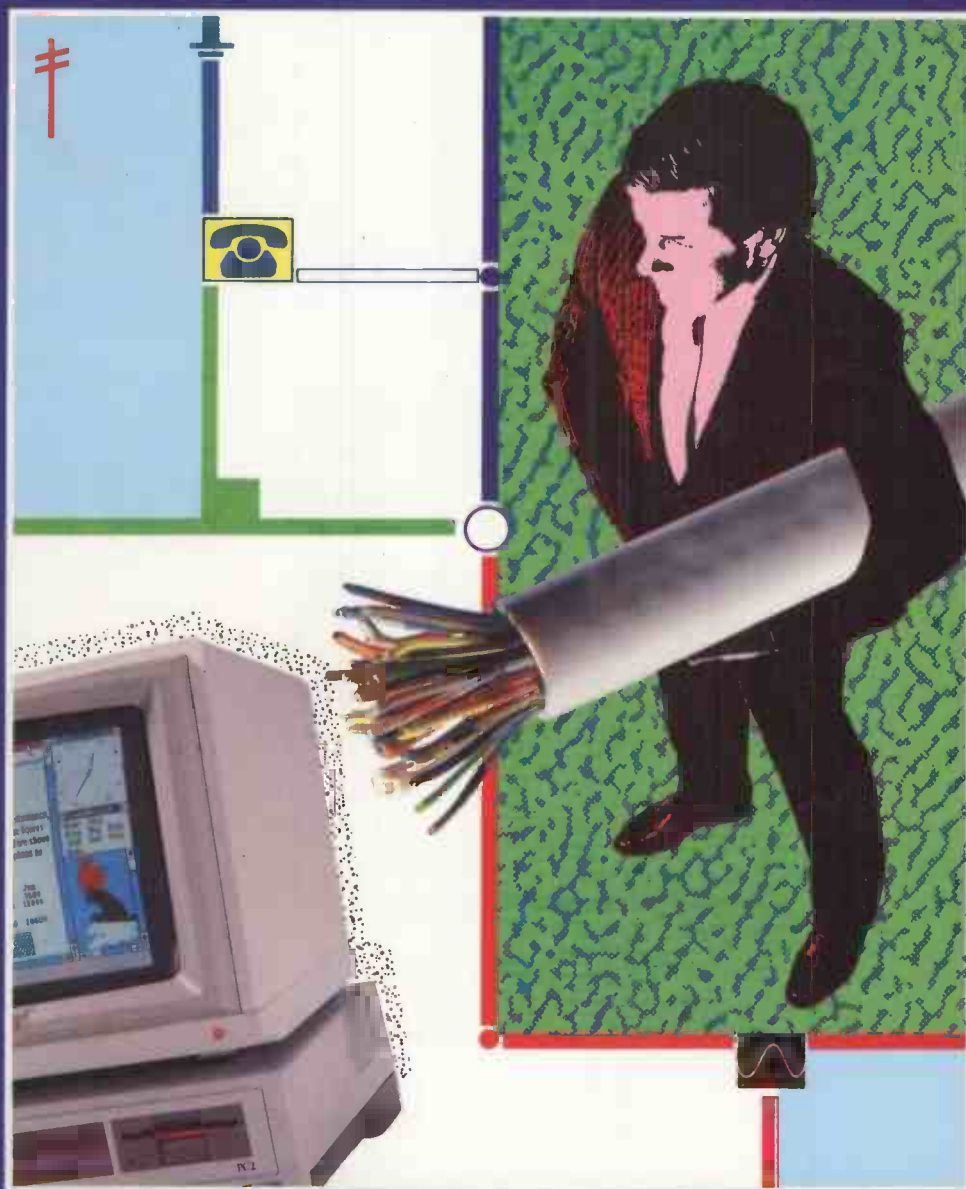


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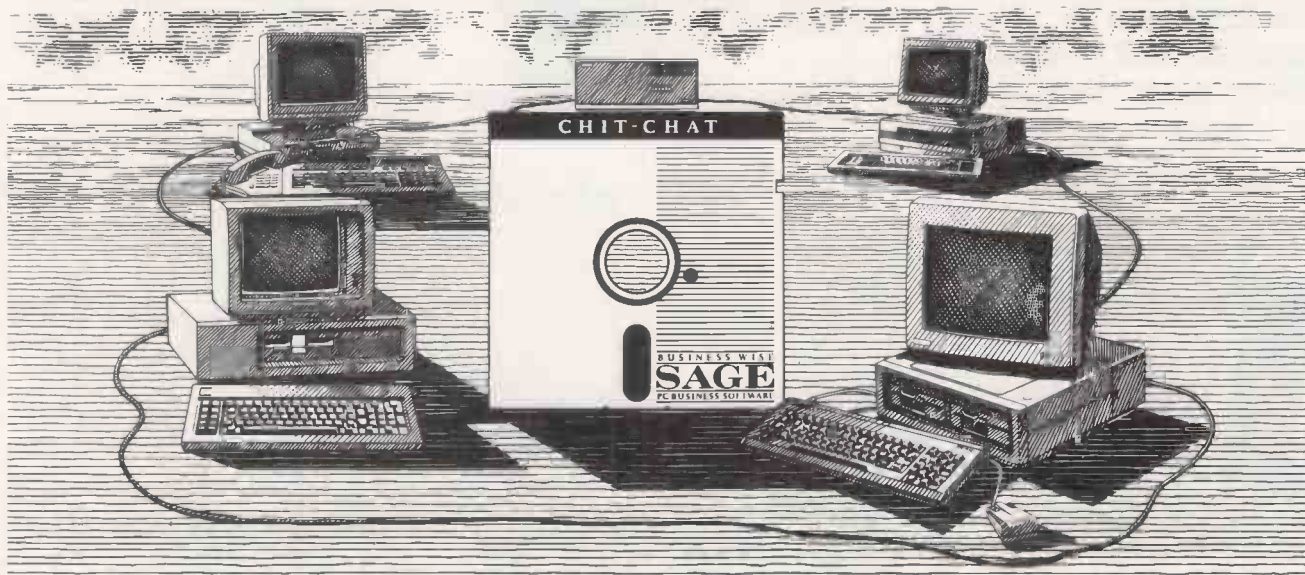
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# Pas de deux



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## THE 64-BIT QUESTION

The only thing you learn from history, they say, is that you learn nothing from history. This is certainly true in the world of micros. When the eight-bit CP/M systems first came out their 64K upper limit on RAM hardly seemed a restriction at all. Compared to the four-bit systems with their paltry kilobyte or two of RAM this was surely a wealth of memory.

But no: along comes the 16-bit generation of machines running under MS-DOS. An apparently extravagant 640K of RAM was potentially available to software developers. Again, people were confident that this would prove ample for many, many years. But it was not long before complex programs were beating against this barrier. Various tricks like expanded memory boards appeared, but the solutions were makeshift and unsatisfactory.

Now the industry's wide-eyed innocents are at it again. With the advent of the 32-bit chips like the 80386 and 68020 and their gigabytes of address space they are once more proclaiming that we are entering a land of milk and honey, with memory beyond the dreams of avarice. But in a few years' time we shall see the same pattern of growth in the size of applications until they can barely squeeze their by then colossal bulk into the maximum memory space.

This puritanical attitude to such a never-ending bounty is largely a product of microcomputer history. In the good old days, so the tacit reasoning goes, with only 4K or 64K available, you were forced to program in the tightest and most efficient manner. Now, these old curmudgeons continue, the youth of today can squander almost limitless quantities of RAM on their sloppy coding. Disgusted of Tunbridge Wells knows that many of the modern world's worst excesses can be laid at the door of this lack of discipline.

Programming has moved on since those heady early days of the Z-80 and 6502 chips, when miracles of compression were regularly achieved in garages and on kitchen tables throughout the world. Today, writing a 500K program is an exercise in project management. There is no room for inspired but incomprehensible programming; instead, everything must be organised, modular and legible. If this means that the code is 20 percent longer than it need be, so what? It will be easier to fix any bugs and simpler to modify and update.

The same crypto-Luddites also question whether we will ever need the raw processing power of 32 bits. They point out that we have only just seen the first operating system which exploits the full range of facilities offered by the 80286 chip, so what hope is there for the 80386? What they fail to note is that we have entered a hardware-driven period in computing to follow a lengthy software-driven one.

As a result, advances in chip technology are continuing to forge ahead at such a rate that the software world is getting left behind. For example, everyone has been waiting for the new 80286 DOS from Microsoft. As expected MS OS/2, as we must now call it, moves strongly in the direction of the Macintosh by

incorporating a modified Windows approach as the standard interface to several hundred kilobytes of code; it also offers enhanced connectivity as a matter of course. But it still feels like a product which should have appeared two years ago.

We can thank IBM for the non-appearance of the full 80386 DOS. If Microsoft had launched it ahead of IBM's own 80386 machine, companies like Compaq would be unstoppable; even as things are, they look to be doing rather well with their new supermicros. This success shows the wrong-headedness of insisting that there is no need for an 80386 machine or corresponding DOS. The mere existence of the 80386 chip makes the previously long-awaited 80286 DOS irrelevant; it has been leapfrogged by technology. And for the next year or so this pattern is likely to continue. The question is not whether we really need more advanced chips, but how we are going to use them.

There are already straws in the wind. As well as the 80386, the 68020 is now starting to crop up in micros: its appearance in the Macintosh II signals that its time has come. Moreover, the 68030 is already here, and mock-ups are believed to exist for a 68040. The same is presumably true of an 80486. Another indication of the way things are going is the announcement that IBM is to take a hefty consignment of Transputers worth many millions of pounds. Transputers are currently the most advanced 32-bit chips around, so it says much to see perhaps the most staid of all the manufacturers adopting them.

The microcomputer industry is founded on innovation, and on a succession of new and previously unimaginable price-performance levels. The day it stops delivering more, faster and smaller is the day it dies. It can only be a matter of time before the 64-bit micros arrive — and before they, too, are superseded.

## 5 YEARS AGO...

Hewlett-Packard's 32-bit system could leapfrog 16-bit microcomputers. Strictly speaking the 32-bit computer would come within the mini end of the computer market, but its price might well place such a machine in direct competition with the larger micro systems.

A custom-built 32-bit VLSI chip will be used in conjunction with five similar custom chips. Hewlett-Packard is cagey about what products might incorporate 32-bit technology, but expects the first of a new range of such products to appear later this year. The chip set comprises memory controller, RAM, ROM, I/O processor, clock generator, and a 32-bit processor chip less than 0.25in. square which contains 450,000 transistors.

The system has been designed from the ground up. There are no off-the-shelf chips involved; every one has been designed to complement the others. In turn they required a fast data bus. It has a transfer rate of 36Mbyte per second. Hewlett-Packard has also had to develop a special copper-core technology to provide dissipative cooling for the system.

Volume 5 Issue 3

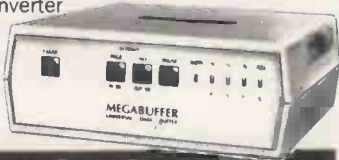
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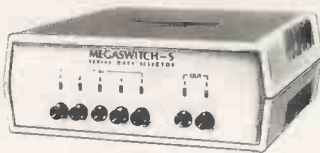
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## Fujitsu 2020

HAVING read your review of the System 2020 in the February issue of *Practical Computing*, I must correct some inaccuracies.

First, you say that "its processor can support up to eight users". The System 2020 can, in fact, support up to 20 users which can be connected either locally, or remotely via a modem using an RS-232 link.

Secondly, you say that an SSIO port can be used to attach an external hard disc or tape backup interface. In truth, the external hard-disc expansion sub-systems and tape streamer backup sub-systems are supported through an SCSI interface.

Thirdly, you report that "the fast SSIO can be configured to support eight users. Thus with all expansion ports used as SSIO ports, up to 64 users can be supported — although nobody could then get much done." This statement is totally inaccurate and extremely misleading.

The expansion slots on the System 2020 are used as follows. The first three are for the 80286 processor, 1Mbyte of RAM and SCSI interface respectively. One of the other slots can be used either for a two-user expansion interface card or a network card. The final two slots can either accommodate two-user expansion cards or be used as SSIO expansion ports. In addition, there is an RGB monitor interface, an RS-232C serial interface and a parallel Centronics-type printer interface.

If the System 2020 is fitted with three RS-232 expansion cards up to eight users are supported on the single 80286 processor. However, if the two SSIO ports are used, the system will support 20 users. In this case each SSIO card has its own 80186 processor, thereby ensuring no performance degradation.

The third element of the System 2020's expansion capability is provided by the network adaptor card which replaces one two-user interface. Via the network, up to 64 work stations can be connected, and these can be a combination of System 2020s and IBM PCs, XTs or ATs. In networking mode the maximum number of users per System 2020 work station is 18.

The last inaccuracy in your review relates to the specification chart. The internal hard disc, and all external expansion hard discs, are of 86Mbyte capacity.

Finally, the Fujitsu 2020 has been designed as a multi-user system. We have, therefore, been very deliberate in providing sufficient microprocessor support to ensure that good performance is

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

### WRITE TO:

Feedback, Practical Computing, Quadrant House,  
The Quadrant, Sutton, Surrey SM2 5AS

# THE COPY PROTECTION RACKET

THE common statement on the wrapper of software packages which says that by opening the packet you have accepted the terms of the licence does not apply if the goods contained are not what you ordered. Sometimes this can only be discovered by opening the packet. Provided you have specified on the order that the software required must be without copy protection you can send the discs back. You will not have entered into the licensing agreement and will be fully protected under the Sale of Goods Acts.

It seems to me that copy protection is nothing more than a racket. Programs are sold that are quite incapable of doing what it is claimed they will do. When the hapless purchaser discovers this, he is told that it would have worked if he had not wrecked it by activating the copy protection. Another copy may be supplied as a gesture of goodwill. If that doesn't work either, the purchaser is conned into believing that it is his own fault, and that because he is to blame, the supplier should not even be asked to refund the cost of the program, let alone compensate the would-be user for wasted time and effort.

Is it not high time that computer users agreed never to use copy-protected software?

JOHN W PEPPITT,  
Wembley,  
Middlesex.

maintained as and when more users are added.

ROGER HANDLEY,  
Fujitsu Europe Ltd,  
Langley,  
Berkshire.

STEVE MALONE REPLIES: When we were discussing the review Roger Handley asked me not to do "a standard PC review and take the box apart" — I'm quoting from memory. Although I had some reservations I saw that the 2020 was not the kind of machine designed to be dismantled by the user and agreed not to tamper with the innards.

The trouble with this approach, as I now realise, is that you are dependent on what people tell you. When I went to Fujitsu I was told about the "SSIO hard disc interface". I repeated this back to the person concerned, as it struck me as unusual, and it was confirmed.

With regard to the capacity of the hard disc, *Practical Computing*

gives the formatted capacity. The figure of 76Mbyte was given to me as the formatted capacity whereas 86Mbyte is the unformatted size.

I was given the impression that all the expansion slots were available for use by the SSIO cards and remember discussing the "motherboard processor". At no point did Fujitsu inform me that the 80286 and 1Mbyte RAM were on expansion cards, and without Fujitsu's permission to look inside I had no way of finding out.

In my notes I have written down that the "SSIO boards can support eight users", so I must have been told that too. From these two points I came to the conclusion that 64 users could be supported.

I knew about the 80186 processors on the SSIO cards and perhaps I should have mentioned them. It was not the I/O bottleneck I was concerned with but the bottleneck at the disc, particularly with a system like Pick where disc calls are likely to be frequent.

## Whose interface?

WITH reference to your article on user interfaces which appeared in the March issue I would draw your attention to a package called MBA by Context Management Systems. This uses the same menu system as Lotus 1-2-3, but I'm sure Context had it first. Therefore, "the next breakthrough" did not come with Lotus 1-2-3.

C F BEESLEY,  
Cheadle,  
Staffordshire.

## Amstrad Portfolio

THERE were some errors in the Portfolio listing published in the February issue of *Practical Computing* which I would like to correct.

In line 370 the string should be read as

```
"xazmpslv ncrtideyq"
```

In line 210 amend the window setting to

```
FNwind$(4,4,23,86)
```

In line 400 make the following amendment

```
...:IF p$(r,p) = "" THEN GOSUB  
900:GOTO 360
```

In line 500

```
loc$(24,15)
```

should be

```
FNloc$(24,15)
```

In line 670 alter

```
(a(r,c,p)
```

to

```
(a(r,0,p)
```

Line 960 should be altered to

```
rx=r:IF rlast(p)>19 THEN  
rcx=rc:r=r-rc+20:rc=19:...
```

Insert a new line 865

```
IF rlast(p)=0 THEN 890
```

In line 910 amend the window setting to

```
FNwind$(4+rc,4,2,22)
```

and delete

```
IF a$<>"q" THEN 400 ELSE
```

In line 1310 position

```
p$(0,p)
```

at

```
FNloc$(35,8+p)
```

In line 1410 position at

```
FNloc$(35,8+p)
```

and

```
FNloc$(35,8+newp)
```

In line 1510 insert

```
tax=0.1:
```

A M TUCKER,  
Dorchester  
Dorset.

## Zenith

A FEATURE in our March issue on the top 10 IBM compatibles quoted a phone number for Zenith Data Systems which we have since discovered to be incorrect. Zenith's correct phone number is (0494) 459266.



# The data protector.

(A SOFTWARE LOCK ON YOUR MICRO)

Is 'personal' data on your micro secured in accordance with the Data Protection Act?  
Is sensitive data secure on your micro?

If the answer to either of these questions is NO then you need CLAM from MICROFT TECHNOLOGY. CLAM, as the name implies, provides a software 'shell' around your computer to prevent unauthorised access to programs and data. Once the simple task of setting up CLAM has been completed on any disk, the data can only be accessed through the user defined menus. (The menu system offers all the facilities of MICROFT's popular menu system MENUGEN.)

On starting the computer users are asked for a password. They then see on their menus only those options for which they have authority. If no valid password is entered at the third attempt no more tries are allowed until the computer has been switched off and then on again.

CLAM works by locking subdirectories. Users can only access those subdirectories for which they have authority. Only the copy of CLAM that locked a subdirectory can unlock it. Access is not possible by loading an operating system from another disk.



## MAIN FEATURES

1. All data held on a hard or floppy disk can be kept secure from unauthorised access. 2. Security is by default. Once CLAM has been set up the user does not have to take any positive action to secure data. 3. Access to all activities is via user defined menus within CLAM. 4. Each user is given a user name and password. These determine which menu options the user will see. Each user needs to remember only one password. 5. Even those with access to the DOS prompt can be limited to some (or no) subdirectories. 6. A complete audit trail of all use of the system is kept.

CLAM is available for most micros with PC/MS DOS version 2.0 or later: These include the IBM PC and all compatibles. CLAM costs £148 + VAT for a single user licence. Site and corporate licences are available. Existing MENUGEN users may upgrade to CLAM for £110 + VAT. CLAM may be purchased from MICROFT TECHNOLOGY LTD. The Old Powerhouse, Kew Gardens Station, Kew, Surrey TW9 3PS or from most dealers. To order or obtain further information telephone 01-948 8255.

# CLAM

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WITH COMPLETE SYSTEM SECURITY.

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CLAM is a Trade Mark of Microft Technology Ltd and is a British product.

## Kaypro's 80386 family

KAYPRO'S chairman Andrew Kay flew into London last month to announce a batch of new products. Among those launched were an 80386-based micro, an LED page printer and a networking system.

Three models of the PC/AT-compatible Kaypro 386 have been announced. The entry-level system, the model A, has a 16MHz clock speed switchable to 6MHz from the keyboard. It also has a 80387 maths co-processor and 512K of 32-bit RAM fitted as standard. Mass storage is provided by a 1.2Mbyte floppy-disc drive. The model A costs £3,699.

The model E — the power-user system — has 1Mbyte of RAM included and a 40Mbyte hard disc. It is priced at £4,839. The final model announced is the model N, designed to act as a network server. It is identical to the model E except that there is a choice of 150Mbyte, 240Mbyte or 330Mbyte hard disc. To coincide with the release of the Kaypro 386 model N, the company has introduced a proprietary version of Novell Netware.

The page printer is based on a new LED engine from NEC. It is said to form the basis of Kaypro's desk-top publishing (DTP) system to be launched later this year. The printer will appear in two versions. The first will contain 128K of RAM and will emulate the Diablo 630 and IBM Proprinter. The DTP printer will emulate the Hewlett-Packard Laserjet. Prices for the LED printer start at £2,669. Further details from Kaypro U.K. Ltd, Osnaburgh Studios, 46-48 Osnaburgh Street, London NW1 3ND. Telephone: 01-387 5530.

## DG drops prices

DATA GENERAL has announced price reductions on its range of micros. The entry-level PC/AT-compatible Dasher 286 now costs £2,187, while the 20Mbyte hard-disc version is priced at £2,698.

The cost of the Dasher One intelligent terminal has also fallen. The price for the entry-level single-floppy machine is £1,453 with the 10Mbyte hard-disc version costing £2,862. For further information contact Data General, Hounslow House, 724-734 London Road, Hounslow, Middlesex TW3 1PD. Telephone: 01-572 7455.

# IBM ANNOUNCES PERSONAL SYSTEM/2

AT the beginning of April IBM announced its new generation of personal computers, the Personal System/2. Innovations include use of 3.5in. discs, a proprietary expansion bus and built-in main-frame communications.

The four machines in the new range use surface-mounted technology. They all have a serial port, display adaptor, mouse port, and parallel printer port built into the motherboard.

The IBM Personal System/2 model 30 is based around the Intel 8086 CPU. It is available in twin-floppy and hard-disc versions. The 002 version has two 720K 3.5in. drives; the 021 has one 3.5in. floppy and a 30Mbyte hard disc. The prices for the model 30 002 begin at £1,106, while the model 021 is priced at £1,559. Model 30 machines should be available from late April onwards.

The model 50 is based around the 80286 CPU. It has a 1.44Mbyte 3.5in. disc drive and a 20Mbyte hard disc. It will be available from July, priced at £2,847.

The third model in the range,

the model 60, is a floor-standing unit also based around the 80286. The 041 has a 44Mbyte hard disc, while the 071 has a 70Mbyte hard disc. Both versions also have a 1.44Mbyte floppy-disc drive. Machines will be available from July, priced at £4,075 upwards.

IBM's long-awaited first 80386 machine is the model 80, which is also a floor-standing unit. It comes in three versions, two of which correspond to the configuration in which the model 60 is available. The final version, the model 80 111, has a 115Mbyte hard-disc drive. IBM has set up the model 111 to run the processor at an unusually fast 20MHz. The other two models run at a more conventional 16MHz. Prices start at £4,916, although machines are not expected much before the autumn.

The proprietary IBM bus, known as the Microchannel, has 32-bit architecture with a 16-bit subset and runs at a 30MHz clock speed. IBM is publishing its full specification to allow third-party manufacturers to build expansion cards.

IBM has also announced a new graphics standard. The resolution supports 640 by 480 pixels with two colours. Alternatively it supports 320 by 200 pixels with 256 colours on-screen from a palette of 262,144.

In conjunction with the hardware announcements IBM also announced a new set of operating systems. PC-DOS 3.3 is available for the whole range of machines from PC/XT up to the Personal System/2 model 80. For the 80286 and 80386 machines there is to be a new operating system called Operating System/2. It will allow multi-tasking and will have a user memory area of 16Mbyte. It will also support existing applications and will have windowing built in.

OS/2 is not expected to be available to the public until early next year. In the meantime a version of Windows for the 80386, called Windows 386, will be out in the next few months.

A version of Unix used on the PC/RT, called Aix, will also be available on the model 80, as will a Worm disc option.

## Hercules introduces colour display card

HERCULES COMPUTER TECHNOLOGY, well known for its monochrome graphics card, has introduced a new version of its colour card. The Incolour Card is a colour version of the Graphics Card Plus which it launched last year.

Priced at £375, the card can support 16 colours from a 64-colour palette and a resolution of 720 by 348 pixels. The secret of the card, like the Graphics Card Plus, is the use of RAM Font. This is a technique whereby custom-designed fonts can be loaded into RAM on the board and accessed as quickly

as if they were stored in ROM. Like the IBM EGA, the Incolour card requires a multi-synchronous monitor.

Hercules says shipments will start at the beginning of May. By that time the company expects to have drivers written for most popular programs. Further details from First Software, Intec 1, Wade Road, Basingstoke, Hampshire RG24 0NE, telephone (0256) 463344; Softsel, Softsel House, Syon Gate Way, Great West Road, Brentford, Middlesex TW8 9DD, telephone 01-568 8866.



## Zygal's five-way laser

THE F-2010 is a new laser printer from Zygal which has five different collection trays. The machine, which costs £4,965, has more than 60 resident fonts, including Prestige Elite and Helvetica.

The printer is fitted with a Motorola 68000 processor and 1.5Mbyte of RAM. The input feed is via two cassettes each of which can hold up to 250 sheets. Paper sizes can vary between Legal, Letter, A4 and B5. Throughput is claimed to be up to 10 pages per minute.

Details from Zygal Dynamics, Zygal House, Telford Road, Bicester, Oxfordshire OX6 0XB. Telephone: (0869) 253361.

## Net/One bridges the gap

UNGERMANN-BASS, one of the world's largest network manufacturers, has released a high-speed bridge to connect Token Ring and Ethernet networks.

The Token Ring to Ethernet bridges, known as the Net/One Data Link Bridges, are available as both local and remote devices. The bridge has no built-in protocols and can therefore support a num-

ber of popular configurations, including ISO and DEC Net.

The Data Link Bridge is claimed to be much faster than IBM PC based bridges as it only transmits data addressed to the opposing network.

Further information from Ungermann-Bass Ltd, Belmont Road, Maidenhead, Berkshire SL6 6ND. Telephone: (0628) 71411.

# HP AND CANON BRING LASERS UP TO DATE

HEWLETT-PACKARD and Canon have both launched completely new laser printers. This is a major development because between them the two companies dominate the low-end laser market.

HP's new machine is called the Laserjet Series II. It costs £2,618 and is available now. Canon's offering is the LPB-8 II, costing £2,195, and becomes available in April.

Both machines are based on the same laser-printer engine, the LBP-SX made by Canon. The engine is considerably smaller than previous models, and makes both machines about 30 percent lighter at 50lb. Both print at a resolution of 300 dots to the inch and have a maximum speed of eight pages a minute, which is the same as previous HP and Canon machines.

However, cost per copy is lower, with longer-lasting toner cartridges which now produce up to

4,000 pages rather than 3,000 for a cost of about £90. This works out at about 2.2 pence per page plus the cost of the paper. The machines should also require less maintenance, and the claimed life has gone up to five years.

Both machines have improved paper handling, with 200-sheet input trays, a straight paper path so you can print on card, and face-down paper output so pages come out stacked in the right sequence.

The electronics controlling the engine are different on the two machines, and this is where Cannon and HP differentiate their products. Canon offers 512K of memory as standard, expandable to 1.5Mbyte. HP's machine also has 512K of memory as standard, but you can increase it to 4.5Mbyte.

HP's machine offers full compatibility with PCL, the HP laser command language. This is pro-

bably more widely supported than the Canon standard as HP does better in the U.S., where most software packages are written.

HP has still to launch its full page-description language, DDL, which is intended as a rival to Postscript for DTP applications. However, it is now clear that DDL will be implemented on an upgrade board that you plug into your PC, which means it is likely to work with any existing HP laser printer.

For the time being HP is retaining its original Laserjet and Laserjet Plus models in its product lineup, but is reducing the price to £1,995 and £2,902 respectively.

For more details contact Hewlett-Packard, Enquiry Section, Eskdale Road, Winnersh Triangle, Wokingham, Berkshire RG11 5DZ, telephone (0734) 696622; or Canon (U.K.), Canon House, Manor Road, Wallington, Surrey SM6 0AJ, telephone 01-773 3173.



A new laser engine makes the HP Laserjet II (left) and Canon's LBP-8 II (right) more compact.

## HARDWARE SHORTS

●Torch Computers has launched a multi-user version of the Triple-X Unix engine. It can support up to 16 users. Ring (0223) 841000.

●AST has combined its Rampage and EGA cards on a single board. The new card is called Rampage/EGA and comes with a range of memory configurations. Prices start at £795.

●Televerket, the national telecomms company of Sweden, has developed Vocofax, a combined computer printer, fax machine, telex machine and modem. Details on (01046 752) 639 62.

●Toshiba has upgraded its popular T-3100 portable. Known as the T-3100/20, the new version has a 20Mbyte hard disc and costs £4,350. Ring (0932) 785666.

## Compaq beats the clock

FOLLOWING the release of the 12MHz Portable III which we review this month on page 48, Compaq has introduced a new clock speed to the Deskpro 286.

The new machine is said to be 50 percent faster than previous versions. To maximise the performance, Compaq has fitted the machine with extra-fast 100ns. DRAM. The range consists of five models. The 256K RAM model 1 costs £2,181, while at the other end of the range the model T-70 has a 70Mbyte hard disc and a 40Mbyte tape backup drive and costs £5,581. Further details from Compaq Computer Limited, Ambassador House, Paradise Road, Richmond, Surrey TW9 1SQ. Telephone: 01-940 8860.



## Future's new 80386 line

FUTURE COMPUTERS has launched a range of IBM-compatible work stations and file servers. The machines are intended to complement Future's existing networking and multi-user products.

The flagship models are the FX-50-S60-386 and the FX-50-S160-386, which go under the collective name of the Server-386 range. The computers are based around the 80386 processor running at 16MHz.

Future has fitted the machines with 2Mbyte of RAM on the motherboard. This can be expanded to a total of 16Mbyte using the PC- and AT-compatible slots. The company says that further memory expansion potential is available via a 32-bit connection bus on the motherboard. This would theoretically allow the machine to address the full 4Gbyte available under the 80386 chip, although

practical considerations will limit this.

Mass storage is provided by a 1.2Mbyte floppy-disc drive which has also been configured to read the 800K format of Future's earlier FX-20 and FX-30 machines. The two machines in the range also have a 60Mbyte and 160Mbyte hard-disc capacity respectively. They are supplied with Concurrent DOS-386, although MS-DOS 3.2 is available as an option.

Among the other products on offer is an 80286-based version of the servers and a range of PC-compatible work stations. FX-16, FX-21 and FX-31 work stations are all fitted with 1Mbyte of RAM and the NEC V-30 chip running at 10MHz. They run under Concurrent DOS 4.1. Further details from Future Computers (Systems) Ltd, 7 Imperial Way, Croydon, Surrey CR0 4RR. Telephone: 01-680 6040.

## Wang high-speed modem

WANG (U.K.) Ltd has launched two modems. The units cover both the stand-alone and high-speed transmission markets.

The low-end machine is the SB-2422 Quattro. The modem operates the V-21, V-22, V-23 and V-22bis protocols and supports

autodial, auto log-on and auto-answer facilities. It costs £795. The second modem is the SB-9629L costing £995. It has an operation speed of 9,600 baud. Details from Wang (U.K.), 1000 Great West Road, Brentford, Middlesex TW8 9HL. Telephone: 01-568 4444.

# WORLDWIDE PRICE LIST



All prices excluding VAT and DELIVERY. APR. B

## LONDON

Worldwide House, Quicks Road,  
Wimbledon, London SW19 1EX  
Telex: 8955888 Fax: 01-543 7812

### 01 543 2211

## BRIGHTON

Regent House, 2 North Road,  
Brighton, Sussex BN1 1YA  
Telex: 877649 Fax: 0273 671513

### 0273 609331

## SCOTLAND

11-14 Maritime Street,  
Edinburgh EH6 6SB  
Telex: 728298 Fax: 031-554 2581

### 031 554 4361

### IBM

IBM PC-XTS 640kb 2x360kb DD	750.00
IBM PC-XTS 640kb 1x360kb DD + 20mb HD	1075.00
IBM PC-XT286 640kb 1x1.2mb DD + 20mb HD	1750.00
IBM PC-ATX 512kb 1x1.2mb DD + 30mb HD	2825.00
IBM PC-XT Keyboard/Enhanced	115/130.00
IBM PC-AT Keyboard Enhanced	150.00
IBM Mono Display	115.00
IBM Colour Display	299.00
IBM Enhanced Display	475.00
IBM Colour Display/Graphics Adaptor	115.00
IBM Mono Display/Printer Adaptor	115.00
IBM Enhanced Display Adaptor 256kb	515.00
IBM Async Comms Adaptor (RS232)	65.00

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Deskpro M1 128kb 1x360kb	
Deskpro M2 256kb 2x360kb	
Deskpro M3 640kb 1x360kb + 20mb + RS232 + Clock	
Deskpro M4 640kb 1x360kb + 20mb + RS232 + Clock & Tape	
Deskpro 8/12mhz 286 M1 256kb 1x1.2mb	
Deskpro 8/12mhz 286 M20 640kb 1x1.2mb + 20mb	
Deskpro 8/12mhz 286 M40 640kb 1x1.2mb + 40mb	
Deskpro 8/12mhz 286 M40T 640kb 1x1.2mb + 40mb + Tape	
Deskpro 8/12mhz 286 M70T 640kb 1x1.2mb + 70mb + Tape	
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### Amstrad Mono/Colour

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Amstrad PC 512kb 1x360kb DD + 20mb HD K/B	899/1069.00

### Software

<b>Data Base/Accounts</b>	Energraphics 240	Wordcraft Elite 600
Cardbox Plus 244	VXN Execuvision 396	Wordstar 170
Datamaster 440	Gem Draw + 125	Wordstar 4 205
dBase II 270	Gem Graph 125	Wordstar 2000R2 265
dBase III plus 357	Gem Wordchart 89	Wordstar 2000 + 285
Clipper dB3 Comp 430	Freelance 333	Writing Assst. 79
Delta 4 Prol 390	<b>Amstrad PC 1512 (Budget)</b>	<b>Spreadsheet</b>
IBM Filing Assis 99	Reflex 60	Framework II 345
Multisoft A/Cs from 390	Wordstar 1512 60	Open Access 290
Pegasus A/Cs from 175	Delta 4 1512 87	Smart Suite v3.1 388
Sage Bookkeeper 85	Domino 1512 87	Symphony 357
Sage Accountant 125	Supercalc 3 60	Javein 380
Sage Accountant + 65	Sage PC Write 84	Lotus 123 247
Sage Filn Cont 249	Sage Desktop 69	Lotus HAL 110
Paradox 430	Sage Retrieve (DB) 84	Multiplan v2.0 169
IBM Teamwork from 305	Sidkick 25	Supercalc 4 225
<b>Desktop Publishing</b>	<b>Word Processing</b>	<b>Utilities &amp; Games</b>
Fleet Street Editor 210	DisplayWrite 4 350	Crosstalk XVI 110
PageMaker 595	Lotus Manuscript 333	Flight Simulator 35
scLASEPlus 299	1-2-3 Report Writer 99	Gem Collection 94
Ventura 795	Symphony Text Outliner 89	Gem Desktop 47
<b>Graphics</b>	Multimate Adv 395	Norton Util V4 65
Autosketch 75	Multitymate 295	Sidkick (NCP) 55
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### Epson

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Epson PC + 640kb 1x360 kb 20mb HD + K/B	1225.00
Epson AX + 512kb 1x1.2 kb 20mb HD + K/B	1799.00
Epson AX + 512kb 1x1.2 kb 80mb HD + K/B	3175.00

### IBM Compatible Monitors & Adaptors

Hercules Mono/Graphics Plus Adaptor	180.00
Hercules Colour/Graphics Adaptor	475.00
Hercules InColour/Graphics Adaptor	285.00
Orchid EGA 256kb + Printer Adp	220.00
AST 3G EGA 256kb	220.00
Interquadram Quad EGA + 256kb	280.00
Interquadram ProSync	370.00
Vega Deluxe Enhanced EGA	390.00

### Plotters

Epson HI 80 A4 4pen	349.00
Hitachi 672 A3 4pen	499.00
Hewlett Packard 7470 A3 4pen	750.00
Hewlett Packard 7475 A3 6pen	1360.00
Hewlett Packard 7550A A3 8pen	2850.00
Hewlett Packard 7570A A1 8pen	3799.00
Houston DMP500 A0 1pen	5170.00
Roland DXY 980A Plotter A3 8pen	930.00
Roland DXY 880A Plotter A3 8pen	655.00
Roland DPX 2000 Plotter A2 8pen	3540.00

### Laser Printers

Canon Laser LBP-8 A1 S or P 8ppm	1899.00
Canon Laser LBP-8 A2 S or P 8ppm	2799.00
Hewlett Packard LaserJet S 8ppm	1495.00
Hewlett Packard LaserJet Series II 8ppm	1999.00
Hewlett Packard LaserJet 500 S + P8ppm	3465.00
Kyocera F1010 10ppm	2799.00
Kyocera F2010 10ppm	Call
OKI Laser Line 6 6ppm	1645.00
Qume Laser Ten 10ppm	2300.00
Qume Laser Ten + Plus 10ppm	2900.00

### Maths Co-Processors

Maths Co-Pro 8087 5mhz/8mhz	120/145.00
Maths Co-Pro 80287 6mhz/8mhz	175/250.00

### Mouses

Summa Graphics Mouse	110.00
Microsoft Mouse (Serial or Bus)	140.00
Logitech Mouse	99.00

### IBM Compatible Turbo Upgrades

AST Flashpack 9.54mhz NEC V30	295.00
Orchid Tiny Turbo 80286 8mhz	399.00
Orchid 286e Turbo 80286 8mhz 1mb Memory	778.00
Orchid JET386 Turbo 80386	795.00

Talung EGA Monitor	430.00
ADI EGA Monitor	450.00
NEC Multi Sync Monitor EGA/Colour/Mono/PGA	550.00
IRMA Card 3270 Emulation Adaptor	939.00
IRMA Graphics Card 3270 Emulation Adaptor	1525.00

### IBM Compatible Memory Upgrades

384kb Multifunction XT	199.00
Intel/EMS Compat Ram Adaptor Upgrade 1.5mb XT	399.00
AST SixPac Plus 384kb Multifunction XT	275.00
AST SixPac Premium 2mb EMS Multifunction XT	430.00
AST Advantage 1.5mb Serial + Parallel AT	425.00
AST RAM Advantage 3mb AT	650.00
AST Rampage! 2mb EMS XT	350.00
AST RampageAT 2mb EMS AT	595.00
Interquadram Quad Board 640kb XT	320.00
Clock Card with Batt Back up + Ser + Parallel XT	85.00

Olivetti DY300	35cps	599.00
Olivetti DY800	80cps	1175.00
Qume 11/55	55cps	1275.00

### Hard Disks

10mb to 20mb Hard Disk Exchange	320.00
360kb to 10mb Hard Disk Exchange	260.00
360kb to 20mb Hard Disk Exchange	345.00
360kb to 30mb Hard Disk Exchange	425.00
Fitting on the above	15.00
Outright Sale on the Above	50.00
Bernoulli Box 20 + 20mb	2155.00
Large Capacity Hard Disks	Call

### Printers Dot Matrix

Brother M1109	25/100cps	175.00
Brother M1409	45/180cps	295.00
Brother M1509	45/180cps	380.00
Brother M1709	50/240cps	445.00
Brother TwinWriter 5	40/160cps	970.00
Brother 2024L	96/160cps	690.00
Epson LX86	16/120cps	210.00
Epson FX800	32/200cps	322.00
Epson FX1000	32/200cps	420.00
Epson EX800 opt Colour	50/300cps	415.00
Epson EK1000 opt Colour	50/300cps	550.00
Epson LQ800	60/180cps	469.00
Epson LQ1000	60/180cps	625.00
Epson LQ2500 opt Colour	90/270cps	785.00
Honeywell 4/21	40/200cps	415.00
IBM Proprinter	40/200cps	363.00
IBM Proprinter XL	40/200cps	395.00
NEC PSXL	88/264cps	915.00
NEC P6	77/216cps	410.00
NEC P7	77/216cps	490.00
OKI Microline 84p	50/200cps	629.00
Olivetti DM100	25/120cps	199.00
Panasonic KP 1080	20/100cps	185.00
Panasonic KP 1091	29/120cps	245.00
Panasonic KP 1092	33/180cps	320.00
Panasonic KP 1595	51/260cps	520.00

### Scanners

AST Turbo Scan	1475.00
Hewlett Packard ScanJet	1395.00

**Network Systems Available**  
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### Special Offers

<b>20mb Amstrad</b>	<b>20mb Olivetti</b>	<b>20mb IBM XT/286</b>	<b>20mb IBM XTS FD</b>
1512 Base Unit Compat 20mb Hard Disk 1 x 360kb Floppy Disk Monitor + Keyboard 512kb Memory + Clock Serial + Parallel Dos + Gem + Mouse	M24 Base Unit Compat 20mb Hard Disk 1 x 360kb Floppy Disk Monitor + Keyboard 640kb Memory + Dos 3.1 Serial + Parallel Ports	IBM XT/286 Base Unit IBM 20mb Hard Disk 1 x 1.2mb Floppy Disk Monitor + Adaptor Enhanced Keyboard + Clock 640kb Memory + PC Dos 3.2 Serial + Parallel Ports	IBM XTS FD Base Unit IBM 20mb Hard Disk 1 x 360kb Floppy Disk Monitor + Adaptor Enhanced Keyboard 640kb Memory + PC Dos 3.2 Serial + Parallel Port

<b>Mono £849</b>	<b>Mono £1575</b>	<b>Mono £2160</b>	<b>Mono £1499</b>
<b>Colour £1019</b>	<b>Colour £1795</b>	<b>Colour £2355</b>	<b>Colour £1694</b>

<b>30mb Hard Disk</b>	<b>Mono £1640</b>	<b>Colour £1860</b>	<b>New IBM's Please Call</b>
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## Solving the equation problem

MATH CAD from Mathsoft International is for users who want to be able to enter and calculate mathematical formulae on-screen. It allows you to type in formulae straight from the keyboard.

A template is provided showing the key combinations that are used. For example, Alt-P will display the Greek letter  $\pi$  on-screen. Solutions are calculated automatically and results may be plotted as graphs on-screen. The program will recalculate any formula automatically if you make any alterations to it.

Math CAD supports standard mathematical notation and symbols, including those signifying summation, product, integral, derivative, subscripts, square roots, powers and parentheses.

It runs on IBM PC, PC/AT and compatible micros with a minimum of 340K RAM. It supports the IBM Graphics Printer, Proprinter, HP Laserjet or compatible printers. For more details contact Mathsoft International, 129 Beaufort Street, London SW3 6BF. Telephone: (0827) 862339.

## All change

LETRASET has signed an agreement to handle the distribution of the Ready Set Go 3 DTP package worldwide. Previously Letraset was the U.K. supplier of the competing Letrapage, but it has now dropped this package. Letraset says it has abandoned Letrapage because it would not be ready within the time scale Letraset required.

Ready Set Go's previous distributor, Heyden and Son, says it has had no battle with Letraset. In its place Heyden is now supplying a DTP package called Xpress from Quark Inc. of Denver. It runs on the Mac Plus and Mac SE micros and allows Mac II users to display documents in colour. When used with the Laserwriter Xpress produces colour separations, and it will print spot colour using the Imagewriter II. It costs £695.

For details of Xpress contact Heyden and Son, Spectrum House, Hillview Gardens, London NW4 2JQ. Telephone: 01-203 5171. Ready Set Go 3 costs £395 and is available from Letraset U.K., 195-203 Waterloo Road, London SE1 8XJ. Telephone: 01-928 7551.

# SOFTWARE IS ARRIVING FOR NEW MACS

THE LAUNCH of the Macintosh SE and Macintosh II has led to a flurry of activity in the software arena. From Apple come a file server called Appleshare and the Lasershare print-spooler.

Appleshare will allow up to 25 users to share information on an Appletalk network. It requires a dedicated Mac Plus, Mac SE or Mac II and at least one hard disc. A minimum of 512K memory is necessary for each work station. Appleshare file servers may also be accessed by MS-DOS systems connected to the Appletalk network by an Appletalk PC card. Appleshare costs £595.

Lasershare, due out in May, will provide print-spooling services to Appletalk users. Apple also hopes to provide a version of Unix later this year, which together with an Ethernet card will allow users to integrate the Mac II into Unix-based networks.

For more details on Appleshare and Appletalk contact Apple Computer U.K., Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244.

At Apple World in Los Angeles Lotus previewed a modular inte-

grated business package for the Mac, code-named Galaxy. It is expected to be launched in the U.S. in the summer. In addition to graphics, word-processing, worksheet, forms and communications modules, Galaxy will include its own command language. Users will be able to transfer Lotus 1-2-3 and Symphony files to and from Galaxy. For details contact Lotus Development U.K., Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone: (0753) 840281.

McMax from the Nantucket Corporation is a dBase-compatible database package for the Mac, Mac Plus, Mac XL and Lisa micros. Due out in April, McMax allows users up to 2,000 fields per database, 2,000 memory variables and 2,000 procedures per procedure file. It costs £299. Contact Nantucket Corporation, 2 Bluecoats Avenue, Fore Street, Hertford SG14 1PB. Telephone: (0992) 554621.

Ashton-Tate's own version of dBase for the Mac, dBase Mac, had yet to appear at the time of going to press. An Ashton-Tate spokeswoman said the delay was to ensure that the package worked with the new Mac machines.



## Ashton-Tate Rapid File

ASHTON-TATE'S Rapid File is a file manager aimed at users who do not want to develop specialised applications.

Rapid File runs on the IBM PC, PC/AT and compatibles with 256K RAM and two 360K floppy-disc drives, or one 360K floppy and one hard disc. It has facilities for data management, creating

reports, writing form letters and producing mailing labels. It uses the same file format as dBase III Plus, so users can transfer files between the two packages. The price is £275.

For more details contact Ashton-Tate, 1 Bath Road, Maidenhead, Berkshire SL6 4UH. Telephone: (0628) 33123.

## SOFTWARE SHORTS

●Caxton Computer Systems has reduced the price of its Fantasy DTP program to £49.95. Ring (093586) 2609.

●Ashton-Tate has announced an enhanced version of the dBase III LAN Pack. Copy protection has been removed, and it supports up to six users. Details on (0628) 33123.

●Topcopy is a memory-resident pop-up WP program for the IBM PC and compatibles. It costs £55 and is available from Innova Software on (0453) 845153.

●Tom Rettig's Library is an add-on tool kit for Clipper and dBase III Plus. The price is £99. Ring Nantucket Corporation on (0992) 554621 for more details.

●dBLX is a dBase III Plus clone from Wordtech. It costs £129 and is available from In-Touch Computer Solutions on (0222) 882334.


●Blyth Software has dropped copy protection on single-user and multi-user versions of Omnis 3 Plus for the Mac. Ring (0728) 3011.

●Precision Software is importing a range of Atari ST utilities from the U.S., including a business-graphics package, Chart Pak, at £49.95, and an enhanced version of Paint Pro, Paint Pro Library I, at £24.95. Ring 01-330 7166.

## Integrated WP for 1-2-3

AN INTEGRATED word processor for Lotus 1-2-3 called 4Word has been launched in the U.S. The program was designed by Le Blond Software of Indianapolis using the Lotus 1-2-3 add-in tool kit. It is claimed that this will ensure that 4Word shares resources with 1-2-3 and will not interfere with pop-ups like Sidekick and HAL.

4Word uses a 1-2-3 style menu and cursor-movement keys. It requires PC-DOS or MS-DOS 2.0 or later to run and will run on versions 2.0 and 2.1 of Lotus 1-2-3. It costs \$99.95.

For more details contact Turner-Hall Publishing, 1021 Torre Avenue, Cupertino, Ca. 95014, U.S.A. Telephone: (U.S. area code 408) 253-9607. 



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# PERSONAL COMPUTER SALES KEEP CLIMBING

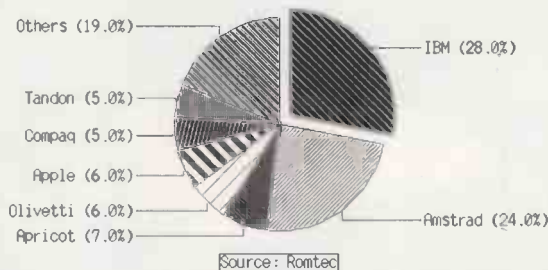
SALES of business micros in the U.K. rose to 280,000 in 1986 to bring the total installed base of machines to over 650,000, according to Wharton Information Systems. IBM is still in the lead, with Olivetti second and Amstrad third. The latest figures from Romtec place IBM first, Amstrad second, Apricot third, and Olivetti and Apple level pegging in fourth place.

Romtec's figures are based on single-user desk-top machines in the micro market sold through business micro dealers and exclude multi-user micros and battery portables. Amstrad's rapid rise is particularly impressive, considering it only launched its PC-1512 range in September; Romtec's figures also fail to take into account micros sold through retail outlets, where Amstrad is particularly strong.

Amstrad's success has also been reflected in profits. The company reported record sales of £272.5 million and a pre-tax profit of £71.3 million for the six months

## U.K. Business Micro Market

Unit sales through dealers, February 1987



ended 31 December 1986. Amstrad claims that by February of this year the PC-1512 had the largest share of personal-computer market sales, with 26 percent.

In fact, profits appear to be healthy all round. Compaq Computer reported that the company's sales were up 24 percent from 1985 giving it a net income of \$42.9 million. Atari Corporation reported sales up 82 percent with a net income of \$44.5 million.

Software houses also report record sales. Ashton-Tate Corpora-

tion had a net income of \$30.1 million in 1986, an increase of 81.3 percent from 1985. Lotus Development Corporation announced net income for 1986 up 27 percent from \$38.1 million in 1985 to \$48.3 million in 1986. The publisher of the PFS products and Harvard Presentation Graphics, Software Publishing Corporation, announced a net income of \$1.2 million for the fiscal quarter ending 31 December 1986 — just double the figure for the same quarter in the previous year.

## Speech recognition

IBM SCIENTISTS at the T J Watson Research Center in New York have demonstrated a 20,000-word PC-based speech-recognition system. Its vocabulary is claimed to include 97 percent of all the words a speaker is likely to use in business. The system uses two sub-systems each containing a digital signal-processor chip that has been developed by IBM.

A user will speak into a microphone with brief pauses between words. To recognise continuous speech will require more processing power than is available from the PC-based system.

Speakers have to complete a preliminary 20-minute session in which the user reads a standard document into the machine. The system uses it to characterise and remember the individual's way of speaking. Punctuation is added verbally, and a contextual ability enables the system to differentiate between like-sounding words.

For more information contact IBM U.K., PO Box 41, Baltic House, Kingston Crescent, Portsmouth, Hampshire PO6 3AU. Telephone: (0705) 694941.

# WordPerfect, MathPlan, SSIData



WordPerfect

WORD PROCESSING

MathPlan

SPREAD SHEET

SSIData

DATA BASE

WordPerfect  
Library



## Fuji floppy

FUJI's MF2HD 3.5in. double-sided floppy discs have a memory capacity of 1.6Mbyte, expandable to 2Mbyte. Fuji claims the discs can store the equivalent of over 625 pages of A4 text, and that this represents an increase of about 60 percent over standard 3.5in. discs.

Each disc is guaranteed to operate continuously on the same track for over 20 million passes without deterioration. A box of 10 will cost around £78.

For details contact Fuji Photo Film (U.K.), Fuji Film House, 125 Finchley Road, London NW3 6JH. Telephone: 01-586 5900.

## First Computer

OLIVETTI'S customer-support group is taking over First Computer's maintenance contracts. Olivetti says the move is part of the company's continued push into the third-party maintenance business.

For details contact Olivetti, Olivetti House, PO Box 89, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.



## Observer daily service available on Prestel

BRITISH TELECOM Prestel is offering an on-line daily news service in conjunction with the *Observer* newspaper. A roundup of news will appear every morning, and will be followed by headline news stories throughout the day with comment on selected items.

Prestel users will be able to access the service on page number 3456 or through the on-line magazine Focus. There will be no frame charges. For details contact Prestel, Telephone House, Temple Avenue, London EC4Y 0HL. Telephone: 01-822 1056.

## SHORTS

● Adobe Systems has signed a contract with IBM giving IBM licensing rights to the Postscript page-description language.

● Apricot Computers has set up a division dedicated to Apricot Xenix. It has also announced a 45Mbyte 80386-based Xenix machine, the Xenix System 8, capable of supporting up to eight users. Ring 021-456 1234.

● The first 77,000 entries to be recorded on the Data Protection Register can now be viewed on microfiche in 171 public libraries throughout the U.K. Details on (0625) 535777.

● Ashton-Tate has announced plans to offer £2 million worth of shares of its common stock to the public. Ring (0628) 33123.

● Telecom Gold has dropped the minimum billing charge of £10 per mailbox per month for Télécom Gold club accounts. Details on 01-403 6777.

● A Simple Concept will re-ink old Amstrad PCW ribbons for £2 per ribbon. Contact (0222) 35820.



# ... You may confer.

WordPerfect Library brings new meaning to the subject of software integration by linking three of today's most advanced software packages – WordPerfect, MathPlan and SSIData.

Programs are immediately accessed from the Shell menu by a single key stroke as are the 6 powerful utilities which provide a full function Calculator, Calendar, Notebook, File Manager, Macro and Program Editor.

The movement of text, figures, graphs and records

is simplicity itself within WordPerfect Library, which provides an impressive degree of flexibility, in operation and is simplified by the use of function keys and a colour coded template dispensing with the need for complex control codes. Create your own menu structure, from which you can run DOS commands and batch files.

To improve your knowledge and to find out details of how you too can join the WordPerfect Library, telephone or write to Sentinel Software.



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# The new IBM Personal computing w



It may come as a surprise that IBM is launching a new generation of personal computers that are not called PCs.

But there is a good reason. The IBM Personal System/2™ models are much more than personal computers. In fact they're based on many of the successful concepts used in our mainframe computers.

The IBM Personal System/2 breaks new ground by using technology that was simply not available

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The eight new Personal System/2 models are loaded with features that will help shape the future of personal computing. They also bring about dramatic improvements in operating speeds, memory capacity, and flexibility.

They have been designed to take advantage of continuing technological advances as they are introduced by IBM. That's why our

new range has the future built in.

But just as important, the Personal System/2 builds on past success. It is compatible with the existing IBM PC range, and most current PC DOS software.



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The Personal System/2 is a family of fast workers.

The secret lies with IBM's new Micro Channel™ Architecture. It features a radical new bus design which can handle more instructions and information than most of today's fastest personal computers.

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has designed IBM Operating System/2.™ It will allow you to address above 640Kb, opening the way to a new range of advanced and multi-tasking applications.



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Today it is essential that computer users can communicate with each other. With the new Personal System/2 no product is an island.

Completely new hardware and software allow you to connect up to more powerful IBM systems, down to less sophisticated personal computers, back to previous models of the IBM PC family, forward to products we may announce in the future, and sideways to outside information sources.

These are true personal systems that are multi-connectable, multi-purpose, multi-tasking tools; not just suitable as stand alone boxes for the single user.

The Personal System/2 introduces the first step in a long range plan to provide consistency across the IBM product range: Systems Application Architecture.

By providing a consistent look for the way that data appears on any IBM screen, and a universal set of operating commands, the new architecture will allow you to feel at home with your computer regardless of which type of IBM system you are using.

All of the Personal System/2 models use the sturdy 3.5 inch diskette format for which we have developed a range of tools to ease the transition from, and help you co-exist with, the 5.25 inch diskette media.

The range can meet all your storage and memory needs, with RAM from 640Kb to 20Mb and storage from twin 720Kb drives to an enormous 230Mb capacity. We are also introducing a new 200Mb optical disk drive. Its interchangeable cartridges bring you "Write Once Read Many" technology for file backup, archiving and special applications.



Store volumes of data:  
without sacrificing desk space.

A great deal of thought has been put into the internal design of the new Personal System/2.

Very large scale integration of internal circuitry and surface mounted technology results in improved performance, lower power consumption and increased reliability. All models have a compact new design and take up much less desk space.

Furthermore, through the use of surface mounted technology, we have been able to build in 6 input/output functions allowing you more room for expansion. These are a keyboard port, a bidirectional parallel port, a fast serial port for printers and other devices, a port for a mouse or other pointers and support

for high function colour graphics.

Four new analogue displays have been specially designed to allow you to benefit from the Personal System/2's improved graphic capabilities. The Monochrome Display allows you to choose from 64 shades of grey, while the three Colour Displays offer a choice of 256 colours from a total palette of 262,144 different hues.



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The resolution of our character matrix has been improved by nearly 30%, making text sharp and clear, while graphics take on a clarity and realism more akin to photographs than traditional computer generated images.

The best place to learn about the future is from the people who have helped you in the past. Your IBM Authorised Dealer can tell you more about the IBM Personal System/2. They'll explain how it can help make your business more efficient today, and what it can do for you tomorrow.

For more details and a list of IBM Authorised Dealers contact Wendy Castle at the National Enquiry Centre, IBM United Kingdom Limited, 414 Chiswick High Road, London W4 5TF, or telephone 01-995 7700 during working hours.

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Company \_\_\_\_\_

Type of Business \_\_\_\_\_

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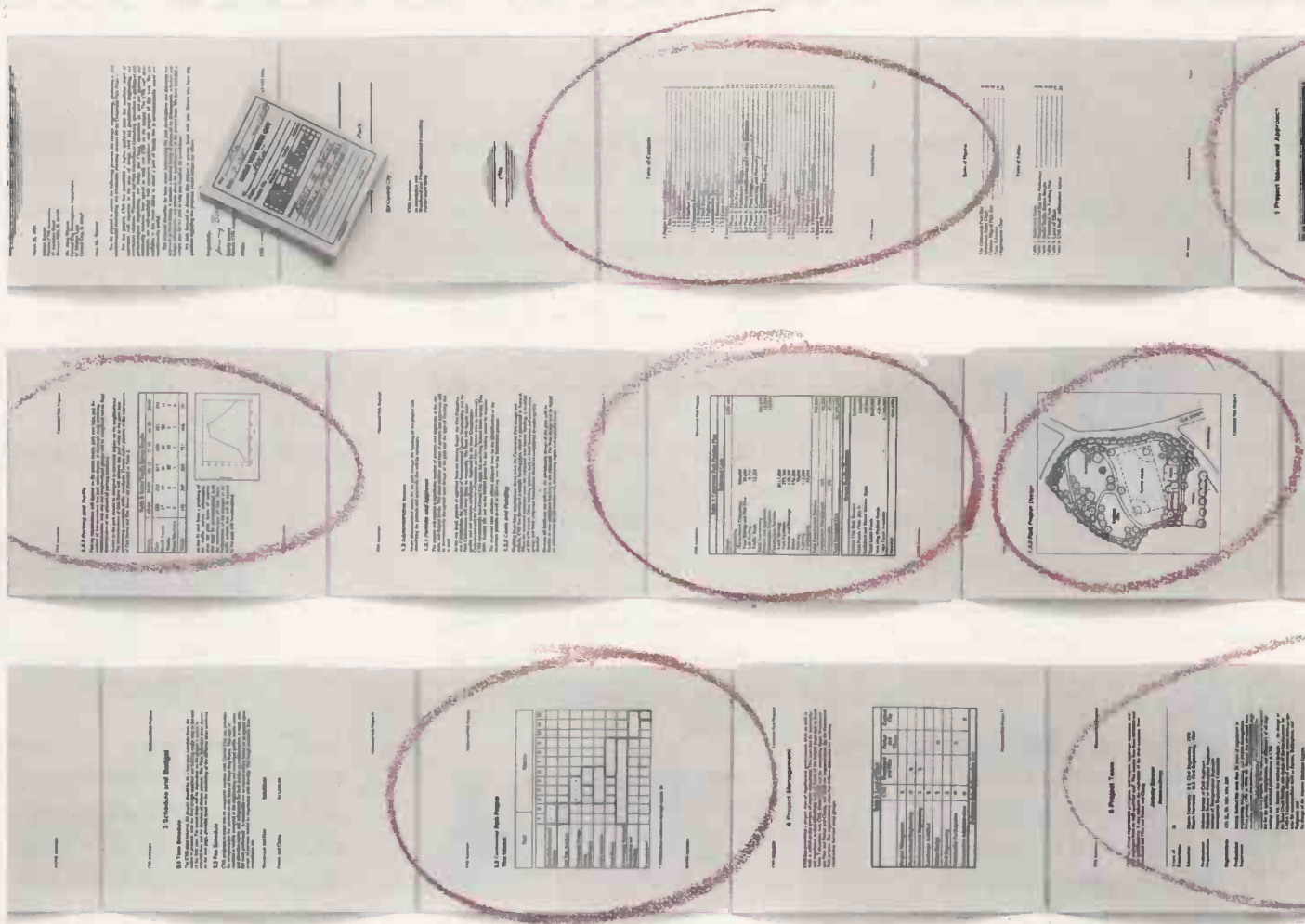
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# Manuscript. How to process

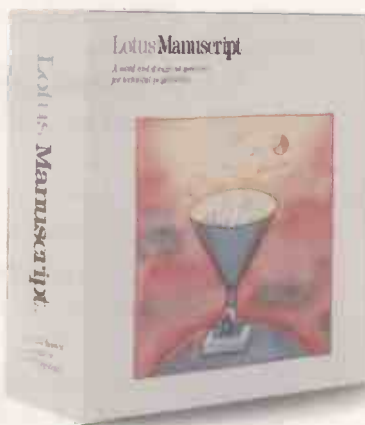


You may be content with your present word processor. And it's easy to understand why.

Even the clumsiest word processor is light years beyond the electric typewriter, the accepted standard only a decade ago. However, just the term word processing conjures up a rather modest expectation. The ability to process words.

But, the mere processing of words is hardly the challenge today. When you're creating a 20-page report, an 80-page proposal, a 200-page specification, or just a 2-page letter, you often have to work with graphics, equations, tables and more.

That's simply too much to ask of a product designed to process words. But, that's exactly what you can expect from Lotus Manuscript, it provides a complete document creation system for



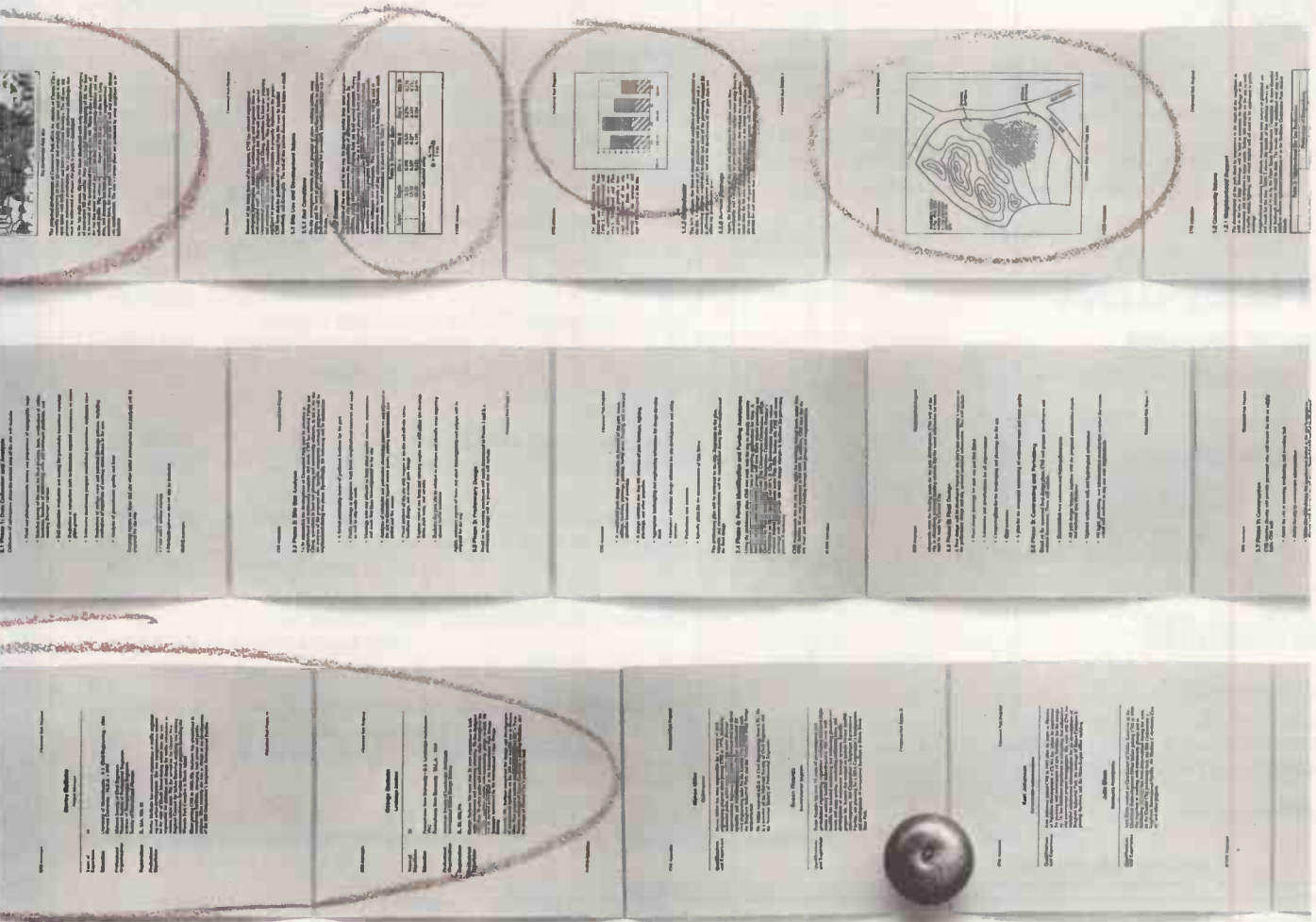
business and technical professionals.

Very often documents require the mixing of text and graphics on the same page, for example, graphics from Lotus 1-2-3, Symphony and Freelance Plus. With Manuscript you can import spreadsheets and charts, as well as diagrams and scanned images.

Another feature that goes beyond conventional word processing is Manuscript's integrated Outliner. When you reduce the document to a series of headlines, you're able to navigate more easily than wading through the entire piece. You can move a page, or even an entire chapter with just a few keystrokes.

Because Manuscript understands the structure of your docu-

# s documents, not just words.



ment, you can globally format an entire document or format by individual sections. Imagine changing all headlines from 14 point plain text to 16 point bold, by a simple menu selection.

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As for the quality of output, Manuscript takes full advantage of today's printing technology, from dot-matrix to laser including PostScript printers.

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compatibles. Its familiar 1-2-3 interface makes it easy to use. And our Manuscript evaluation kit makes it easy to try. Send us the coupon together with £15 and we'll send you a presentation disk, trial software, and a 100-page tutorial manual.

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To: Lotus Development (UK) Ltd., Consort House, Victoria Street, Windsor, Berks. SL4 1EX. Tel: (0734) 342875.

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PC ATX:(512k RAM 1.2Mb + 30Mb Disk)	£3250.00	£3310.00

All prices include Keyboard, Monitor & DOS

8087 Chip £195.00 80287 Chip £295.00 AT360k Disk £145.00

## TOSHIBA

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T1100:(256k RAM, 3 1/2" 720k Disk, 80C88 Co-pro, DOS 2.1)	£1122.00
T3100:(640k RAM, 3 1/2" Disk + 10Mb H/Disk, 8MHz 80286 Co-pro, Clock Cal)	£2772.00

### TOSHIBA T1100 PLUS

640k, 2 x 720k Disks, DOS 3.2 and inclusive of A/C Adapter-Charger and Carrying Case. **£1395.00**

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M24:(640k RAM 360k + 20Mb Disk)	£1683.00	£1897.00
M24SP:(640k RAM 360k + 20Mb Disk)	£1826.00	£2040.00
M28:(512k RAM 1.2Mb + 20Mb Disk Bs. Con)	£2266.00	£2493.00
M28:(512k RAM 1.2Mb + 40Mb Disk Bs. Con)	£2730.00	£2958.00

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Portable II Model 2:(256k RAM 2 x 360k Disk)	£1680.00
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## TURBO TRICKS

PASCAL CAN BE A CUMBERSOME LANGUAGE TO USE BUT TURBO PASCAL PROVIDES MANY WAYS OF MAKING IT MORE STRAIGHTFORWARD.

Regular readers of this column will know that I am a Turbo Pascal fan. But my enthusiasm for this compiler owes nothing to the Pascal language itself. It is Turbo Pascal's superior development environment, its fast in-memory compilation and its portability between eight-bit and 16-bit systems that has won Borland so many loyal followers.

But Pascal can still be a very cumbersome language to use. Its syntax is inconsistent and fussy, its rigid type checking often gets in the way of the programmer, and it lacks a standard method of handling essentials like strings and random files. Fortunately, Turbo Pascal provides many ways of making the language more palatable and it is worth studying the manual carefully because there are lots of Turbo tricks to be learnt.

A typical example is Pascal's poor handling of dynamic memory. Suppose your program has to do some sort of processing on a text file. You would like to read all or part of the file into a RAM buffer and to be able to work on it there. But you do not know in advance how big the file is or how much memory will be free. In C, the program would simply grab whatever RAM is available, read in the file, then access individual characters by manipulating a pointer.

In Pascal things are not so easy. The programmer is limited to allocating dynamic memory of a specific data type, which means that you have to know at compile time how much you will need. If you want an array of however many bytes there is space for, you have to grab the RAM in small chunks and make them into a linked list.

However, Turbo Pascal supports the Getmem procedure. It allows you to allot a given number of bytes, which can be decided at run time, to a pointer of any type. If it is a pointer to a character array you would be able to get at the individual characters of the file but you would still have the problem of not knowing in advance how big to make the array.

One solution is to use Mem, which is one of Turbo's built-in arrays. It is an array of bytes which maps to the entire RAM of the computer. You can locate your buffer within this space by looking at the contents of the pointer returned by Getmem. In 16-bit systems this is a 32-bit value expressed as a segment and offset. So if P is the pointer

Mem[Seg(P):Ofs(P)]

contains the first character of the buffer. In eight-bit versions, you would write

Mem[Ord(P)]

Admittedly, all this is something of a

### HEX DUMP ROUTINE

```
program HexDumpDemo;
  (A skeleton program to show how the hex dump routine is used, to
   demonstrate absolute variables; requires Turbo Pascal (any version) )
const
  MaxField=6000; ( size in bytes of largest structure that can be dumped )
type
  string2= string[2];

  DataType=record
    Count: integer; ( this is the type of the variable to )
    Name: string[16]; ( be dumped; any record, array, etc. )
    Amount: real; ( would be suitable for this )
  end;
var
  AnyVar: DataType; ( this is the variable to be dumped )

function hex(number:byte):string2;
  (returns the number as two hex digits)
const
  digits: array[0..15] of char = '0123456789ABCDEF';
begin
  hex:=digits[number shr 4] + ( high-order digit )
    digits[number and $F]; ( low-order digit )
end;

procedure HexDump (var AreaToDump; Size:integer);
  (Outputs the specified area in hex, sixteen bytes per line; Size is the
   number of bytes in the area. AreaToDump can be any data type, subject
   to the maximum size indicated by MaxField)
var
  Area: array[1..MaxField] of byte absolute AreaToDump;
  j: integer;
begin
  writeln;
  for j:=1 to Size do
  begin
    write (hex(Area[j]), ' '); ( output byte in hex, followed by space )
    if (j and $F)=0 then ( if byte count is a multiple of 16 )
      writeln; ( go to next line )
  end;
end;

begin (main program)

  ( .. statements that assign values to AnyVar can go here .. )

  HexDump(AnyVar, SizeOf(AnyVar)); ( output the variable in hex )

  ( .. further statements can go here .. )

end.
```

kludge. However, it is worth getting to know the Mem array if you like working with the bare bones of your machine. On the IBM PC, for example, you can examine the various keyboard toggles like Caps Lock and Num Lock by looking at

Mem[0:\$147]

In CP/M-80 the IObyte can be found at Mem[3].

You can also use Mem with addresses relative to individual segments of the 16-bit processor's RAM, thanks to Turbo's built-in segment pointers. For example, the contents of

Mem[DSeg:\$8]

on the IBM PC show the current settings of Turbo's text and background colours. But be cautious about using such information: there is no guarantee that it will apply to future versions of the compiler.

Pascal's strict type checking can be another headache, especially where the matching of parameters is concerned. The compiler will stamp on any attempt to pass a parameter to a sub-program if it is not of the type that the sub-program is expecting to receive. Of course, this is usually a good thing since it can keep some hard-to-trace bugs out of the program.

(continued on next page)

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But there are times when a little more flexibility would be nice. For instance, it is often desirable to write general-purpose routines that can operate on any type of data. A good example would be a procedure that gives a hexadecimal display of the exact contents of any variable. This could be a valuable debugging aid in much the same way as the Write statement, except that it would work with arrays and records as well as with simple variables.

In standard Pascal this would be impossible. But Turbo comes to the rescue with its absolute variables. Any variable can be declared as absolute, meaning that it will reside at a specific address in memory. This can be an actual physical address, or it can be the address of any other variable. So defining

A absolute B

means that A and B will both reside at the same location and will therefore contain the same data.

There is nothing stopping A from being a variable declared within a sub-program, while B is a parameter that the sub-program receives. Also, if B happens to be untyped, Pascal's type checking is neatly sidestepped. Untyped parameters are normally only used in operations where the type is immaterial, such as Move and Fillchar. But they can also be used in the definition of absolute vari-

ables. The listing on the previous page shows how to take advantage of this to implement the hex dump routine.

The absolute variable in the example is defined as an array of bytes, this being the most convenient structure for the hex routine. Since the compiler needs to know the size of this array, you have to impose some arbitrary limit on the size of the variable. You might as well set this limit fairly high since it does not cause any additional space to be allocated.

An important point about untyped parameters is that they must be passed by reference rather than by value; that is, they must be Var parameters. Otherwise the sub-program would not know the address of the data item — and the mapping of the absolute variable would not work.

Var parameters are also important where efficiency is concerned. When value parameters are passed, the sub-program receives a copy of the entire variable on the stack and this is discarded when the routine exists. With reference parameters, only the address is passed. This is necessary for processes that have to alter the data for the benefit of the caller.

It is clearly more economical to use Var parameters even if the called routine does not change their contents. With large arrays and records, many hundreds of bytes might have to be copied, compared to just two or

four bytes — depending on the processor — for copying addresses. The time and space costs involved can be excessive and many programmers make a point of always calling by reference for all non-simple data types.

Compiler directives are another area to watch. During program development it is usually a good idea to switch on the R directive, which does run-time checks of array subscripts, because untrapped subscript errors could otherwise cause the program to go crazy. The same applies to the K directive, which checks for stack overflow. However, there is surprisingly little to gain from switching these directives off when testing is finished.

In a series of experiments I found that keeping R and K passive increased running times by only one percent to three percent. There was also only a very small increase in the size of the Com files. This is at odds with the Turbo manual's advice to switch the directives off for live running.

The U directive is a different story. It causes the program to make constant checks of the keyboard in case the user wishes to interrupt execution by pressing Control-C. Programs compiled with this directive take from 80 percent to 150 percent longer to run. Using the C directive is a better bet, because the checks are then only carried out when there is console I/O, and the effect on total running time is usually small. PC

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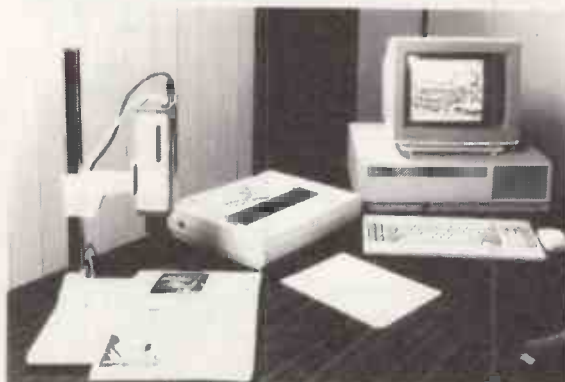
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BY JACK SCHOFIELD

## SOURCES FOR YOUR SOURCES

IF YOU WANT TO FIND WHICH DATABASES HOLD THE INFORMATION YOU ARE LOOKING FOR YOU WILL HAVE TO GO BACK TO GOOD OLD PAPER AND PRINT.

On-line databases are valued as a quick and easy way of finding out detailed information at any hour of the day or night. Unfortunately this only applies as long as you know which database to call to get the information you need. In many areas this is far from obvious. And if you have to spend three days finding out which database to call, then arranging for an ID, you might as well get the information by some other means.

But help is at hand. There are two sources of information on databases readily available: *Brit-line* and *Online Business Information*. Both are reliable, and since both have been going for over a year they can now — in this overnight industry — be considered established.

*Brit-line* is a 376-page A4-size printed directory of British databases, which aims to publish updated versions twice a year. Volume 2 No. 1, 1987 has just come out, under the sponsorship of ICL. The directory opens with some general features on the on-line business, comms, Alanet and Janet, and a piece from me comparing Prestel and the French Teletel system. Pages 23 to 349 are the meat of the book that describes particular databases. Pages 351-76 contain a very thorough three-column index.

The main database guide is divided into 34 sub-sections covering such topics as Agriculture, Chemistry, Education, Finance, Grants, Health and Safety, Law and Politics, the Media, Travel and Tourism, and Veterinary Science. There are three further sections on services where a database of information is not the key offering. They are financial and insurance services, special on-line services such as ICL's Tradanet, and electronic-mail services, including Telecom Gold.

Each database entry contains most if not all the following items of information: the owner/producer; the type, whether it is bibliographic, numeric or referral; the subject; a brief description of content; the host; file size; file update interval; period covered; printed version; whether the information is available on other storage media such as CD-ROM; documentation and training; notes; and a sample record from the database.

The section on the host may contain several entries, with the name of the host, annual fee, charge per connect hour, other costs and times available for each. The ICC Directory of Companies, for example, is available from Data Star at 156 Swiss francs per hour, Dialog at \$96 per hour, Hotline at

£120 per hour, and ICC Viewdata at £60 per hour.

The databases listed cover an astonishingly wide range: from the Food Additive Suppliers and Traders (FAST), to Rhine barge and tank-wagon prices from Petroleum Argus; from the carbon-13 nuclear magnetic resonance spectral search system to the Incunable short-title catalogue of books printed with movable type before 1501.

One of the many new sections in the latest edition is of Community Information. This includes such delights as Basil from Basildon District Council, Brainfax from Braintree District Council, Kent Viewdata and the Hackney Bulletin. There are only eight pages on this type of material but the development is important for two reasons. First, we all want local councils to put more information on-line — not just welfare and council services, but town planning, rates, grants and other useful stuff. And second, we also want plenty of real people to become ordinary, everyday on-line data consumers, thus removing the slightly weirdo image from the rest of us. Community databases are not intrinsically of much importance yet, but their appearance is an encouraging sign.

The index includes a nine-page list of addresses, with the frequent inclusion of contact numbers for telephone, telex, facsimile, Telecom Gold and — wonder of wonders — the occasional PSS NUA, as well as the usual postal address. The fact that one company involved with cable and satellite information cannot do better than a PO Box fills me with horror; I'd be ashamed of myself if I couldn't quote at least one data address in a catalogue like *Brit-line*. Let's hope the companies that have not managed to quote a telex or Telecom Gold number get their acts together before the next edition.

The only extra thing I would like from *Brit-line* is an on-line version to provide casual users with a source of database information. For regular users who have actually bought the book, the on-line version could provide updates and alterations, which are important in a fast-changing field where services come and go all the time. *Brit-line's* Hannah Khayyat confirms that an on-line version is in progress, and it may be made available via Telecom Gold.

*On-line Business Information (OLBI)* from Headland Press is a rather different type of product to *Brit-line*. It evaluates databases rather than simply cataloguing

them. There is more detailed information on fewer databases, and its basic format is a monthly issue of hole-punched pages to fit in the blue four-ring binder which you get to start with.


The most useful part of the monthly *OLBI* is the so-called "test drive". A user — usually the editor, Dr Frank Ryan — tries out a database, describes what it contains and how to use it effectively. Screen dumps may be provided as illustrations. *OLBI* also keeps you up to date with the news.

The most recent issue to hand — February 1987 — includes test drives of both Guardian Business Information — which has no connection with the *Guardian* newspaper — and Infocheck. The news items include the addition of *Super Marketing* magazine to Magic, Data-Star opening its first U.S. office, Kompass Online training seminars, and the inclusion of the full text of the *Financial Times* in the Dialog database.

Test drives last year included all three marketing databases Harvest, Maid and Magic, both Mars and Prompt on Data-Star, McCarthy Online, Kompass Online and BT's Hotline. There were also numerous items monitoring the progress of CD-ROM.

Naturally there is a tendency for *OLBI* to concentrate on local databases — which in this context means the European ones, rather than the American ones which tend to be well-known already. *Brit-line* obviously concentrates on British-produced databases, though of course a large proportion of them are hosted by U.S. suppliers such as Dialog. *Brit-line* also has over 30 entries for databases hosted by Data-Star, which is owned by Radio Suisse in Switzerland.

*Brit-line* is a reference work which ought to be part of every public or company research library. Anyone can use it, and perhaps the only thing that would stop any individual from buying it is the price of £30 per copy or £55 per year. *OLBI* is, by contrast, more suited for full-time researchers and information scientists. For this level of database user the background information and practical tips that come up in the test drives make it worth the price of £89 a year plus £5 post and packaging.

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## • C H I P - C H A T •

BY RAY COLES

# FILLING IN TIME

WHILE THE REST OF US ARE CATCHING UP WITH THE LATEST GENERATION OF CPU AND MEMORY CHIPS THE DESIGNERS ARE BUSY CONJURING UP DEVICES WHICH DO SOME BORING OLD JOBS IN EXCITING NEW WAYS.

**W**ith 1Mbit dynamic memory chips and 32-bit microprocessors now established as everyday devices, chip designers have been puzzling over what to turn their attention to next. They are facing up to the fact that it will be several years at least before equipment designers have fully exploited today's huge memories and greedy processors. In consequence they are busy seeking new applications for their awesome technology which do not involve 4Mbit RAMs or 64-bit processors.

One way for chip designers to ensure continuing employment is to design a new acronym and then persuade the world that it can't live without it. ASSP or application specific standard part rolls nicely off the tongue, and will do for a start.

One of the first ASSPs has just been launched by Toshiba. It is intended to breathe new life into the venerable old Z-80 processor. There is still a lot of mileage in the Z-80 if you have the right acronym. And even if you are not impressed by acronyms, I bet you go weak at the knees for buzzwords. The Toshiba designers have come up with a splendid one: super integration.

The first super-integrated ASSP is coded TMPZ-84C011AF — a work of art in itself, you'll agree. It combines on a single CMOS chip an 8MHz Z-80 processor, a clock-generator controller, a counter timer, five eight-bit I/O ports, and a dynamic RAM refresh controller, all housed in a 100-pin flat pack. Now that the acronym has been designed, further parts will follow thick and fast. They include the TMPZ-84C013AT communications orientated super Z-80, and the TMPZ-84C015AT serial/parallel interface ensemble.

The level of integration is not terribly impressive perhaps, but the beauty of the Toshiba ASSP approach lies in the ease with which yet more versions can be turned out when required, to suit the whim of any system builder who needs nothing more powerful than a Z-80 but also needs to keep system cost and size to a minimum.

The Toshiba Super Integration approach is unusual in that it relies on the use of the existing die designs already available for the Z-80 and its peripheral chips, such as PIOs and SIOs. The final die includes the die layouts of the individual devices, plus an area of random logic for the "glue" and a interconnecting bus arrangement. This approach does not provide the ultimate in chip density but it does mean that new com-

binations can be produced very easily and economically in relatively small quantities.

The designers at Zilog, who of course developed the Z-80 in the first place, have a job-creation scheme of their own, although they do appear to have a lot to learn from Toshiba about acronyms and buzzwords. Zilog is bringing new technology to bear on its old Z-80 and Z-8000 designs by introducing new CMOS versions of those chips. It is also developing a pair of support chips which integrate most of the glue logic required in eight-bit and 16-bit systems.

The Z-84C80 is intended as a companion to the Z-80. It could replace 70 to 100 discrete glue-logic parts by integrating a clock oscillator, watchdog timer, Z-8500 bus interface, wait-state generator, a dynamic-RAM controller for 64K and 256K memory devices, and a variety of other goodies. All this is packed on to a single CMOS chip in a 68-lead package. The Z-8020 does a similar job for Z-8000 designs, but operates with multiplexed address and data lines and caters for larger dynamic-RAM arrays. Unlike the Toshiba ASSPs, the Zilog chips are full-custom parts which have kept more designers employed for longer, so perhaps acronyms aren't everything.

With silicon foundries offering ever larger CMOS gate arrays which can be turned into application-specific integrated circuits (ASICs) by means of a final layer of metal interconnection, there is also plenty of scope for small bands of itinerant CPU designers to form their own company to produce exciting new ASIC peripherals.

One such device, the 82C206 integrated peripheral controller (IPC) has been designed by Chips and Technologies Incorporated. It can do wonderful things for all IBM PC/AT clone builders as it combines on a single chip the functions of seven VLSI


chips found on a conventional AT circuit board. They include two 8237 DMA controllers, two 8259 interrupt controllers, an 8254 timer counter, a 146818 real-time clock, a 74LS612 memory mapper and a handful of glue-logic devices.

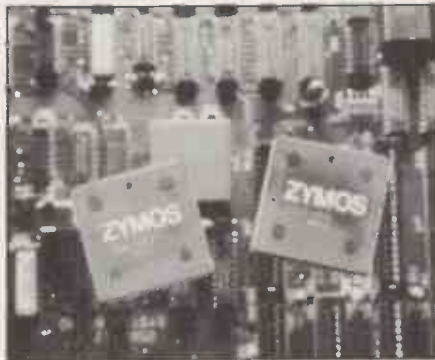
Implemented in CMOS and housed in an 84-pin package, the IPC consumes 1/10th the power, operates 60 percent faster and provides a more flexible set of programming and configuration options than the separate Intel peripherals it replaces. Since 1985 Chips and Technologies has also had available a five-chip set which provides all the glue logic for an AT design. Used in conjunction with an 80286 CPU and a memory array, the 82C206 and the CS-8220 chip set can be used to build an AT clone with one-third the chips and one-third the power consumption, and running at 10MHz rather than 8MHz.

That's not bad, but Zymos can do better with its aptly named Poach two-chip set. Not only does the Zymos chip set do everything that the six-chip Chips set does, it also has the ultimate accolade of an unintelligible and unexplained acronym. Yet another small design company, Faraday Electronics Inc., has a two-chip set for a do-it-yourself AT. In this case the functions have been packaged differently, and some seldom-used features of the standard AT have been left out.

For the best in chip-designer youth-opportunity schemes, however, you have to go after 32-bit processors like the Intel 80386. Intel itself has announced several new peripherals recently, including the 82380 integrated system peripheral (ISP) which includes eight DMA channels, interrupt controller, timers, memory-refresh logic, wait-state generators and a reset system.

Our old friends from Chips and Technologies Inc. are in there too, with the seven-chip CS-8230 set. It replaces just about everything except the CPU and the memory, cutting a full 80386-based AT-compatible chip complement from 200 devices down to less than 40.

With computer-aided engineering work stations for ASIC design and simulation now available which are themselves based on AT/286 and AT/386 machines, the design of circuits like these could become a cottage industry. Higher levels of integration also mean lower prices for finished systems and that has to be good for us all. 



The Zymos Poach two-chip set.



## UNHOLY ALLIANCE

EUROPEAN REGULATIONS WILL SHORTLY GIVE CHIP DESIGNS THE SAME PROTECTION THEY ALREADY RECEIVE IN AMERICA AND JAPAN — BUT NOT BEFORE THOSE TWO COUNTRIES HAVE ENTERED INTO A TRADING PACT DESIGNED TO SECURE THEIR POSITIONS.

There is growing cause for concern that European computer manufacturers will soon lose what little control they have left over the supply and price of chips. If this should happen the blame may fairly be attributed to the European Communities' notorious inability to reach agreement. For while Europe has been thinking — and bickering — about harmonising its member states' laws and policies in order to create a common market in semiconductor products, the U.S. and Japan have begun to present the united trading front that European industry so badly needs.

As yet the U.S.-Japan alliance is fragile. Probably the greatest threat to its continued existence is hostility from U.S. chip manufacturers. They fear that the Japanese are unfairly exploiting the trade pact on which the alliance is based, and this has resulted in unprecedented moves, in a traditionally fragmented industry, towards co-operation in research, development and marketing.

That the alliance should have come into existence at all is a tribute to the tenacity and political sophistication of MITI, the Japanese Ministry of International Trade and Industry. MITI's real achievement in promoting Japanese high-tech industries has been its ability not only to plan a long-term strategy but also to implement it by means of an interlocking and carefully designed package of measures.

One of MITI's early — albeit unsuccessful — attempts was to create a special legal environment for computer software. MITI argued that software was generically different from the literary works traditionally protected by copyright and should be protected instead by a tailor-made or *sui generis* program rights law. This led to a clash with the Japanese Ministry of Culture from which MITI emerged the loser. Computer software is now covered by copyright law in Japan in much the same way as in the West.

A more immediate effect of the Japanese software wrangle was that it paved the way for MITI's subsequent proposal to introduce a *sui generis* law to protect semiconductors. MITI's success in this instance has meant that Japanese law expressly protects chips first marketed in Japan, providing an obvious incentive to any chip manufacturer to operate from Japan. At the same time Japan's trade competitors have offered chip manufacturers copyright protection only. In most countries this remains the case.

Relying on copyright is haphazard to say the least. Proof of copyright infringement depends upon the ability of a non-expert, using only the naked eye, to relate the design of the chip's layout to the topography of the three-dimensional chip. At the time MITI's proposals were being enacted, a bill was under discussion in the U.S. Senate to extend copyright to chips. In response to the Japanese moves, a rival Semiconductor Chip Protection Bill was rushed through the House of Representatives and was enacted in 1984. Both in the U.S. and in Japan, chips are thus protected by specially tailor-made laws.

It has taken three years for Europe to follow suit. A recently published EC directive granting express legal rights in respect of semiconductors must be implemented in member states, including the U.K., by November. In the meantime, the superior legal framework in place in both the U.S. and Japan is one frequently cited reason for the industry's concentration in those countries. It is, for example, among the suggested reasons for the withdrawal of Inmos from the U.K.

The two major competitors are now engaged in an uneasy truce which is viewed within the British computer industry as potentially the most significant technology cartel ever. The U.S.-Japan chip agreement was signed last year and was due to be fully implemented on 1 April. It commits Japan to preventing its chips being dumped in the U.S. and other markets, and to opening up the Japanese market to U.S. competitors.

Sematech, the newly created organisation that is promoting the interests of the U.S. semiconductor industry, is ambivalent in its attitude to the deal. Two alternative forecasts are available: that the U.S. semiconductor industry will become the next victim of the economic onslaught from Japan, or that it will be the first survivor. Sematech is not prepared to leave the outcome to chance, or to the unguided efforts of government. It has mounted a determined lobby to persuade Congress of its fear that the U.S. industry may be unfairly exploited through the pact. Its argument that the U.S. depends on this technology for military superiority has already won it the support of the Defense Department.

MITI, on the other hand, seems determined to make the deal work. When Sematech complained that its members'

sales in Japan had fallen since the agreement was signed, and that Japanese chips were being sold at below face value in Asia, MITI immediately responded with a directive to Japanese manufacturers to cut memory chip production.

But there are reasons closer to home for which the agreement may still falter. Last year Intel successfully sued NEC Electronics Inc., a U.S. subsidiary of the Japanese firm NEC, over the copyright in its chips' micro-code. NEC is now producing these chips under licence from Intel. The facts from which the case arose took place before the Semiconductor Act came into force, and the provisions of that legislation were thus not at issue. Nevertheless, the case has given the U.S. industry pause for thought.

The Semiconductor Act gives to the owner of the mask work — that is, the topographical design — exclusive rights to reproduce, import or distribute a chip in which the mask work is embodied. But reverse engineering a chip design is not an infringement of the owner's rights, provided it is for the purpose of teaching, analysing or evaluating the concepts or techniques it embodies. The report of the Committee on the Judiciary that accompanied and explained the Semiconductor Bill to Congress made it clear that the intention was to encourage competitors to improve on existing chips but to prohibit slavish imitation.

In practice the two concepts are often indistinguishable. The possibility remains of Japanese companies reverse engineering the products of U.S. licensors, and then producing cheaper and better clones with which to beat U.S. manufacturers in their home market. This may prove to be the most potent threat to the U.S.-Japan alliance. Certainly the Intel case indicates that Japanese companies may be ready and willing to exploit what the U.S. industry increasingly views as a loophole in the Semiconductor law.

The EC, meanwhile, fears for its own economic well-being and is attacking the U.S.-Japan agreement as a violation of the General Agreement on Tariffs and Trade (Gatt). Both the U.S. and Japan predictably refused an EC demand at the most recent Gatt meeting for the creation of a disputes panel to determine the issue. Without U.S. and Japanese co-operation there is very little that Europe can do other than hope that the pact dies a natural and speedy death.



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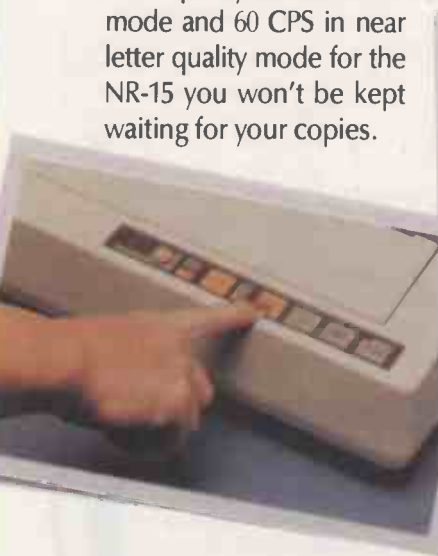
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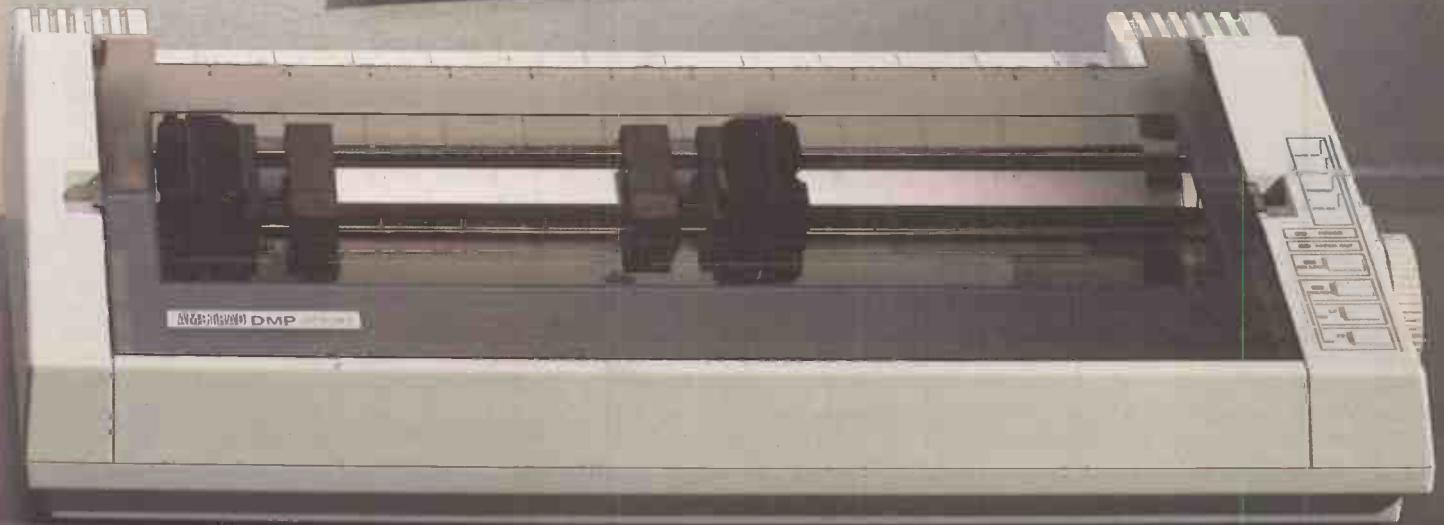


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# AMIGA 2000

## COMMODORE BRIDGES THE GAP

By David Barlow

This hybrid combines the outstanding sound and graphics potential of the original Amiga with IBM compatibility.

**A**lthough Commodore had a head start in the field of business micros with the now legendary Pet range, in recent years it has been unable to maintain its grip on this most lucrative sector of the microcomputer market. Its image has been dragged down by its highly visible involvement in home computers, and the unexceptional Commodore PC-10 range of IBM compatibles has done little to restore confidence.

But it has not been all bad news. Things started to look up last year when Commodore started to ship the Amiga 1000, a truly revolutionary and innovative personal computer. Judged on specification alone it should be wiping the floor with nearly all the IBM PC- and PC/AT-compatible opposition. It features the powerful Motorola 68000 processor and one of the most advanced graphics and sound systems ever seen on a micro.

But there is more to a successful personal computer than just mind-blowing hardware. Without a comprehensive range of robust and easy-to-use business software the chances of success are small. Commodore even shifted the emphasis of the Amiga 1000 away from general-purpose software — where the IBM standard now dominates — to vertical markets, in the hope of encouraging software houses to develop specialised applications that could make full use of the Amiga's advanced hardware. Although this ploy boosted sales, it made little impact on the IBM-compatible market.

### HYBRID

Commodore has responded with the Amiga 2000, which to all intents and purposes is an Amiga 1000 combined with a built-in IBM compatible. The new system unit is considerably larger than the old one, most of the increase going into extra height to allow a conventional expansion bus to be included. The top half of the front panel houses the Amiga floppy-disc drive; the standard machine is fitted with one 3.5in. unit but there is room for a second. The

lower half is where the optional IBM-compatible 5.25in. disc drive is located.

The rear panel offers a similar array of ports to those found on the Amiga 1000, including stereo phono for audio, external disc drive, monitor, and serial and parallel interfaces. The last two conform to IBM PC standards, so it should be possible to use standard peripherals on the Amiga 2000.

The internal layout has changed, though the basic components remain largely the same. The Motorola 68000 chip running at 7.14MHz is supported by the three very powerful custom chips called Agnes, Paula and Denise, which handle screen, I/O and sound facilities. The chip is coupled to 1Mbyte of RAM which can be expanded to 9Mbyte by plug-in memory expansion cards.

You convert the Amiga 2000 to an IBM

Amiga memory can be expanded to 9Mbyte by adding cards. There are two types of board: the 2Mbyte, also available with 512K or 1Mbyte of RAM; and the 8Mbyte board, also available with just 6Mbyte of RAM. The IBM memory expansion is not quite as efficient on space because the bridge board can only be expanded to 512K. If you want to expand up to the current DOS limit of 640K you have to fit the extra 128K on an expansion card.

The review machine was fitted with the IBM bridge board, an Amiga 3.5in. floppy drive, a 5.25in. floppy and a 20Mbyte hard disc. With this configuration there is still room for a further Amiga 3.5in. floppy. Commodore will supply a 40Mbyte hard-disc version and an optional tape streamer, so it is clear that the Amiga 2000 is aimed at the serious end of the business market.

### KEYBOARD

The Amiga 1000/Sidecar combination had distinct limitations when it came to IBM compatibility. Most of them arose because the Amiga keyboard did not conform to the IBM layout. Commodore has now made further concessions to the IBM camp by giving the Amiga 2000 a keyboard that should prove adequate for both sides of the machine's complex personality. All the original Amiga 1000 features are there, including the two special Amiga keys, but a closer look reveals dual engraving on many keys — one for the Amiga environment and one for the IBM.

The 2000's keyboard is more akin to the PC/AT layout and has dedicated cursor keys but only one LED indicator on the Caps Lock key. However, on the review machine for some reason this often worked in reverse. The keyboard is well made, with a good action and a three-position tilt facility.

The Amiga is primarily intended for use with the Commodore 1081 colour monitor. Connections are more what you would expect to find in the world of video rather than micros, and include a Scart plug on one end and a 25-pin D-type plug on the other, with flying phono audio leads. The 1081 monitor is only medium resolution, and many serious users may find this unacceptable for prolonged periods of use. Unfortunately, you cannot just use another unit from an alternate supplier as you might with an ordinary IBM compatible because of the specialist nature of the Amiga. Commodore

AMIGA 2000				
VERDICT	POOR	AVERAGE	GOOD	EXCELLENT
	Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Great for users hooked on the as yet unexploited potential of the Amiga but who occasionally need to run functional software.

compatible by fitting a plug-in board. It contains an Intel 8088 processor running at 4.77MHz, a floppy-disc controller, a PC BIOS ROM, the interface electronics necessary to communicate with the Amiga and 256K of non-parity-checking RAM which can be expanded to 512K by plugging in 256Kbit chips. To complete the IBM-compatible specification there is a blank socket for the Intel 8087 arithmetic coprocessor. The board is based on the Sidecar IBM-compatible option offered on the original Amiga 1000, which has been modified to plug into an expansion bus.

Expansion potential, one of the weak areas of the original 1000, has been turned into one of the 2000's strengths. There are five Amiga-compatible slots and four IBM-compatible slots, two of them eight-bit and two 16-bit PC/AT ones.

(continued on page 39)



**SPECIFICATION**

**CPU:** Motorola 68000 running at 7.14MHz  
**RAM:** 1Mbyte expandable to 9Mbyte  
**ROM:** 256K Amiga Plus, IBM PC BIOS by Phoenix Corporation  
**Mass storage:** 3.5in. 880K floppy-disc drive; optional 5.25in. IBM, floppy-disc drive, and 20Mbyte or 40Mbyte hard-disc  
**Display:** Commodore 1081 medium-resolution colour  
**Keyboard:** Amiga IBM PC/AT hybrid with 94 keys  
**Size:** 440mm. (17.5in.) x 400mm. (15.75in.) x 159mm. (6.25in.)  
**Weight:** system unit 12.7kg. (28lb.)  
**Software in price:** Amigados, Amiga Basic, Amiga Desktop  
**Hardware expansion:** IBM PC bridge board, hard discs, floppy discs  
**Price:** £1,095; monitor costs £300 extra; IBM PC bridge board £299; price of 5.25in. disc and hard disc not available  
**Manufacturer:** Commodore, West Germany  
**U.K. distributor:** Commodore Business Machines (U.K.), Commodore House, The Switchback, Gardner Road, Maidenhead, Berkshire SL6 7XA. Telephone: (0628) 770088.



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Imaging Information

(continued from page 37)

offers a high-resolution screen, but it is considerably more expensive.

The Amiga 2000 uses two operating systems. The 68000 CPU runs multi-tasking Amigados 1.2, enabling users to run several applications at one time. The easy-to-use windowing environment makes the most of this feature by allowing background applications to be monitored in small frames inside the foreground activity.

The other operating system is MS-DOS — in this case the now outdated version 2.1. MS-DOS on the Amiga looks the same as MS-DOS on any IBM compatible with the difference that it is effectively booted up from within Amigados. This means that IBM PC applications can be run alongside Amiga applications and — in theory at least — data can be transferred from one environment to the other using cut and paste techniques.

Even though the review machine was fitted with a hard disc it was still necessary to boot it up from the Kickstart floppy. This takes you to the traditional Amiga Workbench, where you can select either Amiga or IBM PC activities. There are two IBM PC icons, one called PC Mono the other PC Colour.

All IBM applications are initially run from the mono window and, when loaded, convert to colour if required by calling in the PC Colour icon. One snag is the time it takes to get into an IBM application when switching on the machine: loading dBase III took 3

minutes 10 seconds. But once into PC applications, the Amiga ran at the rate of an ordinary IBM PC.

The 4.77MHz Intel 8088 processor is now almost unacceptably slow. Commodore must have seen this problem coming, so why it did not develop an 8086- or 80286-based bridge board is a mystery. The Amiga IBM PC display is a bit on the coarse side and appears to be closest to the CGA standard; it is OK for colour graphics but too grainy for long-term use on text applications.

**COMPATIBILITY**

Processor benchmarks are almost identical to those of the IBM PC. Unfortunately it was not possible to test disc performance as the floppy drive on the much travelled review machine was not working. This also precluded the running of any IBM compatibility tests, but early reports from the U.S. are encouraging in this respect. However, it may not be as compatible as a dedicated IBM clone because of the highly complex way in which PC applications work within an alien multi-tasking environment. A similar setup developed by Digital Research with Concurrent DOS runs PC applications under its PC Mode emulator, and it has never proved as robust or compatible as machines running software under their native operating systems.

The Amiga side of the 2000 works more or less like the original Amiga. The advanced Workbench environment makes it easy to use, and the windowed multi-tasking capa-

bility can be used to its full extent. But despite an improvement in the availability of applications software the Amiga still seems to have more than its fair share of games and demos that are intended to exhibit its superb graphics and sound. There are now many more business applications, but Amiga owners do not have anywhere near the same degree of choice as the IBM-compatible owner.

The Amiga is bundled with a few desktop aids and Amiga Basic, which is similar to Microsoft Basic but is extended to support the powerful graphics and sound facilities. The review machine was accompanied by two brief manuals covering an introduction to the system and a description of Amigados. Presentation was rather dull, with black-and-white printing making otherwise useful screen shots difficult to read. Production models will be shipped with a more comprehensive set of documentation.

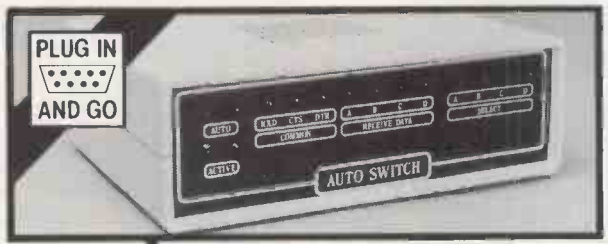
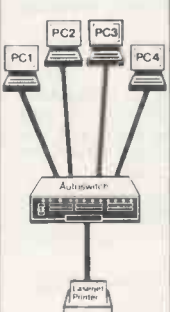
**CONCLUSIONS**

- The Amiga 2000 is one of the most powerful personal computers currently available and on this basis alone it must be regarded as something of a bargain.
- It offers impressive expansion potential in both Amiga and IBM-compatible areas.
- The price will ensure that nobody is likely to buy the Amiga on the strength of its IBM compatibility alone. The success of the machine is likely to be dependent on the more widespread availability of Amiga business software.

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- U501. SWEEP.** Famous file-handler. Reads, mass copies, deletes, etc.
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- U503. NIMBLE DISK.** Helps you move more easily around a hard disk.
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- U606. SQUEEZE/UNSQUEEZE.** Compresses files to save space. Also uncompresses.
- U607. LIBRARY CREATOR.** Combines files into libraries. Adds to, deletes, extracts files.

- U608. LIBRARY DISPLAY.** Displays the directory of a library. Related to above programme.
- U609. NEW NAME.** Changes volume name of a disk.
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## SPECIAL FEATURES

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- U702. NEW DATE.** Changes date of file entry in disk directory.
- U703. BYTE CONVERTER.** Converts all bytes to 2 byte (7 bit) for serial transfer.
- U704. COMPILING AID.** Simplifies, automates compiling and linking.
- U705. ALARM.** Sets time for alarm to sound.
- U706. NEW TIME.** Sets system time and clock.
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- U708. GET TIME.** Simplifies getting time and date.
- U709. CLOCK.** Shows time on screen while you work.
- U710. CALCULATOR.** Memory-resident for convenient access.

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307	308	309	310	401	402	403	404	405
501	502	503	504	505	506	507	508	509
510	601	602	603	604	605	606	607	608
609	610	701	702	703	704	705	706	707
708	709	710	801	802	803	804		

# THREE INK-JETS

## THE SOUND OF SILENCE

By Ian Stobie

There is renewed interest in ink-jet technology for fast, quiet printing, with new units coming from Epson, Siemens and Diconix among others.

Ink-jet printers work along very similar lines to conventional matrix printers. Both types build up characters from a pattern of dots, but instead of banging a set of needles through a ribbon the ink-jet fires ink directly on to the paper from a row of nozzles. As no impact is involved ink-jets are quiet, and this is their one big advantage.

There seems to be a major resurgence of interest among printer manufacturers in ink-jet technology. Here we look at three of the latest offerings, which differ a great deal in both physical size and price.

Epson's SQ-2500 is the biggest, and at £1,345 the most expensive. Its 24-nozzle print head provides good print quality, and the SQ-2500 is intended primarily for word processing and other high-quality work. A 16.5in. wide carriage is standard, making it suitable for spreadsheets as well.

Siemens is offering two new machines. We looked at the PT-88S, which costs £735 and is the 80-column version with a 10in. carriage. The PT-89S costs £100, for which you get a wider carriage more suitable for spreadsheet work. Both models have nine-nozzle print heads so they are best for applications where top quality is not of prime importance.

The Diconix 150 is very much the smallest of the machines we looked at, measuring 11in. by 6.5in. by 2in. That makes it smaller than the manuals for most IBM software packages. It will run off rechargeable batteries as well as the mains and it weighs just 3.5lb., so it is a truly portable machine. It costs £399 and has a 12-nozzle print head.

Historically the big problem with ink-jet printers has been paper. Most machines have been unable to give consistent results on all the different types of paper encountered in a normal office. You could only get the best output quality on special ink-jet paper. This has prevented ink-jet technology gaining wide acceptance. Both Epson and Siemens claim to have overcome the problem; Diconix still recommends ink-jet paper for best results.

The key to coping with different paper types is the ink. Both Siemens and Epson are using reformulated inks for their new printers. Ink-jet ink must dry rapidly once it

gets on the paper to reduce the chance of smearing, but it must not dry in the head itself or it will clog the nozzles.

Epson seems to have got the inking about right. We found the SQ-2500 gave very good results on our normal listing paper, and quite acceptable results on our letter-head, which is printed on Conqueror paper. Conqueror is a rough-surfaced, textured paper and so it is difficult for ink-jets to cope with. Character outlines were slightly more jagged on this surface, but the results were still perfectly acceptable.

On normal listing paper we thought draft mode looked a bit thin, but the typeface is still attractive. In letter-quality mode you get a choice of five founts: Courier, Prestige,

the ink hitting the paper probably really is near silent, the print-head noise is quite distracting — something like someone sharpening a knife with a steel. Letter-quality mode is much quieter than draft.

Paper feed on the SQ-2500 is excellent. The standard machine comes with friction feed only; tractor feed is an option, along with a cut-sheet bin feeder. But the paper guide is very accurate, so we found that even with long documents of 20 pages or more we had no trouble using continuous fanfold paper. You probably only need a tractor if you are going to print really long documents or batch jobs, or use software which rewinds the paper. Of course, with any ink-jet you cannot use multi-part stationery or carbon paper as it is a non-impact technology.

Epson claims a very high speed for the SQ-2500: 450 characters per second (cps) in draft mode and 150cps in letter quality. Corresponding figures for the Siemens printer are 200cps draft and 67cps quality, while Diconix claims 150cps draft and 50cps quality.

The Diconix figures should be downrated by 20 percent straight away for a fair comparison as it normally prints at 12 characters per inch, not 10. But even after this adjustment has been made it is unwise to take these figures very seriously. Manufacturers' quoted speed figures always seem to overstate the throughput you could expect in a real printing job by a factor of two at least.

To check the claims we therefore devised our own test, printing out a series of realistic documents and timing the machines with a stop watch. The results are summarised in the charts on page 44. All three ink-jets did quite well, with the Epson SQ-2500 the fastest, the Siemens PT-88S a fairly close second and the portable Diconix 150 trailing behind, as expected.

### NEARLY UP WITH LASERS

Figures expressed in characters per second are rather meaningless to most people, so we have given the results in pages per minute. In draft mode the Epson manages over five pages per minute when printing our set of test letters, the Siemens over four. Even in letter-quality mode the Epson manages 3.5. This is pretty good even compared to laser printers, which rarely get anywhere near the eight or 10 pages a minute typically claimed for them.

On our test letters the printers were able to skip over blank lines to save time, something a laser printer cannot do. Printing our test spreadsheets took the machines longer,

EPSON SQ-2500				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

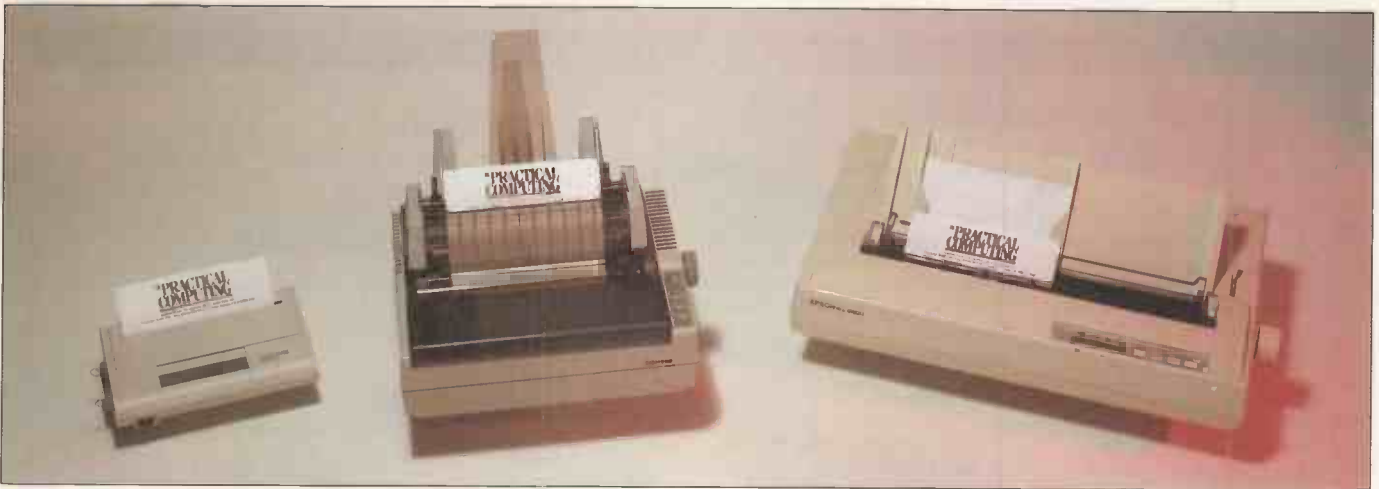
Fast, with excellent print quality on a wide range of different papers, but not all that quiet.

Roman, Sans Serif and Script. You set them up using buttons on the front of the machine in conjunction with the SQ-2500's 20-character liquid crystal display.

The Epson's ink comes in a large rectangular cartridge which fits into the side of the machine. Fitting and replacement are very easy and only take a few seconds. Smearing can be a problem with ink-jets, especially if you are using a program which winds the paper back to overprint, but we had no such difficulties with the SQ-2500.

However, we found the SQ-2500's noise level disappointing. It was definitely the loudest of the three ink-jets we looked at and also louder than any laser printer we have used. We found we could take phone calls with the printer going alongside, but it was still irritating.

Instead of the high-pitched bandsaw noise of the typical matrix printer, the SQ-2500 gives you two distinct noises: a guttural stuttering of the paper advance mechanism, and then a periodic whine as the print head shoots back and forth. While



Left to right: The Diconix 150, Siemens PT-88S and Epson SQ-2500.

as the pages are fuller. The listings test is intended to give a guide to performance at printing things involving a high proportion of short lines — single-column mailing labels, Basic programs and the like. Speed comes out somewhere between the letter and spreadsheet printing.

Print quality on the Siemens PT-88S is not as good as on the Epson machine as it only has a nine-nozzle head. It also offers just one font in its top-quality mode rather than a choice of several. But we still found the results fairly good and in step with its lower price. The PT-88S is a development of an earlier Siemens printer, the PT-88. The main difference is its reformulated ink, which is contained in a cartridge that fits into the print-head assembly. Installation is fairly easy.

**SPECIAL PAPER**

While the PT-88S did give usable results on our normal paper stock, it was very much better on ink-jet paper. We would not hesitate to use the Siemens with normal listing paper for internal use, but it would be worth switching to a more absorbent ink-jet paper for correspondence or graphics work. With all the types of paper we tried the ink dried very quickly.

What most impressed us about the PT-88S was the noise level: it really is very much quieter than a conventional matrix machine, and the extra drop in noise is enough to take it down to a level where it does not intrude at all. The machine's small details are well worked out too. The paper tears off neatly just above the perforation, for example, saving you a wasted sheet. Paper handling is very good: you get a tractor feed as standard along with friction feed. The paper advance is both accurate and fast, which is one reason why, despite a big difference in claimed cps figures, the Siemens got quite close to the Epson SQ-2500 in our practical speed tests.

Unlike the other two manufacturers, Diconix does not claim that its machine can cope with ordinary office paper. Nonetheless it will work at a push on normal listing or copier paper. Diconix has its own ink-jet technology and uses it on its larger machines, but the Diconix 150 uses a print head made by Hewlett-Packard. The same

**SIEMENS PT-88S**

**PC VERDICT**

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Quick, quiet and not too expensive. The one we wanted to keep, though print quality is not top-class.

**DICONIX 150**

**PC VERDICT**

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A neat, compact and quiet unit ideal for portable use, though fussy about paper.

head is used on HP's Thinkjet printer. It has 12 nozzles and the ink reservoir is built-in. When the ink runs out you throw the head away; a new one costs about £9.

Although it boasts more jets than the Siemens machine the end result does not look as good. Particularly on rough paper like our Conqueror letter head the image tends to break up. It is definitely worth using the right paper, and Diconix can also supply special overhead-transparency film with which we were able to get a very acceptable chart.

In construction the machine is very neat. The whole thing is about the size of a dictionary and fits easily in a briefcase. Both friction and pin feed are standard, and printing is pretty quiet.

Cleverly concealed inside the platen is a battery compartment which will hold five rechargeable Nicad cells. With the machine you get a mains adaptor, but you need to buy the batteries yourself. With the batteries fitted the 150 makes a very effective printer for use alongside a portable machine. The whole thing weighs under 4lb. with the batteries in place.

This small size does have a penalty though. While the 150 will print quite happily on A4 cut-sheet paper or standard 11in. fanfold paper, the print area is only a fraction over 7in. wide. This is not enough to allow you to print a full 80 characters at 10 pitch; in fact we were unable to get the machine to print at all at 10 characters per inch. The 150 prints at 12 characters per inch instead, which is quite acceptable but obviously gives a smaller character size.

Graphics also come out compressed. For compatibility with normal software the Diconix uses just its top nine nozzles when printing graphics. But since they are spaced more closely than on a standard nine-pin matrix printer the image is compressed vertically. To preserve the right aspect ratio the Diconix's built-in software then reduces it horizontally. The end result is that images come out three-quarters size. However, on the right paper the quality is good: the three charts reproduced here were all produced on the Diconix.

**CONCLUSIONS**

- Ink-jet technology has clearly come a long way, though it still has its limitations.
- If the noise of a conventional matrix printer really gets on your nerves these ink-jets are well worth a look.
- Epson's SQ-2500 gives quality output and is very fast. Although the quality is not up to laser standards the speed almost is, and since this is a wide-carriage machine it is better than a laser when it comes to printing spreadsheets. Its weak point is noise.
- Siemens' machine is genuinely quiet. Output quality is not as good as with the Epson offering, but the machine is cheaper. You also need special paper to get the very best results.
- The Diconix product is a fine piece of engineering, but it makes sense only if you need either portability or silence. For the same money you could get a conventional matrix printer which would give better results and print on a broader range of paper.

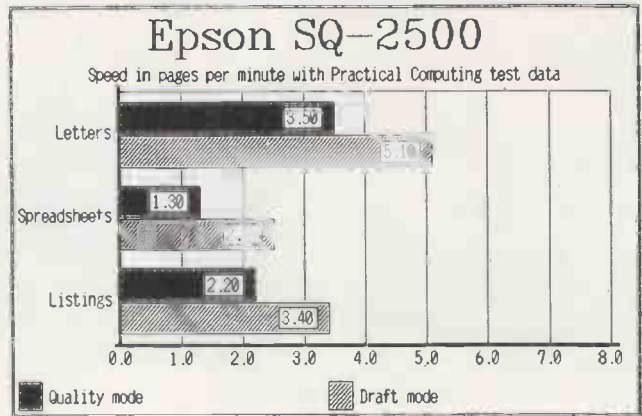
(continued on next page)

SPECIFICATIONS

EPSON SQ-2500

**Print head:** 24 nozzles  
**Print width:** 136 characters at 10cpi  
**Cartridge life:** claimed six million draft characters or three million at LQ; replacement costs £25  
**Print quality:** characters are formed on a 29-by-23 matrix in letter-quality mode, 15-by-23 in draft mode; maximum graphics resolution is 180 by 360 dots per inch  
**Fonts:** Courier, Prestige, Roman, Sans Serif, Script and Draft; optional font modules include OCR-B  
**Claimed speed:** 150cps in quality mode, 450cps in draft mode at 10cpi  
**Noise:** claimed less than 50dB(A)  
**Paper handling:** friction feed

standard; takes single-sheet and fanfold up to 16in. wide; optional tractor £80, dual-bin cut-sheet feeder £335  
**Interfaces:** Centronics parallel and RS-232C serial with six-pin DIN-type socket; options include IEEE-488, Apple II and current loop  
**Compatibility:** Epson FX and LQ  
**Dimensions:** 618mm.(24.3in.) x 380mm.(15in.) x 135mm.(5.3in.); weight 11.2kg.(24.7lb.)  
**Price:** £1,345  
**Manufacturer:** made in Japan by Seiko Epson Corporation  
**U.K. supplier:** Epson U.K., Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. Telephone: 01-902 8892  
**Available:** now

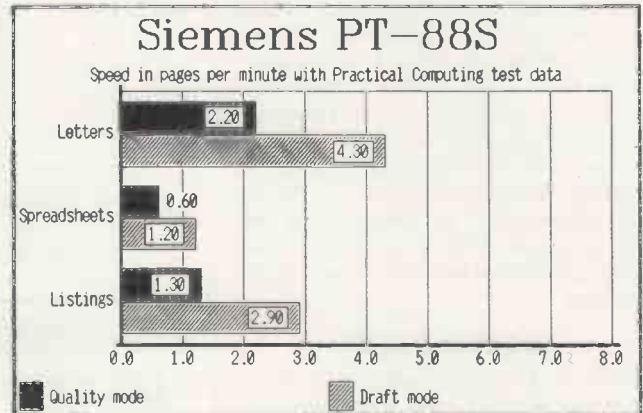


Epson SQ-2500  
 Epson SQ-2500

SIEMENS PT-88S

**Print head:** nine nozzles  
**Print width:** 80 characters at 10cpi; £835 PT-89S is wide-carriage model, printing 136 characters at 10cpi  
**Cartridge life:** claimed five million characters, replacement costs £10  
**Print quality:** characters are formed on a nine-by-18 matrix in quality mode, nine-by-nine in draft mode; maximum graphics resolution is 144 by 144 dots per inch  
**Fonts:** NLQ and Draft  
**Claimed speed:** 67cps in quality mode, 200cps in draft mode at 10cpi  
**Noise:** claimed 45dB(A)  
**Paper handling:** tractor and friction feed standard, taking single-sheet, fanfold and roll paper; sheet feeder £170

**Interfaces:** Centronics parallel; options include RS-232C and IBM coaxial  
**Compatibility:** plug-in modules for IBM PC, Epson FX or mainframe ECMA protocols  
**Dimensions:** 410mm.(16.1in.) x 310mm.(12.2in.) x 140mm.(5.5in.); weighs 7.5kg.(17lb.)  
**Price:** £735  
**Manufacturer:** made in West Germany by Siemens AG  
**U.K. supplier:** Siemens, St. Catherine's House, 2 Hanworth Road, Feltham, Middlesex TW13 5BA. Telephone: (0932) 785691  
**Available:** now

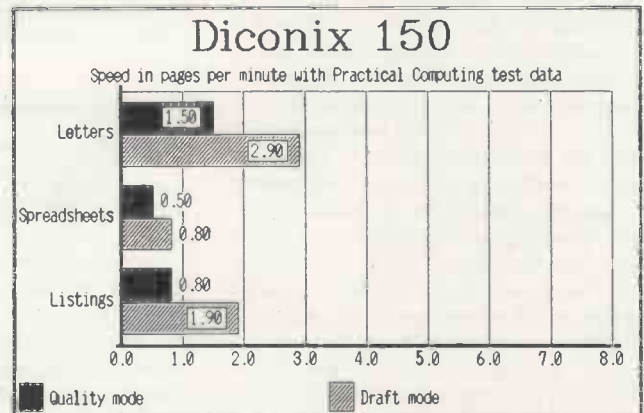


Siemens PT-88S  
 Siemens PT-88S

DICONIX 150

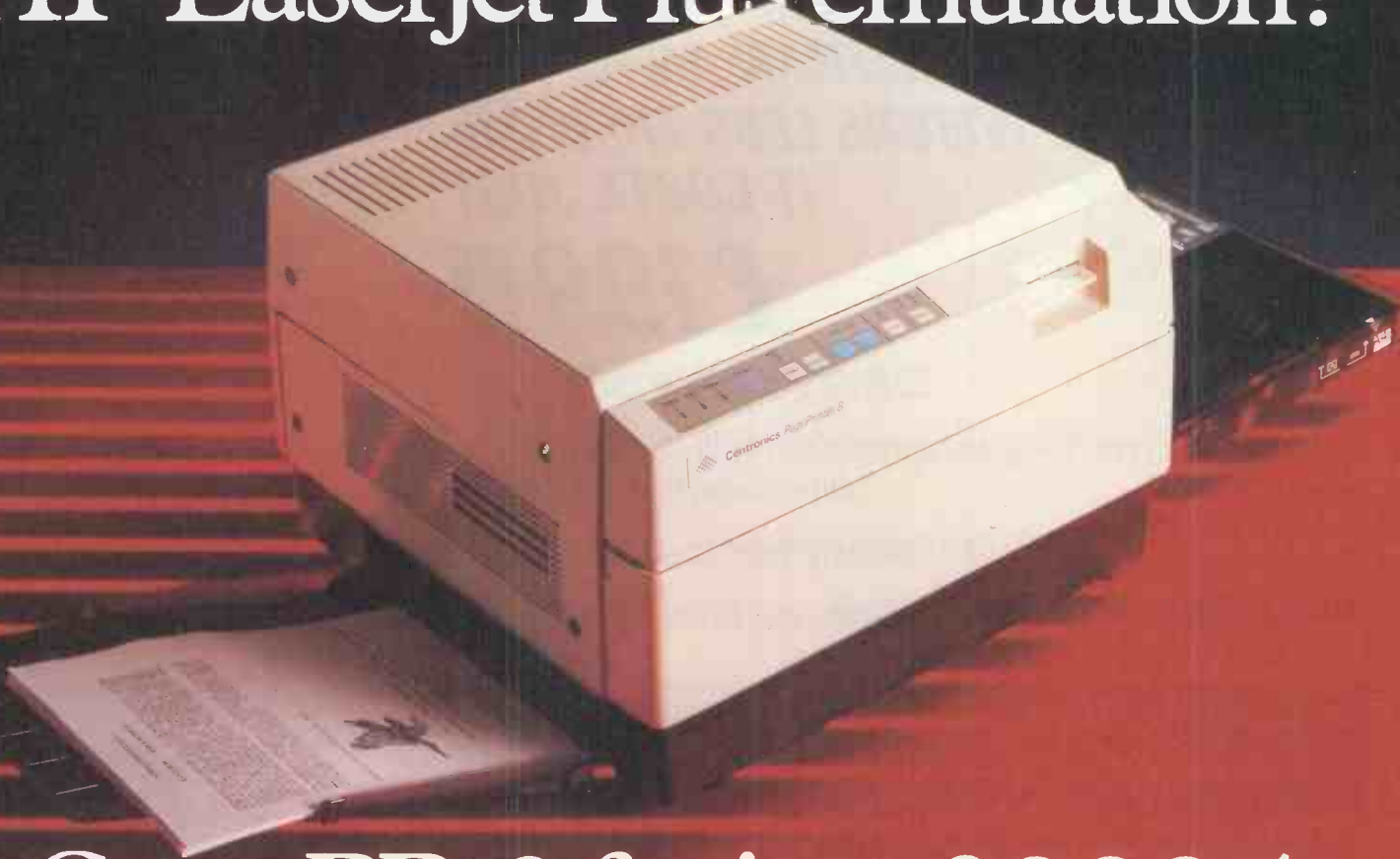
**Print head:** 12 nozzles  
**Print width:** 7.1in., giving 85 characters at 12 cpi  
**Cartridge life:** claimed 500 pages, replacement costs £9  
**Print quality:** characters are formed on a 13-by-18 matrix in quality mode, 13-by-nine in draft mode; maximum graphics resolution is 160 by 96 dots per inch  
**Fonts:** Vintage NLQ, Script and Draft  
**Claimed speed:** 50cps in quality mode, 150cps in draft mode, both at 12cpi  
**Noise:** claimed better than 50dB(A)  
**Paper handling:** pin feed and friction feed standard; takes single sheet and fanfold up to 9.5in. wide and special transparency film which costs 40p a sheet; best results on ink-jet

paper costing £12 per 1,000 continuous paper or £41 per 1,000 art sheets  
**Interfaces:** Centronics parallel  
**Compatibility:** IBM Proprinter and Epson FX  
**Dimensions:** 265mm.(10.8in.) x 159mm.(6.5in.) x 48mm.(2.0in.); weight 1.7kg.(3.75lb.)  
**Portability:** will take five C-size Nicad rechargeable batteries, with a claimed life of 150 pages; supplied with mains adaptor/charger  
**Price:** £399  
**Manufacturer:** made in Japan for Diconix Inc. of Dayton Ohio  
**U.K. supplier:** Norbain Micros, Norbain House, Boulton Road, Reading, Berkshire RG2 0LT. Telephone: (0734) 868855  
**Available:** now



Diconix 150  
 Diconix 150

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Company \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

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Telephone \_\_\_\_\_

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It's an extraordinarily powerful machine which offers word-processing, spreadsheet, and a set of time- and data-management tools in a single, highly portable package.

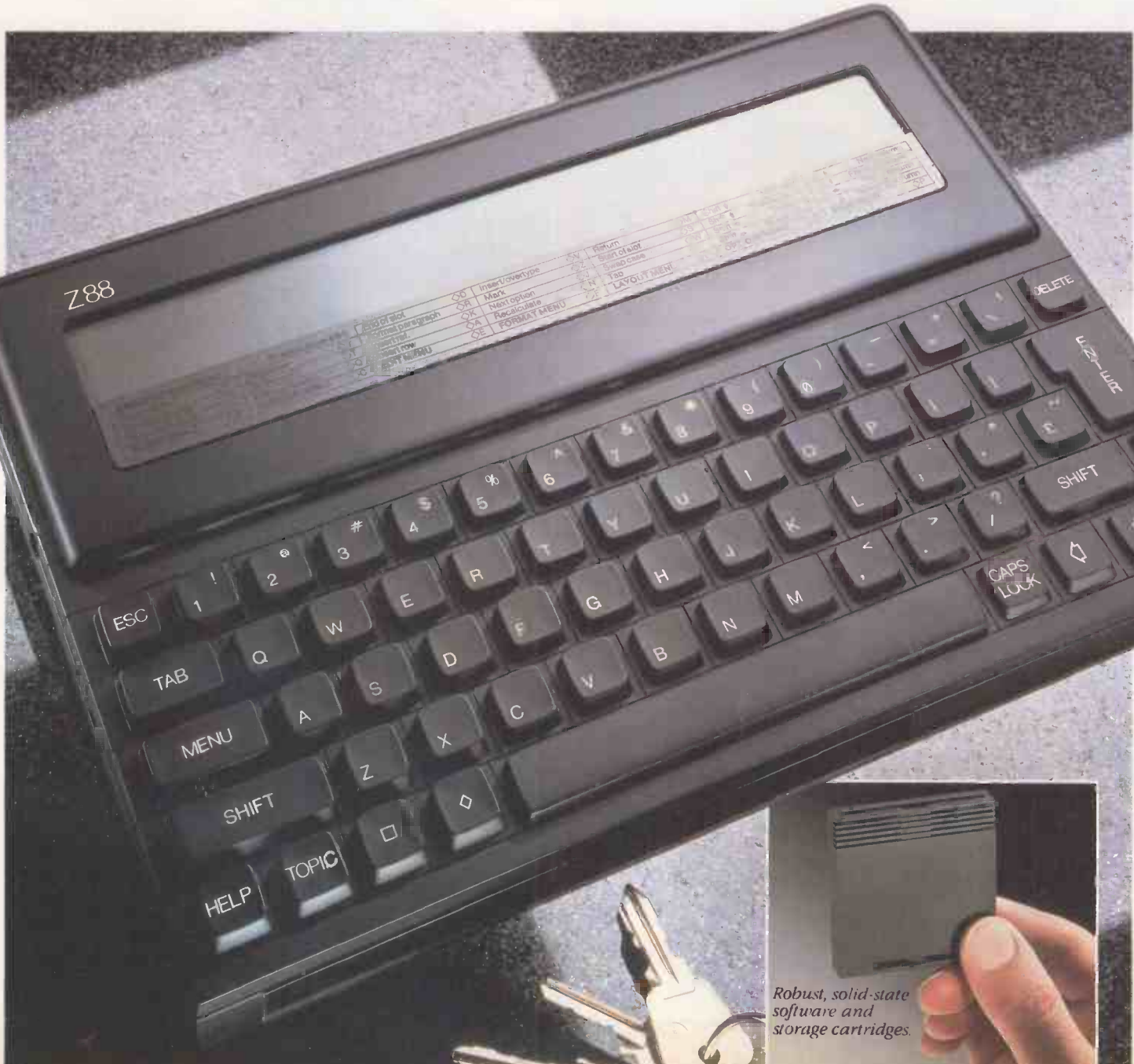
At £199.95 + VAT; the Z88 is supplied with 32K resident RAM. Extra 32K costs under £20 – extra 128K under £50!

And heavy users will be able to expand the RAM to an astonishing 3 Mbytes, using plug-in RAM cartridges.

For printing text or data, the Z88 connects directly to most popular RS232-compatible printers, while for permanent storage the Z88 employs removable solid-state EPROM cartridges – no tape to break, no delicate disc to damage.

Though the Z88 is a powerful, full-facility, self-contained computer, it also acts as an extension of an office micro, connecting directly to allow exchange of text or data.

For every personal computer user, the Z88 offers a comprehensive specification in a package of unparalleled portability.



Robust, solid-state software and storage cartridges.

## THE FACILITIES OF THE Z88

**RAM** Resident 32K, around 15K available (enough for around 2,000 words). Extra RAM available in 32K or 128K cartridges, up to three of which can be plugged into the Z88 to give a total of 416K (enough for a 200-page novel). 1 Mbyte cartridges available shortly. A built-in capacitor or the mains adapter preserves data in RAM while batteries are changed.

**Permanent storage** Where other machines rely on cassette recorders or disc drives, the Z88 uses solid-state EPROM - Erasable Programmable Read-Only Memory - cartridges, with very rapid electronic access and absolute reliability. Up to three EPROM cartridges can be plugged in: 32K and 128K cartridges and ultra-violet eraser are available now. 1 Mbyte cartridges available shortly.

### RS232-compatible port offers:

Printing RS232 cable connects the Z88 to popular printers. Cables can also be made up for virtually any RS232-compatible printer.

**Text- and data-interchange** Resident software formats data for IBM-compatible micros with 5 1/4" or 3 1/2" disc-drives. If your micro can run such popular programs as Wordstar, Lotus 1-2-3 or WordPerfect, you can exchange text and data between it and the Z88. Cable and software available now.

Modem allows text- and data-transmission by telephone.

**Power supply** Optional mains adapter, or 4 AA batteries. (CMOS technology allows about 20 hours active computing - or about a year of life for RAM if machine is switched off).

**Dimensions** 11 1/2" x 8 1/4" x 7 1/8"; weight: under 2 lb.



Full QWERTY keyboard offers 'silent', moving short-travel keys. Foldaway foot raises the Z88 12 1/2" for comfortable viewing and typing.

## ADVANCED INTEGRATED SOFTWARE PACKAGE

The operating system of the Z88 is unique to Cambridge Computer Ltd, supporting as its main in-built software an advanced software package, adapted by Protechnic Ltd for the Z88.

The Z88 automatically preserves data in RAM when switched off.

The software is a set of spreadsheet and word processing applications, with a

sophisticated help function, designed from the first as an integrated package which allows text to be run within a spreadsheet, or a spreadsheet to be run within text.

Word-processing facilities include multi-column layout, global search and replace, and embedded calculations, as well as all the normal word-processing activities. The display shows such commands as bold, italics, underlining, and page breaks. Spreadsheet includes text-handling and sorting.

Other built-in software includes database selection; calculator; free-form diary, calendar, real-time clock and alarm.

An outstanding feature of the Z88 is its ability to switch between tasks within an application, and between applications, without the need to save, exit the package, or restart on return.

While computing a spreadsheet, for example, it is easy to switch directly to the diary, and then go straight back to the spreadsheet - which immediately carries on from the point it had reached.

## STATE-OF-THE-ART SUPERTWIST LCD DISPLAY

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CURSOR	A47	might even prove actively dangerous, and would certainly be unwise. To understand our position, it may be worth looking at the costs in the following spreadsheet extract:		
EDIT				
LAYOUT				
FILES				
BLOCKS				
PRINT				
OPTIONS				
		1987	1988	1989
		45,500	5,900	5,500
		23,750	2,600	

1. 'Topic bar' - seven general menu options, each supported by function menus.
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# IBM PORTABLES MOVING ON A STEP

By Steve Malone

New machines from Compaq, Sharp, Olivetti and Goupil exploit the latest technology to provide useful gains in functionality and compactness.

Several factors have coincided to bring portable computers to the fore in the past year. The first was the U.S. launch of the IBM Convertible. While the machine has not exactly been raking in money for Big Blue, it did confer respectability on the lap portable and its 3.5in. drives. It also gave other manufacturers a standard which they could emulate and improve on.

Just as vital, the technology has improved too. Reduced chip sets have meant that more punch can be packed into a smaller area. And the development of back-lit super-twist LCD screens means you no longer have to eat your weight in carrots to be able to decipher the display.

The final factor has been Toshiba's range of portables. They are the first lap portables to have gained a reasonable share of the market and, more importantly, to have made respectable amounts of money. Taken together these events have convinced wavering manufacturers that there really is money in the lap-portable market, and many have taken the plunge.

Olivetti was one of those who saw an opening even before the launch of the Convertible. The company demonstrated its M-22 early last year, several months before the Convertible saw the light of day. Alas, for reasons which are still obscure, Olivetti decided against the M-22 and withdrew it before launch.

Undeterred, the company has returned to the fray with the M-15. This machine is based around the 80C88 processor running at 4.77MHz. It is equipped with 512K RAM, which matches the Convertible and some of the older lap portables but looks a bit miserly compared to the 640K offered by comparable Toshiba and Zenith machines. There is currently no provision for expanding the memory to 640K or for installing an 8087 co-processor.

The M-15 has no handle but instead comes with its own shoulder bag. Inside, you get the computer, a combined mains transformer and battery charger, and leads. Systems shipped to dealers will also have manuals included but they were not ready in

time for this review. MS-DOS 3.2 was provided with the review machine but is not included in the system price; it will set you back an extra £60.

The M-15 is considerably smaller than the M-22 but it has a full-depth screen, pivoted at the bottom, which swings down over the keyboard when the machine is folded up for carrying. This is in contrast to the M-22, where the screen lifted up halfway along the body. The advantage of the new arrangement is that you get a much bigger screen for your money, which more accurately emulates the kind of display you would see attached to a desk-top machine.

In the carrying position the screen is held by two clips on either side of the machine.

OLIVETTI M-15				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Light and functional, but marred by a poor display.				

They were rather stiff on the review model, but presumably they loosen with use. Lifting the lid reveals the screen and keyboard. Fitted inside the lid to the right of the screen is a speaker, and power and battery LEDs. The controls for contrast, volume and speaker on/off are on the far right.

The LCD screen itself measures just over 10in. diagonally and has about the same height-to-depth ratio as a normal CRT display. The LCD provides a full 80- by 25-character screen, compatible with the IBM Colour Graphics Adaptor, resolving to a pixel definition of 640 by 200.

The LCD is not one of the new back-lit super-twist displays. Its green background colour resembles that of a stagnant pond, but the dark-blue foreground is reasonably easy to read in direct background lighting. However, under strong ambient light the characters become more difficult to read. The tones also leave something to be desired.

When displaying a program like Sidekick, which highlights the text, the display

becomes barely readable, as the highlighting almost matches the text tones. The contrast control is of little use here, only mitigating rather than curing the problem; we found ourselves wishing for a brightness control to bring the text out. It is not the sort of display you would want to look at for any length of time.

The M-15 is fitted with twin 3.5in. drives as standard, one on each side of the machine. They are normally protected by a cover that you flip down when you want to insert a disc. Next to the covers is a release button which pops the disc out of the drive. The drives themselves have a tendency to creak while running, but this seems to be a standard feature with 3.5in. units.

The full-travel keyboard has a nice sculpted feel to it, although we thought it tended to rattle a bit. It is detachable from the main unit, to which it is linked by a 640mm. cable. The cable allows you to work at a comfortable distance from the display rather than having to sit hunched up over it. While Olivetti is not the first company to adopt this idea, it is one we feel ought to catch on with lap-portable manufacturers, particularly as these machines are now beginning to be adopted for desk-top use.

## KEYBOARD LAYOUT

Olivetti has managed to space the keys out pretty well, and there are no problems hitting the right key. As on many other lap portables, the numeric keypad has been sacrificed for compactness and the number keys are doubled up on the right-hand side of the QWERTY area. They are selected by a special Edit/Shift key positioned towards the bottom left-hand corner of the keyboard. On the M-15 the numeric keys also turn into cursor keys when Scroll Lock is on; with Num Lock on they return to their numeric function.

The power-input ports are round the back of the M-15. Two such ports are provided, connecting to the external transformer. One supplies direct d.c. power while the other is used to recharge the machine's batteries. Below the power points are the peripheral interface ports. From the left they are: a Centronics parallel printer port, an interface for an external 5.25in. floppy-disc drive, a 25-way serial port and a bus interface. Olivetti claims to have no plans to do anything with the bus but hopes that third-party manufacturers will step into the breach.

As far as compatibility is concerned, all the usual test programs performed as

(continued on page 51)



COMPAQ PORTABLE III



OLIVETTI M-15



Left to right: The Compaq, Sharp, Olivetti and Goupil packed up for transportation.



GOUPIL CLUB



SHARP PC-7100

# TAS<sup>TM</sup> Modifiable Accounting

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### Flexible

If you don't like a report you can change it. If you want to combine two reports into one you can change it. If you want a different customer account format you can change it. Never will you have to hear "we can't do that because we do not have the source code".

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"Combination of good, basic menu driven facilities with powerful programming tools make it excellent value for money, especially for novices wanting to learn, and developers wanting economical runtimes systems". (Personal Computer World)  
 "On a value for money basis, this must be one of the most attractive databases on the market". (Accountancy Magazine)  
 "TAS manages to pack plenty of power into its small price. It performed well in our tests and you can quickly write dense and efficient code for custom applications". (PC Magazine)  
 "There is no doubting that TAS is a very capable product—it handles serious-sized applications and does so with speed." (What Micro Magazine)

## System Requirements

TAS Modifiable and Advanced Accounting runs on any IBM XT, AT and true compatible with a hard disk and at least 384KB RAM. A version for Concurrent CP/M is also available with a different specification.

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expected. Lotus 1-2-3, Microsoft Word and Sidekick all worked reasonably well, although when Sidekick was running on top of Lotus the pop-up program could not be invoked if the Scroll Lock key was on; once the key was switched off, Sidekick worked perfectly. A drawing package called Auto-sketch came out in reverse video, which made it pretty well unusable. It also failed to respond to the dedicated cursor keys, though it did recognise the QWERTY numeric keys with Scroll Lock on. This is a bit of a nuisance, but you could probably learn to live with it.

Turning to the speed trials, the Bagshaw Disc Benchmarks came home at 827 seconds. This is not particularly zippy, but is about twice as fast as the Zenith Z-181. The Basic Benchmarks also came in at 15.4 seconds, which is faster than the IBM PC. The Norton SI rating was 1.0 — an exact match to the IBM PC.

The Goupil Club bears a marked similarity to the Olivetti M-15, as it too is a twin-drive Convertible compatible with a fold-down screen covering the keyboard. The most significant difference is the price: the M-15 costs just under £1,300, while the Goupil is a hefty £1,895.

The machine comes with its own carrying case and also has a built-in handle that folds away at the rear of the machine. The Club looks sturdily built and is unusual in having a metal casing behind the screen. From the outside it looks almost identical to the Kaypro 2000, because both machines have a casing, keyboard and disc drives sourced from Citizen. Goupil's U.K. distributor, SMT International, assures us that the motherboards are completely different.

### MAINS SUPPLY

The Goupil's battery charger plugs into a small jack socket at the back of the machine. The mains plug on the transformer is of the two-pin variety found on electric shavers so you will need an adaptor to plug it into a British mains socket.

The Club automatically turns itself on when you lift the lid, and off again as the lid is closed. Once the screen has been lifted back into position it locks there until you press a Lid Release button at the bottom of the screen. As on the M-15, the keyboard can be removed from the system unit, allowing you to sit back at a comfortable distance from the screen. Once again the cable plugs into a telephone jack socket.

The keys themselves are nicely spaced, with plenty of room to spare. The 10 function keys run along the top of the keyboard, with the cursor-control keys in the bottom right-hand corner, doubled up with Home and Page keys. A blue button to the left of the cursor cluster selects the Page keys. The numeric keypad is once again doubled up with characters on the QWERTY pad. The numbers themselves are marked in bright orange and stand out easily from the letters.

Behind the keyboard are the twin 3.5in. floppy-disc drives. As on the Zenith-181

they spring up from the body of the main system unit to let you to insert a disc. The Club differs from the Zenith machine in that the drives are mounted sideways with the drive on the right-hand side, presumably to economise on space. While this may be OK for the majority of the population, left-handed people might find it annoying. When we ran the Bagshaw Benchmarks for the drives they came in at 650 seconds, which is about average for this type of machine.

SMT was unable to supply a copy of MS-DOS 3.2 with the machine, so we resorted to using Olivetti's version. But for some reason the Olivetti MS-DOS 3.2 would not run on the Club, and for the remainder of the review we ran the machine using a Sony version of MS-DOS 2.11.

The screen used by the Club is similar to the green LCD display of the Olivetti M-15. The first time we used the machine we ran it

GOUPII CLUB				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Likely to be overshadowed by the Olivetti M-15.

from the transformer supplied by SMT. The screen looked diabolical: the basic green background had bluish patches and flickered constantly. During scrolling, the aftershadow of the characters remained for almost a second before fading away. I was on the verge of dipping my word processor in poison, when I turned the machine on under battery power. This made a great improvement to the display, and the problems with flicker and blue patches mostly disappeared. Although not perfect by any means, it put the Club's display at least on a par with the M-15's.

To adjust the contrast you press the blue key together with f1 and f2. A variation on this theme is used to check the battery supply: pressing the blue key with f10 will produce four beeps for full, three beeps for three-quarters full and so on.

The Club uses the 80C88 processor for its CPU, and comes with 640K of main memory. Goupil has also fitted an additional 128K of RAM between addresses D000 and F000hex that you can install as a RAM disc via the Config.Sys file.

Because the machine has a handle at the back the normal array of interfaces are not present. Rather, there is a single 44-pin universal port on the left-hand side into which you plug an interface unit that is supplied as standard with the machine. It contains interfaces for serial transmissions,

parallel printer, an external 5.25in. drive, and composite and RGB video sockets.

To test compatibility we tackled some applications on the machine, beginning with Sidekick. The program seemed to run, although in the case of the calculator utility it was hard to be sure as the figures window was so obscured by the bad display that it was impossible to tell if any numbers were actually appearing.

Lotus 1-2-3 fared a little better; at least you could see what figures you were entering. But trouble occurred when we tried to construct a pie graph from the data, as the final result looked more like a sliced potato. The version of Lotus 1-2-3 we were using was set up to run on a IBM Convertible or compatible. SMT claims that the Club is compatible with the Convertible's graphics, but though we tried reinstalling 1-2-3 in CGA and Hercules modes, we were unable to improve matters significantly.

Running the Basic Benchmarks produced an average timing of 14.6 seconds, which may not be wonderful but is still better than many lap portables in its class. The Norton SI rating for the Club came out at 1.7.

While true portables like the M-15 and the Goupil Club have only recently become a practical proposition, mains-powered transportable machines are a more established concept. It was Compaq that gave this type of machine its first big push with the original Compaq Portable. But of late this company's machines have been looking a bit old fashioned, and the range has been in danger of becoming displaced by trendier models like the Toshiba T-3100.

The Compaq Portable III continues the best traditions of the Compaq range, including rugged construction, advanced technology and optimised components. The most obvious innovation is the gas-plasma screen, as used in the T-3100, which is licensed from Panasonic.

Instead of the hulking suitcase-sized box that housed the previous Compaq Portable models the Portable III fits into a neat package about the size and shape of a medium-sized ghetto blaster. The machine is neatly balanced, and though it weighs around 20lb. it is a great deal easier to carry than its predecessors.

### KEYBOARD PULLED ACROSS

The keyboard clips on to the front of the unit to cover the screen; it is actually the same as the one used on the Portable II, with 10 function keys across the top and a separate numeric keypad. It is connected to the base of the Portable III via a coiled cable just over one foot long. One curious and annoying feature of the cable is that it runs from the right-hand side of the system box to the left-hand side of the keyboard. As a result it tends to pull the keyboard to the right, and the maximum distance from the screen is shortened considerably.

You raise the screen from its carrying position to the work position by releasing two clips on the top. Two spring-loaded metal clips then lift it to a suitable height. The viewing angle can also be adjusted. A

(continued on next page)

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control at the bottom right-hand side of the screen adjusts its brightness; in practice we found it very legible and comfortable to work with in all lighting conditions when set to full brightness.

In the top right-hand corner of the system unit are three LEDs to denote power and disc-drive activity. They are unobtrusive to the point that it took us a while to realise they were there. Flying in the fact of current trends, Compaq has equipped its Portable III with 5.25in. 1.2Mbyte floppy-disc drives. The way the machine is designed, there would not be a great deal of point in fitting 3.5in. drives as the weight saving would be minimal and size reduction non-existent.

Compaq has so far announced three models in the Portable III range. The model 1 is the entry-level version that maintains AT software compatibility with its one 1.2Mbyte floppy-disc drive but has no hard disc. At the top end, the model 40 is fitted with a 40Mbyte hard disc.

The machine we received for the review was the model 20, fitted with a 20Mbyte hard disc. Continuing the Compaq tradition of high-performance fixed discs, the hard disc ran the Bagshaw Disc benchmarks in an impressive 43.1 seconds. It is also the quietest Winchester disc unit we have encountered: even if you strain to listen you cannot hear it running against the background of normal office noise. The floppy-disc timing was a creditable 25 seconds.

At the back of the machine the usual collection of interfaces is to be found. They include an RGB socket for connection to an external monitor, a parallel printer port and a serial interface. Above the peripheral interfaces is a port marked Expansion, which allows an add-on box to be fitted, providing two 16-bit expansion slots. Also on the back is the power-supply input. The Portable III, like the Toshiba T-3100, runs entirely from the mains.

Getting inside the machine is much easier than with many portables; you undo six screws and the back cover comes away. The single circuit board inside is something of an achievement. Compaq has managed to cram an AT motherboard — without expansion slots — floppy- and hard-disc controllers, and peripheral control circuitry on to a board not much bigger than an ordinary AT card. This has been achieved by using surface-mount technology to cut down the amount of space required by each chip.

Compaq has also made extensive use of the application-specific integrated circuits (ASIC) technology mentioned by Ray Coles on page 29 of this issue. The ASIC chips are divided into several cells, each of which performs a specific function. The cells are made application specific by the way in which the flip-flops connecting them are burned into the circuitry. The six ASIC chips fitted to the Portable III cover major functions such as disc control.

The Portable III is based around the 80286 processor running at 12MHz. This is not the first time the chip has been run at that speed, but it is a first for Compaq and,

as far as we are aware, a first for any transportable micro. The company says that it had to perform a complete redesign in order to run the 80286 at that speed while maintaining hardware compatibility. The processor and RAM chips running at 12MHz are linked by special interface circuitry to the expansion buses, which run at the normal 8MHz.

There is not enough room inside the case for expansion cards. If you need to expand the system you have to buy Compaq's plug-in expansion unit, which costs £150. It plugs into the back of the machine to provide space for two full 16-bit cards.

To fit the box you position it over the expansion bus and slide in a pair of clips at

COMPAQ PORTABLE III				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Still leading the pack.

SHARP PC-7100				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

An economically priced and serviceable XT-compatible transportable.

the top on to the Portable III's casing. You then locate a pair of hooks attached to a sliding ledge at the bottom of the box into holes in the main casing. This action also slides the box's connector on to the expansion bus. Once it has been fitted the box can be left in place without seriously compromising the machine's portability.

Getting inside the expansion box proved something of a struggle. The clips are of the push-down, slide-out variety and they took some persuading. Inserting cards was a tight squeeze, but once secured they worked without problem.

With a 12MHz clock speed you would expect the machine to be fast, and it is. The Basic Benchmarks romped home at an average time of 2.8 seconds, less than a second behind the 32-bit 16MHz Deskpro 386.

The Norton Utilities Sysinfo test proved particularly interesting. Running it from the

floppy-disc drive produced a rating of 7.7 — hardly more than a standard 8MHz AT. But if you copy the SI program to the hard disc and run it from there you get a rating of 11.7. The difference is the result of a speed trap that Compaq has incorporated into the machine so that it is pulled down to 8MHz automatically when the floppy-disc drive is accessed. This ensures that the machine remains fully compatible with existing software which uses timing loops for their copy-protection mechanisms.

As on earlier Compaq machines, you can control the clock speed with a variation of the Mode command. The speed can be set to 8MHz or 12MHz or to Auto mode. A nice touch is that you don't have to use the Mode command if you are already in an application: pressing the Ctrl, Alt and Backslash keys together also toggles between the two speeds.

Lotus 1-2-3, Sidekick, Microsoft's Flight Simulator, Autosketch and Microsoft Word all ran on the Compaq III without any errors being detected.

The Compaq Portable III is obviously an attempt by the company to meet the Toshiba challenge head-on. It is clearly not designed for use on the move, but as a machine to be carried to the car and driven from home to work, say, it should provide the T-3100 with a worthy opponent.

Like Compaq, Sharp Electronics has been in the portable-computer business for some time. It entered the market with the well-received 7000 series, which we reviewed in our December 1985 issue. Sharp has now updated the range with the release of the PC-7000A and PC-7100 models.

The PC-7100 machine, which we look at here, is based around the same fold-away system used on the PC-7000. The keyboard slots over the screen so that the whole system can be carried in a unit not much larger than a small portable stereo-cassette player. Like the Compaq Portable III, the PC-7100 has a handle on top for carrying.

The cable connecting the keyboard to the system unit fits into telephone-type sockets. They are both on the right-hand side of the keyboard and system unit, so the PC-7100's keyboard does not get dragged across your desk in the way that the Compaq's does. When the system is not in use you unplug both ends of the cable and store it behind a flap underneath the screen.

## FUNCTION KEYS

The keyboard layout is identical to that of the Portable III, with 10 function keys in two groups of five across the top and a combined cursor cluster and numeric keypad to the right-hand side.

One of the major enhancements that Sharp has made to the PC-7100 is the inclusion of a back-lit super-twist LCD screen, of the type popularised by the Zenith Z-181. Like the Zenith machine, the Sharp PC-7100 provides a full 80- by 25-character text display and a 640- by 200-pixel graphics resolution. The computer's video circuitry emulates IBM's Colour Graphics Adaptor (CGA).

## SPECIFICATIONS

## OLIVETTI M-15

**CPU:** 80C88 running at 4.77MHz  
**RAM:** 512K  
**Display:** LCD screen, providing 80 by 25 characters and 640 by 200 pixels  
**Keyboard:** 78-key detachable, including 10 function keys  
**Weight:** 5.7kg. (12.5lb.)  
**Mass storage:** twin 3.5in. 720K floppy-disc drives  
**Interfaces:** parallel printer interface, serial port, RGB monitor socket  
**Software in price:** MS-DOS 3.2

**Price:** £1,295

**Manufacturer:** made in Japan for Olivetti

**U.K. distributor:** British Olivetti Limited, PO Box 89, 86/88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666

**Available:** now

## GOUPIL CLUB

**CPU:** 80C88 processor running at 4.77MHz; socket for 8087 maths co-processor

**RAM:** 786K

**Display:** LCD screen, providing 80 by 25 characters and 640 by 200 pixels

**Keyboard:** 77-key detachable, with 10 function keys

**Weight:** 6.5kg. (14.3lb.)



**Interfaces:** serial port for modem, interface-unit port; interface unit has parallel printer interface and serial port  
**Price:** £1,895

**Software in price:** MS-DOS 3.2 and GWBasic

**Manufacturer:** made in France by SMT-Goupil International, Cambridge House, 180 Upper Richmond Road, London SW15 2SH. Telephone: 01-785 2411

**Available:** now

## COMPAQ PORTABLE III

**CPU:** 80286 running at 12MHz, switchable to 8MHz; socket for 80287 maths co-processor

**RAM:** 640K, expandable to

6Mbyte

**Display:** dual-mode plasma display; 80 by 25 characters or 640 by 400 pixels in Compaq mode and 640 by 200 in CGA mode

**Keyboard:** 84-key detachable, including 10 function keys and a separate numeric keypad

**Weight:** 9kg. (20lb.)

**Mass storage:** 1.2Mbyte floppy-disc drive; model 20 and model 40 have 20Mbyte and 40Mbyte hard discs

**Interfaces:** parallel printer interface, serial port, RGB socket; optional £150 two-card expansion unit

**Price:** model 1 £3,250, model 20 £3,950, model 40 £4,395

**Software in price:** none

**Manufacturer:** assembled in

the U.S. by the Compaq Computer Corporation  
**U.K. distributor:** Compaq Computer Limited, Ambassador House, Paradise Road, Richmond, Surrey TW9 1SQ. Telephone: 01-940 8860  
**Available:** now

## SHARP PC-7100

**CPU:** 80C86 running at 7.37MHz; socket for 8087 maths co-processor

**RAM:** 320K expandable to 740K  
**Mass storage:** one 5.25in. 360K floppy-disc drive and one 10Mbyte hard disc

**Keyboard:** full-size 84-key detachable, including 10 function keys and separate numeric keypad

**Weight:** 9kg. (20lb.)

**Display:** back-lit super-twist LCD screen, 80 by 25 characters and 640 by 200 pixels

**Interfaces:** parallel printer interface, serial port, RGB monitor socket

**Price:** £1,995

**Software in price:** MS-DOS 2.11

**Manufacturer:** made in Japan by Sharp Corporation

**U.K. supplier:** Sharp Electronics (U.K.), Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. Telephone: 061-205 2333

**Available:** now

The display itself is quite good enough to be used for long periods of work, but because it has had to be fitted into the existing PC-7000 box the characters are not as tall as they should be. This is acceptable for working with text but it becomes noticeable when you are working with graphics. For example, a pie chart created with Lotus 1-2-3 ends up looking more like an egg than a pie. It is not a major defect, but if you want to create diagrams to be dumped to a printer you will have to compensate accordingly.

To the right of the display is a set of LEDs that indicate hard- and floppy-disc activity, screen standby and power. Underneath is a contrast control which adjusts the appearance of the screen across the full range, from blackout to blizzard. Set underneath is a tilt button which sets the angle of the screen to five, 10 or 15 degrees from the vertical. To restore the display to its carrying position you simply push it down at the bottom.

On the right-hand side of the computer is a 360K 5.25in. floppy drive. As on the Compaq Portable III, you insert the disc with the label facing you, and press a button to close the drive. I did not really like the disc-drive mechanism on either of the machines. I was never quite sure whether the drive was engaged properly, and frequently got drive errors on-screen.

Luckily the floppy-disc drive is not used very often as the PC-7100 has a 10Mbyte hard disc fitted. While the Sharp hard disc is

not quite as silent as the Compaq unit it sounds comfortably efficient.

The PC-7100 is fitted with all the usual peripheral ports, including a parallel printer port, a serial interface and an RGB monitor socket. Like the Compaq, the machine has no provision for battery operation; it has an internal power-supply unit connected to a standard mains input socket.

The compact dimensions of the machine do not provide enough space for expansion cards. For those who require additional facilities — say for networking — Sharp can supply an optional expansion box containing three eight-bit slots.

The machine is built around an 80C86-2 processor running at 7.37MHz; it is software switchable to 4.77MHz if your applications require it. The machine also has a socket for an optional 8087-2 maths co-processor. The machine is fitted with 320K of RAM as standard, expandable to 704K with Sharp's own 128K RAM kits. This is something Sharp ought to see to. Even IBM is fitting 512K to the Convertible and a competitor really cannot be seen to be left behind as programs are getting bigger all the time.

As the PC-7100 is an XT compatible, the machine is supplied with MS-DOS 2.11, with GWBasic as an option. The BIOS is Sharp's own version. The generally slow performance of CMOS chips is mitigated to some degree by having a full 16-bit processor. The Bagshaw Benchmarks came out

at a respectable 865 seconds for the floppy-disc drive and 200 seconds for the hard disc. The Basic Benchmarks came home at 11 seconds — a perfectly respectable figure for a modern machine.


We encountered no problems with software compatibility running the usual Microsoft Flight Simulator, Lotus 1-2-3 and Sidekick. At first sight, Sidekick looked as if it would crash, as only a fraction of a window would appear on the screen. However, the rest of the window followed and from then on the program worked as normal. Invoking Sidekick on top of a 1-2-3 graph made a terrible mess, but this is a common failing. Pressing Escape and returning to the spreadsheet put everything back in its place.

## CONCLUSIONS

■ The Olivetti M-15 with its fold-up LCD screen and twin 3.5in. disc drives adopts what is becoming a classic design for a lap portable. At a shade under £1,300 it is also just about the cheapest.

■ In direct comparison, the Goupil Club does not look good. It has an almost identical specification, but its £1,800 price tag is a distinct liability.

■ By adding a back-lit super-twist screen and a 10Mbyte disc drive to its existing transportable, Sharp has kept a neat design abreast of its competitors.

■ As always, Compaq has set the pace for others to follow: its Portable III is a worthy opponent to the Toshiba T-3100. 

# CANON IX-12

## LEARNING TO READ

By Steve Malone

For a computer it is an enormously complex task to recognise even quite a limited range of text styles. Canon's latest device takes the process one step on.

**T**he history of optical character readers (OCRs) has not been a glorious one. Previous products have either been extremely expensive — way beyond the reach of the average office — or have required patience and a detailed knowledge of founts and pitch sizes.

Even then, they often did not work very well. Much of the problem has been due to the way many low-end OCRs recognise characters. The technique they use is known as matrix matching. The OCR reads in a bit image of the character and superimposes it on a template that it holds in memory until it finds a match. The big drawback to this system is that it is not at all flexible. A slight change in the fount or in the size of the letter will throw the template out. It also means that large amounts of memory are used to store the template characters.

The Canon IX-12 scanner claims to be much more efficient at reading characters, and it is being sold at a price which a typical office may be able to justify, especially if people routinely have to retype large amounts of typewritten text. The complete system consists of the scanner itself, an interface card and the software. It costs £1,500.

The scanner measures 340mm. by 290mm. by 90mm. — about the size of a smallish dot-matrix printer, which is pretty much what it looks like. The paper feed for the documents which are to be read in can be adjusted to accept sheets up to 300mm. wide. The IX-12 will only scan separate sheets; it cannot be used to read from bound volumes. It is connected to the computer via a full-length eight-bit expansion board, which is largely populated by RAM chips to buffer the incoming data.

Neither the scanner itself nor the board is particularly intelligent. It is the software provided, called Readright, which does almost all the decoding and character recognition. There are two parts to the software as supplied on its single 5.25in. floppy disc. One is a small Com file which loads the drivers into the system; the other is the OCR Readright program itself.

Running the program displays a menu of options which you choose using the function

keys. If you wish to read in a document, it is simply a matter of inserting it face down into the scanner's input tray and pressing Enter. The software asks you to give a file name. The sheet is fed automatically through the scanner and the text appears on the screen.

The scanning process is very different from the earlier matrix-mapping systems. A row of 2,592 photo-diodes detects whether the area above them is black or white, just as in a standard photocopier. The default resolution of the scanning process is 300 dots per inch (dpi) although this is switchable to 200dpi.

The bit stream generated by the photo-diode array is transferred to the computer, where the Readright software has the task of

CANON IX-12				
VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

A good attempt at a large problem — and a boon for two-fingered copy typists.

turning it into characters. It does this by examining the black pattern of the character as it is formed. Any image surrounded by white is assumed by the software to be a complete character.

The Readright software attempts to identify the character using a process known as topological mapping. This involves recognising the lines and arcs that make up a character and analysing their relationship to each other. In effect it does the same kind of deconstruction performed by Postscript and other page-description languages. After the analysis Readright decides which letter has been read and displays it on the screen.

By using the topological mapping method the software avoids any need to specify the fount or the size of the character. Using its set of rules, Readright is able to read a large number of founts in a wide range of sizes. However, there are serious limitations. One of the major dislikes of the program is proportional spacing, as it sets the pitch or size of the characters early on in the analysis and works from there. The

### SPECIFICATION

**Description:** image-input device and software with character-recognition capability

**Hardware required:** IBM PC, PC/AT or compatible with one full-length eight-bit expansion slot and at least 384K RAM, running MS-DOS 2.11 or above; CGA/EGA graphics card required for image scanning

**Resolution:** 300dpi, switchable to 200dpi

**Character sizes:** can read between 6 point and 12 point, and between 10 pitch and 15 pitch

**Price:** £1,500

**Manufacturer:** Canon (U.K.) Ltd, Canon House, Manor Road, Wallington, Surrey SM6 0AJ. Telephone: 01-773 3173

**Available:** now

IX-12 therefore has problems reading type-set material, and even computer printout which features proportional spacing may cause unacceptable difficulties.

The further a fount varies from the norm, the harder it becomes for Readright to decipher. For example, we used an Epson EX-800 in NLQ mode to print out the same paragraph of text twice — once in roman and once in italic. When we ran them both through the IX-12 there were many more errors in the scan from the italic than from the roman.

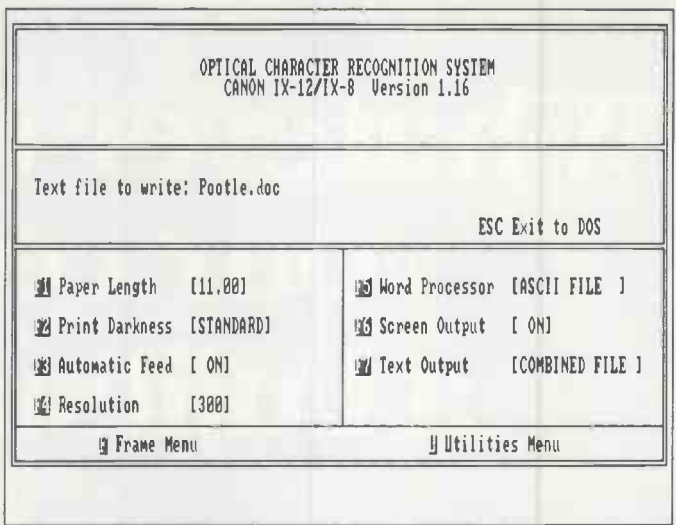
Canon says that it considers more than five errors per page to be unacceptable. We tried the IX-12 on about a dozen press handouts we had in the office. It made a decent stab at the majority of them, though in most cases the error rate was up around Canon's limit. Only a small minority of documents were completely unrecognisable, and they tended to be ones with graphics on them or with very small print.

Canon suggests a number of fine-tuning options to improve performance. For example, you can alter the Print Darkness setting to accommodate particularly faint typefaces or dark papers. This option showed improvement in some cases, although for some reason the Light or Dark options sometimes hung up the computer. In general the IX-12 performed better with originals than with photocopies, and it could not cope with dark photocopies at all. It also failed to decipher draft-quality print where the dots do not overlap.

Readright will save the text it has scanned either as a standard ASCII file or in Word-



The Canon IX-12 is roughly the size of a small printer.



You choose options from the main menu using the function keys.

dollars. Topological systems that cost about the same as ReadRight are "trainable" systems and are barely usable.)

### 1.1 Advantages

ReadRight represents the state-

- \* It recognises a wide variety
- \* Fonts can be mixed on a page,
- \* You needn't tell the system w
- \* Documents that it scans can b
- printer, near-letter-quality
- \* The program can read photocop
- \* It can read a range of point sizes and pitches — 8 to 12 points, 10 to 15

the same as ReadRight are @'trainab barely usable.)

### 1.1 Advantages

ReadRight represents the state-of-t character recognition:

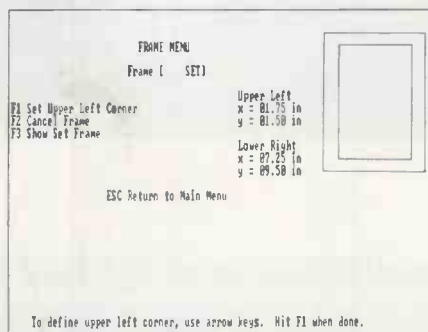
,@.  
It recognises a wide variety of sizes.

Star or Word Perfect format. One of the problems with the software is that when it reaches the end of a line of the original text it puts in a Carriage Return before moving on to the next line. When you load the resulting file into your word processor each line has a Carriage Return at the end, and you will have to remove them if you do any editing.

Whenever the scanner encounters an area of white space, it loses track of where it is and simply makes a guess at the number of lines that have passed. You may therefore find that there is a mixture of single- and double-line spacings throughout the text.

Another drawback to the system is that it cannot cope with graphics. In particular, vertical lines tend to throw it out completely. In a way this is a result of the software being too clever for its own good. Because it has been designed to cope with different sized characters it will attempt to interpret a long vertical line down the side of a page. When it fails, having decided that it cannot work out the pitch, it gives up on the rest of the document too. To get round this

Even reading its own press release (above) the system made mistakes (inset). Below: The Frame menu allows you to specify the area to be scanned.



problem — in some circumstances at least — Canon has included a Frame menu that allows you to narrow the boundaries which will be scanned. With luck you should be able to exclude lines or other graphics which might interfere with the text analysis.

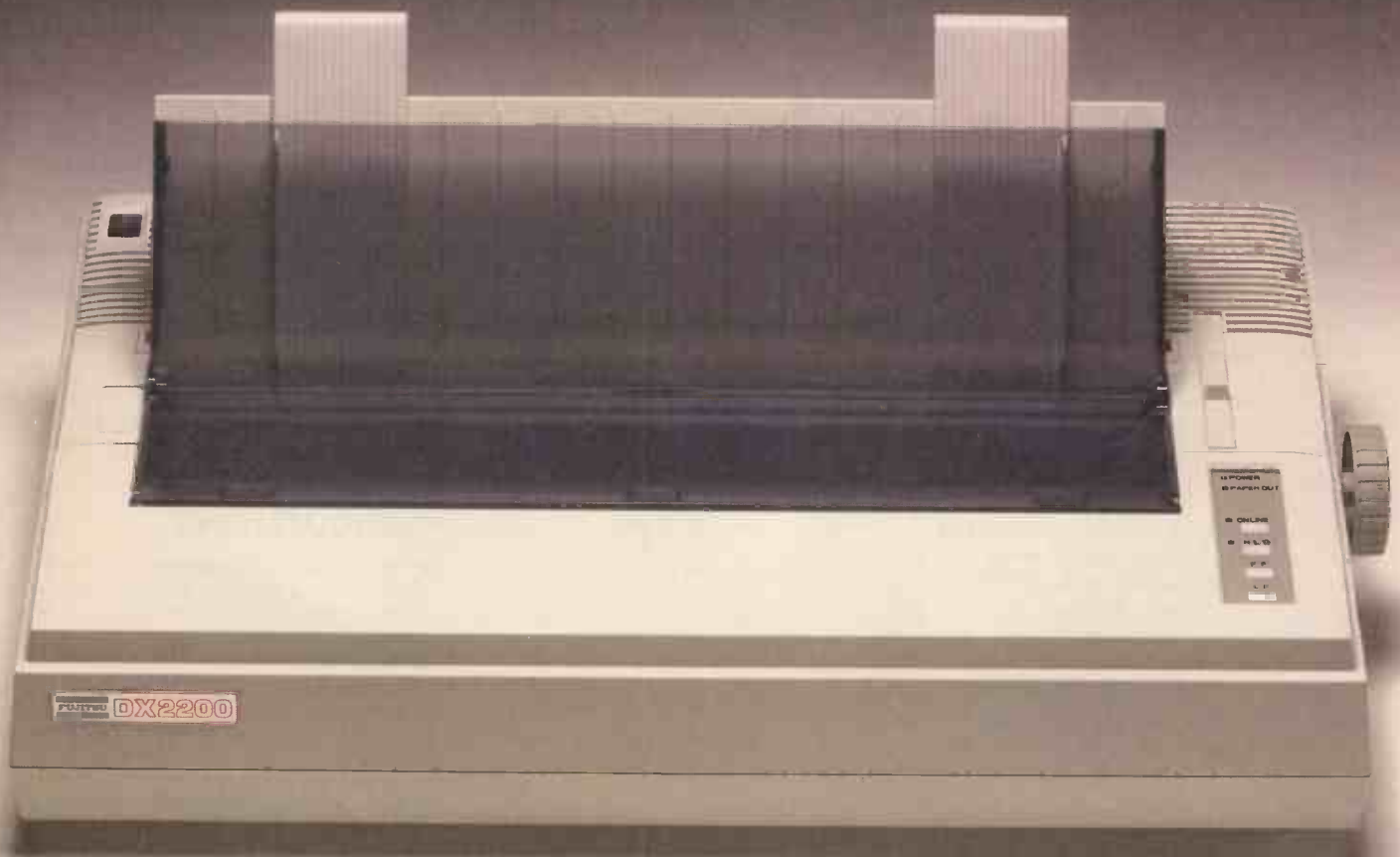
Though the IX-12 is likely to be of most interest as a character-recognition system it can also perform the much easier task of

image scanning. Using the same 300dpi resolution as it does for text, it simply scans the image and dumps it into a file. This could make it a useful adjunct for desk-top publishing applications. Canon says that it is working on drivers that will allow the scanned images to be dumped directly to a number of printers.

## CONCLUSIONS

- The Canon IX-12 scanner and Readright software use a radically different method of character recognition from earlier low-cost systems.
- The system is able to read characters from a wide range of fonts of different sizes.
- It is by no means perfect, but has a reasonable stab at most documents it is offered, as long as they are typewritten or computer printed in a good NLQ face.
- Some features of the software could do with improvement, particularly its practice of inserting Carriage Returns at the end of each line of the original.
- While most documents will require some cleaning up, the system will be a useful tool in offices where a lot of retyping is done. **K**

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# LOTUS MANUSCRIPT TRYING TO DO TOO MUCH?

By Carol Hammond

Document processors are all the rage. Lotus's contribution provides a wide range of formatting features but you need a big investment in equipment and effort to make the most of them.

Lotus describes Manuscript as a word and document processor for technical professionals. The implication is that Manuscript must be capable of doing a number of things over and above the usual word-processing functions like cut and paste or search and replace. Indeed it does have all the facilities you can now expect from a document processor: there is a spelling checker, you can mix text and graphics, you can format text in columns, incorporate footnotes and an index, and produce long documents. You can cross-reference entries, do a word count and preview the final appearance of your document on-screen. You can compare a revised document to the original, with any revisions highlighted. And in line with Manuscript's technical pretensions you can print multi-line equations which include Greek and mathematical characters.

Manuscript certainly does attempt to do an awful lot, as the two weighty manuals accompanying it testify. As a result, getting to grips with the package is no easy task. Yet it is unlikely that every Manuscript user will regularly want to use all the program's facilities. More important than its sheer versatility is how well it does what it sets out to do, and some of Manuscript's features turn out to be less useful than you might at first expect.

Manuscript is a big program. It comes on eight floppy discs which together contain about 2Mbyte of code. This means that for most purposes a hard disc is really a necessity, though by dropping some of the printer drivers you can reduce the amount of disc space you need. To run the program you have to have at least 512K of RAM, and 640K is advised.

When you begin a Manuscript session you are met by the Document Manager panel, which lists 10 options. Here you choose whether you want to edit a document, print out an existing document or import a file, for example. Some of the options found in the Document Manager can be accessed while you are editing a document. You use the Up and Down keys to highlight the option you want, or press a key which corresponds to its first letter; since two options begin with P and two with C the second method is not as convenient as it might otherwise be. You then press Ins to continue.

At the top of the editing screen there is a status line which lists the document name, the attributes of the current text, the current cursor position and a mode indicator. Below the Status line lies the text area. Pressing f10 replaces the Status line with a list of menu commands. In standard Lotus fashion, the first line lists the commands, and you can move the highlight to the one you want using the left and right arrow keys. The second line displays a brief description of the highlighted command. You select the highlighted command by pressing Enter. You can also select any command simply by keying its first letter. Pressing f1 will provide useful on-screen help.

LOTUS MANUSCRIPT				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Probably worth a look if you produce long, highly structured technical documents.				

A Manuscript document is made up of one or more of five elements: text, block, column, section and level. One of Manuscript's useful features is that you can automatically change any chosen section of text from capitals to lower case or vice versa. There is also a Proper option which capitalises only the initial letters of the words in the chosen section of text.

Manuscript allows you to divide text into blocks to which you can assign particular founts, tabs, margins and so on. A block is indicated on-screen by a horizontal line; it could be a paragraph or a row of a table, for instance. Settings and commands can be made to apply to all blocks or only to selected blocks in a document. You can cut and paste whole blocks or smaller sections of text using the function keys.

A column is defined as a vertical portion of a block, and is indicated on-screen by a



## SPECIFICATION

**Description:** word processor suitable for documents up to 800 pages long; includes spelling checker, outlining facility and facility for generating mathematical equations and symbols

**Hardware required:** IBM PC, PC/AT or compatible with 512K memory; 640K and hard disc recommended; graphics card required to support document preview facility

**Copy protection:** none

**Price:** £395

**Publisher:** Lotus Development Corporation of Cambridge, Massachusetts

**U.K. supplier:** Lotus Development U.K., Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone: (0753) 840281

**Available:** now

vertical line of dots. You can edit in columns just as you would in blocks. As you type text into a column Manuscript wraps it within the column width. However, each column is considered as a separate entity; text does not snake into adjacent columns as it might on a desk-top publishing (DTP) package. Using the function keys, you can add to or split existing columns to form a table.

The proliferation of lines and dots that define blocks and columns make the screen look very cluttered, and I found the effect rather confusing. What is missing is a WYSIWYG facility that would allow you to switch off the rules underneath blocks and instead see the vertical rules marking off the columns of a table that at present you only get when you add borders at a later stage. Admittedly, Manuscript has a Preview Document option that makes some attempt at doing this, but here the depiction of the document is so poor that it is not really worth the bother. In its miniaturised representation of the document you can see where some clumps of text lie — like an address at the top left of a page — but it is

LETTERZ.DOC Attr: Normal Pos: 34 UNSTRUCTURED EDIT

appropriate improvements.¶

▶Groundwater analysis and monitoring of groundwater level.¶

▶Continuous monitoring of both settlement rates and groundwater.¶

These are our primary concerns, but you may determine other areas requiring your attention.¶

Here is the information the city has about the settlement rates. Unfortunately there are no records of the amount and type of fill dumped at the site.¶

\\picture cns123gr.pic\\*

Layer¶	Depth¶	Site A¶	Site B¶	Site C¶	Site D¶
1¶	8-13¶	0.298¶	0.329¶	0.276¶	0.236¶

Above: A fragment of a Manuscript document as it appears on-screen.  
 Below: The same fragment printed in Draft and Final mode on an Epson EX-800.

Here is the information the city has about the settlement rates. Unfortunately there are no records of the amount and type of fill dumped at the site.

\\picture cns123gr.pic\\*

Layer	Depth	Site A	Site B	Site C	Site D
1	8-13	0.298	0.329	0.276	0.236
2	13-18	0.197	0.227	0.183	0.157
3	18-23	0.123	0.189	0.104	0.079
4	23-28	0.064	0.078	0.055	0.026

10-Mar-87 14:24

Let me know if you need any other information about the Central City site before our meeting on March 7.

impossible to distinguish a word or sentence, let alone a rule.

The alternative is to print out your document in draft mode. But here there is the disadvantage that you will not be able to see all the items you have incorporated, graphics being one example. It also means that you have to have access to a printer, and waste time and paper printing out.

A group of related blocks is known as a section, and is indicated by a double horizontal line. Every section has a level. For example the first section will be level 1, and a number will appear at the beginning of the section in front of the headline block — say, Practical Computing. If you divide that sec-

tion into sub-sections the first sub-section will be a level 2 section, labelled 1.1 — say, Software Reviews. And if that section is divided into sub-section the first sub-section will be a level 3 section labelled 1.1.1. — say, Lotus Manuscript.

Each sub-section is divided from the previous one by a double horizontal line, and every time a new level is created the indent before the section is increased, giving you a stepping pattern down the page. The advantage of having sections is that you can apply a common format to all sections that are at a particular level so that, for example, all level 2 sections appear in bold and all level 3 sections appear in italics.

The idea behind sections is that you can reorganise text in a long document easily. If you move or delete a particular section or sub-section, other sections and sub-sections are automatically renumbered and reformatted if necessary. You can also use the headline blocks to give you an outline of your document.

Documents consisting of sections with headlines and levels are what Manuscript calls structured documents. They are created in Structured Edit mode. Documents that do not incorporate sections but consist merely of text, blocks and columns are created in Unstructured Edit mode. You choose the mode you want to work in from the Edit option on the command menu.

Choosing Window from the command menu allows you to work on two documents at a time. You can make more or less of the foremost window visible by moving it up or down the page, using the cursor keys; you cannot move a window sideways, or contract or expand it. You can move the cursor position between windows by choosing the Switch option, though a quicker way is to key Ctrl-W.

This Control-key combination is one of Manuscript's accelerators — key combinations that reduce the number of keystrokes it takes to execute certain commands. You can use Ctrl-S to save a file, for example. The accelerators are a handy time saver as far as they go, but Manuscript does not extend this facility further to provide user-definable macros.

Manuscript's ability to incorporate equations and special symbols into a document is quite versatile, but it is not particularly straightforward. You insert equations using a Backslash command. There are two kinds of Backslash commands. One type substitutes one text string for another — say the date or the author's name. The other kind will modify the appearance of the document by inserting a page break, for example.

The Manuscript manual advises you to write down the equation you want to use on a piece of paper before you start entering anything into your document. This is because you have to think of the relevant keywords to describe parts of the equation, including the Greek and mathematical characters. It would be easier if you could access the alternate character set directly from the keyboard, perhaps with the assistance of an on-screen keyboard template.

As it is, entering formulae is a tedious and fiddly business. You enter

\\equation "formula"

where the formula inside the double quotes consists of the symbols you want to enter, along with the size of the equation, if you wish. Manuscript will automatically size equations to fit the amount of space on the page, but you can also specify size by giving the overall width and height or the scale at which you wish the equation to appear relative to its default size.

The fact that Manuscript is not WYSIWYG again proves awkward. If you have entered a long equation that may trail down the page you do not really get any idea

(continued on next page)

(continued from previous page)

what it might look like. Printing in draft mode is useless, since only the Backslash command will appear. Equally, selecting the Preview Document option will not give you much idea of what a particular part of the document will look like relative to other elements on the page.

You can, however, use Preview's ability to zoom in on an equation. You place a magnifying rectangle over the area you want to look at, and it will then appear in a box to the right of the previewed page, or on a full screen if it is a graphic element like a chart or equation.

Backslash commands are likely to be used frequently in Manuscript and I found them frustrating. For example, to insert a horizontal line you use the

`\line\`

command together with instructions as to its length, width and position. Although you can get considerable precision it seems cussed not to allow you to see such a line on-screen when the package has the ability to display so many other lines to divide blocks, sections and so on. Presumably things would have looked even more littered and confused.

You use the Backslash commands

`\pic\`

or

`\picture`

to incorporate graphic information such as 1-2-3 and Symphony Pic files, sizing them as you wish. Manuscript provides utilities to

`\eqn "A rho rho delta h"\`

`\eqn "(1+x) over 200 + K + (1 + 2) over 200"\`

`\eqn "-lambda super 11 over beta J sub m (lambda sub 11 a super 2)"\`

Verbose command sequences (above) are needed to create equations.

$$A\rho = \rho\delta h$$

$$\frac{1+x}{200} + K + \frac{1+2}{200}$$

$$-\frac{\lambda^{11}}{\beta} J_m(\lambda_{11} a^2)$$

import and export DCA files as well as to import files from 1-2-3, Symphony and Thinktank. The program does not wrap text around graphic images as a DTP package might.

Manuscript comes with two large manuals. One is mainly for beginners and contains several sections to help you when using Manuscript for the first time. The information it provides is reasonably helpful, though you can get bogged down in the minutiae it contains. The second manual details the various features of Manuscript.

Although the layout is good and the manuals are generally well illustrated, not every

explanation is as clear as it could be. I frequently had to do a fair amount of jumping about between sections to clarify particular points. Perhaps this is because the package contains so many complicated features.

Having to remember which keys do what in various circumstances can also be quite a task. Perhaps this too is because Manuscript offers so much, making it difficult to keep track of exactly what is on offer and how to get to it. A mouse might have made life easier, and it seems strange that Manuscript does not support one.

## CONCLUSIONS

- Manuscript is a sophisticated word-processing tool with powerful formatting abilities. It is particularly useful for setting up documents with columns of text and tables.

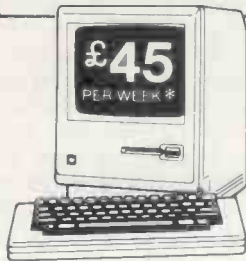
- The program sets out to do a lot of different things, and its attempt to be all things to all people is not entirely successful. More attention to making sure every feature provided met people's expectations would make the product easier to use and of more benefit.

- Manuscript's failure to show an the editing screen what your printed document will look like is a particular disadvantage when it comes to equations and the like, making the entry of formulae a tortuous process.

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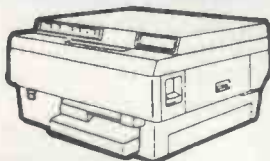


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- 1024Kbytes RAM (1040ST-F)
- 192Kbytes ROM
- 128Kbytes external plug-in ROM option

## ARCHITECTURE

- Motorola 68000 Central Processing Unit (CPU) with a clock speed of 8MHz
- 16-bit external data bus
- 32-bit internal data bus
- 24-bit address bus
- 8-32-bit data & address registers
- 7 levels of interrupts
- 56 instructions
- 14 addressing modes
- 5 data types
- DMA (Direct Memory Access)
- real time clock as standard

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- Using Atari Monitors (on 520 & 1040):
  - 640x400 high resolution - monochrome
  - 640x200 medium resolution - 4 colours
  - 320x200 low resolution - 16 colours
  - 80 column text display (40 col low res)
- Using Domestic TV (on 520):
  - 640x200 medium resolution - 4 colours
  - 320x200 low resolution - 16 colours
  - 40 columns x 25 line text display

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- MIDI in ..... (6 pin DIN) 31.25K baud
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- audio in ... 1.0V DC peak to peak, 10K ohm
- RGB monitor ..... 1.0V DC, 75 ohm
- mono monitor ..... 1.0V DC, 75 ohm
- mono horizontal scan rate ..... 35.7KHz
- mono vertical scan rate ..... 71.2KHz
- sync ..... 5V DC (active low) 3.3K ohm
- modem/serial ..... RS232C, 50 to 19,200 baud
- floppy disk ..... 250 Kbits/s
- hard disk ..... 11.3 Mbits/s
- mouse ..... standard Atari connector
- joystick ..... standard Atari connector
- cartridge port ..... 128K capacity
- RF output (520ST-FM) ..... for TV use

## OPERATING SYSTEM

- TOS with GEM environment in ROM
- hierarchical file structure with sub-directories and path names
- user interface via GEM, with self explanatory command functions
- multiple windows + icons
- window resizing, re-positioning and erasing
- drop down menus (selected by mouse)
- GEM virtual device interface

## COMMUNICATIONS

- RS-232C serial modem port
- 8-bit parallel printer port
- MIDI port (also for networking use)
- VT52 terminal emulation

## KEYBOARD

- standard QWERTY typewriter format
- 95 full stroke keys
- 10 function keys
- 18 key numeric keypad + cursor keys
- variable auto-repeat & key click response
- keyboard processor reduces CPU overhead

## MOUSE

- high precision
- 2 button control
- free with 520ST-FM/1040ST-F
- non slip ball motion sensor
- removable ball for easy cleaning

## STANDARD SOFTWARE

- GEM desktop + TOS operating system
- ST BASIC Interpreter/language system

# ... IT'S AFFORDABLE

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Finally, there's a personal computer that not only solves problems like other computers, but also solves the one problem that other computers have created. Affordability. Silica Shop are pleased to present the ST range of personal/business computers from Atari. The ST was designed utilizing the most recent breakthroughs in semiconductor technology, producing a personal computer that performs tasks with fewer parts. Which means it costs less to make. And less to buy. The latest ST computers now include built in power supplies and built in disk drives. The TOS operating system and GEM window environment are now on ROM chips which are already installed in the ST keyboard. This enables automatic instant booting when you switch on. Silica Shop are pleased to offer the complete Atari ST system. Our mail order department is situated in Sidcup and we have 4 retail outlets at Sidcup, Orpington, Lion House (Tottenham Court Rd) and Selfridges (Oxford Street). We have eight years experience of Atari products, longer than any other UK company, and are well established as the UK's No.1 Atari specialist. With a group turnover of over £5 million and in excess of 70 staff, we provide unbeatable service and support. We provide several facilities which you will find invaluable during your Atari computing life and most of these facilities are available ONLY FROM SILICA. We suggest that you read through what we have to offer, before you decide where to purchase your Atari ST.

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- BASIC Language Disk
  - BASIC Manual
  - ST Owners Manual
  - TOS/GEM on ROM
- If you buy your ST from Silica Shop, you will also receive:
- "Medochrome - colour graphics program"
  - 1st Word - Word Processor
- In addition, we at Silica would like to see you get off to a flying start with your new computer, so we have put together a special ST STARTER KIT worth over £100, which we are giving away FREE OF CHARGE with every ST computer purchased at our normal retail prices. This kit is available ONLY FROM SILICA and is aimed at providing users with a valuable introduction to the world of computing. We are continually upgrading the ST Starter Kit, which contains public domain and other licensed software, as well as books, magazines and accessories all relevant to ST computing. Return the coupon below for full details.

### DEDICATED SERVICING - Only From Silica

At Silica Shop, we have a dedicated service department of five full time Atari trained technical staff. This team is totally dedicated to servicing Atari computer products. Their accumulated knowledge, skill and experience makes them second to none in their field. You can be sure that any work carried out by them is of the highest standard. A standard of servicing which we believe you will find ONLY FROM SILICA. In addition to providing full servicing facilities for Atari ST computers (both in and out of warranty), our team is also able to offer memory and modulator upgrades to ST computers.

**1Mb RAM UPGRADE:** Our upgrade on the standard Atari 520ST-M or 520ST-FM keyboard will increase the memory from 512K to a massive 1024K. It has a full 1 year warranty and is available from Silica at an additional retail price of only £86.96 (+VAT = £100).

**TV MODULATOR UPGRADE:** Silica can upgrade the 1040ST-F to include a TV modulator so that you can then use it with your TV set. This is an internal upgrade and does not involve any untidy external boxes. A cable to connect your ST to any domestic TV is included in the price of the upgrade which is only £49 (inc VAT). The upgrade is also available for early 520ST computers at the same price.

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We aim to keep stocks of all Atari related products and our warehouse carries a stock of £1 million. We import many software titles direct from the USA and you will find that we have new releases in advance of many of our competitors. Unlike dealers who may only stock selected titles, we have the full range. In addition, we carry a complete line of all books which have been written about the Atari ST. A range as wide as ours is something you will find available ONLY FROM SILICA.

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We hope that the combination of our low prices, FREE UK delivery service, FREE Starter Kit and FREE after sales support, will be enough to make you buy your Atari equipment from Silica Shop. If however, there is something you wish to purchase, and you find one of our competitors offering it at a lower price, please contact our sales department, providing us with our competitor's name, address and telephone number. If our competitor has the goods in stock, we will normally match the offer (on a 'same product - same price' basis) and still provide you with our normal free delivery. We realise that we are not the only company who will match a competitor's price. However, if you come to us for a price match, you will also be entitled to our after sales service, including free newsletters and technical support. This makes our price match promise rather special, something you will receive ONLY FROM SILICA. We don't want you to go anywhere else for your Atari products. So shop at Silica, the UK's No.1 Atari Specialist.

## 520ST-M

The affordability of Atari computers is reflected in the price of the 520ST-M keyboard, which is a mere £259 (inc VAT). This version of the ST comes with 512K RAM, as well as a modulator and lead for direct connection to any domestic TV. The price does not include a mouse. In addition, when you buy your 520ST-M from Silica, you will also receive the FREE Silica 'ST Starter Kit'. During 1987, many software houses will be producing games software on ROM cartridges, which will plug directly into the cartridge slot of the 520ST-M keyboard, giving instant loading without the expense of purchasing a disk drive. With the enormous power of the ST, you can expect some excellent titles to be produced, making this the ultimate games machine! If your requirement is for a terminal, then the 520ST-M can fulfill this role too. Leads are available to connect the ST to a variety of monitors, and with the imminent introduction of terminal software on ROM cartridge, the ST provides a low price terminal for business use. If you wish to take advantage of the massive range of disk software available for the ST range, you will need to purchase a disk drive. Atari have two floppy disk drives available, a 1/2 Mbyte model £149 and a 1Mbyte model £199. Full details of these drives, as well as the Atari 20Mbyte hard disk are available on request. If required at a later date, the mouse may be purchased separately.

# £259

## 520ST-FM

The 520ST-FM with 512K RAM and free mouse, represents a further breakthrough by Atari Corporation in the world of high power, low cost personal computing. This model is the latest addition to the ST family, and is not only powerful, but compact. It is priced at only £399 (inc VAT) a level which brings it within the reach of a whole new generation of computer enthusiasts. When purchased from us, it comes with the FREE Silica 'ST Starter Kit' see paragraph on left. To make the 520ST-FM ready for use straight away, Atari have built into the keyboard a 1/2 megabyte disk drive for information storage and retrieval, allowing you easy access to the massive range of disk based software which is available for the ST. This new computer comes with all the correct cables and connections you will need to plug it straight into any standard domestic television set. You do not therefore have to purchase an Atari monitor. If you do require a monitor however, these are available with the 520ST in the following money saving packages:

- 520ST-FM Keyboard Without Monitor - £399 (inc VAT)
- 520ST-FM Keyboard + High res mono monitor - £499 (inc VAT)
- 520ST-FM Keyboard + Low res colour monitor - £599 (inc VAT)
- 520ST-FM Keyboard + Med res colour monitor - £699 (inc VAT)

Because the 520ST-FM has its own power transformer built into the keyboard, there are no messy external adaptors to clutter up your desk space. You are left with only one main lead, serving both the disk drive and the computer. You couldn't ask for a more stylish and compact unit.

# £399

## 1040ST-F

For the businessman and the more serious home user, Atari have their most powerful model, the 1040ST-F with 1024K RAM. This low cost powerhouse can be introduced into a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F not only features twice as much memory as the 520ST-FM, but also includes a more powerful built-in disk drive. The drive featured on the 1040ST-F is a one megabyte double sided model. The extra memory facility of the 1040ST-F makes it ideal for applications such as large databases or spreadsheets. Like the 520ST-FM, the 1040ST-F has a mains transformer built into the console to give a compact and stylish unit with only one main lead. The 1040ST-F is also supplied from Silica Shop with a free software package and 'ST STARTER KIT'. In the USA, the 1040ST-F has been sold with a TV modulator like the 520ST-FM. However, for the UK market, Atari are manufacturing the 1040ST-F solely with business use in mind and it does not currently include an RF modulator, this means that you cannot use it with a domestic TV (Silica Shop do offer a modulator upgrade for only £49). The 1040ST-F keyboard costs only £599 (inc VAT) and, unless a modulator upgrade is fitted, will require an Atari or third party monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

- 1040ST-F Keyboard Without Monitor - £599 (inc VAT)
- 1040ST-F Keyboard + High res mono monitor - £699 (inc VAT)
- 1040ST-F Keyboard + Low res col monitor - £799 (inc VAT)
- 1040ST-F Keyboard + Med res col monitor - £899 (inc VAT)

The 1040ST-F comes with a mouse controller and includes 1Mbyte of RAM. It has a 1Mbyte double sided disk drive and mains transformer, both built into the keyboard to give a compact and stylish unit, with only one main lead.

# £599

# ATARI

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Address: .....

Postcode: .....

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1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX

**LONDON** 01-580 4839  
Lion House (1st floor), 227 Tottenham Court Rd, London, W1

**LONDON** 01-629 1234 ext 3677  
Selfridges (1st floor), Oxford Street, London, W1A 1AB

# WORDS & FIGURES SPREADSHEET WITH WP

By Glyn Moody

Undeterred by Lotus's legal threats to other publishers, another cheap, augmented 1-2-3 compatible program has hit the market.

The recent action brought by Lotus against Paperback Software and Mosaic has highlighted the uncertain position of software clones. Despite this, with 1-2-3 established as what is surely an unassailable standard in the spreadsheet market, several firms are still willing to risk a confrontation with Lotus for the sake of a slice of this exceedingly rich cake.

One of the latest is Words & Figures from Lifetree Software. As its name indicates, it offers the combined functions of a spreadsheet and a word processor. This continues the tradition of VP-Planner and The Twin, the two programs at the centre of Lotus's present action. In addition to spreadsheet facilities, the former offers a powerful database and the latter much extended graphics. Another Lotus clone, Farsight, offers additional word processing. To a certain extent this trend is a reflection both of the stinginess of the Lotus product and of how programming techniques — admittedly building on the work of others — have progressed since 1-2-3 was first launched. Words & Figures costs £99, which is in tune with the other 1-2-3 work-alikes.

The program is not copy protected and installation is relatively straightforward. Using a separate installation program provided you simply opt for hard- or floppy-disc based systems. You then use one of two versions supplied, the small or large program. There is no difference in the functionality and the smaller version will fit in only 256K. The larger program needs more memory but works faster by doing away with the need for program overlays.

After installation and before use you must stamp your working copy with your name and company address. Schemes like this one, designed to discourage piracy, can be tiresome when they require you to enter all this data every time you use the program. Happily Words & Figures confirms the disc's origins by displaying the information on the opening screen, which is fair enough.

At the top of this screen there is a short Lotus-style menu which allows you to choose between the spreadsheet and word-processing parts of the programs. Choosing the spreadsheet brings up the familiar 1-2-3 layout. There are a few differences of form and more of features. For example, the status information is in the top left-hand

corner, not the right, and cells can be 75 rather than 72 columns wide. The spreadsheet can have up to 9,999 rows and uses a sparse-matrix approach which makes economical use of memory by ignoring empty cells. Expanded memory is supported as is the 80287 maths co-processor.

One nice touch is the use of pop-up boxes for information such as the list of files available for retrieval and graph names. This contrasts with the rather cruder approach of 1-2-3. There are also a number of extra commands. The Audit command, invoked from the Worksheet menu, allows you to search out circular references or other kinds of more subtle errors which may be lurking in a spreadsheet. The command found in the latest release of 1-2-3 which transposes

WORDS & FIGURES				
PC VERDICT	POOR	AVERAGE	GOOD	EXCELLENT
	Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

1-2-3 compatible power with the bonus of a useful integrated word processor.

rows and columns is also available in Words & Figures.

Such additions to the command menus pose a problem as far as true compatibility is concerned. Words & Figures offers the same macro facilities as 1-2-3 and is designed to accept pre-existing macros. The trouble arises when such macros make assumptions about the layout of the command menus. For example, the 1-2-3 macro commands {left} and {right}, used to move among the menu options, may not work unless altered to take the new options into account. The changes needed will not be great, but they do highlight once more the cloner's dilemma: if you add features over and above those on 1-2-3 you may lose full compatibility.

Apart from this potential snag, Words &



## SPECIFICATION

**Description:** spreadsheet compatible with Lotus 1-2-3 release 1A, with built-in integrated word processor

**Hardware required:** IBM PC, PC/AT or compatible with at least 256K RAM

**Copy protection:** none

**Price:** £99

**Publisher:** Lifetree Software (Europe), Lowndes House, The Bury, Church Street, Chesham, Buckinghamshire HP5 1HH. Telephone: (0494) 772422

**Available:** now

Figures seems to be fully compatible with 1-2-3 release 1A. It imported and graphed spreadsheets without difficulty. As with Lotus, there is a separate program for producing hard-copy versions of graphs.

One of the extra commands in Words & Figures lets you switch to the word processor. Both spreadsheet and word processor can operate simultaneously; you simply switch between the two and can even display both at once using split screens.

Adding a full text-manipulating facility to a spreadsheet is sensible. Once they have become familiar with 1-2-3, many managers tend to use it for everything, word processing included. Words & Figures capitalises on the Lotus interface and carries it over effectively to the word-processing environment. Thus there is the same command menu called up by the Slash key, with many of the commands the same as those on Lotus. The sub-menus are often radically different but there should still be enough uniformity to ease the move across from figures to words.

MENU  
Worksheet Range Copy Move File Print Graph Data **Text** Quit  
Enter Word Processor

	Sales	Product	Model
A	27358694	A	17
B	29564738	B	23
C	24726351	C	54
D	23793748	D	37
E	24729114	E	8
F	26968398	F	7
G	27319470	G	9
H	29735264	H	11
I	29483856	I	10
J	27719432		
K	28395789		
L	29028895		
M	27484627		

Bar Graph Figures      Pie Chart Figures

MENU  
Enter name of .WKS file to retrieve:

	Sales	Product	Model
A	27358694		
B	29564738		
C	24726351		
D	23793748		
E	24729114		
F	26968398		
G	27319470		
H	29735264		
I	29483856		
J	27719432		
K	28395789		
L	29028895		
M	27484627		

Bar Graph Figures      Pie Chart Figures

Both the spreadsheet (above) and the word processor (below) have a Lotus-like look to them. You can flip from one to the other without losing data or text.

Above: The Retrieve option picks out files of a suitable format. Below: A spreadsheet pasted into a WP document remains active in both windows, along with a limited set of commands.

WORKING.WAF Page: 1 Line: 4  
Global Insert Delete Copy Move File Print Spreadsheet Quit  
Locate, Replace, Format, Window, Justify, Erase, Setting, Default

Words & Figures

This shows the basic similarities between the text-processing side of Words & Figures, and the Lotus menu structure.

MENU Page: 1 Line: 5  
Worksheet Range Copy Move Graph Data  
Global, Insert, Delete, Column-Width, Erase, Window, Status, Audit

This is a text window, simultaneously open with a spreadsheet. Information can be transferred across.

2353	2343	3253
3253	4632	4634

The above figures refer actively to the spreadsheet below

Example	Jan	Feb	Mar
Sales	2353	2343	3253
Costs	3253	4632	4634

Beneath the command area there is a ruler where the cursor, tab and page widths are indicated. These settings are altered from a pop-up menu invoked from the Global command. Headers and footers are also controlled from here. Two headers or footers can be used; if you wish they can be spread across the page, centred in segments defined using vertical strokes. Current page number and current date can be inserted using @ and # respectively.

As well as Lotus-type menus there are some other borrowings from established programs. Some of the standard WordStar cursor codes are also used by Words & Figures. For example, Control-F will move you forward a word at a time; alternatively you can use the Control key in combination with the right cursor key as in PFS Write and Professional Write. There are all the usual block moves, and search and replace facilities. In operation, the word processor seems fast, particularly when it comes to automatic reformatting as text is inserted.

Perhaps the strongest feature of the word processor is that you can turn any part of it into a spreadsheet. Using the /Insert Spreadsheet command a range of rows from the current

spreadsheet can be placed in the current document. Particularly impressive is the fact that this region now acts as a spreadsheet: most of the spreadsheet commands are active there, and all the features of row and column addition are present. The spreadsheet region of a text document is indicated by a change in the cursor.

Several spreadsheet regions can be created in a document. They can then be enlarged or reduced, although it is the window rather than the spreadsheet which changes. To alter the underlying spreadsheet structure you must flip over to the current spreadsheet. This is done using either the Spreadsheet command from the main menu or by using Alt-f10, which is also used to flip back. The current spreadsheet and the document can be displayed simultaneously by opening each in a different window.

It is probably not every day that you would want to include spreadsheet-like structures in a letter, but when you do it is often awkward — if not impossible — on many word processors. For anyone who regularly includes small tables, the approach adopted by Words & Figures must make it a strong contender as a simple, low-cost word processor.

For most people, however, it is likely to be the 1-2-3 compatibility which is more crucial. If you decide that you want a Lotus look-alike the main basis for choosing comes down to what additional functions you want. VP-Planner scores with its database, Twin with graphics. Words & Figures lives up to its name and offers about the best text-processing facilities among the clones. Perhaps the only cloud on the horizon is the uncertain legal position of 1-2-3 work-alikes in general. Until that is resolved, buying a software clone might be seen as something of a risk; alternatively, you might want to seize the opportunity before it disappears.

## CONCLUSIONS

- Words & Figures is a Lotus 1-2-3 clone with very strong word-processing facilities.
- The ability to switch between the two functions and to embed a live spreadsheet within a text document is potentially very useful.
- The future of software clones is still in question, which could pose long-term problems of support if the product is taken off the market.
- Although the documentation is not up to Lotus's current high standards, it is more than adequate.

# Born Leader.

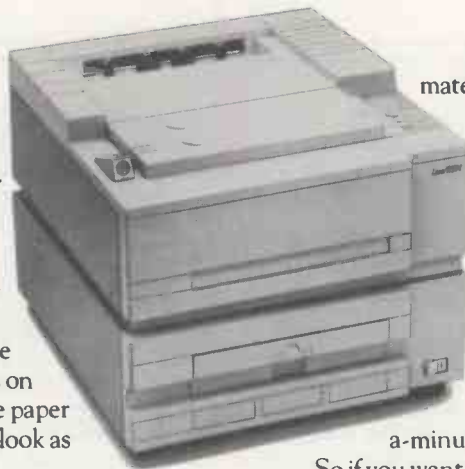
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# FOXBASE PLUS

## FASTER, CHEAPER dBASE CLONE

By Mike Lewis

Not all systems will be capable of running this database package, but for those that can it has some considerable advantages over the Ashton-Tate original.

If Lotus 1-2-3 holds the title of the world's most imitated software package, Ashton-Tate's dBase family must be running a close second. In fact the dBase language, as distinct from any particular implementation of it, is virtually in the public domain and has become a fair target for anyone who feels they can write a better interpreter or compiler for it.

One company that has done just that is Fox Software. Its Foxbase Plus must be one of the few dBase look-alikes that is causing Ashton-Tate real anxiety. Foxbase Plus has one overriding advantage, and that is speed. Other products — notably the true compilers like Quicksilver and Clipper — will also run dBase programs much faster than dBase itself. But Foxbase is the only one that does so without sacrificing the convenience of the dot prompt. You get the speed of a compiled program with the flexibility of an interpreter.

Foxbase achieves its speed by compiling programs on the fly. There are two options. You can work entirely with PRG files, exactly as in dBase except that the source code is pseudo-compiled each time it is loaded. This makes program development easier and gives fast execution, but going from one PRG file or procedure to another is very slow.

The alternative is to use the free-standing compiler which creates pseudo-compiled programs on disc with the extension .Fox. They can then be run in the same way as PRG files, either from the dot prompt or from within other programs. They give the same speed-up as for the other option but without the delay for compilation each time a file is read in.

Of course, the ordinary user at the dot prompt need not be concerned with any of this. Interactive commands can be entered in just the same way as in dBase; in fact, there is no visible difference between the two packages. The only dBase III Plus features which Foxbase does not support are the Assistant, views, queries, catalogues, the screen printer and certain import/export formats.



### SPECIFICATION

**Description:** database-management system; pseudo-compiler for dBase III Plus

**Hardware required:** IBM PC, PC/AT or compatible with at least 375K of free RAM; more RAM and a hard disc recommended

**Copy protection:** none

**Price:** £395 for single-user version; £895 for multi-user version, regardless of number of users

**Publisher:** Fox Software of Perryburg, Ohio

**U.K. distributor:** In Touch, Fairfield House, Brynhyfryd, Caerphilly, Mid-Glamorgan CF8 2QQ. Telephone: (0222) 882334

**Available:** now

To balance these omissions, Fox has added a few language features not found in the original, the most important being arrays and multiple relations. The constraints are less restrictive too: you are allowed 48 files open at a time instead of 16, for example. But on the whole the authors have resisted the temptation of adding lots of extras that could make the product incompatible with other implementations.

So how well does Foxbase perform in practice? Running standard benchmarks for dBase is a hazardous task: someone is bound to say that they are not typical of his or her real dBase application. But with the help of a City-based firm of investment consultants we decided to try out Foxbase on a live system. The application was a demanding

one. There were 90 PRG files and procedures, with some 13,000 lines of code, using 5Mbyte of data, running on a Novell network with up to 11 simultaneous users. It would be a tough test for any database package.

The result was a very creditable performance for Foxbase. Converting the system from dBase III Plus took two hours, of which only six minutes was needed for the actual compilation. Most of the remaining time was taken up with reindexing the databases. Foxbase indexes are not compatible with those of dBase so a once-only conversion was necessary. If you forget to do this, the software will reindex the files automatically the first time it uses them.

Reindexing had a pleasant side effect. The Foxbase indexes needed only 700K, compared to 2Mbyte for the dBase versions. Also the compiled programs were about half the size of the original source. This gave an immediate saving in disc space of nearly 27 percent.

### RUNS MUCH FASTER

But the most impressive results were in the timings. A complex search that took 20 minutes under dBase III Plus now ran in three minutes. The time needed to display a particular report was reduced from well over a minute to just 13 seconds. And retrieving a record from a database of 8,000 items was so fast that we could not time it.

These results were in line with Fox's advertising, which claims a six-to-one improvement over dBase III Plus. The only operation that did not run noticeably faster

(continued on next page)

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was the creation of index files. We also ran a comparison against a version of the application produced by Wordtech's optimising compiler, Quicksilver. Even here Foxbase had a slight edge, although the results were not so conclusive.

But against these gains there was one serious loss: memory. The Foxbase manual says that the software needs a minimum of 375K of RAM. "Minimum" is the operative word here, as to get the best performance you need nearer 500K. Even at this level you might have to make compromises on the number of memory variables, the size of the history stack and so on.

Foxbase is not very intelligent in the way it allocates memory. It is up to the user to set up a Config file to specify the amounts to reserve for various purposes. The manual does not give much guidance on this. We needed a lot of trial and error to come up with the best figures for the company's 512K work stations. And the users' joy at having a speeded-up system was diminished when they realised that they could no longer run both Superkey and Sidekick at the same time as the main system.

There were also some difficulties with language compatibility, though they were very minor. The only real problem was in using date fields in an index. In dBase, when you index a file on a date field you have to set the date format to ANSI to get the correct sequence. Once that has been done you can use a normal format, such as British, when



FOXBASE PLUS				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Well worth considering, either as a replacement for dBase III Plus or as a powerful database package in its own right.

retrieving records. Foxbase is a lot fussier, as it crashes if you use a different date format for indexing and retrieval.

But apart from this one problem our 13,000 lines of dBase III Plus source code ran correctly without change. Aside from the very short list of unsupported commands the only other differences were in the layout of

the help screens and the wording of error messages.

Foxbase has several further advantages over dBase III Plus. First, there is the manual. Although a little skimpy in certain areas, it is for the most part clearly written and easy to navigate. It will not help you to learn dBase from scratch — one of the many third-party paperbacks would be better for this — but as a reference source it is very good.

The second advantage is price. The single-user version of Foxbase costs around £200 less than dBase III Plus, with much bigger savings for the network version. Finally there is portability. Fox has released versions for MS-DOS, Unix, Xenix and AOS/VS. This now provides a clear upgrade path for dBase users who have their sights set on bigger machines.

## CONCLUSIONS

■ Foxbase Plus has so many advantages over dBase III Plus that there seems to be little point in buying the original. Foxbase is faster, cheaper and more portable.

■ If you already have a large dBase application, converting to Foxbase should speed it up enormously.

■ Since Foxbase is not a true compiler you still get the convenience of the dot prompt, though the purely interactive user will not enjoy the same speed advantages as the person who works with pre-written programs.

■ It is not worth trying to run Foxbase on a machine with less than 512K; 640K would be better.

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# LOTUS METRO POWER POP-UP

By Steve Malone

Power users will find most of their needs satisfied by this comprehensive set of desk accessories.

For some years one of the standard combinations for general office use has been the odd couple: Lotus 1-2-3 and Sidekick. Sidekick is particularly suitable as an adjunct to 1-2-3 as it contains useful functions such as a calculator and import/export routines.

The marriage has not always been a happy one. It is not by chance that both these programs are used by *Practical Computing* as tests of IBM compatibility. The way in which both programs attempt to write directly to video RAM has caused all kinds of grief. But despite such difficulties, users have remained loyal to Sidekick, even forcing Lotus to change the code of 1-2-3's version 2 to accommodate clashes between them.

Viewed as a piece of business software, Sidekick is an unlikely success, coming as it does from the programming rather than the general-purpose end of the market. When Lotus was looking around for new products to develop, the idea of a more business-orientated version of Sidekick must have been appealing.

The result is Metro. It is not the first pop-up program to appear under the Lotus flag, as the company acquired Spotlight from Software Arts some time ago. But Metro is the first Lotus product written by the company's own programmers to tackle Sidekick directly. Spotlight is being discontinued, although copies will continue to be available while stocks last.

While Metro is a pop-up program in the sense that it appears on top of an application, it is not memory resident. Even the smallest utilities fetch overlays from disc before they appear on-screen. This is fine if you have a hard disc and just about bearable with twin floppies, but impossible with a single floppy drive.

The other thing you quickly notice about Metro is the prodigious quantity of memory it occupies. The bare minimum for the program is 80K, and even that is not enough to run many of the utilities. Lotus recommends 120K be set aside for normal operations, and this is the default setting. If you want to run macros you need to reserve at least 130K, and the program can happily occupy half a megabyte. Considering the amount of memory the program uses it comes as a sur-

prise to find that Metro does not support Lotus's own Enhanced Memory Specification. The company says that it is looking into this question, but no definite date for an upgrade is available.

Metro is clearly not aimed at the entry-level Amstrad owner. In fact, it is hard to escape the conclusion that it is not aimed at the current generation of MS-DOS users at all; instead it seems to be intended for AT-type machines running DOS 5.0 and beyond. If it is any consolation for those with restricted memory space, Metro has a function which allows you in effect to unload it from memory.

When the program is installed you set the amount of memory it can use, whether or not it is to drive a colour screen and the amount of memory to be earmarked for

LOTUS METRO				
VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> The pop-up program for over-achievers.				

macros. You can also choose whether or not to suppress the snow — that is, the breaking up of the screen image — that sometimes occurs when the program is invoked. The pop-up positions of the windows can also be altered and the Kaleidoscope utility lets you select the colours of the windows. You can configure Metro for the kind of keyboard you are using: PC, Enhanced PC and AT layouts are supported. Utilities like the calculator display a partial view of the keyboard, and the format naturally needs to match the physical layout of your system.

Once the program is running it can be invoked by pressing Shift and Alt together. This seems like a good choice as you can press the hot-key combination with one finger. The opening menu that greets you shows the utilities that are available. The selection is not actually fixed but is built up from the utilities that are available on power-up. This is a clever move as it allows Lotus or third parties to add extra utilities to

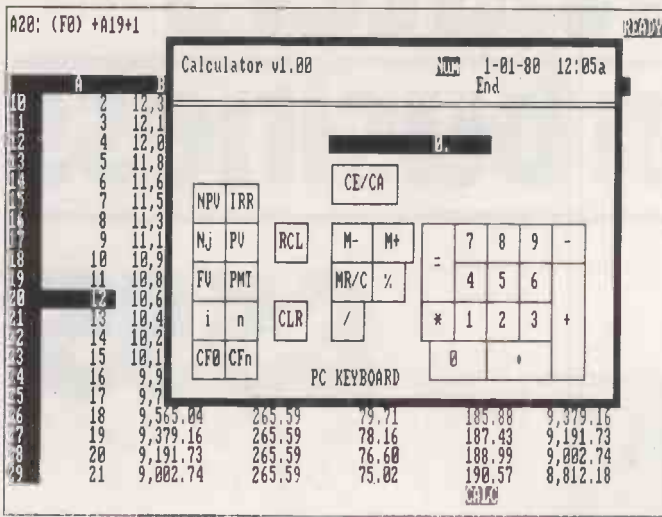
the Metro repertoire; Lotus is said to be actively considering a toolbox for third-party programmers. It also means that Lotus could sell a cheap cut-down version of Metro while allowing users the option of buying upgrades later.

Individual utilities are selected by holding down the Shift/Alt combination and pressing a third key. When Metro is invoked it also configures some of the function keys. The f1 key provides on-screen help, while f10 invokes a menu at the top of the accessory window. However, most of the menu selections are specific to a particular utility, and some call a subsidiary set of menu options. While this arrangement is useful in widening the scope of the individual accessories, the program did have one feature which we found particularly irksome. To close the utility window you have to scroll along to the Quit option and select it. We would have preferred to press the Escape key, as used in other pop-up programs.

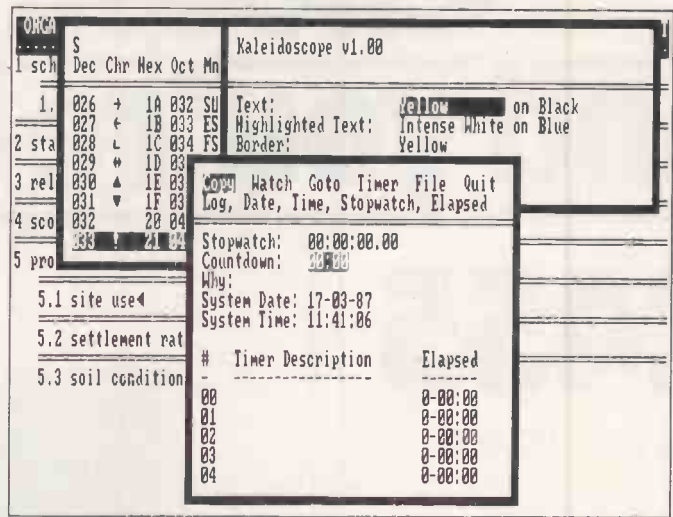
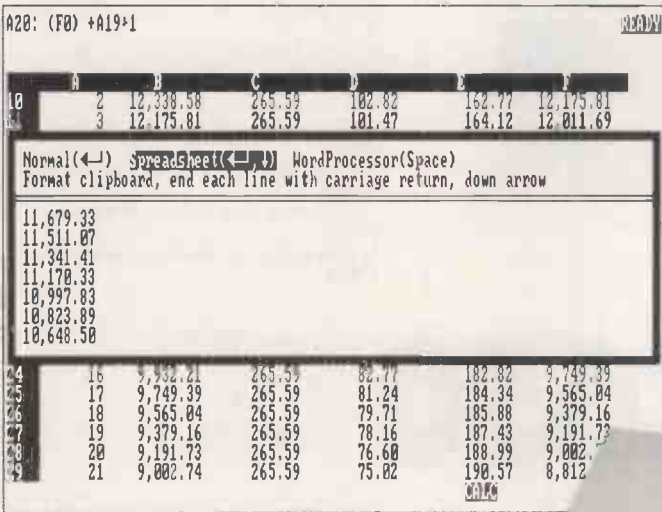
Utilities like the Calculator, Notepad, Appointment Book/Calendar and Phone Book can do more or less everything their Sidekick equivalents can do. There is also a Special Characters Utility — the Metro equivalent of Sidekick's ASCII table. Many of the utilities also have extended functions beyond those provided by Sidekick. For example, the calculator uses shifted function keys as registers for financial transactions.

One of the most useful accessories for people with a number of programs or worksheets on the go is the ability to move data between them. Under Metro this is done by the Clipboard: you can dump data into the Clipboard either by the screenful, just as text, or by marking a block on-screen.

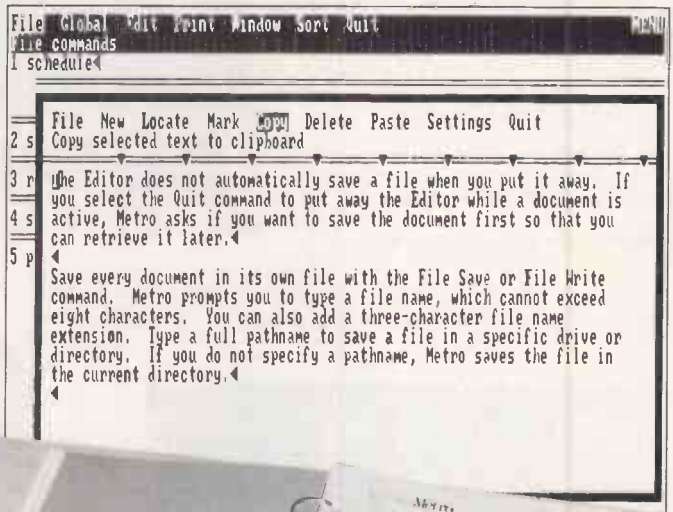
One interesting feature of the Clipboard is that it allows you to format the data once it has been captured. For example, if you have dumped a column of numbers into the Clipboard from your 1-2-3 spreadsheet you may wish to transfer them to another worksheet. Data from the Clipboard is transferred into another application as though it were being entered at the command line. Thus the column of figures from one spreadsheet would normally end up in a single cell of the receiving spreadsheet. Formatting the data with the Spreadsheet option that is built into the Clipboard adds a Carriage Return and a down arrow after each figure so that the data will be entered into the worksheet as a column. A similar procedure can be used with text for entry into word processors; in this case each word will have a space entered after it.



Above: The Calculator utility's display mimics the layout of the function keys and numeric keypad of your system.  
 Below: Clipboard allows text and data to be transferred between packages. Formatting options are part of the Clipboard.



Above: The Watch utility includes alarm and timing functions. Kaleidoscope and Special Characters windows are also visible. Below: The Editor's command line is similar to Lotus 1-2-3. You select Quit to close the pop-up window.



## SPECIFICATION

**Description:** suite of pop-up desk utilities

**Hardware requirements:** IBM PC, PC/AT or compatible with two floppy-disc drives; requires a minimum of 80K RAM but 320K is recommended

**Copy protection:** none

**Price:** £69

**Publisher:** Lotus Development, Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone: (0753) 840291

**Available:** now

One useful feature of Metro, which was overlooked by Sidekick's programmers but has been picked up by other pop-up suites, is the facility that lets you enter DOS commands from within an application. It is available in the Filer utility, which allows you to change and examine directories, format discs, and rename and print files.

Curiously, while Metro has a Sidekick-type Notepad, it also has a text editor. Called Editor, it contains many of the features you would normally associate with a full word-processing package, including



block operations, wordwrap and text location. Perhaps to discourage people from thinking they have got a proper word processor — and thus not buy Manuscript — Editor does not support partial file retrieval from disc. If a file is too big to fit in memory it asks you if you will accept a truncated version. If you do accept it, beware! Resaving the file under its original name will wipe out the text which Editor did not retrieve.

One of the winning features of Lotus 1-2-3 has been its ability to create macros. The same facility has sensibly been incorporated into Metro. From the Macro window you can create a file, assign a unique key combination to it and then enter a sequence of keystrokes. Once the file has been run, hitting the appropriate hot-key combination will execute the keystrokes.

## CONCLUSIONS

■ Metro is a Sidekick-type pop-up program for the business power user. The size and architecture of the program means that it is really only suitable for power computers too.

■ Many pop-up accessories not present in Sidekick have been included in Metro, making it one of the most comprehensive systems around.

■ The way Metro loads accessories from disc indicates that there are a lot more utilities to come, both from Lotus and from third-party programmers. This gives Metro the room to expand in the future which other programs currently lack.

■ Metro may not immediately sweep Sidekick out of office micros around the world, but it is sure to provide a difficult challenge to the Borland product.

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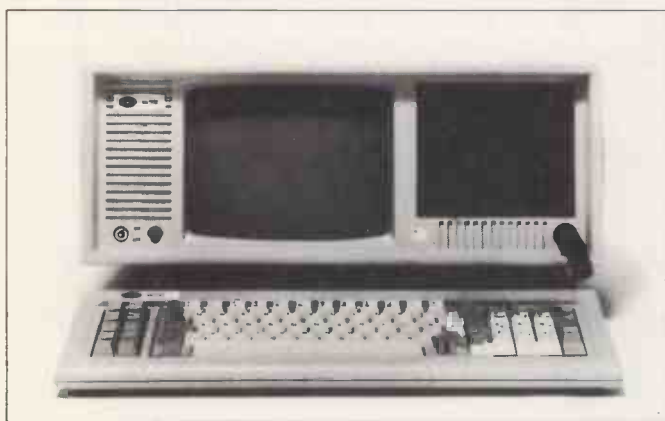
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# TORNADO NOTES CATCH THE FLEETING THOUGHT

By Ian Stobie

This unusual utility exploits the fact that a pop-up program is always at hand, making it an ideal medium for instant note taking.

I should come straight out and say that Tornado Notes is one of my favourite programs. I have it loaded most of the time my machine is on. Tornado Notes is a pop-up, memory-resident note-taking utility — really a simple but novel kind of database or word processor. It is small enough to have running on your system all the time and this greatly increases its usefulness. It was developed by Micro Logic Corporation, a small American software house, and is available in the U.K. from Ideal Software for £60.

The basic concept of the program is simply a pile of notes from which you can extract the one that interests you by typing a keyword. You can then transfer the text contained in the note to a word processor, database or spreadsheet.

Tornado Notes fits in just over 70K, which includes 20K for the resident note file. I like to have one large file resident in memory all the time, so I allocate more space for the note file; you can have up to 54K. On a 640K system, even with a 40K note file I can have Tornado Notes running alongside all but the most heavyweight graphics or desk-top publishing program with no difficulty. If you do find yourself short of memory you can separate your notes into several smaller files, which you load from disc as required.

## BROWSING

You invoke Tornado Notes by hitting Alt-J. Your existing notes appear on the screen as you left them, with the one you were working on last shown on top of the rest. To create a new note you just type N and start typing. Alternatively you can browse through the existing notes in the pile, using the cursor keys to flip down through them one by one.

The End key takes you to the bottom of the pile and Home gets you back to the top. The current note is always highlighted, either by being brighter than the other notes on a monochrome system, or by being a contrasting colour. You can override the default colour scheme if you do not like it. To edit the current note you simply type E.

The program decides how many notes to

display on-screen at a time unless you override it. Typing 3, for instance, displays just the topmost three notes. Left to itself, the screen usually look a bit crowded, but you soon get used to it.

There is no doubt that it takes a while to get used to Tornado Notes commands. Most commands are accessed by keying single letters, corresponding to the first letter of the commands in the current menu. The disadvantage with this system is that some of the commands have had to be rather obscure, just so that they can have a unique first letter. For example, on the topmost menu you delete things by using the T or Throw command, which you have to confirm with a Y.

The help key, f1, provides context-sensitive information. The help text is fairly terse, but at least this means that the program does not take up too much room.

TORNADO NOTES				
M	VERDICT			
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Wonderful pop-up if you think along the same lines as it does. Most likely to appeal to WP and database users.

Tornado Notes follows WordStar conventions in its use of the basic editing keys. Editing is confined to the basic commands; block operations are possible within a note but there are no sophistications like find and replace.

Notes can be of any size within the memory you have available. To make a note appear wider you hit Escape, then use the cursor. Other commands are provided for duplicating and joining notes.

Get is a key Tornado Notes command that provides a very fast search of the pile of notes. To use it you just type G from the main command level then start typing the string you wish to search for. The string can be anywhere in the target note; it does not have to be in any special key field.

As you type the string Tornado Notes displays a row of blobs on-screen in front of you, each blob corresponding to a note



## SPECIFICATION

**Description:** memory-resident note program

**Hardware required:** IBM PC, PC/AT or compatible running MS-DOS 2.0 or higher, with at least 128K of memory and one floppy disc

**Copy protection:** none

**Price:** £60

**Publisher:** Micro Logic Corporation of Hackensack, NJ

**U.K. supplier:** Ideal Software, Tolworth Tower, Surbiton, Surrey KT6 7EL.

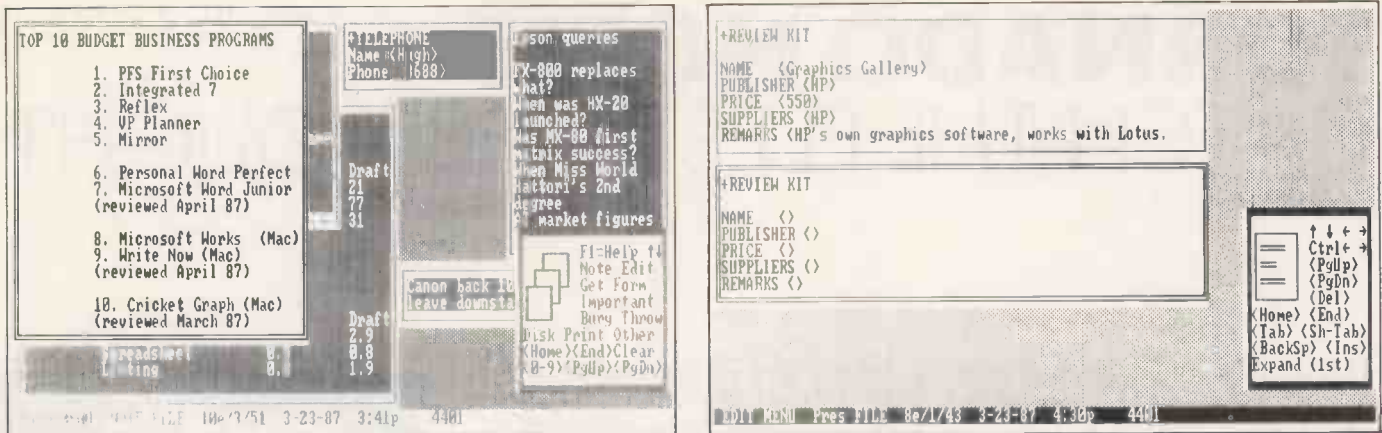
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which matches your search criteria. As you continue typing, the number reduces until one of three things happens. You might end up with just one note, in which case Tornado Notes immediately displays it on-screen as the current note. Or you might finish typing your string and still have several blobs visible, in which case the program displays them all and you can browse through them or edit in the normal way. If you type a letter which produces a string with no match Tornado Notes beeps and redisplay the last matching character you typed. You can then continue or abandon the search. Tornado Notes also supports wild-card searches.

The program is very fast: I find it is quick enough to make a very effective system for holding telephone notes. When someone calls, hitting Alt-J gets me into Tornado Notes from my foreground application, and then I type G to invoke the Get command followed by the first few letters of a contact name for company. This usually produces two or three notes on-screen corresponding to recent dealings, all within the first few seconds of the call.

(continued on next page)



(continued from previous page)

Another extremely useful Tornado Notes function is the Grab command. It is located on a menu called, rather unhelpfully, the Other menu, so you type OG to invoke it. It copies the contents of the screen currently displayed by your foreground application, be it spreadsheet word processor or whatever, and puts it into a new note.

Complementary to Get is the Put command, which lets you transfer a Tornado Note into your main application. You are not limited to transferring one screen; you can transfer the entire note, however long. Put does this by emulating keyboard input, so it will work with any well-behaved MS-DOS application. Text goes in at the current cursor position.

Taken together the Grab and Put commands are exceptionally useful. Any sudden thought not immediately relevant to the work you are doing can go into Tornado Notes, to be Put into the relevant document later on. Grab is useful for pulling in screens full of data from spreadsheets, which can then be edited and Put into word-processed reports as tables. Tornado Notes thus provides a rough-and-ready though effective way for the IBM user to get some of the benefits of integration available on the Macintosh.

## ADDRESS BOOK

Get and Put work together as a convenient way of handling addresses. If you make each address a short note you can then Get the relevant note whenever you need it by typing in a fragment of the name or address, and then Put it immediately into your word-processing document or database record at the current cursor position.

In addition to the Put command, there are two other ways of getting data from Tornado Notes into other programs. You can use the Export command, which will write a note as an ASCII file with the name of your choice. Tornado Notes holds the whole of the note file in a form which is basically ASCII, so you can just load the whole note file straight into most word processors. Various blocks of numbers used by the program are scattered throughout the file but you can easily delete them if you need to.

For simple note-taking Tornado Notes is probably a better option than a proper data-

Tornado Notes can look confusing at first as it simply displays a pile of notes on the screen. Notes can be virtually any shape or size. As well as text typed in at the keyboard a note can be generated by grabbing a complete screenful of information from your foreground application. Tornado Notes also lets you create up to 26 form templates (right) which you can then fill up with variable information to make a new note.

base program. This is because it does things the right way round. Most databases require you to think about the format of your data before you start using it. You can waste a lot of time loading up the right file or tabbing through redundant information to get to the items in the record you are interested in, and then have data rejected as invalid when you try to type it in. By contrast the information in a set of Tornado Notes is often disorganised and with no discernible format because it has been entered quickly and spontaneously. This is precisely why it is useful.

Tornado Notes does allow you to make use of more structured information if you want to, with the Form command. First you create a special template note. This is a note like any other but you have to put a keyword preceded with a # sign in the top left-hand corner. You can have up to 26 different form templates, each with a keyword starting with a different letter of the alphabet. The rest of the template note can contain a mixture of fixed information in any format and gaps for variable data, which you enclose between angle brackets.

When you want to enter data into the forms you select the appropriate template and type in the data, tabbing from field to field. Each record entered this way just becomes a normal Tornado note, and it can be edited, Put and searched for in the normal way.

Tornado Notes also makes a good substitute for a thought organiser or outliner program. Outliners tend to assume you know what you are doing before you begin. Where Tornado Notes scores is in capturing your thoughts whenever they occur, assuming you always have it resident. You can then select the notes relevant to any particular project later on, rewrite or discard them, or just transfer them to a word processor.

Tornado Notes does have limitations and there is one known bug. If you want to free the space Tornado Notes occupies it is best to reboot the system. Tornado Notes has its own Unload command, but using it can later create havoc with some combinations of software. In practice rebooting is not much of a hardship, as it is not often that you want to unload.

Tornado Notes' Documentation is not very good. It takes the form of a 94-page booklet which is square in shape and about the size of a floppy disc. It has no index and has obviously been prepared with Tornado Notes. While this shows commendable confidence in the product, the end result confirms one's worst fears for the habits of thought Tornado Notes encourages. It is basically disorganised: all the information you want is there somewhere but it is not at all clear under what heading you are likely to find it.

## NOT FOR SORTING

Perhaps the program's most irritating limitation is the absence of a Sort command. It would be very useful to be able to sort notes into order, even if this was just on the basis of the characters at the top left of each note. You could easily arrange to have a name, a sequence number or a keyword in this position. But the best you can do is sort manually, which is difficult. You only have the two commands, Important and Bury, to help you. Important moves a note to the top of the pile, Bury to the bottom, and using them to try to get notes into some desired order is a tedious business.

Tornado Notes is no match for a conventional database in this respect. But it is excellent as a note program or as a thought organiser. It is probably best used in conjunction with a word processor, where you can assemble your random thoughts into a disciplined form.

## CONCLUSIONS

- There are many pop-up programs on the market which have note-taking capability, starting with the archetypal Sidekick.
- Tornado Notes scores by concentrating on the note-taking function, allowing you large notes and providing good exporting and importing functions. It is also fast.
- A very useful pop-up if it fits your style of working.





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The problems addressed by X/Open are as old as computing. Traditionally manufacturers have developed specifications and protocols for new equipment and systems in isolation from their competitors. Naturally enough, the designers wish to maximise the performance of their product and can hardly be expected to consult with their rivals when deciding on its key features.

The result is that no one's equipment is compatible with anyone else's, unless the specific intention has been to create a clone. But as clones are an exact copy of the original they effectively freeze the technology to the prototype design and so hinder progress. Normally, when you buy kit from one manufacturer you are effectively locked in to that system and its upgrade path. If someone else comes along later with something better, you cannot use it without dumping all of your previous investment in both hardware and software.

The X/Open group is an assembly of 11 computer manufacturers who have come together to agree on a standard which would allow applications written for one machine to run on another. End-users would then be able to mix hardware from a variety of manufacturers, and to port software from one machine to another. The initiative is a European one, but some American companies are also involved. The group at present consists of AT&T, Bull, DEC, Ericsson, Hewlett-Packard, ICL, Nixdorf, Olivetti, Philips, Siemens and Unisys.

Earlier this year the European Communities' Commission hosted a conference to publicise X/Open and provide a progress report on its development. It is not difficult to see why the EC feels the need to bang heads together. The Commission wishes to invest in information technology for its centres throughout Europe. The trouble is that most of the larger member countries have their own flagship computer manufacturers: ICL in the U.K., Bull in France, Olivetti in Italy and so on. When governments discuss which system to adopt, each will insist on using those from its own company, while the EC Commission has to make sure all the equipment works together without crippling translation costs.

The cornerstone of X/Open is the adoption by all the participating companies of a standard operating system called Posix. It was developed in the U.S. by the Institute of Electrical and Electronics Engineers, and is in fact the IEEE version of AT&T's System V Interface Definition (SVID) Unix. At the conference Geoff Morris, the Chairman of X/Open, was asked what the difference between System V Unix and Posix was. He replied that "System V is a proprietary AT&T product while Posix is a public-domain definition from the IEEE."

Morris went on to explain that Unix was chosen by the X/Open committee as it is "the de facto industry standard". Yet according to X/Open's own figures, of the 7.4 million computers U.S. vendors expect to ship worldwide in 1987, only three percent will have Unix installed. Presumably



# UNIX SANS FRONTIERES

Can the Common Market succeed where others have failed? **Steve Malone** looks at an ambitious attempt to establish a standard which will allow software to run on any manufacturer's machine.

Unix was chosen as the only system everyone could agree on.

Nevertheless, the X/Open group believes Posix will provide a common interface to application software so that any application written to the SVID standard will run on any machine which supports Posix. The differences in the hardware will be masked from the application, allowing software to be ported from one system to the next.

Shifting the burden of standardisation on to the software leaves hardware manufacturers free to carry on pretty much as before. The only thing they must not do is develop proprietary closed-architecture systems, which end-users are increasingly reluctant to buy anyway. All the hardware vendor has to do is write the drivers for Posix for its machine.

This bright picture leaves a number of



questions unanswered. To begin with, can X/Open be made to stick? Can vendors who have spent the last 30 or 40 years at each other's throats stick to the rules? What happens if they don't? Finally, is a company like DEC likely to abandon VMS, the operating system used across its entire range of products?

In answer to the last question, Jim Despathy of DEC replied: "What people don't understand is that it doesn't have to be Unix. X/Open is an interface with a number of hooks for the application to latch on to. It is not impossible to build these hooks into VMS". Fine words, but will it happen?

At the conference the X/Open grouping gave a demonstration of the kind of result it hopes to see. A copy of an Access 20/20 spreadsheet was compiled on a range of machines, including an ICL Clam, an AT&T 3B2/400 and a DEC Microvax II. The resulting executable file ran on all the machines simultaneously. To allow data to be physically ported, a standard 5.25in. floppy and 0.5in. tape format has been agreed on.

It is source code, not object code, which is ported from each machine. To ensure that the source code — for example a C file — can be cross compiled on a range of machines, X/Open has had to define the features and library routines which are acceptable under the standard. In the case of C, X/Open is to adopt the ANSI standard currently undergoing final validation in America. But many versions of C, like System V Unix itself, have a host of additions to the basic system. Many of these extras are so widespread as to be almost standard features, while others are hardly used at all.

When asked to comment on the problem Mike Lambert, X/Open's Technical Group Chairman, said: "We recognise this as a problem. If a feature becomes universal we will take account of it. In the meantime we've adopted a safe subset of the operating system, which is enough for a software house to write applications."

X/Open does not see itself as a body which sets standards. Rather, it takes a pragmatic approach and adopts de facto standards such as RS-232 and MS-DOS, and

**If a feature becomes universal we will take account of it. In the meantime we've adopted a subset of the operating system which is enough to write an application.**

recommends that everyone conforms to them. While it strives for standardisation it cannot dictate to manufacturers but simply endorses a de facto standard when it arises. Large areas, such as graphics and linked networks, still remain to be defined. Details of the X/Open software interface have been published in a five-volume set known as the *X/Open Portability Guide*, which gives details of the System V specification, source code transfer, programming languages and data management.

The group says that a wide range of Unix software already complies with X/Open, and that more will be made compatible this year. It will be difficult to assess precisely how many such packages there are, before a validation suite becomes available later this year. At present the only way of testing compatibility is to run the program across the range of machines operating the X/Open standard.

So where does X/Open go from here? The group has set itself five objectives for the immediate future. First, it aims to get the standards accepted around the world. To this end it is co-operating with other international standards bodies like the ISO, ANSI and IEEE to achieve compatibility. The group is also entering into discussions with some Japanese companies with a view to including their products within X/Open. The second objective is to keep the standard open by ensuring that everyone keeps to the interface it has defined.

At the same time, the third objective is to persuade software houses to write portable packages. This will only happen if the hardware is available. The fourth objective is for every member of the group to launch X/Open products. The final objective is to generate a common understanding of the standards by explaining them to users, dealers and software houses and pointing out the benefits of X/Open.

As yet IBM is not a member of X/Open, and its absence casts doubt on the credibility of the project. Of course, IBM could choose to abide by X/Open standards, but at the same time it is hard to imagine X/Open making much headway in the face of outright IBM opposition. With IBM in the ranks the group could actually set standards and expect them to stick. Perhaps X/Open should forget its five objectives and replace it with one: get IBM into the fold.

*The X/Open Portability Guide is published by Elsevier Science Publishers, Amsterdam. It is priced at \$125.*



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## USER SUPPORT

**CAROL HAMMOND** REPORTS ON THE TELEPHONE-SUPPORT SERVICES YOU MAY BE ABLE TO CALL ON IF YOU ARE HAVING TROUBLE WITH YOUR COMPUTER SYSTEM.

**W**hen you are having problems with a new system or unfamiliar software package, you usually need help fast. What could be better than, than to be able to ring up an expert who will provide you with the information you need? It is quick, cheap — for the user, at least — and requires the minimum of effort.

From the point of view of the software house or hardware manufacturer things look a little different. Telephone support can be a complex and expensive business, yet the availability of backup services can be a crucial issue in someone's mind when deciding what software and hardware to buy. This is all the more so as the micro market becomes more standardised and the competition fiercer: a hotline number to ring with their queries is something users are beginning to expect.

Apple and Borland are two companies that provide telephone support direct to end-users, though you are still encouraged to turn to dealers first for your information. Other firms provide support only for their dealers, who will in turn handle any end-user queries. Some manufacturers will make a hotline available free of charge to end-users, while others only provide it as part of a warranty or maintenance agreement. There are also independent companies which will sell you support for a particular package or machine.

When you are told that a hotline will be available it is worth asking a few questions to find out exactly how hot it will be. You will want to know when the lines are open, how many lines there are, who you will be speaking to when you ring up, and how quickly they will be able to solve your problem. You also need to know how much, if anything, it is going to cost. It is also worth knowing when your hotline's busiest time is; if your query is not urgent it is better to ring during a slack period as you will probably find it quickest to get through then. Companies often list commonly asked questions and answers on a bulletin board that you can access direct; if you have a modem, find out if such a service is available.

Most hotlines are open during office hours on weekdays, though some close for lunch. A few open up late and close early so that the staff who operate them can do other work, tackle complex queries that need fur-

ther attention, or just catch up on administration tasks. Some hotlines are open on Saturday mornings. Out of hours the hotline number may be connected to an answering machine on which you can leave a request to be rung back.

Hotlines normally aim to answer a customer's query immediately. If that is not possible they are usually willing to ring back on the same day. Lotus claims to answer 95 percent of queries within a day. When a tricky problem arises companies based abroad — say, in the States — will often have access via electronic mail to their head office which they can use to get a quick answer.

### SUPPORT FOR LONG-TERM PROJECTS

Hotlines are not just for straightforward problems and novice users. Support staff are often willing to provide tips for solving more esoteric problems. If you are working on an extended project, or trying to do something with a product over an extended period, a company may well assign you to an individual member of staff who you might then be able to call direct.

Apple expects its dealers to carry out the majority of technical support for users. Its technical-support service runs a bulletin board for dealers which they can use to get the answers to questions rather than ringing up. Failing that, users can contact Apple direct; its customer relations department will answer both letters and telephone queries.

IBM has a technical enquiry centre for PCs which users can ring, even though dealers are normally expected to provide support. Dial-IBM provides an electronic-mail link for users of IBM's Managed Network Service to IBM's central support groups and local IBM contacts. It also offers a product-support section which carries commonly asked questions and their answers. Users have to bear the cost of interfacing with the IBM network but the Dial-IBM service is free.

DEC's Customer Support Centre in Basingstoke is open 24 hours a day all year round. DEC does not charge callers, though obviously those who do not have a service contract go to the end of the queue. During the night only those users with urgent needs will be attended to. The service is open to dealers and end-users alike. When necessary, your call will be passed on to senior engineers who have access to hard-copy files and a database of known problems and their solutions. Some large DEC systems are fitted with a remote diagnosis facility: the machine is hooked up to the phone system to enable an engineer at the other end to pinpoint the fault.

DEC has a maximum of 12 people answering calls during peak hours. Callers are asked to give the serial number of their system to identify themselves. A traffic-light system is used to control the flow of calls: a green light means no calls are holding, amber means customers have been waiting 10 seconds and red means callers have been waiting 20 seconds. A monitor lists how many people are waiting in a queue at any time. DEC's sophisticated service is obviously aimed primarily at mainframe and minicomputer users, typically those with service contracts.

# JUST A PHONE CALL AWAY



JANE ECCLES





## USER SUPPORT

Other operations, even much smaller ones, work on broadly similar lines. Ashton-Tate asks users for the serial number of products too. This is done for a variety of reasons, not least from a desire by the company to police the use of its products. Where illicit copies of a program have been made the serial number can be used to trace the source of the original misdeemeanour. It also helps the company in other ways to keep a record of a history of the product; it is then in a position to know, for example, when the same faults keep occurring or if the item is part of a defective batch.

Companies also use hotlines as an encouragement to users to register the software or machine that they have bought, even if the companies do not insist that you give a registration number when you ring. By returning the registration card you explicitly consent to the licence agreement, whereas the mere act of using a program leaves the position in some doubt. Having your registration number on file also helps companies keep track of users so that they can contact you with news of the latest version of their product or send you newsletters containing tips, answers to common problems, and so on.

Companies are particularly keen to get hotline users to register because in many cases bugs or other difficulties that have come to light in an early version of a program are fixed in a later release. If you have the latest version you save yourself the inconvenience of a call, and the company is saved the cost of answering it. It turns out that surprisingly few users return their registration forms. A spokesman for Microsoft said it was lucky if 30 percent of its users registered; Lotus estimates that around 25 percent register, even though users who have lost their original registration card can still do so.

### RESPONDING TO USER DEMANDS

Many companies log calls to help them improve their services and their products. Commonly asked questions and answers may be kept on file or incorporated in an expert system. A large number of calls about a certain feature in a product may also indicate to a company that there is a bug in the software or that a manual needs to be rewritten to explain the point more clearly. Repeated requests to do something a package cannot manage might prompt its authors to try to develop the application to meet users' demands.

Thus hotlines provide a useful channel for feedback to manufacturers and give them the opportunity to chivy users into registering their purchases. They are undoubtedly cheaper than sending out a technician every time to repair a machine or help someone use a package.

Nevertheless, as a Microsoft spokesman pointed out, hotlines remain one of the most costly parts of a company's operations. A large proportion of a company's technical expertise may well be bound up in answering queries rather than developing applications, for example. A hotline will typically be staffed by a few people who will filter calls through to experts; the greater the number of products, the larger the number of people that will be required and the wider their expertise.

The advent of low-cost machines like the Amstrads has brought in its wake a new and increasing demand

for support from novice users who are finally able to afford their own kit. Amstrad has its own free hotline service that answers queries which range from the rating of the fuses you should use to the way you have to load a certain package. Unfortunately, Amstrad's customer-services line is open to purchasers of Amstrad goods of any kind and handles about 1,000 calls a day; you may well have to wait a while to get through.

The trend towards low-cost machines has had a far-reaching effect on dealers too. Their margin has been cut so much they are no longer able to provide software support for free. Computers are now being sold from a different kind of outlet — the chainstore bookshop, electrical-goods supplier or chemist — which specialises in retailing rather than in computers. This has placed a greater burden on manufacturers in providing even the most basic user support, and has caused some to start charging for their hotlines. It has also led to the rise of the third-party support specialists.

Olivetti is setting up its own hotline to support PCs and the PC software it markets. It aims to operate during office hours and to offer a variety of different kinds of support which users will pay for. Large corporations will obviously have different needs from a single user, and in some cases corporations may choose to have Olivetti staff service their own internal hotlines, thus freeing their own people for other tasks.

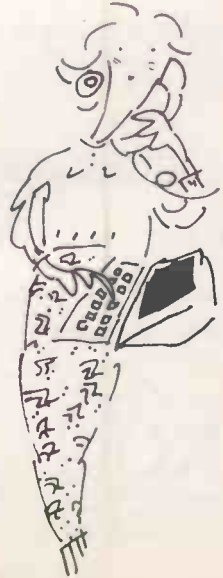
An independent company called Interlex offers a telephone technical-support service for a wide range of software. For £29.95 you can buy a year's access to Interlex's On-line hotline. You can nominate to have sub-£150 Amstrad-type software supported, or it can be for a particular package like dBase II or Supercalc.

Interlex's managing director, Mike Lane, claims that third-party support services have advantages for both users and suppliers: users benefit because the service is independent, and the phone really does get answered. Apricot has recently handed over to Interlex responsibility for its hotline support of the F series and Xen micros. Lane sees the trend continuing, and claims that it will become increasingly economical for software houses, maintenance companies and hardware manufacturers to farm out telephone support.

It seems that hotlines are here to stay. Users want them, and computer companies need to keep their customers happy. How long the service will remain a free one is less certain. When the companies' goodwill runs out and their profits feel the pinch users will start paying a realistic price for the expert information that is provided on call.

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**DEC:** (0256) 57122 daily 24-hour service  
**Interlex:** 01-943 4366 9am to 7pm; also 9am to 1pm on Saturdays  
**IBM:** 01-578 5199, 9am to 5.30pm  
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**M**y first visit to Epson's U.K. headquarters in Wembley was in 1982. I found it depressing. I was having an early look at the HX-20, a light-weight eight-bit portable computer that went on to win itself a big niche in specialist and OEM markets. It was a nice machine but it seemed too perfect. It was the first time I had seen a computer that was engineered like a real product. It appeared to mark the beginning of the end of the exciting days of computing.

In fact things have not turned out the way I feared. Innovation and change have continued to characterise the computer scene; it is still a long way from being a mature and boring commodity market. And Epson has gone from strength to strength, propelled in large part by its willingness to adapt to local user needs.

Epson is the dominant force in the world matrix-printer market. In the U.K. it accounts for nearly half the dot-matrix printers sold through dealers, according to market research company Romtec, and according to IDC about 30 percent of those sold direct. Its Esc-P command language is supported by more software packages than any other standard.

Matrix printers are still at the heart of Epson's business, but it has other strings to its bow. The Epson range now includes the full gamut of printer technology appropriate to the PC market, from low-cost daisywheels to up-market ink-jets and lasers.

Desk-top computers are a growing part of

the business. According to Romtec, Epson was taking about 4.5 percent of the U.K. IBM-compatible market in February. This makes it the best-performing Japanese company by a long way.

Epson also has a flourishing components division, which is particularly strong in large LCD displays. The company continues to be successful with its portable computers and hand-held terminals, which it sells mainly into specialised markets.

Epson U.K. Ltd. is the British subsidiary of Seiko Epson Corporation. It has an annual turnover of £60 million, while Seiko Epson worldwide has a turnover of around \$1.6 billion. Seiko Epson is itself part of the Seiko Group, which includes the company that makes Seiko watches. In its native Japan



The PC AX. In Britain Epson is ahead of other Japanese micro builders.

Epson makes a range of other products such as electric shavers, spectacle lenses and industrial gems. It even makes a portable TV with a colour LCD screen.

Epson started as a spin-off from the Seiko watch business. Seiko needed a quick printer as part of a timing system it was providing for the 1964 Tokyo Olympics. For some reason Japanese companies like using English-language names and the printer Seiko developed was called the EP-101, "EP" standing for electronic printer. The first commercial variant of this was called the Epson — the son of EP — and this later became the brand name for the whole range.

The key to Epson's success in Western computer markets compared to other Japanese companies is partly a consequence of its early start. Epson launched the MX-80 dot-matrix printer into the U.S. in 1979, and it rapidly became the top seller. Until then the market had been dominated by Centronics, the company which gave its name to the standard parallel interface still used on most PCs. The MX-80 gave Epson a reputation for reliability, and enabled it to build up strong distribution channels in the U.S. and other Western computer markets. This gave Epson a head start over other Far Eastern rivals when it came to introducing portable and desk-top computers.

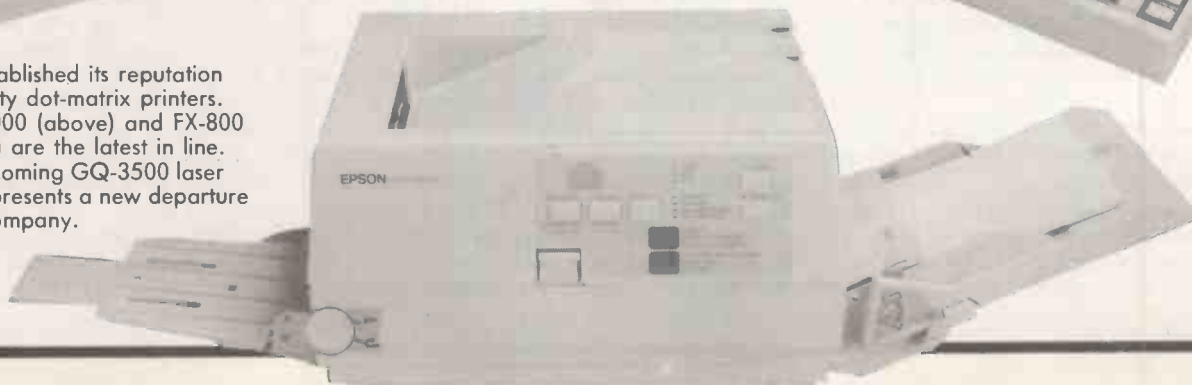
But there is another reason behind Epson's success. It maintains bigger operations in the U.S. and the U.K. than other

(continued on next page)

# EMPIRE OF THE SON

In this first article in an occasional series profiling major suppliers in the computer industry, **Ian Stobie** takes a look at Epson — the company that could claim to be the IBM of the printer world.

Epson established its reputation with quality dot-matrix printers. The FX-1000 (above) and FX-800 (top right) are the latest in line. The forthcoming GQ-3500 laser (right) represents a new departure for the company.



(continued from previous page)

Japanese PC or printer companies, and they are now much more than simple sales operations. As well as undertaking marketing they help design and specify products for both local and worldwide needs.

This is of key importance in the computer market, where product definitions are still a long way from being stable. Ask any computer user to list four or five improvements they would like to see on their machines and they will probably come up with sensible suggestions immediately. This would not be the case with a more mature product like a suitcase or a lawnmower — or even a car. In the PC market the best production engineers in the world can still be beaten by innovators who respond to user demand.

As a result, the specification of Epson products varies from country to country. For example, Epson's early 16-bit micro, the QX-16, was launched in the U.S. with a front end called Valdocs which did not make it over to the U.K. Instead we got Taxi, a Windows-like interface that was developed here. In the U.S. Epson's AT clone, called the Equity III, was launched with a slower hard disc than the equivalent machine here, the PC AX.

Epson maintains a U.K. research and development centre at Milton Keynes, its only full-blown R&D centre outside Japan, where it employs 25 people. The company has also recently opened a manufacturing facility at Telford. It is scheduled to start production in June, producing FX series dot-matrix printers. This is hardly the latest technology, but the Telford site covers 55 acres so expansion into other products seems likely. The printer lines are expected to employ 250 people.

So what is it like to work for a Japanese company with a strong U.K. presence? According to one ex-IBMer in Epson management the corporate culture is surprisingly similar to IBM's. The main differences are in the way decisions are taken and in the general attitude to people. Decisions are taken fast. If a decision is important everyone involved in it will be assembled so that the matter can be resolved there and then.

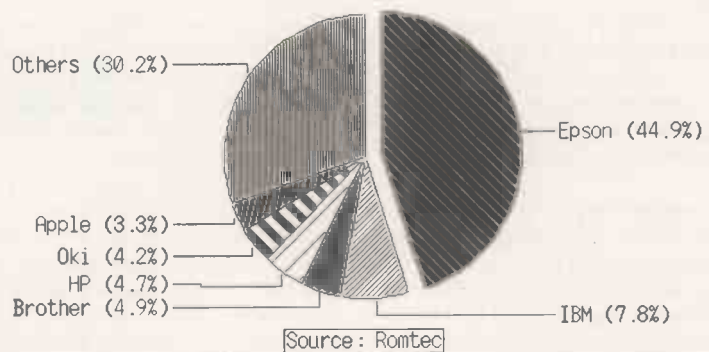
In this country meetings have a bad name as a way of taking effective action, but there are crucial differences in the Epson approach to consensus management. For a start, the meetings are ad hoc and focus on solving a problem. The participants are chosen because they have something to contribute to the solution — meetings are not stuffed full of people whose only speciality is in attending meetings. By the same token they are not class conscious, and shop-floor people are as likely to attend these key meetings as financial managers.

The advantage of this approach is that a final decision is arrived at rapidly. The down side is that you are less likely to be able to find one individual who can give you a snap judgement affecting a whole range of issues.

Top man in the U.K. is Masakazu Sakisaka, chairman and managing director of Epson U.K. He is an engineer by back-

## U.K. Printer Market

Unit sales through dealers, 4th Quarter 1986



Above: Epson dominates the printer market in Britain.

Below: Ichiro Hattori, World President of Seiko Epson.



ground. In public Sakisaka comes over as rather diffident, though he was one of the judges of the 1985 Miss World contest in the days when Epson used to sponsor such high-profile events. The company, as now moved on to more up-market pursuits — the European golf Grand Prix, for example.

Japanese companies have the reputation of treating their staff well. Don Pinchbeck, Epson U.K.'s general manager, describes many British companies as punishment orientated: they expect you to provide your best performance after a thorough drubbing. The Japanese approach is to make sure you realise that your individual contribution is valued. Among other things this means doing away with many of the outward hierarchical trappings such as executive dining rooms.

One aspect where Japanese companies appear old-fashioned is in the absence of women in management posts. In Japan women are seldom present at business meetings in roles other than hostess-style secretaries and translators. This may come to be an important divergence between Western and Japanese business cultures as women slowly make their way up the corporate ladder here.

I put this point to Jenny Lynn-Jones, who is product manager for ink-jets and one of three women employed in medium-level management roles in Epson U.K. She did not seem very impressed with this argument, as she said she had not noticed U.K.-owned companies doing much better.

The boss of Seiko Epson, the worldwide parent of Epson U.K., is Ichiro Hattori. He is a grandson of the original founder of Seiko, Kintaro Hattori, who started out as an importer of foreign clocks and watches into Japan in the 1880s. Many of the leading Japanese companies are still family firms; Casio is another notable example.

Hattori was in Britain recently to announce the opening of the Telford plant. He has a degree in law from the prestigious Tokyo University, and read Economics at Zurich and Yale. The EC is currently considering action over alleged printer dumping, and Hattori was at pains to point out that the Telford operation was not a dodge to avoid such measures.

These pleas ring true. Epson has never attempted to be the cheapest supplier around; if anything, there has usually been a small premium attached to buying an Epson printer. According to Hattori, Epson has a long-term plan to move 30 percent of its total printer production overseas, and it has been considering the Telford move for five years.

While the company is beginning to stress price as a feature in some of its products, this is not happening with basic items like matrix printers, which are what concerns the EC. The Epson strategy in this sector is to continually upgrade performance to prevent its printers becoming commodity products — witness the recent replacement of the FX-85 with the upgraded FX-800.

But Epson is stressing price on its high-end products like the GQ-3500 laser printer which will be launched in May. This is its first laser printer and Epson intends to price it competitively — well under £2,000 we hear — to make it volume market leader. The company also appears to have a new portable up its sleeve — this time a 16-bit IBM-compatible machine. The signs are that it too will have a very competitive price, and it may give the MS-DOS lap-portable market the kick it needs.

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**T**he marriage of micros to mainframes has become almost inevitable. Many managers who have come to accept the micro as an indispensable tool now wish to use it to analyse the corporate information typically held on their company's mainframe, and which is the lifeblood of management accounting. Yet the mainframes themselves are hard-pressed enough to meet the needs of traditional users as they access and process such information through dumb terminals.

An obvious solution would be to treat the mainframe as a kind of super-database resource, and to use micros to pull in the required data and analyse it off-line. This approach capitalises on the particular strengths of both the mainframe and the micro: on the one hand centralised and unified information, on the other distributed processing power. Unfortunately, however logical this move might seem, there are strong historical reasons on both sides why its implementation may well prove long and hard.

In the early days, business micros were regarded as little more than corporate toys, roughly akin to Newton's balls. DP departments knew that so-called personal computers like the Apple II would never supplant their mainframe's company-wide role. After all, had not IBM itself, the epitome of the corporate computer culture, decreed that micros would never catch on?

Of course they did, as it turned out. At one level, this was just a nuisance. Since micros were acquired despite DP departments' sentiments, the DP people were unable to enforce a coherent purchasing policy. This led to the growth of a motley and unmanageable collection of micros throughout most organisations. Their mutual incompatibility seemed only to reinforce the feeling that they were doomed in the company environment. After all, business is about collective action and economies of scale.

What DP managers failed to perceive was that for all their inadequacies, micros represented a fundamentally different approach to computing, not just a failed version of an earlier one. With personal computers the emphasis was on the personal, not the computer. It represented a devolution of power, and struck at the very heart of the DP department's role within a company. By the time this was realised, the inroads were too great and the benefits too clear for there to be any going back. Reluctantly, DP managers recognised that they would have to work with rather than against the new machines.

But having tasted power, users of micros were reluctant to give it up. As a by-product, everything connected with the DP department — including the mainframe — had become tainted for them. This attitude lingers on to this day.

The DP establishment's counter-attack took two forms. First, they insisted — quite rightly — on a standard. Nobody would contemplate using incompatible telephones within a company, so why should computers be any different? The arrival of the IBM PC was both a cause and effect of this about-face by the DP departments. It responded to their needs and provided them with a weapon.

The second phase of their response is still under way, and is more ambitious. It is no less than the re-integration of these errant personal computer users

(continued on next page)

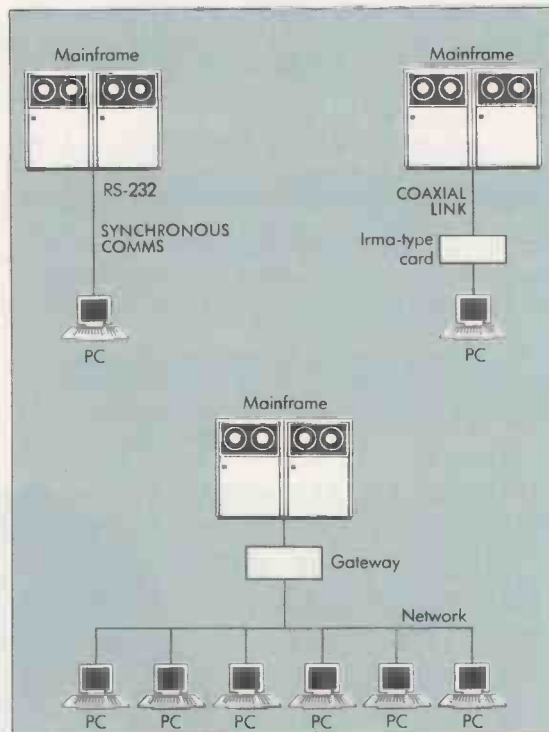
MICROS AND MAINFRAMES  
HAVE DEVELOPED ALONG  
SUCH DIFFERENT LINES  
THAT JOINING THEM  
TOGETHER POSES  
ENORMOUS  
PROBLEMS — BOTH  
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AND HUMAN.  
**GLYN MOODY**  
EXPLAINS WHAT  
THEY ARE AND  
WHAT IS BEING  
DONE TO SOLVE  
THEM.



# THE MAINFRAME CONNECTION

# THE MAINFRAME CONNECTION

A synchronous connection through RS-232 ports is the simplest micro-mainframe link, but also the most limited. With an Irma-type card fitted the micro can act as a full terminal, while a gateway links a fully functional PC network to the mainframe.



(continued from previous page)

within the corporate computing environment. We are already witnessing the first, tentative steps along this road in the form of departmental networks. As last month's *Practical Computing* explained, a standard is now emerging which, no less than the PC standard, is providing DP departments with the tools for asserting their influence over micros.

But the full and final integration has yet to come. Linking micros to mainframes is an order of magnitude more complicated than linking micros to each other — or indeed linking mainframes together. We have seen how slow and painful the process has been with micros alone; the next few years will witness the evolution of strategies for linking micros to mainframes. With this will come the emergence of standards — just as necessary here as for the lower levels of integration — and the routine acceptance of the two-way flow of information from micro to mainframe and back.

In the following pages, the main techniques for effecting that flow are discussed. At the lowest level, the micro simply pretends to be a dumb terminal, either using a comms package or through an add-in board. This approach vitiates much of the power of the PC and thus much of the point of linking up with a mainframe in the first place. As a result, many manufacturers of terminal-emulation packages have moved beyond this simplistic approach.

At a level above the terminals there are the gateways. They are pre-existing networks to link one or more micros to the mainframe. The full functionality of the micro and its network are retained. IBM's Token Ring is one increasingly popular example, offering both departmental connectivity with the bonus of a natural path to central computing resources. In a similar vein, there are totally independent communication networks such as the Integrated Services Digital Network (ISDN), which potentially offer global solutions to the problem of hooking up micros to mainframes.

In part, the difficulty is technical. Many standards are at best sketched in, and like the network market the world of micro-to-mainframe links is waiting on the

emergence of a standard to allow manufacturers to channel their efforts more effectively. However, the main obstacle to the swift implementation of micro-to-mainframe links remains as much organisational as technical, largely because little thought is being given to its company-wide implications.

Each of the successive stages of micro integration can be thought of as reflecting the extent to which a kind of computing maturity has been achieved. The stand-alone micro represents childhood: it is basically egotistical and takes no account of the working practices or needs of others. Bad habits go no further than the immediate user. The fact that micros can be used so sloppily is one reason why so many PCs fail to deliver their hoped-for improvements in efficiency or performance; without the requisite discipline, micros merely exacerbate old problems.

Networks, on the other hand, correspond to something like an adolescent phase. There is a growing awareness of the needs of others; the individual becomes part of a larger working group of his or her immediate peers within a department. As many pioneering users have found to their cost you cannot begin to use networks without first establishing consistent procedures for avoiding disasters.

At the most trivial level, this means that the networks must be fault-tolerant; one micro going down must not crash the whole system. Similarly, any software used over the network must have appropriate levels of record and file locking to prevent inconsistent and meaningless results from being generated by multiple access. More difficult but just as necessary is the education of users about what they can and cannot do over a network. For example, it would be quite easy for one inconsiderate data-intensive action to tie up the entire network. Networks by their very nature impose stiffer constraints as far as security is concerned: the greater the possible damage, the more stringent the checks and higher the individual vigilance needed.

At the final stage, when micros are linked to a mainframe, the user is part of a global community and has responsibilities to all its members. The problems associated with networks are multiplied yet further as the power of the system and the potential to wreak havoc on a company-wide basis increase enormously.

The implementation of any network requires a great deal of thought: who will be part of which network; what information will be available centrally and what locally; who will have access to what; and what capacity network will be needed and with what expansion capabilities? Company-wide linking up of micros and mainframes implies nothing less than a full information audit of that organisation.

In practice, it is the software which will determine how the data held centrally is accessed and handled by individual users operating independently. Ultimately, the solution may be for the connection between micro and mainframe to act intelligently. You would tell the software what you want, but the details of obtaining it would be left up to the system.

Unfortunately we are still a long way from this kind of approach. Even before the hardware problems can be solved, there are fundamental issues which have to be addressed. In the end, the coming together of micro and mainframes remains a meeting of opposites: the former is about unconstrained freedom, the latter about rigidly controlled power. Bundled in with the differences of computing technology there are large quantities of ego involved. As is so often the case with computers, it is the human element which will pose the greatest problems.



# GOING INTO PARTNERSHIP

**STEVE MALONE** DESCRIBES THE STRATEGIES AVAILABLE WHEN YOU ARE LINKING MICROS TO A MAINFRAME.

In the past the only way for a user to gain access to mainframe computers was through a dumb terminal. The arrangement held sway until the late 1970s, when the arrival of the microcomputer opened up a range of new possibilities. By using a micro equipped with its own processing power as the terminal, the mainframe could be relieved of some of the work of supporting it. As the power of the micro has increased it has been possible to devolve to the terminal more and more of the tasks previously considered the domain of the mainframe. This philosophy, known as distributed processing, allows the mainframe to get on with what it does best — providing a data resource where vast quantities of information can be held and accessed centrally.

When companies started linking their stand-alone micros to the corporate mainframe, the sensible course was to use existing facilities as far as possible. This meant that the micros had to emulate the IBM 3270 mainframe dumb terminals. At first, the terminal-emulation program took over the micro completely, so that while it was on-line to the mainframe it could not be used for other tasks. Nowadays the 3270 emulation takes place in a window on the screen. Data captured from the mainframe can be cut and pasted into local applications.

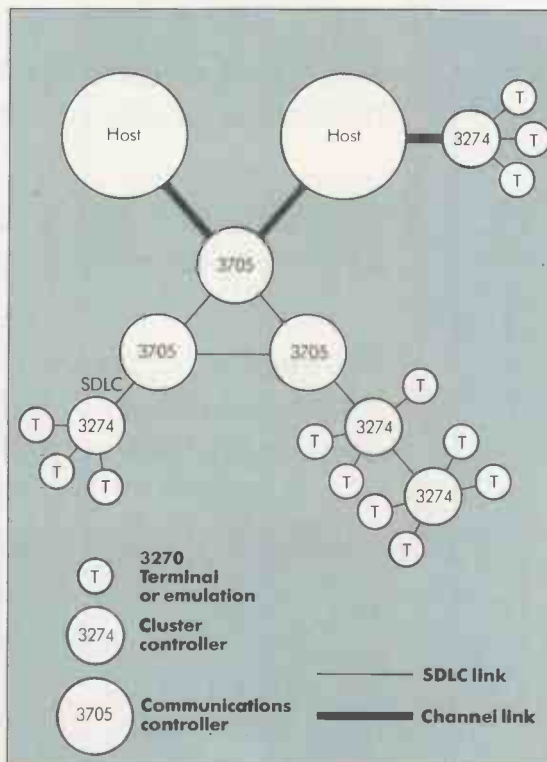
The 3270 terminals do not plug directly into the mainframe. Instead there is a whole system of links and controllers that stands between them, allowing large numbers of terminals to have access to the mainframe without burdening it with the task of controlling them all. The whole assemblage goes under the collective name of Systems Network Architecture (SNA).

The concept of SNA was announced by IBM almost a decade ago. The original design provided for a single host mainframe computer — known in the jargon as a physical unit (PU) — at the root of a tree-like distribution structure. Each unit on an SNA network has a unique address, allowing communication across the whole network. The structure of the network remains transparent to the user.

Under SNA, access from a terminal to the mainframe is via a 3274/6 cluster controller, which connects the terminals together in a star-like configuration. Data from the 3274/6 is then passed to a 3705 communications controller, or to a minicomputer such as the System 34 which emulates it. Terminals attempting to gain access to the mainframe pass through the cluster controller and communication controllers, which manage access to the host in an ordered and logical fashion. In SNA terminology terminals are known as logical units (LUs).

The 3705 controller can interface with the mainframe host in two ways. The simplest is to have a dedicated channel to the host. Alternatively, if the mainframe host is at a remote site, the connection can be made via a modem on a dedicated line.

The original SNA specification was not without problems. Only a single host was permitted, and it could only support a limited number of terminals. The diffi-



IBM's SNA architecture has several levels of control. Users get flexible communications without having to worry about the structure of the network.

culties have been overcome by the introduction of the Systems Network Interconnection (SNI), which allows a bridge between different SNA networks. If your SNA gets too big you can now simply cut it into two sub-nets with a bridge to connect the halves.

When there are several sub-nets, connection is most efficient when it is performed by a backbone. The backbone itself is a network which is used to connect a number of local networks together, providing them with the ability to communicate.

IBM has made strenuous efforts to make sure that all its products have access to SNA. The final configuration includes a whole gaggle of controllers, boards and gateways to connect almost every conceivable piece of IBM kit to SNA. Nevertheless, IBM has allowed its SNA pitch to be queered by the microcomputer division, which has developed networking protocols of its own.

There are currently two major strands in micro networks: the CSMA/CD networks like Ethernet and IBM's PC LAN, and IBM's Token Passing Ring. Token Ring, at least, has been accepted by IBM as a major part of its office-automation strategy for the 1990s.

To allow the competing systems to connect to a mainframe, a gateway is usually employed. It takes the form of a dedicated micro — usually an AT — or other unit which acts as an interface between the network and the host mainframe. It is, in fact, a sophisticated version of a protocol convertor. Information arriving at the gateway from the network is translated into an acceptable format for the mainframe and then passed on. Likewise, infor-

(continued on page 91)

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# THE MAINFRAME CONNECTION

(continued from page 89)

mation from the mainframe is converted by the gateway into an acceptable format for the network. A gateway hooked on to a Token Ring can provide access directly to a mainframe; alternatively it can act as a bridge into SNA.

Microcomputer networks have developed along very different lines from those in the SNA/mainframe universe. The difference lies at the fundamental data-link level, and is concerned with the protocols by which data is transmitted over the network. There are essentially two types of protocols: asynchronous and synchronous. The cheaper of the two is the asynchronous solution, the bit-orientated system that is commonly used on microcomputer-based local area networks.

On an asynchronous system, before a byte of data is transmitted the source machine will place a start bit on the beginning of the data byte and one or two stop bits on the end. The start bit is intended to tell the target computer that information is on its way, while the stop bits inform the computer that the transmission has ended. The advantage of this system is that each byte has its own transmission information built-in, and can therefore be transmitted almost at random.

The disadvantage of the asynchronous system becomes apparent when bits get altered or lost in transit. If, for example, the start bit is lost on the way, the target computer has no way of knowing that the first bit to arrive is not the start bit, and so the entire byte will be received out of sequence. To minimise this possibility, asynchronous transmissions are limited in the distance they can travel and in their speed.

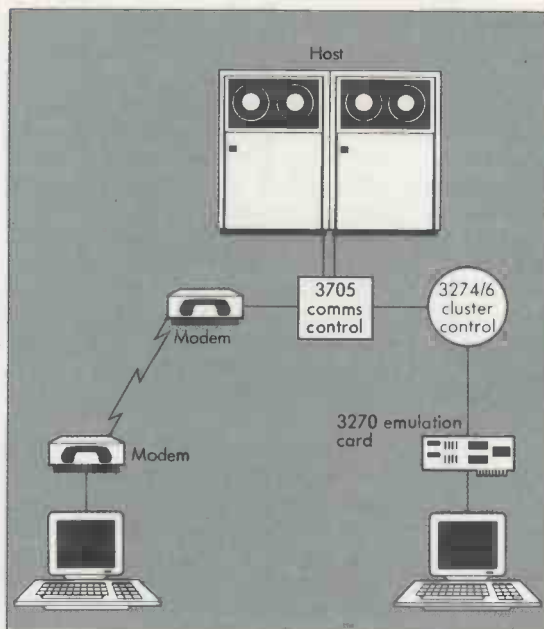
Synchronous transmissions, on the other hand, are byte orientated. Here each block of data that is transmitted is preceded by two or more synchronising bytes. Once synchronised with the source transmission, the target machine will accept the entire block of data until it receives a terminating set of synchronising bytes, which usually includes a check sum.

Three widely used sets of protocols are used in mainframe communications: the Binary Synchronous Communication protocol (BSC), Synchronous Data Link Control (SDLC) and X-25. The BSC protocol was originally developed by IBM over 20 years ago, and is the basis on which the 3270 terminal works. It is available for use on voice-grade twisted-pair cabling and can support both ASCII and EBCDIC formats. It is capable of a data rate of 9,600 baud.

X-25 is another format commonly used over standard twisted-pair lines. It can support transmission rates of 19.2Kbaud. The X-25 system defines the Physical, Link and Network layers of the OSI model. The seven-layer OSI model for networks was described in detail on page 86 of last month's *Practical Computing*. X-25 has been widely adopted, not least as the physical layer is equivalent to the RS-232C serial interface supported by most manufacturers.

Recently IBM has adopted the SDLC protocol for use with SNA. The protocols are used for communication between the 3275 cluster controller and the 3705 communications controllers, and among the communication controllers themselves. SDLC is a subset of the ISO High-Level Data Link Control (HDLC) system, designed for high-speed networks with a lot of traffic. SDLC uses a technique whereby a congested node can transmit a signal that tells the adjacent node not to transmit any more information until the congestion is cleared.

The problems of linking a micro to a mainframe are



Under SNA you either have to fit a 3270 emulator card to your PC or go through a modem to the 3705 comms controller.

not confined to the hardware; there are also difficulties with data interpretation. Most of them are due to the different paths along which mainframes and micros evolved. To begin with data is held in different formats on the two classes of machine. Micros have grown up using the seven-bit ASCII format to encode data, and this system has become universal throughout the micro world. IBM mainframes, and those of other manufacturers who have followed its lead, use the Extended Binary Coded Decimal Interchange Code (EBCDIC) eight-bit format.

In ASCII, the binary code for A is 1000001, whereas in EBCDIC it is 11000001, for example. In order for a microcomputer and a mainframe to have any sensible communication some kind of translation needs to be performed. Unless there are special reasons for doing otherwise, this happens at the mainframe before the data is put on the network.

Microcomputer users expect to be able to run their own software, be it WordStar, dBase III or Lotus 1-2-3. They have spent a great deal of time learning the package they use, and will not take kindly to having to change. In any case, many microcomputer packages are far more advanced in terms of user-friendliness and in their graphics capabilities than the mainframe equivalents.

But while a mainframe expects all its programs to run along strictly pre-defined lines, at the micro end things are more disorganised. Many popular packages have their own internal data structures, and it can reasonably be assumed that software houses will continue to create their own formats in the future. This opens up the daunting prospect of having to create ever more complex translation programs for each application.

The alternative is to try and reach agreement on some sort of standard for the transmission of data over the micro-to-mainframe link. There are currently two standards on offer. IBM's Document Content Architecture (DCA) and the ISO's Office Document Architecture (ODA). Though the two standards differ in detail, the functionality involved is much the same.

The ODA protocols cover the content of a document along with its logical and layout structures. The idea is that if a number of different word-processing programs, computers and printers understand the ODA protocols,

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a document created on one of them will appear in exactly the same form on another.

The ODA model has two basic elements. The Document Profile covers such aspects as storage and retrieval details and contains information relating to the second element, the Document Body, including the structure and content. It is used to enable the target machine to interpret the document correctly. The Document Body itself can be further sub-divided into three parts. The Generic Structure describes a document class — that is, documents which have the same headers, footers, titles, etc. The Document Style is the collection of attributes that define such things as the size of a title, underlining, and placing graphics in a specific position with a caption.

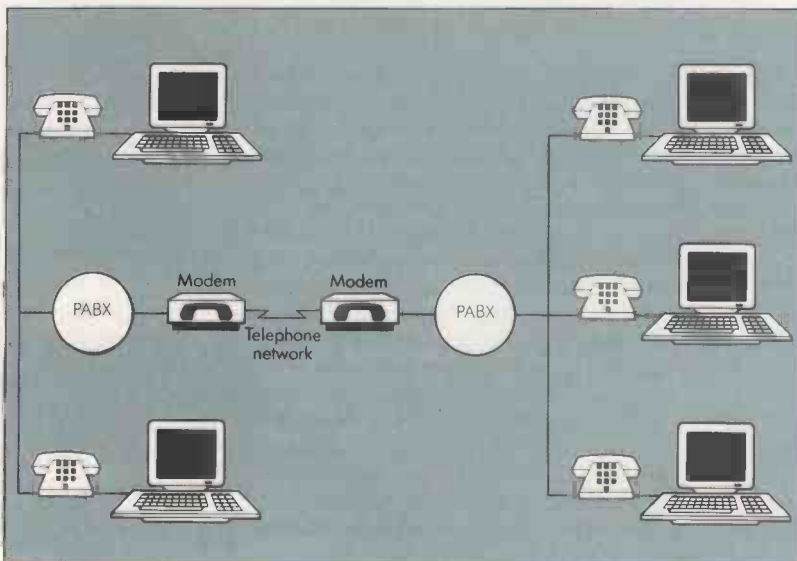
The final part of the Document Body is the Specific Structure, which sub-divides further into two sections. The Specific Logical Structure refers to the general appearance of the document, such as chapter divisions, spacing and paragraphs. The Specific Layout Structure, on the other hand, deals with the presentation — such things as page breaks and the number of columns.

Micro-to-mainframe links are definitely for the present, but what of the future? Here the direction is pretty clear as the computer and telecommunications industry are converging rapidly, driven by the development of Integrated Services Digital Network (ISDN).

The opening for ISDN came when telecommunications undertakings began to install digital exchanges. For the first time, digital signals could be transmitted directly rather than having to be passed through a modem for conversion into analogue form. With ISDN you just plug your computer into an RS-232 socket on the telephone. What is more, the data-grade systems for ISDN specify that the maximum transmission rate is 19.2Kbaud — much faster than the current safe maximum.

With a national network of digital exchanges it will be possible for any computer to talk directly to any other. Something of the kind is already happening in some companies with their own private automatic branch exchanges. Computers are simply plugged into the company's own telephone sockets and are connected through them to other digital devices in the building, without any need for expensive dedicated network cabling.

Digital PABXs allow company telephone systems to be used directly for data. When ISDN arrives modems will not be required even for links through the public network.



# HOW NOT TO PLAY DUMB

MICROS CAN ACT AS TERMINALS WITHOUT SACRIFICING ANY OF THEIR STAND-ALONE POWER. GLYN MOODY LOOKS AT HOW IT IS DONE.

However the connection between micro and mainframe is made, there has to be some way for the micro to access the data made available. In other words, the micro has to be made to behave as a terminal. We concentrate here on terminal emulation for IBM mainframes, partly because of the dominance of those machines and partly because the general principles remain the same for other manufacturers' systems. The same principles also apply to micro-to-mini connections where the mini is in its traditional role of a departmental machine. However, as micros become more powerful — and therefore take over some of the mini's functions — a network solution may be the more appropriate approach.

The terminal approach to micro-to-mainframe links recognises that micros and mainframes are used in totally different ways and so should be treated differently when it comes to passing information between them. For micro users, terminology is the first barrier to understanding what is happening in a mainframe system. Where the micro world at least manages to use letters like XT, AT and RT for names of machines, equipment belonging to the world of mainframes seems locked into forbidding sequences of digits. The main terminal family which micros emulate goes by the name of 3270. The 3270 range has been around for nearly 20 years and is now being superseded by the 3170 range. However, we refer mainly to the 3270 versions since most manufacturers of terminal-emulation packages do the same.

Within the 3270 range the principle terminal is called the 3278/9 and normally connects to a 3274 controller. A micro emulating 3278/9 can hook up to a 3274 like a normal terminal. The alternative is to run the micro as an ordinary PC network work station and to link the network to the mainframe through a gateway.

For a micro to emulate a terminal requires two things. A card is needed to provide the appropriate port for connection to the controller. In addition software is needed to interface with the card and make the PC appear as if it is a terminal to the mainframe at the other end. IBM was not the first company to adopt this solution to accessing a mainframe. The trailblazer in this field was Digital Communications Associates (DCA), a U.S. company based in Georgia.

# THE MAINFRAME CONNECTION



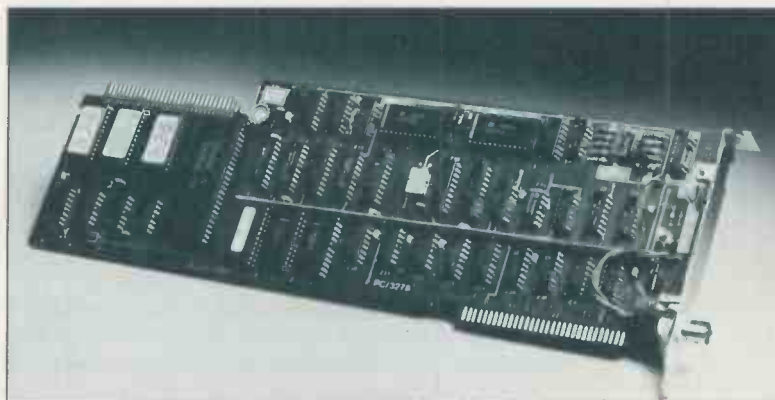
As is so often the case in the micro world, whoever is first with a really good product and/or brilliant idea seems to define the standard, and DCA is accordingly the de facto standard terminal emulator. Something like 450,000 DCA terminal-emulation packages have been sold worldwide, 10 percent of them in the U.K.

DCA's first offering was the Irma board. There is now a whole range of associated products which have lifted turnover from \$21 million in 1983 to \$140 million in 1986, and profits from \$2 million to \$21 million in the same period. DCA has also joined the acquisitions bandwagon, buying a smaller rival manufacturer of emulation cards called Forte, and more recently Microstuf Associates, the originator of the Crosstalk comms package.

The first Irma board was launched in 1982 in the U.S., and a year later in the U.K. It offers standard 3278/9 emulation, and consists of a full-length card with a coaxial cable connector plus some software. On the Basic Irma card the software is rather crude. It simply takes over the entire micro screen, and as far as the mainframe is concerned the micro behaves just like a terminal thereafter. The terminal-emulation program is loaded into memory and called up using hot keys, just like a pop-up program. This allows you to switch between a mainframe session and a micro session, but not to cut and paste between them directly. However, there is a file-transfer program included in the rather hefty price of £1,158.

Most of the other Irma products are variations on this theme. For example, Irmacom allows direct connection to a mainframe via a modem, without the need for a 3274 controller. Irmaprint is a stand-alone box which allows PC-type printers to be connected to a cluster controller instead of the more expensive dedicated printers. Irmakey is a replacement keyboard — the standard 3278 terminal uses a different layout from PCs — which can be plugged into the micro and is fully programmable. There are also a number of products designed to work as gateways to networks of micros. Due out shortly is Irmac Multi-session. Unlike the original Irma, this allows four mainframe sessions, a DOS session and two simple text facilities for storing notes, known as notepads.

This seems to be an area where IBM is ahead. The IBM 3270 PC is an AT with cards and keyboard added to turn it into a terminal emulator offering high-resolution colour graphics of 720 by 350 pixels. Four host sessions and one PC session are available, together with two notepads. It is also possible to buy the emulation cards separately. Three versions of the software are available:



Above: DCA's Irma set the standard. Far left: The PCC-3270 work station. Left: IBM's 3278 terminal and the more compact 3178 which supersedes it.

the PC 3270 Emulation Program at both entry level and version 3, and the 3270 PC Control Program. The hardware and software will work with PC, XT and AT machines.

The entry-level software offers one mainframe session and one PC session; you switch between them by means of a hot key. Version 3 offers enhanced connectivity, and can cope with a wider range of micro-to-mainframe links. The 3270 PC Control Program supports up to four mainframe sessions and up to six PC sessions, together with two notepads. The 3270 PC costs £5,720, the entry-level emulation program £168, version 3 £450, and the Control Program £361.

Given these high prices, and the fact that Irma prices have remained largely static against a background of sharply falling hardware prices in the rest of the market, it is surprising to find that more third-party suppliers have not moved in to undercut DCA and IBM. This is probably because micro-to-mainframe links have until recently been a rather specialised area not subject to the market forces operating elsewhere in the micro-computer world.

But things may be about to change. One factor is likely to be the increasing acceptance of cheap clones in the corporate sector, bringing the price of an intelligent terminal down to less than half the cost of the terminal-emulation cards and software. Just as software prices have tumbled in the wake of the clones, it is quite possible that the costs of terminal emulation will fall dramatically too. Equally, the availability of PCs considerably cheaper than dumb terminals will encourage companies to install them on a far larger scale. As the market for emulation packages increases, so we can expect reductions in the price of products, and more players entering the market.

For example, Personal Computer Compatible, the manufacturer of the PCC IV-VIII clone reviewed in the April 1986 issue of *Practical Computing*, has brought out the PCC-3270. It uses the PCC IV-VIII together with a choice of cards and software. A 3278-type keyboard is provided. The cost is £1,495, which is not even 50 percent more than the Irma card alone. It seems

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likely that other clone manufacturers, keen to enter the corporate market, will start to offer similar packages.

The Amstrad PC is an obvious candidate for such treatment, and Xenon Computer Systems has brought out a package which emulates a 3278 terminal. However, instead of linking the PC to a 3274 controller via a coaxial cable as with the Irma card, it uses a synchronous RS-232 link instead. The software and card cost £350, and this price falls to £250 if you are also buying a PC from Xenon.

As IBM PC clones become cheaper, they are likely to become increasingly common as terminal emulators. However, there may be circumstances where non-IBM compatible equipment is in use in a company. DEC has bridged the gap between itself and IBM with the Vaxmate, which offers IBM compatibility plus the ability to hook up to DEC minis as a terminal. The Vaxmate's IBM compatibility means that 3278 terminal-emulation cards and software can be run as normal.

Packages are also coming through which allow the Macintosh to be connected to IBM equipment. For example, Apple has launched a card for IBM PCs which allows them to hook up to Appletalk networks. In this way a Macintosh can access information held on IBM equipment — even mainframes — although the route is a fairly circuitous one. More important is the new Macintosh II. With its expansion slots and planned MS-DOS emulation facilities it can only be a matter of time before Macs are being hooked up to mainframes directly.

Clearly the hardware side of terminal emulation presents few problems. If products are still overpriced, that may change with the new wave of corporate clones which will soon be wired in. However, the software side of micro-to-mainframe connections is not so straightforward, as the following article relates.

## SUPPLIERS

**IBM:** IBM U.K. Ltd, PO Box 32, Alencon Link, Basingstoke, Hampshire RG21 1EJ. Telephone: (0256) 56144

**Irma:** Computer Marketing Associates Ltd, CMA House, Lansbury Estate, Lower Guildford Road, Knaphill, Surrey GU21 2EW. Telephone: (04867) 4555

**PCC-3270:** Personal Computer Compatible Ltd, Mayo House, Mayo Road, Walton-on-Thames, Surrey KT12 2QA. Telephone: (0932) 231199

**Xenon:** Xenon Computer Systems Ltd, Xenon House, 10 School Lane, Didsbury, Manchester M20 0RD. Telephone: 061-434 6133

# THE SOFTWARE LINK

IAN STOBIE REPORTS ON THE SOFTWARE DEVELOPMENTS THAT CAN GIVE USERS THE BEST OF BOTH MICRO AND MAINFRAME WORLDS.

**Y**ou can achieve four main things with a mainframe link and the appropriate software. The first and easiest is to get your micro to simply emulate a terminal. The next step is to go beyond this purely literal emulation and start making proper use of the discs attached to your micro. This lets you work on data derived from or destined for the mainframe even when you are no longer connected to it. At present the majority of micros that have a mainframe link are used in one of these two ways.

The third approach involves tackling things from the other direction entirely: you get the mainframe to pretend to be a disc attached to your micro. This way you can still work in MS-DOS, but get at data located on the mainframe. With all three of these approaches you are still fairly limited in the kind of access you have to mainframe data, so the fourth step is to get full access to data within the mainframe's main applications and databases. This involves a big increase in complexity, full co-operation from the people responsible for the mainframe, and careful matching of the software in use at both ends.

It is generally true that choice of software for micro-mainframe applications lies well outside the normal sphere of the individual micro user. Most of the work in the current generation of micro-to-mainframe links is done at the mainframe end, where the key constraints also tend to be.

When your micro is acting simply as a terminal little or no change is required at the mainframe end to support you. It does not even matter much what sort of micro you have. A Macintosh, an Apple II — even a BBC — can emulate a terminal just as effectively as an IBM PC. Although a terminal is now usually made up of a VDU and a keyboard it does not have to be so. Originally it might have been just a printer attached to a keyboard, or a card reader or punch. The early days still exert their influence in the 80-column width of most present-day computer screens — the same width as a punched card — and the way text often scrolls up the screen, which is a software emulation of the flow of paper through a printer. Terminals are completely separate from the main processor and are usually located some distance from it at the end of a communications link.

Micros, by contrast, were designed with their own dedicated keyboard and screen; indeed these elements were usually mapped directly into the memory space of the microprocessor to give response times undreamed of

# THE MAINFRAME CONNECTION

by the mainframe user. From the outset micros have been fast, highly interactive work stations, ideal for providing personal productivity applications directly to the user.

Terminals now come in two main types, either of which you can emulate with the appropriate software on a microcomputer. DEC's VT-100 and the IBM 3101 are examples of the slower sort, designed for connection through public or private telephone lines to the mainframe via a modem. They typically operate at speeds of only 300 baud or 1,200 baud. The emulation of this type of dial-up terminal will be familiar to anyone who has used an electronic mail service like Prestel or Telecom Gold. When you look in your Telecom Gold mailbox you are in fact linking through to a Prime mini and extracting data from a file under the control of specialised database software residing on the Prime. To the mini, your PC is simply a dial-up terminal.

To emulate a dial-up terminal you can use the same sort of comms software you would use for getting access to Telecom Gold: packages like Crosstalk, Mirror, Datatalk and Vicom. You initially have to set up the parameters required by the mainframe to establish the link, such as baud rate, stop bit and parity. You then dial through either manually or automatically.

IBM's 3270 family exemplifies the more powerful approach of a directly connected terminal which links to the mainframe through a coaxial cable and some kind of communications controller. This is usually the more expensive solution. To implement it on a PC you need a 3270 emulator board plus software which specifically emulates the 3270 protocol. The board and software often come together, as in the Irma family of products.

Compared with the VT-100, 3270 terminal emulation is quick, typically letting you communicate with the mainframe at 4,800 baud or 9,600 baud — or more if unusually elaborate hardware is used further down the line. But for anyone used to even a home micro this is still pretty slow stuff. Even a ZX-81 on a bad day has a lightning-fast response time compared to most terminals when you are actually sending or receiving data from the mainframe.

With either type of emulation, keyboards can be a problem. Most mainframe terminals have a different keyboard layout from the standard PC, although this has improved somewhat with the introduction of IBM's new micro keyboards with 12 function keys. To get around these problems you may find yourself having to use elaborate control-key combinations to emulate special function keys found on the dedicated terminal. Sometimes there are also problems with screen size as many terminals have a 25-line display rather than the 24 lines that is standard on micros. The extra line is often used for status information or prompts, and this information has to be repositioned elsewhere on the screen. The emulation software may have to adopt a toggle on/off solution to avoid obscuring data.

What appears on the screen is dictated by the mainframe software, and once you have established the link you are under the control of whatever mainframe application you invoke. With some emulation packages the mainframe session appears in a window so that you can still initiate some PC functions such as saving to a file or printing a screen. It makes sense to use at least some of the facilities you get with a micro, in particular your printer and disc drive. You can generally echo the whole session to the printer if you like, or capture it to a disc file for later editing.

How file transfer works depends on the type of

terminal you are emulating. With a dial-up terminal you can, in principle, capture only what appears on the screen, as the mainframe application has to think it is displaying the information on your screen. In practice your emulation software may spare you from actually having to watch the transfer line by line, but this requirement does restrict you in the kind of data formats that can be transmitted.

To move data the other way the micro has to emulate the keyboard of an ordinary terminal. You can, of course, simply type on the keyboard in most applications, and many micro terminals are used in this way. The usual approach to transferring larger blocks of data is to prepare a file using user-friendly micro software before dialling up the mainframe. You then invoke the screen editor from the mainframe operating system, and use it to create a new file on the mainframe before handing over to the emulation software which will put the file across by emulating keystrokes.

With 3270 emulation the file-transfer facilities are better. You can move entire files either way without having to pretend to be using either keyboard or screen. And you can generally flip between the mainframe and PC environment at will by hitting a couple of keys. But you are not really multi-tasking at the micro end. Interaction with the mainframe application is suspended while you are outside the emulation window, and the mainframe will also have to suspend execution as soon as it requires a response.

Much of the mainframe workload has historically been in handling batch tasks; screen-based interactive computing and personal-productivity tools only came later. Typical batch tasks are things like complex calculations which require little interaction with the user once it is set running, or handling large volumes of repetitive transactions like reading in customer records or printing statements. There are a number of terminals designed specifically to excel at tasks of this kind using protocols that go under the collective name of remote job entry (RJE). Examples are the Hasp and IBM 3780 protocols, both of which can be emulated on a micro.

It is worth investigating RJE emulation with your mainframe department if you have high volumes of data which you wish to prepare off-line for transmission to the mainframe in a block. Different hardware is required, and RJE can work out quite expensive, but it might make sense to have one Hasp terminal emulator

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Microstuf's Crosstalk comms program lets you emulate a dial-up terminal.

# THE MAINFRAME CONNECTION

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running on a network of micros engaged in some intensive data-preparation task.

There is one fly in the ointment with all these terminal-emulation approaches, which is that the mainframe does all the real work. Even if you want to download a file into Lotus 1-2-3 the conversion will probably be done at the mainframe end. This is not distributed processing as it has been idealised in the literature over the last decade, and if you add another processor to the system — even a powerful 80386-based PC — the system as a whole slows down. A true distributed-processing system would become quicker as more processors are added. Having the mainframe do the work also means that the user has to deal with mainframe software. It is generally agreed that the rapid evolution of mass-market micro software has produced products that are much more usable than their mainframe equivalents.

These considerations have led to the virtual-disc approach. Here the main application is run on the PC while the mainframe emulates a hard disc. The user is still in the familiar MS-DOS environment, but now has access to an extra virtual drive that contains data physically located on the mainframe.

IBM itself offers this approach with its VM Bond. The product consists of matching software that runs on the PC and on an IBM mainframe under the VM operating system. As well as offering conventional 3270 terminal emulation, VM Bond lets you work from PC-DOS to address virtual discs actually located on the mainframe. You can have up to eight drives active, each of which can be up to 32Mbyte in size. You also get utilities for converting VM files into common micro formats such as Lotus WKS, Dif and Syk.

In theory this approach seems ideal, but there are problems. Performance is the main one. With all the delays inherent in the typical comms link you end up emulating something like a very slow floppy. The mainframe still has quite a lot to do providing the emulation, which has to be available whenever you make a virtual-disc access, so mainframe response time is not greatly improved. The MS-DOS limit of 32Mbyte on disc size is again a handicap as it prevents you mapping very large data sets on to a virtual drive. In practice, if all you want is more disc storage you are probably better off with a local area network.

To go further requires a more complete melding of the resources of the mainframe and micro cultures. Mainframes excel at handling large quantities of data and keeping it properly organised and under control; micros provide an ideal interface.

The mainframe world does now contain the basis of

such a development. It is called Structured Query Language (SQL) and is a very powerful way of specifying and extracting data. The concept was developed by IBM, but SQL itself has become a standard interface which will be embodied in a number of independent products over the next few years. While terminal emulation and the virtual-disc approach confine the micro user to operations that are little more sophisticated than copying a file, an SQL-based solution would make possible ad hoc extractions of tailored sets of data down to the field level — true utilisation of a company's total recorded knowledge.

Even so, there are very considerable difficulties in letting micro users get involved with operations at this level. Mainframe DP departments have taken much of the last decade implementing the concept of the database. Unlike its micro equivalent, a mainframe database is not one package among others but a central resource used by all the different packages and applications on the system. The key idea is that there should be just one occurrence of each logically unique item of data held on the system. Different programs should not hold the same company's address in different places for instance; they should all use the same database so that the information is always up to date and consistent.

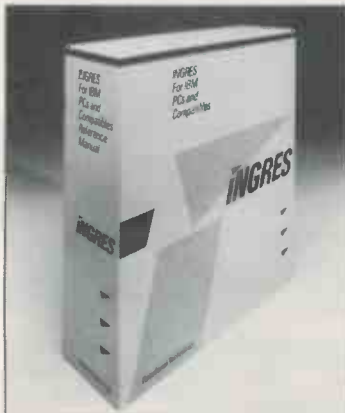
Mainframe database administration is therefore all about security: controlling access to it, archiving it and validating it. A micro user cannot just go in and write a spontaneous Basic program to update real corporate data, so more than a simple password is necessary to control who gets through to the mainframe. The central system will need to know what applications and what kind of data you should be allowed to get at.

On many mainframes a piece of software called a data dictionary looks after this sort of thing. The data dictionary will say, for example, that your department is allowed access to the personnel records, and that you personally will be reading certain fields from it into a file-transfer program but will not be allowed to change any of the data. It might also say that you have a separate departmental mini-database in which you will be able to create your own records but which only people from your department will be allowed to use.

This is all very much more complex than anything encountered on a stand-alone micro, or even on a micro network. But the number of users on a mainframe system is likely to be very much higher, the volume of data much larger, and therefore the effects of incorrect data that much more widespread and harder to detect. A defensive attitude on the part of mainframe staff is not only understandable — it is essential. To maintain these safeguards while giving micro users access to the corporate database imposes an appreciable workload at the mainframe end. Each request you make will be validated and probably logged, and data you store on the mainframe system will automatically be archived and protected.

Some organisations have ended up by concluding that micro users should only be given very restricted access to update mainframe data at all. Products like Micro/Answer and Lotus/Answer let you transfer data from a mainframe to the PC environment but not the other way. Another approach is to create a separate database for the likes of micro users. This is a retreat from the all-embracing database concept but it is deemed safer and easier to maintain. The mini database, which might be called something like the decision-support database, is updated every few days with a subset of the information from the main one, which may be called, say, the production database.

Ingres PC works with a matching mainframe package to provide access to the mainframe database.





In some cases things have gone further. Where micro users also want to emulate hard discs the information-management or DP department may end up buying a separate machine for them. This really takes the concept of the micro-mainframe link full circle. With no live access to the real corporate database you are running little more than a classy kind of local area network with a gateway through to the mainframe for periodic data transfers. If this is the case, a standard micro LAN solution may work out cheaper. It is also likely to be more satisfactory from the micro user's point of view: they can forget about terminal emulation, and instead use familiar and user-friendly micro software to work on the data.

It is only when the micro and mainframe communities agree to go ahead and inhabit the same universe that products from the fourth category in our original list are required. For full access to the main corporate database, with the ability to extract information in a truly flexible and ad hoc way, you need powerful matching software at both ends. It can be either generic or specific to a particular mainframe database.

The generic approach is exemplified by products like Beaufort's Kopy King, which lets you access data from any database running in the CICS transaction-processing environment. IBM itself offers ECF, the Enhanced Connectivity Facilities, which is available for the MVS, TSO and VM mainframe operating systems. ECF consists of matching PC and mainframe system software called Requester and Server. The PC user gets full access to mainframe databases like IBM's DB2, with a prompted SQL interface provided at the micro level. ECF also gives you programming access to the mainframe and provides a virtual-disc facility. File transfer for common PC formats like Lotus, dBase, Dif and Syk are supported.

The specific approach is exemplified by products like Ingres PC or IBM's Host Data Base View (HDBV). Again, you have matching sets of software on the mainframe and micro, but the user interface can be simplified because the software does not have to provide for every eventuality. Ingres PC mates to the Ingres/Star database, which runs under VM on IBM mainframes or VMS on Vax. HDBV links to DB2 and other SQL databases. Facilities are similar to those available using DB2 with ECF, but in addition you can browse interactively from your micro.

The specific approach with matching sets of software may seem like the ideal solution. It is likely that major micro software houses will start offering closely coupled interfaces through to the main mainframe databases before long. Ansa has just announced an SQL link for Paradox, which seems to be the first of the bunch. On a slightly less elevated plane, links between spreadsheets and mainframe financial-modelling packages have been common for some time. But the database is the key mainframe application and probably provides data services for the financial-modelling system, so it makes sense to concentrate on it.

The problems with this approach are that it is expensive, and it is a major organisational commitment. Micro users cannot just demand a solution unless it fits in with existing mainframe database policy. If they do not manage to swing it, micro users may end up with some kludged solution involving much labour for all concerned, but this may still be the most rational choice for the organisation as a whole. The solution for micro users may not be totally optimal, but the organisation will continue to compute.

## A COMPANY SOLUTION

### STEVE MALONE FINDS OUT HOW ONE COMPANY IS MATCHING ITS NEW MICROS TO AN ESTABLISHED DP SETUP

**A**s a company grows larger it tends to find many of its operations scattered between different buildings, or even different parts of the country. Many organisations have recently begun to encounter the twin problems of connecting their stand-alone micros into local networks, and linking the networks in such a way that micros at different sites can talk to each other.

Reed Business Publishing (RBP), the company that publishes *Practical Computing*, is one of Britain's largest publishing houses. It has numerous divisions scattered across several sites, and to allow users in the various locations to access the company's central databases it has invested heavily in communications equipment. Over the last two years, it has also installed a large number of personal computers.

As in many other large companies, RBP's data processing has grown up piecemeal, with various incompatible computers being installed in various departments. This central data processing is taken care of by two ICL 2966 mainframes at Haywards Heath, in Sussex. Most of the circulation figures, subscriptions service, payroll transaction processes and advertising management transaction processing services are held on the mainframe. Other sites in the group have Prime and Altos minicomputers, and a range of IBM PCs and compatibles.

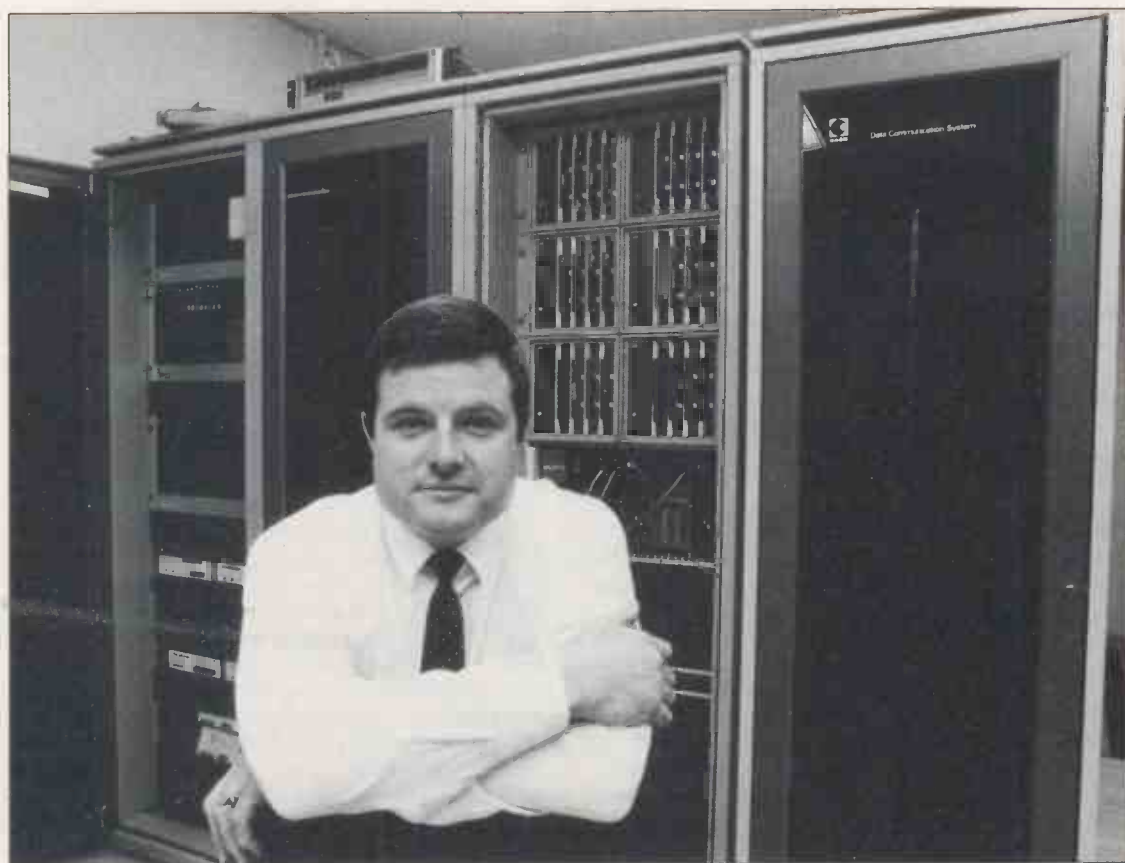
The four central nodes of the Reed network are scattered around Surrey and Sussex: at the head office in Sutton, and at Haywards Heath, East Grinstead and Morden. They are connected together via Case Data Concentration Exchanges (DCXs) over a British Telecom 64Kbaud Kilostream line. The Sutton, Haywards Heath and Morden nodes are joined in a triangular configuration; if the direct link between two sites fails, traffic can be rerouted through the third centre.

Len Holt, the company's Communications Manager, told us: "The development of the network has been in earnest since 1984. We had a number of stand-alone telex machines, but the system was not very efficient. They couldn't talk to each other, and nobody had the time to make the paper tapes. We decided to put in a message-switching system and within six months we had an increase in traffic of over 60 percent. We decided to use DCXs for the switching. When you think that the average voice call is two minutes and the average data call is 20 minutes, there is a great saving if the traffic goes through one leased line."

Having a variety of kit from a range of manufacturers

(continued on next page)

# THE MAINFRAME CONNECTION



RBP Communications Manager Len Holt in front of one of the Case DCX units.

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means that compatibility difficulties are bound to arise, particularly at the mainframe end. They stem from the days when manufacturers who sold you a mainframe also expected to supply the terminals and other necessary pieces of equipment. Although cynics like to suggest that mainframe manufacturers supply idiosyncratic equipment purely in order to lock their customers into their particular brand, this is a little unfair.

Customers would approach them wanting, say, to automate the accounts and expect to be provided with everything at one stop. Shopping around for terminals, disc drives, cables and whatnot was almost unheard of. A manufacturer's developments therefore grew up around its existing kit and in isolation from its rivals. Happily, the situation is changing as end-users become more knowledgeable and sophisticated. Vendors are responding by building in some compatibility with de facto standards.

There are, however, problems when trying to match newer machines with older ones. Mike Blakeman, RBP's Network Controller, pointed out: "Most ICL terminals are 25 lines, but others like the Wyse only have 24 lines, so they provide a racking system so you can look at the top and then the bottom of the screen."

Although ICL has solved many of the incompatibility problems, some of the solutions have been late in arriving. Blakeman went on: "The ICL mainframes have been a drawback in connecting to other systems, but a number of protocol converters have come along in the last four or five years."


The ICL technology has not been alone in causing problems, as Len Holt explained: "There have been troubles with almost all the manufacturers. When there are a wide range of machines on the network we need the two sides of the coin to look the same. When you ask

a manufacturer whether a machine can talk to the rest of the system, they say 'Yeah — No Problem'. Then six times out of 10 there are problems. The companies send round one of their blokes who says 'We usually do it like this'. But that doesn't work with the rest of the system because they haven't got the control flow set correctly or whatever."

It is no use installing the new technology if no one is going to use it. Holt says he is meeting some resistance to the idea of linking a department's micro to the company mainframe. "We try to explain to people how they can be more efficient. The trouble is that people who have bought an Amstrad 1512 out of the departmental budget object when the network card costs more than the computer. And that has to come out of the departmental budget also." As to why central networking projects should have to be funded out of departmental budgets, Holt suggested "the management doesn't understand the technology either".

But Holt sees signs of change: "Training has to start at the PC end. In the beginning people feel it's almost like a status symbol to have a PC on your desk. Someone may be completely computer illiterate, doesn't know how to use a computer when they've worked out how to switch it on, doesn't know what DOS is for — and yet doesn't have time to learn.

"It's only recently that the company has taken on teaching people. Once you've taught them how to use a PC you can explain how to connect to the network and use the other information that is there. Training is becoming more and more important in this company."

The kind of problems that RBP has had in its development of a workable office systems policy is typical. While the commitment to new technology is there, getting the system up and running is left to the people on the ground and a few highly qualified individuals. 

In the days when you had to pay upwards of £2,000 for a competent business PC, applications packages costing around £400 did not really seem that exorbitant. But now that hardware prices have tumbled to around £600 for a perfectly adequate system, nobody is prepared to cough up more than double figures for an application package unless there is a very good reason. After all, it does not make sense for just one item of software to cost more than the hardware.

While software prices were coming down slowly before the launch of Amstrad's IBM compatible, they more or less crashed after the event. Reflex is a classic example. When first launched it cost nearly £500. Then Borland, the pioneer of cheap software, took it on board and cut the price to under £100. Shortly after this, and following an agreement with Amstrad, the price has bottomed out at a mere £69.95 including VAT.

The basic selection criterion for this budget-business package top 10 has been that the price should be below £200. Microsoft Works, priced at £245, was allowed to slip through the net simply because it is such good value and runs on the Macintosh. This machine is attracting more and more software houses, though asking prices are still higher than for similar IBM packages, most likely because of the reduced profits that can be extracted from its substantially smaller user base.

The top 10 includes a fair cross section of office productivity software. There are two integrated packages, two word processors, one presentation-graphics package, one communications package, one database and one spreadsheet. The final two categories on the list are represented by Reflex and VP-Planner, which in fact cross over into each other's territories. Reflex uses a database structure but has a spreadsheet-like display and graphics-display capabilities. VP-Planner is a Lotus 1-2-3 work-alike that includes a powerful two- and three-dimensional database built around the spreadsheet principle.

Although most of the packages in this top 10 are likely to be used by those relatively new to computing it would be a mistake to assume that a low price necessarily means that a package is restricted in scope or particularly easy to use. Some of the packages here are remarkable value in terms of the functionality they offer but are not suitable for first-time users. To some extent Reflex falls into this category, but the prime example is VP-Planner. It is a real power user's program at a bargain price and not one for the squeamish, despite its superb manual.

It is also not the case that all budget software will run on budget hardware. Most of

# TOP 10

**David Barlow** picks out the programs that provide a full range of features without you having to pay through the nose for them.



First Choice combines some of the best features of PFS Write and PFS File.

the packages here will just about run in 256K, but they will prove far more useful with a full complement of memory whether on IBM compatibles or Macintoshes. Hard discs used to be considered a real luxury, but they are now becoming an accepted part of budget PC hardware. A graphics card is also more or less essential equipment now, and many packages can exploit high-resolution display systems if available.

Two of the top 10 are what is called "work-alike" packages, based closely on established programs in their respective fields and using compatible command structures and file formats. This means that data can be transferred freely between the two systems, and anyone capable of using one will immediately be at home with the

other. But lacking the originals' pedigree the work-alikes have to offer other incentives like more features and a lower price.

VP-Planner and Mirror are first-class examples of work-alikes; they are based on 1-2-3 and Crosstalk respectively. Each costs a fraction of the price of the real thing and both are considerably more powerful. On the debit side, the work-alikes cannot lay claim to the huge number of third-party add-ons, user groups, books and training courses available for users of the original.

Not surprisingly the software houses behind the originals object strongly to the usurpers. Both Lotus and Microstuf/Softklone have taken those responsible for the work-alikes to the U.S. courts in an attempt to have the products withdrawn before they can do any real damage to sales of their own programs. As there seems to be no infringement of copyright of the programs' code the chances of successful court actions seem in doubt. Whatever the result, these actions may well dictate the future of all work-alike programs.

With cheap PC hardware now a fact of life, budget business software is here to stay. It has produced some impressive software in its first year and should go from strength to strength from now on. The big question is how the established top-end players will respond to the threat of ever more power at ever lower prices.

## SUPPLIERS

**Cricket Graph** Heyden & Son, Spectrum House, Hillview Gardens, London NW4 2JQ. Telephone: 01-203 5171

**First Choice** Software Publishing Europe, 85-87 Jermyn Street, London SW1Y 6JD. Telephone: 01-839 2849

**Integrated 7** Neric Automation Ltd, Gunsell Lodge, Wood Lane, Tugby, Leicester LE7 9WD. Telephone: (0533) 783399

**Mirror** MDP Ltd, 37 Great Pulteney Street, Bath, Avon BA2 4DA. Telephone: (0225) 60491

**Personal Word Perfect** Sentinel Software, Wellington House, New Zealand Avenue, Walton-on-Thames, Surrey KT12 1PY. Telephone: (0932) 231164

**Reflex** Amstrad, Brentwood House, 169 Kings Road, Brentwood, Essex CM14 4EF. Telephone: (0277) 230222

**VP-Planner** Newstar Software, 200 North Service Road, Brentwood, Essex CM14 4SG. Telephone: (0277) 220573

**Word Junior, Works** Microsoft, Excel House, 49 De Montfort Road, Reading, Berkshire RG1 8LP. Telephone: (0734) 500741

**Write Now** Mac Serious Software, 17 Park Circus Place, Glasgow G3 6AH. Telephone: 041-332 5622.

# TOP 10

## CRICKET GRAPH

This Macintosh graphics package can produce 11 different types of chart, including scatter, line, area, bar, column, pie, stack bar, and stacked column. Cricket Graph is particularly easy to use. Once you have entered your tables of data and selected the type of chart required a dialogue box appears from which you can select the variables to be plotted. In the best Macintosh tradition the completed graph can be displayed in the background with the relevant data items in the foreground, though changes to data will not be reflected in the graph until it is replotted. Cricket Graph supports the Apple Laserwriter, Imagewriter II and the Apple Colour Plotter as well as a variety of HP units.

**PRICE:** £155

**FOR:** Price. Range of facilities. Not copy protected.  
**AGAINST:** No slide-show function.

## FIRST CHOICE

From the established Software Publishing Company, First Choice is an integrated package that combines some of the best features of PFS Write and PFS File with communications and spreadsheet modules. Ease of use is its strong point: it really is intended to be the first choice for the novice. The package makes the most of pull-down menus, and copious help screens are always on hand. Although the modules are not as powerful as those provided by the more expensive competition they should be more than adequate for most users. The word processor includes a spelling checker, which can also be used in the database module. Data transfer between modules is aided by a system of bookmarks and the traditional cut and paste technique.

**PRICE:** £149

**FOR:** Ease of use. Spelling checker. Handy database.  
**AGAINST:** No graphics. Modules lack power.

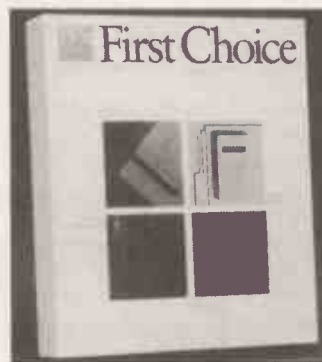


## INTEGRATED 7

As the name suggests this is an integrated package which claims no less than seven functions: database, mail-merge, spreadsheet, graphics, word processing, terminal emulation and communications. Although really only a four-module package, Integrated 7 offers a good specification at a reasonable price. It needs a minimum of 320K RAM but runs in full user-definable colour. The spreadsheet will read and write files in 1-2-3 format and supports a matrix of 255 rows by 2,047 columns. The graphics module can produce pie charts, three-dimensional bar charts, and line graphs; they can all be enhanced with text in any one of 11 fonts. The word processor has a relatively small 35,000-word spelling checker.

**PRICE:** £87

**FOR:** Wide range of features. Flexible graphics module.  
**AGAINST:** Chequered history of support in U.K.



## MIRROR

When it first appeared this program was a clone of Crosstalk. The latest version of Mirror retains compatibility with that well-established communications package but offers many more features. Mirror is memory resident, so it can multi-task with practically any PC software to make communications facilities available at all times. It requires 192K of RAM and will drive any of the IBM's communication ports at up to 115,200 baud on AT compatibles or 57,600 baud on PC com-

patibles. It can drive most autodial modems, including many which do not use Hayes codes. The program is command driven with extensive prompting. It has a built-in WordStar-like editor and its terminal mode emulates DEC, Televideo, TI, IBM, Lier Siegler and Adds units.

**PRICE:** £69

**FOR:** Crosstalk compatible. Multi-tasking. Modem support.  
**AGAINST:** Not as user-friendly as some.

## PERSONAL WORD PERFECT

This is the middle member of the Word Perfect family, sitting between Word Perfect Junior and the full Word Perfect. It is in fact much closer to the top-end package, which is now regarded as probably the most powerful word processor available. Personal has the same excellent on-line spelling checker and thesaurus, but it lacks the macros, case conversion, dual-document support and indexing of the larger version. The powerful and versatile data-merging facility has also been stripped out. But Personal only requires 192K of RAM, and can still boast the most comprehensive set of printer drivers around. It is not the easiest package to use but it will amply reward the user who perseveres.

**PRICE:** £195

**FOR:** Price. Spelling checker. Comprehensive functionality.  
**AGAINST:** No mail-merge. Not very easy to learn.





**REFLEX**

Although Reflex is strictly speaking a database it looks and works a lot like a spreadsheet in certain modes. Despite these visual similarities Reflex is best regarded as database with a strong financial bias. Records can be viewed in either the conventional Form view, where the whole screen is taken up with one record, or in List view, where records are displayed in rows one above the other. It runs in IBM graphics mode, and this makes it possible to combine text and graphics on the same screen. You can select a single point of interest on a graph and display its corresponding record alongside. Reflex include a powerful set of analysis tools and features a comprehensive report builder.

**PRICE:** £61

**FOR:** Price. Analytical power. Graphics.  
**AGAINST:** Financial bias. No data security. No programming language.

**VP-PLANNER**

This 1-2-3 clone uses almost identical command syntax to the Lotus original and is available for a fraction of the price. But it is much more than just a copy of 1-2-3 as it offers many more functions. Maximum spreadsheet size is 256 columns by 9,999 rows, but as the current version does not support extended memory it is unlikely that this will be attainable in practice. The user interface is similar to Lotus's, but the commands have moved to the bottom of the screen and can be selected by the function keys. VP-Planner's most distinctive feature is its two- and three-dimensional databases that are largely compatible with dBase

III data files. Graphics are easier to use on a floppy-based system than with Lotus, as it is not necessary to swap discs. Finally, VP-Planner is supplied with an excellent manual.

**PRICE:** £86

**FOR:** 1-2-3 features and compatibility. Three-dimensional database. Price.  
**AGAINST:** Complicated, so not especially suitable for novices.

**WORD JUNIOR**

Although this program is basically a cut-down version of Word, most of the economies have been made in the packaging; many of the full version's features have been kept. The user interface is robust, and in typical Microsoft fashion up to eight documents can be manipulated at a time thanks to the use of windows. Formatting is outstanding, with perfect alignment even when different sized

founts are being used. There is a glossary feature which allows frequently used paragraphs to be stored, and Word Junior also supports style sheets that contain format instructions for different types of standard document. There is no spelling checker, but Word Junior does include a mail-merge facility.

**PRICE:** £61

**FOR:** Price. Robust user interface. Windows.  
**AGAINST:** No spelling checker.

**WORKS**

Although its price is a little above the threshold we have chosen for budget packages Works deserves to be included as it does so much for the Macintosh. The Works database allows up to 60 fields per item, and records can be displayed in form or list format. The spreadsheet is a cut-down version of

the superb Excel and offers a capacity of 256 columns by 9,999 rows. It also features 54 built-in functions and an easy-to-use graphing facility. Finished charts can be printed out on their own, or merged with documents prepared by the Works word processor, which has a useful Draw mode for creating boxes and circles around text. Works makes the most of the Macintosh high-resolution display and mouse.

**PRICE:** £245

**FOR:** Ease of use. Graphics. Modules are well integrated.  
**AGAINST:** Needs 512K Mac. High price.

**WRITE NOW**

There is a new breed of packages which sits somewhere between the conventional word processors and the more advanced desk-top publishing package. This one runs on any Macintosh — even basic machines with only 128K. Write Now provides facilities like picture insert, multiple-column text and footnotes, which are not found in any but the most expensive word processors. The program is supplied on two non-protected discs. It supports eight basic fount sizes and eight text styles plus a superscript and subscript facility. Write Now allows graphic images to be transferred from other packages such as Cricket Graph via the Clipboard, and once an image is in Write Now it can be moved, expanded or contracted simply by using the mouse.

**PRICE:** £165

**FOR:** Desk-top publishing features. Ease of use.  
**AGAINST:** Documentation. Dictionary.



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THERE IS A fundamental shift under way in the world of computers. Currently, the effects of this change are being felt at the top end of the market but it can only be a matter of time before the technology and its implications begin to affect the micro user too.

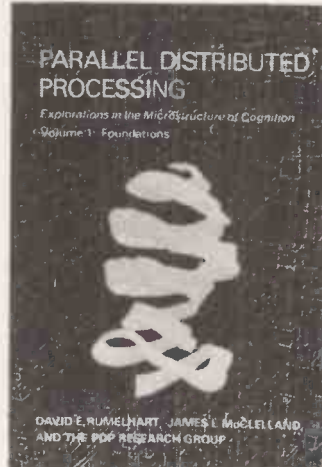
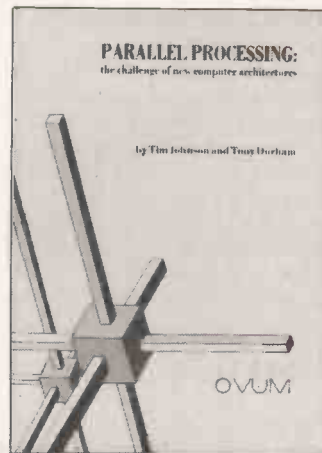
The shift is towards parallel processing. Several books have appeared which chart in varying depth and from varying viewpoints the route towards tomorrow's computer. Perhaps the most approachable is *Supercomputers of Today and Tomorrow* by Richard Jenkins. A journalist by trade, he has set out to provide a painless introduction to the field, viewed in its broadest sense. But what you gain in ease of digestion you tend to lose in sharpness of focus, and throughout there is a fair amount of waffle padding out the kernel of interesting facts.

For example, the first three chapters are very general and rehearse the familiar story of computers to date. Only in the fourth chapter does the author begin to address the central theme of parallelism. Entitled "Creeping Parallelism", it gives an excellent introduction to the world of the early supercomputers: the IBMs, the CDCs and the Crays. Less familiar are the Star 100 and Iliac IV, both early warnings that the road to supercomputing power is not strewn with roses. The Star system was never built in its original form, and Iliac took so long to get going that it was out of date before it was even finished.

The following chapter looks at the nub of the problem with current processing technology: the central processing chip. It quotes the sobering statistic that the features etched on a typical modern chip are only about 10,000 atoms across; clearly this technology cannot be pushed much further.

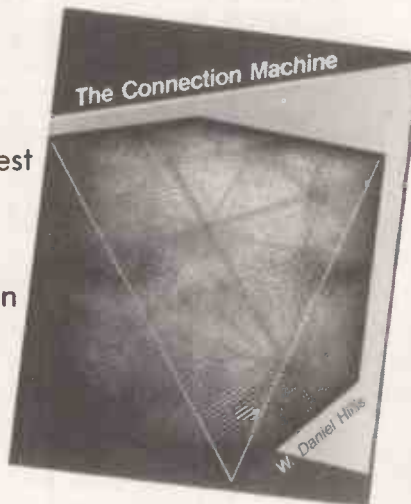
Finally there is a look at the main parallel-processing machines around today, including hypercubes and the Connection Machine. The rest of the book then takes off with more general chapters on applications of parallel systems. It points out that despite their likely points of similarity with the brain's functioning, parallel machines are not just for artificial-intelligence work. As pure number crunchers they do not just offer more power but different approaches.

The essence of their applications lies in the very detailed modelling of systems which are typically far too complex for precise mathematical analysis. Examples might be the weather, fluid flow in car engines or molecular structure. The new generation of comput-



## A PROBLEM SHARED

As the limits of conventional computing techniques loom ever closer, interest in parallel processing is growing. Glyn Moody has been reading some recent books on the subject.



ational tools is allowing scientists and engineers to test theories in a totally novel way; they can carry out simulations as accurately as experiments. The parallel-processing revolution will affect most spheres of life if only because of this ability to carry out the ultimate What-If?

The remaining chapters on artificial intelligence, expert-

system vision and language are pretty standard. But for a good general introduction to the field of supercomputers and parallel processing, Jenkins' book is good value.

Among the subjects Jenkins deals with is the Japanese fifth-generation computer, and an

## BOOK REVIEWS

interesting book devoted to this subject has been written by the director of the project, Tohru Moto-oka. Its tone is in marked contrast to the slightly loud journalism of the previous work. It is studiously balanced and fair, though slightly bland.

However, as the inside story of the Japanese attempt to leapfrog the world and produce a viable parallel-processing supercomputer, it offers some interesting insights. There is a strong awareness of the social implications of such a machine. The author cites various areas where it could have an impact, such as saving energy and resources in a land short of both, and raising Japan's international profile by overcoming the language barrier.

Other chapters in the book go through the reasons for needing a different computer architecture and how they might be implemented. Recently there has been some suggestion that the fifth-generation computer project is running out of steam. Be that as it may, there is no doubt that its announcement served to stimulate interest and — more importantly — government funding worldwide, both of which have given a useful boost to research and products.

Another very personal perspective is given in *The Connection Machine* by W Daniel Hillis. The author is the designer of the Connection Machine, which is one of the few parallel-processing machines to use fine-grained parallelism — that is, large numbers of weak processors — and to be commercially available. The book is an explanation of how the machine's design came about.

It starts off with some useful reflections on the von Neumann architecture, which is causing all the problems at the moment. Hillis points out that the current way of building computers goes back to the time when processors were valves — and hence expensive — and memory was very crude and cheap. Today processors are cheap,

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# BOOK REVIEWS

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but the huge quantities of memory are relatively more expensive. Yet most computers use the memory chips for only a fraction of the time that the processor chip is busy. Hence the von Neumann bottleneck.

One of the bases of the Connection Machine is that memory is distributed locally among the thousands of processes, and is used more intensively. The current version of the machine uses 64K basic processors, each with 4K of memory. It has a peak instruction rate of 100 million instructions per second, and generates about 12kW of heat.

Unfortunately, most of the book after the introductory chapters is too technical for all but the most

avid of readers. An exception is the concluding chapter entitled "New computer architectures and their relationship to physics, or why computer science is no good". Hillis points out that physics works on the assumption that things only have local actions, while in computers — and more specifically in their programs — any event can have huge consequences at any remove. He suggests that the Connection Machine approach, where only nearby processors affect each other, is more like physics.

The book closes with the thought that as computers become more parallel, their behaviour will become smoother and more like physics. This is the reverse situation to modern physics, which has gradually become more concerned with the discrete nature of an apparently continuous world.

Finally two books which, in different ways, say it all about parallel processing. They are both seriously flawed, though for totally different reasons. *Parallel Processing, the Challenge of New Computer Architectures* by Tim Johnson and Tony Dutham is a massive report on the current state of the subject. It is thorough and detailed — and incredibly expensive at £320. Clearly this is only for the company library, which is a pity since the

information it has is fascinating.

Almost every aspect is covered. As well as a general introduction, there are estimates on the size of the future market, a consideration of the opportunities in the area, and the strategies that various sectors should adopt. The report is excellent on the technology. There is a full and moderately sanguine look at the Transputer, and an examination of the issues of programming parallel machines. The book concludes with an exhaustive survey of current commercial products and research projects under way, all complete with helpful comments and informed judgements.

In its own way *Parallel Distributed Processing, Explorations in the Microstructure of Cognition* is equally thorough in its two 500-page plus volumes. It is intriguing to see the roots of the parallel-processing revolution in neurobiology drawn out.

Unfortunately, the whole approach is too academic to be useful to the general reader. Given the importance of this field and the pace of developments, no doubt there will be many future volumes which treat similar topics in a more accessible way. In that respect, Jenkins' book, for all its faults, is a harbinger of interesting things to come. **PC**

## A PROBLEM SHARED

**Parallel Processing: The Challenge of New Computer Architectures** by Tim Johnson and Tony Durham. Published by Ovum Ltd, £320. ISBN 0 903969 31 9

**The Fifth Generation Computer** by Tohru Moto-oka and Masaru Kitsuregawa. Published by John Wiley, £9.95. ISBN 0 471 90739 1

**The Connection Machine** by W Daniel Hillis. Published by MIT Press, £22.50. ISBN 0 262 08157 1

**Parallel Distributed Processing. Volume 1:**

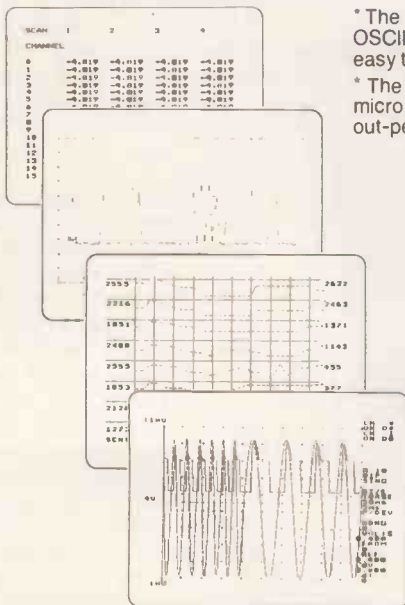
**Foundations** by David E Rumelhart, James L McClelland and the PDP Research Group. Published by MIT Press, £27.50. ISBN 0 262 18120 7

**Parallel Distributed Processing. Volume 2: Psychological and Biological Models** by James L McClelland, David E Rumelhart, and the PDP Research Group. Published by MIT Press, £27.50. ISBN 0 262 13218 4

**Supercomputers of Today and Tomorrow** by Richard A Jenkins. Published by TAB Books, £14.95. ISBN 0 8306 0322 0

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# • O P E N F I L E •

Open File offers programming tips and software to key in. We welcome submissions from readers. We are interested in business programs for any of the main machines such as IBM, Apple, Amiga, Atari 520ST, BBC and Amstrad PCW-8256. We are also interested in applications written in dBase, or for standard spreadsheets like 1-2-3. Utilities are also welcomed.

Submissions should include a brief description which explains what your program does and how it does it. This should be typed with lines double-spaced. The program should be printed with a new ribbon or at double-intensity; the width should be between 75mm. and 90mm., or between 105mm. and 135mm. Also include a disc of your program.

Please send your contributions to

Open File, Practical Computing, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

## UTILITIES

THIS SERIES of articles will be presenting various types of utility programs for the IBM PC and compatible machines. Utilities are programs which enhance the operating systems, either by improving existing commands or by adding new ones. They can be divided into two distinct groups: those which, once loaded, remain in memory and form a permanently resident extension to the operating system, and those which simply add extra commands to those available as standard on the operating-system disc.

An example of a resident utility is the improved Screen Print facility listed in the January 1987 issue of *Practical Computing*. This type of program simply waits in memory until the right conditions are fulfilled for its operation, at which point it produces a printed copy of whatever text may be on your screen. Non-resident utilities are program files which are loaded only when you wish to execute some pre-arranged function. Examples of operating-system commands which use programs like this are Format, Diskcopy and More.

To gain access to the low-level areas where maximum control can be achieved, and to get maximum speed of loading and operation all the programs in this series have been written in assembly language to produce Com files which can be invoked directly from the MS-DOS or PC-DOS operating system. This does not mean that you will need intimate knowledge of machine-code programming techniques.

If you do not have an assembler and you do not wish to modify the programs, you should type in the basic program shown in listing 1 and save it on a disc for future use. Each article will have a data listing with built-in error checking. It will enable you to produce and use the program discussed without needing to know anything about assembly language.

To use the Basic loader you simply run it and enter the numbers in the data listing to produce your machine-code utility. As you enter each line of 11 numbers the program will check them; if an error is found you will

# POP-UP CLOCK

**Jim Bates** opens his series on utility programs with a real-time clock that you can display at will on top of your application.

be prompted to re-enter that line. Once all the data has been entered the program file will be written to disc and you can then use the utility from the operating system.

The data listings have been spaced out and numbered in lines to make them easier for you to read when you enter the data. Do not type in the line numbers. You should type in each of the following numbers followed by a

comma, except for the last number in each line; the spaces are not important. Within each line, the first 10 numbers are part of the program code, and the last number is the sum of the previous 10.

Assembly language differs from the higher-level languages in that it accesses the processor and memory directly. If you want to add two numbers together using

Basic you would enter an instruction like

$$A=B+C$$

This makes A equal to the sum of B and C. You do not need to know where A, B and C are stored in memory. The Basic environment can maintain lists of memory addresses, and when you want to display or use the value of a number, Basic provides it without reference to you. Similarly, Basic knows how to display information on the screen, how to send characters to the printer, and so on.

In assembly language the programmer has to take total control, and adding two numbers together can become a major undertaking.

(continued on next page)

## LISTING 1. GENERAL-PURPOSE BASIC LOADER

```
10 DIM FIL$(200),A(10):CLS
20 PRINT"Basic Machine Code File Construction "
30 INPUT"Enter the Name of COM file (without the .COM) ";FIL$
40 INPUT"Enter number of Lines ";LINS
50 FIL$=FIL$+".COM"
60 PRINT"Enter each line of numbers exactly as listed ";
70 PRINT"(including commas) and hit <ENTER>":PRINT
80 PRINT"There are 11 numbers in each line, ";
90 PRINT"if an error is made, you will be"
100 PRINT" prompted to enter that whole line again !":PRINT
110 FOR LIN=1 TO LINS
120 PRINT"Line "LIN" ";
130 INPUT A(1),A(2),A(3),A(4),A(5),A(6),A(7),A(8),A(9),A(10),B
140 CHECK=0:FOR X=1 TO 10
150 CHECK=CHECK+A(X)
160 FIL$(LIN)=FIL$(LIN)+CHR$(A(X))
170 NEXT X:IF CHECK = B THEN 200
180 BEEP:PRINT"ERROR - Re-Enter this line!":PRINT:GOTO 120
200 NEXT LIN
210 PRINT" Data Entry Completed "
220 PRINT" Preparing to write file - "FIL$
230 PRINT" Hit any key when ready"
240 K$=INKEY$:IF K$="" THEN 240
250 OPEN FIL$ AS #1 LEN=10
260 FIELD #1,10 AS D$
270 FOR LIN=1 TO LINS
280 LSET D$=FIL$(LIN)
290 PUT #1,LIN
300 NEXT LIN:CLOSE:PRINT"File "FIL$" written."
```

**POP-UP CLOCK. ASSEMBLER LISTING**

COMMENT \*  
===== CLOCK =====

Program remains resident after loading  
Intercepts INT 0H Time of Day routine

Routine occurs 18.20445 times per second  
Counter in DELAY only allows execution of the  
interception routine on 18th time of calling.

Toggle ON/OFF occurs when <Ctrl> and <Right Shift>  
keys are pressed together.  
This toggles the JNZ instruction at SWITCH between  
JBE and JMP (76H & EBH).

Installation uses INT11H to poll the equipment and decide  
whether MONO or COLOR Screen is in use.

Once installed - program can only be removed by reboot.

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\*\*\*\*\*  
; Equates  
\*\*\*\*\*

SCREEN EQU 90H ; Location of first position on  
; Screen

; Low memory data pointers

INT8\_OFF EQU 20H ; Position of Interrupt 8 Offset  
INT8\_SEG EQU 22H ; Position of Interrupt 8 Segment  
CTRL\_KEYS EQU 417H ; Position of Control Keys Byte  
TIM\_HI EQU 46EH ; Position of Timer Hi-word  
TIM\_LO EQU 46CH ; Position of Timer Lo-word

\*\*\*\*\*

CODE SEGMENT  
ORG 100H ; MUST BE 100H FOR .COM FILE

ASSUME CS:CODE,DS:CODE,ES:NOTHING

BEGIN: JMP INSTALL

\*\*\*\*\*  
; DATA Area  
\*\*\*\*\*

FLAG: DB 0 ; Shows condition of Control Keys  
DELAY: DB 0 ; Counts up to 18 to allow update

\*\*\*\*\*  
; Interrupt Intercept  
\*\*\*\*\*

NEW\_INT8 PROC NEAR

PUSH AX ; Save registers  
PUSH BX  
PUSH CX  
PUSH DX  
PUSH DS  
PUSH SI  
PUSH BP  
SUB AX,AX ; Quicker than XOR AX,AX  
MOV DS,AX ; Access Page Zero of RAM  
MOV AH,DS:[CTRL\_KEYS] ; Keyboard access  
AND AH,05H ; <Ctrl> <RShft> pressed?  
CMP AH,05H  
JNZ CLOCK ; No - so go to CLOCK  
MOV AX,CS ; Get CS into DS  
MOV DS,AX ; Now point to our Segment  
CMP BYTE PTR [FLAG],OFFH ; Check FLAG indicator  
JZ QUITSTEP ; Keys active - so jump out  
MOV BYTE PTR [FLAG],OFFH ; Set FLAG to active  
XOR BYTE PTR [SWITCH],9DH ; Toggle jump instruction  
JMP QUITSTEP

CLOCK:  
PUSH CS ; Put our Segment  
POP DS ; into Data Segment  
MOV BYTE PTR [FLAG],0 ; Set FLAG - keys released  
INC BYTE PTR [DELAY] ; Bump the DELAY Counter  
CMP BYTE PTR [DELAY],12H ; Update once per second

SWITCH:  
JBE QUITSTEP ; Change to JMP to disable  
MOV BYTE PTR [DELAY],0 ; Reset the counter  
SUB AX,AX  
MOV DS,AX  
MOV CX,DS:[TIM\_HI] ; Get the System Clock time  
MOV AX,DS:[TIM\_LO]

; --- Now Divide down to find Hours, Minutes and Seconds ---

PUSH CX ; This already represents Hours  
MOV DX,0 ; Prepare to divide  
MOV CX,91 ; by 91 (18.2 x 5)  
DIV CX ; Quotient in AX, remainder in DX  
MOV BX,DX ; Save remainder in BL  
MOV DX,0 ; Prepare to divide  
MOV CX,12 ; by 12 to get minutes  
DIV CX ; Quotient in AX, remainder in DX  
MOV BH,AL ; Save Minutes  
XCHG DX,AX ; Remainder to AX  
MOV DX,0 ; Prepare to multiply  
MOV CX,5 ; by 5 (back to seconds)  
MUL CX ; AX has major seconds  
L1: SUB BL,18 ; How many 18's in BL?  
JC L2 ; no more left  
INC AX ; Add 1 second  
JMP L1 ; Go again

QUITSTEP: JMP QUIT ; This is a stepping stone only

L2: PDP CX ; Recover Hours  
PUSH AX ; Save Seconds  
XCHG CH,CL ; Hours into CH  
MOV CL,BH ; Minutes into CL  
PUSH CX ; Save Hours & Minutes

(continued from previous page)

It is necessary to know where in memory the numbers are stored, how big they may be, where the result is to be stored, how and where to display the answer, and so on. Fortunately there are short cuts which allow use of some of the sub-routines already in the machine's memory. They are called interrupts and are very roughly equivalent to the GOSUB statement in Basic.

In Basic you can just type in a program and Run it, but the production of a machine-code program is a multi-stage process. All of the programs in this series will be in the form of Com files which can be executed directly from the operating-system prompt and all of them will be available on disc. Producing a Com program is

a four-stage process detailed as follows.

Stage 1 is writing the program. This must be done using a plain-text editor or word-processor program. Most word processors have a non-document or ASCII mode specifically for plain-text processing. The convention is to produce a plain-text file which has the extension Asm.

**PLAIN TEXT**

If you have any doubts about a particular editor or word processor you can test it by first typing some text into a file and saving it to disc. Then use the Type command to display the file on your screen. If you see exactly what you typed into the file, then you have plain-text processing. If there are any strange characters displayed, then your

editor is not suitable for program writing.

Once you have checked your editor you should type in the source-code text for each example exactly as it appears in the listing. You can save a little time by omitting the comments from the program; they are not necessary for correct assembly, although if you are going to keep the listing you should make sure that the comments are included. Comments are a particularly important part of any assembler listing because the program flow is much less obvious than it is in a high-level language.

The comments are indicated in two ways: the text at the top, between and including the word "Comment" and the two asterisks, is a comment, and so is a semicolon and all text following it

to the end of any line. Convention decrees that assembler programs are written with a file-name extension of Asm.

Stage 2 is assembling the program, and for this you will need an assembler program suitable for the processor of your machine. All the examples in this series are written for the 8088 processor in the IBM PC, though they should be suitable for use on most 8088, 8086, V-20 and 80286 machines. Simply follow the instructions for assembly of programs.

During assembly, all comments are ignored and any programming errors will be reported. You will need to correct them and reassemble the program before continuing. All the programs in this series have been assembled

# • O P E N F I L E •

## UTILITIES

```

RAM:
MOV AX,0B000H ; Screen RAM (set by INSTALL)
MOV DS,AX ; Set DS to point to screen seg
POP CX ; Hours & Minutes
MOV AL,CH ; Hours
AAM ; Change to DECIMAL
OR AX,3030H ; to ASCII
MOV DS:[SCREEN],AH ; Tens of Hrs - to screen
MOV DS:[SCREEN+2],AL ; Units of Hrs - to screen
SUB AX,AX
MOV AL,CL ; Minutes
AAM ; Change to DECIMAL
OR AX,3030H ; to ASCII
MOV BL,AH ; Tens of Minutes
MOV DS:[SCREEN+6],AH ; to Screen
MOV BL,AL ; Units of Minutes
MOV DS:[SCREEN+8],AL ; to Screen
MOV BYTE PTR DS:[SCREEN+4],3AH ; COLONs to Screen
MOV BYTE PTR DS:[SCREEN+10],3AH
POP CX ; Seconds & Hundredths
MOV AL,CL ; Seconds
AAM ; Change to DECIMAL
OR AX,3030H ; to ASCII
MOV BL,AH ; Tens of Seconds
MOV DS:[SCREEN+12],AH ; to Screen
MOV BL,AL ; Units of Seconds
MOV DS:[SCREEN+14],AL ; to Screen

QUIT:
POP BP ; Restore registers
POP SI
POP DS
POP DX
POP CX
POP BX
POP AX
DB OEAH ; This is a bare JMP instruction
JSEG: DB 0,0 ; Segment collected from Page Zero
JOFF: DB 0,0 ; Offset collected from Page Zero

NEW_INT8 ENDP

PROTECTOR LABEL BYTE
; All code to here will be protected by DOS
;=====

INSTALL PROC NEAR
; Installs the above code, adds the JSEG and JOFF words as
; copied from the Vector Table at Interrupt 8.
; Checks which CRT Mode is active and alters RAM accordingly.
; Finally leaves all code in this segment up to PROTECTOR
; resident and protected.

PUSH DS ; Save register
LEA DX,MSG1 ; Sign-on message
MOV AH,9
INT 21H ; Display it
SUB AX,AX
MOV DS,AX ; Access Page Zero of RAM
MOV SI,DS:[INT8_OFF] ; Interrupt 8 Offset
MOV DX,DS:[INT8_SEG] ; Interrupt 8 Segment
MOV DS,DX ; Look at start of

CMP WORD PTR [SI],5350H ; current Interrupt 8
JNZ NEXT1 ; Already installed?
POP DS ; No - continue
LEA DX,MSG3 ; Yes - so Quit!
MOV AH,9 ; Point to Abort message
INT 21H ; Display it
INT 20H ; DOS Program terminate.

NEXT1:
MOV DS,AX ; Access Page Zero of RAM
MOV AX,DS:[INT8_OFF] ; Old Interrupt 8 Offset
MOV DX,DS:[INT8_SEG] ; Old Interrupt 8 Segment
POP DS ; Restore our Data Seg
MOV [JSEG],AX ; Set up final JMP Seg.
MOV [JOFF],DX ; and Offset
INT 11H ; Equipment Poll
AND AL,30H ; Check Video Mode
CMP AL,30H ; Is it Mono or Color?
JZ NEXT2 ; It's Mono - no change
MOV BYTE PTR [RAM+2],0B8H ; Set to RAM to Color

NEXT2:
LEA DX,NEW_INT8 ; Set Interrupt 8
; to point to our Code
MOV AX,2508H ; Function Call 25H
INT 21H ; Change Interrupt
LEA DX,MSG2 ; Installed OK Message
MOV AH,9
INT 21H ; Display it
LEA DX,PROTECTOR ; Set program length
INT 27H ; Terminate and stay resident

;END of program code

;=====
; Installation Message Area
;=====
MSG1 DB 'BATES Associates Copyright 1987',13,10
DB 'Toggle CLOCK - resident utility '
DB ' - Version 1.30',13,10,'$'

MSG2 DB 'Installed - use <Ctrl> <Right Shift> '
DB ' to Toggle',13,10,'$'

MSG3 DB 'INSTALLATION ABORTED',7,13,10,13,10
DB 'CLOCK already installed.',13,10,'$'

INSTALL ENDP
CODE ENDS
END BEGIN

```

and tested and have no errors. If you get any error reports from your assembler you should carefully recheck all the text that you have typed in.

After assembly you will have an object file, which is denoted by the extension Obj on the file name. This file contains the machine-code version of your program.

In stage 3 you link the object file using the Link.Exe program which is usually provided with your operating-system files. The main purpose of the Link program is to link a series of separately produced object files into one coherent file.

The examples in this series are all single files, but the linker is still required to convert the object file into a relocatable Exe file. Since all the examples are written to produce Com programs, the Link

program will always inform you that no stack segment has been defined. This is not an error; it is a prerequisite that Com programs should not redefine the stack segment.

The fourth and final stage is to convert the Exe file using the Exe2bin program, which is again provided with your operating-system files. Exe2bin converts the actual layout of your program within the .Exe file to a form that is compatible with Com program files. After the conversion, if you have overridden the default Bin extension you will have a file with Com as the extension.

For example, to assemble, link and convert the program file after completing the text file Clock.Asm you would enter the following three commands in

```

sequence:
ASM CLOCK;
LINK CLOCK;
EXE2BIN CLOCK CLOCK.COM

```

### EASY RUNNING

All this work in producing the program is amply rewarded. There is a significant saving in disc space, since Com programs produced by this method are usually relatively small. Com programs will also load and execute much more rapidly and will usually take up much less memory than their high-level equivalents.

While assembly is a little involved, running the programs is extremely easy. Just type in the name of the Com file from the system prompt, and the program will load and execute automatically. When the operating

system loads a Com file it locates the lowest 64K block of unused memory that it currently has available and saves the address of this block, which is called a segment. The first 256 bytes of this area are prepared with data relevant to the operation of the Com file; this first 256 bytes is called the program segment prefix (PSP).

The program is then loaded into memory addresses numbered 256 (100hex) and upwards. Once loaded, the instruction at address 256 is sent to the processor and the program instructions are run sequentially from that point. This method of writing assembly-language code for the IBM PC provides up to 64K of memory without the need for any complex memory-switching arrangements.

(continued on next page)

(continued on next page)

There is occasionally a need to access certain special areas of memory which are outside this 64K range, but this is an easily understood process. Whenever the processor is instructed to collect data from somewhere in memory, it requires an address. This address is made up of a segment number and an offset number. The segment number tells it which 64K block of memory you want, and the offset tells it the address within that 64K.

There are four segment registers in the 8088 series of micro-processors, but in this series we shall only be concerned with two of them. For present purposes the code segment register (CS) will always point to our own block of 64K. When the program needs to access memory outside this block, it uses the data segment register (DS). So to access memory in the first 64K block — also called page 0 — of memory, zero must be placed in DS and the assembler is then told to use this as the segment part of the address. Most assemblers will use the contents of DS in this way as a default.

### STANDARD LAYOUT

The general layout of the assembler listing in this series follows a standard form. Immediately after the comment section, which simply describes the program's action and requirements, there is a section labelled Equates. This area simply attaches labels to particular numbers, thus helping to make the eventual coding easier to read.

The next section will usually be headed Code Segment. This is where the program instructions actually start and there will be an ORG 100H

statement, meaning Originate at 100hex (256 decimal). This statement tells the assembler program to start assembling the relevant code from the 256th byte in this particular statement — that is, immediately after the PSP.

The usual style that I adopt is to make the first instruction a Jump, equivalent to a Goto command in Basic. By putting it at the beginning of the code I can reserve an area immediately after it for relevant data to be stored. This data area is marked in the listing and is used for the storage of mainly transient information which the program may need during operation. After the data area comes the main body of the program code.

If the program is intended to become resident as an extension of DOS there will be an installation section at the end of the main

### POP-UP CLOCK. DATA FOR BASIC LOADER

Line 1	233, 212, 0, 0, 0, 80, 83, 81, 82, 30, 801
Line 2	86, 85, 43, 192, 142, 216, 138, 38, 23, 4, 967
Line 3	128, 228, 5, 128, 252, 5, 117, 24, 140, 200, 1227
Line 4	142, 216, 128, 62, 3, 1, 255, 116, 85, 198, 1206
Line 5	6, 3, 1, 255, 128, 54, 68, 1, 157, 235, 908
Line 6	73, 144, 14, 31, 198, 6, 3, 1, 0, 254, 724
Line 7	6, 4, 1, 128, 62, 4, 1, 18, 118, 54, 396
Line 8	198, 6, 4, 1, 0, 43, 192, 142, 216, 139, 941
Line 9	14, 110, 4, 161, 108, 4, 81, 186, 0, 0, 668
Line 10	185, 91, 0, 247, 241, 139, 218, 186, 0, 0, 1307
Line 11	185, 12, 0, 247, 241, 138, 248, 146, 186, 0, 1403
Line 12	0, 185, 5, 0, 247, 225, 128, 235, 18, 114, 1157
Line 13	6, 64, 235, 248, 235, 77, 144, 89, 80, 134, 1312
Line 14	233, 138, 207, 81, 184, 0, 176, 142, 216, 89, 1466
Line 15	138, 197, 212, 10, 13, 48, 48, 136, 38, 144, 984
Line 16	0, 162, 146, 0, 43, 192, 138, 193, 212, 10, 1096
Line 17	13, 48, 48, 138, 220, 136, 38, 150, 0, 138, 929
Line 18	216, 162, 152, 0, 198, 6, 148, 0, 58, 198, 1138
Line 19	6, 154, 0, 58, 89, 138, 193, 212, 10, 13, 873
Line 20	48, 48, 138, 220, 136, 38, 156, 0, 138, 216, 1138
Line 21	162, 158, 0, 93, 94, 31, 90, 89, 91, 88, 896
Line 22	234, 0, 0, 0, 0, 30, 141, 22, 52, 2, 481
Line 23	180, 9, 205, 33, 43, 192, 142, 216, 139, 54, 1213
Line 24	32, 0, 139, 22, 34, 0, 142, 218, 129, 60, 776
Line 25	80, 83, 117, 11, 31, 141, 22, 184, 2, 180, 851
Line 26	9, 205, 33, 205, 32, 142, 216, 161, 32, 0, 1035
Line 27	139, 22, 34, 0, 31, 163, 211, 1, 137, 22, 760
Line 28	213, 1, 205, 17, 36, 48, 60, 48, 116, 5, 749
Line 29	198, 6, 136, 1, 184, 141, 22, 5, 1, 184, 878
Line 30	8, 37, 205, 33, 141, 22, 135, 2, 180, 9, 772
Line 31	205, 33, 141, 22, 215, 1, 205, 39, 66, 65, 992
Line 32	84, 89, 83, 32, 65, 115, 115, 111, 99, 105, 878
Line 33	97, 116, 101, 115, 32, 67, 111, 112, 121, 114, 986
Line 34	105, 103, 104, 116, 32, 49, 57, 56, 55, 13, 690
Line 35	10, 84, 111, 103, 103, 108, 101, 32, 67, 78, 795
Line 36	79, 67, 75, 32, 45, 32, 114, 101, 115, 105, 765
Line 37	100, 101, 110, 116, 32, 117, 116, 105, 108, 105, 1010
Line 38	116, 121, 32, 32, 45, 32, 86, 101, 114, 115, 794
Line 39	105, 111, 110, 32, 49, 46, 51, 48, 13, 10, 575
Line 40	36, 73, 110, 115, 116, 97, 108, 108, 101, 100, 964
Line 41	32, 45, 32, 117, 115, 101, 32, 60, 67, 118, 717
Line 42	114, 108, 62, 32, 60, 82, 105, 103, 104, 116, 886
Line 43	32, 83, 104, 105, 102, 116, 62, 32, 116, 111, 863
Line 44	32, 84, 111, 103, 103, 108, 101, 13, 10, 36, 701
Line 45	73, 78, 83, 84, 65, 76, 76, 65, 84, 73, 757
Line 46	79, 78, 32, 65, 66, 79, 82, 84, 69, 68, 702
Line 47	7, 13, 10, 13, 10, 67, 76, 79, 67, 75, 417
Line 48	32, 97, 108, 114, 101, 97, 100, 121, 32, 105, 907
Line 49	110, 115, 116, 97, 108, 108, 101, 100, 46, 13, 914
Line 50	10, 36, 0, 0, 0, 0, 0, 0, 0, 0, 46

program code, usually separated by a byte labelled Protector. This byte is used to mark the end of the code to be made resident, and is passed to DOS at the end of the installation section.

The installation section is effectively a mini-program in its own right. It is responsible for checking the available hardware, setting up the resident code, and hooking into the required interrupts. Data used by this section — the sign-on message and so on — is stored after the Protector byte, since it is only required during the installation phase.

### CLOCK PROGRAM

The Clock resident utility program is designed to display a digital clock in the top right-hand corner of the screen. The code is attached as a resident extension of DOS and hooked into system interrupt number 8. This interrupt is run automatically every 54 milliseconds or so, more or less regardless of whatever else the PC might be doing. The clock will therefore continue to display during all

program operations performed.

To keep the program simple the clock display is put directly into screen memory, and no effort has been made to correct the display for graphics screen modes. This means that the display in graphics mode will not be readable, but since the clock can be switched off from the keyboard at any time this should not prove to be too much of a problem.

The Clock program accesses six areas of memory outside its own 64K segment, as noted in the Equates section. Screen is the address where the program places the first character of the Clock display. Int8\_off and Int8\_seg are the memory locations where the full address of the interrupt 8 routine is stored, segment and offset.

Control\_keys is a memory location where the condition of some of the control keys is stored. By reading this byte it is possible to tell if certain keys are pressed. It is used here to check when the Control and right Shift keys are pressed, allowing the Clock to be

toggled on and off. Tim\_hi and Tim\_lo are the addresses for the current setting of the system clock.

Two bytes are reserved for information required by the program, and they are labelled Flag and Delay. Flag is used to indicate whether the Control key has been released, and Delay is used to store a counter number which is checked each time the program runs, to see if the required time has elapsed before updating the clock. Next comes the new interrupt routine — the code that will be run approximately 18.2 times per second as long as the machine is switched on.

### HOOKING

Since Clock is to be a resident program it must be connected into the appropriate part of the operating system. This is done by replacing the address for interrupt 8 that DOS is currently using with the address pointing to the Clock routine; this is called "hooking the interrupts". Since something else might be hooked into interrupt 8 it is essential to allow the original interrupt routine to continue after our own has done its job.

Once the program has displayed the sign-on message it must collect the existing interrupt 8 address and put it into the program. In Clock, this address is placed at the end of the new interrupt code for the program to jump to when it has finished. Clock also checks the first two bytes of the code at Interrupt 8 to see if it has already been installed. If it has, the program displays an abort message and returns to DOS without making any modifications.

The installation routine continues by using interrupt 11hex to check what hardware is in use. Since it only needs to know whether a monochrome or colour monitor is in use it only needs to check bits 4 and 5 of the code returned in AL. If these bits are set, then a monochrome monitor is in use and no modification is necessary. Otherwise the address used at label RAM needs to be changed to B800hex, since this is the start of the area of memory used by the colour monitor.

The next step in installation is to hook the program into the system instead of the existing interrupt 8 routine. DOS provides a special routine to do this: function 25hex of interrupt 21hex. The correct segment address must be put into DS and the relevant offset into DX. The function number is placed in AH and the number of the interrupt to be changed is placed in AL. Interrupt 21hex then does the hooking. The program can now display the installed

message and go on to the final step of the installation.

At this point the routine is in place and functioning, but if you return to DOS subsequent programs might be loaded over its code. DOS must therefore be told where the program is and must protect it from future program operations. The special function to do this is Interrupt 27hex, known as the terminate and stay resident (TSR) interrupt. The highest address to be protected — in this case it has been labelled Protector — is placed in DX, and Interrupt 27hex is called. DOS now protects the area from the beginning of the segment up to Protector, and the installation procedure ends. The program is now permanently resident in memory, hooked into the system, and will not be overwritten.

The actual code in Clock is quite simple in operation. The interrupt that it is hooked into is processed approximately 18.2 times every second, whatever else might be running, since it is driven by a special timer chip in the machine. It is unnecessary to run the whole of our program this often, so it includes a timing counter which only activates every 18th time the program is called; the other 17 times processing is passed straight through to the original interrupt 8.

### KEYBOARD CONTROL

The program allows the Clock to be turned on and off under keyboard control, so the first section of code — after saving the contents of the registers that are to be used — checks the current status of the Control\_keys byte. Pressing the Control and right Shift keys should toggle the operation of the Clock program off and on. The program also needs to remember that the keys have been pressed.

The toggle process changes the instruction at Switch between a conditional JBE and a JMP. With a JBE the clock program will function every 18th time of calling; with a JMP, the program will never function. The Flag byte is a simple indicator which is set to OFFhex every time the control keys have been pressed. The only way that the Flag byte can be reset to zero is when the first part of the Clock sequence is completed, and this can only happen when the Control\_keys byte is not 5 — indicating that either the Control key or the right Shift key has been released.

Once the toggling is completed, processing skips the clock routine and continues to do so until the keys are released. The reason for this is that this code is being processed over 18 times a second.

Holding the Control and right Shift keys down for about half a second would toggle Clock on and off about nine times, and you could not be certain which way the toggle would end up. To prevent this, the Flag byte is set to reflect the condition of the control keys.

The first part of the Clock routine sets the DS register to point into our own segment. After resetting the Flag byte the Delay counter is incremented by 1 and then checked. If it is lower than 19 then the remainder of the routine is skipped; if it is equal to or greater than 19 processing will continue.

This assumes that the clock is toggled on — that is, the instruction at Switch is JBE and not JMP. If the clock is toggled off, then processing will skip to Quit, regardless of the number in the counter. The Delay counter will continue to be incremented even though the clock may be toggled off. It is for this reason that the instruction at Switch is JBE, since the counter could be higher than 18 when the clock is re-enabled after a period of inactivity.

After Switch comes the working part of the code, which has to do three things: read the time, convert it to a displayable series of numbers, and finally display it on the screen. The time is stored in low memory in the form of a four-byte number which contains the number of times the master system clock has ticked since midnight. This number is first loaded in two parts into the CX and AX registers. It must then be divided down to arrive at the correct number of hours, minutes and seconds. The routine that DOS uses to do this is quite complicated, as is most binary arithmetic. I have therefore made the division routine simpler at a slight cost in accuracy.

At first sight, approximately 18.2 ticks per second seems a strange number to use for the system clock. However, a little simple arithmetic will show that this multiplies up to 65536 ticks per hour. Since 65535 is the decimal equivalent of FFFFhex you will see that at the end of each hour the Tim\_lo word of the counter becomes full and carries 1 across into Tim\_hi. DOS zeroes both words at midnight, so Tim\_hi always contains the number of hours since midnight. The hours count can therefore be saved in CX by pushing it on to the stack.

AX now holds a number between 0 and 65535 which represents a portion of an hour. One simple way of dividing this down is to divide first by 91, since this represents fairly accurately the

number of ticks in five seconds. After this division you are left with the number of five-second blocks in AX and the remaining number of ticks in DX. The remainder is saved in BL — it cannot be greater than 90. Dividing AX by 12 gives the number of minutes. Since this number must be less than 60 the answer actually only occupies AL and it can be saved into BH. DX now contains the remaining number of five-second blocks so it is moved into AX and multiplied by five to get seconds.

### TICKS

Finally the program has to deal with the remaining number of ticks left after the first division — these are in BL. Strictly speaking it is necessary to divide this by 18.2 and add the answer to the seconds in AX. An easier way — though less accurate — is to subtract 18 from BL, and if the answer is not negative to add 1 to AX and try it again. This loop continues until BL goes negative, the ultimate effect being to have added 1 to AX for every 18 that it was possible to subtract from BL. This is equivalent to dividing BL by 18.

Hours, minutes and seconds can now be shuffled into convenient form for later access and pushed on to the stack. The registers that are used are AX for the seconds, CL for the minutes and CH for the hours. Once these values are safely on the stack the program prepares to display the results. As a result of the slight inaccuracy introduced by the simplified calculation routine, Clock will appear to gain about half a second per hour until it becomes roughly nine seconds faster than the DOS time at midnight. This is not a great problem since the whole process of calculation counts from midnight and Clock is therefore reset to proper accuracy at that time.

The Installation routine determines which monitor is in use and will have altered the address of the screen RAM that is now put into the data segment register, thus enabling the direct transfer of data on to the current monitor screen. The calculated numbers can now be recovered from the stack, converted to their equivalent ASCII characters and put on to the screen. The number of hours is put into AL. The program then issues an AAM instruction which splits the number in AL into two parts. AH contains the result of dividing AL by 10 (0Ahex), while AL contains the remainder of this division; thus AH has the 10s and AL has the units.

All that is needed now is to convert the binary number in each part of the register to a character.


This is achieved by Oring the number with 48 (30hex) so that number 1 becomes character number 49 (31hex), and so on. Both AH and AL can be dealt with simultaneously in this way by the instruction

OR 3030H

Since the data segment register (DS) has already been set to point to the screen area the results of these calculations can be placed directly into screen memory at the offsets indicated by the Screen equate. The minutes and seconds amounts can be displayed in the same way.

Screen memory actually uses two bytes to store one character when in text mode. One byte holds the character's ASCII code and the adjacent byte holds a number which indicates the attributes — colour, flashing, inverse, etc. — that this byte will have on the screen. Since only the character bytes are being changed the attributes will remain as previously set. This ensures that the clock will always be displayed using the same attributes that have been set for that portion of the screen that is being used. Once the characters are placed in the screen memory it can be left to the video processor to display them on the screen.

### INTERFERENCE

There is one slight problem, however, due to the fact that the screen memory is accessed by both the main processor and the video processor in the IBM. Some interference is occasionally evident in the form of snow on the monitor screen, though it can be avoided by carefully timing the point at which the main processor accesses the screen. The timing process can be quite involved, and although it would improve the display slightly on a colour monitor it would make no noticeable difference on a mono monitor. To keep the program as simple as possible the timing problem has been ignored. The effect that you get without it is a slight flash on the screen approximately once a second as the clock updates. Obviously, while the clock is disabled there is no accessing of the screen, and the flash will not be apparent. 

*All the programs in this series are available on IBM-formatted discs at a cost of £5 for each program. Each disc contains the assembler source code, the assembled program and a document file describing the operation of the code in detail. Please send your order to Jim Bates, c/o Practical Computing; cheques should be made payable to Jim Bates.*

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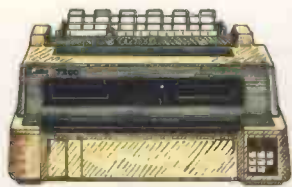
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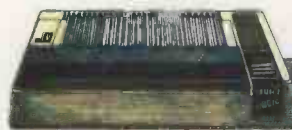
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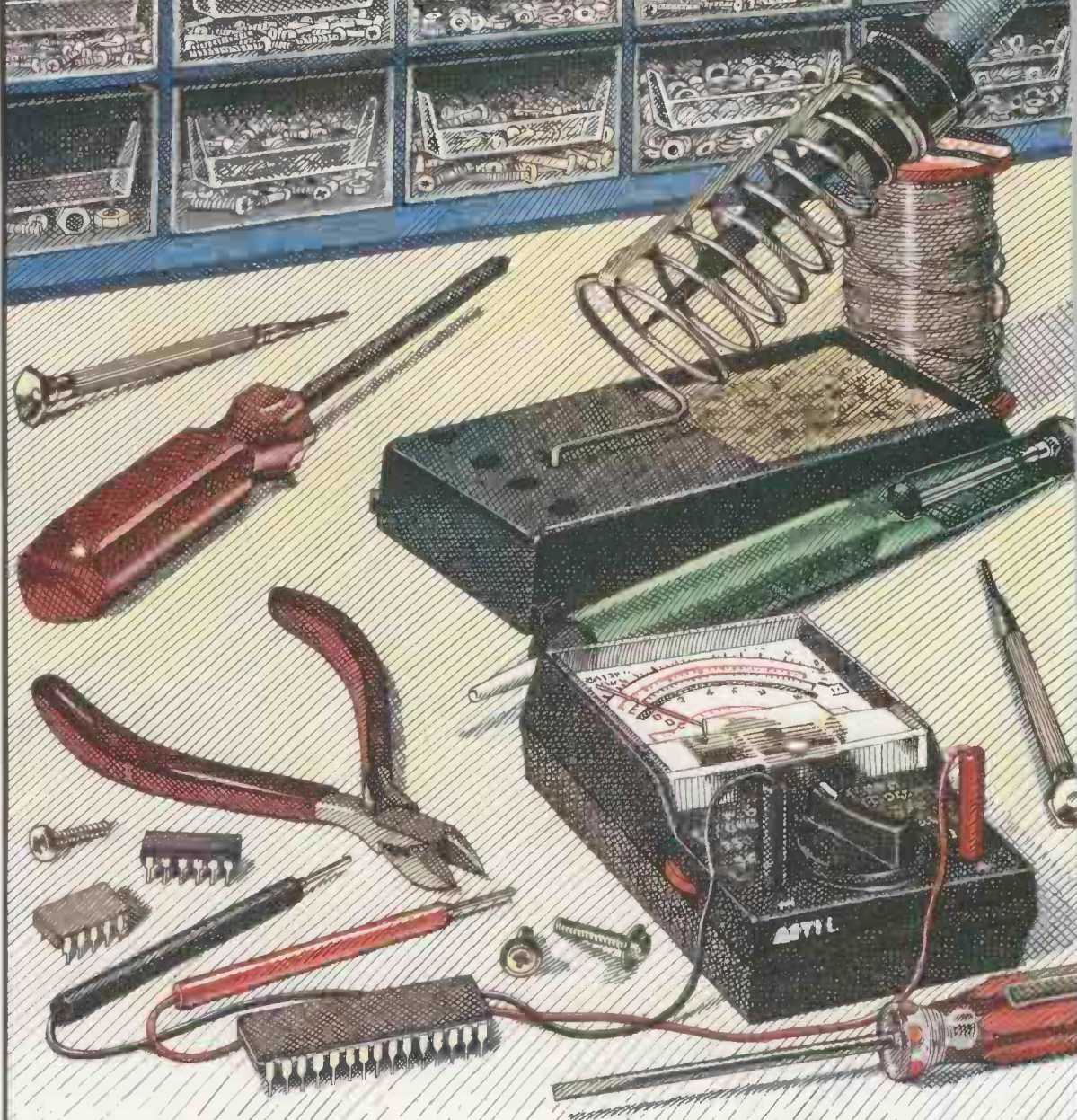
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