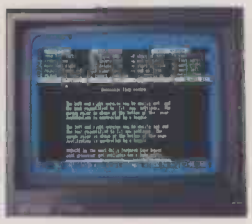

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REVIEW

BBC B+
PREMIUM PRODUCT

By Roger Cullis

SPECIFICATION

CPU: eight-bit 6512 running at 2MHz, further eight-bit processors may be connected via the Tube 2MHz asynchronous bus
Memory: 64K RAM, up to 192K ROM
Discs: built-in double-density disc interface, but current software only supports single-density
Display: RGB, composite video or modulated UHF; two parallel sets of modes each giving eight alternative displays with up to eight colours and 40/80-column text; VDU not included
Sound: three channels plus noise; built-in speaker, no sound output socket
Speech: optional speech upgrade
Other interfaces: parallel printer, RS-432 serial I/O, Econet LAN optional extra, cassette, disc, 6522 VIA user port, analogue/joystick input, 1MHz bus, low-voltage d.c.
Price: £499 including VAT
Supplier: Acorn Computers Ltd , Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN. Telephone: (0223) 245200

There are no dramatic changes, just a number of useful refinements on Acorn's upgraded machine.

Acorn has sold over half a million BBC Micros in the three-and-a-half years since the machine appeared. With the announcement of the B+ model it is clearly hoping to revive its flagging fortunes and make fresh inroads into the educational and home-computer markets. The question is: at a price just short of £500 for some not very new technology, does it stand a chance?

From external appearances, only those with an intimate knowledge of serial numbers will be able to distinguish the B+ from the B. The shape is the same, the colour is the same and the keyboard is the same. The Break key is still in the same vulnerable position, and the cursor controls are still non-ergonomically grouped with all of the other keys. There is still no numeric keypad.

Internally the changes are more significant. The motherboard has been completely redesigned, and Acorn has adopted a different processor, the 6512. The 6512 has been chosen because it uses a two-phase clock, which eases internal hardware-timing problems. This is a major factor, as it has to support the BBC Micro's many peripherals. The instruction set of the chip is exactly equivalent to that of the 6502, so software will require no amendment on this score.

The 16K RAM chips of the old model B have been replaced by 64K devices, but the main memory map remains unchanged with RAM located at &0000-7FFF and ROM at &8000-FBFF and &FF00-FFFF. The extra 32K of RAM gave the designers some spare read-write memory to play with.

The disc interface is the other area where there has been a major innovation. The expensive and outmoded 8721 single-density floppy-disc controller has finally been consigned to the graveyard — probably to the relief of Intel, which reopened its production line to supply Acorn's needs. In its place is a new double-density controller, the Western Digital 1770. It is far more versatile, and with suitable software permits the use of a number of different disc formats, including IBM's.

The total chip count has not been much reduced, because the principal role of the BBC Micro is that of an input/output processor, an application which requires large numbers of peripheral-controller chips with their associated gating devices. Most of the semiconductors are now soldered directly to the motherboard, and this should improve still further the reliability of a computer which already performs well in that department. The losers here will be third-party suppliers who make add-ons which require the removal of chips to make a connection to the motherboard. The only sockets on the B+ motherboard are for the speech system and the paged ROMs.

The layout of the pcb has been completely revised and a number of chips have been relocated to reduce track lengths. The paged-ROM sockets have been moved into an accessible position, so that it is no longer necessary to remove the keyboard to install or remove the chips. An extra ROM socket has been combined with the operating system in a single 23256 ROM, which liberates a further space.

The disc-filing system now occupies a single 27128 EPROM on its own, whereas the previous DFS 1.2 had been combined with the Econet routines. A ROM socket may hold either a 16K or a 32K ROM, the appropriate address decoding being selected by adjustable links on the pcb. However, although more physical locations have been provided, each of the six sockets addresses

Spot the difference . . . the motherboard of the BBC B+ (below left) is still very similar to the old-fashioned design of the BBC B (below right).

FOR TORCH USERS

Torch has established itself as the largest third-party supplier of peripherals for the BBC Micro and since its inception has used the BBC motherboard as the base processor for its own range of computers. Torch says that it will continue to support its users and to make upgrades freely available. Acorn will still be supplying the existing model B for the time being, so Torch will not be making a changeover in the immediate future. In the meantime, Torch will be actively evaluating the B+ motherboard to see how best to exploit its new features, such as the double-density floppy-disc controller and the shadow-mode screen display.

only two sideways ROM pages, a total of 192K, whereas in the model B each of the four sockets can address four pages; a total of 256K.

The language interpreter supplied with the B+ machine is the 1982 version of Basic 2. The further enhanced 1983 code, released with the 6502 second processor, has not been used; it would have required relocation as it runs at &B800-F7FF.

The operating system is designated OS 2.0. It contains many of the routines from its predecessor, OS 1.2, but has been substantially revised. The starting locations have been changed, so the naughty people who have written software which does not use Acorn's standard indirection addresses will have to get busy again because their code will not run on the new machine. An interesting point is that the greetings message has been changed and the computer announces itself as "Acorn OS 64K"; the "BBC Computer" message has been dropped, presumably to avoid the confusion with the Brown Boveri Company which has got Acorn into trouble outside the U.K.

64K RAM CHIPS

The main innovation in the new operating system is concerned with the VDU routines and results from the extra RAM made available by the use of 64K RAM chips. Acorn has located the extra 32K at addresses &3000-AFFF, in parallel with the existing CRT screen buffer and the bottom 12K of paged ROM. The lower part, &3000-7FFF, is used to implement a further set of display modes 128-135, known as the shadow modes. They function in a similar manner to modes 0-7 in the existing machines, but have Himem always set to &8000.

The system is similar to that introduced by Cambridge Computer Consultants with its Aries RAM board. For compatibility with the model B, the Acorn system defaults into the normal mode, whereas the Aries board defaults into the shadow mode. The new *Shadow command and an associated operating system Osbyte call select shadow memory. Acorn uses Osbyte 72 and Aries uses Osbyte 6F for this purpose. A further and hitherto unused Osbyte call EF is used to invoke the shadow mode.

The upper part of the extra RAM, &8000-AFFF, is configured as sideways RAM. It uses different protocols from the paged ROMs, so it may not be used for ROM emulation by loading software from disc. The already comprehensive Plot graphics command, and associated VDU25, have been further enhanced to permit the drawing of a horizontal line until a defined background colour is reached. New operating system calls Oswrsc and Osrdsc are used for a direct write to or read from the screen. These calls will not work across the Tube.

FORMAT AND VERIFY

The disc-filing system is a disappointment since it is merely an emulation of the model B's DFS 1.20 and earlier versions. Acorn's explanation is that this is done for software compatibility. What it means in practice is that the constraints of the earlier system, such as a maximum of 31 files on a disc, have been ported across to the new code. A number of new utilities, together with Tube communications code to operate a second processor, are now included since there is space available on the 27128 EPROM. The new utilities are format and verify, plus one which allows you to read, but not write, 40-track discs with an 80-track drive. They were previously supplied on disc, while the Tube comms came with the Econet firmware.

There is no means of tapping the extra facilities of the WD 1770 floppy-disc controller chip except by writing directly to its registers via Sheila. This will have to await the B+ implementation of Acorn's advanced disc-filing system (ADFS). It is currently available on the Electron and the Winchester disc and is, according to the User Guide, the "filing system for all future filing operations". It incorporates a proper hierarchical file structure, with 47 files per directory, but carries an additional RAM overhead of three pages for housekeeping.

John Coll's excellent User Guide has been reset and, where necessary, updated. Basic 2 changes are now documented and the sections on assembly language and operating-system calls have been expanded. There is a new chapter on the use of the shadow screen and the incorrect drawing of the serial DIN connector has been put right. Most of the changes are minor, such as the replacement of "operator precedence" by "operator priority" and the renaming of the "pling" operator as the "shriek" operator.

Consigning its Advanced Business Computers to limbo obviously created a big components inventory to add to Acorn's well-publicised cash-flow problems. As the BBC B+ shares the ABC's motherboard, there was a powerful incentive to launch the new machine now rather than in September as was previously rumoured. Acorn has never before launched anything early.

At first sight the price tag of £499 makes the B+ vastly overpriced in relation to the Ataris, Commodores, Amstrads and Sinclairs, which all offer more bytes per buck. The price is, however, merely a reflection of free-market economics with the manufacturer charging the price the customers prepared to pay, albeit under protest. Acorn commands a premium because it has a captive education market and because it designs for a product life of more than two years. On the same principle, the Apple II is more expensive because it has a huge software base, and IBM charges extra for its logo.

With a tremendous range of internal and external facilities available, the BBC Micro is an exciting computer to use. The B+ removes a number of limitations of the previous model and there is more mileage in the concept for the future. However, before the launch of the next model, I hope Acorn will pause to take a look at what its competitors are offering and that when the model C eventually materialises, it will have at least some extra features. Among those worth considering are: an LCD display for function keys; a separate numeric keypad, Shift-lockable to alternate function key set; ergonomic positioning of the cursor keys and a safe place for Break; and facilities within the case for adding accessories so that the computer does not have to be festooned with ribbon cables. Another welcome innovation would be a clean 64K RAM shadow memory map so that OS and paged ROMs can be changed at will.

BBC B+

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	■	☐	☐
Documentation	☐	☐	☐	■
Value for money	■	☐	☐	☐

It's B+ for compatibility and potential but C– for timing and price.

CONCLUSIONS

■When the BBC Micro was launched it was a superb machine. The second processors, and other enhancements such as teletext, IEEE, instrumentation and music synthesis, have kept it abreast of the state of the art. It is still a superb machine with facilities which will keep it vital for several years yet.

■Acorn should have concentrated its resources on the computer itself, and left the add-ons to third-party suppliers.

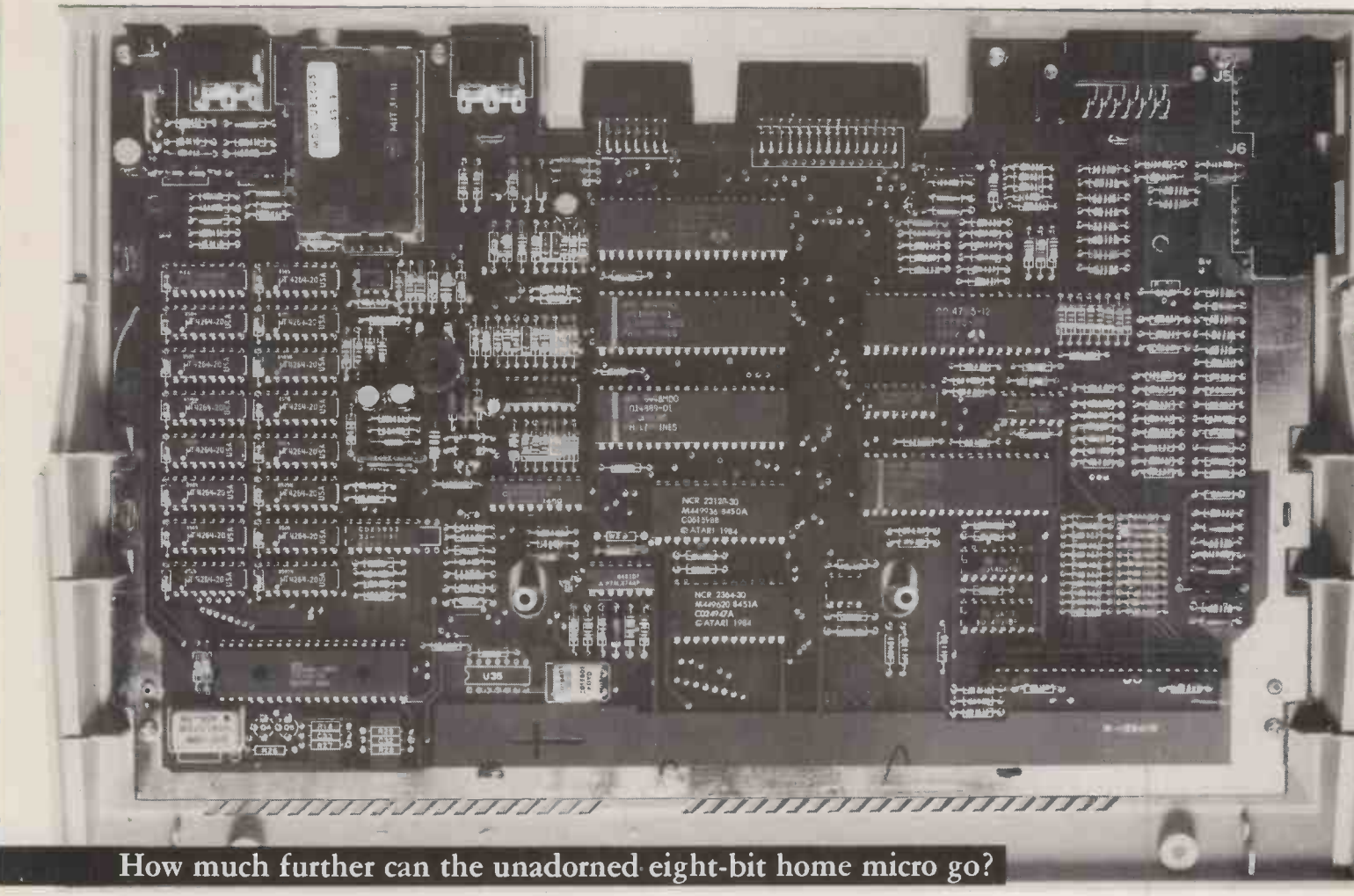
■The B+ is at least two years late yet it still bears indications — such as the outmoded DFS software — that it was released in a hurry.

■The price includes a heavy premium because the principal purchasers are a captive market.

■The new motherboard offers improved performance coupled with lower manufacturing cost, so there is no doubt that it will completely replace the existing model B as soon as current stocks are sold. PC

ATARI 130XE
MORE BITS PER BUCK

By Jack Schofield



How much further can the unadorned eight-bit home micro go?

SPECIFICATION

CPU: 6502C running at 1.79MHz
RAM: 128K; 38K immediately available to Basic
ROM: 24K including Basic
Keyboards: 62-key QWERTY, including five function keys
Display: five text modes up to 40 characters by 24 lines; 11 graphics modes with resolution up to 390 by 192 pixels; up to 16 shades of up to 16 colours
Sound: four independent voices with 3½ octave range
Ports: two joystick I/O ports, serial interface, cartridge slot, expansion slot, TV and composite video ports
Other features: four eight-bit graphics sprites; international character set; self-test routines
Supplier: Atari Corp., (U.K.), Atari House, Railway Terrace, Slough SL2 5BZ. Telephone: (0753) 33344
Price: £169.99 inc VAT

The Atari 130XE is the first 128K micro to sell for under £200. In fact it costs a lot less than that — £169.99 is the guide price. It also has a very good keyboard, disc drives and a well-established range of peripherals, plus useful programs like Atariwriter and VisiCalc.

With this sort of capability, the 130XE is worth considering for serious home use and some small-business tasks. It is certainly powerful enough, though it does have one major drawback: the maximum text resolution is only 40 characters by 24 lines. But where an 80-column screen is not required, the 130XE may find useful applications.

Externally the new Atari looks a smart, modern machine. It is well finished, and styled like the forthcoming Atari 520ST 68000-based micro. Inside is a single board with many familiar components, including an eight-bit 6502 CPU and Atari's custom chips Antic, GTIA and Pokey. This foursome has been part of every Atari micro since 1979, including the 400, 600XL, 800 and 800XL, with which the 130XE is compatible.

Antic is a large chip which controls the display. It offers sprites, a range of 256 colours, five text modes and 11 graphics modes which can be mixed on-screen and changed dynamically during vertical blank interrupts (VBIs). GTIA is a video interface chip. Pokey is a sound chip and I/O controller, offering four sound channels with eight-bit resolution covering three-and-a-half octaves, or two 16-bit sound channels covering seven octaves.

RAM comprises 16 64Kbit chips. There is an extra custom chip, Freddy, to manage the extra 64K, which is bank-switched in 16K pages alongside the usual 64K. This approach is necessary since the 6502 can only address 64K of RAM at once.

The other large chips on the board are two ROMs. They provide 24K of firmware, including the operating system, self-test routines and 8K of Basic. The Basic fitted is revision C of the standard Atari version, which is slow and very limited by today's standards. It can be switched out from the keyboard for loading and running alternative languages including Forth, Pilot,

Pascal and small C. The superior OSS Basic XL, Microsoft Basic, Logo, Action! and Assembler Editor are all available on cartridges.

None of the chips are socketed, but the board is beautifully laid-out and extremely well made. With only 34 chips present — and nearly half of those RAM — it is quite spacious. Undoubtedly the high degree of integration explains the very low price.

The keyboard is, in absolute terms, quite good; for a machine of this price it is exceptional. It is also rather limited, with only 57 keys plus five function keys. There is no separate cursor-control block or numeric keypad. However, all the keys are sensibly placed, and my only real criticism is that the Return key is far too small. The odd key in the bottom corner, outside the right Shift, toggles inverse video.

There are two standard nine-pin D-shell joystick ports on the right-hand side of the case which can provide output as well as accept input. All the other ports are on the back. These comprise a power socket with on/off switch, composite-video monitor and UHF TV ports, a cartridge slot, expansion interface and a single serial input/output (SIO) port. The cartridge slot and expansion bus combine to provide a full pin-out from the motherboard. The cartridge slot does not look as robust as previous Atari ones.

The SIO port is for attaching a cassette recorder, up to four disc drives, printers and modems, etc, which can be daisy-chained together. The major disadvantage is that the SIO system means only Atari peripherals can be attached easily, unless an 850 interface is added or special cables are used to drive them from the joystick ports. It also makes disc operations relatively slow, though nothing like as slow as with the Commodore 64.

The review machine was used with a wide range of Atari peripherals, including the 810 disc drive, 850 peripheral interface, and various others such as an Epson MX-82F/T printer and Minor Miracles WS-2000 modem. It worked well, though of course the 130XE styling does not match that of either of the two previous Atari ranges. A new range of peripherals is on the way, including printers, 3.5in. microfloppy discs and possibly a hard disc.

The 130XE ran all the existing software I was able to try from the 800 and 800XL ranges, including third-party programs. Some pre-XL non-Atari programs are stated to be non-compatible, but these can be run with the aid of a translator disc.

The only noticeable difference was that the video display signal was much stronger, and so produced a sharper, brighter, more contrasty picture. This was an advantage with programs like word processors and VisiCalc, but was less kind to the graphics of some older programs like Atari's Defender. Newer games programs like Drop Zone looked wonderful.

I could not find any programs that were able to exploit the extra 64K of RAM, so unless you write your own it is of mainly theoretical interest.

For now, the main virtue of the extra memory is that it can be used as a RAM disc or virtual disc. The capacity to do this is part of the new DOS, version 2.5, which seems otherwise to be very similar to DOS 2. Of course this is a boon with serious applications where there would otherwise be frequent accesses to a slow physical disc drive.

Silicon Chip, based in Slough, is also planning to adapt its business software for the 130XE. The range, first launched for the Atari 800 in 1982, comprises stock control, sales ledger, purchase ledger, mailing list and PAYE modules. Some American programs written for an independent Atari 800 RAM disc should be easily modifiable.

Of course the Atari does not have the range of serious software available for the Acorn BBC B and the Commodore 64. But there may be enough for some purposes and, if so, the 130XE could form the basis of an extremely cheap outfit — while still offering the best performance on games.

In sum this is a fine machine, and a year ago it might have swept the market. However, it is a moot point whether any eight-bit micro is now a wise buy for serious use. That also includes the Acorn BBC B and B+, Commodore 64, Amstrad and even the old Apple IIe and IIc. Machines like the Apricot F1 offer more power and a more sensible upgrade path, while the forthcoming Atari 520ST looks even better.

BENCHMARKS

The Atari 130XE hardware is reasonably fast, but the performance of the built-in Basic is mediocre — especially on BM8. The optional OSS Basic XL is snappier, but again let down badly by BM8, where sines and cosines have to be calculated.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Atari 130XE — 6502C	2.3	7.3	19.7	24.1	26.3	40.3	60.1	424.2	75.5
Commodore 64 — 6510	1.4	10.5	19.2	20.0	21.0	32.2	51.6	116.0	34.0
Sinclair Spectrum — Z-80	4.5	8.1	20.1	19.5	22.9	52.6	71.0	240.0	54.8
Atari 130XE (XL fast) — 6502C	1.5	2.9	15.3	14.9	14.8	22.3	32.3	414.6	64.8

ATARI 130XE

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	■	☐	☐
Documentation	■	☐	☐	☐
Value for money	☐	☐	☐	■

☐ At just under £170 the Atari 130XE lives up to Tramiel's slogan, "the power without the price", for those who still want a 40-column eight-bit micro.

The Atari 130XE is compactly designed, well made and smart in appearance.

CONCLUSIONS

■ The Atari 130XE is a well-designed and well-made machine at an extremely low price. On "bits per buck" it ought to be a winner — as long as there is still a market for eight-bit 6502-based micros.

■ It is compatible with previous Atari micros, and this gives it a large base of programs — mostly games — and peripherals.

■ As a games machine it murders the Commodore 64 and Acorn BBC B, especially now that available software is much cheaper than before. However, the 40-character screen width and serial disc operation are limiting factors for more serious use. PC

PREVIEW

EPSON QX-16
SOFTWARE BY TAXI

By Ian Stobie

A Mac-like user interface that goes right down into ordinary MS-DOS software marks this 8088/Z-80A machine as something out of the ordinary.

Epson's first 16-bit computer is an IBM compatible, but one with a difference — it has a Macintosh-like graphic interface. Epson has equipped its QX-16 machine with a mouse, and developed its own software package, Taxi, to provide the mouse/icon/graphics environment.

Taxi will undoubtedly be the major selling point of the QX-16. Its advantage is that it does not replace MS-DOS but sits on top of it, so you can run quite ordinary IBM application software without having to adapt it.

In most other respects the QX-16 is conventional. It is built around the same 8088 chip as the IBM PC and XT, and the standard system has 256K of RAM and twin IBM-format 5.25in. floppy drives. A 12in. monochrome display unit comes with the system, but you can also connect up any standard IBM-compatible colour monitor, as the QX-16 has the circuitry to support colour.

Epson is selling the QX-16 bundled with a printer and application software included in the price; several combinations of package and Epson-made printer are on offer. For example, the QX-16 with a DX-100 daisy-wheel printer and WordStar will retail at £2,650 plus VAT, while the system costs £2,750 with the RX-100+ dot-matrix printer and an integrated American software package called Enable. The QX-16 should be available in its standard floppy-based form in June. A version with 10Mbyte built-in hard disc is promised for September.

Externally the QX-16 looks very similar to Epson's existing eight-bit desk-top system, the QX-10. It is a three-box system, with separate keyboard and display unit, and a flat but rather large system box, measuring 20 inches wide by 13 deep, which houses the main circuit board and disc drives. As long as IBM sticks to the 5.25in. floppy-disc format, IBM-compatible machines are condemned to be quite bulky. All the different boxes are pale grey in colour, matching Epson's printers.

Inside the system box is the 8088 processor. Epson has probably chosen the 8088 rather than a more powerful Intel chip, such as the 8086 used in the Olivetti M-24, because it makes IBM compatibility easier to achieve.

Also on the main board is 256K of RAM together with another 128K dedicated to mapping the screen display. You can add another 256K of RAM but that's it: the QX-16 memory will not expand any further. In fact, the QX-16 is no worse than most other IBM compatibles on this score, as MS-DOS is only capable of addressing 640K.

Epson has not gone for 100 percent IBM compatibility, a fact which becomes clear when you look at the keyboard. The function keys are along the top, not down the side, and the Backslash key is not in the standard IBM position next to the Z key. There are other differences below the surface: the keyboard is one of the least IBM-compatible parts of the QX-16. According to Epson, most IBM business programs will run on the QX-16, including familiar packages like Lotus 1-2-3, but the company admits that many games, including Microsoft's Flight Simulator won't, because of differences in the way the keyboard is read.

Display compatibility is probably of greater importance to most business users, as much of the latest IBM business software now makes use of graphics. In this respect the QX-16 is closely IBM compatible. The display shows the normal IBM character set and 200- by 640-dot graphics, and has an enhanced 400- by 640-dot graphics mode. Graphics packages like Lotus 1-2-3 and VCN Execuvision run O.K., according to Epson.

The QX-16 does have one unusual hardware feature: a built-in Z-80A second processor. It is there so that you can run CP/M software, but the CP/M operating system itself is not included in the basic system price; it will be available later as an option. Epson seems to have included this feature for any users of the QX-10 or PX-8 machines who might want to run existing software on the QX-16.

The standard operating system of the QX-16 is MS-DOS, working in conjunction with Epson's own interface manager, Taxi. Taxi is not an operating system in itself: it sits on top of the quite conventional MS-DOS 2.1 supplied with the system and takes control of the user interface. If you like you can bypass Taxi and just use MS-DOS normally.

However, this would be a pity as Taxi is rather good. It provides a mouse/icons graphic environment of the kind made famous by the Apple Macintosh, albeit a simpler one. Taxi is also less ambitious than Digital Research's Gem, which is perhaps the more appropriate product to compare it with as Gem also is a Mac emulator in software, designed to run on IBM-compatible kit. Indeed, there is nothing to stop you going out and buying a copy of Gem and running it on the QX-16.

But the whole point of Taxi is that, because it is simple, it works well with ordinary unmodified MS-DOS applications. Macintosh programs have to be specially written from scratch. Gem does allow you to select and run existing MS-DOS programs from its graphic desk top, but once you are

SPECIFICATION

CPU: 8088 running at 5.3MHz; Z-80A running at 4MHz
Memory: 256K RAM expandable to 512K; separate 128K video RAM
Discs: twin 5.25in. floppy drives, 720K per drive; optional external hard disc; built-in hard disc scheduled for later this year
Display: 12in. green monitor included in price; also works with standard IBM colour monitors; shows 25-line by 80-column text, IBM-compatible colour graphics or 640- by 400-dot graphics
Keyboard: QWERTY layout with separate numeric keypad; function keys and main keyboard not in IBM layout
Other interfaces: parallel printer port, RS-232C serial port, three non-IBM compatible expansion slots, colour monitor socket
Size: system box measures 508mm. (20in.) x 340mm. (13.4in.) x 114mm. (4.5in.)
Software in price: all systems come with MS-DOS version 2.1 and Taxi, plus one application package — either WordStar, the Software Group's Enable, or Graffox's Logistics
U.K. price: £2,750 plus VAT for 256K system with twin floppies, Enable and RX-100+ dot-matrix printer; the same setup but with WordStar instead of Enable and a daisywheel printer costs £2,650; graphics-orientated system with Graffox Logistics and an HI-80 plotter costs £2,550
Manufacturer: Epson Corporation of Shinsu, Japan; part of the Seiko Group
U.K. distribution: from June 1985; Epson (U.K.) Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. Telephone: 01-902 8892

The QX-16's Taxi software allows conventional MS-DOS packages such as Lotus 1-2-3 and WordStar (below) to be run using icons and the mouse.

in the applications they work exactly the same way they always have. Only by re-writing or heavily modifying them can the Gem interface be used properly within applications. The Taxi approach gives you at least the use of the mouse and pop-up menus within the abundant world of existing MS-DOS software.

When you turn the machine on Taxi first shows a largely empty screen with two disc icons on it. Using the mouse to point to a disc icon brings up a disc directory, itself displayed as a set of icons. For example, a disc might show a set of labelled filing cabinets, which represent the different application programs and data files on the disc. Clicking on one of the icons will bring up a further directory or run the application involved. As with the Mac, there are different-shaped icons for different kinds of application.

Taxi is not a slavish imitation of the Mac environment. For a start, you can only have two windows on the screen at a time, plus an active desk accessory. In fact, this is not too severe a limitation; apart from copying, I have always found it difficult to think of activities for which you even need this many. Taxi's menu bar is along the bottom of the screen, not the top, so while the Mac menus pull down when you point to them, Taxi's pop up. The QX-16 mouse has three buttons on it while the Mac mouse has just one, so the clicking conventions are also different.

The Taxi desk accessories are always contained in the rightmost menu at the bottom of the screen. When you choose the calculator, for instance, a high-resolution picture of a pocket calculator appears on the screen, over the top of any application you happen to be running. You can then enter numbers, either by pointing at the keys on the screen image with the mouse or, more practically, by using the numeric keypad on the right of the QX-16's actual physical keyboard. You can send calculated results into your application at the current cursor position simply by hitting the Send button on the calculator.

The Notepad accessory lets you create short documents and print them out. Although allowing up to 10 pages, which is more than the Mac equivalent, it is in some respects more limited. It does not let you copy fragments into other applications, for instance, so you cannot usefully employ it as a name and address file. However, you can copy the notepad as a whole into a WordStar document.

Other useful accessories are an alarm clock/calendar and printer set-up tables which make it easy to select features like double strike or proportional print on Epson-compatible printers. According to Epson, independent third-party software vendors will be able to get the information necessary to create their desk accessories for Taxi.

Once in an MS-DOS application, Taxi makes its presence felt by putting a menu bar along the bottom of the screen. This will vary, depending on where you are in the application, but when doing normal editing in WordStar, for instance, the menu bar reads

File/Edit/Format/Style/Help/Block/Find/Cursor/Accessories

Pointing to any of these items pops up a sub-menu, and from this you can select the option you want. Obviously you can still use the old control-key commands if you are familiar with them.

What is going on here is that Taxi is emulating the keyboard input which you would have to type to initiate the selected option yourself. The advantage is that you do not have to remember all the detailed commands yourself. You just use the mouse, prompted by the menus.

For each package Taxi obviously has to know what commands to generate and what text to put in the menus, so existing MS-DOS packages have to be installed to work with Taxi. However, this only has to be done once, probably by Epson or the software publisher. The end result of this process is a Taxi information file for a specific package. All the user then needs to do is get hold of a copy of this file; Epson says that it will be issuing Taxi information files for the most popular MS-DOS packages free through its dealer network.

There is room for three non-IBM cards.

CONCLUSIONS

■The QX-16 will probably sell well, as Epson has a strong dealer network and the machine itself is well built. Taking into account the bundled software and printer, the pricing is competitive rather than aggressive.

■The QX-16 offers better IBM compatibility than the ACT Apricot, for example, but rather less than the Olivetti M-24 or the true IBM clones such as the Compaq. Most IBM business software should run, but you will not be able to use IBM add-on boards, as the QX-16 is not completely compatible in hardware terms.

■Taxi is the QX-16's main selling point and our first impressions are that it is a realistic compromise between the ease of use of the Macintosh/Gem type of environment and the practical need to be able to run the vast base of existing MS-DOS applications. It is a pity that it looks as though it is only going to be available on Epson's own kit. PC

PREVIEW

ERICSSON, TAVA, GRID
THREE IBM-COMPATIBLE LAP-TOPS

By Ian Stobie

IBM-style computing in a briefcase-sized package is here — for those who can afford it.

Amid tales of gloom from some parts of the computer market, one particular sector appears to be booming: IBM-compatible portables. A large number of companies are launching new briefcase-sized machines into this market. As well as the machines from Ericsson, Tava and Grid previewed here, other companies such as Kaypro, Zenith and Texas Instruments also have competing products.

On the face of it, all this activity is rather inexplicable. Is there really a demand for these machines, generally costing upwards of £2,000 and not even properly portable — they are almost all mains powered? To answer this it helps first to establish exactly what the alternatives are.

Probably the lowest-priced reasonable alternatives are A4-size lap-top machines like the Tandy 100 and Olivetti M-10, costing between £300 and £500. These machines have small 40-column by eight-line liquid crystal displays and full-sized good-quality keyboards. Genuinely portable, they weigh only about 4lb. and have built-in battery packs which typically last for a couple of weeks.

Their chief drawback, apart from the small display, is their lack of proper disc drives and their inability to run the same software as common desk-top machines. But they are quite adequate for many people's requirements, particularly for word processing, spreadsheet analysis and electronic mail. If you are prepared to pay more money — up to around £1,000 — you can get a better A4 lap-top such as the Epson PX-8 or

ERICSSON PORTABLE PC

ERICSSON INFORMATION SYSTEMS is part of the large Swedish-based Ericsson electronics multi-national, and a major supplier of mainframe terminals. An IBM-compatible personal computer is an obvious product for such a company, and last year Ericsson came up with a desk-top PC notable for its eye-catching ergonomic design. The new portable version is an altogether uglier machine, but it is undoubtedly functionally very effective.

Ericsson has decided that since the machine is mains powered it might as well have both a bright display and a fully IBM-compatible disc drive, so the machine has an orange plasma screen and a full-size 5.25in. drive. One reason for the machine's slightly peculiar looks is that the

FOR Bright display. Good IBM compatibility. Add-ons.

TAVA FRONTIER FLYER

TAVA INC., maker of the fancifully named Frontier Flyer, is an established U.S. manufacturer of IBM-compatible desk-top computers. The Flyer portable is actually put together in Hong Kong.

The machine represents good value for money, having two built-in 5.25in. disc drives as standard. The basic 256K memory can be expanded up to the usable MS-DOS limit of 640K, which is another plus.

However, the Tava is rather let down by its display, which is of the conventional liquid crystal variety. While it can handle IBM text and graphics all right from the software point of view, like all LCDs it is rather hard to read unless lighting conditions are exactly right. On a battery-powered machine such as

FOR Twin discs. Good memory expansion. Good value.

GRIDCASE

GRID SYSTEMS probably has more experience making 16-bit portables than most other suppliers, its Compass having been among the very first such machines. While the ruggedly built Compass sold mainly to military and industrial users the new Gridcase is aimed at business professionals, and so is designed to be both cheaper and more IBM compatible. The Gridcase still looks very similar to the Compass, but the earlier machine's bubble memory has given way to a built-in Sony-type 3.5in. floppy disc.

Grid is offering a choice of three display options: conventional liquid crystal, a yellow, back-lit liquid crystal, and a plasma display. The plasma display is the most readable, but it is also the most expensive and consumes the most power. The LCD models work effectively with an optional rechargeable battery pack, which

FOR Good looks. Battery option. Quite rugged.

the Tandy 200. These machines are still battery-powered and about the same size and weight, but have more memory and bigger displays.

Starting at around £2,000 are still more powerful battery-powered portables such as the Data General One, the Sharp PC-5000 and the Hewlett-Packard Portable PC. These machines are heavier — from 6lb. to almost 15lb. — but they are still quite compact, and run full-scale standard software packages such as Lotus 1-2-3. However, with these machines you are really putting yourself near the limits of present-day technology. The manufacturers have been forced to make various compromises to reduce power consumption, such as providing a large proportion of the software in ROM or using bubble memory rather than conventional disc drives. The machines all use liquid crystal display technology, again to keep power consumption down.

Once you relax the requirement for true battery-powered portability the need for most such compromises disappears. Ericsson, Tava, Grid and their competitors can now build in proper disc drives and use more power-hungry but more readable display technologies, such as electroluminescent plasma screens. Generally built around Intel chips — 8088, 8086 or 80186 — these machines all offer some degree of IBM PC compatibility. This offers access to the huge IBM PC software base. Indeed, one advantage of using the full 5.25in. floppy-disc size rather than the more compact Sony discs is to enable users of desk-top PCs to save money by running the same actual discs. The legality of a user doing this is not at all clear, but the economies are substantial.

So who exactly needs an IBM lap-top? The machines are in many ways little more than an update on the original Osborne transportable concept. However, the potential users are not precisely the same. The original machines appealed on price, and were often bought by budget-conscious business people as their only machine. By contrast, the new IBM lap-tops are quite expensive, and are probably most likely to appeal to professionals working in larger organisations that already have desk-top PCs. People who require real processing power at a variety of different office locations, such as roving auditors, seem the most appropriate users. However, there must still be a suspicion that the IBM lap-top is too expensive a sledgehammer for use on ordinary nuts, and far cheaper machines like the Tandy 100 can do many more straightforward tasks almost equally well.

ergonomically minded Swedes have designed the keyboard so that it can be used either clipped to the main unit or detached on the end of a cable; another is that the screen hinges are hollow, to allow a cooling fan to blow air over the plasma display.

The Ericsson PC is probably one of the most straightforwardly IBM compatible of the machines in its class; I had no trouble with Sidekick, Microsoft Word and Execuvision. An expansion chassis, allowing you to fit two IBM add-on boards, is available as an option and fits neatly underneath the machine.

The Ericsson is covered with flaps into which you can fit things; an acoustic coupling modem is available to go into a compartment under the carrying handle. Two other interesting options are a 512K internally fitted silicon disc, and an 80-column thermal printer which fits into the space behind the display.

AGAINST Slightly bizarre looks.

the DG One or the battery variants of the Gridcase there is a good reason for putting up with a poor display, but the Tava is mains powered. It could therefore support a plasma display, though this would push the price up.

Tava ambitiously claims that the Flyer is compatible with IBM's multi-user 80286-based PC/AT. We are not sure how seriously this is meant to be taken, given that the Flyer is built around the less-powerful Intel 80186 chip, but Tava's machine does at least make a good job of emulating the IBM PC and XT models. All the IBM business software we had to hand seemed to run OK. Flight Simulator would not respond to the keyboard; this is quite a common problem on PC compatibles and seems only to affect games. At the time of writing there seems to be a dispute over Tava's U.K. distribution — we give here the name of the company we obtained our machine from.

AGAINST Poor display.

fits into a space in the back of the machine and according to Grid can provide about six hours of operating time.

Grid offers a number of software products such as dBase, Multiplan, etc., on ROM rather than disc, which also helps to conserve power. The chief question mark hanging over the Gridcase is the extent of its IBM compatibility. Using 3.5in. discs rather than the IBM standard 5.25in. means programs and data have to be reformatted to run on the Gridcase. Grid provides utility software to do this with MS-DOS, but we were unable to ascertain whether this approach works in all cases.

The Gridcase keyboard layout is clearly different to the IBM PC's, but you can attach a PC keyboard to a socket in the back of the machine if you like. Grid also sells a local area network system called Grid Server, which can support a mixture of Gridcase and IBM PC machines.

AGAINST Disc and keyboard not completely compatible. Price.

SPECIFICATIONS

ERICSSON PORTABLE PC

CPU: 8088
Memory: 256K RAM expandable to 512K; 15K ROM
Discs: one built-in 5.25in. IBM-compatible 360K floppy drive; optional second external cassette
Display: flat fold-away orange neon plasma display, active viewing area 192mm. × 144mm.; shows 25 lines by 80 columns text, IBM-compatible graphics and higher-resolution 640- by 400-dot graphics
Keyboard: 84 keys with separate numeric keypad, but function keys not in IBM layout
Other interfaces: parallel printer port, RS-232C serial port, one expansion slot
Hardware options: 512K silicon disc, built-in CCITT acoustic-coupling modem, built-in 80-column thermal transfer printer, expansion chassis for two IBM-compatible add-on boards
Size: 390mm. (15.6in.) × 310mm. (12.4in.) × 115mm. (4.6in.); weighs 7.6kg. (16.7lb.)
Software in price: MS-DOS 2.11, GWBasic
U.K. price: around £2,850 for 256K model with one 360K disc drive but no printer
Manufacturer: Panasonic of Japan to a design by Ericsson Information Systems of Sweden
Supplier: Ericsson Information Systems Ltd, Maidstone Road, Rochester, Kent ME1 3QN. Telephone: (0634) 402080. Available July

TAVA FRONTIER FLYER

CPU: 80186
Memory: 256K RAM, expandable to 640K
Discs: two built-in 5.25in. 360K IBM-compatible floppy drives
Display: flat fold-away liquid crystal display, active viewing area 245mm. × 90mm.; shows 25 lines by 80 columns text, and IBM-compatible monochrome graphics with up to 640- by 200-dot resolution
Keyboard: 83 keys in QWERTY layout, with separate numeric keypad
Other interfaces: parallel printer port, RS-232C serial port, one expansion connector
Size: 390mm. (15.5in.) × 310mm. (12in.) × 90mm. (3.5in.); weighs under 6.8kg (15lb.)
Software in price: none, MS-DOS 2 costs around £50
U.K. price: around £2,500
Manufacturer: made in Hong Kong for Tava Inc., of U.S.
Supplier: Computer Frontier (U.K.) Ltd, PO Box 9, Letchworth Garden City, Hertfordshire SG6 7TE. Telephone: (04626) 73374

GRIDCASE

CPU: 80C86 CMOS processor
Memory: 128K RAM expandable to 512K; optional 512K of ROM
Discs: one built-in 3.5in. Sony-style 720K floppy drive; optional second external 3.5in. or 5.25in. floppy or 10Mbyte hard disc
Display: flat fold-away display available in choice of three display technologies — liquid crystal, back-lit liquid crystal or red plasma; all share active viewing area of about 210mm. × 90mm., show 25 lines by 80 columns of text, and IBM-compatible monochrome graphics with up to 640- by 200-dot resolution
Keyboard: 57 keys in QWERTY layout somewhat different to IBM PC's, with no separate function keys or numeric pad, but socket for external keyboard
Other interfaces: parallel printer port, RS-232C serial port, expansion connector, colour RGB monitor socket
Hardware options: 8087 arithmetic co-processor, local area network
Size: 380mm. (15in.) × 290mm. (11.5in.) × 57mm. (2.25in.); weighs 5.4kg. (12lb.)
Software in price: none; MS-DOS costs around £150 on disc
U.K. price: £2,975 with LCD, £3,250 with back-lit LCD and £4,350 with plasma
Manufacturer: made in U.S. by Grid Systems
Supplier: Grid Computer Systems Ltd, Unit House, 33 London Road, Reigate, Surrey RH2 9HD. Telephone: (07372) 41211. Available now PC

REVIEW

HEADSTART ATS
SMALL, FAST AND POWERFUL

By Jack Schofield

BAGSHAW BENCHMARKS

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	TOTAL
Headstart ATS	16	11	10	14	14	38	12	65	18	8	17	70	48	52	393
Apricot PC	17	7	7	19	11	20	2	22	2	7	14	98	44	8	278
IBM PC	21	10	21	21	20	30	8	65	17	7	15	311	145	51	742
Canon A-200	20	17	16	23	28	50	12	76	18	8	15	326	162	61	832

The standard disc Benchmarks were run — see page 99 in this issue — using the Ericsson PC's Basic. The ATS is the second fastest of all the floppy-disc based machines we have tested, in spite of using the same slow drives as the Canon A-200.

Less than a PC/AT but more than just a work station, this muscular little package could find a place in many people's plans for office automation.

The Headstart ATS, previewed last month, is the first clone of the IBM PC/AT to reach us in production form. It even has a U.K. mains supply built-in.

The most remarkable thing about the machine is its small size. The keyboard is about the same size as the IBM PC/AT one, while the monitor box is much smaller. And there is no huge system box at all. Instead of the AT's massive pancake, the only thing to clutter your desk is the optional 720K twin disc drive, which is also tiny. These Canon third-height 5.25in. floppies are the ones used in the Tava portable, reviewed on page 62.

The Headstart does not have a system box because all the circuitry, including a minimum 256K of RAM, is crammed inside the monitor box. It does not seem to run hot, either. The disadvantage is that there is no room for standard IBM PC expansion cards. However, the Headstart has most of the things you might need built-in already, so expansion is not likely to be required.

The system already provides both the excellent IBM green-screen display and graphics. A four-pole DIL switch on the front can be used to select either the monochrome or colour-graphics display driver, though of course the colour graphics are displayed in monochrome on the built-in 12in. monochrome screen.

Also fitted as standard are ports for floppy disc, printer, a network and serial communications. The only extras you might want and can't have are things like a clock/calendar card or integral modem. However, there is an expansion bus which could be taken to an expansion box. The remaining features are a power on/off switch, and a brightness wheel for the video display.

On power-on, the Headstart looks for a system disc, and if one is not available it tries to boot from the built-in local area network. For this review a version of ATS-DOS version 2.11/1.05 was used. This appeared to be the same as PC-DOS 2, though much was missing. Conspicuous by their absence were GWBasic and such handy little programs as DDT. Also missing was DOS 3's VDisk, for setting up RAM as a virtual disc, though we ran this from a PC-DOS 3 disc. We were reduced to using Compaq, Olivetti and Ericsson discs to provide GWBasic for running Benchmarks, etc. They all worked correctly, as far as we went.

The ATS was also happy running other IBM software from standard 5.25in. IBM discs. We found no programs that would not run, except for the original Microsoft Flight Simulator, which also refused to run on a PC/AT. However, the Headstart did run the newer version.

The facility to switch from monochrome mode to graphics was a great boon compared to the IBM, though it did involve changing the DIL switch and rebooting the system. The facility to switch in mid-program would be even nicer.

There were only two problems with the system, one minor and one rather more troublesome. The minor problem with the Headstart is the sheer speed of the cursor, compared to the slow crawl of the IBM PC. Using destructive backspace, it was easy to delete a line of text by mistake, so fast is the operation.

More troublesome was the large Headstart keyboard. It is spacious, but the placing of some keys is less convenient than on the IBM — Alt is one such. The numeric keypad lacks the arrows and labels of the IBM version, including Home, End and Page Down. The functions still work, and are even documented in the ultra-slim manual — final documentation was not available — but this was not very convenient with unfamiliar packages.

But there are also some improvements over the PC keyboard. For example, the Backslash key has been moved. LEDs are provided for keys like Caps Lock and Num Lock, though they are on the top of the keyboard, not built into the keys themselves. Also there are three keys labelled, curiously, S1, S2 and S3, plus eight extra function keys from F11 to F18.

The keyboard feels nice to use and works well. However, it is sufficiently different from the IBM version to feel odd, without being decisively better. It should satisfy people who only use the Headstart, though it will probably annoy those who use a number of PC-compatible machines.

The Headstart includes a coaxial connection for the well-known Multilan multi-user network, first developed on the Superbrain. This is fast — 3Mbit/sec — and can connect up to 255 work stations using an 80186-based 25Mbyte file server. IBM PCs can be joined to the net using the PCN-255 adaptor card, and the hard-disc storage can be expanded to 725Mbyte.

The networking facilities were not tested, but for some users will represent a major attraction of the system. The fact that the standard Headstart is supplied as a compact system without disc drives should enable networks to be assembled cheaply and easily. Only a few dual-floppy drives need be purchased, as they can easily be moved around as required for loading software.

SPECIFICATION

CPU: Intel 80286
RAM: 256K, expandable to 512K, 1Mbyte or 3Mbyte
Storage: optional 5.25in. 720K twin half-height floppy discs; Multilan storage systems with 25Mbyte to 725Mbyte options
Keyboard: 104-key detached with four LEDs; optional 70-key portable keyboard snaps on to front of screen in a protective casing
Display: 12in. green screen with P-39 phosphor with 80 characters by 24 lines, switchable to 640 by 200 pixels
Sound: one-voice speaker
Interfaces: RS-232C compatible RS-449 serial port, Centronics parallel printer port, data bus interface, coaxial LAN port
Dimensions: 400mm. (15.75in.) × 325mm. (12.75in.) × 286mm. (11.30in.) with small keyboard; weight 13.5kg. (30lb.)
Price: £1,995 plus VAT; discs £495; 25Mbyte network server £2,795
Supplier: Intertec, 123-125 Gloucester Place, London W1H 3PJ
Availability: U.K. deliveries scheduled for mid-summer; contact Zircon Micros, 452 Fulham Road, London SW6 1BY. Telephone: 01-385 0850

HEADSTART ATS

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	☐	■
Ease of use	☐	■	☐	☐
Documentation	■	☐	☐	☐
Value for money	☐	☐	☐	■

The Headstart ATS is a fast, powerful machine. It should be seriously considered as a high-powered work station.

BASIC BENCHMARKS

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Headstart ATS— 80286	0.6	2.5	5.5	5.7	6.2	11.2	17.6	18.2	8.4
IBM PC/AT — 80286	0.5	1.9	4.6	4.7	5.2	9.1	14.6	13.5	6.8
Olivetti M-24 — 8086	0.5	2.0	4.6	4.7	5.2	9.4	14.8	16.1	7.2

The standard Basic Benchmarks were run using a version of Microsoft Basic from Ericsson's PC. The ATS is not quite as fast as the IBM PC/AT or the speedy Olivetti, but is nevertheless faster than most IBMulators.

CONCLUSIONS

■The Headstart is an attractive and competitively priced competitor for the IBM PC/AT. It is easy to buy, as the standard system provides most of what most people need, including switchable monochrome and graphics displays.

■The ultra-compact design saves a very considerable amount of desk space. The whole system takes up less room than many dumb terminals.

■Compatibility with the IBM PC seems excellent, which will appeal to single users, though the lack of expansion slots must be seen as a drawback. For this reason it will probably appeal more to the corporate market, where the small footprint and built-in network will be more appreciated. PC

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WORDSTAR 2000: For the IBM PC £440

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LANGUAGES

Microsoft	CP/M	MSDOS	Digital Research	CP/M	CP/M-86	PCDOS
Basic Interpreter	£340	£340	CBASIC Interpreter	£130	£275	
Basic Compiler	£385	385	CBASIC Compiler	£425	£500	£345
FORTRAN Compiler	£485	£340	PASCAL MT +	£300	£345	£345
COBOL Compiler	£680	£680	C Compiler		£295	£295
C Compiler		£485	PERSONAL BASIC Int		£130	
PASCAL		£295	CIS COBOL	£425	£425	
BUSINESS BASIC		£450	FORMS-2	£110	£110	
Compiler	£195	£150	FILESHARE	£250	£425	
MACRO ASSEMBLER	£195	£150	FORTRAN-77		£295	£295
SUPERSOFT C Comp	£185	£185	SUPERSOFT BASIC Compiler		£200	£200
PRO FORTRAN	£220	£320	PRO PASCAL	£220	£320	£320

UTILITIES

ASCOM: The most flexible asynchronous communications package available to the micro worls. Interactive, batch, menu-driven. Available for CP/M, CP/M-86, MS/PCDOS.....£170
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CONVCP: Operating system converter. Runs CP/M-86 programs under MSDOS.....£70
ASSEMBLER PLUS: Disassembler for 8080 and Z80 programs.....£167
DISKEDIT: Facility for editing disk held data by sector. Invaluable aid.....£70
IBM-CP/M COMPATIBILITY: Set of programs that enable IBM 3740 disks to be used on CP/M, permitting transfer of files to/from IBM mainframes.....£110
SPP: Speed Programming Package for use with Pascal/MT +.....£167
XLT86: Converts 8080 assembler code to 8086.....£70
EM80/86: Emulator to run CP/M software under CP/M-86 and DOS.....£70
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SUPERSORT: Full function Sort/Merge/Selection package£145
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MAGSAM: MBASIC utility to provide multi-key ISAM file facilities.....£150
TOUCH 'N' GO: Teach yourself keyboard skills.....£40
PROSTAR TRAINING GUIDE: Independent instruction on the use of MicroPro 'STAR' products.....£30
TERMCOM VT100: Emulator.....£160
FIXED ASSETS SYSTEM:.....£600
INCOMPLETE RECORDS SYSTEM:.....£350
EXPRESS BASE II: Productivity aid for dBase II.....£125

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TICKTACK
CRAUNCHING THE MARMOSET

By Glyn Moody

Aimed at being more than just a translation aid, this program will help you write foreign business letters.

Translating is fraught with dangers, particularly if you are unacquainted with the foreign language in question. Ticktack is a translation program designed to protect you from some of the more obvious pitfalls.

Just how grave these can be is nowhere better illustrated than in Pedro Carolino's *The New Guide of the Conversation in Portuguese and English*, published in 1855. Carolino relied solely on a Portuguese-French phrase book and a French-English dictionary, and was unprejudiced by any personal knowledge of English. To borrow a phrase found in the book under the heading "Idiotisms and Proverbs", Carolino's efforts are a perfect example of "craunching the marmoset" — whatever that may mean.

Ticktack aims to avoid any such craunching. It is designed primarily for business use, where letter writing is a key activity, and creating the right impression is often crucial. Since the range of phrases encountered is relatively circumscribed, it is quite possible to cover most situations using a combination of standard phrases.

Taking this as its starting point, Ticktack works in two stages. First it provides a list of several hundred such common phrases, each of which is assigned a unique reference code of the form D34. The particular phrase allocated to this number happens to be "Will you please send us your current price list and indicate what discounts apply."

The second aspect of Ticktack is the translation itself. This eschews any fancy kind of AI approach, and simply replaces the English phrase D34 by the foreign equivalent. For example in the German version reviewed here, this is "Würden Sie uns bitte Ihre neueste Preisliste zusenden und uns mitteilen, welche Rabatte Sie gewähren." Since the phrases are numbered in exactly the same way for all the languages, it is possible to translate between any of them if you have the two relevant manuals and a disc containing the phrases in the end language.

The range of languages available is impressive. Apart from all the popular European ones, there are Ticktack packs for sending letters in Finnish, Romansch — Switzerland's fourth national language — and Basque. The phrases in all the modules are the work of a native speaker who is also what the publisher calls a "bright business person." For example the Basque version was produced by the chief translator for Basque Television.

New languages are being added. A Russian publishing house is interested in jointly producing a version in Cyrillic characters. Similarly, the 4,000 or so Chinese ideograms needed to cope with the standard phrases are being hand-crafted, and so far about 250 have been designed.

The latter development will be on the BBC Micro. Ticktack is available on the BBC, IBM PC and compatibles, Apple II, IIe and IIc, Apricot and Sirius.

The latest versions of Ticktack will work with any word processor capable of dealing with ASCII files. By keying in the relevant codes, phrases can be strung together on a data disc. In the other disc drive is the main Ticktack floppy, on which is stored all the phrases in the target language. There is also a small front end which places the appropriate phrase on the data disc as you type in the codes.

Once the letter has been built up in this way, it can then be edited with a word processor like any other file. For example, addresses can be added, or phrases modified to reflect the particular situation. Of course, as soon as you start playing around with the phrases themselves, you run the risk of introducing the idiocies Ticktack is designed to avoid. For this reason the publisher suggests that the programs are best used by people with some knowledge, however basic, of the language. Ticktack then becomes more of a way of clarifying your own foreign fumblings, rather than a stand-alone translation program.

Ticktack encourages the former approach by including a useful manual on letter writing in the relevant language, which points out pitfalls and makes many suggestions for improving your letter-writing style. These go far beyond matters of punctuation. For example, there are benevolent injunctions like "be courteous and charitable and put your correspondent in a positive and receptive mood."

Happily the manuals go a long way to inspiring confidence in these words of wisdom. They are well thought out and well written. There are some useful exercises at the end, and a very full selection of photocopies of sample letters. The sentences provided would seem to cover most general business situations quite well.

Interestingly enough, there has been considerable interest from the Continent in Ticktack. One of the advantages of the whole system is that it works both from and to English. Where other nationalities make the effort to write in the appropriate language, British executives seem more disposed to fire off letters in English and hope that someone out there will understand. Perhaps the appearance of something so simple in concept and easy in use will help change all that.

SPECIFICATION

Hardware requirement: 48K Apple II, IIe, IIc, 64K IBM PC or compatibles, Apricot, Torch, Sirius, BBC Micro
Price: £150 including VAT for first program, £75 including VAT for second program on same machine
Availability: now
Author and distributor: Primrose Publishing, 11 Church Street, Thriplow, Cambridge. Telephone: (0763) 82512

TICKTACK

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	■	☐	☐
Documentation	☐	☐	☐	■
Value for money	☐	☐	■	☐

☐Ticktack uses a very simple idea effectively. For ordinary day-to-day overseas business correspondence it is a real boon.

CONCLUSIONS

■Ticktack is a business-letter generator which works by stringing together standard phrases. It is not a translation program as such.
■Within its circumscribed field, for which it is well suited, it seems to be a workable solution.
■No matter how accurate the component phrases are, it would be unwise to entrust weighty commercial matters to this kind of blind letter generation.
■The documentation is very well designed; the general hints on letter writing are practical and down-to-earth without ever being patronising.
■The price of $150 might seem a little steep for one disc and a few manuals. Whether they are worth it depends on how much the user attaches to presenting an efficient and business-like image to foreign clients or partners. PC

LIGHTYEAR
EASY EXPERT SYSTEM

By Chris Naylor

No previous experience is required when using this graphics- and menu-based package to help with your decision-making.

The current pardigm of an expert-system shell is a program which allows the user to carry out tasks in structured selection, choosing between a number of different alternatives in an orderly fashion, and which allows the user to readily input details of his or her own particular problem area. Lightyear fits in with this paradigm and provides a very stable method of setting up your own expert system to act as a decision aid. Suggested uses include marketing decisions, recruitment selection, financial analysis, purchasing decisions and a great many more.

There is no doubt that Lightyear is one of the easiest-to-use expert-system shells currently available. You need no knowledge of expert systems to set it up or to use it, and the screen display and prompts make its operation so obvious that it would be hard to envisage a user who was stumped by it. Menu-driven and graphics-orientated, it is something of a model of clarity, especially when used with a colour display.

The general procedures for using Lightyear consist of naming the system you are about to put up and then listing the alternatives available to you under this system. So, if you wanted expert advice on which computer to buy, you would list as alternatives all of those computers you might consider.

You then list the criteria by which you are going to make your choice. These might be price, disc size and speed, for instance. Each of these criteria is assigned a weight from 0 to 100 to show the importance you place on the value of that criterion overall. You also specify whether each criterion is to be regarded as a numeric, verbal or graphic item.

For numeric items you specify a range of possible values. One end of the range is defined as most desirable and the other end least desirable. For verbal criteria you first choose from a menu the category of words that best apply to that criterion. The list includes Quality, Degree, Yes/No, Frequency, Risk and Attitude. A sub-menu then appears giving a choice of actual words that might be used.

For graphical criteria the system simply presents you with a bi-polar scale. You use the arrow keys to position an X at the point on the scale which you think gives a fair representation of that particular criterion on each alternative.

You can also add rules to the overall decision model. They are written either as simple conditions, such as

price MUST NOT BE GREATER THAN 5000 (ELIMINATION RULE)

or as If-Then rules, such as

IF disc size LESS THAN Average THEN price MUST BE AT MOST 1200 (ELIMINATION RULE).

It is also possible to add rules of the form

IF price GREATER THAN 2000 THEN disc size SHOULD BE GREATER THAN Average (WEIGHT = 20)

The rule only comes into play if the condition is satisfied, and in that case it has a weight assigned to it in the same way as the other criteria possess weights.

The rules may look as if they require you to learn a new language, but in fact all the forms of words are selected from pop-up menus. The menus heavily constrain the rules you can form, but they do so in a reasonable way.

LIGHTYEAR

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	■	☐	☐
Ease of use	☐	☐	☐	■
Documentation	☐	☐	■	☐
Value for money	☐	■	☐	☐

☐ Lightyear must be one of the easiest products of its type to set up and use and should give useful support with many types of decision.

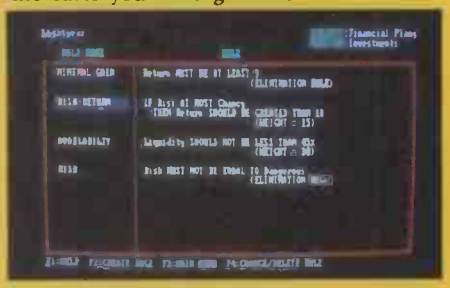
With the criteria set up, an Evaluate option enables you to compare the score for all the alternatives on a graphical display. Each alternative can be displayed individually showing the criteria that have contributed to its overall score, or two alternatives can be picked out for side-by-side comparison with each other. At any time the model can be altered to see what happens if any weights, criteria or rules are altered.

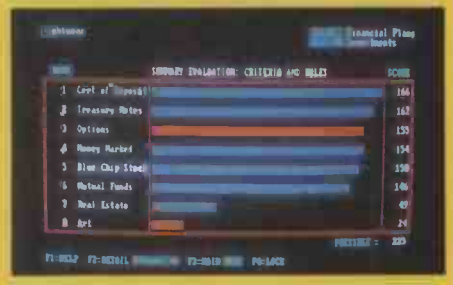
The quality of the program from the user's point of view is really superb, with screen presentation of a high order. However, the presentation actually masks a very simple internal model. Lightyear appears to consist of nothing more than a set of linear equations of the form

$$y = w_1x_1 + \ldots + w_nx_n$$

where w_i is the weight for a criterion and x_i its value. Even where the input is verbal, it simply locates points on an equally subdivided scale. The rules either bring a new criterion into play or point out that a given alternative has failed some rule.

Having listed the alternatives and criteria for choosing between them, you enter evaluations in words or on a scale. Lightyear then ranks your options, using the rules you have given it.





SPECIFICATION

Description: easy-to-use expert-system shell into which you put your own data.. Lightyear makes use of graphics whenever possible to simplify the task of data entry
Hardware required: IBM PC or machine running MS-DOS version 2 or above, with at least 192K RAM and floppy or hard discs. Mono screen can be used but colour screen will give much better results
Publisher: Lightyear Inc.
Price: £495 plus VAT; demo disc costs £20 plus VAT
U.K. distributor: Intelligent Environments Ltd, 20 Crown Passage, London SW1Y 6PP. Telephone: 01-930 2967

CONCLUSIONS

- Lightyear could act as a useful decision aid in a wide variety of circumstances.
- The model it uses for evaluating alternatives is simplistic.
- Presentation and graphics displays are excellent: they make the package appear quite natural to use and useful in its results. PC

Seikosha. Advanced business printers for every size of business.

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Take the BP 5420 for example.

Fast, quiet and designed for heavy duty use, it combines high speed quality print at 420 cps (draft) and 104 cps (NLQ) with an 18K buffer. For ease of operation all user controls, plus the selector switch for the 8 built-in fonts, are located on the front panel of the printer. Parallel and serial interfaces are standard.

Then, exclusively for the IBM PC and compatibles are the BP 5420I and BP 5200I.

The BP 5420I combines most of the features of the BP 5420 printer with all IBM characters, symbols and graphics as standard. The BP 5200I operates at 206 cps (draft) and 103 cps (NLQ) and represents one of the best value printers of its kind on the market.

Finally, the compact SP NLQ printer series meets the needs of smaller businesses.

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THE NEW FORCE IN DISTRIBUTION

WORDWISE PLUS
ON A TV NEAR YOU

By Richard Lambley

Ease of use is the key to this ROM-based word processor for the BBC Micro, which is now endowed with a comprehensive programming language of its own

The original 8K ROM-based word processor for the BBC Micro has been joined by a 16K version, Wordwise Plus. The new program retains the simplicity which has made Wordwise consistently popular but embodies improvements and extensions which make it very powerful indeed.

Operation of both versions centres on a menu page, which gives access to the Edit mode, used for typing text in, and to various options for loading and saving. No special command words are needed to initialise the system, which makes it easy for inexperienced users.

A feature of Wordwise Plus is the segment menu, through which memory not used for the main text can be split automatically into up to 10 areas for subsidiary tasks, such as making notes or preparing address labels. Like the main text, segments can be saved, loaded, previewed or edited.

The Edit mode is perhaps Wordwise's most notable idiosyncracy. Its screen format is a 40-column Teletext-mode display. Characters typed in appear halfway up the screen, which scrolls upwards to accommodate them, word-wrapping as necessary. The user can move freely about the text by means of the cursor keys.

To see the text as it will appear on the finished document you have to return to the menu by pressing Escape and then select Preview mode. Wordwise allows lines of up to 180 characters, but no sideways scrolling is provided and lines more then 80 characters long are folded over in Preview mode. Hitting the space bar halts the text as it rushes upwards.

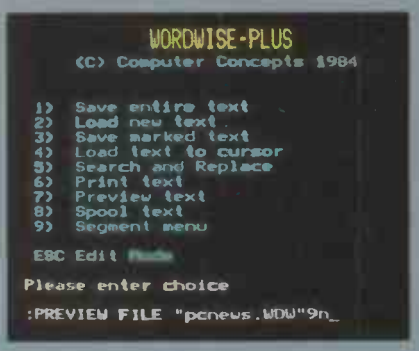
Some may regard the enforced use of the Teletext mode as an inconvenience, but it is a compromise with several practical advantages. Even on the poorest colour TV Wordwise remains usable, and Teletext mode is the key to Wordwise's most flexible and convenient feature — its powerful embedded commands. In Edit mode, embedded commands are coloured green; in Preview mode they are hidden but are acted upon where possible. A typical command consists of a simple two- or three-letter mnemonic, which is sometimes followed by a number.

One especially useful command sends control sequences direct to the printer, eliminating the need for special printer-driver programs. A feature carried through from later editions of standard Wordwise makes it possible to insert commands directed to the machine operating system or to other sideways ROMs, which might include printer utilities such as Computer Concepts' own Printmaster. An important addition in Wordwise Plus is the Print File command. This concatenates the file in memory with others on tape or disc for viewing or printing as a continuous document of unlimited length.

The most unusual and significant extension is Wordwise Plus's built-in high-level programming language. This Basic-like language for manipulating text contains about 70 keywords, which is as many as you get in Basic itself on some computers. They handle keyboard input, output to printer or screen, subroutines, Repeat-Until loops and a full range of filing commands.

Programs can be stored in the segments and executed by pressing Shift plus an appropriate function key. They can even call each other. The possibilities are extensive, though it is hard to imagine the average user exploiting them fully. The demonstration cassette gives some interesting examples of what can be achieved, among them a mail-merge routine and a utility for printing text in dual columns.

Owners of the standard Wordwise can upgrade for £21 plus VAT by returning chip and manual to Computer Concepts. A disc extension for use with the 6502 second processor to take advantage of the extra memory is available at £4.95. An EPROM-based spelling check is available from Beebugsoft for £31.



Wordwise Plus's programming language commands can be entered on the menu or into a memory segment.

SPECIFICATION

Description: EPROM-based word processor for the BBC Micro with disc or cassette filing system; maximum document length is limited only by the storage medium; includes an introductory booklet and reference manual, cassette containing an example document, utility programs in the Wordwise language and typing tutor
Hardware requirements: BBC Micro model A, B or B+; Wordwise Plus works with the Aries B-20 and Watford screen-memory boards, with the 6502 second processor, DFS, ADFS and NFS and with version 104j onward of the Kenda double-density disc interface
Price: £49 plus VAT
Availability: now
Distributor: Computer Concepts, Gaddesden Place, Hemel Hempstead, Hertfordshire HP2 6EX. Telephone (0442) 63933

CONCLUSIONS

- Wordwise scores heavily for convenience, and in its expanded form scores also for versatility.
- Wordwise Plus's novel text-handling language extends its capabilities far beyond those of other word processors for the BBC Micro.
- Its 46 embedded commands give flexibility in layout and enable the user to take full advantage of printer facilities.
- The segment menu allows you up to 10 areas for subsidiary tasks without disturbing the main text.
- The Spool option generates a text file stripped of control codes, useful for writing Basic programs and for electronic mail. PC

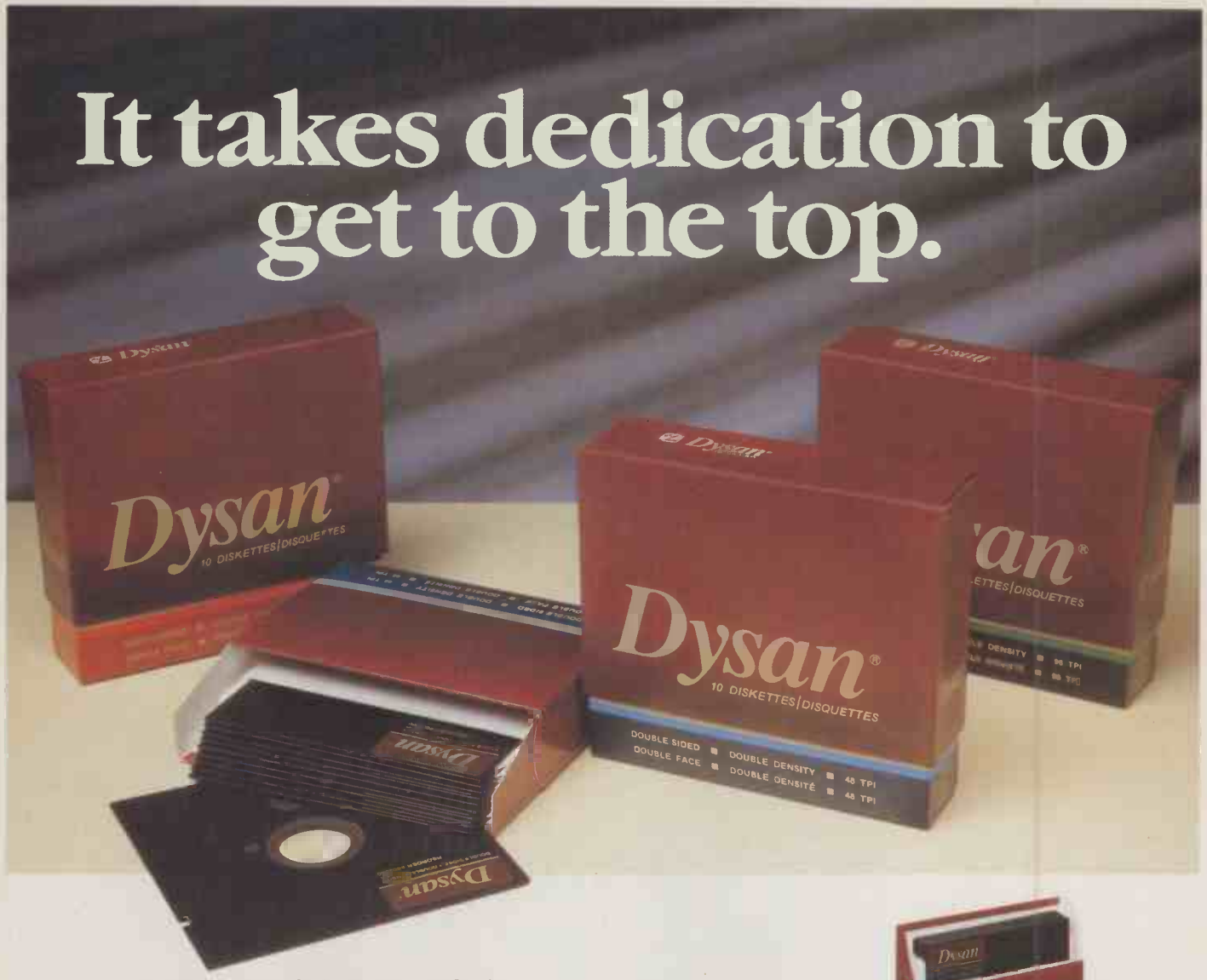
WORDWISE PLUS

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	☐	☐	■
Documentation	☐	☐	☐	■
Value for money	☐	☐	☐	■

☐ Wordwise Plus is simple to use, versatile and very convenient. Existing Wordwise users will find the upgrade well worth having.

It takes dedication to get to the top.



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FACTFINDER
A FREE-TEXT DATABASE

By Mike Lewis

This easy-to-use filing system for the Mac stores and retrieves ordinary text.

Factfinder is a free-text filing system for the Macintosh. Its strongest feature is its simplicity. All the usual database paraphernalia of record structures, relationships and field types has been swept away, leaving a program that is so easy to use that it can be put to work almost as soon as you take it out of the box.

The basic unit of information in Factfinder is called a factsheet. Unlike normal database records, factsheets are variable in length, have no structure, and need not be related in any way. A set of factsheets might contain file notes, lists of things to do, diary entries, recipes, or all of these mixed together. While most filing systems are built around the concept of forms, Factfinder data is more akin to scraps of paper.

You can create and edit factsheets using Factfinder's built-in word processor. This is based on the standard Mac editor, and therefore closely resembles Macwrite, but without rulers, founts and the like. The editing is carried out within the factsheet's own window which, like all the windows in this program, comes complete with standard scrolling bars, size box, etc.

A collection of factsheets is called a stack. You can merge, print, delete and copy stacks, move factsheets between stacks, and convert stacks to standard text files. Especially useful is the browse option, which brings each sheet in turn into the window. A stack may contain any number of factsheets, depending on disc capacity.

The main purpose of Factfinder is to search for factsheets that contain specified keywords. Keywords have to be explicitly flagged during the creation or editing of the document, which can be a little tedious. First, you have to highlight the word or phrase in question, then pull down the Keys menu and click the Mark option. Alternatively, you can strike Command-M, which has the same effect.

Factfinder puts the specified keywords into their own window, which you can open in the usual way. This allows you to add keywords that do not otherwise appear in the text. You can also add the same keywords automatically to several factsheets. So if you were entering abstracts from a journal, you could attach the title and issue number to every article. Another handy feature is that the names of factsheets and the dates on which they were created and last modified are all added to the keyword list, without any user intervention.

When you are ready to do a search, you type your instructions into the Find window. The search argument can contain Boolean operators, ranges and word stems. As a further option, opening an index window causes all the keywords in the current stack to be displayed in alphabetical order, along with the operators And, Or, Not, etc. By carefully clicking and moving these words, you can build the search query automatically. However, this is a slow job which will only appeal to dedicated non-typists.

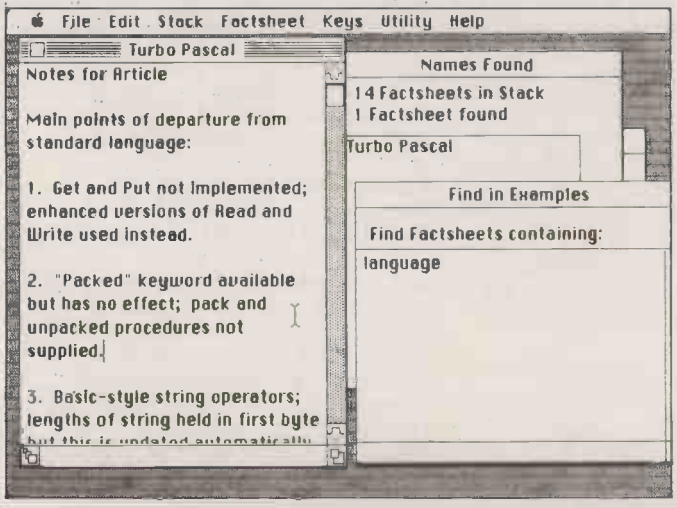
The results of one search can be passed forward to the next, allowing increasing selectivity. When the search is finished, a window of the names found is opened, containing a list of the relevant factsheets. You can browse through the sheets and edit or carry out any of the stack operations on them.

The biggest problem with Factfinder is that it is slow. Once the stack grows beyond a couple of dozen large documents, searching takes several minutes, and browsing from one document to another is decidedly sluggish. Even the simple task of scrolling a window can take several seconds.

Another drawback is that because factsheets are held entirely in RAM during editing, their size is limited. On a 128K Mac, you can go up to the equivalent of about nine A4 pages per sheet. However, given that Factfinder is designed for people who have a large number of small documents to organise, this limitation should not seriously hamper your work.

SPECIFICATION

Description: filing and retrieval system for unstructured data and text; includes a built-in text editor, but can also be used to do keyword searches on ordinary Macwrite documents
Hardware required: 128K or 512K Macintosh
Publisher: Forethought Inc., Mountain View, California, U.S.A.
Price: £139 plus VAT; available now
U.K. distributor: P&P Micro Distributors Ltd, New Hall Hey Road, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 217744



A Factfinder screen, showing the factsheet window (left). Other windows show the current search arguments and a list of factsheets found during the search.

FACTFINDER

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	■	☐	☐
Ease of use	☐	☐	☐	■
Documentation	☐	☐	■	☐
Value for money	☐	☐	■	☐

☐Factfinder succeeds in its goal of being simple and easy to use. It is particularly useful if your data is best held as ordinary free-form text.

CONCLUSIONS

■Factfinder is an attractive filing and retrieval program, intended to be used with free-format text rather than structured records.
■Because of its slowness and the present limitations on Mac hardware capacity, Factfinder is unlikely to be used for large-scale text-retrieval applications.
■The program is so easy to set up and use that people with more modest aims should find it very appealing. PC

TRIGGER
MANAGEMENT SNITCH

By Susan Curran

Managers spend a lot of their time monitoring their own and other people's performance, and Trigger aims to help them. We find out whether this pioneer of management reporting lives up to its promise, or whether a database or spreadsheet system would cope just as well.

Trigger is a management reporting system. Its general approach is based on exception reporting, and it is designed primarily for use by senior managers in large organisations. It runs on the IBM PC and compatibles, and on the PC needs only 128K of memory. It has graphics capability, and will make full use of colour.

I tested the program on an IBM PC/XT, without a graphics card. The program works perfectly adequately without full graphics capability, though it loses the prettiness which seems to be one of its main selling points.

The package comes in two sections. Section 1 is a training course called Managing by Exception, which is also sold as part of a series of management training courses. This consists of two discs, and has its own manual. I thought the manual entirely unnecessary, as the course is both brief and self-explanatory, and the manual itself is almost content-free. The course takes about an hour to complete, and provides a lucid, if rather elementary, introduction to the principles of designing management controls and exception reporting procedures.

The main Trigger program consists of three program discs, one training disc and another manual. Both manuals are in glossy ring-binders with slipcases. They are clearly written, though not always well planned for reference purposes, and woefully short on hard technical information. The discs are all protected. The main program discs can be copied on to a hard disc, but the program will only run with disc 1 in the computer.

No backup program discs are provided. According to the manual only a two-week warranty is provided on the discs, and subsequent accidents will mean that it is necessary to return them and pay a small replacement fee. Though not uncommon, this kind of approach to an expensive program which managers are expected to use intensively, even daily, is appalling. Disc errors are far too frequent to make this an acceptable backup process.

The program uses a variety of data files, which are not documented in the manual. It works on the assumption that only one manager will be using it. Files are given pre-assigned names by the program: there is no choice of file names. In order to run a second application, it is necessary to reinstall the program using a different data disc. On a hard disc, this is an extremely cumbersome business, and it seems that the program is not designed for running multiple applications.

Trigger's approach is unusual. It assumes that the program will be used by, or for, a manager in a large organisation. Though there is a tentative suggestion that it could be adapted for small-organisation use, I find it hard to believe that any small business user would find the program worthwhile.

The manager is expected to divide his or her empire up into organisational units: departments or important individuals responsible for aspects of the activity to be controlled. Up to 50 of these are provided for. There is no inbuilt organisational hierarchy, and the sample worksheets seem to assume a single level of organisation. It is possible to adapt the approach to allow for a conventional hierarchical organisation, but I am at a loss to understand why this was not programmed in.

For each organisational unit, one or more management control can be defined. There is an overall maximum of 200. These must be quantifiable: for example, amount of stock, number of sales, average sales amount per salesperson. The unit of quantification must be listed, and the program does not accept a £ sign. The manager selects a reporting period of a day, week or month for each of these management controls. For each reporting period the manager must give a target value, and an acceptable percentage deviation above and below this value. When actual data is entered, the program calculates whether the data is within the permissible zone, and if it is not, it marks a trigger.

Planned and actual values of mangement controls can be either entered directly, or calculated from other values. The calculations can only be one-deep so it is not possible to calculate a third figure from a figure that has already been calculated. For example, it would be possible to set up organisational units for Sales 1, Sales 2 and Sales 3, and combine their performance in a higher-level Sales unit. But it would not then be possible to forward the data from this to, say, a Financial Control unit, without respecifying the entire calculation from scratch.

SIMPLE CALCULATIONS

The calculations permitted are very basic, on the add/subtract/multiply/divide lines. Target data must be entered individually, reporting period by reporting period, and there is no facility for replicating data. So to input a sales target of 100,000 widgets per month over one year, it is necessary to type 100,000 12 times. I found this so incredible at first that I had serious difficulty in understanding how the program worked.

Single above and below percentages can be entered for each control, though these can be changed — for future time periods only — at any time. The program will not calculate percentages from actual figures, so if you work with, say, target sales of 110,000 and trigger level of 87,000, you must work out the percentage by hand.

The main trigger device is a trigger memo like the one reproduced opposite. One copy is produced automatically for the person in charge of the organisational unit in question; other copies can be ordered. The content and layout is predetermined, and there is no way of modifying it. The idea is that the unfortunate recipient should complete the causes and actions, and return the memo to the originator. Causes and actions can then be entered into the Trigger database.

SPECIFICATION

Description: monitoring and reporting tool aimed at managers
Hardware required: IBM PC with or without graphics card, IBM-compatible printer
Publisher: Thoughtware Inc., Coconut Grove, Florida, U.S.A.
Price: £453 plus VAT from Softsel; £495 plus VAT from Thorn EMI
U.K. distributors: Softsel Computer Products Ltd, Softsel House, Syon Gateway, Great West Road, Brentford, Middlesex TW8 9DD. Telephone: 01-568 8866. Thorn EMI Computer Software, Thomson House, 296 Farnborough Road, Farnborough, Hampshire GU14 7NF. Telephone: (0252) 543333. Available now

Causes and actions are a major part of the Trigger philosophy, something I found slightly laughable. The program will hold a database of up to 700 possible causes and actions. It is possible to indicate on a yes/no basis — no partial hits are registered — whether any suggested cause was actually a cause of a deviation from plan, and whether a recommended action was successful in curing the deviation. Multiple causes and actions can be entered. Trigger keeps track of these cause/action hits and later memos will then bombard the recipient with a list of potential causes and possible actions for comment.

So, for example, the sample firm described in the manual has an inventory turn (stock turnover) below plan. A possible cause is "merchandise is outdated", which is given a probability of 7/10. Recommended actions, with their probabilities of success, are: update product lines, 8/10; reduce inventory by reducing prices, 8/10; and change selling promotions, 8/10. The user selects the initial probabilities, and feedback on the suitability or success of these suggestions will cause Trigger to update the probabilities.

Other program output includes a modest variety of fixed-format reports and graphs. I found these to be moderately well designed. The graphs all work on percentage deviation from plan rather than actual amount, and though this simplifies the scaling task for the program, it would have been useful to see actual amounts as an alternative.

The graphs also handle data from only one organisational unit at a time. To compare the performance of two units, it is necessary to set up a third, dummy unit and duplicate their data into it, which is a tedious business. Graphs are produced, albeit in a rough-and-ready fashion, on a computer without graphics capability.

Both graphs and reports can be printed, but the program will handle graphics printing only on an IBM graphics printer. Printer support is of the rudimentary kind: no special printer features are supported, not even boldface or underlining, and the program sailed cheerfully past the end of the form without leaving any gap in a long report.

The program works on a strictly annual basis, from a start date which is determined by the user. There is no provision for a rolling year: at the end of the year the data is cleared and the program begins again with week 1 of a new year. At the start of the year, the graphs produced are filled rather inelegantly with question marks for future months. A rolling year facility would be far preferable for this type of reporting activity.

Within the year, all data must be entered week by week and/or month by month. I would have liked a failsafe procedure for entering back data when necessary. As it is, if you decide at month 3 to set up a dummy unit to combine the results from two existing units, there is no way of feeding data from months 1 and 2 into it.

Generally, it is not possible to check backwards on past data, not even on past target figures. When being asked to give a target figure for month 2, for example, there is no way of checking in the program what value you gave for month 1. The only way to access past data, except for the data specifically used in reports, is by checking archival data discs.

ATTENTION TO APPEARANCES

Trigger's user interface has obviously been designed with enormous care. The screens are all elegantly laid out, and full advantage is made of colour-graphics capability on systems which possess it. Though the program loses in visual appeal, it does not lose functionality without its graphics.

All the program functions are handled through a series of hierarchical menus, rather coyly described as a Throughtree. The arrangement of the menu occasionally surprised me. In the Management by Exception training program there was an unfortunate tendency for sub-sub-units to return the user to the top-level menu. There is no way of circumventing the menus for regular users, and use of the system proves to be a slow and tedious business.

In use, the ergonomics of the program were less impressive. There are few default responses, and the program never seems to anticipate what data will be required. It is necessary to type the same information over and over again, for example code for organisational unit, choice of daily/weekly/monthly reporting period. On completing one menu choice, the program never simplifies the route to the next. For example, after defining a new management control, there is no prompt or quick route to the menu option that lets you define values for it.

The program does very little automatically. To enter a single batch of data and obtain exception reports, the user has to go through the following series of menu choices: Actual Data and Check Management Controls; Actual Data — leads to data entry; Check Management Controls — system check required prior to reports, must be specifically ordered; Input Compliance Report — checks all required input is available, must be specifically ordered; backtrack to top level; Reports; and specifically order up to eight reports through two menu levels.

Again, though this is a fixed routine that most users would follow regularly, there is no guidance from one of these processes to the next. As a result, even a small batch of data entries takes a great deal of time. I

A single Trigger memo is produced automatically for the appropriate manager.

```
                    TRIGGER MEMO
                  Sample Bookshop

     To: John Smith
   From: Rufus Curnow
Subject: sales    15% Below Plan
   Date: 05/02/85
================================================================================

Organizational Unit:  Fiction

Management Control:  202 sales          Plan Value:          2000.00
         Period:  Month  1 (02/05/85)   Actual Value:        1700.00
      Condition:     15% Below Plan     Above Plan %:   20%
                                        Below Plan %:   10%


Possible Causes and
Recommended Actions:




Copies to:


--------------------------------------------------------------------------------

Cause of off plan condition:

     ---------------------------------------------------------------------
     ---------------------------------------------------------------------
     ---------------------------------------------------------------------

Action taken:

     ---------------------------------------------------------------------
     ---------------------------------------------------------------------
     ---------------------------------------------------------------------

Signed: ____________________          Date: ____________________

Please return this report ASAP to:  Rufus Curnow
```

(continued on next page)

(continued from previous page)

would have found it much preferable if the program had a simple regular weekly update option which led the user in a sensible sequence through all the processes needed.

Each Trigger memo must be individually accessed, its printing ordered, and its deletion ordered. There is no Block Print or Block Delete function. This too is extremely time-consuming.

All these failings make the program much less user-friendly than it might otherwise be. On the credit side, the program works consistently reliably, with neat escape routes from wrong choices, and plenty of confirmation before any data is erased. I did not encounter any reliability problems or accidentally lose any data during my test.

It is difficult to knock Trigger itself without appearing to knock the useful principle of management by exception. It is desirable for the attention of managers to be focused on exceptional events; my doubt is whether Trigger does this effectively. The program is so cumbersome to use that in a moderately complex organisation with perhaps 50 controls to be checked, it would take much longer to locate exceptions using it than it would to locate them by hand using a piece of paper and a calculator.

An improvement on paper and a calculator, as every executive surely knows, is a simple spreadsheet. Any spreadsheet could manage a first-round knockout over Trigger when it comes to ease of calculating and replicating data, and the flexibility of testing the effects of different limits. A spreadsheet with graphics capability could easily reproduce Trigger's graphics reports, and add more flexibility to them.

For those less enamoured of graphics, just about all Trigger's non-graphics capabilities could be handled quite simply on a programmable relational database like dBase II.

Of course, Trigger demands less of the manager than does a serious spreadsheet or database application. But its by no means perfect ease of use is largely the result of its very limited functionality. Whatever the blurb suggests, there is really no way of tailoring the program except in the most trivial ways. I find it difficult to believe that any competent manager would be unable to devise a similar system with the aid of a spreadsheet and a good textbook on exception reporting.

It is difficult to overemphasise the inflexibility of the program, and its very limited capabilities. In spite of the expensive packaging, the six discs and the two manuals, Trigger really does little more than a one-level lookup embellished with a few frills.

A reasonable price tag to place on Trigger's capabilities, compared to those of spreadsheets, databases, accounting programs and similar tools, would be £100, with £200 as an absolute maximum. At £495, it costs considerably more than Lotus 1-2-3, and as much as dBase III. In terms of capability, any comparison is laughable. It is a lot to pay for a few fixed-format reports and memos, and a selection of pretty graphics.

TRIGGER

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	■	☐	☐
Ease of use	☐	☐	■	☐
Documentation	☐	☐	■	☐
Value for money	■	☐	☐	☐

Any manager seriously interested in monitoring exceptions could do better with a spreadsheet or database system.

CONCLUSIONS

- The idea of a managing by exception program is a worthy one, but in spite of its surface flashiness, Trigger is a very limited and inflexible interpretation of it.
- Poor data-entry ergonomics makes the program cumbersome.
- The program is not at all suitable for small businesses.
- It may prove worthwhile in large businesses as a luxury tool for busy managers who can delegate the time-consuming data entry.
- Fixed time periods and the ability to deal only with percentage data make the graphs and reports less useful than they should be.
- The program is appallingly overpriced. PC

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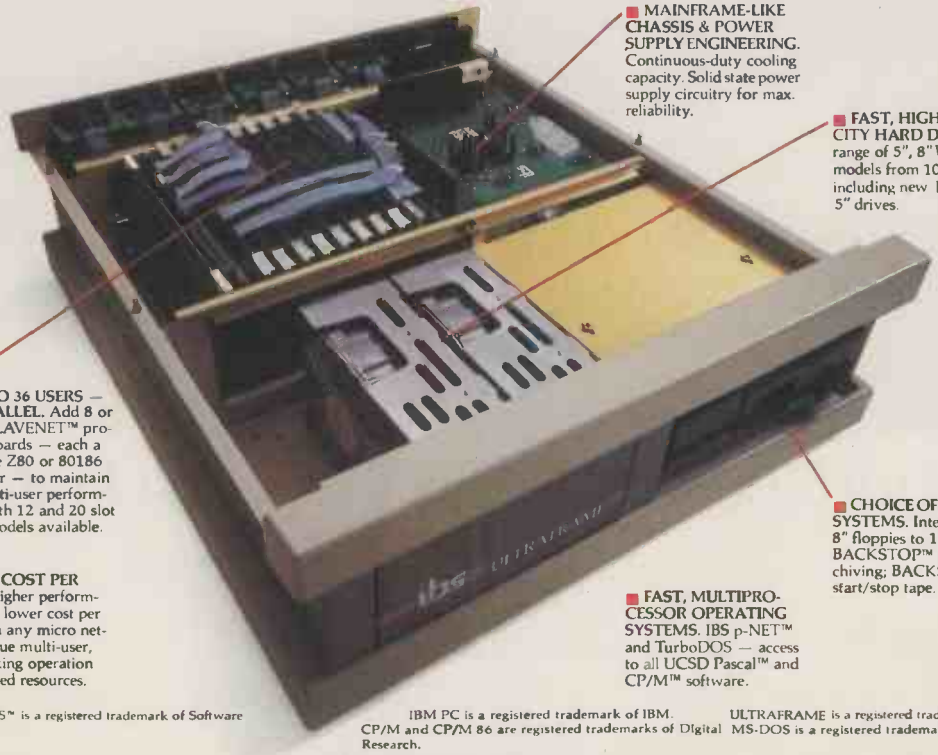

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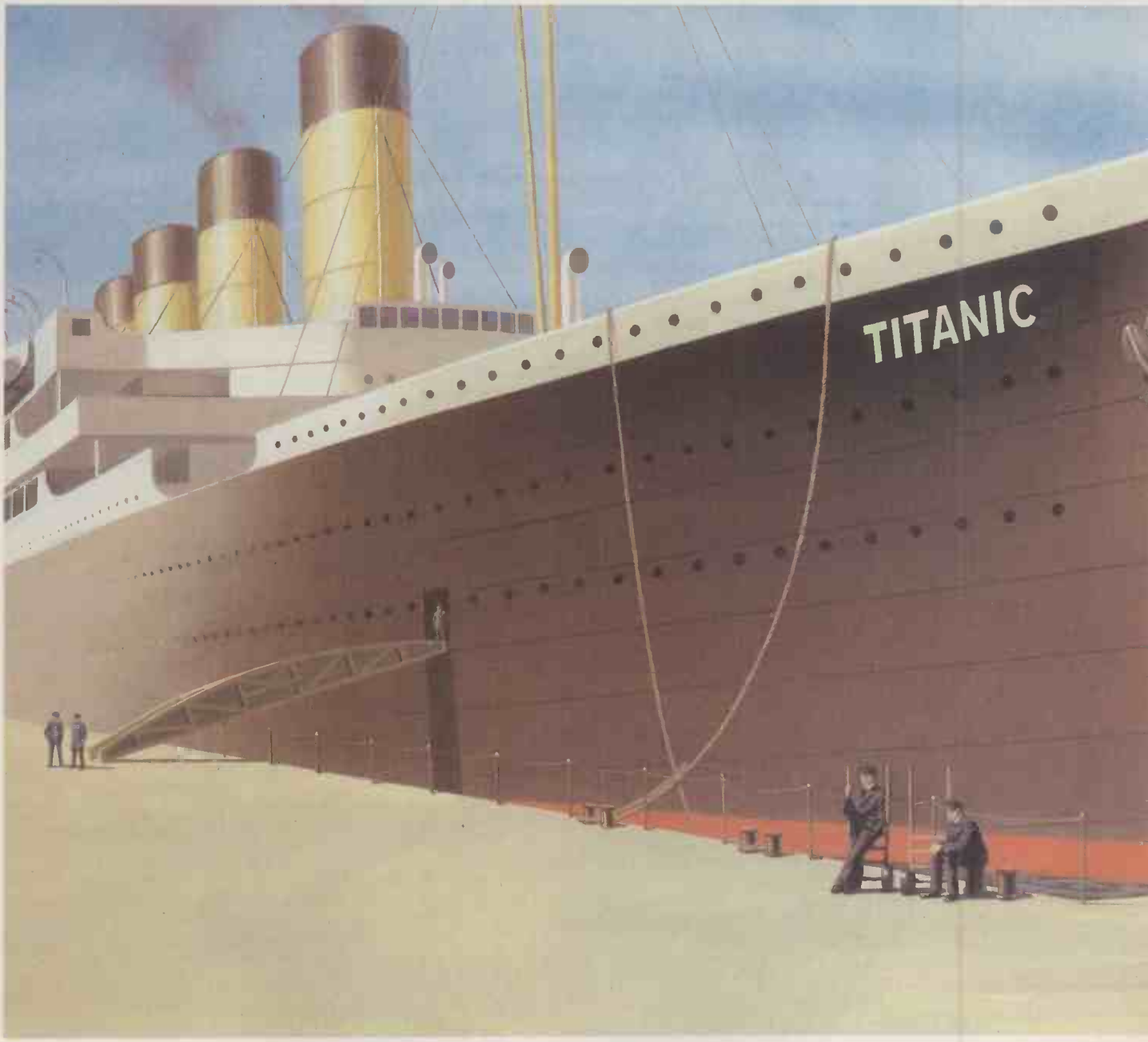

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SETTING THE STANDARD

We explain what to look for when choosing an IBM-compatible micro — though you may well be better off with one of Big Blue's own machines.

Today it seems most businesses — and not a few individuals — need no persuading to buy an IBM PC or compatible. The herd mentality is so strong that arguments only start when someone suggests buying something else. However, people spending real money to tackle real applications have to do better than this, so it is worth examining the advantages of going the IBM way.

The major advantage of choosing an IBM PC or compatible micro is that it represents the standard arrived at by the marketplace. This means it offers the widest choice of software, and gives the buyer the best chance to getting add-ons ranging from simple printers to elaborate micro-to-mainframe connections.

The range of software available is truly amazing — see "Soft Options" in last month's issue, page 105. If you want a wide choice of standard packages, or a wide range of different packages, then PC-DOS offers the biggest selection. However, when only one or two standard packages are required — say, WordStar and an accounts package — the software range is of more theoretical than practical benefit.

ADD-ON POSSIBILITIES

The range of add-ons and peripherals is also very wide. It has been encouraged by IBM's open architecture approach, and the slots provided on the motherboard to take expansion cards. For some specialised applications the IBM PC may be the easiest and perhaps even the only choice. But again, if only stand-alone word processing or a similar application is required, the theoretical benefits of expandability may not be worth the price.

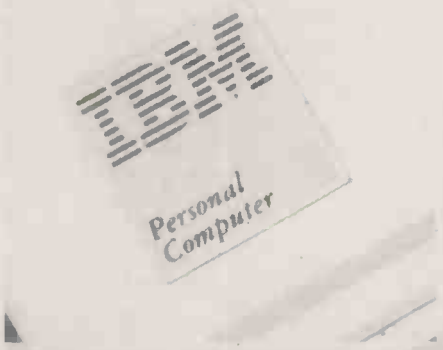
Another reason for choosing an IBM PC is for its ergonomics. The standard PC is undoubtedly a well-designed and well-finished machine. The keyboard, and the quality of the monochrome screen display, are both outstanding, but there are some limitations here. The actual key layout of the IBM PC keyboard has several unfortunate aspects, such as the inconvenient placing of the Backslash key, and the lack of LED indicators on the Caps Lock and Num Lock keys. Also, spreadsheet applications are slowed down by the fact that the cursor controls use the same keys as the numeric keypad.

Further, while the green screen display may be beyond criticism, the standard IBM colour-graphics display leaves a lot to be desired. For a start it requires a separate graphics card and monitor. Also, the actual character set is by no means as legible as it could be, leading to confusion in spreadsheets and fatigue when word processing.

It must also be admitted that, by today's standards, the IBM PC is neither a fast nor a cheap machine. Data processing is slowed by the Intel 8088's eight-bit data bus, and by its relatively slow clock speed of 4.77MHz. As for price, IBM's habit of charging for everything, right down to the Basic language and manual, means that a fully equipped system may cost more than you think. These shortcomings have all provided ways for rival manufacturers to try to claim a share of the market.

The first requirement of an IBM PC compatible is that it should run nearly all of the IBM software from standard IBM PC discs. No lesser standard is acceptable. Today, all the leading compatible micros can run all the leading programs. In addition, most can cope with most of the expansion cards and other peripherals.

The second requirement is that the compatible must either offer more standard features than the IBM PC, or be cheaper, or both — otherwise you might as well buy the IBM in the first place.



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Obviously the second requirement conflicts to some extent with the first: it is not possible to be both better and the same. However, the IBMulators have succeeded in offering enhancements such as better keyboard layouts, combined monochrome/colour printer adaptors, and extra features as standard. As a result, even where the compatibles are not much cheaper, they are often better value. Whether that is enough depends, of course, on numerous other factors, ranging from the specific application to the machine's eventual resale value, if any.

NEW VERSION?

It must be acknowledged that IBM also recognises the growing limitations of its original 1981 design. This is one factor in the launch of the AT or Advanced Technology version of the PC, with its fast 80286 chip and superb keyboard. It is also a factor in strong and continued rumours that IBM will shortly be launching a new version of the PC, known unofficially as the PC II. It is generally supposed that this will also feature an 80286 chip and — though this appears to be less likely — 3.5in. microfloppy-disc drives.

However, it is already clear that while the IBM PC is today's standard, it will not be tomorrow's. Already Compaq, Intertec, Televideo, Texas Instruments, Corona and Kaypro have announced AT-alikes using the 80286 chip. Many more will follow.

This is not something to be alarmed about for now. The AT runs the standard PC-DOS version 2 as well as its own version 3. Indeed, it runs much of the standard IBM software range in 8086-mode, and faster. But the PC/AT is still not using the full power of the 80286, and over the next three years the standards can be expected to diverge as this is exploited.

It would be premature to announce the decline of the IBM PC standard. If prices continue to fall over the next year or so it should continue to get stronger and stronger. Eventually, however, it looks as though 8088-based machines like the IBM PC and most IBMulators will be replaced by ones running the 8086, 80186 and, especially, the 80286. This is something to bear in mind.

Over the page we provide a guide to the advantages and disadvantages of the leading machines in this market. If you are thinking about buying an IBM PC or IBMulator for desk-top use, these are the main ones to consider. The guide prices given for comparison are based on a 256K system with monochrome screen and two floppy-disc drives, serial and parallel ports and the operating system. PC

IBM PC — £2,568

The machine that started it all and continues to notch up impressive sales, despite the availability of compatibles offering improved specifications and better value for money. Obviously hardware and software compatibility problems need not be considered when opting for this model, but performance is down when compared to most of the competition. The monochrome display and keyboard, however, are still among the best in the business. IBM has just announced a dual-floppy version of the XT. It uses the XT motherboard, whose four vacant slots improve expansion potential, but serial, parallel and monochrome-graphics card are all extras as before. Our guide price figure is based on the new model.

FOR The Real Thing: no compatibility worries. IBM name. Build quality.

AGAINST Slow. Comparatively expensive.

ADVANCE 86B — £1,156

Despite its incredibly low price and surprisingly high specification the 86B has not enjoyed the success many observers though it would. At £1,086 for an 8086-based machine with 128K RAM, dual floppies and a full suite of bundled software it is still by far the cheapest PC compatible on the market even though the price does not include a monitor. Compatibility is good. Visually, the machine is a disaster of Titanic proportions, and the standard of construction also leaves a lot to be desired. Advance Technology includes an excellent one-year on-site maintenance agreement in the purchase price. The Perfect software suite bundled with the 86B includes a spreadsheet, card index filing system and a powerful word processor.

FOR Good value. Bundled software. On-site warranty.

AGAINST Monster size. Ugly. Yet to establish itself.

CANON A-200 — £1,875

From the Japanese company that brings us cameras, copiers and league football, the A-200 is a competent latecomer which makes up in impeccable presentation what it lacks in innovation. Based on the full 16-bit 8086 processor, though only running at 4.77MHz, it is appreciably faster than the IBM PC. 256K RAM is standard. Additional memory boards are available from Canon that use the 16-bit data path to reduce read/write times. Though the machine is large it is very attractive and beautifully finished. Canon guarantees that it will run IBM software.

FOR Looks. Quality of construction. Compatibility. Good value.

AGAINST Low clock speed on 8086 processor. Bulky.

COMPAQ DESKPRO — £2,595

The original Compaq portable still sets the compatibility standard others seek to achieve, but operating speed is not its strong point, hence the launch of the 16-bit 8086-based Deskpro machine. This range covers a wide spectrum of equipment all the way from a single-floppy system up to the top version with hard disc and integral tape-streamer backup. This machine is currently eating into sales of the IBM PC/AT. The Deskpro distinguishes itself by offering a dual-speed processor. Speed 1 is a compatibility mode for use on software that objects to running any faster than the IBM's tardy 4.77MHz. Speed 2 is a flat-out 8MHz. As with all Compaqs the display also has two modes, enabling high-resolution text and graphics to be displayed on the same screen.

FOR Fast. Compatible. Dual-mode screen. Integral tape-streamer option.

AGAINST Expensive. Bulky.

ERICSSON PC — £2,129

Although the Ericsson PC is a very pretty machine its specification does little to raise the blood pressure. Based on an Intel 8088 running at 4.77MHz it offers very similar performance to the IBM PC — which means slow. Despite this shortcoming it has proved a good seller, probably due to Ericsson's useful hand-holding support program covering many popular software packages as well as the hardware. The Ericsson PC is very compact and is supplied as standard with an impressive amber-screen monitor. Ericsson itself has a good reputation in office-automation products, and apart from telephone systems also produces a wide range of computer terminals. The company has also just announced a very interesting compatible portable.

FOR Compact. Excellent display. Comprehensive customer support.

AGAINST Mediocre value. Slow.

OLIVETTI M-24 £2,078

Olivetti's tie-up with American telecommunications giant AT&T now makes it one of the few conglomerates with the power to threaten IBM's stranglehold on the computer/office-automation market. The M-24 is Olivetti's second business micro, and one of the first compatibles launched with the full 16-bit Intel 8086 processor running at a clock speed almost double that of the IBM PC. Two keyboards are available; an IBM PC look-alike, and an enhanced version with extra function keys and dedicated cursor controls. Even with the fast processor and enhanced keyboard, compatibility is excellent. The M-24 also includes a high-resolution colour-graphics board as standard, though there is not yet a great deal of software available which can exploit this feature.

FOR Fast. Vast expansion potential. Excellent displays. 16-bit expansion bus.

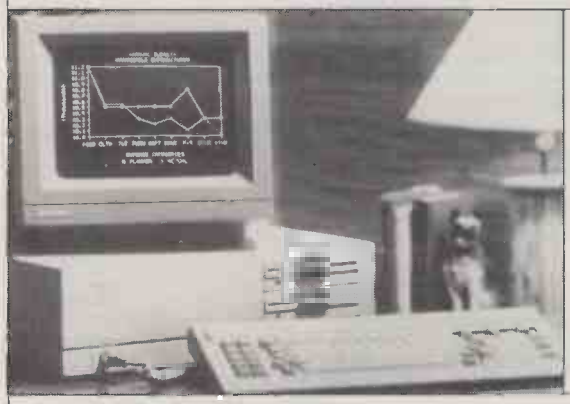
AGAINST Cannot be used with other manufacturers' monitors.

TANDY 1000 £1,777

A late arrival but a welcome one, the Tandy 1000 offers PC compatibility and bundled software at an extremely competitive price. Included as standard is a colour-graphics board, but this is incapable of displaying high-resolution text and cannot therefore be recommended for applications with a high text content. The guide price is for a system with monochrome monitor. The keyboard is beautifully made and very pleasant to use but does not follow the IBM layout, causing compatibility problems. There are three expansion slots, but they are not long enough to take standard IBM boards. The memory is not parity checking. Bundled with the Tandy 1000 is Deskmate, an integrated package including word processing, spreadsheet, filing and a time-management system.

FOR Good value. Colour graphics standard. Integrated software in price.

AGAINST Non-standard expansion slots. No serial port.



SPERRY PC £2,195

The Sperry PC is a dual-speed machine based on the Intel 8088-2. It is designed and built by Mitsubishi in Japan. It is available in a wide variety of specifications, even the most basic of which includes 256K memory, battery-backed clock/calendar, serial and parallel ports and up to five expansion slots. The Sperry has above-average display capabilities, including an option for a high-resolution 640- by 400-pixel colour monitor. As with most other computer-orientated multi-nationals, Sperry's pricing policy is closely linked to the current asking price of the IBM PC. Savings of 10 to 15 percent are usually offered.

FOR Dual-speed processor. Big-name company. Good display.

AGAINST Mediocre value.

TELEVIDEO TELE PC £2,295

Televideo is a well-established company in the field of business micros. Its current diverse range is distributed in the U.K. by Thorn EMI and is backed up by customer hotline support and hardware maintenance. The most outstanding feature of the Tele PC is the unusual hardware configuration, which is a design it shares with most of the Televideo range. The system unit is located vertically to the right of the monitor, which is mounted on an integral cradle. Supplied as standard with 256K RAM and serial and parallel ports, the PC is a good, solid performer with excellent compatibility. Bundled with the machine is Telesolutions software including word processor, spreadsheet and database.

FOR Unusual design. Thorn EMI backup. Compatibility.

AGAINST Bulky. Expensive.

ZENITH Z-150 £2,195

Zenith has just laid claim to the largest-ever order for PCs from the U.S. Department of Defense. Its Z-150 IBM compatible and the Z-160 portable have enjoyed reasonable success in U.K. The Z-150 is not one of the faster compatibles, but it does offer as standard a colour-graphics card and a serial and parallel port. The system unit itself is some 20 percent smaller than the IBM PC, but can still accept four expansion cards. The display has an interesting Smooth Scroll mode to reduce eye fatigue during prolonged use. Pricing is competitive rather than exciting.

FOR Compact. High basic specification.

AGAINST Slow.

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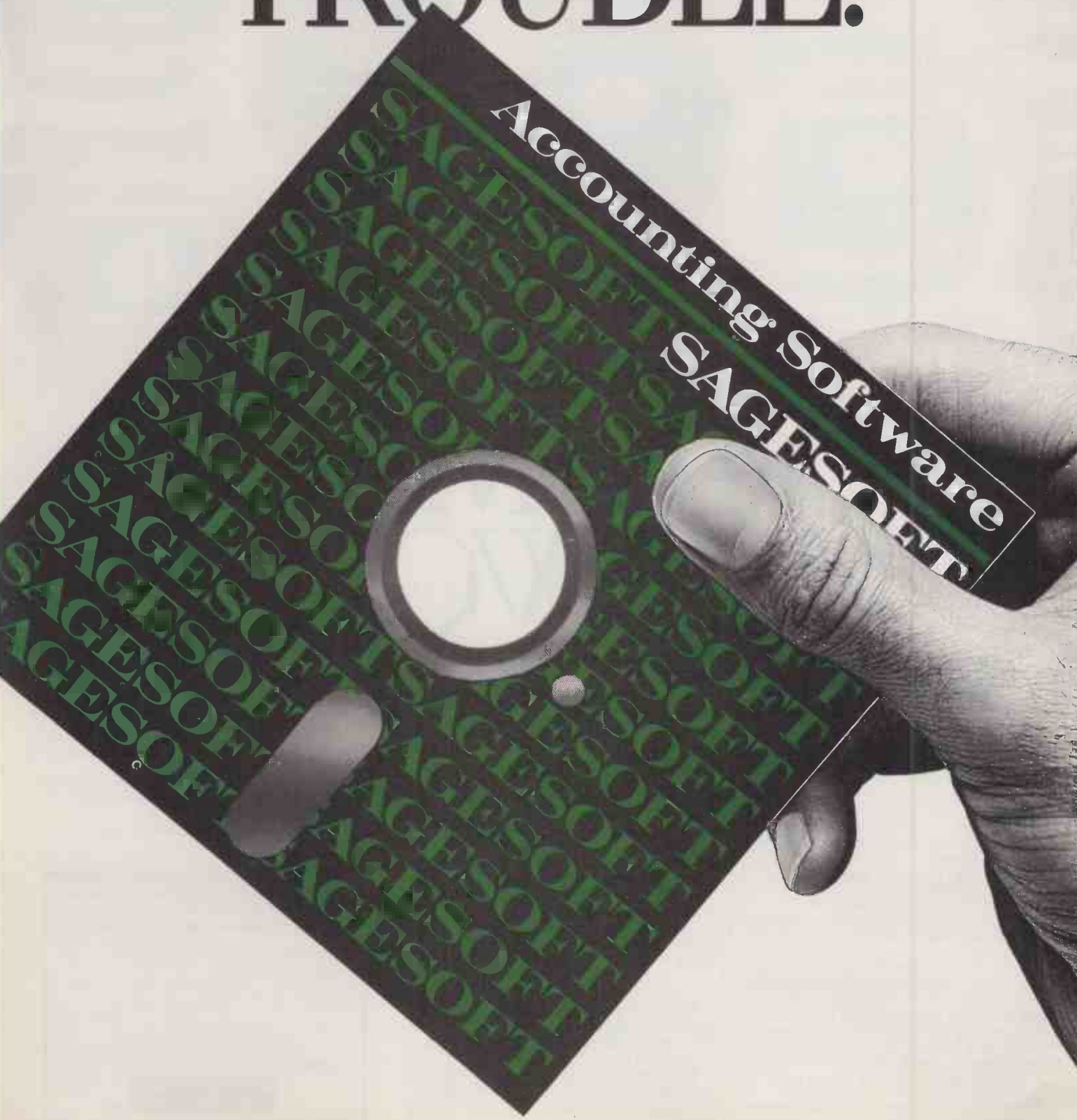

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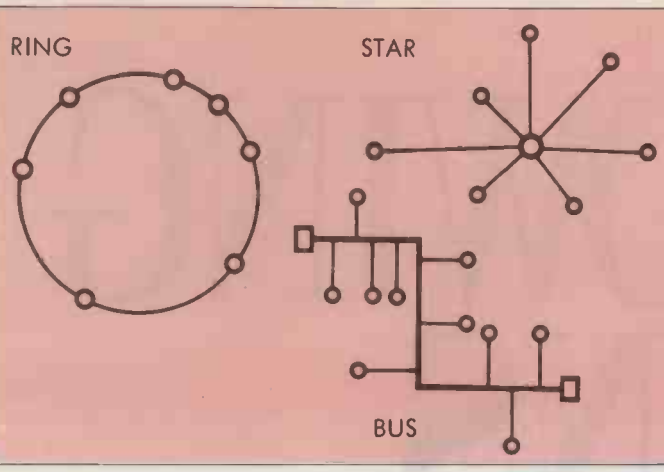


TOPOLOGIES

The term local area network covers a range of different network layouts or topologies, each with different ways of switching, different speeds and different types of cabling. The three most common types are star, bus and ring, with the loop — a variation of the ring — coming a close fourth.

In a star network all the links go to a central point, usually a small exchange, which switches the information from one machine to another. This sort of network is perfectly adequate if you do not have a lot of high-speed traffic. Its main drawback is that if the central switch develops a fault the whole network collapses.

The other types of network offer distributed control, so the risk of total network failure is reduced. The bus network is

OPTIONS FOR SHARING

When information is crucial to a company, LANs can help ensure it is in the right place at the right time. Kathryn Custance outlines the ground rules for network design.

The number of local area networks is growing at an astonishing 156 per cent a year in western Europe, according to a recent study by the International Data Corporation. Yet a few years ago local area networks (LANs) looked like a rather expensive fashion that would be superseded by smart digital exchanges capable of transmitting both voice and data. But local area networks are now definitely part of a lasting computer trend.

As with personal computers a few years ago, this explosion is largely caused by massive price cuts in hardware and software. And as in the past with micros, this immature market is confused, with too many products and standards. Every LAN seems to have a "compatible" label — IBM compatible or Ethernet compatible are the favourites — but as with different versions of the same computer language, compatibility is invariably in the eye of the manufacturer.

In an industry such as computing, technology tends to lead demand, and to start with manufacturers are more eager to compete in technology than to collaborate. This does not mean that LANs are a high-tech con trick. They are not. LANs can be very useful both in the office and the factory. The problems arise when companies buy networking equipment because it is there and relatively cheap, without really considering what they want to connect and why.

EQUIPMENT MUST MATCH YOUR NEEDS

You may well be able to connect all your micros, word processors and electronic typewriters on to a piece of cable, but if all you can then do is to send personal messages between members of staff you have gained very little. There is no need to buy a colour monitor if you only plan to display simple text, and there is no point installing a local area network if all you plan to do is connect a couple of micros to a mainframe, or allow a few people to share files or a printer.

probably the most popular type of network on the market, mainly through the success of Ethernet.

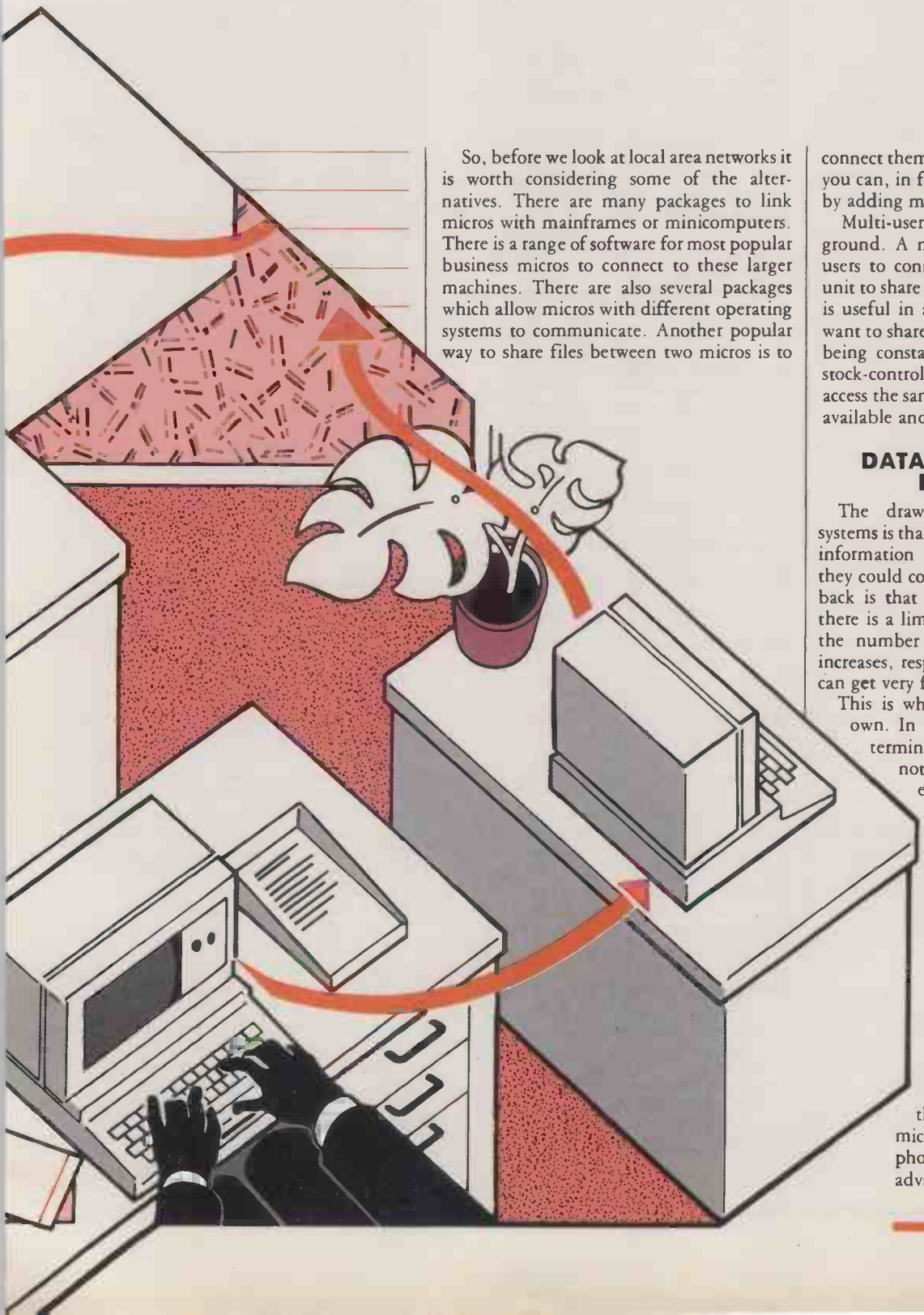
Ethernet was developed by Xerox in the early 1970s, and over 100 manufacturers have adopted the Ethernet standards in their products. Ethernet and other bus networks look like a branch of a tree with equipment attached like leaves to the twigs. Each piece of equipment has its own address. Each message is broadcast on to the network, but only the terminal with the right address picks it up. The problem with a network like this is that with all these packets of information whizzing around there is always the risk of collision.

So that more than user can send data at the same time, most bus networks use a special technique to detect collisions. This is called Carrier Sense Multiple Access with Collision Detection (CSMA/CD). This means that a terminal knows when a collision has happened and can retransmit when the line is free.

These transmission methods make bus networks the fastest type with speeds up to 10Mbit per second. Another reason for Ethernet's success is the availability of Ethernet chips. Other types of network still rely on a number of cards for each interface.

Ring networks are one of the cheapest options because they are often based on simple, inexpensive cable. As the name implies, all the devices are attached to a ring of cable. Most ring networks are based on the Cambridge Ring. The data moves around the ring in an orderly fashion in one direction, and when it reaches its destination the relevant terminal picks it off. This is a very fair way of sharing a network as no one terminal can dominate the network.

A loop network is like a ring, but it has one terminal which can control the network. The controller interrogates each of the terminals in turn and decides who should transmit.



So, before we look at local area networks it is worth considering some of the alternatives. There are many packages to link micros with mainframes or minicomputers. There is a range of software for most popular business micros to connect to these larger machines. There are also several packages which allow micros with different operating systems to communicate. Another popular way to share files between two micros is to connect them both to a hard-disc system and you can, in fact, set up a small star network by adding more micros.

Multi-user systems are also gaining ground. A multi-user micro allows several users to connect to one central processing unit to share the resources of the micro. This is useful in applications where a few users want to share the same information which is being constantly updated. For example, a stock-control system where staff need to access the same files to discover what stock is available and to feed in new orders.

DATA CORRUPTION A DRAWBACK

The drawback with most multi-user systems is that people cannot access the same information at the same time, otherwise they could corrupt the data. Another drawback is that even with a powerful system there is a limit to the number of users. As the number of people using the system increases, response times get longer, which can get very frustrating.

This is where a network comes into its own. In general, adding extra micros, terminals and other equipment will not affect the network, because each device brings with it its own processing power. Even if you do use up all the connections on the network you can usually buy another network and link it with the original one.

As we now have some standard multi-user operating systems, such as Unix and MP/M, it is possible to start off with a multi-user system and expand that by linking through a network to other computers. One of the cheapest ways to link micros is via the PABX office telephone exchange. This has the advantage of using cables and

(continued on page 92)

NETWORK SYSTEMS AND SUPPLIERS

(continued from previous page)

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Arcnet. Baseband co-axial cable using token passing. Datapoint U.K. Ltd, Datapoint House, 400 North Circular Road, London NW10 0JG. Telephone: 01-459 1222.

Cambridge Ring. Baseband ring network. Camtec Electronics, 18 Melton Street, Leicester LE1 3NA. Telephone: (0533) 537534.

Chain. Ethernet-style network based on Zilog's Z-Net. Research Machines Ltd, Mill Street, Oxford OX2 0BW. Telephone: (0865) 249866.

Clearway. Uses a coaxial ring cable; various options available. Real Time Developments Ltd, Lynchford House, Lynchford Lane, Farnborough, Hants GU14 6JA. Telephone: (0252) 546213.

Cluster/One. System for Apple II and III. Nestar Systems, 122-123 High Street, Uxbridge, Middlesex UB8 1JT. Telephone: (0895) 59831.

Constellation. Star network developed by Corvus; compatible with wide range of micros. Keen Computer Systems Ltd, Minerva House, Spaniel Row, Nottingham NG1 6EP. Telephone: (0602) 412777.

Databus. Ring network for up to 31 terminals, developed in Belgium. Walmore Electronics, 9-15 Betterton Street, London WC2 9BS. Telephone: 01-836 1228.

Datavoice. Baseband star network. EB Communications, 20 Imperial Way, Croydon, Surrey CR0 4RR. Telephone: 01-686 5701. Interlekt Electronics Ltd, Interlekt House, 24 Portland Road, Reading, Berkshire RG3 1LU. Telephone: (0734) 589551.

Decision Net. Based on Omninet for NCR PCs and others. NCR Ltd 206 Marylebone Road, London NW1 6LY. Telephone: 01-723 7070.

Decnet. DEC's version of Ethernet. Digital Equipment Ltd, Digital Park, Imperial Way, Reading, Berkshire RG2 0TE. Telephone: (0734) 868711.

DSN-1000. Distributed systems network using various techniques. Hewlett-Packard Ltd, 9 Mile Ride, Wokingham, Berkshire RG11 3LL. Telephone: (0344) 773100.

Econet. Low-cost network for BBC Micros. Acorn Computer Ltd, Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN. Telephone: (0223) 245200.

Ethernet. The most popular LAN standard; over 100 manufacturers now have licences to produce Ethernet products, bus network. Rank Xerox, Bridge House, Oxford Road, Uxbridge, Middlesex UB8 1HS. Telephone: (0895) 51133.

Fibrenet. Low-cost optical fibre ring. Optronics Ltd, The Cambridge Science Park, Milton Road, Cambridge CB4 4BH. Telephone: (0223) 64364.

Flexinet. Baseband star network. IAL Datacommunications, Jays Close, Viables, Basingstoke, Hampshire RG22 4BY. Telephone: (0256) 59222.

Fonet. Optical-fibre ring network for up to 32 ports. DLE Communications Group Ltd, Unit B, Rodd Estate, Govett Avenue, Shepperton, Middlesex TW17 8AQ. Telephone: (0932) 231033.

GE-Net. Broadband network with voice and video facilities. G E Semiconductors, 9th Floor, Belgrave House, Basing View, Basingstoke, Hampshire RG21 2YS. Telephone: (0256) 57361.

G/Net. High-performance LAN with X-25 and SNA gateways. Persona U.K. Ltd, 38 High Street, Kingston-upon-Thames, Surrey KT1 1HL. Telephone: 01-541 4343.

Grapevine. Star network. Case plc, Caxton Way, Watford Business Park, Watford, Hertfordshire WD1 8XH. Telephone: (0923) 58000.

Hinet. CP/M-compatible net. Digital Microsystems, Unit 12, Tavistock Industrial Estate, Twyford, Berkshire RG10 9NJ. Telephone: (0734) 342462.

Hyperbus. High-speed, baseband bus net. Network Systems Corporation Ltd, Kings Ridge Court, Ascot, Berkshire SL5 7JR. Telephone: (0990) 23399.

Icon. Powerful Ethernet-based net with excellent software for IBM PCs. Torus Systems Ltd, Science Park, Milton Road, Cambridge CB4 4BH. Telephone: (0223) 862131.

Infaplug. Extremely low-cost, simple ring network. Infa Communications Ltd, Bulland Lodge, Chipstable, Taunton, Somerset TA4 2QB. Telephone: (0984) 24059.

Instalink 460. Star network for up to 48 ports. Micom-Borer, 15 Cradock Road, Reading, Berkshire RG2 0JT. Telephone: (0734) 866801.

Interlan Net/Plus. Ethernet-style LAN. Data Translation, 13 The Business Centre, Molly Millars Lane, Wokingham, Berkshire RG11 2QZ. Telephone: (0734) 793838.

IS-4000/IS-4002. Baseband ring networks. Infotron Systems Ltd, Systems House, Poundbury Road, Dorchester, Dorset DT1 1TQ. Telephone: (0305) 66016.

Isolan. Ethernet-style net. BICC Data Networks Ltd, 1 Frogmore Road, Hemel Hempstead, Hertfordshire HP3 9RJ. Telephone: (0442) 218383.

Linemaster. Star network. Master Systems Ltd, Network House, Stanhope Road, York Town Industrial Estate, Camberley, Surrey GU15 3BW. Telephone: (0276) 685385.

Micromite. Network for Alphatronic micros. Triumph Adler (U.K.) Ltd, 27 Goswell Road, London EC1M 7AJ. Telephone 01-250 1717.

Mmmost. Network for Televideo micros. Encotel Systems Ltd, 7 Imperial Way, Croydon Airport Industrial Estate, Croydon, Surrey CR0 4RR. Telephone: 01-686 9687.

Modus LAN. Optical-fibre network. Modus Systems Ltd, Park Drive, Baldock, Hertfordshire SG7 6EW. Telephone: (0462) 894848.

Net/One Flexible Ethernet systems developed by Ungermann-Bass. Ungermann-Bass Ltd, 27 Victoria Street, Windsor, Berkshire SL4 1HE. Telephone: (07535) 58981.

Omninet. High-speed bus network developed by Corvus. Keen Computers Systems Ltd, Minerva House, Spaniel Row, Nottingham NG1 6EP. Telephone: (0602) 412777.

Osnet. ICL's version of Ethernet with some sophisticated additions. ICL, ICL House, 1 High Street, Putney SW15 1SW. Telephone: 01-788 7272.

Pacxnet. Switched network with several gateway options, such as X-25. Gandalf Digital Communications Ltd, 19 Kingsland Grange, Woolston, Warrington, Cheshire. WA1 4RW. Telephone: (0925) 818484.

Planet. Cambridge Ring network. Racal-Milgo Ltd, Landata House, Station Road, Hook, Hampshire RG27 9JF. Telephone: (025672) 3911.

Plus Net. Bus network, initially for Sanyo micros only. Icarus Computer Systems Ltd., Linton House, 39-51 Highgate Road, London NW5 1RT. Telephone: 01-267 6732.

Polynet. Cambridge Ring network. Logica VTS Ltd, 84 Newman Street, London W1A 4SE. Telephone: 01-637 7761.

QLan. CP/M-based network. Quorum Computers Ltd, Polygon House, Commercial Road, Southampton SO1 0GG. Telephone: (0703) 30721.

Quorumnet. Network used for Canon, NEC, Olympia, Apricot and Pericom machines. Quorum Computers Ltd — see QLan.

Ringnet. Baseband ring network. Prime Computer (U.K.) Ltd, Primos House, 2-4 Lampton Road, Hounslow, Middlesex TW3 1JW. Telephone: 01-592 7400.

Sopho-LAN. Broadband bus network. Philips Business Systems, Electra House, Bergholt Road, Colchester, Essex CO4 5BE. Telephone: (0206) 575115.

Symbnet. Optical-fibre net. Symbiotic Computer Systems Ltd, 32 Elmwood Road, Croydon, Surrey CR9 2TX. Telephone: 01-683 1137.

Sonnet. Ethernet-style network. Hytec Microsystems Ltd, Sandy Lane West,Oxford OX4 5JX. Telephone: (0865) 714545.

Token/Net. Broadband bus system. Dacon Systems Ltd, Sunrise Parkway, Linford Wood, Milton Keynes MK14 6LU. Telephone: (0908) 675511.

Transring 3000. Cambridge Ring. Seel Ltd, 3 Youngs Square, Brucefield Industrial Estate, Livingston, West Lothian EH54 9BJ. Telephone: (0506) 411503.

Usernet. Basedband bus network for MS-DOS micros. Sperry Ltd (Computer Systems), Sperry Centre, Stonbridge Park, London NW10 8LS. Telephone: 01-985 0511.

Videodata Lan/1. Broadband bus network. 3M U.K. plc, 3M House, PO Box 1, Bracknell, Berkshire RG12 1JU. Telephone: (0344) 58865.

Video Lan/1. Broadband bus network from 3M. Walmore Electronics, 9-15 Betterton Street, Drury Lane. London WC2H 9BS. Telephone: 01- 836 1228.

Wangnet. Broadband network. Wang (U.K.) Ltd, Wang House, 661 London Road, Isleworth, Middlesex TW7 4EH. Telephone: 01-560 4151.

XLan. Baseband ring network. Alpha Datasystems Ltd, Alpha House, Batford Mill, Harpenden, Hertfordshire AL5 5BZ. Telephone: (05827) 667136.

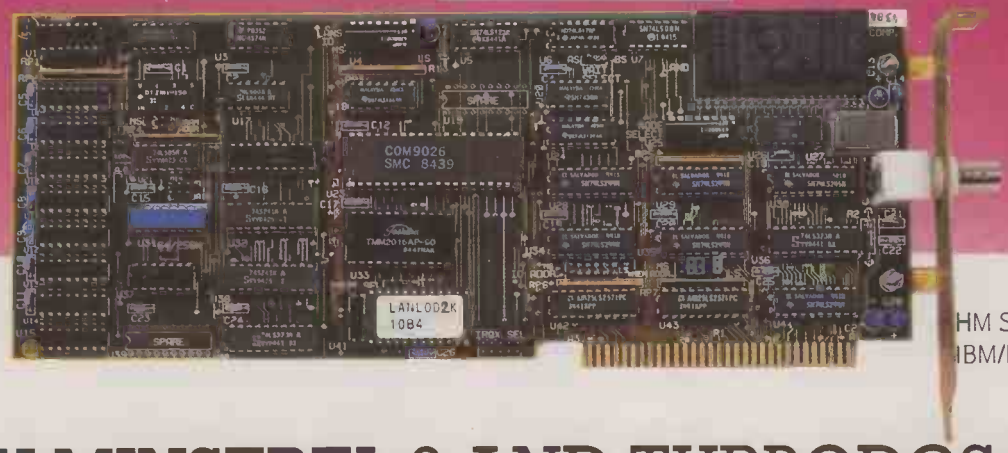
Z-Net. Ethernet-style network. Zilog (U.K.) Ltd, Zilog House, 43-53 Moorbridge Road, Maidenhead, Berkshire SL6 8PL. Telephone: (0628) 39200.

4000 Series LAN. Ethernet-style with extra options. Motorola Information Systems Ltd, Chervil House, 28 Stafford Road, Wallington, Surrey SM6 9AL. Telephone: 01-669 4343.

(continued on page 92)

Networking NOW – IBM/PC and Apricot

HM SYSTEMS
APRICOT ARCNET CARD



HM SYSTEMS
IBM/PC ARCNET CARD

WITH MINSTREL 2 AND TURBODOS/PC

Have you noticed how the mention of the word "network" makes some PC owners (and dealers) reach for the medicine cabinet?

We did. So we looked at the problem and, quite frankly, can't see what all the fuss is about. Then again, we are multi user systems specialists. Networking is our business, and has been for five years.

All you need is a fast file server, network processors and a magnificent networking operating system, we decided.

(The last item is the most important, and the most difficult to achieve.)

Fortunately, we had a head start. HM Systems use TurboDOS 1.41 in a close coupled multi processor network in Minstrel 2, our multi user system. TurboDOS is arguably the world's most widely used networking software, with over 50,000 installations worldwide, since its introduction in 1981.

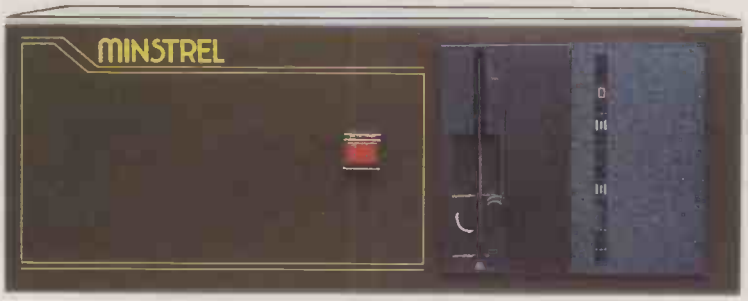
TurboDOS/PC allows any PC running MS DOS versions 1.x, 2.x, 3.x, to share resources of a TurboDOS network. File locking is integral to TurboDOS.

Network interface is through Arcnet. You use co-ax cable to make the physical links, and Minstrel Arcnet cards for your IBMs, Apricots or IBM lookalikes.

This gives your PCs cheap, quick access to large amounts of disk storage and shared resources – which is what networking is all about. Your PCs can access lots of printers and other peripherals along the way. TurboDOS has sophisticated automatic print spooling, which cuts down queuing time.

As a guide to pricing – A four user Minstrel 2 IBM/PC file server with 20MByte Winchester will cost around £7,000.00. A twelve user version with 64MBytes hard disk costs £14,355.00. Plus cables and excluding PCs of course. Extra users cost £595.00.

A twelve user Apricot file server with 64MByte Winchester disk will cost around £11,775.00. Extra users cost £410.00 each.



MINSTREL 2. DESIGNED AND BUILT IN BRITAIN

Proven software, sturdy hardware, file locking, automatic spooling and a fast transfer rate add up to a network that works. Headaches aren't part of the package.

Write or call us for a chat. At the same time, ask about the Minstrel 2 multi user system – you can link your PCs into that as well. We'll be glad to show you how.

† TurboDOS™ Registered trademark of Software 2000 Inc.

IBM/PC is a trademark of International Business Machines Inc
Apricot is a trademark of ACT plc.
MS DOS is a trademark of Microsoft.

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HM Systems

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STANDARDS

No telecommunications manufacturer would produce a telephone that was incompatible with the telephone network, but because microcomputers have a history of being dedicated self-contained machines, the need for common standards and protocols has been largely ignored. Pressure from software houses has ensured a certain amount of standardisation of operating systems but in the area of networking, compatibility has been a big problem.

Manufacturers have now realised that they must work to a common standard, but they have split into two main camps around the Cambridge Ring and Ethernet, with everyone waiting for IBM's definitive PC network. Rather than opting for one system, the International Standards Organisation has shuffled them all together and come up with an Open Systems Interconnection (OSI) reference model.

This is not a case of sitting on the fence, but the most sensible way of making the best out of what we have got while still leaving plenty of room for future innovation. The basic idea is to have degrees of compatibility which all manufacturers will work to to. To do this the ISO is defining standards for seven different layers or levels. Each layer is being developed separately, with the interfaces between the different layers clearly defined. The lower layers cover the nitty-gritty standards for transmission, and the higher layers support the applications.

The most fundamental are the physical and link layers. They define how a specific type of network such as a ring or a bus network transmits data, and the rules for connecting equipment to the network. The next two layers really control the quality of communication, with the network layer also allowing different networks to communicate. The transport layer defines protocols to control the flow of information and functions such as error control.

Considerable work has gone into these first four layers, and there have already been demonstrations between different manufacturers' equipment to show these standards work. The top three levels deal with the more sophisticated applications. They are known as session, presentation and application, and still have a long way to go.

The OSI standards are important because they are being accepted throughout the industry. Even IBM is taking them seriously, and the communications carriers, such as British Telecom, are investing the time and money to incorporate these standards into their networks. BT is already using its packet switched network (PSS) to support small private networks linking different machines running under different operating systems.

The aim is to put as much intelligence into the network as possible, so that micro users can throw away their modems, plug their micro straight into a communications socket and send data at almost any speed, using a variety of protocols, in the sound knowledge that the public network will translate that data to the right speed and protocol for the micro at the other end. On a smaller scale, open systems will eventually give the same benefits to LAN users.

Every manufacturer wants to have a hand in forming new industry standards, and in the computer industry, dominated by such giants as IBM, many computer companies have got together to discuss and implement standards. The latest group to enter the LANs standards debate is the British Microcomputer Manufacturers Groups.

This is a group of mainly small computer companies — neither ICL nor ACT are members — and its aim is to protect and nurture the British micro manufacturers by producing British standards and to promote them to become international standards.

Recently the BMMG has gained government sponsorship to produce a series of recommendations on LAN standards. This included a six-phase implementation plan for British manufacturers to follow. The idea is that if everyone follows the same standard then equipment costs will fall and users will buy British.

On the surface this seems an admirable idea; no one wants to see the British market flooded with American imports that squeeze out the British manufacturers. But since the report came out in March, the BMMG has been accused of protectionism and shortsightedness. The argument is that this David has no chance of beating the Goliath of IBM. In fairness to the BMMG, its planned standard is based on a current popular operation system, Concurrent CP/M, using CP/Net software, and the eventual aim is to work to OSI standards.

It is important that British manufacturers get together to co-operate on research and development, but if they do this in isolation they may well find themselves behind the world competition. Ignoring IBM will not make it go away. The best way forward, is to concentrate on world standards such as the ISO open systems so that Britain can compete and connect with IBM.

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equipment you already have. Although with older exchanges you will need some special equipment, some of the modern digital exchanges have this capability built in.

There are two main disadvantages to using a PABX in this way. First, an exchange is designed to connect only two devices together at any time, so if you want to broadcast a piece of information to several people you have to set up a string of separate calls. Secondly, transmission rates are low, so this solution is now applicable for companies that want to send a lot of high-speed data. Another argument against using PABXs for data as well as voice is that if there is an equipment failure you lose both services.

All these methods are sound for a small number of uses or a larger number of infrequent users, but as information begins to replace manpower and machinery as the vital resource for a successful business, so local area networks become increasingly important. The sales director must know the figures as they are today, not as they were at the end of the month. The finance director must know the value of orders now. The managing director needs access not only to his company databases but also to information about the competition. That urgent telex must go straight to the right person's desk, not hang around in the telex room. And at the same time all this information must be organised and integrated.

If information and the knowledge workers are the important resource, there is little point storing the information and people in separate boxes. If you can link these people, the only thing that needs to move is the data. A local area network can be the key to opening these boxes.

LANS A VITAL TOOL

In years to come a local area network may be as vital a tool in a small business as the telephone and typewriter are today. But to be effective a local area network must do more than just connect devices. It must allow a high level of communication between different equipment so that users can do more than simple electronic mail. This means that manufacturers must take standards seriously.

It is reassuring to know that Britain leads Europe in local area networking. According to the recent IDC report, the U.K. has 58 percent of western European installations, followed by France and Germany. This may well be because over 70 percent of local area networks are installed in offices, and Britain has a large number of business micros. As local area networks become more important in manufacturing this trend may change. In Germany, Computer Integrated Manufacturing is growing at a rapid rate and manufacturers need networks to link all the stages of production.

Currently, the overwhelming majority of local area networks are baseband, but undoubtedly the use of broadband cable will grow. Broadband cable has more capacity and so can transmit more complex information, such as pictures. There are two things that will encourage the spread of broadband systems. One is the increasing use of optical fibre in networks, and the other is the predicted launch of a broadband PC network by IBM next year.

The main trend for the future is that local area networks will become much cheaper. Standard pieces of office equipment and micros will have built-in local area network chips in the same way as micros now come with standard communications interfaces and software. And new office buildings will have LAN cable plumbed in with the electricity and telephone ducts. PC

SURVIVE THE NETWORK CIRCUS!

The world of local area networks is a circus, with so many types of network hardware in existence.

All promise a lot of things, most don't live up to expectations. Networking software is even more disappointing. It doesn't do what's required in terms of security, data integrity and flexibility, whilst performance suffers badly with increasing number of workstations.

You are assured a particular network will cater for all your present needs and future expansion. If it doesn't, who looks the clown?

Can your company tolerate sluggish performance? Will your reputation survive if the network collapses under the strain?

All is not lost. Now there is NetWare — a networking software specially developed for this role by Novell Inc. — and it will run on other manufacturer's hardware. What NetWare will do for you is to increase the performance of your network (benchtests show that in all cases the increase in performance is dramatic). Plus, a host of features normally only seen on mainframes will be available.

No longer will you have to take extended coffee breaks while you load long programs, and if you really want to shine we can supply the star of networks — NetWare/S — Novell's proprietory hardware developed for use with NetWare.

NetWare is easy to use too. In fact, almost too easy. Current DOS application software will run without changes so no retraining is required. NetWare also facilitates the linking of like and unlike networks (i.e. multiple file-servers), plus gateways to host computers or bridges for remote workstation entry.

There's so much more to tell . . . Don't be a clown, be a survivor, be admired.

NOVELL

Novell Data Systems Ltd

78-82 St John's Road, Tunbridge Wells, Kent TN4 9PH
Tunbridge Wells (0892) 47833 Telex 95204 NOVELL G

CABLE COSTS

Your problems are not over when you have decided what networking system to use. Della Bradshaw outlines the choices to be made when establishing the physical connection.

SYSTEMS SUPPLIERS

	Minimum costs	For	Against
Telephone cable	£550 if cable already there	Cheap, wire already installed	Slow, transmission medium only
Twisted pair	£600	Good for micro-to-micro combinations	Cannot have looped networks
IBM system	£350 per terminal	Voice and data in one cable sheath	Not really available in U.K., bulky
Broadband	Generally more expensive than baseband	Supports video, very flexible	Only for large applications at the moment
Ethernet	£800 per terminal	Large user base	Expensive
Proprietary LANs	From about £160 per node to about £1,300 per node	Can be cheaper than standard coaxial	No standards
Optical fibres	Varies	Secure, smaller, more flexible	Best for large numbers of terminals

Buying a microcomputer is one thing, getting it to communicate with someone else's is quite another. And the maze of cabling equipment on offer not only varies technically, but in price as well.

The cost does not only depend on what type of cabling you use, either — that is only a fraction of the cost in some cases. The associated electronics and installation charges are major elements in bumping up the price. As David Flint, senior partner at office-automation consultant Butler Cox puts it: "If you're putting a fair amount of cable in then the costs are high whatever you use — and a good deal of that is labour costs, not materials . . . . On some sites it is as expensive to install and connect a new terminal as it is to buy the terminal."

Other factors, besides the size of the installation, that affect costs are the different types of machines you are connecting together — micro to micro, micro to host — and the speed at which you want the connection to work. Connecting together two micros over a low-speed link works out a good bit cheaper than most other options.

TYPES OF WIRING

Flint breaks down cabling into five categories: twisted pairs, the IBM cabling system, broadband cable, Ethernet, and proprietary local area networks. Twisted pair is the most common form of wiring in offices: in its crudest form it is a telephone wire. Twisted pair has two major drawbacks: it is slow, and as purely a means of wiring it gives no help when trying to connect together different types of machines. But twisted pair is cheap, particularly if there are some spare telephone wires already installed, which you can use.

The cost of the electronics to put a terminal in the telephone wire works out at about £550. Although voice and data cannot be integrated on a twisted pair, a data-over-voice system can be introduced in a large office environment by using one of the message switches on the market, such as Case's Beeline. The most recent PABX branch exchanges on the market, such as the Northern Telecom Meridian, give that kind of support as standard, but are strictly for the larger user.

NECTARRING

With its hidden costs and physical inconvenience, cabling can all too easily represent the unacceptable face of LANs. For those with only limited networking needs, it may often just not be worth the trouble of ripping the floorboards up.

Nectarring caters for these types of situations by offering a networking solution without the need for any special cabling. This is achieved by the superficially lethal idea of connecting your micro's RS-232 port to the mains socket. The point is that the mains in an office is itself a single circuit and, as such, is just like the cabling system employed in other networks. To use it for this purpose all you need is some isolation circuitry and a technique of encoding data.

This whole technique is in itself nothing revolutionary. The cordless intercoms and baby alarms which you plug into the mains work on similar principles, as do various types of control equipment. Data is sent through the mains by modulating a high-frequency carrier. On Nectarring, data rates up to 4,800 baud are supported.

Nectarring comes in the form of small units that plug into the RS-232 port and the mains. The units are available in three versions: Transmit only, Receive only or Transmit/Receive. There are two ranges of baud rate: up to 4,800 and up to 1,200. There is no need to choose baud rates before use: the unit will automatically detect and set the appropriate rate. Prices per unit range from £125 for a Receive only unit with a maximum speed of 1,200 baud, and £195 for a dual unit with speeds up to 4,800 baud.

In principle, operation is simplicity itself. Any micros or peripherals that are to be hooked up together are attached to a Nectarring unit via the RS-232 port. One complication arises out of the fact that there are two different types of RS-232 wiring in common use. One is DTE — Data Terminal Equipment — and the other DCE — Data Communications Equipment. On the front of the Nectarring unit is a small two-position push-button switch which allows you to pass between the two. In practice it is easy enough to try one, then the other.

It is also important to align the baud rates for the two devices. If you are using a printer this may mean fiddling with DIL switches. The same goes for parity and word length. Assuming you survive all these tediousnesses, which seem endemic to comms, Nectarring really is easy to use. For this review, an Apricot was hooked up to an NCR IBMulator, and to a distant printer.

The first connection was effected by running the async. package on the Apricot and opening up a channel on the NCR. In Basica, the following program gives an idea of the type of programming required.

```
10 open "com1:4800,n,8,,cs,ds,cd"as#1
20 A$=input$(1,#1)
30 print A$
40 goto 20
```

This will print out single characters as they are entered on the transmitting terminal. The manufacturer of Nectarring also provides a number of software packages to handle such things.

More spectacular was being able to print on a peripheral located on the floor below and some good distance away. The two Nectarring units simply slot in between the micro and printer, and printing is carried out as if they were joined in the normal way. This worked well enough, although there was some corruption of data arriving at the printer. This was largely due to the fact that the office building in which *Practical Computing* lives has many hundreds of strip lights and photocopiers, all connected to the same mains circuit. These introduce sharp

The next option is to wire a micro with 3270 coaxial cable, but that can only link a micro to a host, not to another micro. The main cost there is the adaptor board to go inside the micro: between £500 and £700 on average. On top of that there is the cost of wiring, which works out at about £1 per metre, split half and half between cable and labour costs. That's great for micro-to-micro communications, but you cannot introduce loops into the network. To do that you need broadband.

Ethernet provides by far the best-known type of cabling. It was originally developed as an in-house product for joining pieces of Xerox office equipment together; now there are over 200 suppliers, which offer between them anything from minicomputer interfaces to public network gateways. Totting up the costs of that make it more expensive than coaxial: about £600 for the adaptor board, £200 plus for transceivers and about £2 per metre for cable — about £30 for the cable for an average micro, plus another £30 for labour installation costs. Some manufacturers — DEC for one — recommend more expensive cable for their micros. There is a cheaper cabling system coming on to the market which is based on Ethernet: not surprisingly, its brand name is Cheapernet.

Most micros already come with a recommended proprietary network, however, and there are probably about 40 on the market for microcomputers alone. The costs of the electronics for each link tend to be cheaper than for coaxial or Ethernet systems because the firms can optimise the designs. The cabling and labour costs of the different networks tend to be roughly similar to the other two types of network, though. Flint divides proprietary LANs into two groups — systems-based LANs and communications-based LANs. The former are almost all non-standard and are often poor in communications. Communications-based LANs have been developed to support terminals already installed, and again do not often comply to any standards.

Among the communications-based LANs are R-loop, Multilink and, probably the cheapest on the market, Clearway. Clearway was developed by Farnborough-based Real Time Systems, and the basic model sells for around £165 per node. The network is a baseband coaxial ring and has been installed in networks with everything from PCs to mainframes. Racked and multiplexed versions of the system are also on sale.

IBM'S SOLUTION

Next on Flint's list is the IBM cabling system, announced by IBM in 1983. IBM's solution to cabling houses telephone and data wires together in the same plastic jacket. That is not yet available in Europe, although in the U.K. BICC is selling a less expensive version based on data transmission only. That system is mainly aimed at the top-end IBM users, and in the U.S. the system works out at about $400 per connection.

That said, IBM's PC network, not yet announced in Europe, will be a broadband, not a baseband network, as with almost every other micro manufacturer. As a general rule of thumb the broadband networks, which are derived from cable-TV technology, are more expensive than baseband ones. IBM proves the point. In the U.S. the price of attaching one IBM PC to the network is around $1,500.

One of the main problems with broadband systems is lack of standards for data transmission. As a result, installations of broadband networks have been concentrated on companies and public utilities that want to install their own large private networks, where the lack of standards is irrelevant. With large installations the cost can come down quite dramatically. One U.K. company quotes £20 per office — but only when it is wiring up a whole office block.

On the micro side Sytek, which is supplying the IBM PC network in the U.S., is also discussing producing a similar product for Apple's Macintosh. Most of the costs of a broadband network are in the electronics rather than the actual cable.

A final solution to networking is to use optical fibre rather than copper cable. The fibre optic cable is smaller and more flexible, but to date most applications have been where security is a big enough problem to justify the cost, or where there is likely to be a very high level of electromagnetic interference.

The general problem with the cost of fibre-optic networks is the cost of the electronics, as glass cable is difficult to terminate and align properly. Because of that, manufacturers have opted to put several ports on one box of electronics — up to about 24 ports on one box, for example. So if you are wiring up one room for 24 micros, the system is relatively cheap; for one micro per room it becomes very expensive. Some users have tried to combat the problem by taking the cabling out of the box, up through the ceiling and down into the next room, which rather defeats the purpose of local networking. PC

voltage spikes into the supply which make it harder to send and receive without corruption.

To be fair, the environment in which Nectarring was tested probably represented an extreme case. In anything approaching an average-sized company the problems should be drastically reduced. Matters were not improved by using the fastest baud rate. Cutting down transmission speeds also decreases error rates.

By using different carrier frequencies, it is possible to have up to four simultaneous exchanges of information. If there is only one frequency available transmitters test the water before letting loose. Future developments include increasing the maximum baud rate, as well as software to provide friendly front ends. Better manuals are promised, too: at present they are rather thin photocopied booklets.

It would be idle to pretend that Nectarring could hope to replace LANs costing many times more. It is slower, and its data integrity is less secure. But for applications where these are less of a problem it certainly represents a very neat and efficient solution. For example, several micros could access a physically distant printer, or messages could be sent to computers round a building without the need for sophisticated electronic mail facilties. As a limited solution to circumscribed problems, Nectarring is an interesting idea.

Nectarring is available from Nectar, Westgarth House, Lyndhurst Grove, Gateshead NE9 6AX. Telephone: 091-482 3745.

The cabling comes free. Nectarring boxes at each node communicate via the building's mains circuit.

WHY NOT MULTI-USER?

Mike Lewis examines the pros and cons of LANs, and suggests that in some cases multi-user and multi-processor systems may equally satisfy your needs.

Communication is all the rage these days. As soon as you have more than one micro in your oganisation, it seems retrograde not to link them up in some way, hence the growing interest in local area networks. But installing a LAN is a complicated and expensive business which could give rise to more problems than it solves. So it's worth taking a hard look at the reasons for having a network, and to consider some of the alternatives.

The commonest argument for LANs is that they allow workers to share information. At its simplest, this means that you can use your micro to help create a word-processed document or a spreadsheet which you can then transmit to a colleague's machine for editing or checking. The LAN will allow you to move text or data around the building as easily as your internal post and a good deal faster.

You could go further by setting up multi-access databases on the LAN, which would give staff immediate access to the information they need to do their jobs. For example, the sales department could get an up-to-date credit rating for a customer, even though this might have been altered by a payment received that day, and they can do this without having to contact the accounts department in another part of the building.

This sounds very attractive but there are problems, most of which revolve around the clashes that occur when two people try to get at the same item of information at the same time. It is not so bad if the users are simply reading the data without trying to alter it: say, if two sales clerks are looking up the price of the same item of stock. Any LAN software worth its salt should handle this situation without the users even being aware of it. The real difficulties occur when one or more of the users is able to alter the data. To understand the problem, imagine a system that lets two sales clerks take simultaneous orders for the same stock, or which books the same hotel room to two different guests.

To overcome such problems many LANs boast a technique called data locking. This can work at one of two levels: record locking, which denies access to a specific customer, stock item or whatever, for as long as another user has access to that record; and file locking, in which a user can obtain exclusive use of an entire file for a limited period. File locking is vital for operations such as file reorganisation in which the whole of the data undergoes substantial change.

What the vendors of networks forget to mention is that data locking is useless unless the application software is specifically designed to take advantage of it. Otherwise, when you try to update the stock level of a product that is locked by another user, the operating system might display a cryptic message on your screen. Meanwhile your stock control program will continue as if it had successfully obtained the record, with some potentially disastrous consequences.

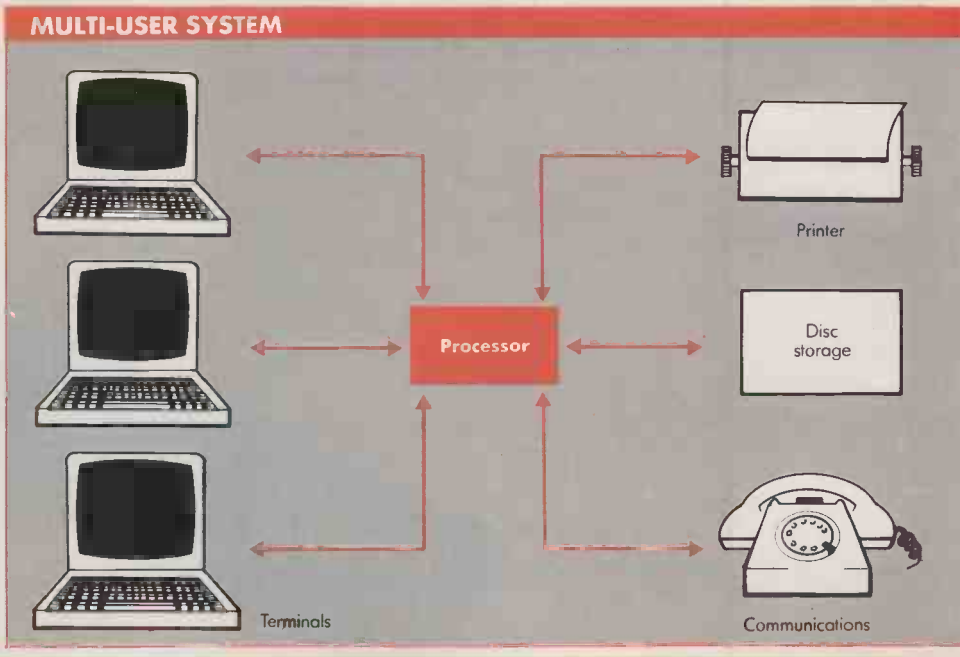
If your main reason for installing a LAN is to move documents, spreadsheets, etc. between individual workers, problems of simultaneous access need not worry you This is because each user will be working on what is essentially a private copy of the data. But if you are attracted by multi-access databases, you will have to be extra careful to select application packages that work correctly with your chosen system. Such packages are very hard to find because LANs are still relatively new and no standards have yet become established for data-locking techniques.

Apart from sharing information, another common reason for installing a network is that it allows the sharing of items of equipment, typically printers. In some systems, when a user wishes to print a report, he or she can allocate a printer for their personal use, releasing it when finished. In other cases, all print jobs are stored in a queue on disc, and are printed out in turn. The actual printing might be done automatically, or it might be controlled by a central operator, who can initiate specific print jobs, change the order of printing, and so on.

Whatever the system, difficulties could arise with the physical operation of the printer, especially if this is in a distant part of the building. Somebody might need to be on hand to load the correct stationery, change the printwheel, and so on. When using pre-printed paper some programs go through a line-up routine, something which is almost impossible if the user is not near the printer. Some of these problems can be avoided by routeing all printing through a central operator, but this is against one of the principles of the LAN, which is to decentralise computing power.

Many of the problems mentioned here also apply to the alternatives to networks. Nevertheless, it is worth looking at some other options, if only because they are all

	CPU	Major OS	Comments	Phone
Alpha Micro 1000	68000	AMOS	up to 7 users	(0753) 821922
Altos 8600	8086	Unix		(0990) 23377
Armstrong Multi-Micro	68000	Unix		(0384) 233433
Bleasdale 68000	68000	Unix		01-828 6661
Cifer 9000	68000	Unix & CP/M Plus	4-8 users	(0225) 706361
Crystal 68000	68000	Unix, Pick & others	up to 12 users	021-359 4861
IMP-68	68000	Unix or Idris	6 optional Z-80 slaves also	(0207) 503481
Jarogate MP5	80286	Concurrent CP/M	up to 16 users	01-671 6321
Newtons Accron	68000	Concurrent CP/M	multi-processor system	01-874 6511
Positron 9000	6809	OS-9		(09252) 29741
Rair BC II	8086/Z-80	Concurrent CP/M	up to 4 users	01-836 6921
Systime S-300	8086	MPS, BOS	up to 5 users	(0532) 702277
TDI Pinnacle	68000	p-system	up to 7 users	(0272) 742796
Torch Unicorn	68000/Z-80B	Unix, p-system	can network BBC Micros	(0223) 841000
Bromcom Superstar	80186	Impos		01-697 8933
HMS Minstrel	various	Turbodos	10-slot motherboard	01-209 0911
IBM Ultraframe	80186	Turbodos	12- and 20-slot motherboards	01-222 4701



cheaper than installing a LAN. In fact, if your communications needs are really modest, you might be able to get away with virtually no additional expenditure at all.

If you have just two micros and you merely wish to move data between them, the chances are that you will be able to link the machines through their serial interfaces, even if they are of different makes. Small text files can often be transferred by means of operating-system utilities, such as Pip in CP/M or Copy in MS-DOS, although you might be better off investing around £150 in a special file-transfer package. By the same token, a printer can be shared between two micros by means of a simple T-switch, costing under £100.

The main disadvantage of connecting machines in this way is that it demands the involvement of both users at the same time. To transfer a file, both of you will have to interrupt the job in hand in order to initiate the appropriate program, and the actual transfer could be quite slow. While this is a straightforward approach where just two micros are involved, it becomes considerably more complicated if there are three or more machines.

Another option is the multi-user micro — a single computer with several terminals. In this setup, all the system's resources, including the central processor, are shared equally between the users, giving each operator the impression of having his or her own personal machine. Until a few years ago, this was the commonest approach to shared access on micros, with firms such as Alpha Micro, Rair and Comart enjoying considerable success.

Although multi-user systems are generally less expensive than the equivalent number of single-user machines, they suffer two serious disadvantages. First, they are slow, which is an inevitable result of users having to share the central processor. Secondly, if one of the operators runs into difficulties, he or she cannot reset the system without interrupting the work of everyone else currently using it.

To overcome these two snags, a new breed of multi-access machine has recently been developed, the multi-processor system. Here, each user has his or her own processor and there is a further processor to handle the shared resources like printers and disc drives. All the hardware is housed in a single box, to which are connected a number of terminals.

Another factor which applies to all the systems discussed here is cabling — the lengths of wire which physically link the system together. The cost of this could amount to many hundreds and possibly thousands of pounds. The actual cost will depend on the distances involved, the layout of the building, the materials used for walls and floors, the existence of modern ducting and so on. Also, the vendor is unlikely to be able to estimate the cost of cabling without a detailed site survey, which could itself cost several hundred pounds.

So far we have only discussed local networks where all the users are in the same building or possibly adjacent ones. Where longer distances are involved, you will have to resort to modems and telephone lines. In theory, this need not alter the basic design of the system, since the phone line simply replaces the fixed cable. However, the telephone charges are likely to be high enough to discourage this approach except where there is absolutely no alternative.

A very useful way of avoiding high phone charges is to subscribe to an electronic mail system such as Telecom Gold. If you simply wish to move text between micros at different locations this is an ideal solution, but it will not allow different users to gain immediate access to shared data. Modems and dial-up lines can be used in conjunction with most LANs, multi-user and multi-processor systems.

Perhaps the overriding advantage of a LAN compared with the alternatives is its flexibility. You can build it gradually using existing micros; you can use machines from different vendors and of different makes and models; you can swap machines around; you can unplug one to take home; and if the need arises you can dismantle the whole thing and use the micros independently. None of these advantages applies to the multi-user or multi-processer system.

In fact, the idea of linking computers on a network is much more in keeping with the spirit of the micro revolution. Each worker sees his or her machine as a personal tool, with communications almost a subsidiary function, rather than as part of a centralised data-processing system.

That said, anyone considering a LAN really must ask how important it is for their micros to communicate. Because for as long as floppy discs are around, it will be considerably cheaper for many organisations to send discs around the building rather than wiring it up. And do not be taken in by advertisements that talk about data communications "at the speed of light". If you have a floppy disc full of data to send to a branch office on the other side of town, a messenger on a bicycle will get it there faster than a 300 baud phone line every time. PC

MULTI-PROCESSOR SYSTEMS

The traditional multi-user system involves one central processing unit (CPU) being shared between a number of users. If they don't all want to work at once, this is a good way to share programs and files. However, when many users try to access the CPU at once system performance is likely to drop. Frequently there comes a point at which the system is overloaded and then processing may effectively collapse.

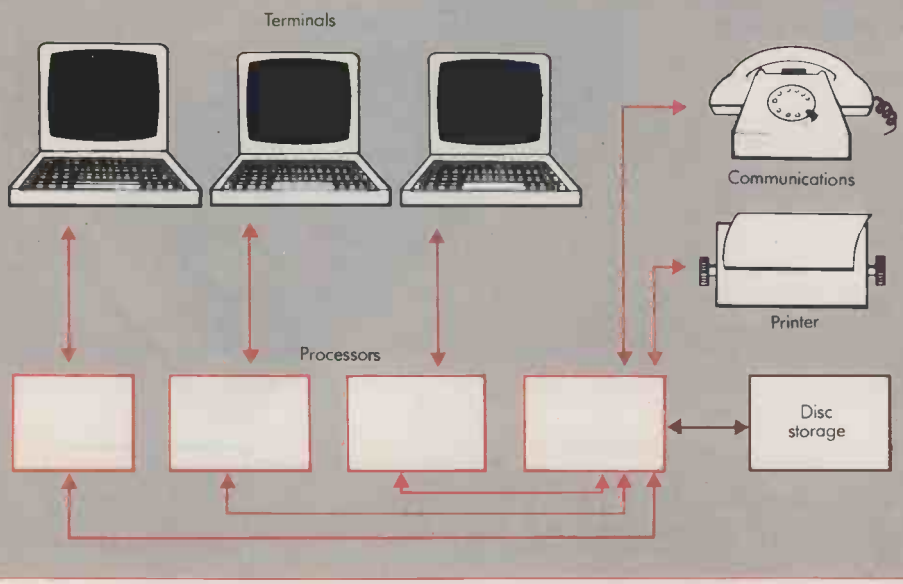
It was, partly, this same problem with minicomputers and mainframes used for on-line processing, that led to the explosion in stand-alone microcomputers. The golden rule of microcomputing is "One user, one CPU", which means no waiting while other jobs are done. However, micros present their own problems when it comes to sharing programs and data.

One interesting and attractive alternative is the multi-processor system, which is effectively a network in a box. Each user has a terminal and his or her own CPU and RAM, just as with a stand-alone micro. However, instead of being in the terminal, the CPU card is slotted into an S-100 bus mainframe along with several others. Thus the CPUs are close-coupled, and can all access the same disc drives and printers, programs and data, under the direction of one master CPU. The performance of individual terminals is not degraded as the number of users grows. Quite large networks can be handled in this way: for example, up to 255 Minstrels can be networked at 2.5Mbit/s, with each Minstrel handling, say, a dozen users and four printers.

Turbodos networks can run standard CP/M and MS-DOS software, though typically with a much higher performance than stand-alone micros. All three multi-processor systems listed here can also network IBM PCs.

This table opposite shows a few of the available systems.

MULTI-PROCESSOR SYSTEM



BAGSHAW'S DISC BENCHMARKS

As you wait while your program performs endless disc accesses you will need no reminding that disc performance is as important to the user as raw processing speed. Eric Bagshaw explains how his test routines compare one machine with another.

The speed of a computer's disc influences the working of all types of business software. Almost all professional software is loaded from disc and much of it — especially databases — makes frequent and demanding use of the disc. Consequently, the performance of this predominantly mechanical device will directly relate to the system's performance as a whole.

In order to compare the performance of different systems I have devised a series of 14 Benchmark tests. They are written in Microsoft Basic as part of a single large program called Diskmark.Bas. There is also a small program on the testing disc which is chained to and then back to the original called Chainpgm.Bas. The Benchmarks have been successfully run on eight-, 16- and 32-bit machines with Basic 80 and IBM's Basica and GWBasic on IBM look-alikes. There has to be a slight change with IBMs by substituting a CLS command for the Clear Screen string. On most machines the program will time itself with a real-time clock; on others, a stop watch is used.

Each of the tests is in two parts. One part actually accesses the discs, the other is a direct replica with disc commands blocked by Rems. Both runs are timed, and the running time of the Basic dummy is subtracted from the time taken by the program which accesses the discs. In this way the influence of the discs alone can be assessed.

The performance of a disc system from the user's point of view is affected by two aspects of its operation: the data-transfer rate and the seek time. In tests such as program loading and the sequential read and write each new block of data required tends to be directly next to the block just accessed and little head movement is required. The performance in these tests corresponds to the speed at which data can be read from the disc and sent to the computer. This is the data-transfer rate.

In contrast, tests such as the random read and write in the random file, and particularly the front-end swap and the close-up, involve a great deal of head tracking. In many cases accessing each new record involves a head movement. Performance in these tests reflects the seek time. Some of the significant differences seen between systems are due to features found with the more advanced operating systems, such as disc caches. Here blocks of RAM are used to read in whole tracks at a time, or store the directory for high-speed access.

Running the Benchmark tests on most machines is very straightforward. If they are run on a floppy, the disc should contain only the two test programs, saved in ASCII format. Inclusion of operating systems, Basic, etc., takes up a variable amount of space and can adversely affect the results. With a hard disc the minimum of other programs should be aimed for to give the system its best possible response.

Timing of the tests on MS-DOS and PC-DOS systems is automatic, as the programs make use of the built-in time strings found on many of their Basics. Some other systems can be made to use the Auto mode. If all else fails you can resort to a stop watch.

The influence of operating systems on the results cannot be understated, and is well represented by the comparison between the Clenlo CP/M 2.2 and CP/M 3.0 systems. These tests are run on identical hardware, the only difference being the disc-loaded operating systems. While sequential access is much the same, random access is greatly

(continued on next page)

CODE TO DOWNLOAD

The Bagshaw Benchmarks are too long to list here, as there is about 16K of Microsoft Basic code. However, John Newgas, Sysop of TBBS, has kindly made the programs available for downloading at 300 baud on his bulletin board.

TBBS is on-line 24 hours a day, seven days a week. The phone number is 01-348 9400.

Download the Benchmarks and test your machine, and please let us know the timings.

WHAT THE BENCHMARKS MEASURE

BM0, Chain Program. Measures the time taken to load the test program itself, which is just under 17K long saved in ASCII format. It starts the timing and then exits to the small Chainpgm.Bas, which then re-chains back the original.

BM1, Sequential Write. The time taken to write 500 records in a sequential file.

BM2, Sequential Read. The time taken to read the 500 records created in BM1.

BM3, Random Write. The time taken to write 500 records in a random-access file.

BM4, Random Read. The time taken to read the 500 records created in BM3.

BM5, Sequential Multiple Open and Write. The time taken to open, write one record and close 20 separate sequential files.

BM6, Sequential Multiple Open and Read. The time taken to open each of the files created in BM5, read one record and then close.

BM7, Random Multiple Open and Write. The time taken to open, write one record and close 20 separate random files.

BM8, Random Multiple Open and Read. The time taken to open each of the files created in BM7, read one record and then close.

BM9, Random Read in Random File. The time taken to read 50 records in a randomly generated sequence within the 500-record random-access file created in BM3.

BM10, Random Write in Random File. The time taken to write a block of stars, **********, in 50 records in a randomly generated sequence within the 500-record random-access file created in BM3.

BM11, Random Front End Swap. The time taken to completely invert the 500-record random-access file; what was the first record becomes the last and vice versa.

BM12, Close Up Holed File. The time taken to close up the file, removing the ********** records created in BM11.

BM13, Multiple File Kill. The time taken to kill all the files created in the testing process.

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enhanced, thanks to improved cacheing.

The tests also uncover some of the misapprehensions associated with other testing where improved bit power and clock speeds suggest that eight-bit should always be inferior to the 16-bit. The eight-bit Wren machine, for example, scores better times than some 16-bit systems.

For the tests to have something more than academic interest they must reflect the perceived performance when used in real-life situations. The time taken for a package to load from disc, for example, will be directly related to the computer's performance in Benchmark 0. In addition, most of the more powerful packages have a series of overlay programs which are chained in and out according to the user's demands. Again, the time taken to do this will relate to the times achieved in test 0. Even the RAM-based integrated systems are influenced by this measure, as their extensive help levels are loaded in from disc. Word processors and spreadsheets have to load large blocks of data from the disc, and here again test 0 applies.

Accounting, specialist and database packages make extensive use of higher-level filing, such as sequential and random access. Attention must be paid to the tests measuring these parameters when selecting a computer for these applications.

BAGSHAW BENCHMARK TIMINGS

The table shows all 27 micros tested, in order of speed over the 14 Benchmarks. All times are in seconds. Naturally micros with hard discs come at the top of the list.

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	TOTAL	RANK
Sprite — 20Mbyte hard	11	3	4	8	2.5	3.5	0.5	4	0.5	1.8	4	34	12	2	91	1
Wyse PC — 10Mbyte hard	20	9	8	10	3	17	3	19	4	3	7	37	31	7	178	2
FTS — 20Mbyte hard	9	3	3	6	4	17	17	18	18	2	3	23	11	53	187	3
Apricot XI — 10Mbyte hard	16	6	7	11	7	26	1	27	2	4	9	50	20	6	192	4
Sirius 1 — 10Mbyte hard	16	4	7	7	6	11	3	12	4	2	3	80	37	11	203	5
Wren — 10Mbyte hard	11	4	8	6	4	19	10	22	12	2	3	66	24	19	210	6
Compaq Plus — 10Mbyte hard	20	6	8	7	5	16	5	25	6	2	3	76	27	26	232	7
IBM PC/XT — 10Mbyte hard	19	5	19	15	3	22	8	27	8	3	3	76	31	15	254	8
Apricot PC — 320K floppy	17	7	7	19	11	20	2	22	2	7	14	98	44	8	278	9
Wyse — floppy	26	19	18	25	12	43	15	69	22	9	16	109	76	56	515	10
FTS — floppy	12	4	5	21	27	45	15	49	16	8	43	229	35	39	548	11
Clenlo CP/M 3 — floppy	17	6	11	18	10	21	8	32	12	9	14	304	135	30	627	12
Future FX-30 — 3 Mbyte	11	4	4	6	5	13	6	14	7	13	22	470	82	15	672	13
Tandy 2000 — floppy	13	8	6	24	24	44	8	50	19	11	16	313	141	45	722	14
Advance 86b — 360K floppy	20	11	7	19	20	42	9	47	18	9	14	315	154	52	737	15
Compaq — 360K floppy	24	11	16	24	24	36	8	67	16	7	13	319	125	49	739	16
IBM PC — 360K floppy	21	10	21	21	20	30	8	65	17	7	15	311	145	51	742	17
Wren — 200K floppy	14	5	9	21	21	38	14	37	16	9	19	385	200	21	809	18
Tandy 1000 — 360K floppy	29	16	16	38	18	48	14	75	21	9	14	305	156	55	814	19
Canon A-200 — 360K floppy	20	17	16	23	28	50	12	76	18	8	15	326	162	61	832	20
Clenlo (CP/M 2.2) — floppy	17	10	11	83	11	17	8	35	12	16	31	717	237	27	1232	21
Rair 3/20	33	9	18	94	97	31	13	39	15	19	33	1009	235	37	1682	22
Future FX-30 — 800K floppy	20	6	6	23	24	35	13	49	20	25	52	1132	311	50	1766	23
Rair 3/30	23	7	14	16	10	50	29	53	32	54	59	1675	31	38	2091	24
Sirius 1 — 600K floppy	27	11	9	57	28	52	18	42	20	32	67	1669	466	39	2537	25
Epson QX-10 — floppy	21	8	13	34	20	49	21	62	27	35	70	1762	486	45	2653	26
Xerox 820 — floppy	39	14	22	83	84	103	53	156	74	55	66	1686	317	165	2917	27

BAGSHAW BENCHMARK RANKINGS

This table shows 25 of the micros tested, in alphabetical order. The figures are the rankings on each Benchmark test where 1 is the fastest and 25 is the slowest time.

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	RANK
Advance 86b — 360K floppy	12	19	7	11	14	16	12	14	15	14	15	15	17	20	14
Apricot PC — 320K floppy	10	12	7	11	11	8	3	6	2	9	9	9	11	4	9
Apricot XI — 10Mbyte hard	8	9	7	8	9	10	2	9	2	8	8	4	3	2	4
Canon A-200 — 360K flappy	12	24	18	16	22	22	14	24	15	12	13	17	19	24	19
Compaq — 360K floppy	20	19	18	18	18	14	8	21	11	9	10	16	14	17	15
Compaq Plus — 10Mbyte hard	12	9	11	4	6	4	6	8	6	2	2	6	5	10	7
Epson QX-10 — floppy	17	14	16	21	14	21	23	19	23	23	23	25	25	15	24
FTS — 20Mbyte hard	1	1	1	1	4	5	21	4	15	2	2	1	1	21	3
FTS — floppy	5	3	4	13	21	19	19	15	11	12	12	11	9	13	11
Future FX-30 — 3Mbyte	2	3	2	1	6	3	7	3	7	19	19	19	13	6	12
Future FX-30 — 800K floppy	12	9	5	16	18	13	15	15	19	21	21	21	22	18	21
IBM PC — 360K floppy	17	18	24	13	14	11	8	20	14	9	11	13	16	19	16
IBM PC/XT — 10Mbyte hard	11	7	23	9	2	9	8	9	8	6	7	7	6	6	8
Rair 3/20	24	16	21	25	25	12	15	12	10	20	20	20	21	11	20
Rair 3/30	19	12	17	10	10	22	24	18	24	24	24	23	6	12	22
Sirius 1 — 10Mbyte hard	8	3	7	4	8	2	4	2	4	2	2	8	10	5	5
Sirius 1 — 600K floppy	22	19	14	23	22	24	22	13	19	22	22	22	24	13	23
Sprite — 20Mbyte hard	2	1	2	6	1	1	1	1	1	1	1	2	2	1	1
Tandy 1000 — 360K floppy	23	23	18	22	13	20	17	23	21	14	15	12	18	22	18
Tandy 2000 — floppy	6	14	5	18	18	18	8	17	18	18	17	14	15	15	13
Wren — 10Mbyte hard	2	3	11	1	4	7	13	6	9	2	2	5	4	8	6
Wren — 200K floppy	7	7	14	13	17	15	17	11	11	14	14	18	20	9	17
Wyse — floppy	21	25	21	20	12	17	19	22	22	14	17	10	12	23	10
Wyse PC — 10Mbyte hard	12	16	11	7	2	5	4	5	4	6	6	3	6	3	2
Xerox 820 — floppy	25	22	25	24	24	25	25	25	25	25	25	24	23	25	25

TEST ROUTINES

```
1 SAVE"DISKMARK",A:STOP
2 SAVE"B:DISKMARK",A:STOP
10 REM ****************************************
11 REM *                                      *
12 REM *  PROGRAM NAME : DISKMARK             *
13 REM *                                      *
14 REM *  FUNCTION     : DISK BASED           *
15 REM *                 BENCH MARK SYSTEM    *
17 REM *                                      *
19 REM *  AUTHOR       : ERIC V BAGSHAW       *
20 REM *                                      *
21 REM *  ACTIVE LINES : 100 - 63023           *
22 REM *                                      *
23 REM *  LANGUAGE     : BASIC-80  V 5.2       *
24 REM *                                      *
25 REM *  VERSION DATE : 21/08/83  17:40       *
26 REM *                                      *
27 REM ****************************************
28 REM
30 REM ************** VARIBLES **************
31 REM
32 REM N()     =  NO USED IN TEST
33 REM DSK$() =  TEST NAMES
34 REM T(,)    =  TIME FOR TEST (,0)=DISK (,1)=
                  BASIC
35 REM T       =  TIME TYPE FLAG (0 OR 1)
36 REM RN      =  RECORD NO IN RND FILE
37 REM NT      =  NUMBER OF TESTS
38 REM C$      =  COMPUTER NAME
39 REM O       =  TEST NUMBER
40 REM H       =  HOURS
41 REM M       =  MINS
42 REM S       =  SECS
43 REM CLS$    =  CLEAR SCREEN
44 REM BELL$   =  RING BELL
45 REM D       =  NUMERIC DATA
46 REM D$      =  STRING DATA
47 REM A$      =  TEMP STRING DATA
48 REM T1+T2   =  TIME TOTALS
49 REM FR      =  FRONT RECORD IN SWAP
50 REM FR$     =    "      "    STRING IN SWAP
51 REM ER      =  END RECORD IN SWAP
52 REM ER$     =    "     "   STRING IN SWAP
53 REM HL      =  PEEK LOCATION FOR HOURS
54 REM ML      =  PEEK LOCATION FOR MINS
55 REM SL      =  PEEK LOCATION FOR SECS
56 REM AT      =  AT=1 AUTO TEST - AT=2 MANUAL
                  TEST
57 REM T$()    =  TEST TYPE DESCRIPTION
58 REM CF      =  CORRECTION FACTOR FOR INTERNA
                  L CLOCK
59 REM I       =  GENERAL COUNTER
60 REM I$      =  NUMBER FOR EXTENTION IN MULTI
                  FILES
61 REM J       =  DISK TEST COUNTER
62 REM Q$      =  QUESTION RESPONSE STRING
65 REM
66 REM *********** END OF VARIABLES *********
67 REM
```

SEQUENTIAL WRITE

```
1000 REM ************************************
1001 REM           SEQUENTIAL WRITE
1002 REM ************************************
1010 OPEN "O",#1,"DATAFILE"+".SEQ"
1020 FOR I = 1 TO N(O)
1030 D=RND(1)
1040 WRITE#1,D
1050 PRINT I;D
1060 NEXT I
1070 CLOSE#1
1499 RETURN
1500 REM SEQUENTIAL WRITE - BASIC
1510 REM OPEN "O",#1,"DATAFILE"+".SEQ"
1520 FOR I = 1 TO N(O)
1530 D=RND(1)
1540 REM WRITE#1,D
1550 PRINT I;D
1560 NEXT I
1570 REM CLOSE#1
1999 RETURN
2000 REM ************************************
```

MAIN CONTROL ROUTINE

```
100 REM ****************************************
101 REM         MAIN CONTROL ROUTINE
102 REM ****************************************
110 GOSUB 50000 : REM SET VARIABLE
120 GOSUB 20000 : REM MAIN SCREEN
130 ON AT GOSUB 27000,23000 : REM TEST START
140 O=0
150 CHAIN"CHAINPGM",11,ALL
160 REM RETURN FROM CHAIN
170 ON AT GOSUB 26000,21000
180 ON ERROR GOTO 60000
190 REM START OF MAIN LOOP
200 FOR O = 1 TO NT
210 IF AT=1 THEN 260
220 PRINT:PRINT "PRESS RETURN TO CONTINUE - AN
Y OTHER KEY TO SELECT A TEST"
230 Q$=INKEY$:IF Q$="" THEN 230
240 IF ASC(Q$)<>13 THEN GOSUB 24000
250 IF O > NT THEN 340
260 T=0:T(O,T)=0
270 ON AT GOSUB 27000,23000 : REM TEST START
280 ON O GOSUB 1000,2000,3000,4000,5000,6000,7
000,8000,9000,10000,11000,12000,13000
290 ON AT GOSUB 26000,21000 : REM TIMING
300 T=1:T(O,T)=0
310 ON AT GOSUB 27000,23000 : REM TEST START
320 ON O GOSUB 1500,2500,3500,4500,5500,6500,7
500,8500,9500,10500,11500,12500,13500
330 ON AT GOSUB 26000,21000 : REM TIMING
340 NEXT O
350 GOSUB 22000
360 END
```

RANDOM FRONT END SWAP

```
11000 REM ************************************
11001 REM      RANDOM FRONT END SWOP
11002 REM ************************************
11010 OPEN "R",#1,"DATAFILE"+".RND"
11020 FIELD #1, 10 AS D$
11030 FOR I = 1 TO N(O)
11040 FR=I:ER=(N(O)+1)-I
11050 GET#1,FR : FR$=D$
11060 GET#1,ER : ER$=D$
11070 LSET D$=FR$
11080 PUT#1,ER
11090 LSET D$=ER$
11110 PUT#1,FR
11120 PRINT I;ER;FR;ER$;FR$
11130 NEXT I
11140 CLOSE#1
11499 RETURN
11500 REM RANDOM FRONT END SWAP - BASIC
11510 REM OPEN "R",#1,"DATAFILE"+".RND"
11520 REM FIELD #1, 10 AS D$
11530 FOR I = 1 TO N(O)
11540 FR=I:ER=(N(O)+1)-I
11550 REM GET#1,FR : FR$=D$
11560 REM GET#1,ER : ER$=D$
11570 REM LSET D$=FR$
11580 REM PUT#1,ER
11590 REM LSET D$=ER$
11610 REM PUT#1,FR
11620 PRINT I;ER;FR;ER$;FR$
11630 NEXT I
11640 REM CLOSE#1
11999 RETURN
12000 REM ************************************
*
```

THE LAN ARM

Glyn Moody visits the Fife Constabulary headquarters to investigate how local area networks are helping the police with their enquiries.

Police and computers are a combination that sends shivers down many people's spines. But north of the border, the pioneering use of local area networks at the headquarters of the Fife Constabulary provides a reassuring example of how police and public alike can benefit from new technology.

Based on the edge of the village of Dysart, on the east coast of Scotland some 10 miles north of the Forth Bridge, Fife's police force has seven subdivisions. Because of its relatively small size, the traditional mainframe solution was never feasible. It was clear, though, that some kind of computing facilities would be invaluable.

The needs of the Operations Room — or Ops Room to those in the trade — were the most pressing. Here the day-to-day activities of the Fife force are planned and coordinated, and the welter of incoming information processed. As far back as 1980, a working party set up by the Chief Constable was looking at ways of modernising the Ops Room, and generally reviewing the possible paths that could be followed in implementing police computer systems, and in particular the alternatives to mainframes.

As the first stage in this process, it was decided to install a multi-user micro to provide a system which would handle resource availability, action files, local information files and the major incident log. The Development Team Leader for the project has been Jan Denton.

"We started off with the North Star Horizon and since then, two years ago, we went on to the HM Systems' new micro, which was the Minstrel. This exemplifies one of the great advantages of not going mainframe, because we can just do part exchanges on our computer systems and get the latest technology," she says. "Since getting our first North Star Horizon with only two users, we've gone up to a Minstrel with 85 percent more processing power in three years, to eight users and a more advanced operating system. If we'd have had a mainframe, we'd have spent our capital, and we'd probably have been into millions. Our system typically costs about £9,500."

NETWORKED MICROS

While this system was being developed, the working party started looking at the possibility of using networked micros rather than one large central computer. This was, and still is, a radical solution. Iain Horn, the Deputy Project Manager, recalls that not everyone was convinced of the wisdom of this approach.

"To be honest, we met some resistance from the Home Office when this solution of networking was first suggested. Because they reckoned we were exploring the leading edges of technology, as they put it, and that we would be safer to opt for a more traditional style of system. But despite that they were convinced it could be of value, and they financed the feasibility study by the Microelectronics Applications Research Institute from Newcastle Polytechnic. A consultant from that outfit looked at the force, and decided that networking was a viable proposition. And that's what really makes our system different from any other police force in the U.K. — the fact that we are networking."

Various LANs were evaluated. "In the end Racal Milgo Planet was the one we went for," says Denton. "Because it was so flexible, you could attach virtually any equipment to a Planet. Plus the speed, it being 10 megabits per second for any data transfer. We thought this would be able to handle any future computers that we'd ever want to put on there."

Planet is a Cambridge-type network with a ring topology — see page 90 for details. It will support up to 250 individual devices. Partly with a view to future expansion, it was decided to use programmable terminals hooked directly on to the network. Denton explains: "As we get a new computer system we can program all the functions on our VDUs to do different things." Backup is also readily accommodated using this system. "We have two Minstrels. The backup machine also sits on the network; it's always on-line waiting to be switched over should the main system fail. So that's our Ops Room system," says Denton.

The next stage of the computerisation at the Fife headquarters involved linking up with the Police National Computer, the PNC. "Every single force in Britain has to have access to the Police National Computer in Hendon. If you don't have an interface to the PNC, everybody has dedicated terminals. We had three dedicated terminals before we got our interface, and a dedicated line down to Hendon," says Denton.

The PNC is used to store information on all licensed vehicles in Britain, and information on wanted or missing persons. It takes the form of a database with a number of fields, any one of which can be searched through. It can also find the nearest equivalent if input data is uncertain or incomplete. Lines to the main computer in Hendon are stringently protected.

USER IDENTIFICATION

Similarly, the software ensures that in addition to numerous passwords, there is rigorous identification of the user and the reasons for use. The PNC authorities may audit transactions at any time, and officers have to be able to justify every search carried out. Although such checks remain purely internal, they may at least go some way to stilling fears about misuse of central computer banks of information held on individuals.

"About two years ago we looked to develop a PNC interface," says Denton. "And also for a message switched system. The two applications were treated separately; as it happens Leasco Software Ltd won the contract. This is based on a Ferranti Argus 700 GL, and we have a dual system again."

"This is the first PNC interface that was developed on a micro system in Britain. It was the first time Leasco had written it for a micro, and they did it in about two months. This is an incredible achievement — we couldn't believe they'd done it so well."

The LAN approach particularly lent itself to this piecemeal development. As Denton says: "When we got the Ferranti all we had to do was attach it to an access point on the network. We use the same VDUs, which gives us a very powerful dynamic approach." Another benefit was cost: the whole double Ferranti system including

software was about £64,000, a fraction of a comparable mini or mainframe interface solution.

Together with the PNC interface, the Ferrantis are used for a message switched service. This allows messages of varying urgency to be sent to any of the 33 terminals hooked up to the network. This includes seven terminals at subdivisional level at distant locations, connected via modems. All terminals have slave printers for hard copies. It is also possible to send messages to other forces via the PNC. Typically this might mean contacting all the forces that lie along a motorway. This has allowed cheap and fast transmission of information countrywide in a way hitherto thought impossible.

Now that the PNC interface has been successfully installed, a further link-up is in the offing. "We are next looking at the dreaded Holmes — Home Office Large Major Enquiry System. Every force in Britain has to take it in some form or other in the next 12 months. It's a large major enquiry system. Should any incident happen, it is a computerised indexing system to help solve the crime," says Denton.

The actual details of the implementation have yet to be hammered out. There is some argument over whether a centralised solution for Scotland should be adopted, rather than a myriad of local systems. Whatever the final result, a micro will be used in some form at Fife, which will be hooked on to the network in the same way as the others. In fact, once more the flexibility of the LAN means that the outcome of present discussions is not nearly so critical as it would have been on a mainframe.

Another interface being worked on is to the Scottish Criminal Records computer, which holds all the criminal records for Scotland. "Again, we'll have an interface computer here, and use our same VDUs programmed for multi-function use," says Denton. Finally, there are plans to set up databases holding such records as the Firearms and Shotguns Index, Property and Premises Index, Licensing System and a Personnel System.

Parallel to this will be growths in the base of users. "We're down to subdivisional level at the moment," says Horn, "but there's no reason why we can't extend these facilities to sectional level." This would mean installing some 20 or 30 further terminals in outlying stations. This kind of expansion can be envisaged because of the slack in the current system. As Denton says: "We've got 33 VDUs now, two systems that are being fairly hammered, and we've noticed absolutely no degradation whatsoever. Even while we were doing acceptance testing for the PNC, something like 720 transactions per hour on 12 users — and that was really hammering the network — the response times were invariably about two seconds."

But what about reactions and results? "When you are introducing something like this which is entirely new to the force, and the force has had no experience of computers other than through the PNC, you always expect some level of resistance, especially from the older and more cynical policemen. But we've been very pleasantly surprised; we've found very little evidence of user resistance," says Horn.

As far as practical benefits, the main ones are "speed of distribution of day-to-day information, and the reduction in the level of paper physically travelling around the force. Because with eight or nine subdivisions there are literally hundreds of forms floating back and forth. A lot of that a message switching system can cope with. It cuts back the delays often as much as days for an individual piece of paper from one part of the system to another," says Horn.

As far as the bobby on the beat is concerned, it is probably the local PNC facilities that have had the biggest impact. As Horn says: "I for one can think back to pre-PNC days, and how difficult it was at times to get something as simple as the owner of a car. A fatal hit-and-run road accident might take you 10 hours to get the registered owner of that car. With our system you can have it in three seconds." PC

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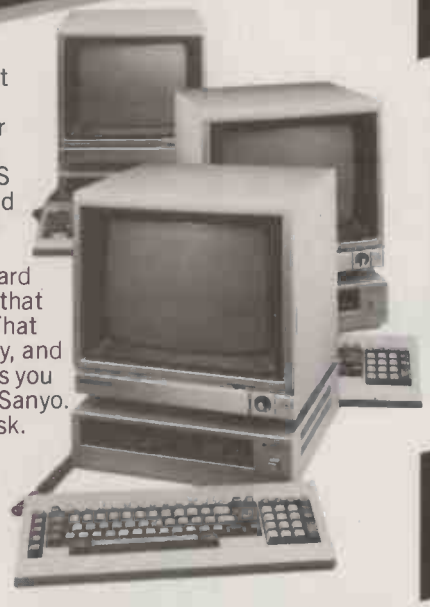

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THE WARNIER APPROACH

Paul Andreas Overaa concludes his presentation of a systematic technique for developing your programs.

LAST MONTH I explained how the Warnier technique of problem analysis can be used to expand a given programming task to the point where it can be coded efficiently and systematically. As an example on which to apply the technique I started to design a routine for the BBC Micro that takes a variable name and returns the address that represents the start of the variable in memory. The problem was developed to the point where it can be represented by the Warnier diagram which is repeated here as figure 1.

There is, at this stage, no guarantee that the diagram we have produced is either an efficient representation of the problem or indeed even that it is correct. It does, however, represent sets of operations that we consider to be the essential characteristics of our task. The subdivision of these tasks has been developed to the point where it is felt that the individual operations can easily be programmed in the language we have chosen to use — Basic, in this case.

The five operations identified as being fundamental to our problem are as follows: Get Key, Calculate Table Address, Get Address of Next Item, Compare Key with Name of Item, and Exit Routine. What I now intend to do may come as rather a surprise: I want to consider the data that the program must use.

Each variable has a specific non-zero address. If 100 variables exist then there will be 100 associated addresses, and so on. We can therefore see that if the chain has n items in it then there will be n addresses. There will also be a single zero address. The general situation is shown pictorially in figure 2.

We are therefore dealing with a total set of n + 1 addresses. Since it is known that one of the non-zero addresses might represent the address of the item we are searching for, we can improve the representation as in figure 3. Figure 4 shows the equivalent representation using a Warnier diagram.

Given a particular item, or a particular address, we could use the subdivision criteria of figure 4 to identify the subset to which the item or address belongs. This is in fact exactly what our program must do if it is to function correctly. The structure of our program must mirror the divisions and the frequencies that we have just recognised and, on the basis of this, tell us whether a key match has been identified. By considering the numbers of items involved when we take all or part of the total data input set we can deduce the frequencies with which each of the action subsets will occur under the two possible outcomes of the program.

Figure 5 shows the frequencies occurring if we take n items from

FIGURE 3.

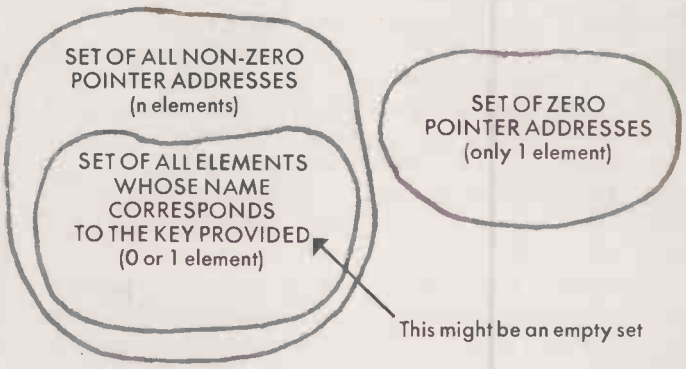
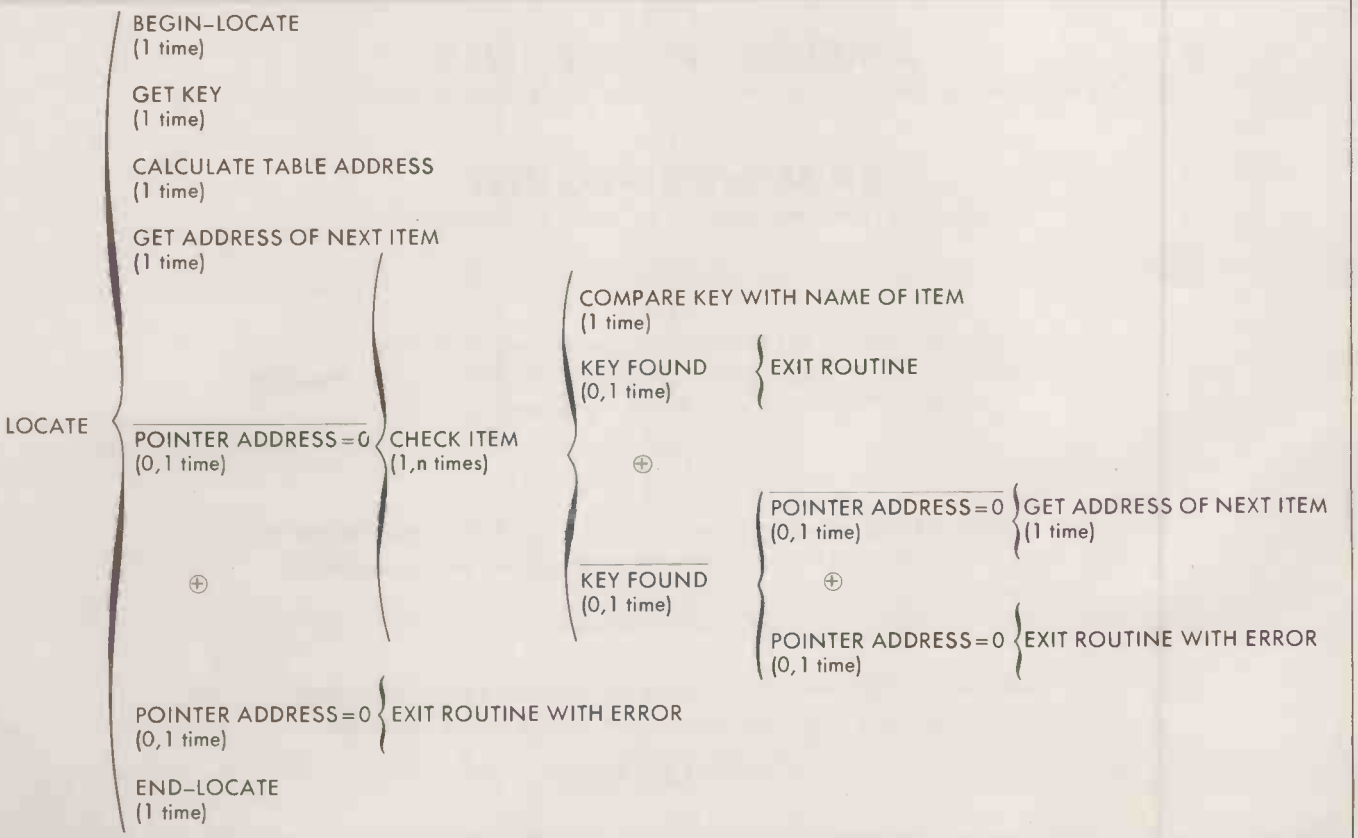


FIGURE 2.

FIGURE 1. WARNIER DIAGRAM OF THE BBC PROBLEM.



our input set but do not find a key match. Now consider figure 6 which shows the situation if we do find a key match after taking m items from the input set. If the program is to be correct then the operations such as Calculate Head Address, Get Address of Next Item, Exit Routine, etc., must occur within the part of the program that occurs the correct

(continued on next page)

FIGURE 4. STRUCTURE OF THE INPUT DATA.

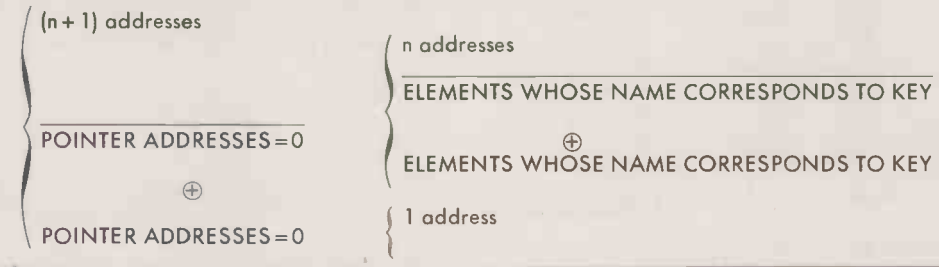


FIGURE 5. FREQUENCIES IF A KEY MATCH IS NOT FOUND.

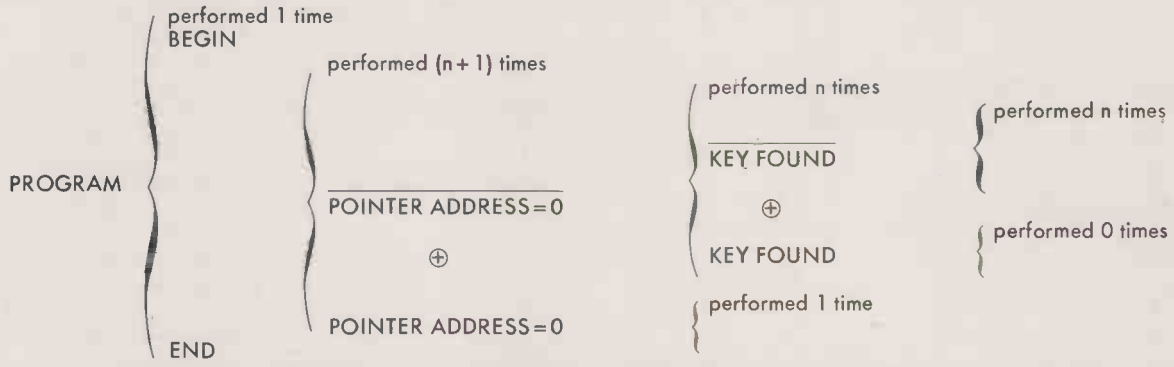


FIGURE 6. FREQUENCIES IF A KEY MATCH IS FOUND.

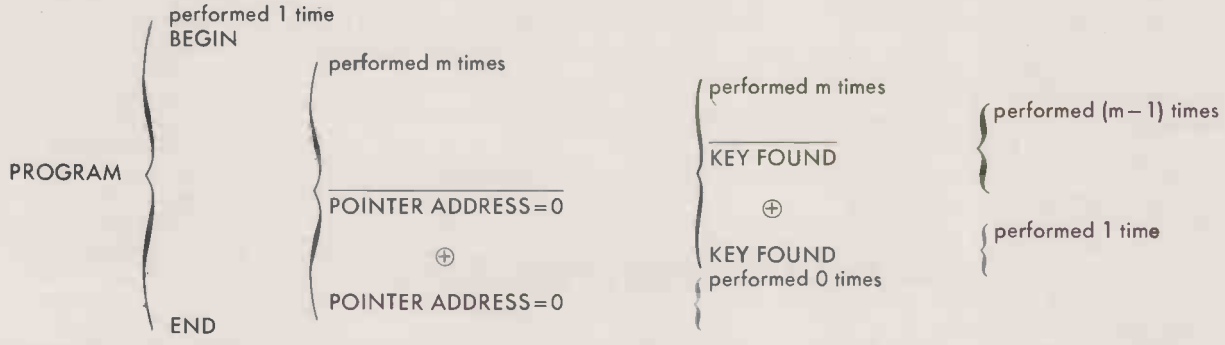
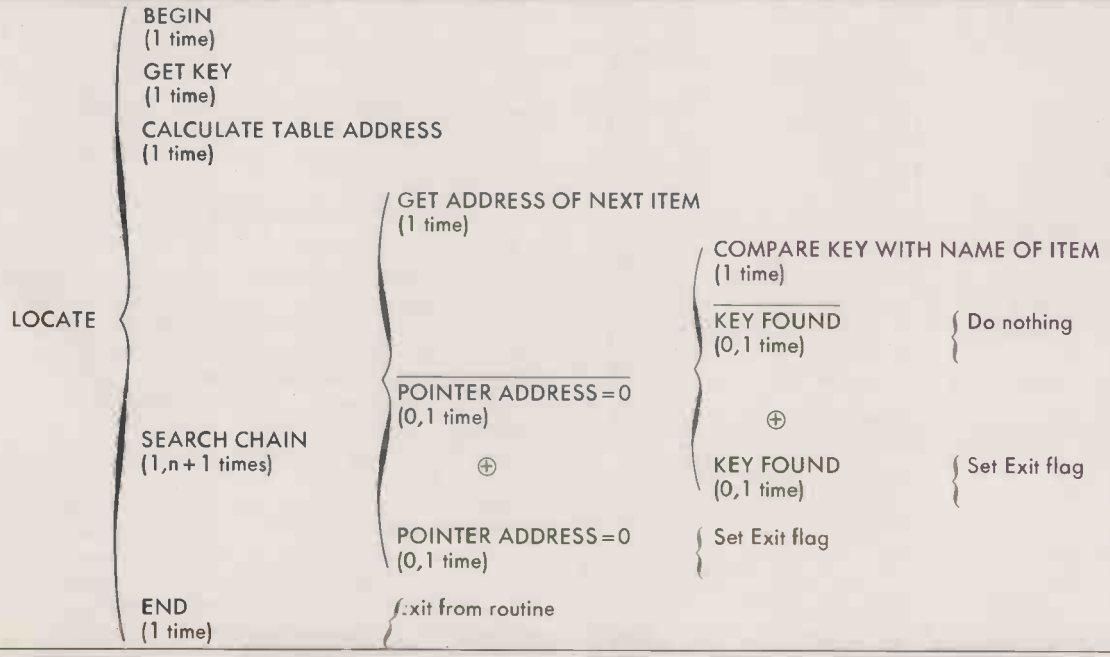


FIGURE 7. WARNIER FORM OF THE FINISHED ROUTINE.



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number of times. The problem now is to identify the appropriate areas, and this can be done by considering how many times each particular operation must occur during the program and relating these frequencies to those dictated by the examination of the program structures shown in figures 5 and 6.

It should be obvious that Get Key and Calculate Table Address will only be performed once. It should be equally apparent that we will only Exit from the routine once. If we search a chain of n items and do not find a key match then we will have compared n keys. But because we also must examine the zero pointer at the end of the chain we will have performed Get Address of Next Item n + 1 times. If on the other hand we do find a key match after searching m items from the chain then we will only have examined m keys. In this latter case we would not examine the end-of-chain zero pointer and would therefore only have performed Get Address of Next Item m times.

The table shows the frequency possibilities. We use the frequency details to ensure that we place each operation into a subset that is performed the correct number of times, using the order dictated by our understanding of the problem gleaned in the earlier analysis. Figure 7 shows the finished design.

Two important points are worth re-emphasising. Firstly, the structure of the program is based on the logical criteria that partition the input set; and secondly the frequency of each element or item in those subsets governs how many times the equivalent action subsets in the program will be performed.

By understanding the way in which the input set is divided we can deduce the program structure. By identifying the frequency of the elements in each division of the input set we can determine how many times each respective part of the program will be performed. Finally, by correlating this frequency to the frequency of the operations we wish to perform we can identify whereabouts in the overall program structure the required operations should be placed.

Figures 5 and 6 showed explicitly how many times each bracket was performed altogether for the two possible outcomes of the program. This figure, placed at the top of each bracket, was a cumulative figure as opposed to the relative figures that we would normally place under each statement. The information helps to show the connection between the number of items taken from the data set and the number of times a given set of operations — the action subset — would be performed within the program. Such details can be easily obtained from the relative frequency that is written underneath each statement, and this is one of the reasons that this latter information is included in the diagrams.

So, how do we convert the design shown in figure 7 into code? In effect we wish to code various sets of actions, and we can do this most effectively by using sub-routines, procedures, functions, etc.

We work from the largest, left-most bracket first. This tells us we must collect a key, calculate an address, then repeat an operation until some Exit flag is set. This can be written as a corresponding function in which the key is passed as a parameter, which we will call Key$, and the address returned in a function variable A%. As error indicator we can use the fact that, if the search fails, the address returned would be zero. A local variable S__O% (Search Over?) will be used to signal an exit condition. Having obtained the address of the head pointer, in A%, the first letter of the key is stripped off and a null placed at the end of the name, thus forcing the key to comply with the stored variable name convention. The corresponding code thus takes the form of listing 1.

We now consider the Search Chain bracket of figure 7. The address of a variable is obtained by looking at the contents of the two bytes that start at the pointer address held in A%. This is easily done using the ! indirection operator, masking out the third and fourth bytes by using the code

A%=!A% AND &FFFF

We then test this for a zero value, and on the basis of this test either set an exit flag or perform the set of actions that start Compare Key, etc. Again, other than indicating its existence by giving it a name, we do not worry about the actual details of this lower-level bracket. We therefore expand our code to produce listing 2.

To complete the routine all that is needed is to decide how to perform the key/variable name comparison. A simple loop is used to check each character of the key name against the equivalent character of the variable name. If all characters match the S__O% flag would remain set to True; if a difference is found the S__O% flag is set to False and the comparison routine terminates. Some typical code is shown in listing 3.

If we combine the code produced so far, using a few Rems for clarity, we produce the finished form shown in listing 4. The coded form was produced from the Warnier description by considering the various bracket levels in isolation. In this particular case functions are appropriate because single values were being returned. At other times procedures and global variable subroutines can be used to good effect. PC

LISTING 1.

```
1030 DEF FNlocate(KEY$)
1040 LOCAL A%,S_O%: A%=&4000+2*ASC(KEY$):KEY$=MID$(KEY$,2)+CHR$(0)
1050 REPEAT
     ( some set of operations )
1070 UNTIL S_O%
1080 =A%
```

LISTING 2.

```
1030 DEF FNlocate(KEY$)
1040 LOCAL A%,S_O%: A%=&4000+2*ASC(KEY$):KEY$=MID$(KEY$,2)+CHR$(0)
1050 REPEAT
1060 A%=!A% AND &FFFF:IF A%<>0 THEN S_O%=FNtest_key%(A%,KEY$) ELSE S_O%=TRUE
1070 UNTIL S_O%
1080 =A%
```

LISTING 3.

```
1100 DEF FNtest_key(A%,KEY$)
1110 LOCAL I%: S_O%=TRUE
1120 FOR I%=1 TO LEN(KEY$)
1130 IF MID$(KEY$,I%,1)<>CHR$(?(A%+I%+1)) THEN S_O%=FALSE: I%=255
1140 NEXT I%
1150 =S_O%
```

LISTING 4.

```
1000 REM ===========================================================
1010 REM            L O C A T E - V A R I A B L E
1020 REM ___________________________________________________________
1030 DEF FNlocate(KEY$)
1040 LOCAL A%,S_O%: A%=&4000+2*ASC(KEY$):KEY$=MID$(KEY$,2)+CHR$(0)
1050 REPEAT
1060 A%=!A% AND &FFFF:IF A%<>0 THEN S_O%=FNtest_key%(A%,KEY$) ELSE S_O%=TRUE
1070 UNTIL S_O%
1080 =A%
1090 REM ___________________________________________________________
1100 DEF FNtest_key(A%,KEY$)
1110 LOCAL I%: S_O%=TRUE
1120 FOR I%=1 TO LEN(KEY$)
1130 IF MID$(KEY$,I%,1)<>CHR$(?(A%+I%+1)) THEN S_O%=FALSE: I%=255
1140 NEXT I%
1150 =S_O%
1160 REM ===========================================================
```

LISTING 5. TEST PROGRAM

```
  10 CLEAR:Y$="THIS":YY$="IS":YYY$="A TEST"
  20 PRINTFNlocate("Y$"),FNlocate("YY$"),FNlocate("YYY$")
 990 END
1020 REM ===========================================================
1030 DEF FNlocate(KEY$)
1040  LOCAL A%,S_O%:A%=&4000+2*ASC(KEY$):KEY$=MID$(KEY$,2)+CHR$(0)
1050 REPEAT
1060   A%=!A% AND &FFFF:IF A%<>0 THEN S_O%=FNtest_key(A%,KEY$) ELSE S_O%=TRUE
1070   UNTIL S_O%
1080 =A%
1090 REM ___________________________________________________________
1100 DEF FNtest_key(A%,KEY$)
1110 LOCAL I%:S_O%=TRUE
1120 FOR I%=1 TO LEN(KEY$)
1130   IF MID$(KEY$,I%,1)<>CHR$(?(A%+I%+1)) THEN S_O%=FALSE:I%=255
1140   NEXT I%
1150 =S_O%
1160 REM ===========================================================
 RUN
       4381        4393        4404
```

FREQUENCY POSSIBILITIES

Operation	Frequency if key is found	Frequency if key is not found
Get Key	1 time	1 time
Calculate Table Address	1 time	1 time
Get Address of Next Item	m times	(n + 1) times
Compare Key with Name of Item	m times	n times
Exit Routine	1 time	1 time

KEY DEFINER

Dick Ruck's initialisation utility provides a convenient way of adapting the Amstrad soft keyboard to your own preferred applications.

WHEN I FIRST READ Amstrad's User Instructions manual for the CPC-464 I had visions of tailoring the keyboard to perform single-key keyword entry. But my illusions were shattered by two discoveries: there are only 120 characters to do all the things I wish, and I did not fully understand the Key and Key Def commands.

The Amstrad's keyboard is substantially software redefinable: nearly anything can be generated from any key or combination of keys pressed. Because of this the computer must have a means of identifying which key has been pressed other than by the character it generates. This is achieved by giving each physical key a key number which cannot be changed by software.

These numbers are shown on page 16 of Appendix III in the User Instructions, which says, for example, that when you press the key marked with an A you are pressing key number 69. You naturally expect to see the letter A appear on the screen, but this may not always happen, as we shall see.

The Amstrad uses the ASCII standard for its character set. ASCII (American Standard Code for Information Interchange) provides a means of exchanging information between computers and peripherals in a common code which is understood by all devices expecting to receive ASCII-coded information. On page 1 of Appendix III of the User Instructions there is a table of ASCII codes.

When you press the A key with Caps Lock or Shift depressed then ASCII code 65 is generated, corresponding to an upper-case A. Without the Shift key a lower-case a is produced, corresponding to ASCII 97. If the Ctrl key is held down at the same time, ASCII 1 is generated. In other words, pressing the A key, physical key number 69, generates one of three ASCII codes. It is by changing the codes generated by each key that it is possible to redefine the keyboard.

Control codes are a special subset of the first 32 ASCII codes, 0 to 31. They each have a name and perform special commands: Bel, for example, causes the speaker to give a short beep. On the Amstrad there are two ways to use the control codes. The recommended way to beep the bell is to type the number of the control code as the argument to the CHR$() function. Therefore to beep the bell type

```
PRINT CHR$(7)
```

or

```
?CHR$(7)
```

if you are a lazy typist.

The second method is to type the control code within inverted commas after the Print command

```
PRINT "Ctrl-G"
```

where G appears on the screen as a semicircle with feet. But be warned: using this method actually places control codes in your programs. They may have unexpected results when they are printed, as many printers use control codes to change character sets, line spacing and other functions — including disabling printing. This method is useful, however, to test the effect of a command in direct mode from the keyboard.

The Amstrad has 32 expansion tokens which can be programmed with up to 120 characters in the default condition. To understand exactly what an expansion token is consider the ASCII codes. They range from 0 to 127, and associated with each code is a standard command or character. Each code is stored in a single byte, which can contain values between 0 and 255. The 128 unused codes 128 to 255 are used for displaying special characters, as shown on pages 2 to 13 of Appendix III in the User Instructions.

Expansion tokens are a special subset of these codes in the range 128 to 159. The character associated with them can be printed as normal using the CHR$() function. However, when a key generates a code in the range 128 to 159 the computer detects this as an expansion token and prints the string of characters associated with it, and not the single character of the firmware character set. You can define the string of characters associated with each expansion token, using the Key command.

The format of the command is

```
KEY key number, string
```

To have the word FRED printed on the screen with expansion token 128 you enter the command

```
KEY 128,"FRED"
```

(continued on page 112)

KEY DEF

```
10 '      KEY_DEF      v 2.02
20 '
30 '   Dick Ruck   -   Feb 1985
40 '
50 '
60 ' remove symbol buffer
70 '
80 SYMBOL AFTER 256
90 '
100 ' allocate 1024 bytes for function k
ey buffer (&a800-&abff)
110 ' plus 256 bytes for m/code routines
 (&a700-&a7ff)
120 ' note if disable CTRL-SHIFT-ESC opt
ion used then &a7fb-&a7ff should NOT be
used for anything else!
130 '
140 MEMORY &A6FF
150 '
160 ' this routine allocates 1k memory t
o keyboard buffer
170 ' uses KM_EXP_BUFFER - jumpblock &bb
15
180 '
190 RESTORE 300
200 destination=&A700
210 FOR offset=0 TO 9
220  READ byte
230  POKE destination + offset,byte
240 NEXT
250 '
260 '      de = start address of buffer,
hl = length
270 '
280 '      ld de,&a800 :    ld hl,&0400:
 call  &bb15  :ret
290 '
300 DATA   &11, &0,&a8,     &21, &0,&4,
  &cd, &15,&bb,&c9
310 '
320 CALL destination
330 '
340 'set up expansion strings and key de
finitions for keywords
350 '
360 RESTORE 460
370 FOR expkey=128 TO 147
380  READ f$,k,l,u
390  KEY expkey,f$
400  KEY DEF k,1,l,u,expkey
410 NEXT
420 '
430 ' keywords generated by CTRL-key of
initial letter
440 ' except sYmbol, 1\st and goto>
450 '
460 DATA "asc(",69,&61,&41
470 DATA "border ",54,&62,&42
480 DATA "chr$(",62,&63,&43
490 DATA "draw ",61,&64,&44
500 DATA "else ",58,&65,&45
510 DATA "for ",53,&66,&46
520 DATA "gosub ",52,&67,&47
530 DATA "goto ",31,&2e,&3e
540 DATA "hex$(",44,&68,&48
550 DATA "left$(",36,&6c,&4c
560 DATA "list ",22,&5c,&60
570 DATA "mid$(",38,&6d,&4d
580 DATA "next",46,&6e,&4e
590 DATA "paper£",27,&70,&50
600 DATA "right$(",50,&72,&52
610 DATA "sound ",60,&73,&53
620 DATA "symbol ",43,&79,&59
630 DATA "then ",51,&74,&54
640 DATA "upper$(",42,&75,&55
```

```
650 DATA "window£",59,&77,&57
660 '
670 ' set up top row numeric keys as fun
ctions
680 '
690 RESTORE 760
700 FOR j=21 TO 30
710  READ f$,k,l,u
720  KEY 127+j,f$+CHR$(13)
730  KEY DEF k,0,l,u,127+j
740 NEXT
750 '
760 DATA "mode 1",64,&31,&21
770 DATA "mode 2",65,&32,&22
780 DATA "ink 0,0:ink 1,13:border 0:pape
r 0:pen 1:mode 2",57,&33,&23
790 DATA "list",56,&34,&24
800 DATA "?int(time/18000)",49,&35,&25
810 DATA "?hex$(himem),hex$(fre(0)),hime
m-fre(0)-370",48,&36,&26
820 DATA "for j=0 to 255:? j chr$(32)chr
$(1)chr$(j),:next",41,&37,&27
830 DATA "run",33,&39,&29
840 DATA "mode 0",32,&30,&5f
850 DATA "cls",16,16,16
860 '
870 ' following prints contents of funct
ion keys
880 '
890 progf$="a=&a800:FOR k=1 TO 32:l=PEEK
(a):PRINT k+127,:FOR c=a+1 TO a+l:PRINT
 CHR$(1)CHR$(PEEK(c));:NEXT:PRINT:a=a+l+
1:NEXT"
900 '
910 ' following prints real time clock
920 '
930 progt$="t=time:h=t/108e4:hh=int(h):m
=(h-hh)*60:mm=int(m):ss=int((m-mm)*60):c
ls:? hh chr$(58) mm chr$(58) ss"+CHR$(13
)
940 '
950 KEY 158,"run"+CHR$(&22)+CHR$(13)
960 KEY DEF 40,0,&38,&28,158
970 KEY 159,progf$+CHR$(13)
980 KEY DEF 25,0,&2D,&3D,159
990 KEY 152,progt$
1000 '
1010 'redefine keypad
1020 '
1030 RESTORE 1090
1040 FOR j=1 TO 11
1050  READ k,m
1060  KEY DEF k,1,m,m,m
1070 NEXT
1080 '
1090 DATA 13,&31
1100 DATA 14,&32
1110 DATA  5,&33
1120 DATA 20,&34
1130 DATA 12,&35
1140 DATA  4,&36
1150 DATA 10,&37
1160 DATA 11,&38
1170 DATA  3,&39
1180 DATA 15,&30
1190 DATA  7,&2e
1200 '
1210 ' replace RUN" on small ENTER key
1220 '
1230 KEY DEF 6,1,&D,&D,158
1240 '
1250 ' short routine to set TIME to valu
es in de hl
1260 ' uses KL_TIME_SET - jumpblock &bd1
0
1270 '
1280 RESTORE 1380
1290 FOR offset=0 TO 9
1300  READ byte
1310  POKE destination + offset,byte
1320 NEXT
1330 '
1340 ' dehl contain real time in 1/300 s
ec  d=msb  l=lsb
1350 ' need to get time from keyboard an
d poke to de hl
1360 '
1370 '     ld de,&???? :   ld hl,&????:
  call  &bd10
1380 DATA   &11, &0,&0 ,     &21, &0,&0,
   &cd, &10,&bd,&c9
1390 '
1400 INPUT "Enter:     HOURS";hh
1410 INPUT "           MINS ";mm
1420 INPUT "           SECS ";ss
1430 ticks=300*(ss+60*mm+3600*hh)
1440 '
1450 ' MOD division with large real numb
ers results in overflow
1460 ' therefore define a Modulus Divisi
on function
1470 '
1480 DEF FNmd(x,y)=x-INT(x/y)*y
1490 b0 = FNmd(ticks,256)
1500 b1 = FNmd(INT(ticks/256),256)
1510 b2 = FNmd(INT(ticks/(256*256)),256)
1520 b3 = INT(ticks/(256*256*256))
1530 POKE destination + 2,b3
1540 POKE destination + 1,b2
1550 POKE destination + 5,b1
1560 POKE destination + 4,b0
1570 CALL destination
1580 '
1590 ' disable CTRL-SHIFT-ESC
1600 '
1610 INPUT "Do you want to disable CTRL-
SHIFT-ESC";a$
1620 IF LEFT$(UPPER$(a$),1)<>"Y" GOTO 19
10
1630 '
1640 ' this routine intercepts calls to
KM_TEST_BREAK - jumpblock &bdee
1650 ' register C contains state of SHIF
T & CTRL keys - this resets C to 0
1660 ' thus system sees ESC key only pre
ssed.
1670 '
1680 destination=&A7FB
1690 RESTORE 1760
1700 FOR offset=0 TO 4
1710   READ byte
1720   POKE destination + offset,byte
1730 NEXT
1740 '
1750 '   ld c ,&0     :  jp  &????
1760 DATA  &e ,&0     , &c3 ,&0 ,&0
1770 '
1780 ' patch routine to KM_TEST_BREAK
1790 '
1800 POKE destination+3,PEEK(&BDEF)
1810 POKE destination+4,PEEK(&BDF0)
1820 '
1830 ' patch jumpblock to this routine
1840 '
1850 POKE &BDEF,&FB
1860 POKE &BDF0,&A7
1870 '
```

(listing continued on next page)

(continued from page 110)

You can terminate the string with ASCII code 13 (CR), which will have the same effect as typing the string in from the keyboard then pressing Enter.

It is not possible to use inverted commas within a string in Locomotive basic as the interpreter thinks you have terminated the string. To create a string similar to that found on CTRL-Enter (Run") you need to add the inverted comma as an ASCII code argument to the CHR$() function. Therefore to assign Run" plus Enter to expansion token 129 enter

KEY 129,"RUN"+CHR$(34)+CHR$(13)

The more complex Key Def command allows you to associate three numbers in the range 0 to 255 with each physical key number. These numbers are then generated by a key when it is pressed in normal, shifted or control states. The format is

KEY DEF Keynumber, Repeat, Normal, Shift, Control

where Keynumber is the number of the physical key you are concerned with; Repeat is set to 1 to enable repeat and 0 to disable it; Normal is the code of the character or expansion token you wish to display when the key is pressed; Shift is the code of the character or expansion token you wish to display when the Shift key is simultaneously pressed; and Control is the code of the character or expansion token you wish to display when the Ctrl key is simultaneously pressed.

For example, to change the A key to display X,Y,Z in repeat mode enter

KEY DEF 69,1,88,89,90

To change the ? key to display three expansion tokens numbers 130,140,150 with no repeat enter

KEY DEF 30,0,130,140,150

This illustrates how the keypad is set up on switch-on. From the data on page 15 of Appendix III you will see that the 1 key on the numeric keypad has expansion token 129 associated with it. Expansion token 129 has effectively been set up with the command

KEY 129,"1"

And the 1 key, physical key number 13, has effectively been set up with

KEY DEF 13,1,129,129,129

So if you redefined expansion token 129 to List followed by CHR$(13) you would stop having a 1 generated on the keypad.

The keypad therefore has to be redefined if you use expansion tokens 128 to 140 and wish to keep the use of numeric keys on the numeric keypad. The program Keydef shows one method of doing this.

If you use Keydef I suggest you load it at the start of a programming session and leave it there for the duration. The program moves Himem, expansion-token storage areas and Symbol character storage areas from their normal locations. As a result Keydef may not be compatible with commercially available software. A Call 0 system reset is suggested to clear the Amstrad before running such programs.

The program has been written so that it is easily maintainable, and as a result it is longer than it need be, with some sections of code repeated. You can pick and choose the code you require. Three short machine-code routines call firmware routines. Only one of them is required after the program has been run, and then only if you opt to disable Ctrl-Shift-Esc system resets.

Line 80 removes the existing Symbol character buffer. If Himem is not immediately below the bottom of the Symbol buffer the Amstrad will not allow Symbol After commands to be executed. To overcome this problem the Sybol buffer is restored below buffers created by this program.

Line 140 moves Himem down 1,280 bytes to make room for two permanent buffers: 1,024 bytes are reserved for the Key definitions and a further 256 bytes are reserved for development of short machine-code routines. Only the last five bytes of these 256 are required after the program has been run. All values associated with memory operations in this program have been written in absolute values. This gives a clearer picture of the resulting memory map. You may prefer to give the program long-term portability by replacing such absolute values with relative values, storing Himem to a variable such as Oldhimem and working from this base value.

The default expansion-token buffer is 120 characters. However, the expansion tokens in the program listing require far more space. This is obtained in lines 190 to 320 by calling KM Exp Buffer to relocate the keyboard buffer to the memory value in registers DE, with registers HL containing the length of the buffer.

Lines 360 to 650 associate 20 Basic keywords with expansion tokens 128 to 147. There is an attempt to place a keyword on the key of its initial letter. The exceptions are Goto on the > key, List on the \ key and Symbol on the Y key. The keywords chosen are the common Basic words I use. Change them if you wish but remember the first 20 of your list will be the only ones read without further changes to the program.

Lines 690 to 850 set up the top row of keys as function keys. They send a command to the Amstrad; each string is terminated with a CHR$(13). Note line 800 prints the number of minutes since switch-on. However, it is later overwritten by a further Key command which prints real-time clock values. The first version is given in case you do not wish to include the Time routines. The functions included are shown in the table.

In lines 890 to 990 Key 152 is redefined for the Real Time routine. Progt$ is a one-line program to print the time in hours, minutes, and seconds. Later in the program you are asked for the correct time. This is converted to the number of 1/300ths of a second that have elapsed since 00:00:00 hours and used to reset Time. Unfortunately, the internal clock is interrupted while the cassette is in use and this will cause the clock to become inaccurate.

Key 158 is defined as Run" and is later transferred to the small Enter key. Key 159 displays the contents of the keys. Progf$ is a one-line program to perform this function. The string associated with each key is held in consecutive memory locations in the function-key buffer.

Lines 1010 to 1230 redefine the keypad by replacing the expansion tokens associated with each key with the ASCII codes for the numerals, full stop and Carriage Return. Run" is replaced on the small Enter key.

Lines 1280 to 1570 set Time to real time. This uses KL Time Set, which requires the number of 1/300ths of a second in registers DEHL, with D containing the most significant byte and L the least significant byte.

Lines 1610 to 1860 disable Ctrl-Shift-Break. This uses KM Test Break. Register C is used to pass the state of the Shift and Ctrl keys to KM Test Break, and the short machine-code routine simply resets register C to 0. The five-byte routine remains in memory at locations &7FB to &A7FF. Do not use these memory locations for your routines if this option is in use.

The Symbol character buffer must be directly above Himem to enable it to be changed with the Symbol After command. This is achieved in line 1910 by recovering the buffer after allocating space for machine code and key functions.

Line 1950 sets the baud rate to 2,000 as a permanent part of the initialisation. White on black in mode 2 is provided for in line 1990.

Line 2030 should be left as a Rem until final program testing has been completed, at which point it may be activated. PC

KEY DEF

(listing continued from previous page)

```
1880 '
1890 ' recover default symbols
1900 '
1910 SYMBOL AFTER 240
1920 '
1930 ' set cassette speed to fast saves
1940 '
1950 SPEED WRITE 1
1960 '
1970 ' favourite edit mode (White on bla
ck)
1980 '
1990 INK 0,0 : INK 1,13 : MODE 2 : BORDE
R 0 : PAPER 0 : PEN 1
2000 '
2010 ' erase program ?
2020 '
2030 ' new
2040 '
2050 END
```

FUNCTION KEYS

Key	Function
1	Mode 1
2	Mode 2
3	Reset favourite screen edit mode
4	List
5	Real Time
6	Himem and Fre in hex, program length in decimal
7	Display Amstrad character set
8	Load and run a program
9	Run the program in memory
0	Mode 0
.	Display expansion tokens and strings
CLR	Clear the screen

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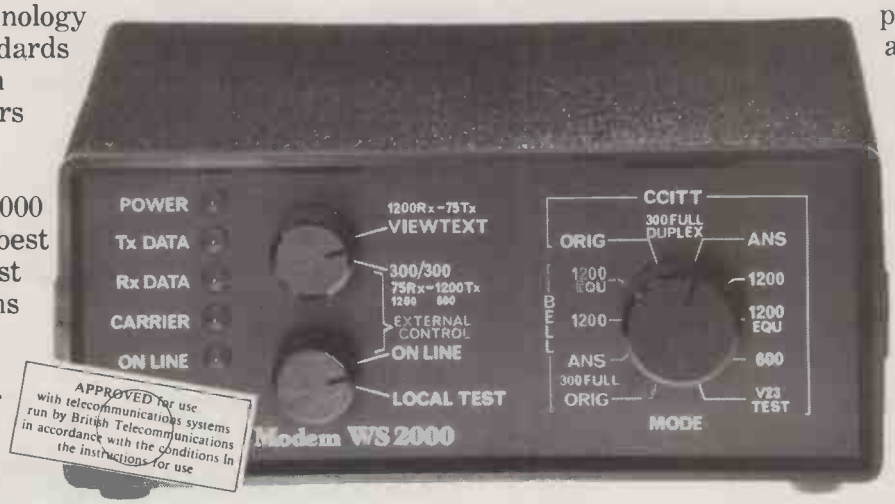

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WORD COUNTER

If your WP program lacks a word count facility, try this utility by John and Timothy Lee.

IT IS PROBABLY TRUE that more microcomputers are now used for word processing than are used to perform arithmetic calculations. The number of words in a manuscript is often part of a contract to write a book, and the number of words a key factor in determining if a magazine article will fit into the space allowed by the editor. In any case the number of words you have written each day provides a useful reminder of your progress.

Most word processors do not provide a utility for counting the number of words, but since the text is stored as ASCII characters in a disc file, it is reasonably straightforward to have a separate program which will read the file and count the number of words. The word-count program WC has been written to do this.

Though it is immediately obvious to a human being what constitutes the end of a word, computers are dumb, and can only do what they are told to do. It is necessary to define what constitutes a word to the computer. For present purposes, a word is a string of one or more letters or numbers that usually ends with a non-word character such as a space, a comma, a semicolon, a colon, a full stop, a question mark or an exclamation mark. To this list of non-word characters must be added the End of Line characters used by the computer — Carriage Return and Linefeed — and also the Tab character.

Problems arise over hyphenated words. If a word is hyphenated because it will not fit on a line and is therefore split on to two lines, the End of Line characters will mean that this counts as two words. If a hyphenated word occurs in the middle of a line, it will only count as one word. If a hyphen is counted as one of the non-word characters, then hyphenated words will always count as two words. There are also problems over counting a full stop as the end of a word, since file names such as WS.Com, Pip.Com or Stat.Com will each count as two words. Since a full stop at the end of a sentence is always followed by one or more spaces, or an End of Line character, it is better not to use the full stop as one of the end of word characters. The problem with file names then disappears.

The WC program works by reading a file character by character, and it counts the number of times when the character just read changes from a non-word character to a letter or number. The end of file character, Control-Z, is 1A hex or 26 decimal. When it is read the program stops reading and displays the number of words, together with the number of lines and the number of bytes used in the file.

A full listing of the program provides the source code in Intel mnemonics, and comments, and the hexadecimal code produced by the standard CP/M assembler Asm. Anybody with CP/M-80 should be able to use the program. To produce an executable .Com file you must first type in the mnemonics into a file called WC.Asm. This file should be an exact copy of the listing, except that the first 15 characters of each printed line should not be typed in. Then type the command

```
Asm WC
```

to make the CP/M assembler produce a hexadecimal .Hex file. Finally type the command

```
Load WC
```

to produce an executable file called WC.Com. To run the program, simply type

```
WC filename.extension
```

The WC program as printed works correctly. You may wish to change the list of non-word characters before assembling the program, but the three characters Space, Linefeed and Carriage Return are always counted as non-word characters. The seven characters comma, dot, question mark, exclamation mark, semicolon, colon and Tab all count as non-word characters, but the hyphen character does not. If you wish the hyphen to count as a non-word character you must change the False to True on line 17 so that the line becomes:

```
FHYPHN EQU     TRUE
```

Similarly if you do not want dot to count as a non-word character, so that WS.Com counts as a single word, you should change line 11 to read

```
FDOT EQU     FALSE
```

Finally, WC gives an indication that it is executing, rather than the machine having gone down, by continually underlining the Signon message. This is particularly useful to show that the program is working when the data file is large. This visible indication can be switched off by setting the flag on line 22 to read

```
FVISIB EQU     FALSE
```

WORD COUNTER

```
0100                    ORG     100H
0000 =                  FALSE   EQU     0
FFFF =                  TRUE    EQU     NOT FALSE
                ;
                ;       Flags to determine which characters count as "non-word
                ;       characters".  Choose whichever characters you want as
                ;       "non-word characters" by setting their flag to TRUE
                ;       If you dont want a character to count as a "non-word
                ;       character" then set the flag to FALSE
FFFF =                  FCOMMA  EQU     TRUE    ;Flag for Comma character ","
FFFF =                  FDOT    EQU     TRUE    ;Flag for Dot character "."
FFFF =                  FQUERY  EQU     TRUE    ;Flag for Question Mark "?"
FFFF =                  FEXCLM  EQU     TRUE    ;Flag for Exclamation Mark "!"
FFFF =                  FSEMIC  EQU     TRUE    ;Flag for Semicolon character ";"
FFFF =                  FCOLON  EQU     TRUE    ;Flag for Colon character ":"
FFFF =                  FTAB    EQU     TRUE    ;Flag for TAB character
0000 =                  FHYPHN  EQU     FALSE   ;Flag for hyphen character "-"
                ;
                ;       A visible indication that the program is executing
                ;       is provided by setting the following flag TRUE
                ;       Set FALSE if the indication is not required.
FFFF =                  FVISIB  EQU     TRUE
                ;
0000 =          REBOOT  EQU     0
0005 =          CPM     EQU     5
                ;
0007 =          BELL    EQU     7       ;ASCII BELL character
0009 =          TAB     EQU     9       ;ASCII TAB character
000A =          LF      EQU     0AH     ;ASCII LineFeed
000D =          CR      EQU     0DH     ;ASCII Carriage Return
001A =          EOF     EQU     26      ;CP/M End-Of-File character
                ;
005C =          FCB     EQU     5CH     ;Address of default CP/M FCB
0080 =          FILBUF  EQU     80H     ;Address of default CP/M buffer
                ;
0100 C37C01             JMP     START
0103 0D0A0A576F         DB      CR,LF,LF,'WordCount',CR,LF,LF
0112 50726F6772         DB      'Program to count the number of words and lines '
0141 696E20616E         DB      'in an input file',CR,LF
0153 5772697474         DB      'Written by Timothy D. Lee 16 May 1985',CR,LF,LF,EOF
```

(continued on next page)

WORD COUNTER

(continued from previous page)

```
017C 31A203    START:  LXI     SP,STACK
017F 117802            LXI     D,SIGNON
0182 0E09              MVI     C,9
0184 CD0500            CALL    CPM             ;Print Signon Message
0187 3A5D00            LDA     FCB+1
018A FE20              CPI     ' '             ;Check if a file name supplied
018C 118702            LXI     D,MSNAME
018F CA7002            JZ      ERROR           ;else error
               ;
0192 115C00            LXI     D,FCB
0195 0E0F              MVI     C,15
0197 CD0500            CALL    CPM             ;Try to open the file
019A 3C                INR     A
019B 11CF02            LXI     D,MSEXST
019E CA7002            JZ      ERROR           ;jump if error
               ;
01A1 AF                XRA     A
01A2 325F03            STA     LAST            ;Set LAST status flag
               ;
01A5 CD2902    LOOP:   CALL    GETCHR
01A8 FE1A              CPI     EOF
01AA CA0C02            JZ      ATEOF           ;Jump if End of File
               ;
01AD 211F03            LXI     H,CHARS+5
01B0 CD5B02            CALL    ADDONE          ;Count number of characters
01B3 7B                MOV     A,E
01B4 215203            LXI     H,LINES+5
01B7 FE0A              CPI     LF
01B9 CC5B02            CZ      ADDONE          ;Count number of lines
               ;
01BC 0600              MVI     B,0
01BE 7B                MOV     A,E
01BF FE20              CPI     ' '             ;Check for a space
01C1 CAF101            JZ      INTER           ;that separate words
01C4 FE0A              CPI     LF              ;check for LineFeed
01C6 CAF101            JZ      INTER
01C9 FE0D              CPI     CR              ;check for Carriage Return
01CB C2F301            JNZ     TEST
                       IF      FCOMMA
01CE FE2C              CPI     ','             ;possibly check for comma
01D0 CAF101            JZ      INTER
                       ENDIF
                       IF      FDOT
01D3 FE2E              CPI     '.'             ;possibly check for dot
01D5 CAF101            JZ      INTER
                       ENDIF

020C 211A03    ATEOF:  LXI     H,CHARS
020F CD6602            CALL    REMZER
0212 213603            LXI     H,WORDS
0215 CD6602            CALL    REMZER
0218 214D03            LXI     H,LINES
021B CD6602            CALL    REMZER
021E 0E09              MVI     C,9
0220 110E03            LXI     D,RESULT
0223 CD0500            CALL    CPM
0226 C30000            JMP     REBOOT

                       ;
                       ;       Subroutine to get next character from file.
                       ;       Character is returned in E and A registers.
                       ;       Returns ^Z at end of file
                       ;
0229 3A5E03    GETCHR: LDA     POINTR
022C 3C                INR     A               ;Increment POINTR
022D CC3B02            CZ      GETSEC          ;Get next sector
0230 6F                MOV     L,A
0231 2600              MVI     H,0             ;Set HL = POINTR
0233 325E03            STA     POINTR          ;store new POINTR
0236 7E                MOV     A,M             ;get next byte
0237 E67F              ANI     07FH            ;strip parity
0239 5F                MOV     E,A
023A C9                RET

                       ;
                       ;       Read Next Sector from disk file
                       ;
023B 115C00    GETSEC: LXI     D,FCB
023E 0E14              MVI     C,20
0240 CD0500            CALL    CPM             ;Read next sector from disk
                       ;
                       IF      FVISIB          ;Visible display of progress
0243 1E3D              MVI     E,'='
0245 3A6103            LDA     COUNT
0248 3D                DCR     A
0249 C25002            JNZ     VISIB2
024C 3E0A              MVI     A,10
024E 1E0D              MVI     E,CR
0250 326103    VISIB2: STA     COUNT
0253 0E02              MVI     C,2
0255 CD0500            CALL    CPM
                       ENDIF
0258 3E80              MVI     A,FILBUF
025A C9                RET
```

```
                        IF      FQUERY
01D8 FE3F               CPI     '?'             ;possibly check for query
01DA CAF101             JZ      INTER
                        ENDIF
                        IF      FEXCLM
01DD FE21               CPI     '!'             ;possibly check for
01DF CAF101             JZ      INTER           ;exclamation mark
                        ENDIF
                        IF      FSEMIC
01E2 FE3B               CPI     ';'             ;possibly check for semicolon
01E4 CAF101             JZ      INTER
                        ENDIF
                        IF      FCOLON
01E7 FE3A               CPI     ':'             ;possibly check for colon
01E9 CAF101             JZ      INTER
                        ENDIF
                        IF      FTAB
01EC FE09               CPI     TAB             ;possibly check for TAB
01EE CAF101             JZ      INTER
                        ENDIF
                        IF      FHYPHN
                        CPI     '-'             ;possibly check for hyphen
                        JZ      INTER
                        ENDIF


                ;
01F1 0601       INTER:  MVI     B,1
01F3 3A5F03     TEST:   LDA     LAST            ;Get the last status
01F6 B8                 CMP     B               ;is it same ?
01F7 CAA501             JZ      LOOP
01FA FE01               CPI     1               ;only count word -> interval
01FC C20502             JNZ     SAVSTA          ;transitions - not the opposite


                ;
01FF 213B03             LXI     H,WORDS+5
0202 CD5B02             CALL    ADDONE          ;Increment number of WORDS


                ;
0205 78         SAVSTA: MOV     A,B
0206 325F03             STA     LAST            ;Save new status
0209 C3A501             JMP     LOOP


                ;
                ;       Jump here when End Of File reached
                ;
```

```
                ;
                ;       Subroutine to Increment the ASCII number
                ;       held at location given by HL
                ;
025B 34         ADDONE: INR     M               ;Increment last digit
025C 7E                 MOV     A,M
025D FE3A               CPI     '9'+1
025F C0                 RNZ                     ;if digit > 9
0260 3630               MVI     M,'0'           ;reset to 0
0262 2B                 DCX     H               ;and increment next digit
0263 C35B02             JMP     ADDONE
                ;
                ;       Subroutine to remove leading zeroes
                ;
0266 7E         REMZER: MOV     A,M
0267 FE30               CPI     '0'             ;Is digit a 0?
0269 C0                 RNZ
026A 3620               MVI     M,' '           ;Replace leading 0 by space
026C 23                 INX     H               ;and test next digit
026D C36602             JMP     REMZER

                ;
                ;       Jump here if an error occurs
                ;
0270 0E09       ERROR:  MVI     C,9
0272 CD0500             CALL    CPM             ;Print appropriate Error message
0275 C30000             JMP     REBOOT

                ;
0278 0D0A0A576F FSIGNON: DB     CR,LF,LF,'WordCount',CR,LF,'$'
0287 070D0A596F FMSNAME: DB     BELL,CR,LF,'You must supply a filename when'
02A9 20696E766F         DB      ' invoking WC', CR,LF
02B7 6567202041         DB      'eg  A> WC report.txt',CR,LF,BELL,'$'
02CF 070D0A5468 MSEXST: DB      BELL,CR,LF,'The filename supplied does not'
02F0 2065786973         DB      ' exist on the current disk',CR,LF,BELL,'$'

                ;
030E 0D0A0A4669 RESULT: DB      CR,LF,LF, 'File has '
031A 3030303030 CHARS:  DB      '000001 characters',CR,LF,'      '
0336 3030303030 WORDS:  DB      '000000 words',CR,LF,'and      '
034D 3030303030 LINES:  DB      '000001 lines.',CR,LF,LF,'$'


                ;
035E FF         POINTR: DB      0FFH
035F 01         LAST:   DB      1
0360 00         BLOCK:  DB      0
0361 0A         COUNT:  DB      10
0362                    DS      64
                STACK:
03A2                    END
```

BY NICHOLAS McCUTCHEON

CHARPLOT

S BEATTIE has submitted a program that prints out a string in a user-specified height and width. It works equally well in any graphics mode.

The program cycles through the string, reads the character definition by an Osword call, then plots it via Oswrch on the screen in the specified size. To use the machine-code routine, call it with

X% = xwidth
Y% = ywidth
CALL CHARPLOT,xpos%,ypos%, A% or A$ or $A

Where Xwidth is equal to the width of 1/8th of one character and Ywidth is equal to the height of 1/8th of one character: Xpos%,Ypos% are the co-ordinates of the top left point of first character; A% is equal to the ASCII of the character to plot and A$ or $A contains the string to plot.

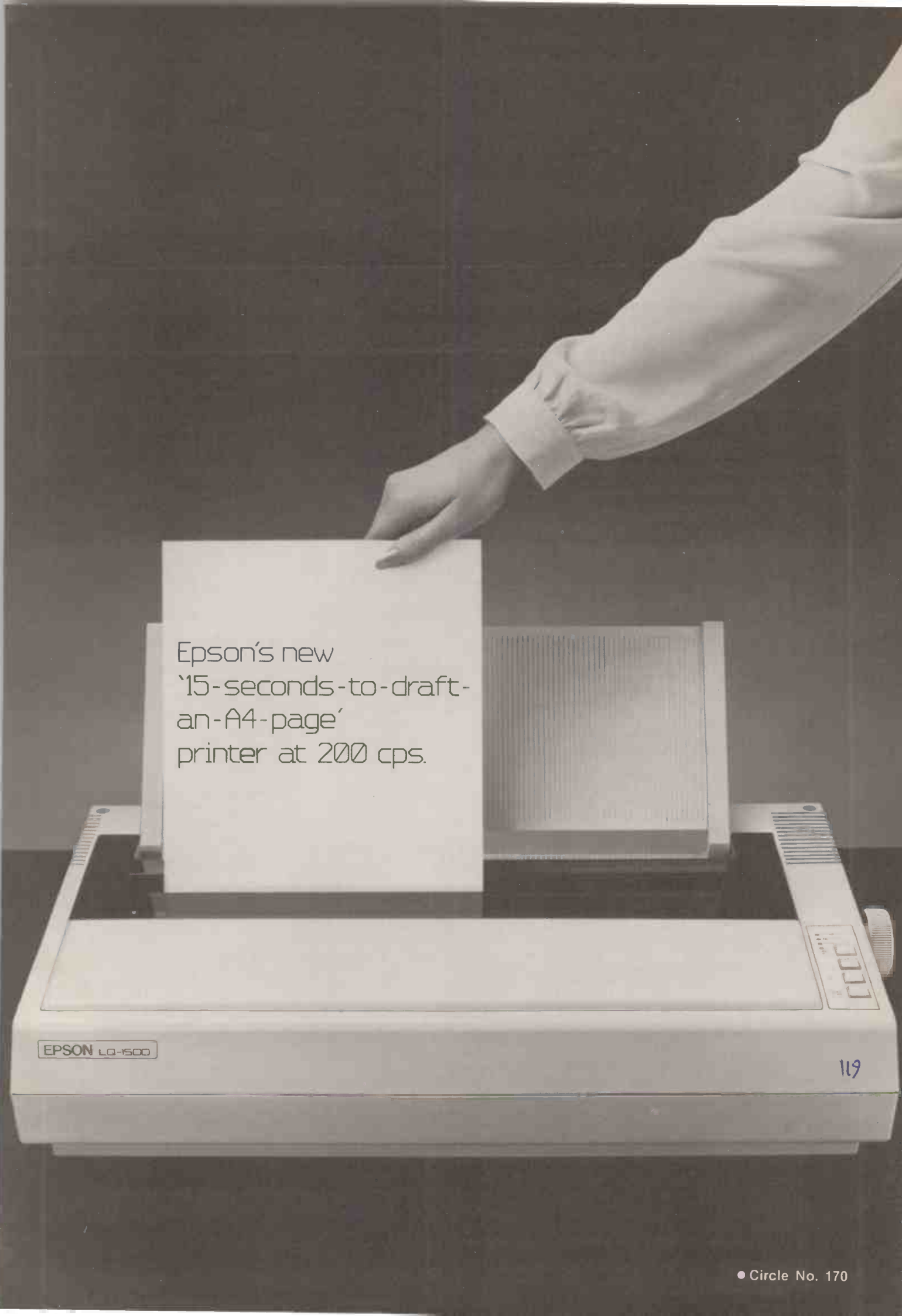
Lines 130 to 230 contain the main program. They call ProcAssemble to assemble the code and then run a short demo. Lines 240 onwards contain the assembly code for the routine: lines 960 to 1830 plot the characters and lines 1870 to 1950 contain a multiply by eight and plot routine.

For better definition with smaller characters it is worth specifying the starting co-ordinates as the top left position of a screen pixel.

CHARPLOT

```
  10 REM Print Large Characters (V
2.4)
  20 REM (C) S.Beattie 1985
  30 :
  40 REMEMBER:- Call this routine
in this form:-
  50 REM CALL M%,XP%,YP%,(A$ or A%
 or $A)
  60 REM with X% and Y% set to the
 x and y width of one letter divide
d by eight,
  70 REM M%=start of code,XP% and
YP%=top left coordinate of first ch
aracter,
  80 REM A$ or $A is the string to
 be printed, A% is the ascii code o
f a
  90 REM character to be printed
 100 :
 110 REM usemem is the start of a
useable zero-page block of RAM, of
27 bytes.
 120 REM M% is the start of a bloc
k of memory, of &180 bytes.
 130 usemem=&70
 140 :M%=&1200
 150 PROCassemble(M%)
 160 REM Demo
 170 MODE5:VDU23;8202;0;0;0;19,2,4
;0;:GCOL0,3:A$="CHARPLOT":X%=119:Y%
=863:FORI%=0TO3:PROCcharplot(X%+(I%
MOD2)*16,Y%-(I%DIV2)*16,16,16,A$):N
EXT
 180 GCOL0,1:PROCcharplot(127,Y%-8
,16,16,A$)
 190 PROCcharplot(575,607,8,12,"by
")
 200 X%=55:Y%=383:A$="S.Beattie"
 210 GCOL0,2:FORI%=0TO3:PROCcharpl
ot(X%+16*(I%MOD2),Y%-20*(I%DIV2),16
,20,A$):NEXT
 220 GCOL0,3:PROCcharplot(X%+8,Y%-
10,16,20,A$)
 230 END
 240 DEFPROCassemble(start%)
 250 charnum=usemem
 260 charstart=usemem+7:nochar=use
mem+9
 270 xmove=usemem+10:xwidth=usemem
+11
 280 ymove=usemem+12:ywidth=usemem
+13
 290 backxmove=usemem+14:backxwidt
h=usemem+15
 300 backymove=usemem+16:backywidt
h=usemem+17
 310 chardef=usemem+18
 320 oswrch=&FFEE:osword=&FFF1
 330 FORX%=1TO3STEP2
 340 P%=start%
 350 [OPT X%
 360 .CHARPLOT
 370 \ Sort out variables
 380 CPX#127:BCS parameters
 390 STX xwidth
 400 DEX:BMI parameters
 410 STX xmove
 420 CPY #127:BCS parameters
 430 STY ywidth
 440 DEY:BMI parameters
 450 STY ymove
 460 LDX #3
 470 :
 480 .backloop LDA#0:SEC:SBC xmove
,X
 490 STA backxmove,X
 500 DEX
 510 BPL backloop
 520 LDX #9
 530 :
 540 .paraloop LDA &600,X:STA usem
em,X
 550 DEX
 560 BNE paraloop
 570 LDA #4
 580 CMP usemem+3
 590 BNE parameters
 600 CMP usemem+6
 610 BNE parameters
 620 CMP usemem+9
 630 BNE string2
 640 LDA #1:STA nochar
 650 JMP start
 660 :
 670 .string2 LDA #128:CMP usemem+
9
 680 BNE string3
 690 LDY #0
 700 :
 710 .stringloop
 720 LDA (charstart),Y
 730 CMP#32
 740 BMI endstring
 750 INY:JMP stringloop
 760 :
 770 .endstring CPY #0:BEQ paramet
ers
 780 STY nochar:JMP start
 790 :
 800 .string3 LDA #129:CMP usemem+
9
 810 BNE parameters
 820 LDY #3
 830 LDA (usemem+7),Y
 840 BEQ parameters
 850 STA nochar
 860 LDY #0:LDA (usemem+7),Y:TAX
 870 INY:LDA (usemem+7),Y
 880 STA usemem+8:STX usemem+7
 890 JMP start
 900 :
 910 .parameters BRK
 920 ]:?P%=46:$(P%+1)="CALL Parame
ters":P%=P%+16
 930 [ OPT X%
 940 BRK
 950 \ MOVE XP%,YP%
 960 .start :LDA#25:JSR oswrch
 970 LDA#4:JSR oswrch:LDY#0
 980 LDA (usemem+4),Y:TAX:LDA (use
mem+1),Y:JSR oswrch
 990 INY:LDA (usemem+1),Y:JSR oswr
ch
1000 TXA:JSR oswrch
1010 LDA (usemem+4),Y:JSR oswrch
1020 :
1030 \ Loop through characters
1040 LDY#0:STY charnum
1050 :
1060 .charloop LDA (charstart),Y:S
TA chardef
1070 LDX#chardef MOD256
1080 LDY#chardef DIV256
1090 LDA #&A:JSR osword
1100 :
1110 \ Loop through rows.  X-regis
ter contains row number (0-7)
1120 LDX #0
1130 .yloop
1140 :
1150 \ Loop through columns. Y-reg
ister contains column number (0-7)
1160 LDY #8
1170 .xloop ROL chardef+1,X
1180 BCC noplot
1190 :
1200 \ PLOT rectangle
1210 .plot JSR move
1220 LDA xmove:JSR vduxyf
1230 JSR vduxyf
1240 JSR fill
1250 LDA backxmove:JSR vduxyb
1260 LDA backymove:JSR vduxyb
1270 JSR fill
1280 LDA xmove:JSR vduxyf
1290 JSR vduxyf
1300 JSR move
1310 LDA#1:JSR vduxyf
1320 LDA ymove:JSR vduxyf
1330 JMP continue
1340 :
1350 \ MOVE or VDU25,0
1360 .move LDA #25:JSR oswrch
1370       LDA #0 :JMP oswrch
1380 \ PLOT81, or VDU 25,81
1390 .fill LDA #25:JSR oswrch
1400       LDA #81:JMP oswrch
1410 \ output +ve relative move
1420 .vduxyf JSR oswrch
1430         LDA #0:JMP oswrch
1440 \ output -ve relative move
1450 .vduxyb JSR oswrch
1460         LDA #&FF:JMP oswrch
1470 :
1480 \ no rectangle to plot, so mo
ve to next position
1490 .noplot:JSR move
1500 LDA xwidth:JSR vduxyf
1510 JSR vduxyf
1520 :
1530 .continue
```

(listing continued on page 120)



CHARPLOT

(listing continued from page 118)

```
 1540 :
 1550 \ next column
 1560 DEY
 1570 BNE xloop
 1580 :
 1590 \ move to beginning of next r
ow
 1600 JSR move
 1610 LDY#&FF
 1620 LDA backxwidth
 1630 JSR move8
 1640 LDA backywidth:JSR vduxyb
 1650 :
 1660 \ next row
 1670 INX
 1680 CPX #8
 1690 BEQ y2
 1700 JMP yloop
 1710 :
 1720 \ move for next character
 1730 .y2:JSR move
 1740 LDY#0
 1750 LDA xwidth:JSR move8
 1760 LDA ywidth:JSR move8
 1770 :
 1780 \next character
 1790 LDY charnum:INY:CPY nochar:BE
Q finish
 1800 STY charnum:JMP charloop
 1810 :
 1820 \ end of routine
 1830 .finish:RTS
 1840 :
 1850 \ this routine multiplys a co
ordinate stored in the Y-register a
nd
 1860 \ Accumulator(lo-byte) and ou
tput to OSWRCH
 1870 .move8
 1880 ASLA:PHP
 1890 ASLA:PHP
 1900 ASLA:PHP
 1910 JSR oswrch
 1920 TYA:PLP:ROLA
 1930 PLP:ROLA
 1940 PLP:ROLA
 1950 JMP oswrch
 1960 :
 1970 ]
 1980 NEXT
 1990 ENDPROC
 2000 DEFPROCcharplot(XP%,YP%,X%,Y%
,A$)
 2010 CALL CHARPLOT,XP%,YP%,A$
 2020 ENDPROC
```

ITALICS

MERLIN GARDNER is indeed a wizard with the screen. This little program allows the display of italics in any mode other than 7.

Writing is unaffected until a { bracket is encountered, when it becomes italic until a } bracket. The effect is achieved by rotating the top of a character to the right and the bottom to the left. It is surprisingly effective and readable.

Once the program has been run it destroys itself, leaving one page of memory occupied. Providing this page is not touched, the program is fully compatible with other software. For example, it will put all writing in Pacman or Killer Gorilla into italics when placed into page &A00.

When you type the program in, leave out the first line until all the bugs have been ironed out, then insert it and save the program before running it.

The program uses a few addresses that are not guaranteed by Acorn against future releases, but it is certainly compatible with OS 1.0 and 1.2

ITALICS

```
  5 ?(PAGE+1)=255
 10 PLACE=&A00:*K.10 CALL&A00|M
 20 LOOKUPL=&F8:LOOKUPH=&F9:ITALM
ODE=&EB
 30 FOR I%=0 TO 2 STEP 2
 40 P%=PLACE:[OPT I%
 50 LDA #(PLACE DIV 256):STA &20F
:LDA #(PLACE MOD 256+11):STA &20E:R
TS
 60 STA LOOKUPL:PHA:LDA &355:CMP
#7:BNE GRAPHMODE
 70 PLA: JMP &E0A4
 80 .GRAPHMODE:TYA:PHA:TXA:PHA
 90 LDX #0: LDY #255:LDA #218: JS
R &FFF4:TXA:BNE NONITAL
100 LDA LOOKUPL: CMP #32:BCC NONI
TAL: CMP #127:BCS NONITAL
110 CMP #123:BEQ GOINTO:CMP #125:
BEQ GOOUTOF
120 LDA ITALMODE:BNE ITAL
130 .NONITAL:PLA:TAX:PLA:TAY:PLA:
JMP &E0A4
140 .GOOUTOF:LDA #0:STA ITALMODE:
BEQ CLEARUP
150 .GOINTO: LDA #1:STA ITALMODE:
 BNE CLEARUP
160 .ITAL:LDA #23: JSR &E0A4:LDA
#255: JSR &E0A4
170 LDA #0: STA LOOKUPH: LDY #3:L
DA LOOKUPL
180 .MULTBY8:CLC:ROL A:ROL LOOKUP
H: BCC NOCARRY: INC LOOKUPH
190 .NOCARRY:DEY:BNE MULTBY8:STA
LOOKUPL:CLC:LDA #191:ADC LOOKUPH:ST
A LOOKUPH
200 LDY #0: LDA (LOOKUPL),Y:ROR A
: JSR &E0A4
210 INY: LDA (LOOKUPL),Y:CLC:ROR
A:JSR &E0A4
220 INY: LDA (LOOKUPL),Y:JSR &E0A
4
230 INY: LDA (LOOKUPL),Y:JSR &E0A
4
240 INY: LDA (LOOKUPL),Y:CLC:ROL
A:JSR &E0A4
250 INY: LDA (LOOKUPL),Y:CLC:ROL
A:JSR &E0A4
260 INY: LDA (LOOKUPL),Y:CLC:ROL
A:JSR &E0A4
270 INY: LDA (LOOKUPL),Y:CLC:ROL
A:CLC:ROL A:JSR &E0A4
280 LDA #255:JSR &E0A4
290 .CLEARUP:PLA:TAX:PLA:TAY:PLA
300 RTS:]
310 NEXT I%
320 CALL PLACE
330 PRINT"{Italics} now operation
al. (NOT MODE7)"
340 PRINT"Open curly bracket to {
enter} italics.":PRINT"Close curly
bracket to {leave} italics."
```

TAPECAT

TAKING PRINTER COPIES of a tape catalogue is very frustrating because the operating system pushes out ODs and OAs like crazy. A J Terry's Tapecat program makes life a little easier. The relevant data is stored in memory, on OS1.2, from &03B2 onwards, terminated by a zero.

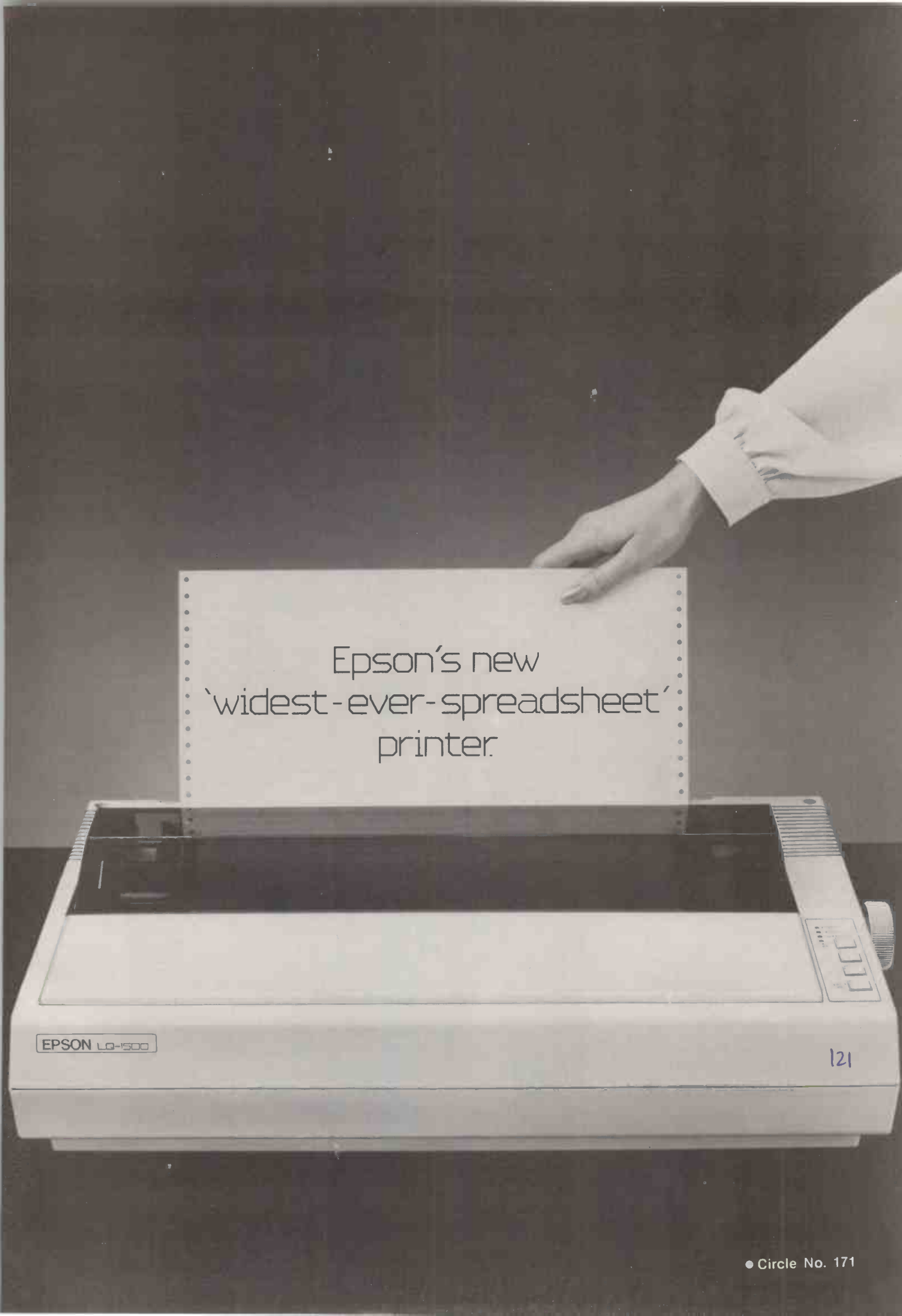
The program asks for and prints out the title of the tape and the side currently being read. To save paper and to make the output look neater, enter 2 in response to the side number request. The printout is then displaced to the right by 18 spaces. After side 1 has been listed, wind the printer back until the print head is in line with the first heading, then press Escape.

Line 30 sends auto line feed signal to printer. Line 40 turns off all loading messages. Line 50 instructs the system to ignore all loading errors. Line 110 turns the printer on. Line 160 reads the next program into RAM to pick up the program name.

In Line 180 the program scans memory for the program name, and line 190 issues a beep to signal that the program has loaded. Line 220 turns the printer off, and displays errors. PC

TAPECAT

```
 10 ON ERROR GOTO 220
 20 *TAPE
 30 *FX6,0
 40 *OPT 1,0
 50 *OPT 2,0
 60 CLS:INPUT''''"Tape name "T$
 70 INPUT'"Side no. "N$
 80 N=VAL(N$): IF N<1 OR N>2 THEN
70
 90 SP$="":IF N=2 THEN SP$=STRING
$(LEN(T$)+8+LEN(N$)+10," ")
100 CLS
110 VDU 2
120 PRINT SP$;T$" - Side "N$
130 PRINT SP$;STRING$(LEN(T$)+8+L
EN(N$),"~")
140 PRINT
150 REPEAT
160 *LOAD "" 3000
170 A$ = ""
180 FOR I=946 TO 957:A=?I:IFA<>0
THEN A$=A$+CHR$(A):NEXT ELSE I=957:
NEXT
190 SOUND 1,-15,150,2
200 PRINTSP$;A$
210 UNTIL FALSE
220 VDU3
230 GOTO 60
```



TERMINAL DEMO

THE LISTING shows a very simple dumb terminal demonstration program for the popular CCS-7710A serial card for the Apple II + and the Apple IIe. The program assumes that the card is in Slot 2. I have included plenty of Rem statements but you should not enter them as they slow down the program.

You will find that even at low baud rates this program will lose characters because Applesoft is not particularly fast. If you compile the program using one of the various Applesoft compilers on the market then the program will function perfectly at 300 baud.

GRAPHICS APPRENTICE

GRAPHICS APPRENTICE is a fun program for making computer doodles on the Apple. Although the program is fairly simple, with a little perseverance you can create some quite complicated drawings.

You can use paddles, but it is far easier to use a joystick which does not self-centre. On running the program, you see a cross-wire cursor appear on the high-resolution screen. The cursor can be moved around the screen using the joystick, without drawing any lines.

If you position the cursor and press paddle button 0 — or the Open-Apple key if you are using the IIe — to indicate the starting point of a line. Keep your finger on the button until the program beeps to tell you that the point has been memorised.

Now you can move the cursor to any other screen position. On pressing Paddle Button 1 — the Solid-Apple key on the IIe — a line will appear from the point you have defined to the point at which the cross-wire cursor is currently positioned.

You can move the cursor about on the screen, and the start of any line drawn will always be the original point defined, until you define a new starting point by positioning the cursor and pressing Paddle Button 0 again. After a little practice you will find this routine quite easy.

To stop the program and save the picture on disc, press the space bar, and type

TEXT<return>
BSAVE<filename>, A$4000, L$2000<return>

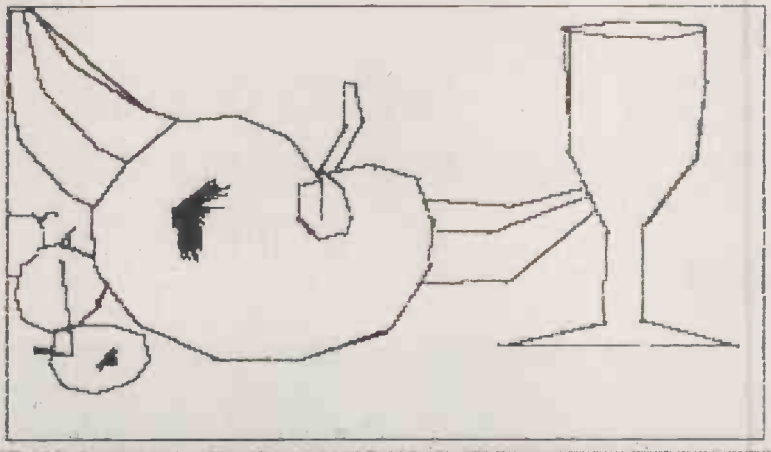
The cross-wire cursor does not wipe out any existing lines when it moves over them. This is because I have used XDraw twice to draw the cursor shape table, rather than Draw and XDraw. My original version of this program used Draw and XDraw, and I had to draw the cursor on HGR Page 1 and the drawing on HGR Page 2 to stop points on the lines being erased by the cursor. So to see the cursor and the drawing simultaneously, the original program had to flip back and forth between the Hires pages. Even though the program was short, the resulting flicker was far too much of an eye strain. But using only Hires Page 2 and XDraw twice to draw the cross wire did the trick. PC

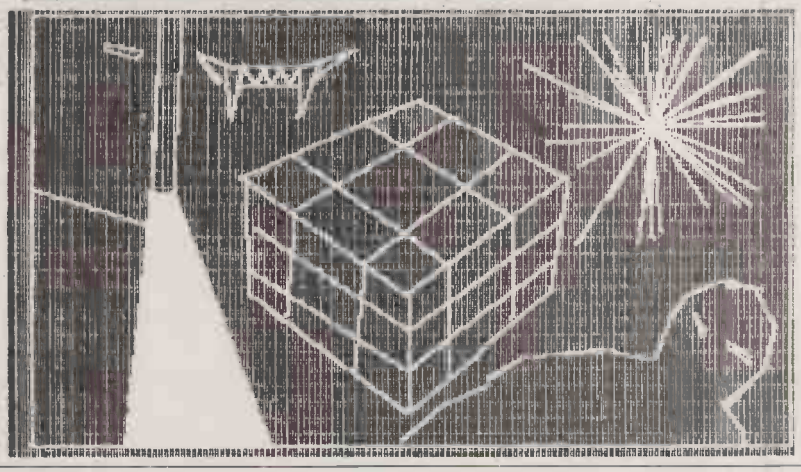
TERMINAL DEMO

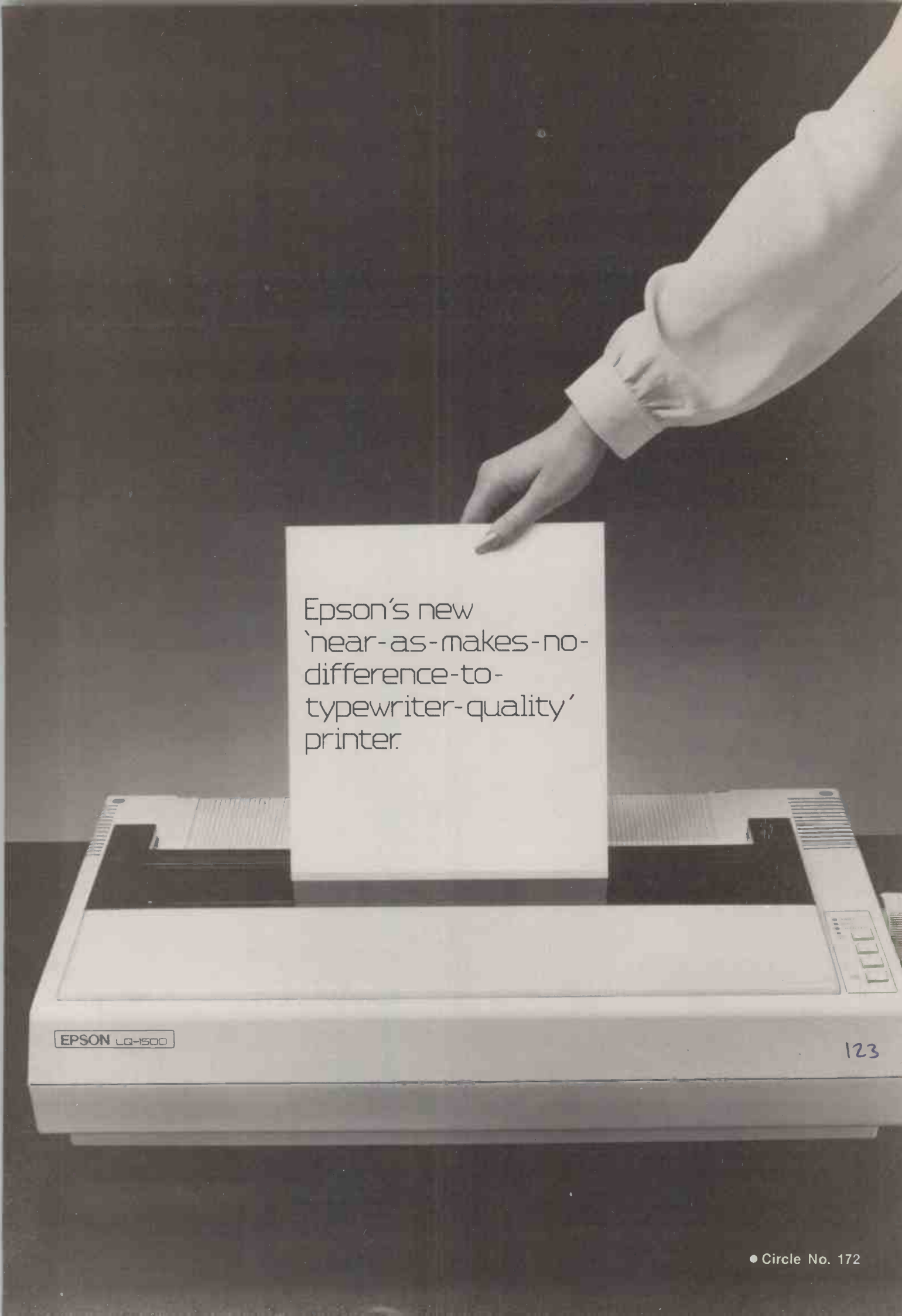
```
1  REM CCS 7710A CARD IN SLOT 2
5  REM 8 DATA + 1 STOP + NO PARIT
     Y
10  POKE 49312,23: REM ACIA RESET
20  POKE 49312,21: REM  SET CTS O
     N THE FEMALE DCE PLUG HIGH
30 B =  PEEK (49312): REM INPUT R
     EADY?
40  IF (B / 2 -  INT (B / 2)) = 0
      THEN  GOTO 80
50 A =  PEEK (49313): REM GET INP
     UT CHAR. FROM ACIA
70  PRINT  CHR$ (A);: REM PRINT C
     HAR. ON SCREEN
80 K =  PEEK (49152): REM HAS A K
     EY BEEN PRESSED?
90  IF K < 128 THEN  GOTO 30: REM
     IF NOT, GOTO 30
100 L =  PEEK (49168): REM CLEAR
     KEYBOARD STROBE
110  IF K = 129 THEN  END
120  WAIT 49312,2: REM WAIT UNTIL
      O.K. TO OUTPUT
130  POKE 49313,K: REM OUTPUT CHA
     R. TO ACIA
140  GOTO 30
```

GRAPHICS APPRENTICE

```
10  FOR X = 24576 TO 24586
20  READ A
30  POKE X,A
40  NEXT X
50  DATA  1,0,4,0,36,36,159,42,45
     ,37,0
60  POKE 232,0: POKE 233,96
80  HGR2
90  HCOLOR= 3
100 X =  PDL (0)
140 P% = X * 279 / 256 + 1
145 Y =  PDL (1)
150 Q% = Y * 191 / 256 + 1
210  ROT= 0
220  SCALE= 2
230  XDRAW 1 AT P%,Q%
240  FOR I = 1 TO 10: NEXT I
250  XDRAW 1 AT P%,Q%
320 R =  PEEK ( - 16287)
340  IF R > 127 THEN X% = P%:Y% =
     Q%: PRINT  CHR$ (07)
400 S =  PEEK ( - 16286)
425  IF S > 127 THEN  HPLOT X%,Y%
      - 4 TO P%,Q% - 4
500 T =  PEEK ( - 16384)
520  POKE  - 16368,0
530  IF T <  = 127 THEN 100
540  END
```







OPEN FILE

EASTER CALENDAR

CALCULATING the day on which Easter Sunday falls is not something you need to do every week. But the rather arcane procedures required are ideally suited to micros.

John Owen has produced a program which does just this for any year from 1751 to 4903. The first cut-off corresponds to the introduction of the present Gregorian calendar. To use the program, you simply run it then type in the year.

BEST FIT

DAVE WESTMORELAND has provided a simple curve-fitting program that uses Lagrange's method to plot a curve to fit a series of given points.

The program begins by asking you to name the graph, give the number of data pairs, and then name the horizontal and vertical variables. You also have to give the maximum vertical value. The program will then set the appropriate scales. You then feed in the points, giving the x co-ordinate first, and in descending order.

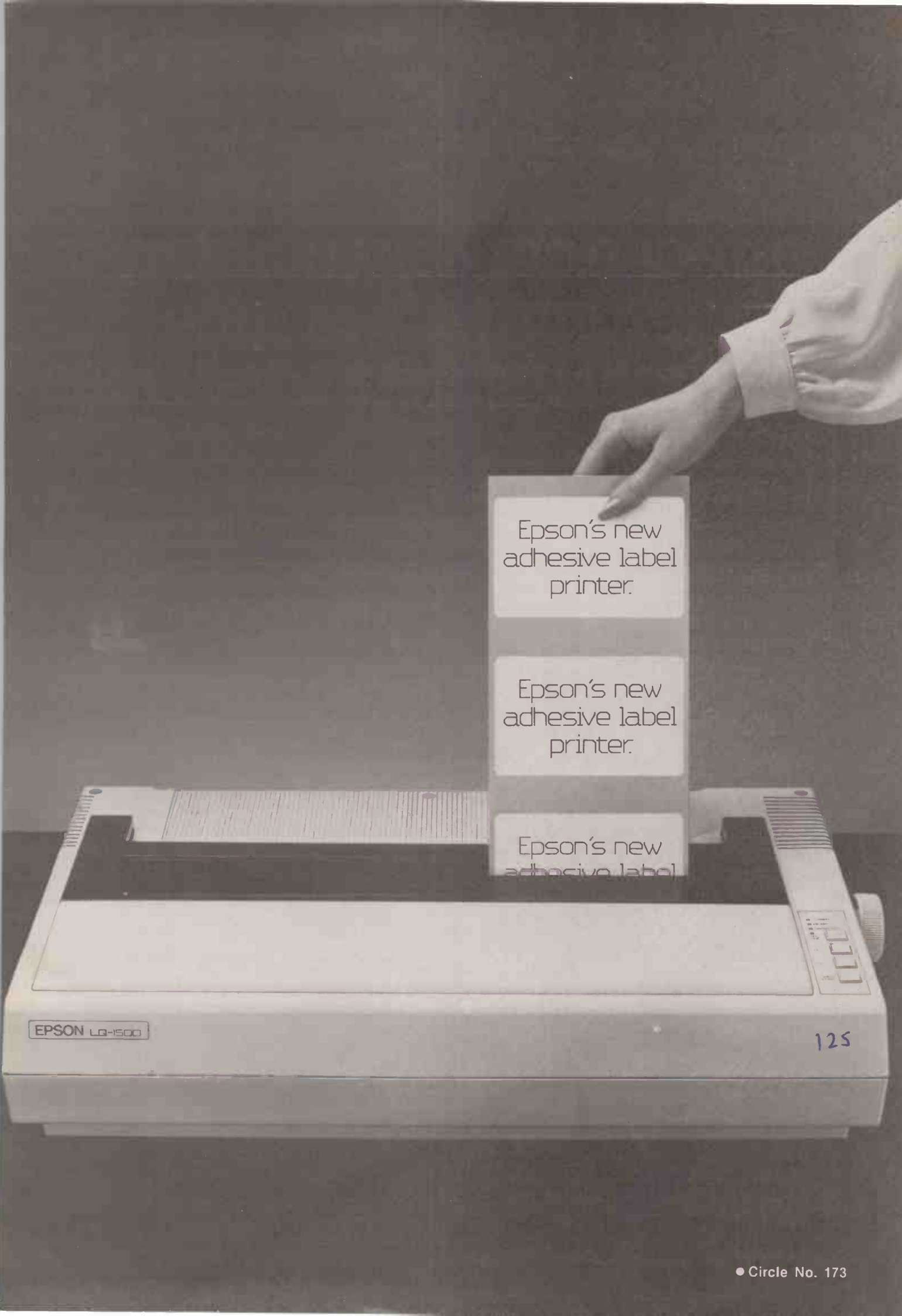
A nice feature is the ability to feed in a new y-value and have the program calculate the relevant x-value. PC

EASTER CALENDAR

```
110 REMark   Easter Sunday cal.
120 REMark finds date of easter in given year (a.d.)
130 REMark J.R.O. 12/1/85
140 REMark
150 DIM month$(5)
160 REMark
170 REMark        open screen
180 REMark
190 MODE 512
200 OPEN £3,con_512x256a0x0
210 PAPER £3,1:CLS £3         :REMark black background
220 OPEN £4,con_424x202a44x27
230 INK £4,7:BORDER £4,1,3
240 CSIZE £4,1,0
250 REMark
260 REMark
270 REPeat cal_estr
280 UNDER £4,1:PRINT £4,"Date of Easter calculator":U
NDER £4,0
290 PRINT £4:INPUT £4,"Year date is to be calculated
for: ";year
300 REMark
310 REMark get 'golden number' (1 to 19)
320 LET g=(year MOD 19)+1
330 REMark
340 REMark get century
350 LET c=INT(year/100)+1
360 REMark
370 REMark leap year and lunar orbit corrections
380 LET x=INT(3*c/4)-12
390 LET z=INT((8*c+5)/25)-5
400 REMark
410 REMark find sunday
420 LET d=INT(5*year/4)-x-10
430 REMark
440 REMark calc epact
450 LET e=(11*g+20+z-x) MOD 30
460 IF (e=25 AND g>11) OR e=24 THEN LET e=e+1
470 REMark
480 REMark calc. full moon
490 LET n=44-e
500 IF n<21 THEN LET n=n+30
510 REMark
520 REMark advance n to a sunday
530 LET n=n+7-(d+n) MOD 7
540 REMark
550 REMark march or april?
560 IF n>31 THEN
570     LET month$="April"
580     LET n=n-31
590 ELSE
600     LET month$="March"
610 END IF
620 REMark
630 REMark output result
640 REMark
650 PRINT £4,"In ";year;" Easter (Sunday) is/was on t
he ";n;
660 LET worka=(n MOD 10)+3*(n<14 AND n>10)
670 SELect ON worka
680     ON worka=1
690     PRINT £4,"st";
700     ON worka=2
710     PRINT £4,"nd";
720     ON worka=3
730     PRINT £4,"rd";
740     ON worka=0,4 TO 9
750     PRINT £4,"th";
760 END SELect
770 PRINT £4," of ";month$
780 PRINT £4,"Press any key to continue..."
790 PAUSE
800 END REPeat cal_estr
```

BEST FIT

```
4100 REMark prog name---lagran1
110 CLS
120 a1=RESPR(1024)
130 DIM x(20),y(20),e(20),g(20),y1(20)
140 PRINT"curve fitting program using lagranges formu
la"
150 PRINT"with optional screen dump"
160 REMark by dave westmoreland 8-10-84
170 PAUSE 500
180 PAPER 0:INK 7:CLS
190 PRINT
200 INPUT"title of graph?"!title$
210 INPUT"enter number of data pairs"!p
220 INPUT"horizontal variable"!hoz$
230 INPUT"verical variable"!vert$
240 PRINT"give max value of ";
250 INPUT(vert$)!ymax
260 PRINT"enter "¡hoz$¡" then ";vert$
270 PRINT"entering "¡hoz$¡" in descending order"
280 FOR i=1 TO p
290 INPUT x(i),y(i)
300 END FOR i
310 gra
320 INPUT£0;"do you want a copy of this graph"!q$
330 IF q$="y" THEN GO SUB 1140
340 INPUT£0;"do you want a listing of data values"!q$
350 IF q$="n" OR q$="no" THEN GO TO 450
360 CLS
370 AT 2,2:PRINT hoz$
380 AT 2,13:PRINT vert$
390 FOR i=1 TO p
400 AT 2+i,2:PRINT x(i)
410 AT 2+i,13:PRINT y(i)
420 NEXT i
430 INPUT£0;"do you want a hard copy"!q$
440 IF q$="y" OR q$="yes" THEN GO SUB 1140
450 INPUT£0;"do you want to do any calculations"!q$
460 IF q$="n" OR q$="no" THEN STOP
470 CLS
480 INPUT"enter number of calculations"!s
490 FOR z=1 TO s
500 INPUT (vert$)!y1(z)
510 e(z)=0
520 FOR f=1 TO p
530 g(z)=1
540 FOR i=1 TO p
550 IF i<>f THEN
560 g(z)=g(z)*(y1(z)-y(i))/(y(f)-y(i))
570 END IF
580 END FOR i
590 e(z)=e(z)+g(z)*x(f)
600 END FOR f
610 PRINT hoz$;"=";e(z)
620 END FOR z
630 INPUT"any more calcs?";q$
640 IF q$="y" OR q$="yes" THEN GO TO 480
650 STOP
660 DEFine PROCedure gra
670 CLS
680 LINE 18,10
690 LINE TO 18,90
700 LINE 18,10
710 LINE TO 160,10
720 AT 18,2:PRINT"   ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !"
730 CURSOR 12,1
740 FOR i=2 TO 17
750 AT i,3:PRINT"_"
760 NEXT i
770 INPUT£0;"plot points only?"!q$
780 IF q$="y" THEN GO TO 930
790 LINE (18+(140*x(p)/x(1))),(10+(76*y(p)/ymax))
800 FOR z=x(p) TO x(1) STEP x(1)/15
810 l=0
820 FOR k=1 TO p
830 r=1
840 FOR i=1 TO p
850 IF i<>k THEN
860 r=r*(z-x(i))/(x(k)-x(i))
870 END IF
880 NEXT i
890 l=l+r*y(k)
900 NEXT k
910 LINE TO 18+z*140/x(1),10+l*76/ymax
920 NEXT z
930 FOR i=1 TO p
940 IF y(i)=0 THEN GO TO 990
950 IF x(i)=0 THEN GO TO 990
960 scay=ymax/y(i)
970 scax=x(1)/x(i)
980 CIRCLE 18+140/scax,10+76/scay,1
990 NEXT i
1000 AT 19,15:PRINT hoz$
1010 AT 19,3:PRINT "0"
1020 AT 19,33:PRINT x(1)
1030 AT 18,35:PRINT"^"
1040 AT 17,1:PRINT "0"
1050 AT 2,1:PRINT ymax
1060 FOR c=1 TO LEN(vert$)
1070 AT c+3,1:PRINT vert$(c)
1080 NEXT c
1090 CURSOR 35,1
1100 PRINT title$
1110 PAUSE 500
1120 END DEFine
1130 REMark gprint_prt is screen dump data from EASEL
1140 CLS£0:a1=RESPR(1024):LBYTES mdv1_gprint_prt,a1:C
ALL a1
1150 RETurn
```



BY MIKE TODD

DIRECTORY DATABASE

THERE IS OFTEN a need for a simple means of storing a small quantity of data on a computer. Expensive database programs are one way, but they are overkill in many applications. Dr Frank Rooney has a simple but effective data-storage program which he uses regularly on his Commodore 64.

The program is self explanatory in operation through a series of menus. It allows a data file of up to 253 entries to be created, data entered, sorted and listed and saved back to disc or tape, and allows selected entries to be displayed.

Each data entry contains a number of lines, each with a title and a maximum length specified when the file is created. The maximum number of entries is a function of the number of characters to be stored, and could be readily changed. The variable EN holds the current number of entries.

Cursor-control characters are shown inside square brackets in the listing. The graphics characters like those in line 540 are obtained by pressing Shift and the asterisk together.

DIRECTORY DATABASE

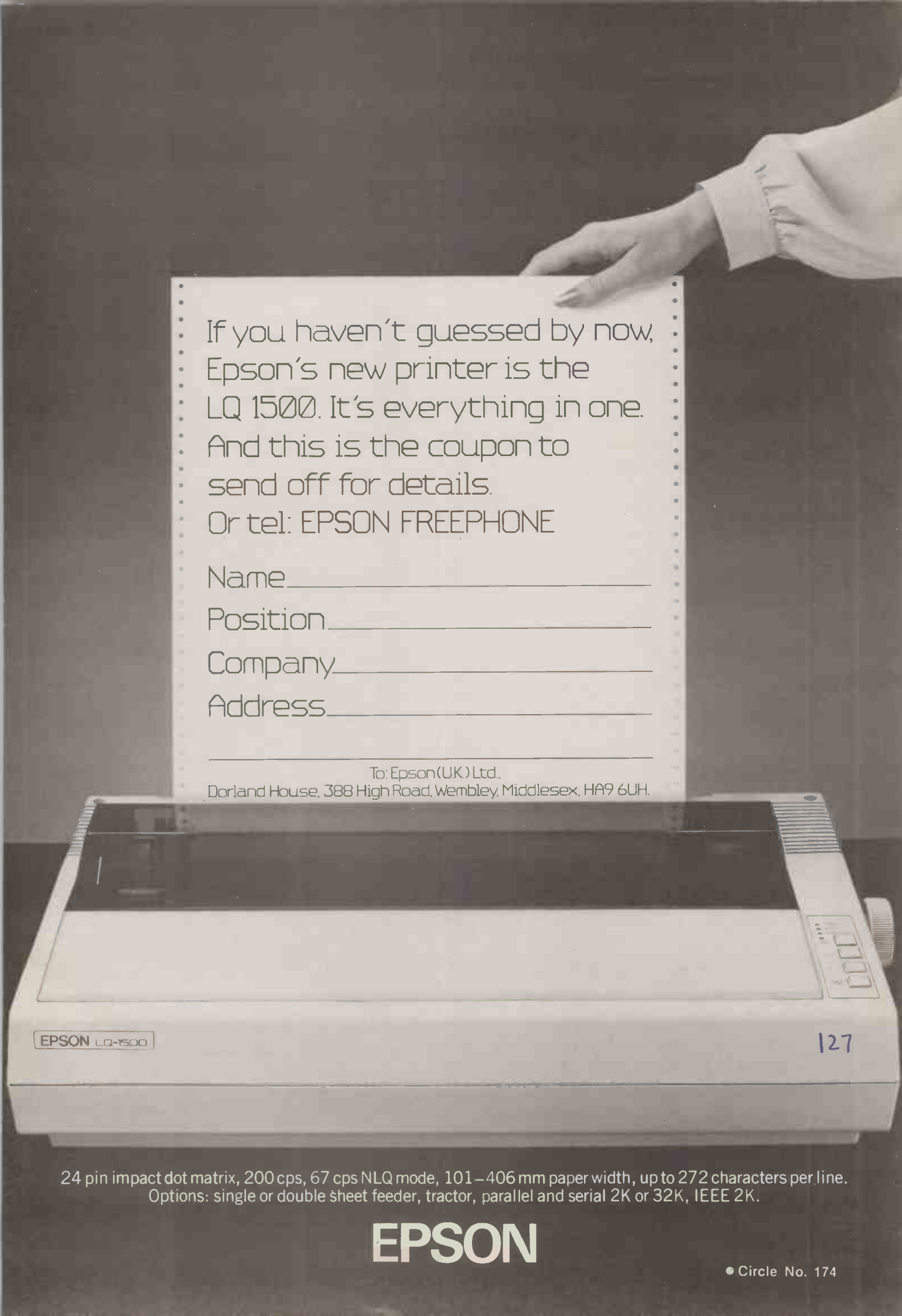
```
10 REM ****************************************
20 REM *  DIRECTORY DATABASE FOR COMMODORE 64  *
30 REM *          (C) FRANK  ROONEY 1983       *
40 REM ****************************************

100 GOTO 2570
110 REM ******************************  S O R T
120 F3$="SORTED":GOSUB 2960:POKE BD,6:POKE SC,6
130 PRINT"[CLEAR,WHITE]SORTING..."
140 S=1:SL(1)=1:SR(1)=EN
150 Q=SL(S):R=SR(S):S=S-1
160 X=Q:J=R:X$=N$(F,INT((Q+R)/2))
170 IF N$(F,X)<X$THEN X=X+1:GOTO 170
180 IF X$<N$(F,J)THEN J=J-1:GOTO 180
190 IF X>J THEN 230
200 FOR I=1 TO N
210 O$(I)=N$(I,X):N$(I,X)=N$(I,J)
    :N$(I,J)=O$(I):NEXT I
220 X=X+1:J=J-1
230 IF X<=J THEN 170
240 IF X>=R THEN 260
250 S=S+1:SL(S)=X:SR(S)=R
260 R=J
270 IF Q<R THEN 160
280 IF S<>0 THEN 150
290 GOTO 520

300 REM *********  R E A D    D A T A    F I L E
310 POKE 53280,15:POKE 53281,15
    :PRINT"[CLEAR,RED]";:INPUT"[RVS]
     ENTER FILENAME: [RVOFF,BLUE]";F$
320 F$=F$+LEFT$(SP$,16):F$=LEFT$(F$,16)
330 PRINT"[DOWN3,RED,RVS] PLEASE SELECT:
    [RVOFF]  T [BLUE]FOR TAPE[DOWN2,
    LEFT10,RED]D [BLUE]FOR DISK"
340 GET A$:IF A$="T"THEN DV=1:DV$="TAPE"
    :DF$=F$:GOTO 370
350 IF A$="D"THEN DV=8:DV$="DISK":DF$=
    "0:"+F$+",S,R":GOTO 370
360 GOTO 340
370 PRINT TAB(10)"[RED,DOWN3]
    INSERT THE DATA "DV$
380 PRINT TAB(7):PRINT"[DOWN]PRESS [RVS]
     RETURN [RVOFF] WHEN READY[DOWN2]"
390 GET A$:IF A$<>CHR$(13)THEN 390
400 POKE BD,5:POKE SC,5:PRINT"[CLEAR,WHITE]
    READING "F$:OPEN 2,DV,0,DF$
410 INPUT£2,N,L
420 FOR I=1 TO N:INPUT£2,C$(I):NEXT I
430 DIM N$(N,255),D$(255),W$(255)
440 INPUT£2,EN:FOR X=1 TO EN
450 FOR I=1 TO N:INPUT£2,N$(I,X)
460 IF N$(I,X)=""THEN N$(I,X)=" "
470 NEXT I:NEXT X:CLOSE 2:GOTO 490
480 DIM N$(N,255),D$(255),W$(255)
490 P$=LEFT$(SP$,L-2)
500 L$="<"+LEFT$(LL$,L)+">"
510 REM *****************  M A I N    M E N U
520 PRINT"[CLEAR]":D1=0:D2=0:D3=0:FD=0
    :POKE BD,6:POKE SC,1
530 PRINT"[CLEAR,DOWN,RED]  "F$;TAB(26)EN
    "[BLUE]ENTRIES"
540 PRINT"[40SHIFT+*] [UP2]"
550 PRINT TAB(11)"[DOWN,RED]1.[BLUE]
       ENTER DATA"
560 PRINT TAB(11)"[DOWN,RED]2.[BLUE]
       SORT DATA"
570 PRINT TAB(11)"[DOWN,RED]3.[BLUE]
       CHECK/ALTER DATA"
580 PRINT TAB(11)"[DOWN,RED]4.[BLUE]
       DELETE DATA"
590 PRINT TAB(11)"[DOWN,RED]5.[BLUE]
       SCREEN-LIST"
600 PRINT TAB(11)"[DOWN,RED]6.[BLUE]
       PRINT-OUT"
610 PRINT TAB(11)"[DOWN,RED]7.[BLUE]
       SAVE FILE"
620 PRINT TAB(11)"[DOWN,RED]8.[BLUE]
       CLEAR FILE"
630 PRINT TAB(11)"[DOWN,RED]9.[BLUE]
       EXIT PROGRAM"
640 PRINT TAB(9)"[DOWN,RED,RVS]
     PRESS NUMBER REQUIRED [RVOFF]"
650 GET A$:A=VAL(A$):IF A<1 OR A>9 THEN 650
660 ON A GOTO 680,120,1420,1330,1580,1890,
    2280,2460,2460

670 REM *************  N E W    E N T R I E S
680 POKE BD,15:POKE SC,15
690 IF EN>253 THEN PRINT"[CLEAR,RED,RVS]
     FILE FULL [RVOFF]":FOR DL=1 TO 2000
    :NEXT DL:GOTO 520
700 X=EN
710 X=X+1
720 PRINT"[CLEAR,RED]ENTER [RVS]-[RVOFF]
     IF NO ENTRY IS REQUIRED"
730 PRINT"[DOWN]ENTRY NO.";X:PRINT
740 FOR I=1 TO N
750 PRINT"[RED]"C$(I);LEFT$(SP$,
    39-LEN(C$(I))):PRINT"[DOWN,GREEN] "L$;
    :PRINT"[UP2]"
760 INPUT"[BLUE]";N$(I,X)
770 IF N$(I,X)="-"THEN N$(I,X)=" "
780 IF N$(I,X)="0"THEN EN=X-1:GOTO 520
790 IF LEN(N$(I,X))>L THEN N$(I,X)=
    LEFT$(N$(I,X),L)
800 NEXT I
810 PRINT"[HOME,RED]  IS ALL THE ABOVE
     CORRECT ? (Y OR N) "
820 GET A$:IF A$="Y"THEN 860
830 PRINT SP$:PRINT"[UP4]"
840 IF A$="N"THEN GOSUB 1440:PRINT"[CLEAR]"
    :GOTO 860
850 GOTO 820
860 PRINT"[HOME] ARE THERE ANY MORE ENTRIES
     ? (Y OR N)"
870 GET A$:IF A$="Y"THEN 710
880 IF A$="N"THEN EN=X:GOTO 520
890 GOTO 870
900 REM *******  S E A R C H    E N T R I E S
910 IF FD=1 THEN 990
920 POKE BD,1:POKE SC,1:PRINT"[CLEAR,RED]
    SELECT FIELD TO BE SEARCHED:"
930 FOR I=1 TO N:PRINT TAB(10)"[DOWN,RED]"I"
    :  [BLUE]"C$(I):NEXT I
940 PRINT TAB(11)"[DOWN,RED]N
    :  [GREEN]RECORD NUMBER"
950 PRINT"[DOWN2]    [RED,RVS]
     PLEASE SELECT NUMBER REQUIRED [RVOFF]"
    :FD=1
960 GET A$:IF A$="N"THEN FD$="RECORD NUMBER"
    :GOTO 990
970 F=VAL(A$):IF F<1 OR F>N THEN 960
980 FD$=C$(F)
990 POKE BD,15:POKE SC,15:PRINT"[CLEAR,RED]
    ENTER "FD$
1000 PRINT"[DOWN,RED](0 TO RETURN TO
      DIRECTORY)[DOWN]"
1010 INPUT"[BLUE] ";DT$:PRINT
     :IF DT$="0"THEN D1=0:D2=0:GOTO 520
1020 IF A$<>"N"THEN GOSUB 1110:RETURN
1030 X=VAL(DT$):IF X>EN THEN PRINT"[UP2]
     "SP$"[UP]":GOTO 1010
1040 IF D1=0 AND D3=0 THEN RETURN
1050 PRINT"[DOWN]ENTRY NO."X:PRINT
     :FOR I=1 TO N:PRINT N$(I,X):NEXT I:D1=0
1060 IF D2=0 THEN RETURN
1070 PRINT"[DOWN]IS THIS THE ENTRY REQUESTED
      ? (Y OR N)"
1080 GET A$:IF A$="Y"THEN RETURN
```

(listing continued on page 128)



24 pin impact dot matrix, 200 cps, 67 cps NLQ mode, 101–406 mm paper width, up to 272 characters per line.
Options: single or double sheet feeder, tractor, parallel and serial 2K or 32K, IEEE 2K.

EPSON

• Circle No. 174

DIRECTORY DATABASE

(listing continued from page 126)

```
1090 IF A$="N"THEN 910
1100 GOTO 1080
1110 V=0:X=1
1120 IF N$(F,X)=DT$THEN V=V+1:H(V)=X
1130 IF X>EN THEN X=EN:GOTO 1150
1140 X=X+1:GOTO 1120
1150 IF V=0 THEN 1220
1160 IF V=1 THEN X=H(V):D1=0:GOTO 1040
1170 PRINT"NO.":FOR X=1 TO V:P=H(X)
1180 PRINT P;" ";N$(F,P):NEXT X:PRINT SL$
1190 INPUT"[RED]ENTER NO.  (0 IF NONE): ";X
     :IF X=0 THEN 910
1200 IF X>EN THEN GOTO 1190
1210 GOTO 1040
1220 PRINT"[DOWN,RED,RVS] NO SUCH ENTRY
      FOUND [RVOFF]"
1230 X=1
1240 IF LEFT$(N$(F,X),3)=LEFT$(DT$,3)
     THEN V=V+1:H(V)=X
1250 IF X>EN THEN X=EN:GOTO 1270
1260 X=X+1:GOTO 1240
1270 IF V=0 THEN 990
1280 PRINT"[DOWN,RED] PERHAPS THE SPELLING
     IS WRONG"
1290 PRINT" SIMILAR ENTRIES ARE:[BLUE,DOWN]"
     :IF V>1 THEN D1=0:GOTO 1170
1300 FOR DD=1 TO 1000:NEXT DD:D1=0
1310 X=H(V):GOTO 1040

1320 REM *************  D E L E T E    D A T A
1330 FD=0
1340 D1=1:D2=1:D3=1:GOSUB 910
1350 POKE BD,0:POKE SC,0
1360 PRINT"[DOWN,CYAN]JUST A MOMENT....."
1370 G=X:FOR I=1 TO N:N$(I,G)="":NEXT I
1380 FOR X=G TO EN:FOR I=1 TO N
1390 N$(I,X)=N$(I,X+1):NEXT I:NEXT X
1400 EN=EN-1:GOTO 1340

1410 REM ***************  A L T E R    D A T A
1420 GOSUB 910
1430 GOSUB 1440:GOTO 1420
1440 POKE BD,15:POKE SC.15
     :PRINT"[CLEAR,GREEN]   <"P$">"
1450 FOR I=1 TO N:PRINT"[RED]"I"[BLUE]"
      N$(I,X):NEXT I
1460 PRINT"[GREEN]"SL$
1470 PRINT"[RED]ENTER NO. OF LINE TO CHANGE
      (0 IF O.K.)"
1480 GET I$:IF I$=""THEN 1480
1490 IF I$="0"THEN RETURN
1500 I=VAL(I$):IF I=0 THEN 1480
1510 PRINT"[UP,RED]  (ENTER [-]
      IF BLANK LINE REQUIRED)   "
1520 PRINT"[DOWN]     PRESS [RVS]RETURN
     [RVOFF] WHEN CORRECTED"
1530 PRINT LEFT$(CD$,I):INPUT"[RED]>
     [RIGHT,BLUE]";N$(I,X)
1540 IF N$(I,X)="-"THEN N$(I,X)=" "
1550 N$(I,X)=LEFT$(N$(I,X),L)
1560 GOTO 1440

1570 REM *************  S C R E E N    L I S T
1580 POKE BD,1:POKE SC,1:PRINT"[CLEAR,DOWN2]
1590 PRINT"[CLEAR,BLUE]PRESS [RVS,RED]1
     [RVOFF] [BLUE]TO DISPLAY [RED]
     FULL RECORD"
1600 PRINT"[DOWN,BLUE]       [RVS,RED]2
     [RVOFF] [BLUE]TO DISPLAY [RED]
     SINGLE FIELD ONLY"
1610 GET A$:A=VAL(A$):IF A<1 OR A>2 THEN 1610
1620 IF A=2 THEN F3$="DISPLAYED":GOSUB 2960
1630 IF A=1 THEN F=1
1640 PRINT"[CLEAR,BLUE]PRESS [RVS,RED]1
     [RVOFF] [BLUE]FOR [RED]SINGLE-STEP
     [BLUE]LISTING"
1650 PRINT"[DOWN,BLUE]       [RVS,RED]2
     [RVOFF] [BLUE]FOR [RED]CONTINUOUS
     [BLUE]LISTING"
1660 GET B$:B=VAL(B$):IF B<1 OR B>2 THEN 1660
1670 INPUT"[CLEAR,RED]ENTER STARTING NO.
     [BLUE]";C
1680 IF C<0 OR C>EN-1 THEN 1670
1690 POKE BD,15:POKE SC,15
1700 IF B=1 THEN 1730
1710 PRINT"[CLEAR,RED]PRESS [RVS]SPACE
     [RVOFF] TO STOP OR RESTART"
1720 PRINT"[DOWN,BLUE]0 TO RETURN TO DIRECTORY":
     :FOR DD=1 TO 1000:NEXT DD
1730 PRINT"[CLEAR]":FOR X=C TO EN
     :PRINT"ENTRY NO.";X:PRINT"[13SHIFT+E]"
1740 PRINT N$(F,X):IF A=2 THEN 1760
1750 FOR I=2 TO N:PRINT N$(I,X):NEXT I
1760 IF B=1 THEN 1810
1770 FOR DD=1 TO 300:NEXT DD
1780 GET B$:IF B$="0"THEN 520
1790 IF B$=" "THEN FOR DD=1 TO 500:NEXT DD
     :GOTO 1810
1800 GOTO 1860
1810 PRINT"[DOWN,RED]PRESS [RVS]SPACE[RVOFF]
      FOR NEXT ENTRY[BLUE]"
1820 GET A$:IF A$=" "THEN 1850
1830 IF A$="0"THEN 520
1840 GOTO 1820
1850 IF B=1 THEN PRINT"[CLEAR]";
1860 PRINT:NEXT X
1870 GOTO 520

1880 REM ******************  P R I N T OU T
1890 POKE BD,1:POKE SC,1
1900 A1=0:A2=0:A3=0:A4=0:A5=0:A6=0
1910 FOR I=1 TO EN:W$(I)="":D$(I)="":NEXT I
1920 FOR I=1 TO 8:B$(I)="":B(I)=0:NEXT I
1930 PRINT"[CLEAR,BLUE]PRESS [RVS,RED]1
     [BLUE,RVOFF] TO PRINT-OUT [RED]
     ALL ENTRIES"
1940 PRINT"      [RVS]2[BLUE,RVOFF]
      TO PRINT-OUT [RED]SELECTED ENTRIES"
1950 GET A1$:A1=VAL(A1$)
     :IF(A1<1)OR(A1>2)THEN 1950
1960 IF A1=1 THEN GOSUB 2210
1970 IF A1=2 THEN GOSUB 2070
1980 PRINT"[CLEAR,RED]LOAD PAPER AND ALIGN
     TOP OF FORM"
1990 IF PR=0 THEN PR=1:OPEN 4,4
2000 GOSUB 2240:POKE BD,0:POKE SC,0
     :PRINT"[CLEAR,WHITE]PRINTING..."
2010 PRINT£4,CHR$(27)"@"CHR$(14)CHR$(27)"E"
     F$:PRINT£4,CHR$(20)CHR$(27)"F"
2020 FOR X=C TO EN
2030 IF A1=2 AND W$(X)=""THEN 2060
2040 FOR I=1 TO N:PRINT£4,N$(I,X)
2050 NEXT I:PRINT£4
2060 NEXT X:GOTO 520
2070 PRINT"[CLEAR,RED]SELECTED PRINTOUT"
2080 PRINT"[17SHIFT+E]"
2090 PRINT"[DOWN]AS EACH ENTRY IS DISPLAYED:"
2100 PRINT"[DOWN]PRESS [RVS]1[RVOFF]
      IF REQUIRED"
2110 PRINT"[DOWN]      [RVS]SPACE[RVOFF]
      IF NOT REQUIRED"
2120 GOSUB 2210
2130 FOR X=C TO EN
2140 PRINT"[CLEAR,RED]ENTRY NO.";X:PRINT:PRINT
     :FOR I=1 TO N:PRINT"[BLUE]"N$(I,X):NEXT I
2150 GET W$(X):IF W$(X)=""THEN 2150
2160 IF W$(X)="0"THEN 520
2170 IF W$(X)=" "THEN W$(X)="":GOTO 2200
2180 IF W$(X)="1"THEN 2200
2190 GOTO 2150
2200 NEXT X:RETURN
2210 INPUT"[DOWN,RED]ENTER ENTRY STARTING
      NUMBER: [BLUE]";C
2220 IF(C<1)OR(C>EN-1)THEN 2210
2230 RETURN
2240 PRINT"[DOWN,RED]   PRESS [RVS]S[RVOFF]
      TO START PRINTING"
2250 GET A$:IF A$="S"THEN RETURN
2260 GOTO 2250

2270 REM ******  S A V E    D A T A    F I L E
2280 POKE BD,15:POKE SC,15
     :PRINT"[CLEAR,DOWN]"TAB(18)"[GREEN]
     <----------------->"
2290 INPUT"[HOME,RED,RVS] ENTER FILENAME
     : [RVOFF,BLUE]";F$
2300 F$=F$+LEFT$(SP$,16):F$=LEFT$(F$,16)
2310 PRINT"[DOWN3,RED,RVS] PLEASE SELECT
     :  [RVOFF]  T [BLUE]FOR TAPE
     [DOWN2,LEFT10,RED]D [BLUE]FOR DISK"
2320 GET A$:IF A$="T"THEN DV=1:DV$="TAPE"
     :DF$=F$:GOTO 2350
2330 IF A$="D"THEN DV=8:DV$="DISK":DF$="@0
     :"+F$+",S,W":GOTO 2350
2340 GOTO 2320
2350 PRINT TAB(10)"[RED,DOWN3]
     INSERT THE DATA "DV$
2360 PRINT TAB(7):PRINT"[DOWN]PRESS [RVS]
```

```
      RETURN [RVOFF] WHEN READY[DOWN2]"
2370 GET A$:IF A$<>CHR$(13)THEN 2370
2380 POKE 53280,2:POKE 53281,2
     :PRINT"[CLEAR,WHITE]SAVING "F$:Z$=","
     :OPEN 2,DV,2,DF$
2390 PRINT£2,N,Z$L:FOR I=1 TO N
     :PRINT£2,C$(I):NEXT I
2400 PRINT£2,EN:FOR X=1 TO EN
2410 FOR I=1 TO N
2420 IF N$(I,X)=""OR N$(I,X)=" "THEN N$(I,X)=""
2430 PRINT£2,N$(I,X)
2435 IF N$(I,X)=""THEN N$(I,X)=" "
2440 NEXT I:NEXT X:CLOSE 2:GOTO 520

2450 REM  C L E A R    F I L E / P R O G R A M
2460 PRINT"[CLEAR,DOWN,RED]"TAB(15)"[RVS]
      CAUTION [RVOFF]"
2470 PRINT"[DOWN2]      THIS OPTION WILL
      ERASE ALL THE"
2480 PRINT"[DOWN]             DATA IN THIS
      FILE !"
2490 PRINT"[DOWN3]   ARE YOU SURE YOU WANT
     TO DO THIS ?"
2500 PRINT TAB(15)"[DOWN](Y OR N)"
2510 GET A$:IF A$="Y"THEN 2540
2520 IF A$="N"THEN 520
2530 GOTO 2510
2540 IF A=8 THEN RUN
2550 POKE BD,14:POKE SC,6:PRINT"[CLEAR]"
     :NEW


2560 REM ***************** I N I T I A L I S E
2570 BD=53280:SC=53281:POKE BD,6:POKE SC,1
     :PRINT"[CLEAR,DOWN3,BLUE]"
2575 PRINT"[DOWN3]             D I R E C T O R Y
2630 PRINT"[DOWN2]             F.R.ROONEY - 1983"
2640 M=12:DIM SL(M),SR(M),H(100):X=0:EN=0
2650 LL$="--------------------------------
     ------"
2660 SL$="[39SHIFT+*]"
2670 SP$="[39SPACES]"
2680 CD$="[HOME,DOWN24]"
2690 PRINT TAB(9)"[RED,DOWN4,RVS]
      PLEASE SELECT 1 OR 2 [RVOFF]"
2700 PRINT TAB(8)"[DOWN2]1  [BLUE]
     TO CREATE NEW FILE"
2710 PRINT TAB(8)"[RED,DOWN]2  [BLUE]
     TO LOAD EXISTING FILE[HOME]"
2720 GET A$:A=VAL(A$):IF A<1 OR A>2 THEN 2720
2730 IF A=2 THEN 310
2740 POKE BD,15:POKE SC,15
     :PRINT"[CLEAR,RED]PLEASE ENTER THE
      FOLLOWING DATA :"
2750 SP$="[40SPACES]"
2760 CD$="[HOME,DOWN24]"
2770 PRINT"[HOME,DOWN3,GREEN]"
     TAB(10)"<----------------->"
2780 INPUT"[HOME,DOWN2,RED,RVS]FILENAME
     [RVOFF] [BLUE]";F$
2790 F$=F$+LEFT$(SP$,16):F$=LEFT$(F$,16)
2800 INPUT"[HOME,DOWN4,RED,RVS]
     NUMBER OF FIELDS (2-9) [RVOFF] [BLUE]";
     A$:N=VAL(A$)
2810 IF N<2 OR N>9 THEN PRINT"[HOME,DOWN4]"
     SP$:GOTO 2800
2820 INPUT"[HOME,DOWN6,RED,RVS]
     MAX FIELD LENGTH (4-36)[RVOFF] [BLUE]";
     A$:L=VAL(A$)
2830 IF L<4 OR L>36 THEN PRINT"[HOME,DOWN6]"
     SP$:GOTO 2820
2840 FOR I=1 TO N
2850 PRINT LEFT$(CD$,7+2*I):PRINT TAB(17);
     "[GREEN]<---------------->[BLUE,UP2]"
2860 PRINT TAB(13);"[RVS,RED]"I:PRINT"[UP2]"
2870 INPUT"[RED,RVS]NAME OF FIELD
      [RIGHT,RVOFF] [BLUE]";C$(I)
2880 NEXT I
2890 PRINT"[CLEAR,BLUE] FILENAME: [RED]";F$
     :FOR I=1 TO N
2900 PRINT"[DOWN,BLUE] FIELD"I"
     : [RED]";C$(I):NEXT I
2910 PRINT CD$"      [RED,RVS] IS THE ABOVE
      O.K. ? (Y OR N) [RVOFF,HOME]"
2920 GET A$:IF A$="Y"THEN 480
2930 IF A$="N"THEN 2740
2940 GOTO 2920

2950 REM *****  F I E L D    S E L E C T I O N
2960 POKE BD,1:POKE SC,1:PRINT"[CLEAR,RED]
     PLEASE SELECT FIELD TO BE "F3$
2970 FOR I=1 TO N:PRINT TAB(10)"[RED]"I"
     [LEFT] [BLUE]  "C$(I):NEXT I
2980 PRINT TAB(13)"[DOWN,RED,RVS]
      PRESS 1 -"N"[LEFT] [RVOFF]"
2990 GET A$:F=VAL(A$):IF F<1 OR F>N THEN 2990
3000 PRINT"[DOWN2,BLUE]"C$(F)" SELECTED"
3010 PRINT"[DOWN,RED]       [RVS]
      ARE YOU SURE ? (Y OR N) [RVOFF,BLUE]"
3020 GET A$:IF A$="Y"THEN RETURN
3030 IF A$="N"THEN 2960
3040 GOTO 3020
```

CLEARING ARRAYS

TO COMPLETELY CLEAR a large string array in Basic takes some time so L V Turner has provided this short machine-code program to perform the task more quickly. The program is written for Basic 4, with additional modifications to allow its use with Basic 2 Pets.

To clear an array you call

SYS 634,A$(0)

where A$ could be any string array. The element number is ignored, but to clear the array from a specified element you have to change the underlined values in line 3020 to 86 and 85 respectively, and add 34 to the value in line 3150.

With Basic 4, it is important not to have any array elements making direct reference to strings in the text. The string must be forced into RAM by adding a null string, as follows

AA$(x)="ABCDE"+""

CLEARING ARRAYS

```
10 REM **** CLEAR STRING ARRAY ****

2000 S = 634
2010 FOR I =S TO S+102
2020 READ A
2030 POKE I,A: C=C+A
2040 NEXT
2050 READ A
2060 IF A<>C THEN STOP

3010 DATA 32,245,190,32,43,193
3020 DATA 165,86,133,69,165,85,133,68
3030 DATA 56,233,2,133,85,176,2,201
3040 DATA 86,160,0,177,85,133,87,200
3050 DATA 177,85,133,88,165,88,201,0
3060 DATA 240,7,32,180,2,198,88
3070 DATA 208,243,165,87,201,0,240
3080 DATA 4,198,87,16,239,96
3090 DATA 160,2,177,68,133,32,136,177
3100 DATA 68,133,31,136,177,68,168,145
3110 DATA 31,200,169,255,145,31
3120 DATA 169,0,168,145,68,200,145,68
3130 DATA 200,145,68,24,165,68,105,3
3140 DATA 133,68,144,2,230,69,96
3150 DATA 12048


...for BASIC 2 PETs change...

2010 FOR I =S TO S+80
3010 DATA 32,248,205,32,109,207
3150 DATA 9504

...and delete lines 3090, 3100, 3110
```

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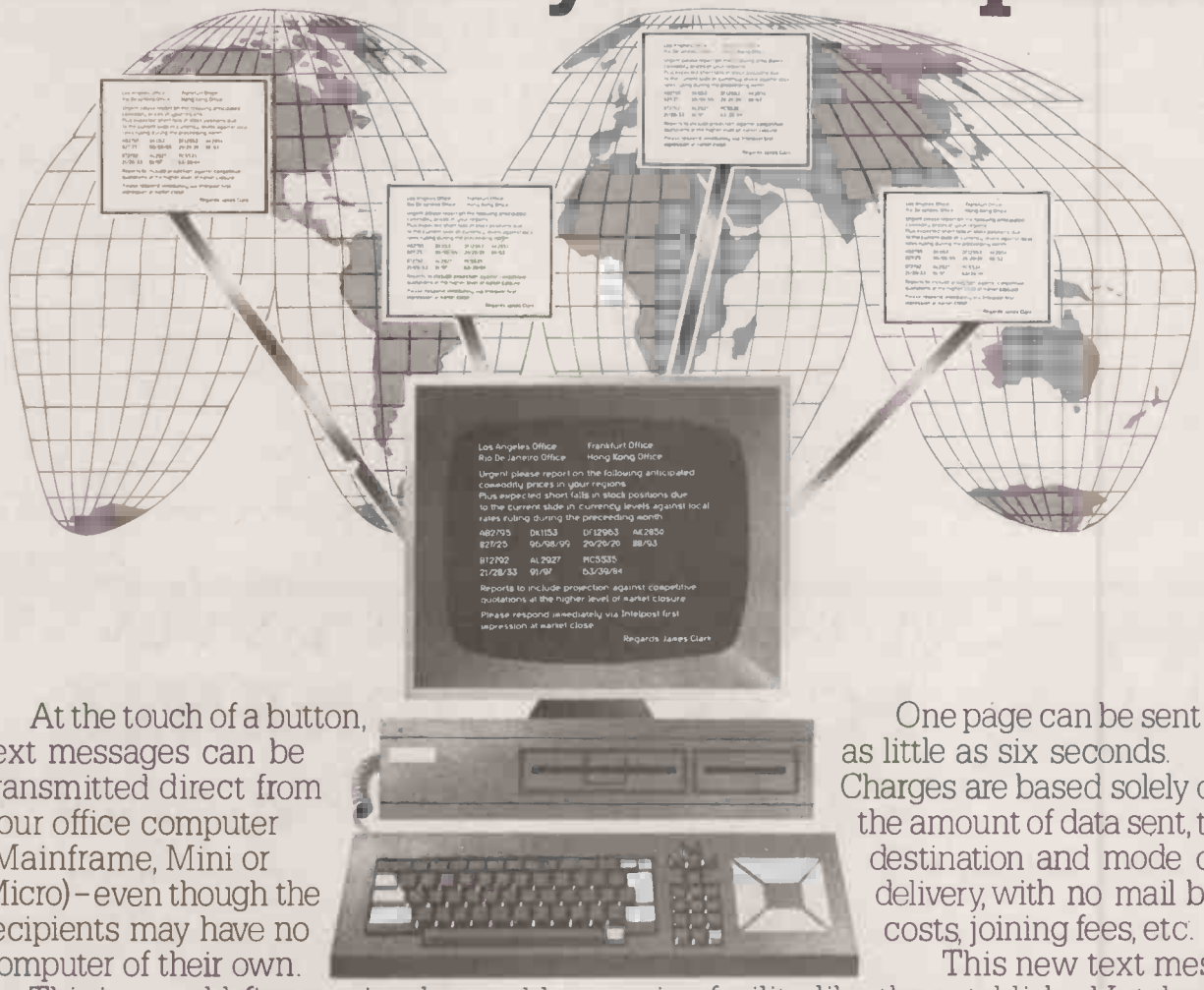

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LAST WORD

By Brian Watling

ARE COMPUTERS REALLY NECESSARY?

An unsuspecting user goes shopping.

Are computers sending us all mad? Could be. The other day I went into a shop — yes, a computer shop — to buy a ribbon cartridge for an Epson MX-80 printer. The shop was filled mostly with game tapes for Spectrums, BBCs, Amstrads, Electrons and the like.

"I'd like a ribbon for an Epson MX-80," I said, quite innocently.

"That's a printer, isn't it?" asked the knowledgeable salesperson behind the counter.

I indicated in the affirmative and tried to give him a friendly smile, as is my wont.

"Can you just wait a minute while I get someone to wait here while I go and get it from our storeroom upstairs?" he said, seeming more interested in his computer behind the counter than the people my side of it.

While I was waiting I browsed around, looking at the machines on display and wondering just how many of them they sold each week. And anyway, with all this high technology, why did he still need someone to keep an eye on me while he went upstairs for my ribbon? And another thing — it was like playing an adventure game getting in and out of the doors to this particular shop.

The BBC Micro looked like an amateur-build monster compared with the other machines on show. The sleek lines of the Amstrad and the smart design of the new Japanese imports put it to shame. My colleague pointed out the enormous range of software for those Japanese MSX machines. All of three game tapes!

My eyes went back to the Amstrad. Some years ago, when I was still suffering tape-storage machines, it would have been a dream. But now — well, it was just a glorified toy. The sort of databases that I need to handle and program for them now take half an hour to load and search on such a machine. But I was impressed by the graphics resolution shown by a semi-static display of a tennis match, where the server constantly and jerkily bounced the ball before serving.

Eventually my attention was attracted by the salesperson, who had found a printer ribbon which he held aloft with pride. I could only assume that it had been a major feat to find it in the stockroom.

"How much?" I asked.

He didn't answer. Instead he gazed fondly at the screen of a computer, of unknown origin, and typed something on to its keyboard.

"Name?" he demanded.

"Smith."

He didn't turn a hair. Just keyed it in, having three goes before he spelt it right.

"Address?" Another demand.

"No fixed abode."

He started to type, and then realised I was having him on a bit. What in fact I was doing was preventing him making even more money from the purchase that I was making by selling my name, as part of a mailing list, to other companies that will inundate me with unwanted circulars through the mail. He was making enough profit anyway asking me six quid for the ribbon which I knew had cost him not much more than three at trade price.

After a quick glance out of the corner of his eye, just to verify that I was in fact human, he restarted the entry routine on this first love and began again.

Customer Name: ENTER
Address Line 1: ENTER
Address Line 2: ENTER
Address Line 3: ENTER
Address Line 4: ENTER
Address Line 5: ENTER

By this time I was getting a little fed up.

"I thought computers were supposed to speed things up," I said.

"Well they certainly do," he assured me in a very convincing tone, coupled with a sneer and a suppressed laugh as if to suggest that I didn't know anything about anything.

"They may be for you," I continued, "but it's not making things faster for me. After all, I only want to give you some money."

He ignored my comment and continued.

Invoice Date: 7/3/85 ENTER
Invoice Number: 1227 ENTER
Order Ref: SJA ENTER
Delivery Address: ----- AS INVOICED ----- ENTER
:ENTER
:ENTER
:ENTER
:ENTER
Quantity: 1 ENTER
Details: Epson Printer Ribbon ENTER
Serial Number: ENTER
Nett: 5.22 ENTER
VAT: 0.78 ENTER

The last entries he had to look up from his price chart.

Carriage: 0.00 ENTER
Packing: 0.00 ENTER
Is everything OK? YES ENTER

The machine's disc drives gurgled for a while and then the printer started to chunter across the two-part stationery and print out an invoice. Out it came:

Sub Totals	5.22	0.78
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Invoice Total	6.00	

He removed it carefully from the printer and, fumbling laboriously, tore off the tractor drive holes from each side. Then the top copy was removed and handed to me.

At last: the answer to my "how much" question.

I handed over a £10 note.

No "thank you". He took it and walked over to a till that stood just a couple of feet away from the computer, keyed in the price that he read from the bottom of his copy of the invoice, the amount that I had given him and, lo and behold!, the cash drawer popped open and the display told him how much change to give me. At the same time the till produced a till receipt, with the company's name, address and VAT number impressed on it. He gave it to me along with four dirty pound notes.

I left the shop, after again negotiating the strange maze of a doorway, carrying my printer ribbon, one A4 piece of paper called an invoice — most of which was blank and the parts that were not were faintly printed showing that the printer needed a new ribbon — one small piece of paper called a till receipt, and an impression.

Are computers really necessary? PC

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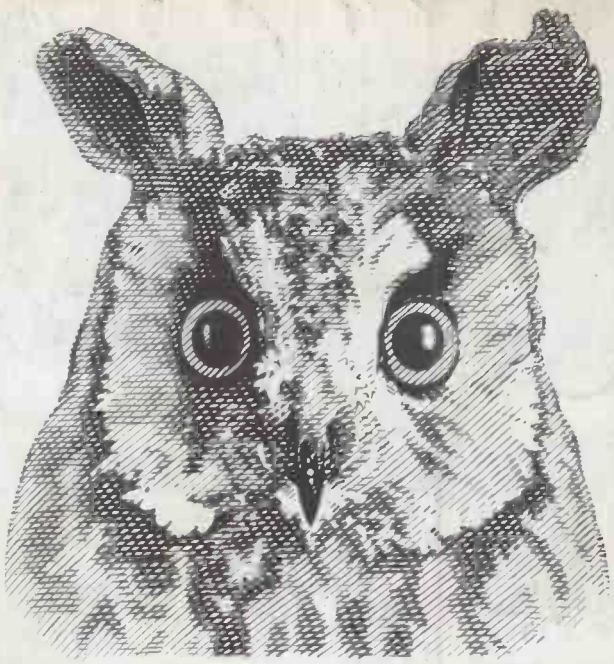

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