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# APC

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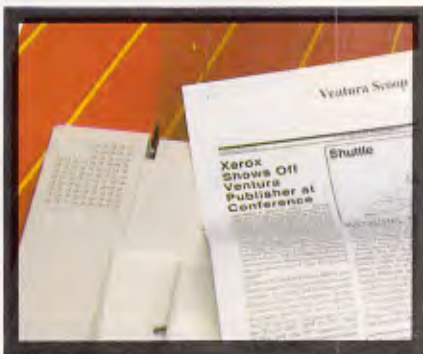
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APC and Microsoft are excited to announce the world's largest prize for a programming competition. This is your chance to win \$30,000 and make your claim to fame. Turn to page 37 to find out how to enter.

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With OS/2, Microsoft hopes to lead the way with new operating systems and graphic windowing environments. But will they supply what we want? Robert Schifreen looks at a beta-test version of OS/2, and explains the options for PC/AT and PS/2 users.

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Five hundred programs are being developed for Microsoft Windows, but there is only one fully relational database among them — Omnis Quartz from Blyth Software. Derek Cohen and Nick Walker take a long hard look at this friendly but powerful database.

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The new Kurzweil scanner isn't cheap but it is very smart. Using artificial intelligence techniques, it is capable of reading printed text regardless of size, font or format. David Tebbutt investigates this ingenious piece of hardware.

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The Apple Macintosh has always been a popular choice for desktop publishing and now, with Xpress, it offers an even more professional set-up, with unprecedented typographic control over page layout. Graham Jones considers it to be a new standard.

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This is the age of the 'information rich'. No longer is it necessary to scour through the local library or pour over a collection of newspapers to access information. With the aid of a PC and modem, a huge amount of information is available and ready for the taking. Robin Howells accesses Australian and international databases and reports on what each has to offer in this comprehensive survey.

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Owen Linderholm can now run multiple PC applications with true multi-tasking — and most within windows. No, he hasn't taken delivery of OS/2 or a new 386 machine — all this is possible on a standard PC with the latest version of DESQview.

## PRINTER SPECIAL

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APC presents a 30-page survey of hundreds of printers available on the market with all the specifications you will need to help you make your choice.



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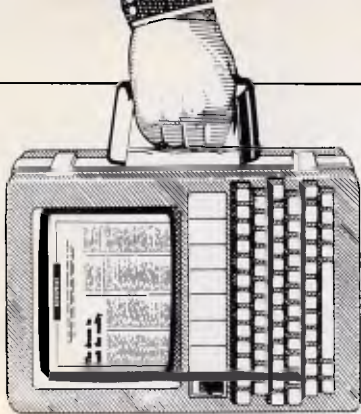
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***Hypertext looks like becoming 'a flavour of the year' (and probably next year). It's already been announced in product form by Apple for the Mac — and IBM users will probably have a range of products before long. This, and the rest of the month's micro news, are presented by APC's experts.***

## Cake eaten, and kept

We have all vastly enjoyed the spectacle of Rod Canion, boss of Compaq, producing in public the cake he ate three months earlier, when IBM launched OS/2.

On the day that IBM announced its PS/2 systems (2 April), Canion went on record deriding OS/2 as useless since there was no software that used it, and the operating system wouldn't be ready for months, if not years.

In June, Canion changed his tune because his biggest customers came to him, saying (along the lines of):

*Dear Mr Canion, We're sorry to hear that you won't be supporting OS/2 on your machines. We have put a recommendation to the board that we go with OS/2, and this, of course, means we will have to remove your machines from the recommended list . . .*

He didn't change his tune in private.

He invited several journalists to a New York conference with Microsoft, Lotus, Oracle and DCA (the Irma firm), and paid their air fares and hotel bills, too.

There, he spoke reassuringly about how he could demonstrate OS/2 on one of his machines (and there it was, switching tasks, see?) and there was his very good friend, Bill Gates, head of Microsoft, the company which wrote OS/2.

We sent Owen Linderholm

over to the Big Apple and, after enjoying the show, he buttonholed Bill Gates, producing the short — but sweet — item that follows. *Owen Linderholm writes:* Bill Gates has proved that black is white.

After the OS/2 conference in New York, I had the chance to question Bill Gates more closely about the system — specifically, why it could only run one 'real-mode' task.

A real-mode task is one that can be found on any PC; and, under OS/2, if you are running one of these tasks, you can't use its famous ability to run more than one program at once. All other programs 'freeze'.

Programs exist, like DESQview 2.0 (see review on page 167 of this issue), which manage to run more than one real-mode task. They do it by partitioning the tasks off, on an 80286 machine, and monitoring them to ensure that conflicts don't occur.

Bill Gates had an easy answer: 'It's not worth doing.' An easy answer perhaps, but not one I could accept. This didn't impress him: 'I'm the world's greatest expert on this subject' (operating systems) he said, modestly.

Finding this self-praise possibly true but unconstructive, I pointed out that it was possible to run two 320k programs in 640k of



***Companies which have appointed a full time employee to refill the departmental laser printer's paper tray will be grateful for this ingenious (but pricey) device. It's Practical Peripherals' MultiFeeder and attaches to the rear end of a range of laser printers. It allows the selection from the computer keyboard of any of six feeder trays. The advantage of course is not only an increased feeder paper capacity but also a range of paper types. So one feeder may contain plain paper, another letter-head, envelope or form etc.***

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memory: and that it was quite possible to run a communications program (like Mirror) in the background, and another program in the foreground.

Gates responded by muttering about "bound to trash the hard disk" and rushed off. I have to admit to feeling rather offended by this arrogant and insulting behaviour — after all, there were plenty of sensible things he *could* have said in reply.

My feelings after the conference and this encounter with Bill Gates are: he tried to hijack the conference as a platform for hyping OS/2,

and for persuading all the major manufacturers to endorse the system before it is shipped.

In other words, Bill Gates is trying to force users to buy OS/2, even before they have had a chance to try it.

This is dangerous — it could lead to the current DOS being left behind as a kind of ghetto for unsophisticated users. But, since many users are quite happy with things as they are, they will resent being pushed into spending more money than they need to.

There was one bright note at the conference: Jim Manzi of Lotus, talking



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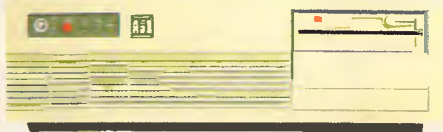
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about the likely price of OS/2 software, revealed a secret design concept for his company's products.

"We will stick" he said solemnly, "with our algorithm of eight cents per byte, for software."

That's eight cents US remember.

**Guy Kewney**

## Microsoft hustles to fix Windows 2.0 incompatibilities

Microsoft is going to have to scramble to get Windows 2.0 out by its scheduled ship date in September and to make it compatible with the current version of Windows 1.04, software developers said last month.

The Windows 2.0 code currently being beta tested by many Windows-software developers will not run major Windows applications, such as the PageMaker desktop publisher from Aldus Corp.

"PageMaker doesn't work, but it's because of bugs in Windows 2.0, not PageMaker," said Michael Sherwood, product manager at Aldus. "But we are working closely with Microsoft, and by the time Windows 2.0 ships, those bugs will be fixed."

Incompatibility presents a dilemma for Windows-software developers because it could take many months for users to upgrade to Windows 2.0, said William Strum, president of software developer Media Cybernetics. "Most people got Windows bundled with hardware. They are not going to go out and buy Windows 2.0," he said.

The principal compatibility problems with Windows 2.0 involve the fonts the program uses; those fonts have been changed so that programs can write text to the screen faster, said Mark Zachman, chief executive officer at Z-Soft Corp, a firm which makes Windows-re-

lated software. "In theory, you can run the same .EXE [executable files] under both [Windows 1.04 and 2.0], but in practice, it just doesn't work," Mr Zachman said. "Most of Microsoft's own Windows development applications don't even work. Our own Windows version 1.0 applications had to be rewritten considerably."

Windows 2.0 will offer several performance and functionality enhancements over previous versions, including increased speed, support for expanded memory and disk-caching capability.

Much of the product's advance publicity has been derived from its new visual interface, which will be very similar to the Presentation Manager in OS/2, Microsoft's forthcoming protected mode operating system, according to Microsoft officials.

Although Windows 2.0 and OS/2 will have a different programming interface, Microsoft has been encouraging developers to write to Windows 2.0 to gain experience programming in a structured, graphical environment. Windows 2.0 applications running under DOS will have a similar user interface to OS/2 applications running under the Presentation Manager.

"We are waiting to move our programs to Windows 2.0 until we get a later version of the code," said Paul Grayson, chairman of Micrografx, a company which sells the first 'hit' Windows program, In\*a\*vision engineering-design software.

Mr Grayson was very confident, however, that Microsoft will solve the compatibility problems before Windows 2.0 is shipped.

"Our goal is to be applications compatible," said Microsoft vice president Steven Ballmer. "We test for compatibility by running commercially available applications under Windows 2.0, but [Windows] developers can find those incom-

patibilities more easily than we can."

Changing Windows applications for Windows 2.0 requires a major overhaul, said Mr Strum. "The only reason [Microsoft] can get away with this is because there are so few Windows applications. They should be more responsible to the software community."

Because Windows 2.0 offers several enhancements over the original version, applications written specifically to Windows 2.0 will not be compatible with Windows 1.04, Mr Ballmer said.

Of more immediate concern to end users will be the need for new hardware device drivers for Windows 2.0.

"The changes that were made in the font format break any device drivers," said Microsoft's Windows product manager, Tandy Trower. "But we decided it was worth it to get the dramatic performance improvement."

Microsoft has already provided information to graphics-hardware manufacturers so that they can have their new Windows device drivers available when Windows ships, Mr Trower said. It will be up to Windows users to obtain the new device drivers from the manufacturers of their own graphics hardware.

Other new features, sources said, include support for the Intel 8087 maths coprocessor, disk caching and more efficient use of expanded or extended memory. The improvements also enable Windows 2.0 to be run on slower 8088-based PCs, whereas the current version requires a 80286 for satisfactory speed.

## Card brings PostScript to LaserJet II

Users of Hewlett-Packard LaserJet Series II printers will soon have access to the PostScript page description

language with a printer controller card being developed by QMS.

The product, called JetScript, consists of a PC controller card that is equipped with Adobe's language, a Hewlett-Packard (HP) LaserJet Series II video adaptor card, cabling, manuals and disk-based software, according to Gary Carroll, the QMS product manager.

JetScript will be available in the US in December of this year and will be priced around \$US2500.

At the time of going to press Hewlett-Packard Australia was unable to provide any details regarding price or when the product will be available to Australian users.

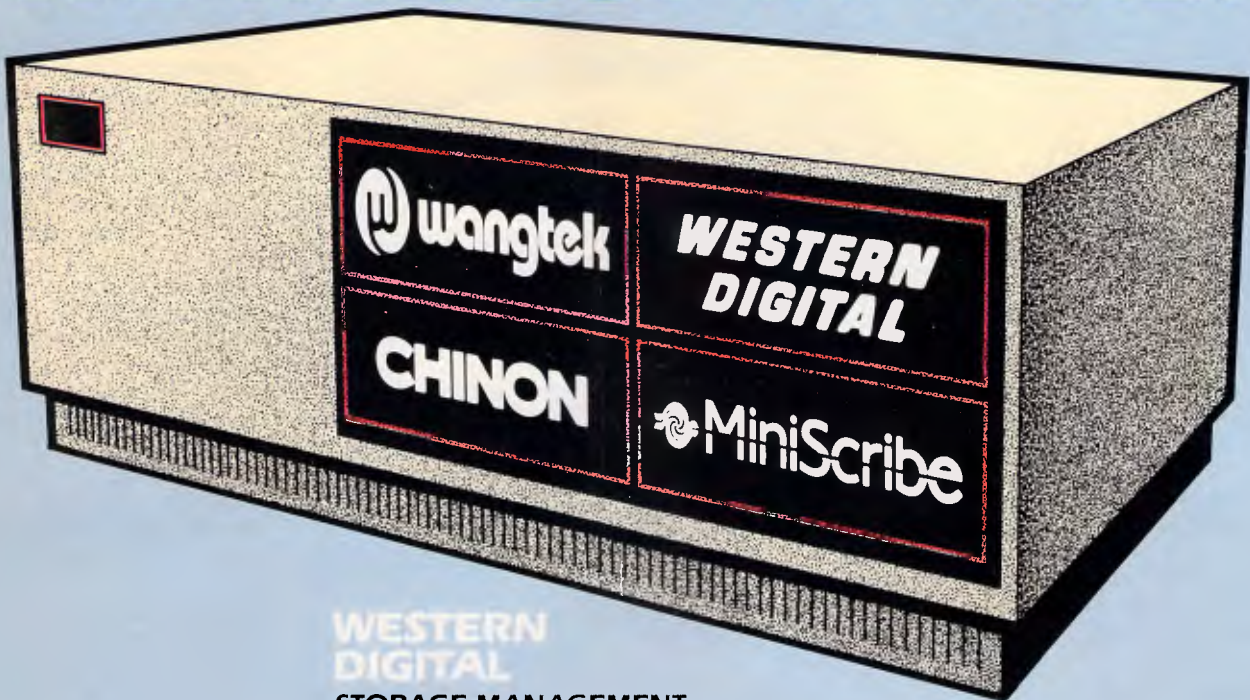
While the JetScript works only with the newer LaserJet II model, a PostScript controller card for the original LaserJets, called the PS Jet, will be available from Megavision in Sydney. The card is from Laser Connection, a QMS subsidiary, and sells for \$US2995.

A page description language is usually implemented as firmware on a printer controller board. It gives a laser printer the ability to produce complex pages of merged text and graphics, an ability most often put to use for desktop publishing.

To access PostScript, LaserJet Series II users must install the QMS PostScript printer controller card into a PC, XT or AT. The 8-bit controller is based on a 68000 microprocessor. A small video-interface card then connects to the printer's video adaptor. For multi-user environments, the PC controller card can reside in a file server, according to QMS officials.

"The interface card ensures graceful switching between the PostScript controller and the HP controller that resides in the LaserJet Series II," Mr Carroll explained. "It acts like a traffic cop between the two control-

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lers. So, if two people send information to the printer it will automatically queue." Once the card is installed, 35 Adobe fonts can be downloaded to the printer controller board in the PC. Users will then have access to the entire Adobe font library at all times, Mr Carroll added.

HP officials announced in April that the printer manufacturer would support PostScript, from Adobe.

Last month, QMS and HP announced the signing of an international marketing and distribution agreement for JetScript. Under the agreement, HP has designated QMS as an approved supplier of JetScript, Mr Carroll said.

Watch forthcoming issues for details of availability in Australia and pricing.

## **dBase Mac shipment delayed**

dBase Mac did not ship on July 31 as had been stated originally; the relational database for Apple Macintosh computers is still in its final testing and debugging stages. The company now plans to ship dBase Mac by the time you read this. Ashton-Tate's managing director in Sydney, Keith van Klink, says he's confident that dBase for the Mac will arrive on our shores in early October. It is expected to retail for \$895.

## **Microsoft works on its first integrated package for PCs**

Microsoft has borrowed heavily from its past successes to develop PC Works, its first foray in the integrated software market for PCs.

Microsoft's PC Works, expected to be released shortly in the US, is based on the Mac Works application developed for Apple Com-



**Competition, it seems, is hotting up in the multi-synch monitor market. The above model from Porchester Computers was recently announced with a retail price of \$1845. So we rang Sony to ascertain the going rate for their model.**

**"\$2220" we were told. So we were about to explain to readers that it would be a good idea to forget the Sony and go for the Porchester unit. But before we had time, Sony rang back to explain that a recent (very recent, we think) revision of prices meant that the Sony would shortly be available for around \$1885.**

puter's line of Macintosh computers. The program also makes use of features from other popular Microsoft packages, including Microsoft Word.

A pre-release version of PC Works examined by APC comprises a spreadsheet, database, charting module, word processor and telecommunications program. The new program is character-based, meaning it does not require colour or enhanced graphics adaptors. PC Works runs on 8088, 8086, 80286 or 80386-based computers running DOS 3.X that have 512k of memory.

According to Microsoft Australia's marketing manager, David Svendsen, PC Works is expected to arrive here early November and it is anticipated to cost \$595, the same as Works for the Macintosh.

Analysts, Ms Quindlen and Rich Sherlund, said there is renewed interest among corporate PC users and first-time computer users in integrated packages such as PC Works or First Choice, a comparable program by Software Publishing (SPC).

Data files can be opened from within the program's modules or from outside the

program by typing the name of a data file at the DOS prompt. For files that are opened from the DOS prompt, PC Works will automatically open the application module that was used to create the file.

Within the modules, commands are initiated by pointing and clicking with a mouse on items in drop-down menus or by using keyboard commands. The spreadsheet module in PC Works uses the same .WKS data-file format as Lotus 1-2-3, version 2.0, and can translate most — but not all — Lotus macros.

Using PC Works, users can create Lotus-compatible spreadsheets as large as 256 columns by 4096 rows — which is about half the size of the largest spreadsheet supported in the latest release of 1-2-3. The program's word processing module contains many of the same features found in the Microsoft Word word processing program. PC Works' word processor provides the ability to format individual paragraphs or characters.

Also supported is the ability to generate form letters and merge them with names and addresses contained in the database module, which can contain as many as 4096 records.

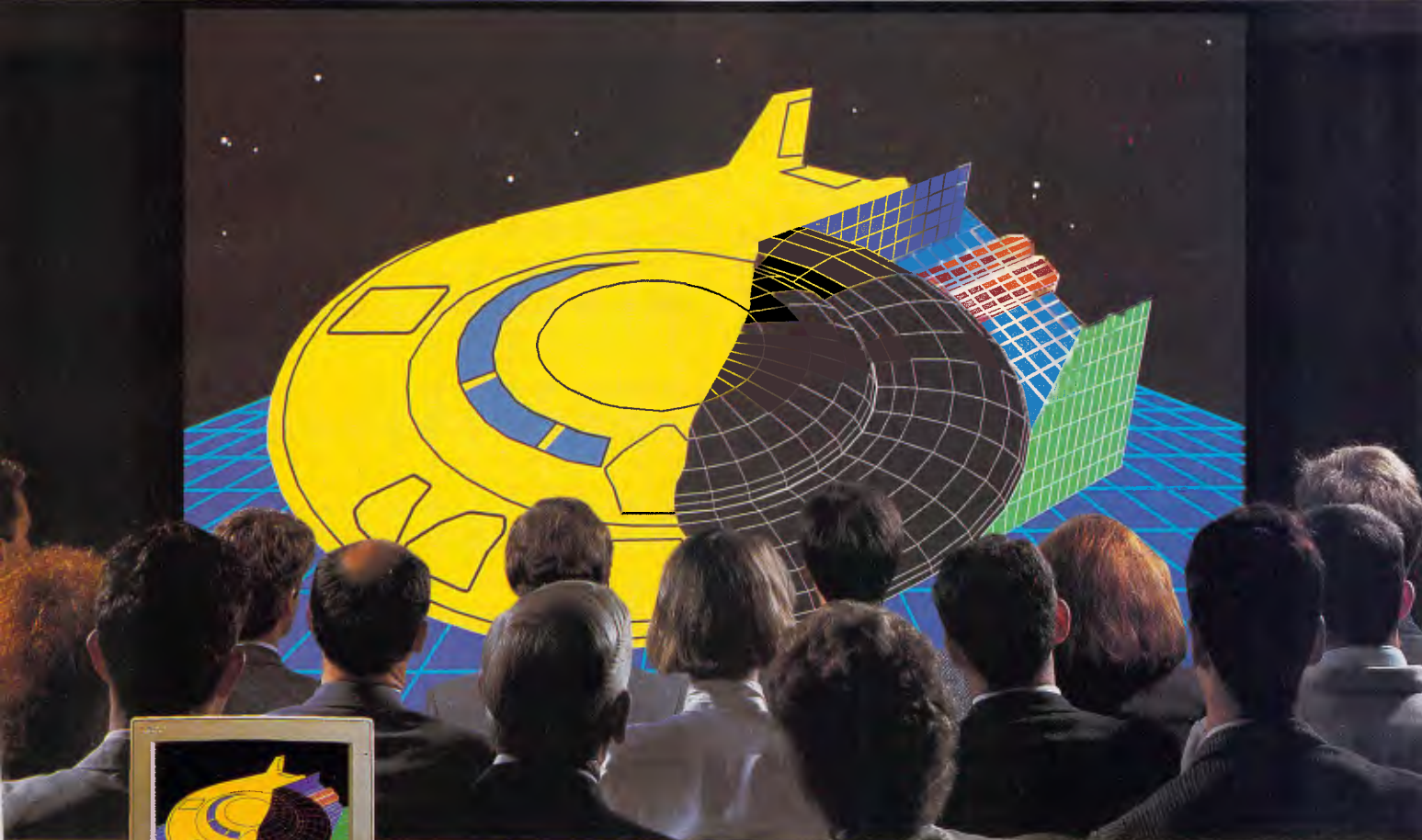
The communications module in Microsoft's PC Works provides VT100 and VT220 terminal emulation and will support data-transmission speeds of up to 9600 bits per second.

The telecommunications module does not support the ability to write incoming data directly to an appropriate applications file. When a communications session is completed, users have to open a data-capture file with the word processing module in order to edit the data.

Microsoft's PC Works could outsell Software Publishing's First Choice, the current leader in the market for low-end integrated programs, said Mr Sherlund. But, he added



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## **AutoShade taps Orchid board power**

Two of the industry leaders in computer aided design/manufacturing (CAD/CAM) last month announced active support of Autodesk's AutoShade on the Orchid TurboPGA graphics board.

Autodesk, maker of the industry-leading AutoCAD, developed AutoShade on the TurboPGA. By using the two products together, CAD designers can perform three-dimensional rendering and shading, said Michael Bruzzone, Orchid's director of corporate communications.

The TurboPGA is the only PGA (Professional Graphics Adaptor) card offering complete software compatibility with more than 70 programs with every industry graphics standard, including PGA, EGA (Enhanced Graphics Adaptor), CGA (Colour Graphics Adaptor), MDA (Monochrome Display Adaptor) and Hercules, Mr Bruzzone said.

"Autodesk supports the Orchid TurboPGA because it offers 32 shades of any one colour, rather than the IBM PGA's 16 shades," said John Forbes, AutoShade product manager.

Another advantage to AutoShade users who choose the Orchid board is the use of Orchid's new PGA Palette Paint Program, Mr Forbes said. The paint program is the only one available for the PGA standard.

PGA Palette enables full use of the 256 colours out of the 262,144 colour palette capability of the TurboPGA. It also provides users of AutoShade, AutoCAD and other popular graphics programs the ability to cap-

ture drawings and enhance them with details, text and hundreds of additional colours, he said.

Orchid products are available from Porchester Computers in Melbourne. Currently, PGA Palette is provided free with every purchase of the Turbo PGA board which costs \$3495. It is not possible to buy the products separately at this stage. Porchester Computers may be contacted on (03) 537 2722.

A spokesperson for Autodesk was unable to provide any details about AutoShade's expected date of arrival in Australia or anticipated price at the time of going to press. Autodesk is on (03) 429 9888.

## **Bug in dBase III can cause retry errors**

A bug recently found in Ashton-Tate's dBase III Plus database program can potentially cause retry errors in certain multi-user situations.

The problem occurs under select instances when a programmer uses the retry command to make an application automatically redo a task that did not work properly the first time.

For example, if two users tried to simultaneously access the same file over a network and received an error message, the retry command would ensure that the process was attempted again until it was successful.

Typically, if a dBase application command issues a retry statement, dBase returns to the line of code in an application where the error occurred and attempts it again. However, if the command that causes the error spans two 512-byte blocks in memory, dBase can't read the entire retry statement so it issues an improper syntax error and doesn't complete the remainder of the task, a company spokesman said.

Ashton-Tate acknowledged

the bug in the February 1987 issue of its newsletter but won't issue a fix, company officials said.

"To handle [the bug], count out each character and make sure that the 512 byte does not fall in the middle of the statement," a spokesman said.

The dBase users who have encountered the bug classified it more as a major headache than as a significant problem.

## **Faster '286 chip sets to bring '386 power to AT compatibles**

The price/performance ratio of '286-based PCs should shift dramatically in the next six months as chip makers use new technology to wring greater processing speeds from relatively low-cost components.

The basic building block of the new machines is expected to be made official this month when Advanced Micro Devices (AMD) announces the 80286-16, a 16MHz '286 processor.

The processor offers a performance increase of 28 per cent over existing 12MHz '286 chips, company officials said. Samples of the chip are currently available, and AMD expects to begin production of the chip in the fourth quarter of this year.

Several chip makers are planning to build chip sets around the new microprocessor, which will result in AT-compatible computers with speeds equivalent to the current generation of 16MHz '386 PCs. Prices of the new machines are expected to be comparable to what 10MHz ATs cost today, said Raj Jaswa, senior product marketing engineer at Chips and Technologies.

One of the foremost contenders in this arena, Chips and Technologies will announce this month a 16MHz AT chip set that, when configured with AMD's 16MHz '286 microprocessor, will

form the basis for a very high performance AT motherboard.

Besides Chips and Technologies, Western Digital and Zymos, are designing similar components that will allow PC makers to build the high-performance machines, officials from both companies said.

But Chips and Technologies leads the pack at this point. Its New Enhanced AT CHIPSet (NEAT) is already sampling and will be shipped in volume to PC manufacturers by the fourth quarter, Mr Jaswa said.

Users and analysts expressed interest in the technology's promises of speed, low cost and compatibility.

"I am looking at the trade-offs between XT's, AT's and the '386," said analyst, Martin Maxwell. "If the price of the '386 comes down enough, the '286 could become an evolutionary dinosaur. But I have a high confidence level in the AT-class machines for right now."

"The unit volume demand for the '386 won't be significant until late 1988 or 1989," said John Maxwell, an analyst with a brokerage firm. "There is a market for the [NEAT] chip set. For the average user, the AT is sufficient."

"Chips and Technologies doesn't have a stranglehold on the technology to develop a 16MHz AT chip set. However, it has been around longer and probably understands the technology better than its competitors. As a result, it can bring a product to market a little faster," said Drew Peck, a semiconductor-industry analyst.

"A few months makes a lot of difference because the vast majority of clones are going to standardise on the chip set that is available first," Mr Peck said.

Chips and Technologies will use a number of techniques to endow its products with the performance improvement. One is a page/interleave



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Naturally, the card should include high-resolution drivers for Microsoft Windows, Lotus (with 120 columns and 43 lines), for 1-2-3 and Symphony. And software support from packages like AutoCAD, Windows, GEM, Dr. Halo, EASYCAD, EGA Paint, In·A·Vision, Windows Draw and Windows Graph. And, of course, a full two year warranty. All of which



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memory technique that allows the PC makers to use relatively low-speed, less expensive (100 nanosecond) DRAM (Dynamic RAM) chips for system memory without degrading the speed of the microprocessor. This is important because higher speed DRAMs are more expensive and have until now forced high speed PCs into a higher price range, Mr Jaswa said.

The memory controller chip of the Chips and Technologies chip set (one of four in the set) incorporates a way to seek the next logical piece of information from memory before the microprocessor requests it — a speed-increasing process similar in concept to paging techniques used in mass storage.

With the advent of OS/2 and Windows applications, user requirements for both speed and memory will increase substantially, Mr Jaswa said.

The Chips and Technologies memory controller chip also incorporates the Lotus/Intel/Microsoft Expanded Memory Specification (LIM/EMS), allowing users to take advantage of several megabytes of memory.

Chips and Technologies has also implemented techniques in the chip set to allow the bus to alternate its speed in order to communicate with slower add-in boards (which usually operate at 8MHz) without significantly degrading the speed of the microprocessor, said Mr Jaswa. This allows the PC to have full compatibility with the AT bus and still maintain high throughput speeds — unlike the PS/2s, which trade hardware compatibility for speed, he said.

One PS/2 feature that Chips emulated in the NEAT chip set is a mode-switching technique that optimises the performance of OS/2, the protected-mode operating system from IBM and Microsoft.



**The gentleman with the bigger smile is Justin Beck, Pacific Data Corp's special projects manager. He stands here with Bob Stewart managing director of WordStar Australia.**

**Mr Beck asserts that Pacific Data "can write at least fifty per cent of MicroPro's total sales in Australia this year".**

**Some time ago Mr Beck was a director of Technology Corporation of Australia, a firm proposing to go public to raise cash and "emerge a major force in the Australian computer industry". TCA, according to Mr Beck, "was not only a computer company but a high tech company with plans to enter the business and personal communications field in a big way". He even went so far as to say that Technology Corporation of Australia's name "properly indicates the direction in which the Group is headed". Sadly, TCA went in an altogether different direction.**

**It went broke a short time later.**

**So if, by chance, you're inclined to take a bet on the fulfilment of Mr Beck's latest prophesy, at least get good odds.**

"Compared to a first-generation AT, OS/2 will run 10 to 15 per cent better on a PS/2," said Chips and Technologies product manager Sikander Naqvi.

This is because IBM has implemented in the hardware a facility for speeding the switch between protected mode and real mode — a process the microprocessor will have to do often under OS/2. The NEAT chip set can perform this switch within one microsecond, Mr Naqvi said.

Another speed enhancement of the NEAT chip set is 'Shadow RAM', a technique used by IBM in its PS/2

Model 80 and by other PC makers that allows the BIOS in ROM to be remapped into high-speed RAM after the PC is booted. This lets the operating system access BIOS functions at much higher speeds, Mr Jaswa said.

Both Western and Zymos expect to distribute samples of their chip sets later this year. Western officials said the firm will show 16MHz and 20MHz chip sets in October, with volume production scheduled for this year's fourth quarter or the first quarter of next year. Zymos expects to have samples in September.

## LIM EMS version 4.0 brings multi-tasking features to DOS

A major revision of the Lotus/Intel/Microsoft Expanded Memory Specification (LIM EMS), slated for release this month, will allow MS-DOS to support a number of features promised by OS/2, according to sources inside and close to the three companies.

EMS version 4.0 will provide users with access of up to 32Mbytes of expanded memory and some of the new specification's other options such as multi-tasking.

New add-in boards that support the new version should be ready as early as the fourth quarter, according to sources inside Intel's Personal Computer Enhancement Operation (PCEO), maker of the AboveBoard.

Owners of current EMS boards in AT clones who are satisfied with the standard 8Mbytes of expanded memory will be able to run any software written to the new specification by adding software drivers from various board manufacturers, which should be available late this year or early next year, sources said.

Software that supports the new specification will likely be available later this year or early next year.

Lotus' 1-2-3 Release 3.0 and Microsoft Windows 2.0 and Excel for the PC will be among the first crop of programs to support the new LIM specification, said sources inside the two companies.

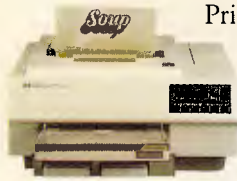
PCEO and Microsoft officials declined to comment. A spokesman for Lotus said version 4.0 "is under development, and we have been working closely with the other parties to make sure it meets the needs of users in light of new technologies."

The LIM EMS, announced in 1985, gives software access to more memory than

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**Soup**  
Canned Soup Council

Mr. J. C. Ryan, President  
Flossmoor Soup Company  
Flossmoor, Illinois 60422

August 1, 1987

Dear Mr. Ryan:

In an effort to help you stay competitive, we are publishing 5-year sales projections for two soup categories: canned and dry. Please keep these projections handy as they will aid you in your product planning over the coming years. Of special interest to you are the dry soup projections.

	CANNED	DRY
1987	\$6,700,000	\$1,100,000
1988	\$7,300,000	\$2,100,000
1989	\$8,400,000	\$2,600,000
1990	\$9,300,000	\$4,800,000
1991	\$9,900,000	\$7,300,000

As you can see, industry experts project that the gap between dry and canned soups will begin to close by 1990. They also believe mergers will follow.

**Noodle Price Hike**  
 Bad news this month comes from TNG (The Noodle Group). By year's end, they project the price of noodles to double - up to eighteen cents a barrel. How will this price hike affect you? A two-cent per can increase on all noodle soups you sell.

**Recommended Reading: "Cup or Bowl"**  
 This in-depth study discusses the habits of the American soup eater. Call and I'll send you a copy.

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## WordPerfect for the Amiga

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the 640k DOS limit. By installing a LIM card with the current version of EMS, programs can utilise up to 8Mbytes of additional memory.

Sources said version 4.0 — the first major revision of the EMS specification — has 15 new software functions and 39 new sub-functions for software and operating system developers. Although they declined to elaborate, the sources said the new functions make it easier to develop programs that incorporate these features.

With the new LIM specification, Lotus 1-2-3 Release 3, for example, will be able to support 'multi-dimensional linked' spreadsheets and expanded macro capabilities — features that were not expected to be available to users until the release of OS/2.

The ability to run several programs simultaneously — another feature promised by OS/2 — is also supported by EMS version 4.0. This will allow users to load several application programs into memory and switch between them using a multi-tasking operating system, such as Unix, or the so-called DOS control programs, such as DESQview, from Quarterdeck Office Systems.

With the new features, version 4.0 will make DOS an alternative for companies considering OS/2, allowing them to make the transition from DOS to OS/2 over a longer period of time, said David Thomas, a technology analyst, who is familiar with the new specification.

The new version will allow the old generation of computers to run applications similar in functionality to those designed for OS/2, which requires a significant amount of memory, said Mr Thomas.

"If customers want to go with OS/2, they can, but with version 4.0, they will not be forced to go that route," said a Lotus source. Added a source inside Intel:

"Version 4.0 breathes new life into DOS and provides a taste of what OS/2 will be like."

## DosEdit's lurking memory

When playing an Infocom adventure on a PC-compatible, use DosEdit. But beware! If you are playing something like Lurking Horror, DosEdit will give you away to your colleagues.

DosEdit is one of those indispensable programs of unknown origin, which was 'found' inside Microsoft. All it does is repeat the last command given to DOS.

Normally, you can do that with the F3 function key. What makes DosEdit nice is that it remembers the previous 15 commands, too. And it lets you edit them.

So, when you type a complex command such as: `pco /r/m = %1/ql = c:\out\pro.cfg` and then find that you should be in a different directory, you can type 'cd\pco', hit the up arrow, and the previous command will reappear.

And if, in an Infocom game, you type: `get red indian head-dress with cowboy lasso` and the system says 'You Already Have It', and you realise it was really the Spanish sombrero you wanted, then don't retype — just hit the up arrow.

But don't be too sure you're safe. Most Infocom games are played by 'serious computer users' at their place of work. And it is generally regarded as good policy, when a supervisor happens by, to be working on something less entertaining — a spreadsheet, perhaps, or copying a list of files onto someone's floppy.

Unfortunately, DosEdit will remember the last 15 commands you typed in Lurking Horror. It can be embarrassing to hit one too many up arrows after typing: `copy *.dif c:\lotus\bak\` if the last command you gave the game was: `kill professor with magic stone`.

**Guy Kewney**

## Graphics software offers easy links

In a new release of its presentation-graphics program, Chart, Microsoft has added links to statistical, database and spreadsheet data residing on a local area network (LAN).

The update, Chart version 3.0, also offers an expanded set of data analysis tools, the ability to create three-dimensional charts and built-in mouse support.

The program's links to data on the LAN can be set up to be direct and dynamic, meaning that when the user changes data in one program, the changes will automatically be reflected in another 'linked' program, according to Microsoft officials.

Chart 3.0 costs \$790 and is available from Microsoft dealers. Registered users of earlier Chart versions can upgrade for \$175.

Like version 2.0, Chart 3.0 allows a direct dynamic link to data from 1-2-3, Multiplan, dBase, SPSS/PC+ and other applications software programs. Because a direct link with these source programs is established, any data that is changed in the application program is automatically updated in the linked chart, explained John Fitzpatrick, the Microsoft product manager.

New to Chart 3.0 is the direct-linking capability with LAN support. Using a LAN that runs Microsoft's network software or any PC-NET-compatible network, users can gain direct access to external data that is stored on a file server and exchange custom chart formats, according to Mr Fitzpatrick. Chart 3.0 includes record locking and password protection to manage files that are being shared.

In a networked environment, permanent links can be set up between Chart 3.0 and applications software programs.

A separate LAN software utility for Chart 3.0 is required. In a five user configuration, the software is supplied with Chart 3.0 and five manuals and costs \$2085. New analytical tools featured in Chart version 3.0 include an array of transformations, regressions, moving averages, descriptive statistics, mathematical calculations on data series and line smoothing. Also, Chart 3.0 can accommodate up to 32,000 data points per chart; this is up from the 128 data point total of Chart version 2.0, according to company officials.

In addition to its gallery of 48 predesigned formats, Chart 3.0 lets users create a 3-D effect for bar, pie, column and line charts. For text charts, version 3.0 adds text alignment, line spacing, text rotation, bullet symbols and line drawing.

Using an IBM Enhanced Graphics Adaptor (EGA) or Video Graphics Adaptor (VGA) card, charts can be displayed onscreen in 64 colours. Chart version 3.0 can also work with up to 177 colours for output on 35mm slides, plots prints or video images, according to company officials.

## A Portable resurrection

You believe that a product launched by IBM will sell because of those three magic letters, don't you?

I received a short, terse illustration of just how false that theory is when I was scrolling through The Source, a (costly) American bulletin board recently.

The Source quoted the Boston Computer Exchange, which reflects the prices of all micro systems new, second-hand, obsolete or simply available. And it had prices for the IBM Convertible (the laptop machine).

I was highly amused to find that the Convertible had reached a high point, on the open market, of \$US650. That was the maximum



price you could hope to get, were you a dealer; and (a footnote added) you'd be lucky to find anyone interested, even at that price.

Amusingly, there was another IBM computer there — the Portable. The Portable was launched a couple of years after Compaq launched its machine, in an attempt to take Compaq's market away. Software which would run happily on the ordinary PC and the Compaq, wouldn't run on the Portable; and, after a few unhappy months, IBM began to deny that it was no longer making the Portable. Then it did stop making it.

The Portable, obsolete, unloved and out of date, now sells for \$US100 or so more than the Convertible.

I assure you that both machines have the letters 'IBM' emblazoned in large friendly script all over them. **Guy Kewney**

## GraphWriter II automates data-retrieval process

A new version of Lotus's GraphWriter business graphics program supports a Lotus-style interface and menu structure, and also automates the process of retrieving spreadsheet data for charting purposes, according to sources who have seen the new software.

GraphWriter, a \$970 program that produces standard business charts and graphs, has not been updated since Lotus acquired the package and its parent company, Graphics Communications, in early 1986.

Lotus officials declined to comment on details of the new program, called GraphWriter II. However, Dave Tarrant, general manager of Lotus's Graphics and Document Products Division, acknowledged that the company is committed to extending its GraphWriter development.

*IBM in the US has rounded out both the low and high end of its PS/2 line with the introduction of the Model 25, a low-cost machine aimed at the education market, and a new version of the 80386-based Model 80 with higher storage capacity for use as a file server on a LAN for advanced scientific applications.*

*The Model 25, priced at \$US1350 for a monochrome configuration or \$US1695 for the colour-display version, is a small-footprint, self-contained 8086 computer that features one 3.5in, 720k, floppy disk drive; 512k of memory expandable to 640k; two expansion slots; and a built-in, 12in analog monitor.*

*Although the machine's packaging looked slick, many educational PC buyers were sceptical about the Model 25's power and its upgrade potential.*

*"It's a beautiful machine. It's sleek and slim," said Eydie Sloane, publisher of the Sloane Report, a newsletter which focuses on the use of computers in education. "However, the machine uses ancient technology — for example, the 8086 chip. If IBM is re-establishing an industry standard, why are they giving [the education market] a low-end entry model that uses old architecture?"*

*IBM's first attempt to break into the educational market was the PCjr. It was not well received by the public, and IBM discontinued it in 1985.*

*Anthony Schaller, a sys-*



*tems development manager said that because the Model 25 uses the 8086 microprocessor and lacks an upgrade path to the Micro Channel architecture used in the rest of the PS/2 family, "Most students will go for a higher performance machine."*

*Other features of the Model 25 include the same graphics capabilities as the PS/2 Model 30 — 256 colours out of a palette of 256,000 — and the new Space-Saving Keyboard, which offers the same layout as the standard PC keyboard but without the numeric keypad, making it around six centimetres smaller.*

*Options for the system include a \$US170 second floppy disk drive, a \$US49 128k memory expansion kit and a \$US314 Collegiate Kit.*

*While IBM did not announce a hard disk drive for the Model 25, sources inside the com-*

*pany said such a drive is forthcoming. Both versions of the Model 25 are available in the US immediately through IBM's authorised dealers. IBM also released a version of its Model 80, an 80386-based machine identical to the earlier offerings except for the inclusion of a high-performance, 314Mbyte, fixed disk drive. The new Model 80, priced at \$US13,995, can also be equipped with a second 314Mbyte drive for a maximum capacity of 628Mbytes. Both the Model 80 and the \$US6495 disk option will be available by the first quarter of 1988.*

*A spokesperson for IBM Australia said that the company is reviewing the products but no decision had yet been reached as to whether these models would be introduced to Australia.*

*APC is not sticking its head out when it says that they'll be here.*

"One area of key importance to GraphWriter is the way in which spreadsheet information is linked to charting information," Mr Tarrant said. "We are developing

GraphWriter with those goals in mind."

Unlike the current version of the program, the new release will allow users to select ranges to be graphed

from their worksheet files without having to exit GraphWriter, several sources said.

Users can name a range, and GraphWriter will





## And you thought the others were good

The Mannesmann Tally MT910 has redefined the price/performance standard in desktop, laser printers. Features such as dual bin feeder, high resolution graphics, selectable/downloadable fonts, 10 pages per minute, letterhead, envelope and overhead transparency printing, plus a combined 500-sheet holdings capacity. All listed as options with most other lasers.

The MT910 maintains software compatibility with standard printers such as the Epson (FX), IBM Proprinter, HP LaserJet, Qume and Diablo. MPA can even supply a shared interface device so that it can be shared by four separate computers.

But, most importantly, the MT910 is supplied by MPA, the company known for its excellent service and support standards.

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automatically go out to disk, retrieve the worksheet data and graph it, sources explained. A built-in window feature also lists the available worksheets in case a user forgets the name of the range he or she wants to graph, they added.

Another feature that links GraphWriter II more closely to a spreadsheet is its ability to automatically reflect a change in the worksheet without the user having to reset a graph.

For example, if a user changes the size of a range by adding another year, the change will be reflected accordingly the next time that graph is called, according to the sources.

GraphWriter II also lets users write scripts to design graphs — a feature that automates the process of creating a set of graphs that are needed regularly.

While corporate users and industry observers were pleased by GraphWriter's prospective ability to link spreadsheet data with graphics, most were more enthusiastic about its change of interface.

"It sounds like they're adding things other graphics programs already have," said John DeBay, a GraphWriter user. "It's important that the menu structure [of GraphWriter] be Lotus-like to increase the learning curve."

GraphWriter is one of two graphics programs offered by Lotus; the company also markets Freelance Plus, a \$970 free-form graphics and editing package.

GraphWriter II is expected in Australia around mid-October and is anticipated to retail for \$970.

Lotus products are available from Imagineering on (02) 697 8666.

## **DTP package aimed at 'everyday' users**

Ashton-Tate has entered the low-end desktop publishing



***SuperPaint for the Macintosh is quite a lot more than a 'latest version of' MacPaint.***

***Where MacPaint lets you put text into pictures but treats it like graphics, SuperPaint treats it as text which you can actually edit.***

***Where MacPaint sees only pixels, SuperPaint sees 'shapes' and has a 'draw' layer where they can be moved.***

***There are multiple windows, and a whole host of goodies like 300 dots per inch 'laserbits', and dot-by-dot editing of pictures at ultra-high resolution.***

***Full details can be obtained from the importer, Imagineering. SuperPaint retails for \$138.***

market with a program designed to improve the appearance of database-driven directories, price lists, inventory reports, memos, newsletters and overhead presentations.

The program, called Byline, is designed for the 'everyday' business user who is not trained in the field of graphics arts or typography, according to officials at Ashton-Tate. Byline was developed by Ken Skier, president of SkiSoft.

Features of the program include its ability to import files from several word processing, database and spreadsheet programs.

Byline directly imports and exports files created in Ashton-Tate's MultiMate word processor, WordPerfect and WordStar. Lotus 1-2-3 worksheets and graphs can be imported into the program.

A limited number of design features are also built into the Byline program.

## **Microsoft translator converts Turbo Pascal to C**

Microsoft officials hope Turbo Pascal programmers will soon be recompiling their programs using its translator, which converts Turbo Pascal source code to Microsoft Quick C code.

The as-yet-unnamed translator utility will be released in September in the US after the company begins shipping Quick C, said Rob Dickerson, Microsoft's group product marketing manager for languages.

The translator will enable Microsoft to tap the huge installed base of Turbo Pascal packages, estimated at 600,000 by its developer, Borland International. Borland officials declined comment.

"We want to paper the world with this thing and give Turbo Pascal program-

mers a straight forward way to get their code up under C," Mr Dickerson said. "If you have Quick C and you get this translator, even if you aren't a C programmer, you could port your stuff across and compile it and have smaller, faster programs."

It is likely the translator will be supplied free of charge in Australia to anyone who requests it after Quick C's release here in October.

Programmers said one reason to move from Pascal to C is that C is a very portable language that runs under a variety of operating systems, whereas Pascal is usually operating-system specific.

The programmers also said that translators are sometimes criticised for the unwieldy code they generate.

Mr Dickerson, however, said the Microsoft translator generates 'pretty' Quick C code. "There'll probably be something somewhere that won't translate, but we're pulling off translations of all of the publicly available Turbo Pascal programs," he said.

"The intent is for it to be able to translate 100 per cent of Turbo Pascal code."

After using the translator, programmers simply recompile the generated C code under either the Quick C or Microsoft C 5.0 compilers, said Mr Dickerson.

Additionally, programmers can use the utility to convert other types of Pascal code besides Turbo, he said, although the conversion would not be as 'perfect.'

The translator runs on PCs with 340k of memory, two floppy disk drives and DOS 2.0 or higher.

## **When the chips are down, Intel strikes**

When you think of Intel, you normally think of a powerful chip manufacturer. But although this is Intel's main



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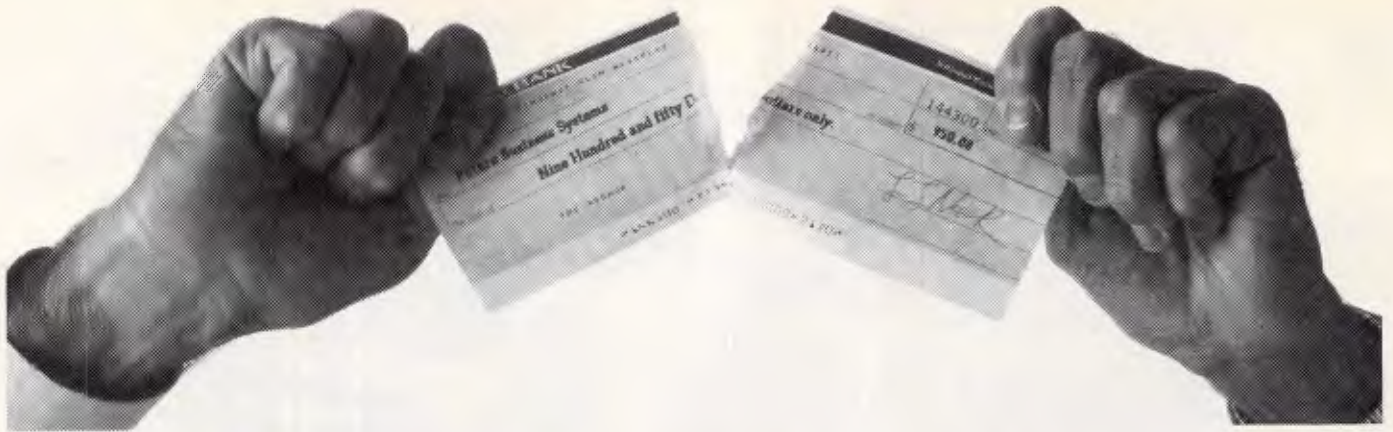
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line of business, it is not the company's *only* business.

Sources close to Intel claim that this leading-edge company is working diligently on many products, including some similar to those which Chips and Technologies (C&T) has developed in the way of chip integration. Intel plans to give C&T a real run for its money on comparative VLSI products.

However, Intel's PCEO group in Oregon, has been busy, too. This is the division which produces various Intel-labelled memory expansion boards, maths chips and add-on cards.

Now, this entrepreneurial part of Intel is jumping on the PC/fax card bandwagon and is about to release a card of its own.

Designed for PCEO by SpectraFax, a small company in Florida, this card will fit into the PC and turn a desktop computer into a fax sending and receiving device.

It will have its own fax modem onboard, and Intel insiders claim that it will offer features which most of the other boards on the market do not presently have.

This development is Intel's first foray into the complicated field of communications, and could be a sign that the company is looking seriously at modem chips and advanced communication logic devices.

Considering the strong competition that Intel is receiving from Motorola and Texas Instruments, it makes sense for the company to enhance some of its capabilities and examine new areas to broaden its product line.

The Intel fax card should be available by the end of the year.

**Tim Bajarin**

## **Sony's portable video system**

As a constant traveller who

often finds himself stranded in airplanes and hotels, I have fantasised about a combination TV and VCR which I could pack into my briefcase and carry with me wherever I go.

I could watch a colour VCR tape even while hurrying through an airport terminal or while standing in a queue waiting to buy tickets, if I so desired.

Word is just beginning to leak from Japan that Sony is actually showing a device like this to selected dealers, and could have it on the market by January 1988.

Called the Personal Video, it is about twice the size of a standard Sony Walkman, uses 8mm video tapes that are the size of audio cassettes, and has a built-in 5in TV screen which will have an improved flat-panel, liquid crystal display. It will use conventional NiCad batteries, and can be recharged to give four hours of use.

The Personal Video is expected to cost between \$1500 and \$2200.

Although Sony does not plan to launch this combined unit until next year, it will have, by the end of *this* year, the first product in its 'Personal Video' line. This will be a plug-in VCR and TV unit which has been designed for busy desks and kitchens. It will use Sony's standard 5in Trinitron tube and is expected to cost less than \$2200.

**Tim Bajarin**

## **PostScript: Apple's slice of the pie is cut**

For some time now Apple has enjoyed a long spell as the price-setter for laser printers. The standard LaserWriter retails for \$9690 while the LaserWriter Plus costs around \$11,069.

But, now that AST Research has introduced an under-\$9000 PostScript printer (available from Im-aging in October), you

can expect to see Apple — as well as Digital, Texas Instruments, Wang and QMS — react quickly to these new pricing pressures.

At the same time, IBM could be forced to lower the target price of its PostScript printer which, at the time of writing, is still under wraps.

In the meantime, Hewlett-Packard (which recently announced support for PostScript) may find it necessary, because of these lower OEM prices, to deal directly with Adobe instead of sub-leasing a printer from QMS, as has been widely speculated.

Adobe has been charging a standard \$US200,000 OEM entry fee, plus a hefty royalty tied to each laser printer with PostScript on the system. As a result, the prices of the PostScript printers have stayed high.

But, the new, lower prices reflect the pressure which Adobe is under from the PostScript clones that are being announced almost daily.

Adobe's most formidable opponent seems to be Phoenix Technologies. Rumour has it that this company, known primarily for its PC-clone BIOS software, will produce a PostScript clone superior to Adobe's.

Although this is bad news for Adobe, it is great news for consumers. Within 12 months, we could see PostScript, or PostScript-compatible, printers as low as \$5000.

**Tim Bajarin**

## **EGA prices erode**

Evidence is mounting that IBM's VGA will be the next widely-accepted graphics standard. Prices for both the standard EGA (640 by 350 pixels) and higher resolution 640 by 480 boards have been dropping and a swathe of manufacturers have announced their intention to produce VGA-compatible boards which will work with existing PCs.

One such manufacturer is Tseng Laboratories which has both cut the price of its existing high-resolution EGA board to \$499 from \$899 and introduced a 1024 by 768 pixel VGA-compatible chip.

The EGA board is sold in Australia by NEC Home Electronics and boasts an extremely fast zoom feature. The VGA chip is not yet marketed here. Dealers interested should call Tseng in Taiwan on (2) 712 1075.

## **Revised version quadruples expanded memory**

A new release of the Lotus/Intel/Microsoft Expanded-Memory Specification (LIM/EMS) offers a number of new features, including the ability to address four times as much memory as the previous version and support for multi-tasking of applications.

Version 4.0, announced last month in a joint press conference by the three companies, increases the amount of expanded memory available to users from 8Mbytes in the old standard to 32Mbytes. The new version also offers enhanced support for software written to execute in expanded memory. Under EMS 4.0, multiple applications can run simultaneously.

Intel next month will release, to registered owners of its boards, software drivers based on the LIM specification that allow those products to work with the new LIM versions, Mr Bader said. AST officials said drivers for its boards will be available by year's end.

Support for the new version of EMS came from many quarters. In addition to Microsoft and Lotus, software companies, including Borland and its Ansa subsidiary, embraced the new standard and promised to support it in future versions of their programs.



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Quarterdeck Office Systems announced support for the new specification in a new version of its Quarterdeck Expanded Memory Manager-386 (QEMM) for 80386-based machines, and a new QEMM product for PS/2 Models 50 and 60.

Lotus officials said future versions of its programs — including release 3.0 of 1-2-3, due in the first quarter of 1988 — would take advantage of two key features of the new LIM: multi-tasking and dynamic linking.

In fact, the new specification gives users some of the capabilities promised in the OS/2 operating system due next year, allowing the migration to the new hardware systems and operating systems to occur over a longer time span.

For corporate users, the new EMS version means they won't have to wait for OS/2 applications that offer multi-tasking capabilities, said David Reed, a Lotus vice president.

### **Borland confirms its plan to offer spreadsheet**

Borland has confirmed its plans to offer Quattro: The Professional Spreadsheet, but has offered scant information about the program.

The 1-2-3 compatible package offers presentation-quality graphics, fast spreadsheet calculations and operations, a complete macro development environment and a customisable user interface, Borland officials said.

The firm has yet to determine the package's price, however.

Borland President Philippe Kahn confirmed the spreadsheet will be sold through Borland's worldwide network of dealers and distributors and through Ansa's direct corporate sales force. He said it will ship before the end of the fourth quarter. Borland's beta testers seem impressed with Quattro.

"Recalculation is just fantastic; you can easily see performance increases over Lotus 1-2-3 of three to four times," said Doug Cobb, president of The Cobb Group of Louisville, Ky., the publisher of business software books and journals. Mr Cobb plans to publish a book on Quattro.

"The graphics are vastly improved over 1-2-3. And it lets you customise the user interface."

Borland beta testers confirmed the program's use of sparse matrix technology or minimal recalc, which improves the speed of recalculations.

### **Hypertext begins to appear in micro programs**

Hypertext, an information-management technology still in its infancy, could become a strategic corporate resource in as few as five years, according to industry experts and corporate executives.

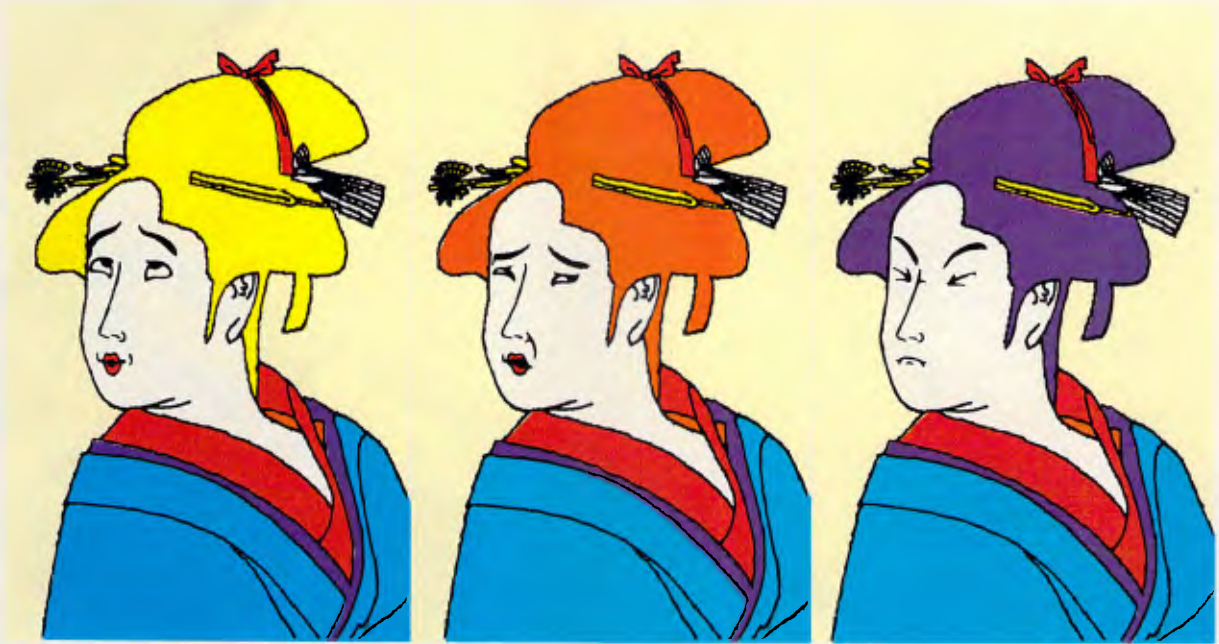
Hypertext programs, which are just beginning to appear, allow personal computer users to quickly search and retrieve text, graphics, video images and digitised music stored in large databases and then to compose electronic documents containing any combination of the gathered data.

The hypertext concept, which was first proposed by academics in the mid-1970s, builds upon several kinds of software applications — including high-speed search and retrieval, data compression, data translation and imaging software — that allow users to actually assemble on screen a dynamic, electronic document with links to many other data files.

Before hypertext can be widely implemented in a PC environment, however, the cost of a number of key hardware components must fall, according to computer scientists.

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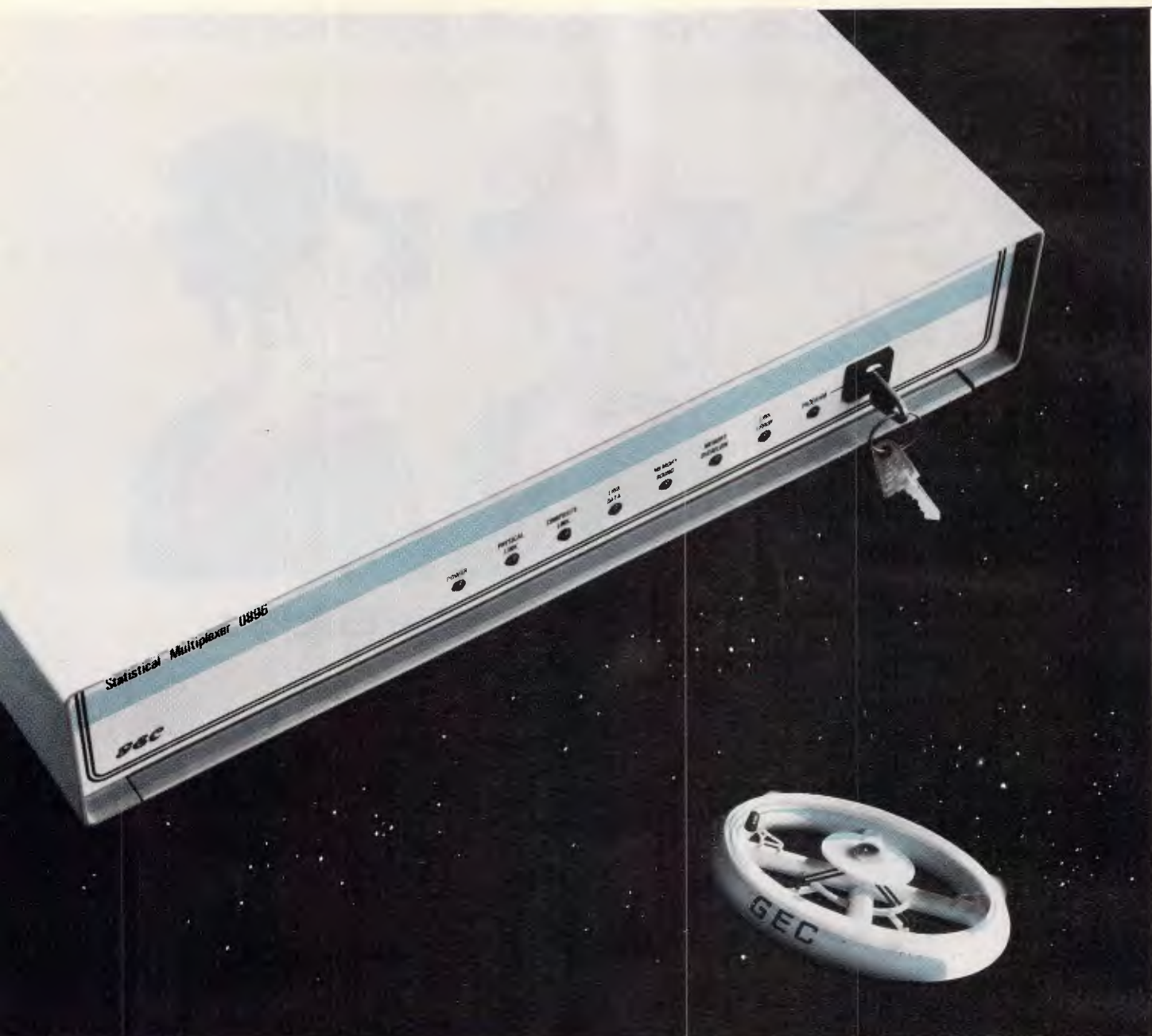
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patibles] PC hardware costs associated with hypertext environments — high-resolution monitors and display adaptors, CD ROM units and other peripherals — to drop before there is a real market for this type of software," said Robert Shostak, a vice president with database manufacturer Ansa Corp.

Still, commitment to the hypertext concept is growing among hardware and software suppliers and some corporate users, according to Thomas Mandel, a researcher with the SRI International think-tank organisation in Menlo Park, California.

Mr Mandel cited the recent release by Apple of HyperCard, a hypertext program for the Macintosh Plus, SE and II computers. Owl International, another US company, subsequently announced that it will provide equivalent functionality for PCs with a revised version of its hypertext-like program, Guide, which runs under Microsoft's Windows for the IBM PC environment.

Apple's HyperCard was written chiefly by Bill Atkinson, a veteran Apple scientist, who said it took him and others about three years to complete the Macintosh

program. First demonstrations of HyperCard-based systems last month at the MacWorld trade show by such on-line database suppliers as Dialog indicate that the new technology will best address the needs of libraries, universities and market-research organisations, primarily because of high data retrieval speeds, Mr Mandel said.

"Hypertext systems let people look at data in ways they've never been able to before," he said.

For example, a hypertext financial-marketing model could integrate real-time inventories with up-to-the-minute sales information and sales projections obtained from an on-line source, providing corporate executives with faster, more flexible ways of evaluating actual performance versus predicted performance.

"There are a lot of corporations — particularly marketing-driven companies — dependent on specific applications, that can benefit from hypertext applications," said Mr Shostak. Because hypertext documents can contain linked files that are limited in number only by the constraints of the system, corporate users looking to develop their own information systems could more ef-

fectively create documents containing graphics linked to text; these in turn can be linked to a database of video or other data files, Mr Shostak said.

However, when shared among large numbers of users, there is a real potential that hypertext documents could become unmanageable, said Robert Carr, a chief scientist at Ashton-Tate. The CPU could be tied up as the hypertext program moves from one database to another, he said.

Also, because hypertext documents are image-oriented and incorporate multiple types of information, it may take some time for users to become familiar with a new way of handling data, said Jeff

Ehrlich, manager of product technology at General Electric. Even so, corporate MIS executives given prerelease copies of HyperCard by Apple expressed interest in hypertext's potential.

"The uses for it are so varied that, in its present state, we are seeing more demonstrations of potential applications than real applications," said Mr Ehrlich.

## Bludner

It seems we (or the PR firm concerned) got IDEAssociates telephone number wrong in last month's Newsprint item on the IDEAcomm 5251 board. IDEAssociates is on (02) 387 5222.

END



*'We've fed all the permutations into the computer and it comes up with the same answer each time.'*

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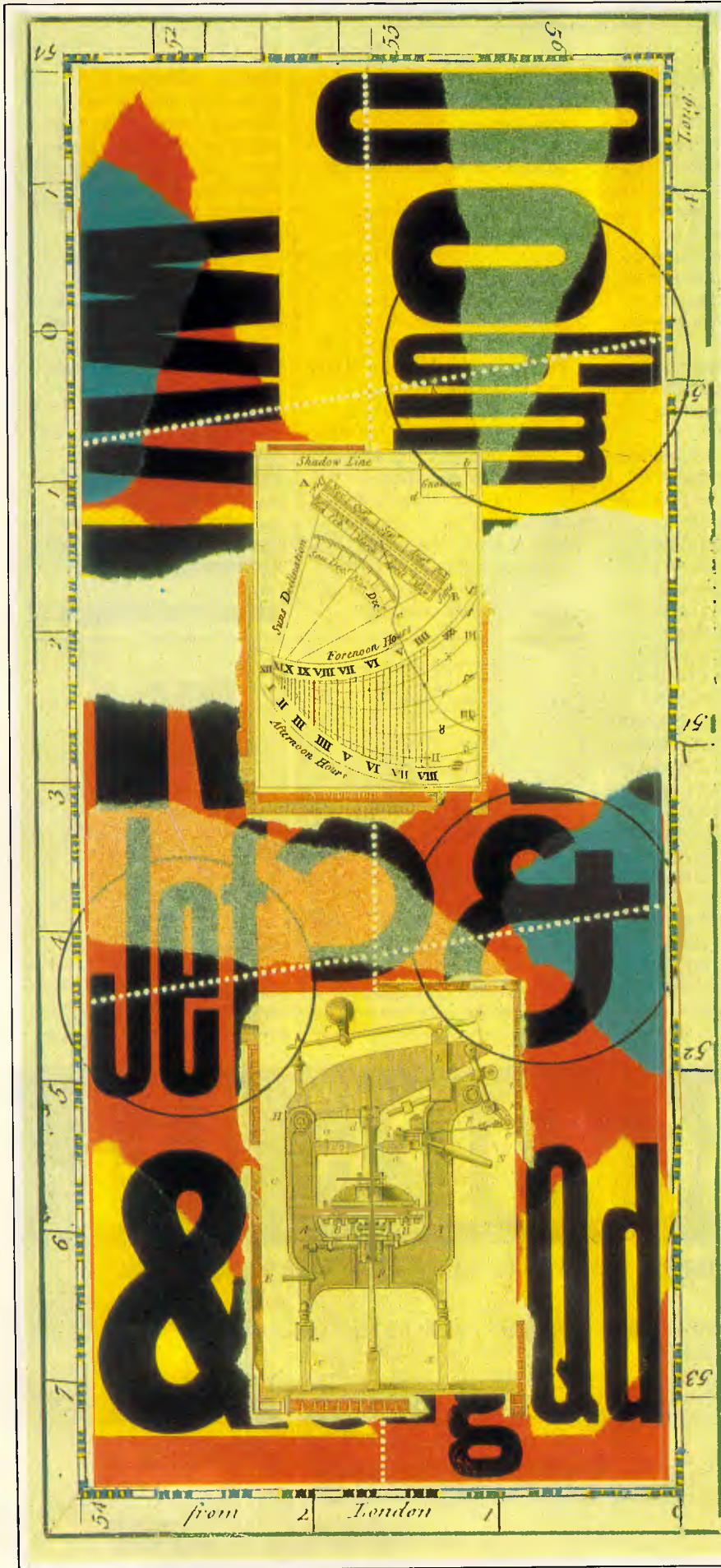
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**The competing methods of forming the printed word are establishing market niches. All methods, it appears, will be with us for the foreseeable future.**

**This month's massive printer survey begins on page 162.**

### **Impact printers**

To most companies the letters, contracts and other printed documents that go winging their way between offices represent the external face of the company. Consequently quality is all important and buying a printer that offers the necessary degree of quality is essential.

Until quite recently, however, a quality printer has meant a daisywheel or 'golfball-type' printer and such devices not only cost dearly in financial outlay — they are expensive — but also in time — they are slow — and human tolerance — many are unbearably noisy. But things have been changing.

The 24-pin dot-matrix printer has arrived and is steadily eating into the 'ready-formed character' printer market. As with the earlier 9 and 12-pin matrix printers the more advanced 24-pin printers are cheaper, significantly faster and far more flexible than daisywheel. The additional pins, which can make character matrices several times more dense than those produced with earlier matrix models, are also chipping away at the differences in quality between these two main types of impact printer to almost nothing.

Consequently, many suppliers are predicting the demise of the daisywheel over the next few years, and are moving out of that area of the market into either advanced dot-matrix or non-impact printers.

A spokesman for Epson, which dropped its daisywheel range two and a half years ago, believes that the daisywheel market has now certainly peaked and is beginning a slow decline that will take place over the next few years. But although the spokesman acknowledges that much of the impetus behind this is due to desktop publishing and the generally higher awareness of what good printers can do, he



# Printer overview

believes that the daisywheel will not just lose out to lasers, but will also continue to be eroded by the continuously improving dot-matrix machines.

Speaking out in defence of the daisywheel, however, is a spokesman for Brother's daisywheel machines. "Certainly enhanced dot-matrix and laser printers have had a big effect on the daisywheel market," he said, adding that "in many cases the effect has been enough to force manufacturers out of the market, but Brother has no such plans and is in fact picking up more sales due to the decreasing number of contenders in the market." He believes that many low-cost daisywheels have been going to users who have bought a low-cost PC and want a similarly priced, but high-quality printer to go with it.

He also points out that even 24-pin matrix printers still produce output that is clearly made up of dots. "For the perfectionist even enhanced dot-matrix output is not as good as daisywheel," he maintains. The future for daisywheels is likely to be in vertical 'quality output' markets such as legal work.

With regard to the speed of product development and enhancement in the dot-matrix market, Epson quotes a typical lifespan of only 10 to 12 months for its printers. "That's as long as they can last without an upgrade," he says, "which will usually be to both speed and quality."

This pressure for continuous development is primarily due to the fact that printers have to mirror whatever is happening in the PC market itself. Although matrix printers started off in data processing applications, speedily producing reams of draft quality print-out, they now accompany the PC in the whole gamut of business applications.

As a result the dot-matrix printer market is now made up of a mass of general-purpose units than can be con-

figured to any one of these applications, but are 'jack-of-all-trade' machines and are not particularly good at any of them, supplemented with an increasing number of more specialist dot-matrix machines.

Selecting from the mass of general purpose machines should theoretically be easy as there is a good selection at each point in the price spectrum from \$400 to around \$4000. There are usually also clear market leaders at each point, but as with the IBM PC these often get to the number one slot by virtue of the marketing muscle of the manufacturer rather than technical brilliance.

As with any type of purchasing decision it helps to know as specifically as possible what the printer will be used for, what equipment it will be used with and any near-future plans to expand the application in any way.

If nothing else, this basic knowledge will help to ensure that the printer has the right interface(s) and comes with the necessary paper feed devices.

In many cases one or other will not be included as standard, in which case it is worth shopping around to see if it is possible to buy a unit with the required add-ons included so avoiding extra add-on costs.

It is also well worth trying out one or two of the printers that fit your bill, as many manufacturers are now turning to the 'user interface' to help make their products stand out from the crowd.

Ideally most of the printer's functions will be easily selectable from the front panel of the printer rather than via the traditional, awkward dip-switch method and in many cases the character pitch (characters per inch) will be dial-selectable from the front panel rather than via obscure downloaded commands. Also look out for protection against overheating and design attributes to minimise the noise level.

## Non-impact printers

Broadly speaking the non-impact printer market is far from an equal three-way fight. The heavyweight is undoubtedly laser-printer technology and close relations thereof, the bantamweight is ink jet technology and the flyweight, content to fight for market niches, is the thermal printer.

But these positions have resulted more from the number of contenders in the market than the real relative strengths. He who shouts loudest gets heard more and in this case it's certainly the combined voices of the laser-printer manufacturers and suppliers that are being heard almost to the exclusion of the other two.

Lasers have got to this leading position for two reasons: falling prices have brought the technology within reach of a far wider sector of the PC-user market; and the conception and meteoric growth of the desktop publishing market have created what many see as a completely new market to sell into. Consequently, few companies have been able to resist the laser-printer bandwagon and each new market entrant has contributed to the escalating hype.

Admittedly these developments are a genuine windfall to those users that really do need what laser printers can offer but others would be well advised to ignore the noise at least for another year, and look instead to the market underdogs.

Both ink jets and thermal printers have one attribute that lasers cannot yet touch — colour printing.

Under software control, leading ink jets can produce several thousand shades and although significantly more expensive than ink jets, thermals are highly commendable on colour quality. But the route to effective colour printing has not been easy in either case.

Ink jets, whether colour or mono-



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## SURVEY

chrome, create characters or graphics in a similar way to dot matrix printers but have a matrix of ink nozzles rather than pins in the print head. Like dot matrix printers, ink jets have advanced from eight nozzle to 24 heads with resultant improvement in both resolution and, in the case of colour units, far more sophisticated multi-hued output.

Not surprisingly one of the main problems in getting to this level of sophistication has been the messiness of the technology — a problem which several of the more basic models still suffer from. Liquid inks have a tendency to clog up either on the page or in the head, which needless to say detracts from both colour quality and reliability.

Techniques used to try and overcome the problem have included vapour inks which are sprayed rather than squirted onto the page and hot inks which are solid while in the printer but melt in the actual act of printing to re-solidify on the paper. It would be inaccurate to say that these alternatives have completely resolved the problems but reports claim that they have certainly improved both quality and reliability.

Thermal transfer printers function by way of a hot print head and a coated print ribbon. The head melts the coating from the ribbon onto the printed page. In the case of colour printing the ribbon is divided into several, usually four, colours and the head has to make several passes in order to get a touch at each colour. The system is similar to colour dot matrix printers but, without an actual impact on the page, thermal printer output tends to look far less battered. As the accompanying APC Printer Survey shows however, thermal printers are not for the financially weak in pocket to either buy or maintain.

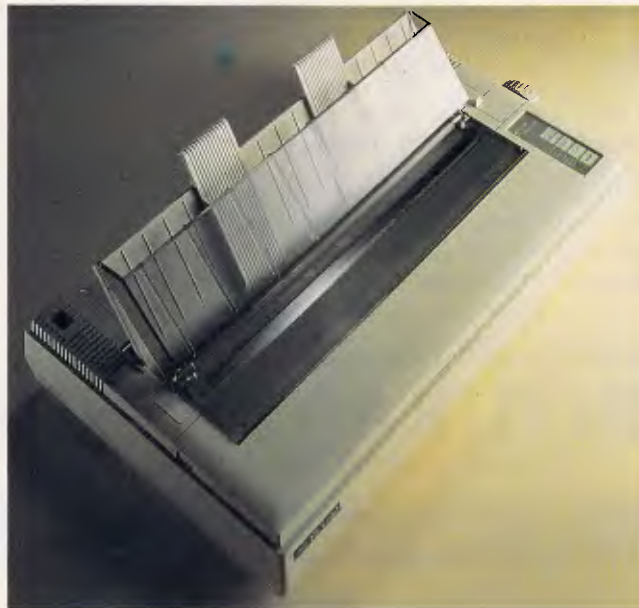
Another problem with earlier ink jet and thermal printers that still cannot be dismissed as fully overcome is that standard office paper won't always do. While some manufacturers do seem to have got over this, others still recommend special paper is used.

With colour lasers still said to be two years away, the obvious application for both ink jets and thermals is in business graphics. As both still produce an obviously dot-based output rather than continuous lines, neither is really competitive with plotters in the CAD market which ties them both to business charting and presentations.

To enhance their suitability to this market most models can print on overhead projector film and can combine text and graphics on a single page.

Unlike most other sectors of the printer market, these two areas are not

# A word of advice for those considering the purchase of an NEC or Epson printer...



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# SURVEY

crammed with competitors but there is still a wide array of prices. This means there is relatively little direct duplication from model to model. Most are fairly specifically targeted and it will certainly help to know exactly what is needed in order to find the right one.

Bowing to market pressure, the rest of this copy is dedicated to lasers, light-emitting diode-based printers, liquid crystal display-based printers, ion deposition printers and other electrochemical page printers, all of which are close enough in features and benefits to be crudely rounded-up into the final category.

For the earnest purchaser, the differences between the technologies stem from the way that the image of the page is etched onto the print drum and transferred to paper. Some technologies etch the characters and others etch the white space around the characters but the exact benefits of the different methods are difficult to assess as contradictory

claims are often made by different manufacturers.

An encouraging fact however, is that there is nowhere near as many technologies as there are printers on the market. This is because most suppliers don't manufacture their own 'innards' but buy them under an OEM deal from a stock of about a dozen core print engines. The Apple LaserWriter and HP LaserJet are, for example, both based on the Canon LBP-CX print engines.

Unfortunately this doesn't mean that the LaserWriter and LaserJet both offer the same features. On top of the basic engine, suppliers have a wide choice of extras that they can bundle into the overall unit to either optimise general performance or steer the printer towards some specific market sector.

Apple's LaserWriter has, for example, been aimed singlemindedly at the desktop-publishing field and is consequently padded out with generous add-ins in order to cope with page layouts

that include both multiple fonts and bit-mapped graphics.

Among the add-ins is a 12MHz 68000 processor chip which houses Adobe's PostScript page-description language — the program that interprets the layout of the page from the information sent by the host PC to a format that means something to the printer.

Since lasers are widely promoted as going hand-in-hand with desktop publishing, it is surprising that so few machines have followed Apple's lead with PostScript or for that matter any other description language.

Where a processor is built into the printer it will invariably be housed on an add-in card. This will also have an amount of RAM and/or ROM, where typefaces can be stored either as resident features (in ROM) or as optional extras downloaded from either font cartridges or disk (in RAM). The image of the complete page is also stored in RAM before printing. The make-up of

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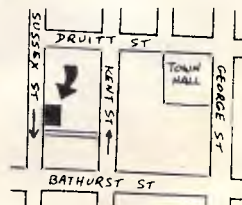
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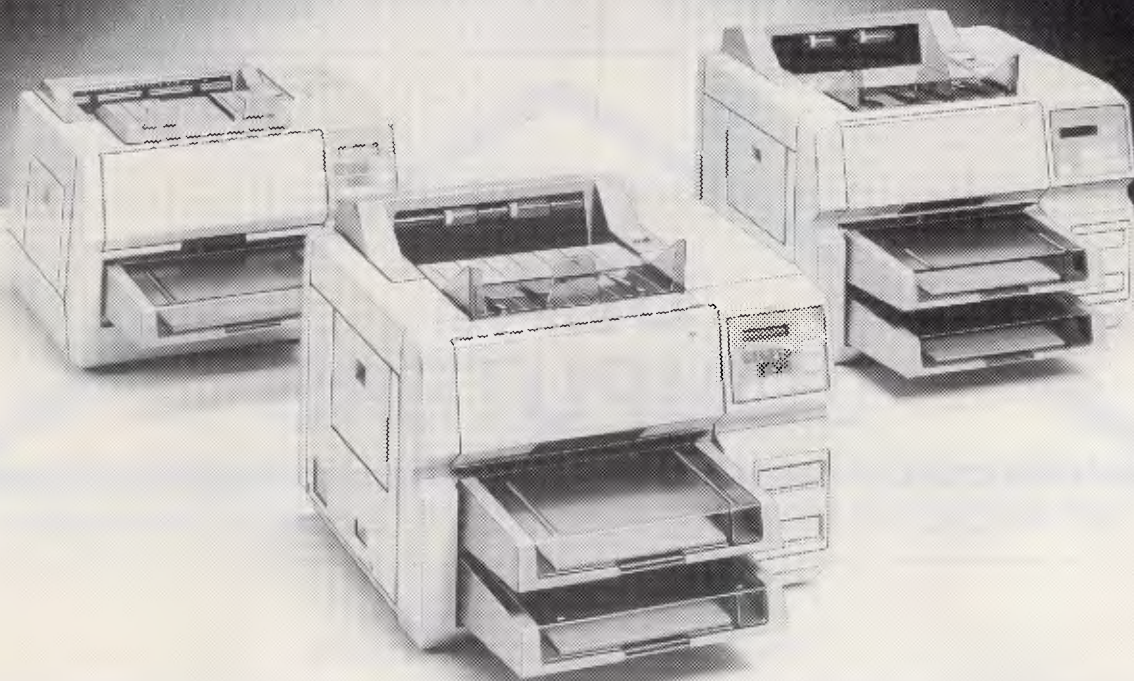


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APC3460



## SURVEY

the add-in board is consequently the major determinant of printing performance.

Also bundled by the manufacturer may be communications facilities that allow the printer to be used as a central resource in a network and this then demands that there is enough memory available for a buffer to store jobs for printing without clogging up the rest of the attached network.

An area in which laser printers are often lacking is in paper-handling facilities. This is particularly true if the printer is used as a shared resource by a number of users, some of whom may

use it remotely. Most, but not all printers, come with standard input and output trays of at least 50 sheets. For a shared printer however, a hopper of at least 1500 sheets would be more appropriate. It would also help to be able to select from different hoppers remotely, ie, either A4 or A3 paper, but this, at the moment, is pie in the sky with most machines. Many don't support anything other than A4 and American sizes.

With the number of grandiose claims that are made for laser printers it is easy to be critical. They are fast, but not usually as fast as the manufacturer claims — as it will usually choose to talk

about time per copy rather than time per original page; and they are flexible although often it will cost dearly in optional extras to reach the flexibility (eg, font and graphics handling) claimed in the supplier's literature.

The standard resolution of 300 dots per inch also guarantees higher-quality output than most dot-matrix printers, but to the discerning eye the impeccable quality of daisywheel printout is worth staying true to if text without different fonts, graphics and letters with varying point sizes are your primary concern.

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**COMPETITION**

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Programs will be rated primarily on the degree of compression they achieve, but with very minor consideration to speed. The programs will be required to operate on a variety of data files, including databases, text files, spreadsheets, source code and executables.

Entrants may utilise absolutely any approach they like, no matter how standard or off-beat.

Source code must be supplied, and

our evaluation panel will rigorously test each entry.

A broad description of the approach employed should also be provided. Any program which does not decompress the data back into its original form will automatically be disqualified, regardless of its speed or degree of compression attained.

Fig 1 shows the conceptual simplicity

of the contest. Your mission (should you choose to accept it), is to construct the compression and decompression programs, each one reading its input from a file and writing its output back to another file. There is only one prize, first prize, and it's \$30,000.

This could prove to be the easiest money you've ever made. Even if you take a week off and dedicate the time to this project, your cash return will equate to \$750 per hour — almost as good as Robert Holmes a Court.

Many of the best compression methods are simply elegant, and so the amount of code you end up writing may not be very large. Many technical libraries contain quite old books on forgotten compression algorithms developed in the fifties and sixties, then abandoned due to their high CPU overheads, never to be used again. These forgotten algorithms are appropriate for use in this contest, as we're mainly after high compression rates, not speed.

Similarly, many other branches of science and mathematics have developed well established disciplines which have implications to data compression. You may well find that some obscure, or well known, branch of statistics leads to a new technique for compression.

Alternatively, you may discover that a number of very well known compression techniques, when applied in a cascade of the correct sequence, yields uncommonly high degrees of compaction. Remember, the time taken to compress the files is of little significance, and if program A provides twice the compression of program B, but takes twice as long to run, then program A will win.

We're leaving you lots of time to ap-

proach this properly. Entries may be received up until January 4, 1988. We will be running articles in the next two issues of *APC* providing insights to some of the approaches to compression, introducing more sophisticated techniques as we go. You can also assume that if your creation cannot exceed the performance of the examples we present, then you'll need to apply a bit more spit and polish.

## Entry requirements

To enter, all you must do is supply a diskette containing two programs, one to compress a file, and one to decompress it. Each program should prompt for the input and output file names. The diskette must be clearly marked with your name and address.

An accompanying note should briefly describe the approach you have taken, naming any recognised algorithms you have employed.

All programs must be able to run in one of the following environments:

- Under Microsoft MS-DOS version 2.0 or higher, on IBM compatible hardware. Entries must be supplied on 5 $\frac{1}{4}$ in MS-DOS format DSDD diskettes, and should be independent of co-processors or other hardware assistance.
- On either a Macintosh Plus or Macintosh SE.

In both situations, entries must be accompanied by a suitable SSA package should its return be desired.

If you do not have immediate access to a Microsoft MS-DOS-based system or a Macintosh, we recommend you develop your software on whatever machine you have, whether it be a Commodore 64 or a CDC Cyber. You can then port your finished solution to



# COMPETITION

an MS-DOS machine or Macintosh before sending it in and planning what to do with the thirty big ones.

All programs received will be evaluated on the same machine, utilising a freshly formatted RAM disk to eliminate any discrimination due to disk fragmentation between runs. Each program will be measured on a variety of file types, and a weighted average will be calculated. The evaluation environment will be carefully controlled to ... er, well.... it'll be carefully controlled.

The entries may be developed in any language or languages you choose, as long as it's a Microsoft language. Microsoft GW-Basic interpretive programs are perfectly acceptable, as are 'C', assembler and Pascal. However, both source code and executable (compiled) forms should be provided. We're interested in how you've done it, but don't want to go searching for other software required to run it. Remember that speed is not of primary importance, but if two programs achieve very similar compression ratios, then the faster program will win.

Details of the index used are contained in the box at the end of this article.

## Compression techniques

All compression techniques are based around the elimination of redundant information.

For example, consider a single bit which may be either 1 or 0. This information takes one bit to store, and contains absolutely no redundancy. There is no more compact way of expressing the fact of 1 or 0, other than utilising a single binary digit to do so.

However, consider a string of bits, for example, 1111111000011111. This information has taken 16 bits to store in its present form. Looking at the data, we see that it contains long 'runs' of bits all the same value. Therefore, rather than store the contents of each bit, the information could be presented more compactly by only storing the transitions from a run of ones to a run of zeros. For example, seven ones, four zeros, five ones. Indeed, utilising perfect knowledge of the data to be encoded, we do not even have to remember whether a given run was of ones or zeros, we can deduce that it is different to the preceding run, and make the assumption that all data streams begin with a one. If it turns out that the first run is not of ones, then we simply store an initial run length of zero.

Using this approach, the above data

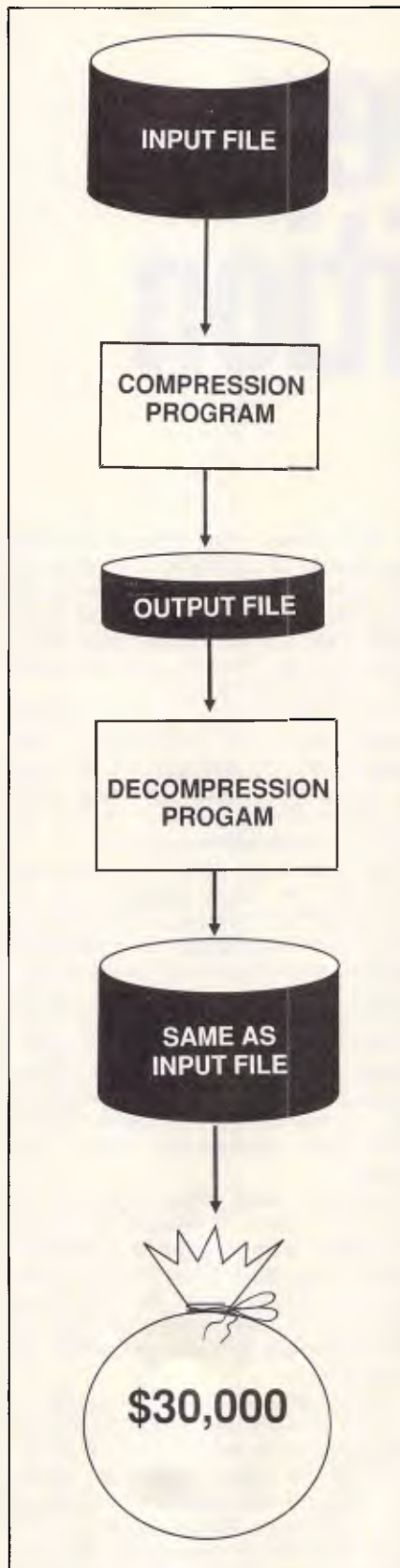


Fig 1 Conceptual structure of the contest

could be encoded to just 7,4,5. Or, assuming three bits are used for each run length, 111100101. The original 16 bits has now been reduced to nine bits. As you can see, the coded form still consists of runs, but smaller runs. In other words, it still has a degree of redundancy and is probably eligible for further compression.

This technique is known as run length encoding, and can be applied to either individual bits or streams of bytes. Most good terminal protocols utilise run length encoding in a transparent manner to reduce line loading, as the average screen full of data contains many runs of blanks, minus signs and asterisks.

The difficulty in run length encoding is that sometimes there will be no suitable runs, for example, 1010101010 or '\*\_\*\_\*\_\*\_\*\_\*\_\*\_\*\_\*\_\*'. These streams may still be suitable for a form of run length encoding, simply by recognising that the unit being repeated is not a single byte or single character, but a sequence. Thus the bit stream could be encoded as five groups of 10.

Run length encoding initially seems to be the answer to all the world's problems, not to mention your new car. However, a number of problems emerge as you get closer to the problem.

The first challenge is that some portions of the data stream may not be at all suitable for run length encoding, and some form of marker must be created to indicate when run length encoding has been employed and when it has not. This marker must be totally unambiguous, in other words, there must be some way of not confusing it with bona fide data. Some approaches to this problem include utilising a run to indicate that run length encoding is about to be used. The decompression software sees the unencoded run, and knows that run length coding is about to be employed.

The other difficulty lies in choosing an appropriate size for the expression of the length of each run. In the above example, we utilised three bits to represent each run length, allowing for a maximum possible run of seven bits. This approach would suffer if a run of more than seven bits were encountered in the input file. Again, various approaches exist to circumvent the problem, including one whereby a run of 10 bits would be encoded as a run of seven bits, followed by a run of zero complemented bits, followed by another run of three.

Choosing a large number of bits to

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represent the run length imposes an obvious overhead, as small runs then become very inefficient to encode. On the other hand, if a small number of bits is chosen, then the massive benefits which normally result from a large run will be wasted away. Some approaches involve using a variable number of bits to represent the length of each run. This technique works well, but introduces its own overhead in somehow representing the end of each number. Bit stuffing is sometimes used to achieve this.

The compressed data stream does not have to be a simple structure. For example, a 'map' could be included so that the decompression software knows what techniques have been employed in various regions of the compressed file. For example, a map of 200-0, 800-3, 30-8 could mean that the first 200 bytes are completely unencoded, the next 800 bytes utilise run length encoding bit a length size of three bits, the next 30 bytes use eight bit quantities to represent the length of each run, and then expect to find another map.

## Under-utilised domains

Sometimes very simple methods provide quite good compression ratios, or at least a good head start.

Take, for example, simple text files.

The ASCII character set contains about 96 displayable characters, including upper and lower case forms of each letter. Computers use eight bits to store each character, when really only seven bits are required to store 96 different values. Simply by eliminating the eighth bit and repacking the characters, a compression factor of 12.5% may be achieved.

A factor of 12.5% may not seem very impressive, and eliminating the eighth bit may not be at all suitable for WordStar document files, but when combined with other techniques, the head start gained through eliminating an under-utilised domain of each byte can prove significant.

This is even more true for upper case streams of text, which only requires six bits to represent all possible characters. Utilising six bits instead of eight produces an up-front compression factor of 25%.

Again, sneaky techniques can be used to make these techniques viable even when they seem not to be appropriate. For example, if text is primarily all in the same case, with relatively few characters in the other case, then a map or switching symbol could be utilised to indicate case changes. Even more sneaky is a technique which can be applied to text files, which are predominantly lower case. Text files contain a few upper case characters,

but their placement is according to rules. One simple rule is that the first alphabetic character following a full stop will be in upper case. If the compression system knows that the file contains normal text, then it can automatically recapitalise the first word in each sentence without spending any file space. Less space-efficient means could then be utilised to identify capitalisation which is not according to the standard rules.

Of course, one must carefully consider the effort expended and the return received. A saving of 25% for simple character packing sounds like good value, but saving an additional 1% for complex upper case prediction is probably not.

Alternatively, rather than eliminate an underutilised portion of the domain, the domain can be preserved and simply redeployed in a more useful fashion. The unused eighth bit, for example, could be utilised to indicate that a space follows. Setting the bit to a one means insert a space after this character, and leaving it at zero means do not insert a space. Where the eighth bit genuinely does form part of the data, then this exception could be dealt with by inserting a space into the compressed file. Since the decompression routine knows that it should see absolutely no spaces in the compressed file, then it can reliably assume that the presence of a space indicates that the preceding byte with its eighth bit set is not a command to insert a space, but a bona fide eighth bit of data. If the average length of a word in normal text is five characters followed by a space, then this approach will yield an immediate saving of 16%.

This approach results in the eighth bit being usefully engaged at the end of each word, that is, only about one fifth of the time. The technique could then be combined with other techniques to indicate capitalisation, thereby reducing the character size from eight bits to seven. While it may seem that using the one bit to indicate special effects both at the beginning and end of the word is ambiguous, particularly when the word delimiters (the spaces) have been removed, it really is not. All you have to do is assume that the text file commences with the beginning of a word and not the end of a word — a reasonable assumption — and then the whole process stays in synch for the rest of the file.

Machine code files and binary data files are rarely suitable candidates for this type of compression, but do offer their own opportunities.

## Entry checklist

1. Two programs: COMPRESS and DECOMPRESS, each prompting for input and output file names.

2. Programs to be supplied on either MS-DOS 5 $\frac{1}{4}$ in DSDD disks or Macintosh Plus or SE disks, clearly labelled and with a suitable SSA should return be required. No responsibility will be accepted should the disk or accompanying documentation be lost or damaged.

3. Both source code and an executable form to be supplied.

4. Description of your approach to be included, detailing any 'known' algorithms you have employed.

5. Only Microsoft language or languages may be utilised.

6. Must be independent of any hardware assistance.

7. Decompressed file must be identical to original input file.

8. Entries to be evaluated on the basis of average weighted compression ratios achieved. Speed is of minor importance.

9. Entry closes at 5pm on January 4, 1988. Entries must arrive at either 47 Glenhantly Road, Elwood Vic 3184 or 124 Castlereagh Street, Sydney 2000 addressed to 'Microsoft's Data Compression Competition' by this time in order to be eligible for inclusion in the competition.

10. Employees of Computer Publications may not enter.

11. Any entry which does not satisfy the entry requirements may be disqualified by the evaluation panel.

12. The winner will be announced in the February 1988 issue of APC, and will receive a cheque for \$30,000 by February 10, 1988.

13. Microsoft's Data Compression Competition is open only to Australian residents. Entry by Computer Publications' employees and their relatives is prohibited.

14. The judges decision is final. No correspondence will be entered into in relation to the selection of the winner.



## COMPETITION

### Repetitious data

A common and effective form of compression relies on the fact that most information consists of a set of repeated symbols and a set of non-repeated or rarely repeated symbols.

For example, in this article, the words 'in', 'and', 'or', 'are' and 'compression' feature regularly. If these words are replaced with markers of a smaller length, then significant savings can be achieved.

The common words can either be identified by an individual symbol which is unlikely to appear in the data stream, such as the non-displayable ASCII characters (which imposes a limit on the number of words which can be encoded) or through a single symbol followed by a word identifier as a subfield. For example, the symbol '\*' could be used as a marker, and '\*1' could stand for the word 'compression'.

Where a true asterisk is required, this could be represented by two asterisks in succession, much the same way compilers recognise a quote enclosed in a quoted string. That is, the character '\*' would be encoded as '\*\*', or two asterisks in the input file would be output as four asterisks.

This implies an overhead when the marker itself is encountered in the input file, but a suitable choice for the marker can minimise the overhead suffered. Some approaches even involve determining a suitable marker depending on the data encountered in the file, and outputting the chosen marker as the first character in the compressed file. The decompressor then takes whatever character appears first and utilises that as the marker in its decompression strategy.

This approach is particularly successful when used on program source files, as any given language consists of keywords which appear with great regularity throughout the source. In Pascal, the words 'BEGIN', 'END', 'INTEGER', 'PROCEDURE' and so on would produce very effective compression. Additionally, user defined variable names will prove quite common and may be good candidates for compression.

It is even possible to utilise some knowledge about the syntax rules of the language to compress the source even further, although the system would have to be able to deal with exceptions when the source is syntactically incorrect.

The key point about this form of compression is to consider local effects within the data stream. A text file may

commence with one set of very commonly used words, and then switch to another set of commonly used words after a few pages. If the system is not adaptive, then it will miss the opportunity to encode the second set of common words. Many systems monitor their own performance as the compression proceeds, both in terms of overall compression and the compression achieved over the last thousand bytes or so. If the recent performance starts to suffer, then it may employ a different technique or back up the file and try to determine a new set of common words.

These techniques, even in the simplest form, can yield up to 50% compression.

### And more

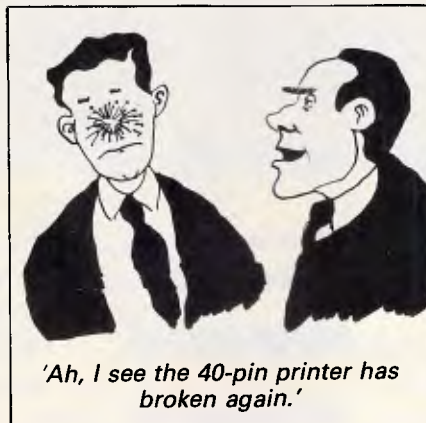
There are so many possibly compression techniques which may be combined together that the possibilities are virtually limitless.

The main point to remember is that the process must be totally transparent; that is, the technique should not place any restrictions on what data may be encoded. A strategy designed to compress text should not fail if it suddenly encounters a non-displayable character, such as hex FF. In other words, the technique must be able to deal with exceptions, and although the exceptions may not be compressed as efficiently, it should never lose data just because it received a character it did not expect.

While it is acceptable in the compression of audio or visual information to lose small amounts of data, it is not acceptable in the compression of digital information.

We'll be presenting some other ideas for compression next month. But in the mean time, get coding and start paying more attention to new car advertisements.

END



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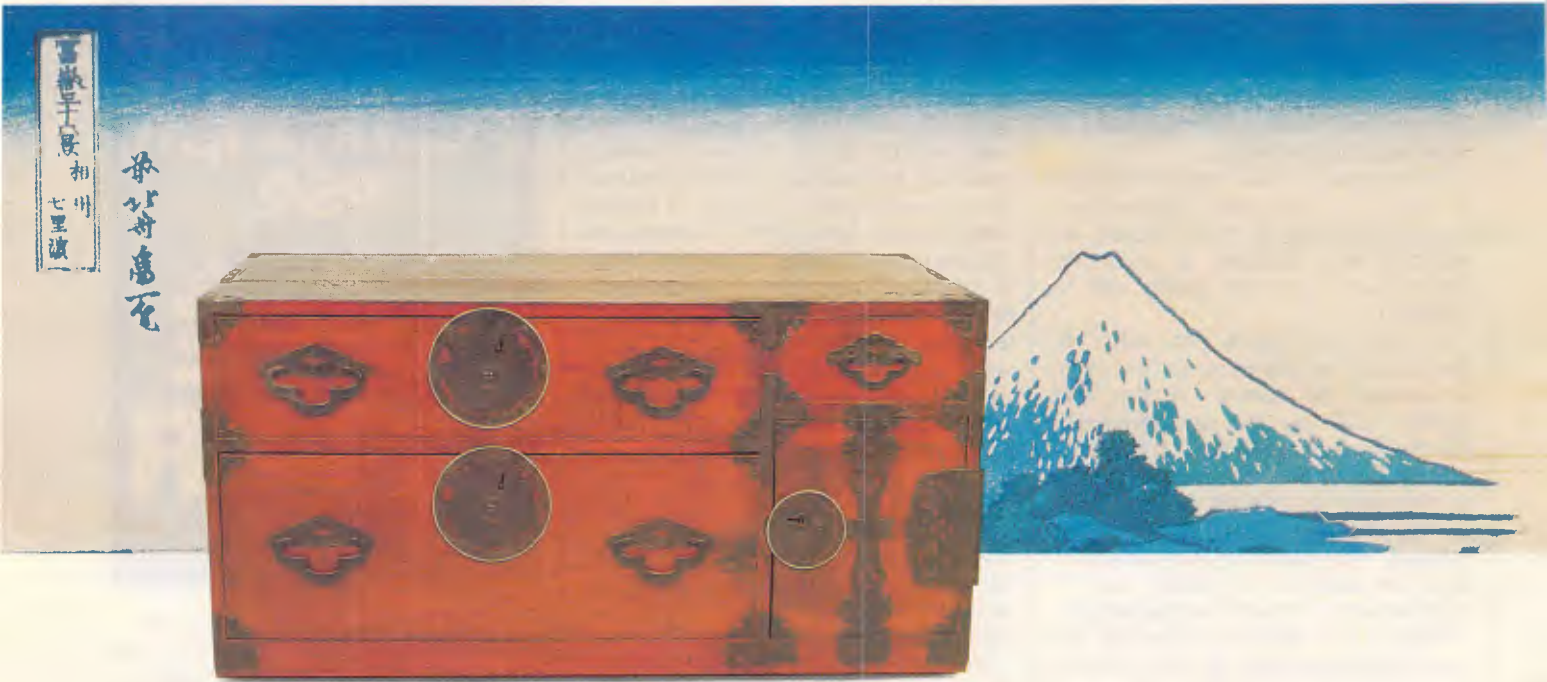
Address .....

Code ..... Bus. Phone .....

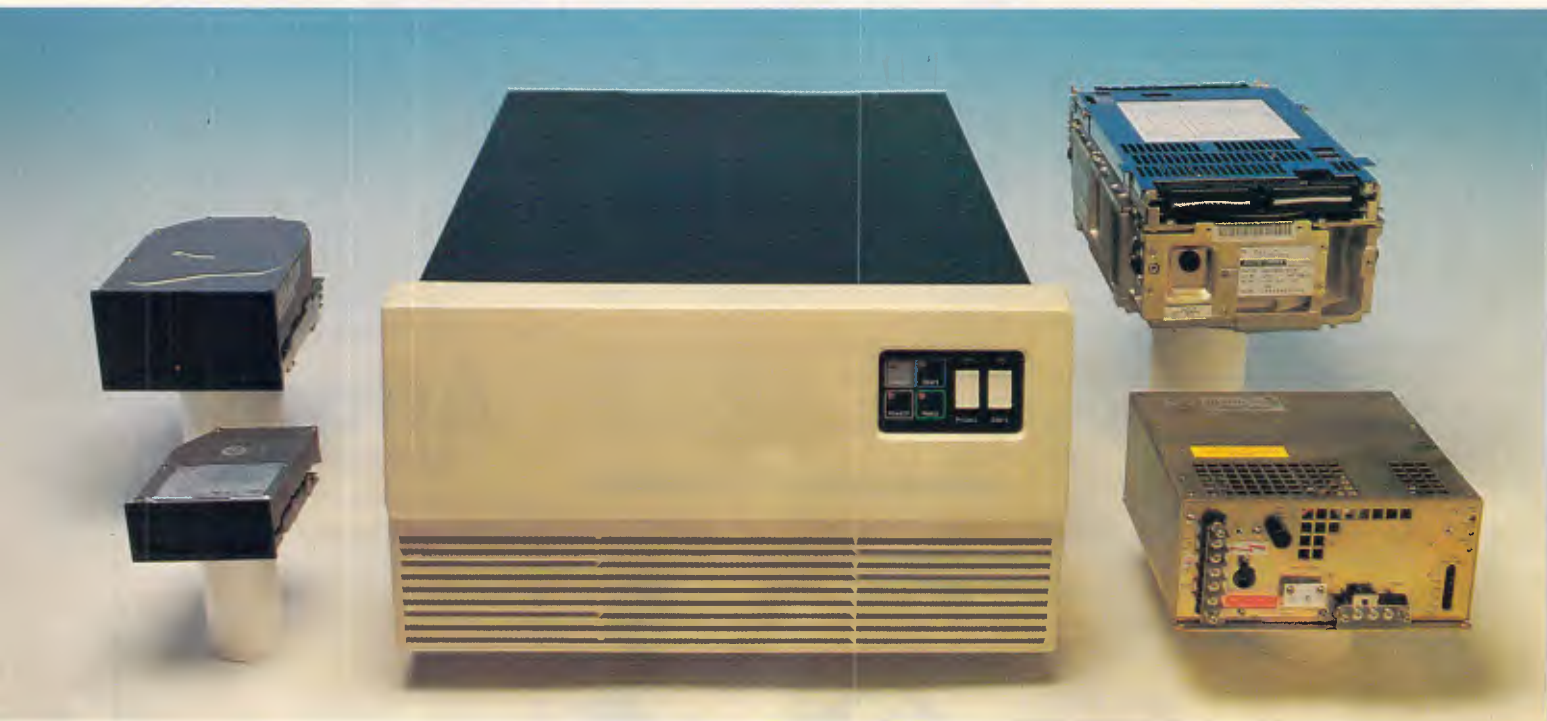
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# C compilers

*Prices of compilers have plummeted ever since Borland set a realistic precedent with its launch of Turbo Pascal. With the increasing number of C compilers now on the market, prices are falling further. Nick Walker looks at two inexpensive versions against Borland's Turbo C.*

Prior to Borland's launch of Turbo Pascal in 1983, compilers for the PC and compatibles cost at least \$1000 and were about as friendly as a wild boar in a pigsty. Since then the market for budget-priced compilers has rocketed, and an increasing number are now offering a 'Borland-like' integrated environment. Particularly numerous are C compilers, probably because C has rapidly become the favourite language among hackers, and hackers as a rule don't have vast amounts of money to spend.

This proliferation of C compilers has given Borland's own version of C, Turbo C, more direct competition than any other Borland language. In this review, I've taken Turbo C and compared it with two of its better rivals — Mix C and Zorland C.

## Mix C

Mix C from Mix Software was one of the earliest of the budget-priced Cs, and has been available in the US for some time. Now, courtesy of Tech Flow, it is available in Australia.

## Overview

Three components are required to turn C source code into an executable program: an editor to create the source code; a compiler to reduce the code into a machine-understandable form (object code); and a linker to collect all the relevant object code from other sources such as libraries, and from these create an executable program.

Mix C includes a compiler and a linker but no editor, but any editor capable of producing an ASCII file (all editors in use today, in fact) can be used. Mix Software does produce a program editor at extra cost, and it was this which I used for the review.

The Mix 'Editor' is a general-purpose editor tailored with features which aid the creation of programs, and like many editors and word processors is fully configurable: its initial WordStar-like configuration can be mapped onto any key combination you wish to use.

Because of its common features it isn't necessary to go into too much detail about the Mix Editor, but the following is a description of some of its more appealing features.

Unusually, for a micro-based program

```
/* char converts to int */
c1 = 'c';
i1 = c1 - 'a' + 'A';
c3 = i1; /* truncate to character */
printf("c1 = %c, i1 = %d, c3 = %c\n", c1, i1, c3);
i1 = 321;
c2 = i1; /* convert integer to char */
c3 = i1 + 1; /* truncate value */
printf("i1 = %d, c2 = %c, c3 = %c\n",
       i1, c2, c3);

/* automatic conversion from int to float */
f1 = 200; /* converted to float */
f2 = 350 * f1; /* 350 converted to float */
/* 7 converted to float - result truncated */
i3 = 3.4 * 7;
/* 350 converted to float - result truncated */

Mix C - Version 2.5.0
(C) Copyright 1985, 1986 by Mix Software

main
No errors detected

(Press any key to continue)
```



Used in conjunction with an editor macro, Mix C offers a crude but effective integrated environment. This is one of the many excellent tutorial programs

Ctrace is an excellent debugger for Mix C only. It maintains six windows of debugging information, of which any four can be onscreen simultaneously



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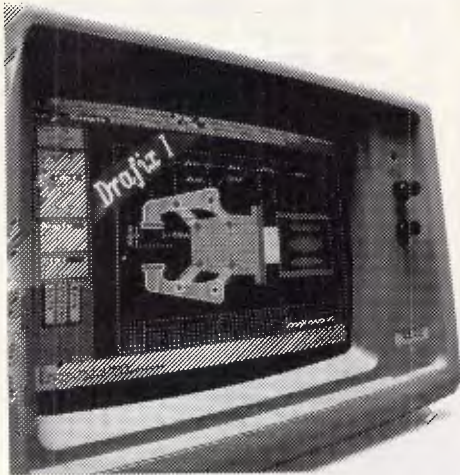
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# SCREENTEST

editor, the Mix Editor provides a macro command language which allows you to combine existing commands into commonly used combinations. For example, one of the pre-defined macros is BOX: typing 'Esc BOX' prompts you for height and width, and you then use the IBM graphics character to draw a box — a feature I frequently use to highlight comments within a program.

Other useful features include: no restriction on file length; the ability to execute DOS commands or run a program from within the editor; and split-screen operation. A macro called 'CC' allows you to run the Mix C compiler over the text in the editor's memory. When CC is used in conjunction with the split-screen facility, you can display the C source code in one window and compile errors in another. This allows you to display and correct multiple errors — unlike *some* integrated environments which stop at the first reported error. The linker and the final program can also be run from within the editor but not from menus such as those found in Zorland C or Borland C.

Mix C is a command-like driven compiler. Unless a '/i' switch is given as an argument, the compiler will list the whole C listing — plus error messages — to the screen, which is fairly meaningless unless you have a degree in speed reading. Mix C is also a single-pass compiler, although like most C compilers it has one very fast pre-processing pass which establishes all external references. Further switches control stack size and destination of the object code.

The IBM PC and its compatibles have what is called a 'segmented' architecture: that is, the whole of the memory area is divided into 64k segments. Compilers which produce code for this architecture have a choice of 'memory models' for the final program (code and data in the same 64k segment; code in one segment, data in another; or code in many segments, data in many segments). Mix C produces object code for one, and *only* one, memory model — the large one (code in many segments, data in many segments), so it is rather inefficient for programs with less than 64k of object code.

The Mix C compiler accepts the full C language as specified in *Kernighan & Ritchie (K&B)* but with one exception — you cannot use an array element address as an initialiser (a silly thing to do, anyway). Also, the following extensions have been added: support for the enumerated data type (an integer that will only take specified named values); structures can be assigned, passed by value to functions, and functions may return structures; locally declared arrays and structures can be initialised; and there are compiler options which allow nested comments, the passing of actual char and float values to a function, and automatic initialisation of local variables to zero.

Mix Software divides the library functions of Mix C into four distinct groups — standard, non-standard, DOS and BIOS. Library header files may contain functions from each group — for example, the 'miscellaneous' library includes: a non-standard random num-

ber generator, 'drand'; the C-standard 'exit', to exit a program; 'getcseg' from DOS, to return the current code segment; and the BIOS call, 'sound', to drive the IBM's speaker. Although the functions are listed according to which files they are in, there is no mention of the actual file names in the Mix C manual. Consequently, you have to snoop around before '#include'ing a library file.

The usefulness of any compiler is defined by its system-specific functions. Mix C is particularly well-endowed with numerous pre-defined BIOS calls, DOS functions and non-standard functions as well as all the standard C functions. For the 'real' hackers, there is a general-purpose BIOS call which gives full access to the IBM ROM.

The Mix C linker is an unusual beast in that it doesn't link .OBJ files — the standard files of practically every other compiler and assembler on the market. This means that you can't link your existing routines from other languages. Also, the .MIX files which are created by the Mix C compiler are not linkable with any of the standard linkers.

Most professional C programmers use different manufacturers' compilers and linkers in their own customised setups, but this is not possible with Mix C.

The linker can be run as a command-line program: a number of switches can define options to the linker, to control stack size, for example. Unless the '/i' option is included, the linker will produce an executable file that requires the file 'RUNTIME.OVY' in order to run; this gives you very small object files but less portability. Alternatively, for those people who like fine control over the linking process, simply typing 'LINKER' with no arguments will take you to a linker menu screen. All stages of the linker (load file, find functions, run, build, and so on) can be controlled manually.

Although Mix C does include some conditionally compiled diagnostics to aid debugging, an independent debugger is really needed to track down the more elusive bugs. I was also provided with Ctrace (a bolt-on extra for Mix C which was written here in Australia by Dr Neil Bennet) and specifying '/t' after the 'compile' and 'link' commands will allow it to do its job.

The program 'CTR' will run Ctrace and it requires your executable file as an argument. Ctrace then maintains six windows of information: position in source code; program output; variables and their values; a 'watch' window that allows you to define a particular set of

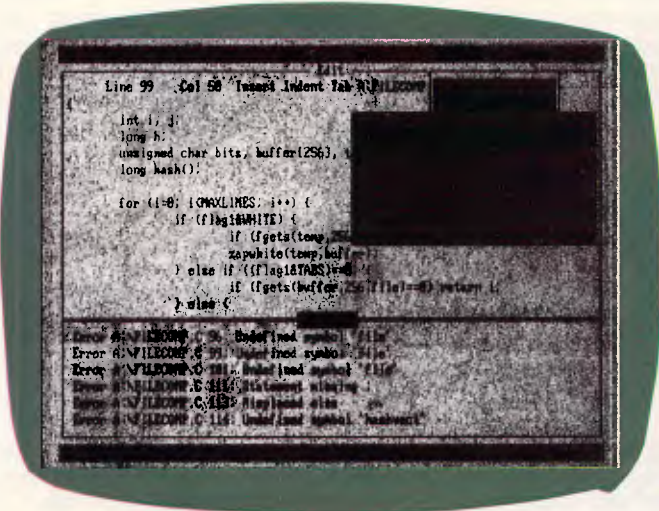
## Benchmarks

	Mix	Zorland C	Turbo C
Intmath	0.075	0.058	0.045
(File size bytes)	(22561)	(9600)	(5484)
Realmath	5.7	4.1	3.7
(File size bytes)	(22824)	(9744)	(19288)
Triglog	101.9	68.7	26.1
(File size bytes)	(22735)	(20244)	(19356)
Textscrn	153.1	64.1	72.3
(File size bytes)	(22672)	(9584)	(5460)
Grafscrn	12.8	-	-
(File size bytes)	(23271)	-	-
Store (hard disk)	5.3	4.7	4.6
(floppy disk)	14.1	13.0	12.8
(File size bytes)	(24221)	(19871)	(19323)
Hack compiling	48mins 12secs	78mins 35secs	45mins 49secs
Hack linking	25mins 21secs	32mins 9secs	15mins 33secs
File size	(312823)	(275261)	(249888)
	(295661)	(after running 'Shrink')	

All Benchmarks were run on an Amstrad PC with a MiniScribe 30Mbyte h/disk



# SCREENTEST



The Turbo C version of Borland's integrated environment is the best yet, with 80-column default windows and the most comprehensive control menus



The Turbo C pull-down menus, plus the reporting of multiple source errors. You can set a maximum limit on the number of errors reported

variables, and a course of action should they reach certain values; a 'symbols' window which shows the address of functions and variables; and a 'memory map' window. Programs can be executed single-step, trace speed or at full speed. Whenever a breakpoint occurs or a watch variable meets its value, a pop-up window appears which specifies exactly what has occurred.

Ctrace includes an animated trace feature which shows you the flow of execution; not just line by line, but statement by statement. Watching the red cursor follow every movement of the program almost made me want to sing along! What a shame that it's limited to Mix C programs.

Ctrace is by far the most delightful debugger I've come across — I actually found myself *enjoying* debugging!

## Installation

Mix C requires a 128k MS-DOS computer with one disk drive, but I would advise 256k and two disk drives as working with less can be limiting.

Mix C is the only C compiler I know of that is usable on a floppies-only machine. Unusually, it will run on a generic MS-DOS machine although it obviously won't be able to use any of the IBM BIOS calls. Mix Software also produces a CP/M version of the compiler which is functionally very similar to the one featured here and requires a 55k, CP/M-80, two-drive machine. For floppies-only machines the files are organised correctly, so it's just a matter of copying the disk and getting started. Similarly, installation on a hard disk simply involves

copying the files to a suitable directory.

Mix C is not copy-protected and has a simple 'treat me like a book' type copyright notice. Programs created under Mix C do not require a run-time licence and can be freely distributed.

## In use

As a test of compilation speed, linker speed, object code size, execution speed and K&R compatibility, I used the source code of a public domain game called Hack. This consists of approximately 60 C source files and header files with a total source code size of around 700k. Hack was originally written for Microsoft C which, with Lattice C, is one of the traditional heavyweight compilers. (Incidentally, the authors of Hack claim that they haven't overstepped the boundaries of K&R.) Under Microsoft C, Hack compiles down to an executable file of 255k. The program embraces a wide range of features including real and transcendental arithmetic, file handling, data structures and even graphics via calls to the BIOS.

The idea behind this 'Hack test' was to see which, if any, problems arose when using the compilers reviewed here on a 'real' application. All three compilers were run from the command line and, where possible, used the 'MAKE' system of showing dependencies and grouping multi-source file compilations.

Mix C performed extremely well, with the Hack Test taking approximately three hours to get the application up and running, including: the creation of a suitable batch file, sorting out the few er-

rors that occurred, and linking the whole system. (The test times for all three compilers can be seen in the box on the previous page.)

Mix C found two errors in the Hack source — and, of course, over such a large application, found them many times. These errors were nested comments and a possible unintentional assignment (using 'if (a=b)' rather than 'if (a==b)'). Both these errors can, in theory, be converted to warnings with the setting of a compiler switch. However, with the switch set, Mix C still objected to some of the nested comments. I eventually solved the problem by putting an extra pair of comment delimiters around the offending code.

I also ran the *Australian Personal Computer Benchmarks* on all three compilers (see *APC* November 1986). In many respects Mix C came off worse: its execution times were the slowest in all tests. Despite the use of the 'shrink' utility, the executable file size was almost always the biggest, although this was due to the large memory model used and would not be so noticeable on large programs.

On the plus side, though, Mix C is a very fast compiler. If you switch off the listing to the screen it's almost a match for Turbo C, because Mix C operates entirely within memory and creates no intermediate files on disk.

## Expansion

The three utilities supplied with Mix C are 'shrink' (mentioned above), 'speedup' and 'convert'. Shrink takes an object file as input and attempts to





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# SCREENTEST

optimise it for object code size; the typical space saving is 10-25 per cent. Speedup operates in a similar manner but optimises for speed. (The effectiveness of these routines can be gauged from the test results box.) Convert takes a Mix C-format object code file and turns it into ASCII.

No extra libraries are available with Mix C, although it is compatible enough to run most of the commercial C libraries.

## Documentation

Mix C comes with a 434-page manual in the usual 'budget paperback' form pioneered by Borland. Approximately 150 pages are dedicated to one of the most complete C tutorials I've seen bundled with a compiler.

The rest of the manual consists of a fairly standard C reference section and a comprehensive description of the library functions.

## Price

Mix C, Ctrace and the split-screen editor cost \$49 each, alternatively, \$89 will purchase all three programs (Mix Works) plus a utility to link assembly code, and an examples disk.

## Zorland C

'No — I want a *real* compiler.' I don't know how many times I have heard

that remark after advising someone to buy Zorland C. Despite its \$99.99 price tag, Zorland C is a true compiler and in some ways more at home alongside the \$500-plus compilers such as those produced by Lattice or Microsoft, than the two it is pitted against here.

## Overview

Zorland C, includes an editor and a compiler but no linker. However, any standard linker can be used, such as the one bundled with MS-DOS. Zorland does provide a linker at additional cost, either as part of the company's 'Developer's Upgrade' or separately, and it was this linker which I used during this review.

Zorland C Version 1.0 had a primitive WordStar-like editor. Its successor, Version 2.0, has retained the original dozen or so WordStar commands and has added to them, thereby upgrading it into a full-function text editor. The additional commands are available via two-line horizontal Lotus 1-2-3 style menus rather than the more usual pull-down style menus, and can be accessed by 'Alt' key combinations.

Everything you would expect from a text editor is here in the new Zorland C but, for some reason, it still feels a little crude. Perhaps it's the monochrome screen or the speed of operation — very slow with big files.

The menu options include 'compile':

the system is configured so that compile calls the linker being used and runs the program if no errors are detected. If an error is detected, the compiler is stopped and the cursor is placed near the error. If the error is a warning, pressing Enter will continue the compilation; otherwise, the error must be corrected and the compiler invoked again.

One word of warning about using the Zorland integrated environment — it does *not* like the presence of any memory-resident programs. SideKick, PC Outline, DeskSet and even Mode would cause it to crash.

Zorland C is a *K&R* implementation, and also features the complete ANSI and Unix System V extensions. Additional features include: the ability to define constant and volatile types (a constant type never changes under any circumstances, and is typically used for data in ROM, whereas a volatile type can change even if the program doesn't, and is exclusively used for memory-mapped devices such as ports); argument checking, for functions; enumerated data types; and void types, for functions which don't return a value.

Zorland C is a two-pass compiler arranged as two separate programs to perform each pass. The \$99.99 version of Zorland C is limited to small systems (up to 64k executable code, 64k data), but an additional \$69.99 will buy a Developer's Upgrade which provides a further three memory models to exploit the full addressing space of the IBM PC architecture.

Zorland C implements a full range of file-handling, arithmetic and input/output libraries, both standard C format and MS-DOS specific, and the complete library is 98 per cent compatible with the more expensive Lattice C libraries. The Developer's Upgrade contains the full source code for these libraries and means that you can create your own customised libraries. While the Zorland libraries do include the necessary DOS and BIOS calls, these are limited to low-level calls — for example, there are no graphics mode calls. This can be a little off-putting for beginners, as consequently there is no easy way to access the more interesting 'goodies' of the machine.

As I have already explained, no linker is supplied as standard with Zorland C but the program's object code files conform to the MS-DOS standard. This means that the linker supplied with MS-DOS operates fine; it also means that the object code from other compilers and assemblers can be linked in.

## Specifications

	Mix C	Zorland C	Turbo C
Passes (compiler)	1	2	1
Creates .OBJ files	No	Yes	Yes
Memory models	1	4 <sub>1</sub>	6
8087/80287 support	No	Yes	Yes
ROM code generation	No	Yes	No
Integrated development environment	Yes	Yes	Yes
<i>Kernighan &amp; Richie</i> standard	Yes	Yes	Yes
ANSI extensions	Yes	Yes	Yes
MAKE utility	No	Yes	Yes
Command-line operation	Yes	Yes	Yes
Approx number of lines per second being compiled <sub>2</sub>	3500	1800	6500
Library source code	No	Yes <sub>1</sub>	No <sub>3</sub>
Size optimisation	No	Yes	No
Speed optimisation	Yes	No <sub>4</sub>	Yes
Number of library functions	190	210	390
Graphics functions	Yes	No	No
Number of compiler error messages	80	105	130
8087/80287 co-processor support	No	Yes	Yes
80286 protected mode code generation	No	No	Yes

1 Only with the Developer's Upgrade or the professional pack

2 With a meaningless large single file containing no include files

3 Available at an extra cost

4 An optional optimiser is available from Zorland at extra cost

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## SCREENTEST

The cut-down MS-DOS shipped with the Amstrad PC1512 does not include a linker. For this reason, Zorland has produced its own much-improved version of the 'LINK' programming facility which is roughly twice as fast as Microsoft's and includes a simple 'librarian' to help create your own libraries.

The one component missing from the Zorland collection, even at extra cost, is a debugger. Unfortunately, the recommended conditionally compiled commands are not really adequate for any serious debugging. If only Mix C's Ctrace would work with other compilers, things wouldn't be so bad, but as it is you could end up paying more for a decent debugger than for a complete, upgraded Zorland C.

### Installation

Zorland quotes no minimum-system configuration but, as far as I can determine, a twin-floppy 256k IBM PC or compatible is the basic system required in order to use Zorland C successfully. To get the most out of it, you really need a hard-disk system. There is no copy-protection on any Zorland product, so in-

stalling the C compiler is just a matter of copying the file over or, if you're feeling lazy, running the 'Install' program. I recommend separate directories for libraries and source code, but this means changing the path within 'CONFIG.SYS' as Zorland C doesn't really understand directories. Not unsurprisingly for a company called Zorland, the licensing agreement is a clone of Borland's aforementioned 'no-nonsense, treat me like a book' agreement. This allows you to use the program on the machine of your choice, provided it is never in use on two machines at the same time.

Programs created with Zorland C can be freely distributed.

### In use

Zorland C made a valiant attempt to compile the Hack system, throwing up warnings about nested comments and then deciding that one of the nested comments was in fact an error. Zorland C doesn't include an option allowing nested comments, so I had to go through the source, 'un-nesting' wherever they occurred. This tedious process, combined with the slowest compiling time of the three programs,

meant that it took me about 5.5 hours to get the game up and running.

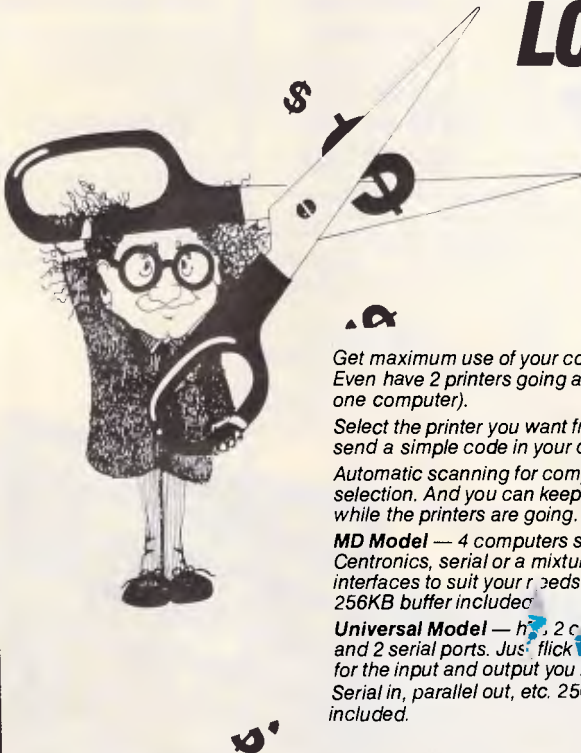
Interestingly, memory-resident programs wouldn't work with the Zorland version of Hack whereas they would with Borland and Mix implementations.

The execution times of Zorland C programs are fast: it consistently beat Mix C, and independent sources assure me that Zorland C produces quicker programs than either Lattice C or Microsoft C. However, with the exception of the 'Textscrn' text mode screen-handling routine, Turbo C had the upper edge.

Don't let this put you off, though — Zorland C produces fast, compact, executable programs.

Two utilities which have been borrowed from the Unix C environment, 'MAKE' and 'TOUCH', give Zorland C a very professional feel. MAKE is an automatic program maintenance facility that comes into its own on large systems spread across many source files. Rather than re-compiling the complete system, in just one source file MAKE will determine which files have changed since the last compilation, which files depend on them, and then compile just the requisite files.

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TOUCH changes the last modified date to the current date, and so forces compilation.

An optimiser can be purchased at extra cost, and performs a third pass on the compiler code, so improving execution speed. Unfortunately, this wasn't supplied with the review package, so I am unable to comment on its effectiveness.

### Expansion

There are two additional libraries for Zorland C. The BTREE/ISAM Database provides the facilities of a simple database, such as indexing. Zorland Windows gives easy controls for the creation and manipulation of ANSI character windows, and also provides a Lotus 1-2-3 menu control.

### Documentation

Zorland C's accompanying literature is a 350-page manual. A rather feeble tutorial occupies the first 80 pages, but otherwise the rest of the book is adequate. The technical information for the professional C programmer is excellent, and includes a discussion of such

problems as producing ROM-able code, memory model difficulties and linking other languages.

### Price

In its cut-down form Zorland C costs \$99.99, but I would recommend the power package. This includes the fast Zorland linker, C compiler and Developer's Upgrade and retails at \$220.

Zorland also sells a linker/librarian for \$69.99. The BTREE/ISAM Database sells for \$99.99 and no price was available for Zorland Windows.

### Borland Turbo C

It's an interesting reflection of the state of the software market that Borland's Turbo C is the most expensive of the three compilers reviewed here. While everyone else has cut their prices to less than Borland's, Borland hasn't budged from the \$200-\$220 price bracket that established the budget PC software market. Still, why reduce the price when the product is selling so well?

### Overview

Turbo C is the most complete of the three programs tested and comprises a compiler (in both integrated environment and command-line versions), an editor, a linker and a number of extra utilities, all as standard. Professional programmers will be pleased that this Borland language incorporates a command-line-driven version. The integrated environment is fine for small applications, but most larger applications are controlled by custom batch files.

The editor supplied with Turbo C is an integral part of the Borland integrated environment and can't be used in any other way. The default editor window occupies the upper two thirds of the screen and is 80 columns wide. This is an improvement over programs such as Turbo Prolog which default to a quarter-screen editing window. The bottom third of the screen is used for reporting error messages.

As with all recent Borland languages, all windows can be resized as required.

The Turbo C editor has the most complete WordStar command set of

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the three programs looked at here. It is also the most program-orientated, with such features as auto-indent and very fast handling of large files. There is no facility to customise the control commands, so if your favourite word processor happens to be WordPerfect, you're stuck with having to learn WordStar. Perhaps this lack of configurability has to do with the forthcoming Borland word processor, Sprint, which is very, very configurable.

The compiler, linker and practically all other aspects of the Turbo C system can be called into action via the pull-down menus at the top of the screen. These can be called up either by Alt and the first letter of the menu or by hitting F10. In either case, the cursor keys are used to navigate around the menus while the Return key selects the desired entry.

Turbo C is a single-pass compiler which conforms to the K&R standard. It creates standard .OBJ files which can be linked in with other object files. Borland has implemented all the ANSI extensions and, as far as I can tell, all the Unix System V extension are included, although Borland makes no mention of this.

Borland C has the richest choice of memory models, capable of producing six different memory mappings for an executable file. These models are labelled 'Tiny', 'Small', 'Medium', 'Compact', 'Large' and 'Huge'.

Turbo C has too many additional facilities over and above K&R and ANSI standards to mention here, but suffice it to say that they include nested comments and more relaxed identifier-naming conventions. Also, Turbo C is the only compiler of the three capable of producing 80286 protected mode object code for use with the full 16Mbyte address space of this processor. This will be a great asset for those people interested in upgrading to OS/2 when it becomes available.

When using the integrated environment, the Turbo C compiler reports all its errors in the lower window. It is possible to specify a certain number of errors, after which the compiler gives up and allows you to correct the errors made so far. This is particularly useful in the initial stages of program development because of the knock-on effect of certain errors in C.

One wonderful feature of the Turbo C integrated environment is the ease with which you can test individual functions and procedures. With a little effort, you can ask Turbo C to prompt you for a

procedures argument and then print the results you wish to see. This feature alone could save hours of development time.

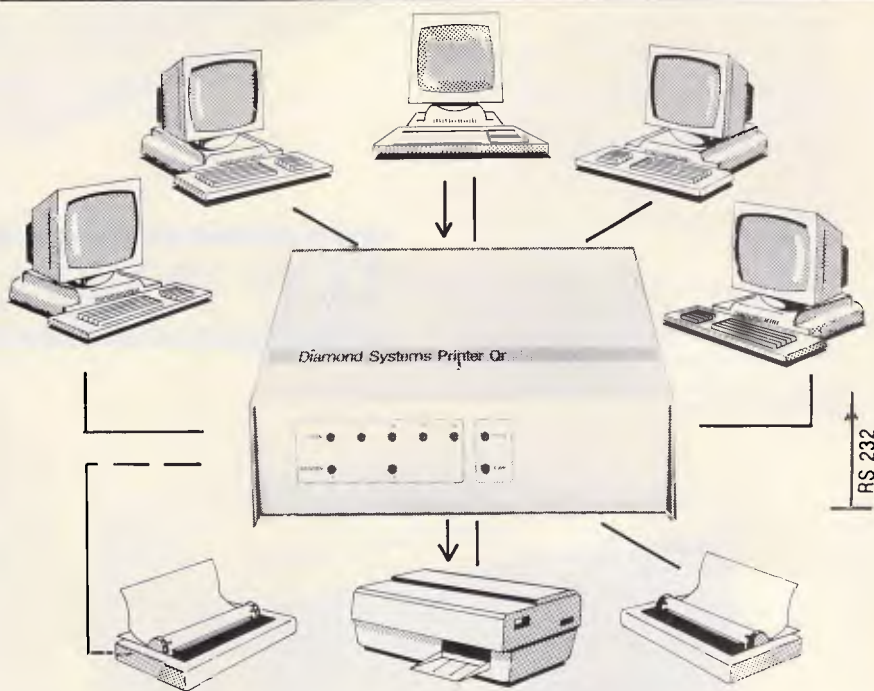
In terms of the quality of functions provided, Turbo C has the most comprehensive library of the three compilers. However, the Turbo C and Zorland C libraries share that same failing — they are both too low-level. I know that C has been likened to a high-level assembler but, nonetheless, it is very frustrating, for example, not to be able to run the APC graphics Bench-

mark, Grafscrn, because there is no 'plot' command.

The Turbo C linker, like the compiler, can be run from the integrated environment or as a command-line program. Borland describes the linker as 'lean and mean', which is fairly accurate as it's very fast, although it does lack a lot of the 'bells and whistles' of other linkers.

No debugger is included with Turbo C, although the program does have a decent collection of optional compiler directives to aid debugging.

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# SCREENTEST

## Installation

Turbo C requires 384k or more of memory and a single floppy; any serious work requires a hard disk. For a Borland product, installation was quite complex, requiring a different kind of file from each of the four disks to be copied into different directories. No installation batch file was provided.

Turbo C is not copy-protected and has a simple licensing schedule that forbids running two copies of the program at the same time. Any programs developed under Turbo C can be freely distributed or sold.

## In use

It took less than an hour to get the Hack program up and running with Turbo C, and the program compiled the Hack C source code first time without so much as a squeak. This was an impressive performance.

Turbo C also lived up to its 'Turbo' label when running the APC Benchmarks. In all tests bar one (Testscrn), the Borland product came out on top.

## Expansion

Included as standard with Turbo C are the TOUCH and MAKE utilities familiar to C programmers in a Unix environment. Between them these utilities take a lot of the effort out of maintaining a large system, as they can be configured to compile only the files which have been affected by any change. I particularly like the inclusion of a 'baby' MAKE facility within the integrated environment, as this allows beginners to become familiar with the concept.

Borland usually releases a set of additional libraries for numeric work, graphics, database design, and so on, some time after the release of a language. In the case of Turbo C, the company hopes to have a collection similar to that of Turbo Pascal released by 1988.

## Documentation

Over 700 pages of documentation is supplied with Turbo C in the form of two manuals, a *User Guide* and a *Reference Guide*. My only criticism is of the tutorial which is good but far too short, and the wealth of advice it contains on using Turbo C with other languages is directed only at Borland products.

Overall, though, the manuals are ex-

cellent, and cover most aspects of using Turbo C. In places, they were interesting enough to be read as guides to programming the PC.

## Price

Borland C retails for \$210. No prices were available for the libraries at the time of writing.

## Conclusion

It's easy to write a conclusion when

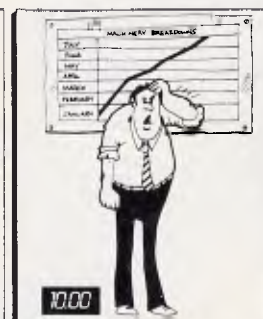
there is a clear winner but, unfortunately, in this case there isn't. All three programs are excellent, and any one would make a good choice for PC owners looking for a C compiler.

At first sight Mix C looks the least attractive because it produces large, slow programs and does not include advanced features such as the MAKE utility. However, Mix C has a truly excellent tutorial which probably makes it the best buy for an absolute C novice who has to start from scratch. If, after using Mix C, you want to

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# SCREENTEST

create a large program, you would be well advised to upgrade to one of the other two compilers.

Zorland C and Turbo C are more than a match for the so-called professional C compilers costing in excess of \$500. The best overall performance was given by Turbo C. It is eminently qualified to take a Basic programmer, for example, and lead him or her all the way to the creation of real applications under C; firstly, with the integrated environment, and then onto a true multiple source file with conditional compilation.

Experienced programmers might find Zorland C the easiest to work with as it's the most similar in function to existing heavyweight C compilers. It is also cheap and very compatible with the very successful Lattice C environment — two arguments that certainly weigh heavily in its favour.

END

Mix C is available from Tech Flow on (047) 58 6924; Zorland C from ISD on (03) 222 2288; and Borland's Turbo C from PC Extras on (02) 319 2155.

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At last your favourite Hercules compatible programs like 1-2-3, AutoCad, Microsoft Windows and many more can run in full colour at this high resolution.

## **Good-bye Driver Worries**

Both cards are completely compatible with each other. Any software you run on your Hercules monochrome graphics card will run in two (and sometimes more) colours on the InColor Card

without changing the video driver. Most popular software packages like 1-2-3, Symphony, Framework, and AutoCad, which run in full colour on the InColor Card, also use a single unified driver to run on both cards.

So, you can use your entire monochrome software library on a multisync or enhanced colour monitor. Or easily move your software back and forth or network between mono and colour systems.

## **WYSIWYG... and More**

And, of course, both the Graphics Card Plus and InColor Card feature RamFont... Hercules' powerful new mode that lets software display 3,072 software definable characters instead of the fixed 256 ASCII character set.

Which means programs like Lotus 1-2-3 can display nearly twice as much data and even gain a pop-up window on the spreadsheet, without losing speed.

Microsoft Word runs up to four times faster. And word processors like Lotus Manuscript require RamFont to display subscripts, superscripts, italics and other attributes in the text processing mode.

But RamFont's power doesn't end there. Using third-party add-on software, most popular word processors can display and print foreign languages, scientific characters, or a wide variety of fonts. Not to mention the new breed of software that will let





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Unified driver. Computer Linguist RussStar, etc. Add on programs use

#### RamFont to convert

**WordStar** to foreign language word processor with screen display and printer support. Dragonfly Software **Nota Bene**. Foreign language word processor uses RamFont to display Russian, Hebrew, Sanskrit, etc. with full printer support. Evolution Software **FastCAD**, **EasyCAD**. 16 colour or monochrome 720x348 graphics. **Image Processing TurboFonts**. Uses RamFont to allow font substitution and printer support for most popular word processing programs such as WordPerfect, Multimate, WordStar, etc. Generic Software **Generic CAD**. 16 colour or monochrome 720x348 graphics. **GSS GSS Library**. Driver library with support for Hercules mono and colour 720x348 graphics. **Javelin Javelin**. Integrated software. 8 colour or monochrome 720x348 graphics. **Lotus 1-2-3 Versions 2.0 and above**. RamFont expands spreadsheet display from 80 columns by 25 to 90x38 (nearly twice data display). 6 colour or monochrome 720x348 graphics or graphic window on spreadsheet. **Lotus Manuscript**. Requires RamFont for display of italics, subscripts, etc. while text processing. **Lotus Symphony**. Uses RamFont to expand data display from 80 columns x 25 rows to 90x30 with faster scrolling. **Mace Utilities GRASP**. PC slide show system. 16 colour or monochrome 720x348 graphics. **Marc Publishing WordMARC**. Uses RamFont for display of italics.

#### A Few Examples...

Here are a few of the programs that benefit from Hercules 720x348 graphics and/

or RamFont in monochrome on

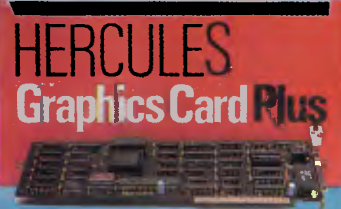
the Graphics Card Plus and full colour on the InColor Card. Not included in this list are the thousands of monochrome standard text Graphics programs which automatically run on both cards.

**Aldus Pagemaker**. Desktop publishing. 8 colour or monochrome 720x348 graphics in Microsoft Windows environment. **Design Board MegaCADD**, a CAD program from 16 colours, or monochrome 720x348 graphics. Unified driver. **Ashton-Tate Framework II**. Expanded spreadsheet display, speeded up wordprocessor using RamFont. Unified driver.

**AutoDesk AutoCAD, Auto-Sketch**. 16 colour or monochrome 720x348 graphics. Unified driver. **Underware Brief**. Program editor uses RamFont for 43 line display. **BPS 35 M.M. Express**. Slide production program. 16 colour or monochrome 720x348 graphics. **Broderbund For Comment**. Editing tool utilizes RamFont for 43 line display. **Computer Associates SuperCalc 4**. Spreadsheet. 16 colour or monochrome 720x348 graphics.

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# All systems go!

***The curtain has finally been raised on OS/2, Microsoft's true, completely new, multi-tasking operating system. For PCs which use the 80286 and 80386 processors, the doors — and Windows — have been opened.***

***Robert Schifreen peers in for a closer look.***

In April 1987 IBM launched its new range of PCs, the Personal System/2. These machines will, as IBM said, change the face of personal computing. However, it's probably Microsoft who will have an even greater impact. As IBM announced the new hardware, Microsoft finally raised the curtain on a multi-tasking version of MS-DOS, capable of exploiting the features of the 80286 and (in 80286 mode only) 80386 microprocessors. More importantly, the product will not be tied to IBM hardware, as rumour-mongers were suggesting prior to the launch, but is available to any compatible manufacturer or power hungry end-user.

The new operating system will not be called 286DOS, or CP-DOS, or DOS 5 — as some of the pre-April rumours suggested. It will be known as Microsoft Operating System/2 or the IBM Personal Computer Operating System/2 or the IBM Personal Computer Operating System/2 Standard Edition, depending on whom you buy your copy from.

Although some companies will have you believe otherwise, PC-DOS running on a new PS/2 machine is *not* known as running under OS/2. OS/2 is a totally new operating system that requires most existing MS-DOS and PC-DOS software to be rewritten or substantially altered.

The time scale for OS/2 is roughly this: software developers are now taking delivery of the initial version of the OS/2 toolkit, though many have gone out already. This kit will contain a pre-release version of OS/2 version 1.0, and some compilers and technical information necessary to write applications to run under OS/2, or convert existing MS-DOS and PC-DOS software.

Towards the end of this year, version 1.0 of OS/2 will go on sale to end-users, at a price of \$706.

In the fourth quarter of this year, or early 1988, OS/2 version 1.1 will be launched. This will include Presentation Manager, which is basically a version of Windows which runs under OS/2 rather than MS-DOS. Until OS/2 version 1.1 arrives, complete with mouse and graphics-based Presentation Manager, OS/2 will be driven from a command line in the same way as MS-DOS.

In late May, Microsoft arranged for me to see the current version of OS/2. At the same time, IBM allowed me to visit its research and development establishment to take a look at a very early version of Presentation Manager. This, roughly speaking, will be to OS/2 what Windows is to MS-DOS.

## MS-DOS

MS-DOS, the Microsoft Disk Operating System, is a single-tasking operating system used by around 99 per cent of PC owners. It comprises three programs, in three separate files on disk. The first two are the guts of the whole system and are usually called IBMDOS.COM and IBMBIO.COM. These two 'hidden' files are present on every bootable MS-DOS disk.

The third and final part of MS-DOS is COMMAND.COM. This is known as the Command Interpreter, and it is this which displays the A> or C> prompt and calls procedures to load the program you specify. COMMAND.COM itself does not contain the routines which make up MS-DOS — it calls on the guts of the system which were loaded into memory from the two hidden files.

COMMAND.COM also processes the resident commands — those that are built into the system — like DIR, COPY, DEL, and so on.

Programs call MS-DOS from the machine code level through the INT

command. If you write machine code programs, you use this command directly in your program to specify what you want MS-DOS to do. If you write in a high-level language like C, the compiler generates the necessary INT commands for you.

Version 3.30, now generally available, is the latest release of MS-DOS. It is still only single-tasking, and still limits you to 640k of RAM and a 32Mbyte hard disk (though you can have multiple 32Mbyte partitions).

## OS/2

OS/2 is a completely new, truly multi-tasking operating system for PCs that use the 80286 or 80386 processors. OS/2 is capable of using the protected mode of the 80286 and 80386 (in 286 mode) chips, which means that programs are protected from each other and, if one crashes, any others which are running continue normally.

Protected mode is not available on the 8088 and 8086 chips, as used in standard PCs. These only have what's known as 'real' mode. In real mode, a program has total control over the entire machine, including all its memory and hardware. If it wants to, a program can control the screen by directly programming the graphics chip. Equally, if it wants more memory, it just looks through the system and finds some.

All this is fine on a single-tasking machine. With multi-tasking though, you have to be more careful. You can't allow a program to control the graphics chip directly, as another program running in the background might be trying to do the same thing at the same time. And there's no way that you can let a program have free rein over the machine's total memory, as it could corrupt another program or its data. The advantage of protected mode is that, if



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# PREVIEW

one program crashes, others that are running at the same time will not be affected and carry on running.

Although multi-tasking, OS/2 is only a single-user operating system so it can't be used to run a network without the optional (and still not launched) LAN manager.

For owners of 8086 and 8088-based PCs who will not be able to use OS/2 at all as these chips do not have a protected mode (including the IBM Model 30) and for those who don't want to pay for OS/2, MS-DOS version 3.3 will still be sold and supported by both IBM and Microsoft.

If you have a 286 or 386-based PC currently running MS-DOS, there's no need to switch completely over to OS/2. File and disk structures are the same so, whichever operating system you choose to install on your hard disk, you can still boot from a floppy disk that contains a copy of the other. Hard disks are still limited to multiple 32Mbyte partitions.

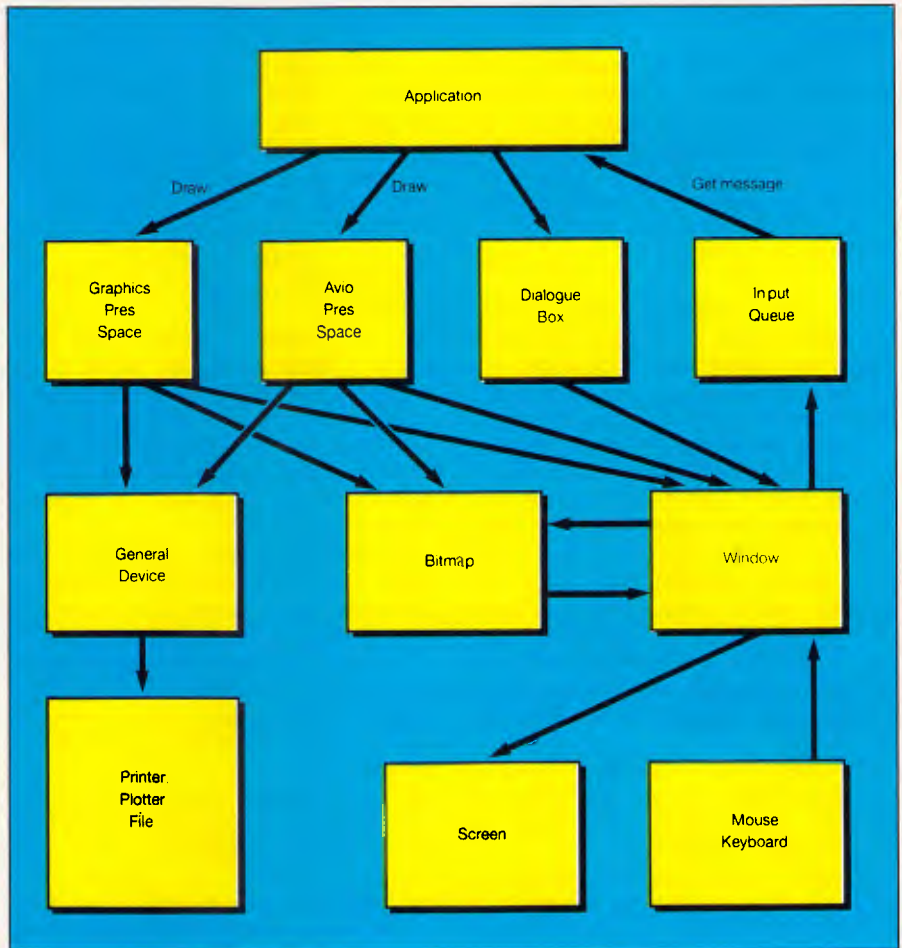
Apart from being multi-tasking, the biggest improvement over MS-DOS is OS/2's ability to break the 640k barrier at last. Programs running in protected mode can use 16Mbytes of real memory and, by using disk files for swapping, one gigabyte of virtual memory.

OS/2 version 1.0 will be available to end-users in late 1987 or early 1988. Like MS-DOS, OS/2 version 1.0 is a command-line operating system, complete with A> or C> prompt, at which you type commands, just like MS-DOS. There is no graphics-based mouse-driven interface.

During the second quarter of next year, version 1.1 of OS/2 will be made available; this will include the Presentation Manager as an integral part. The Presentation Manager is, to the user, a Windows lookalike. When you boot up OS/2 version 1.1, you will go straight into the windowing environment. If you insist on using OS/2's command-line interface, it will be available as an option from the Presentation Manager menu.

## OS/2 in use

The version of OS/2 which I had a chance to use was a beta version of 1.0, running on an IBM AT with 1.5Mbytes of RAM. There was no hint of the Presentation Manager. What I saw was working properly, though some of the headings and terminology may still change. It didn't crash at all. Because the software was not finished, it was not possible to measure speed, or examine the drop in speed with



*This shows the message paths between the system and a Presentation Manager application. The application accesses the screen by opening a communications channel known as a presentation space, which in turn accesses the screen via OS/2 calls. The application can also put dialogue boxes on the screen by sending a message to the dialogue box handler. All incoming messages come from the input queue, and the application examines the message to see what it says and where it comes from.*

*The Windows box contains a high-level representation of the screen, while the bitmap contains a bit-mapped version. A program can read and write to either of these, depending on what it wants to do, and can copy portions between the two*

respect to the number of concurrent programs running.

When you first start OS/2, you are presented with a menu known as the Session Manager. This is not graphics-based, but just a list of options surrounded by a box. Initially, there are two options on the Session Manager menu. The first, called COMMAND.COM, lets you enter an MS-DOS 3.3-compatible command interpreter. This runs in the lower 640k of the machine, just as it would if you were using plain MS-DOS 3.3. If you don't want to devote an entire 640k to this DOS 3.3 environment, you can assign less memory to it.

When you select COMMAND.COM from the menu, the screen clears and

a familiar C> prompt appears, preceded by a copyright message. From this prompt you can do anything that would be possible in DOS 3.3, including obtaining directory listings or running any program that runs under MS-DOS. This DOS 3.3 environment is not running a real copy of DOS 3.3, but is emulating it. At least, it's emulating everything apart from network calls, which aren't supported.

To the user, running in this way looks and feels exactly like running a standard MS-DOS machine. The main difference is that while the DOS 3.3 program is running, pressing the Sys Req key (this may change on later versions) returns you to the Session Manager screen, freezing the program



# PREVIEW

that is running but preserving it in memory.

OS/2 does this by switching the processor between real and protected mode. According to Intel, such an operation is impossible. Microsoft has found a way of doing it, though the method is secret. If it really is that clever, it may not work correctly on future versions of the chip or on every clone.

The other option on the Session Manager screen is 'Start A Program'. When you select this, once again the screen clears and a C> prompt appears on the screen, preceded by a copyright message informing you that you are running under MS-DOS version 5. This is just a code name, and will probably be changed to OS/2. You are now running CMD.EXE, the OS/2, multi-tasking command interpreter. Or actually, you're running just one copy of it. Like the DOS 3.3 command line, you can start a program from the prompt by typing its name, and most of the MS-DOS internal commands work too.

You can return to the Session Manager menu, select the Start A Program option again, and start up another copy of CMD.EXE.

To switch between running programs, only one of which can be onscreen at a time, you return to the Session Manager menu and select the one you want. The entry on the menu will change to reflect the program that the particular copy of CMD.EXE is running at the time. To remove an entry from the menu, you quit a command processor by typing EXIT.

Programs running under CMD.EXE must be specially written applications — you cannot take any old MS-DOS

program and expect it to run under OS/2, except in DOS 3.

In total, you can have 15 programs running at once. Each is started from a command line, from either CMD.EXE or COMMAND.COM. You can only have one copy of COMMAND.COM, as this uses the lower 640k of the machine's memory. The other tasks, running under CMD.EXE, use protected memory above the 1Mbyte boundary.

Like a program running under Windows, a program written to be multi-tasking under OS/2 can't just assume control of the machine and its hardware: for example, it can't write directly to the screen. Instead it must make a call to OS/2, which will do the writing instead.

Because the program running in the DOS 3 environment is not running in protected mode, and can, therefore, write to any of the machine's memory or directly to the screen, it was decided that a program running under the DOS 3 environment would not be multi-tasking. Therefore, the whole system works like this:

When you select the DOS 3 environment from the Session Manager menu, that program becomes active and starts running on the screen. Any protected-mode programs that were started from a CMD.EXE prompt will still multi-task in the background, but cannot communicate with the DOS 3 program.

When you leave the DOS 3 program by pressing the Sys Req key to return to the Session Manager, the DOS 3 program stops execution while it is not visible on the screen. This is to prevent it from writing directly to the screen or memory and so crashing the system.

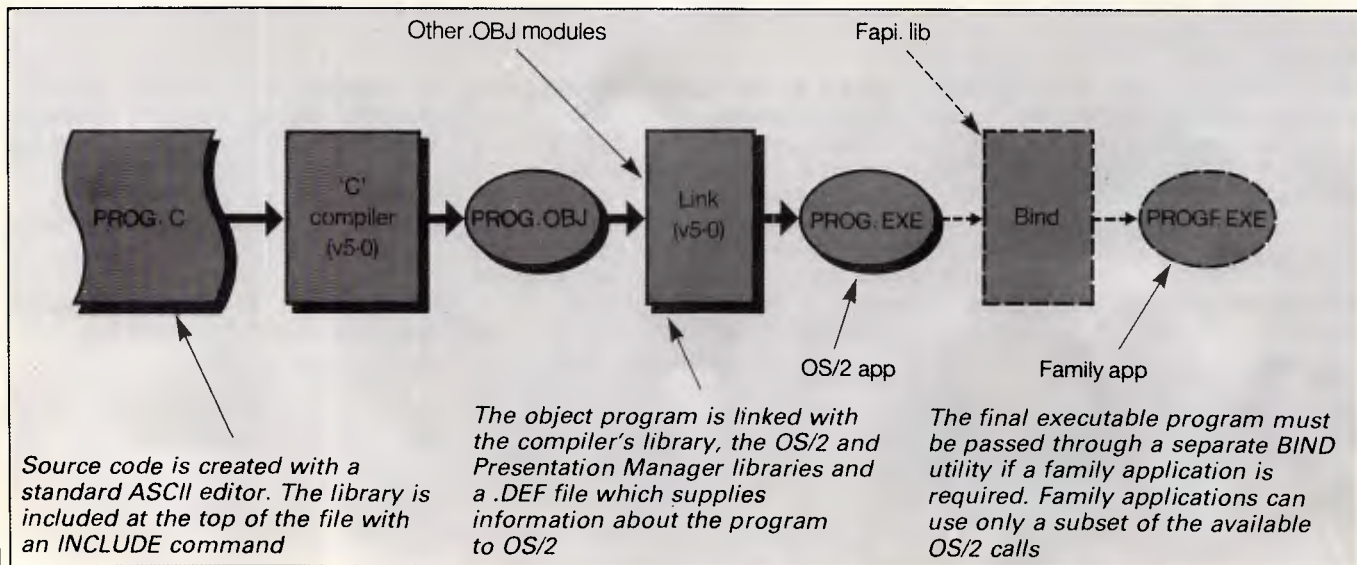
All programs run from the CMD.EXE prompt are true multi-tasking programs and continue to execute even when not visible. You can only have one program visible on the screen, though.

To prove that true multi-tasking was indeed taking place, I started a program that played a tune through the machine's speaker. With this initiated, I returned to the Session Manager and started another copy of CMD.EXE, from where I executed another program. All the time that the second program was running, the tune still continued.

Although only one program is visible at a time, a program running in the background has the ability to communicate with other running programs, and to display information on the screen. So, for example, you could leave a spreadsheet recalculating while getting on with some word processing, and a message would pop up on the word processor screen when the spreadsheet was ready.

Pop-up programs in the MS-DOS sense are no longer required, although something like SideKick runs perfectly well in (though only pops up in) the DOS 3 environment. Making a pop-up program that works under OS/2 is just a matter of writing the program and leaving it running under its own copy of CMD.EXE. If it spends most of its time just waiting for keyboard input, it won't slow the system down at all.

OS/2, as I have said, is a true multi-tasking operating system. It is not based on the message-passing principle (see under 'Windows' for details) but is a time-slicing system, so each running program gets a certain number of milliseconds of the CPU's time, and each program is serviced in rotation.



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The number of milliseconds that each receives is defined by a command in the CONFIG.SYS file (it defaults to 32), and you can also specify a priority order in the same way. The actual number of milliseconds you specify is converted into a number that represents a whole number of clock cycles.

AUTOEXEC.BAT is still used, and is executed the first time you enter the DOS 3 environment. If there's an auto-executing file for CMD.EXE, I couldn't find one. Device drivers, incidentally, will have to be totally rewritten from their MS-DOS versions, to be able to support the system in both real and protected mode.

On the version of OS/2 that I used, the operating system itself occupied around 250k. This compares with around 70k under MS-DOS, where each of the three system files are roughly 20 to 25k. You need a system with at least 1.5Mbytes of RAM to use OS/2 version 1.0. IBM told me that, by the time Presentation Manager becomes available, a PC making full use of the system's facilities and wishing to run a number of concurrent tasks will require at least 4Mbytes.

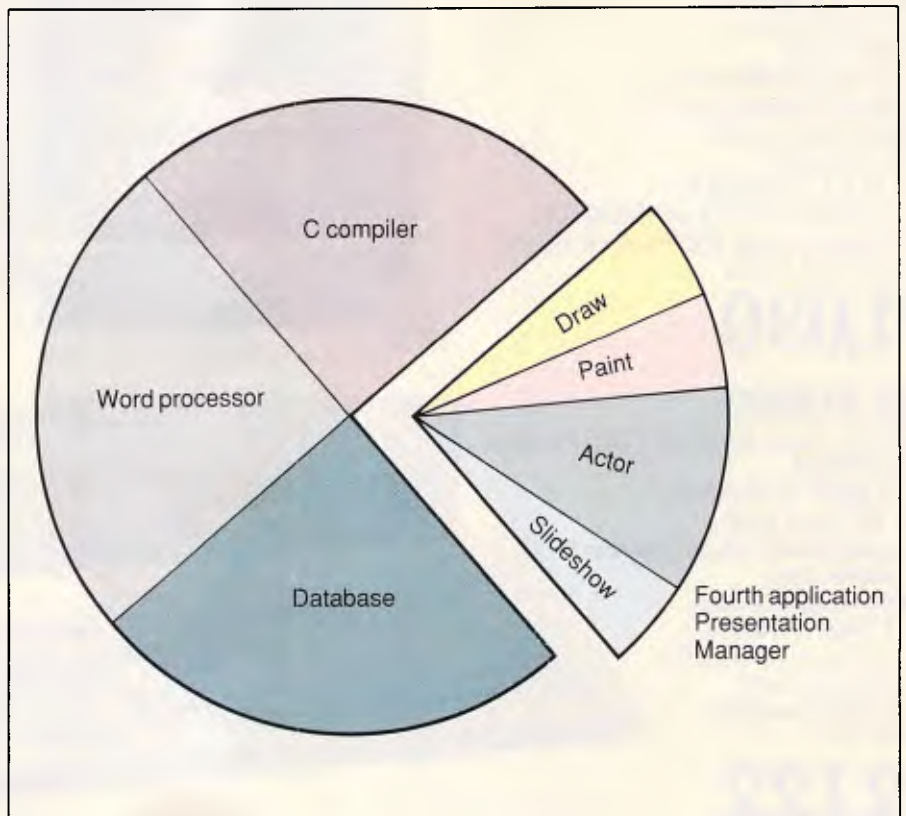
CMD.EXE, the protected-mode command interpreter, currently weighs in at about 42k. COMMAND.COM, the command interpreter for the DOS 3 environment is 25k. The hidden files (equivalent to MS-DOS's IBMBIO and IBMDOS) total about 180k.

## Writing for OS/2

Any program that currently runs under MS-DOS version 3 will run happily in the DOS 3 environment under OS/2 with no modifications. The only exception is certain device drivers and network applications.

Under this environment, though, you don't achieve the power or flexibility of multi-tasking. To run a program from a CMD.EXE prompt, in protected mode, it has to be specially written. To write such a program, you need a special compiler. Microsoft has just announced C5, which is version 5 (the OS/2 version) of its C compiler and not an interpreter powered by a washing machine motor. Quick C, Microsoft's retaliation against Borland, will also support OS/2 and is designed for writing quick prototypes of OS/2 applications. It is not an optimising compiler so you'll need C5 as well. Other languages to be announced include Fortran, Cobol and Pascal, as well as an assembler.

The main reason for the change of compilers is that there is no longer an INT command. Programs no longer



*This pie-chart shows how the processor's time is sliced under OS/2 to service a maximum of 15 tasks, though only four are shown here. Presentation Manager is just one of those tasks, and it splits its share of the processor's time among the programs it is running*

have the power to control the system or hardware directly (and OS/2 doesn't use the machine's BIOS at all); instead, they have to call on a set of 200 or so subroutines, which provide everything that the old INT commands did under MS-DOS. The compiler just generates CALL commands to access them.

If you stick to a certain subset of these calls, you can write what's known as a family application. This is a program that will run under OS/2 in both protected and DOS 3 modes, and also under a normal version of PC-DOS or MS-DOS 3.30 on a standard PC or AT.

A program written for OS/2 has to supply a lot of information to the system before it runs, like which parts of memory it intends to use and the library routines it calls. All such programs have to be .EXE files. Except in the DOS 3 environment, there is no such thing as a .COM file.

## Windows

Before looking at Presentation Manager, the graphics interface for

OS/2, it's helpful to examine its predecessor, Windows, which has been available on standard PCs for some time.

Windows is a graphics-based operating environment that provides multi-tasking even on a standard MS-DOS machine — even 8086 or 8088 based PCs.

Windows 2, due to be launched around the same time as OS/2, is similar to the current version and will run on 8088/6 machines too. The main difference is that the layout will change to resemble Presentation Manager. It will also feature overlapping windows, as opposed to the tiled ones that Windows uses.

Windows 386, also awaiting launch, will run only on 80386-based machines. The 80386 has the capability to simulate 16 separate 80286's running simultaneously. Again, Windows 386 will have the same user interface as Presentation Manager.

Strictly speaking, Windows is not an operating system in its own right as it sits in memory above MS-DOS. However, because of the clever things



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that Windows can do, most of which are not available with MS-DOS (especially the multi-tasking facility), Windows makes hardly any calls to MS-DOS (that is, it uses hardly any INT commands).

There are two major differences between operating under Windows and MS-DOS. Firstly, Windows is graphics-based instead of command-based. So, instead of typing a command to start your word processor under MS-DOS, Windows would present you on the screen with a list of file names, and you'd point with the mouse to the name of the word processor and click a button. The second major difference between Windows and MS-DOS is that Windows is multi-tasking.

Assuming you have enough memory, there's no limit to the number of programs that can be run simultaneously under Windows.

For Windows to be able to do what it does — that is, provide multi-tasking on a machine not designed to do it — it has to take over the hardware of the machine completely. Therefore, a Windows application must not write directly to the screen, or read from the keyboard, or do anything that an MS-DOS program would do. Instead, the application has to send a 'message' to Windows.

Windows is known as a message-passing operating system. A program running on its own under MS-DOS has complete control of the system, and it can do what it likes without getting in the way of other programs that may be active. Under Windows, a program can't be allowed to behave like this; rather, it acts on messages. A message is a piece of information sent by Windows to a program, to tell it that something has happened or is about to happen. At the heart of a Windows program is a loop that simply waits for Windows to send it a message, and then acts on that message before returning to the loop to wait for another one.

There are four places that a message can come from: from the user pressing a key or moving the mouse; from Windows itself; from the current program (that is, a program sending a message to itself); or from another program.

A true multi-tasking operating system like OS/2 works by splitting the processor's time evenly among a number of programs. Windows, on the other hand, does not do this: it allows a program as much time as it needs to process a message. When it has finished processing a message, the program passes control back to Win-

dows and carries on waiting for more messages.

It is, therefore, possible for a program to crash Windows. Suppose a word processing program deals with a certain message (the user pressing the PgUp key, say) by just going into an infinite loop and not returning control to Windows. In such a case, the routine that processed the PgUp command would have total control of the system. The user couldn't press Ctrl-C to get out, because the message saying that Ctrl-C had been pressed wouldn't get anywhere. The computer would have to be rebooted.

## Presentation Manager

The Presentation Manager is to OS/2 what Windows is to MS-DOS. It is a graphics-based operating environment that runs on top of OS/2. The difference is that Presentation Manager makes full use of OS/2 calls, unlike Windows, which hardly calls MS-DOS at all. Presentation Manager currently supports CGA, EGA and VGA display modes and uses each to its full capability. The development work on Presentation Manager is being done at IBM's laboratory, though the size of Microsoft's involvement is not clear. Certainly, there's bound to be some of the original Windows code in there.

The demos I saw were running on a PS/2 Model 50, though there's nothing at present to indicate that it won't work on any compatible AT. This is on condition that the clone manufacturer does not use the BIOS to provide compatibility, as neither Presentation Manager nor OS/2 uses the BIOS at all.

There will be no Presentation Manager with OS/2 version 1.0. It will appear for the first time with version 1.1, and will form an integral part of the operating system. It will not be available on its own — the OS/2 upgrade from 1.0 to 1.1 will include Presentation Manager.

IBM is also working on the Extended Edition of OS/2. This will be an enhanced version of Presentation Manager that includes a DB2 workalike — IBM's database program used on its minis and not to be confused with dBase II. There will also be a communications package to link the machine to a mainframe as a terminal. The Extended Edition will be an IBM product — there is no official Microsoft involvement and Microsoft will not sell it under its own name.

When Presentation Manager is first started, the user is presented with a menu, just like Windows' MS-DOS Ex-

ecutive. Although the menu uses graphics mode to provide fancy colours and fonts, the menu is text-based rather than icon-based.

However, the menu will not consist of plain eight-character file names. Instead, there will be fuller descriptions like Word Processor, Spreadsheet, Communications, and so on. These names are added to the machine's main start-up menu when a program is installed. If you haven't installed a program yet, or you want to call up a small utility program, there will be a way of choosing from file names instead. If you get stuck, there's full context-sensitive help available.

Another option on the menu will let you use the OS/2 command-line prompt as described above — similar to clicking COMMAND.COM from within Windows.

Presentation Manager runs as one of OS/2's 15 tasks, and is itself multi-tasking. So, you could theoretically have a DOS 3 environment, 14 different copies of CMD.EXE and Presentation Manager running at the same time on a machine, with Presentation Manager itself running an infinite number of programs. It's unclear at the moment whether you can run more than one copy of Presentation Manager!

Like Windows 2, Presentation Manager uses overlapping windows as opposed to tiled ones. IBM calls this approach the 'messy desktop' as opposed to a 'tidy' one. Switching between windows will be via the mouse, or with hotkeys.

Programs intended to run under the Presentation Manager again have to be specially written. It won't be possible to start writing them until version 1.1 of OS/2 is launched, as the extra CALLS will not be in the library of version 1.0.

Programming under Presentation Manager is similar to using windows. It is basically a message-passing operating system in its own right. Presentation Manager handles its own multi-tasking, splitting its CPU time among all the applications it is running. However, there is a small degree of true time-slicing, by which the Presentation Manager uses a regular slice of the processor to keep a check on what's happening. Consequently, if a message-handling routine goes wrong and does not return control, it's possible for the user to click on a menu option and kill off the offending process from outside of that non-functioning program.

To keep the size of .EXE files down,



**PREVIEW**

Presentation Manager and OS/2 support dynamic linking. If you have two programs which both use the same subroutine library (one that you have developed), only one copy of the library has to be in memory and both programs will use it.

Another space-saver is that if you run two copies of the same program at a time under either OS/2 or Presentation Manager (or Windows for that matter), only one copy of the actual code is loaded from disk. So, a system with only enough memory to run three programs if they were all different could typically run five copies of the same program.

A major headache for application programmers is the incompatibility between source code for Windows applications and Presentation Manager ones. At the very least, Windows programs will need to be recompiled under an OS/2-compatible compiler before they can run under Presentation Manager.

In addition, the names of most of the CALLs have changed, so the command to draw a line under Windows will not be the same under Presentation Manager. And the order of some parameters will change, too — you may have to specify the size of a rectangle as length, width instead of width, length.

Despite assurances from Microsoft to the contrary, it seems that the conversion process will not be trouble-free.

**Conclusion**

The IBM AT has come and gone over the last two years, and no operating system was able to make full use of the machine's hardware. The days of the 8088 and 8086-based PC are numbered, and so, it may well prove to be, are MS-DOS's. There is no doubt that OS/2 will be to MS-DOS what MS-DOS was, in turn, to CP/M. There will still be many dedicated bands of MS-DOS followers — after all, not everyone wants to run more than one program at a time, and 640k is more than enough for a lot of applications.

The familiar command line will still be there to comfort those who have grown used to it since 1981, but Presentation Manager will be available for those who want to use the machine without caring how it works.

END

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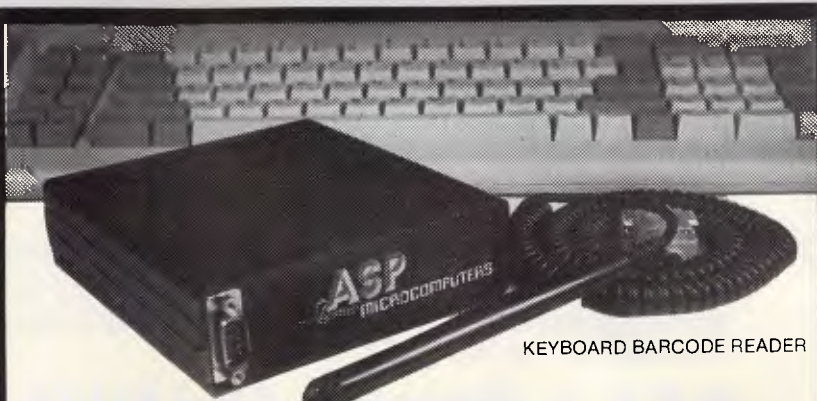
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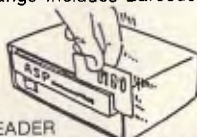
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## LETTERS

*This is your chance to air your views — send your letters or contact us via Microtex on Telecom's Viatel, page 666. The address to write to us is Australian Personal Computer, 124 Castlereagh Street, Sydney 2000.*

### **Verbal overkill promises nothing**

I am becoming thoroughly sick and tired of reading in the computer press the recent airings of some software houses, prognosticating their intention, 'at some future date', of releasing software which will do this, that and, more than likely, the other as well.

The industry has coined a choice expression for this indecision — 'vapourware'.

Companies which, a year or two ago, would not have dreamed of dropping a whiff, inkling or hint of their development plans, are now falling over themselves to proclaim to the world what they are going to release *mañyana*.

Witness the recent ballyhoo over Lotus' carefully stage-managed leak regarding the LAN version of 1-2-3, and the company's subsequent red-faced admission that this launch was being pushed back.

Notwithstanding that little episode, we have been entertained recently with *more* prophetic verbalisations from the software industry's most famous and persistent litigant. Support for VGA and OS/2, 3.5in media, a mainframe version of 1-2-3 and a DBMS have all been promised definitely ... sometime in the future ... probably.

Never before has so much vapourware been released into the atmosphere at one sitting. One can only surmise that the PR pundits at Lotus have been feeding on an exclusive diet of curry,

sultanas, radishes and lager recently.

What is the reason behind all this huffing and puffing? Could it be the old wile of keeping the opposition at bay while you buy time to grind your own development effort into top gear? We should be told.

**T Beken**

### **Taking technology too far**

My initiation into computers involved bashing out punch cards which I never quite learned to read reliably, and waiting two days for a short (twelve-page) printout which could best be summarised as 'Program crash on line 20'. (Notice the helpful addition of a line number which was probably a facility added by a mad, hacker student.)

The new, cheap PC-compatibles have produced lots of new users who know nothing of computing, and are able to jump direct to the very high-level interpretative languages of, say, WordPerfect, Lotus 1-2-3 or GEM Basic.

But while there *is* a market being served here, the computer user base is becoming complacent and — in some 'yuppie' quarters — arrogant about its understanding of computers.

GEM and Windows may be blatantly annoying both to use and to program within, but I fear they are the punch card of tomorrow's computing. Soon, the user interface programmer will become more important than the researching, register-juggling and general-

ly innovative in-house subroutine/utility programmer.

Sure — the world will end up with lots of slow, unimaginative, beautifully packaged, over-hyped, mindlessly over-graphic, intentionally incompatible total office environments. In response, the manufacturers will have to make faster and faster machines in order to get these programs up to a sensible speed.

I'm not sure who will benefit in the long run. But, when I am woken up with a cup of tea and a digitally-synthesised 'Good Morning!' from my 25GHz, 1024-bit 804586Motorintel-based IBM clone, I will still be worried that, if I add just one more background utility, I'll use up my last gigabyte of memory; or I might drop my terabyte holographic optical disk down a crack in the floorboards and never find it again.

**W Roberts**

### **No syntax errors please**

In recent months APC has published several excellent memory resident programs by Ian Davies and Jeff Prosize (XDIR.COM). They both used different approaches when typing in the program. As my Macroassembler is faulty, I was obliged to take the Basic method.

Ian Davies adopted the more common hex format in the data statement section of the Basic program, thereby requiring fewer key presses pro rata. Additionally, he also gave the offset addresses and the hex bytes alongside the assembler statements.

With this approach, I had a better understanding of the program and had the choice of keying in the hex values using the 'e' command under Debug. In fact, using the 'e' command is far less frustrating with no syntax errors and fewer key presses (I only have to worry about the correct hex bytes and the space bar; no punctuation marks, not even the enter key), than using either the 'a' command under Debug or Macroassembler.

On the other hand XDIR.COM is a very long program made longer by the use of decimal values in the Basic data statements, not to mention the absence of offset addresses and hex bytes alongside the assembler statement. Having laboriously keyed in the XDIR Basic program, I was being prompted for errors in the data statements where none existed. To cap it all I accidentally lost the whole program. I was then obliged to translate some 1500 decimal values into hex which I then entered using the Debug 'e' command. It worked the first time.

Perhaps you could set a standard for future programs by requiring the authors to use the approach taken by Ian Davies.

**S Kamaldeen**

### **Modem users unite**

I have just read M Taylor's letter (June APC), and I am surprised at the solution he/she has to the problem of the proposed charges that Telecom is planning for the operators of privately owned Bulletin Boards. Quote

# LETTERS

"Anyone want a modem?" Unquote. What an answer! It's no wonder good services go down the drain when users have an attitude like that!

On that vein, I throw a challenge out to all of your readers who utilise the facilities provided by these people to stand up and be counted, literally.

Write letters! Write to the Federal Minister for communications and tell him how you feel about this outrage. Unless you do this, your voice will not be heard.

I have read many letters and articles in computer magazines recently decrying the heartlessness of Telecom, but how many have written to the Minister concerned? When you count the number of bulletin boards around Australia, then multiply that by the number of registered users of each board, that comes to a lot of letters flooding

into the Minister's office, telling him what the people want.

Come on Aussie, come on. Write those letters. Let it be known what you want. Don't sit back and be dictated to.

PS. I have more faith than M Taylor. I'll buy the modem!  
**B Collin**

## Storyboard patch

I have been using IBM's graphics package, PC Storyboard on an IBM PC/XT for a while. I have also run it on various IBM clones, but recently I bought a Blue Chip system and the PM.EXE module of PC Storyboard does not run. Someone in Melbourne has a patch for it, but he is not willing to share it with other PC enthusiasts unless paid substantially.

Would any of your readers have a patch for the software which he/she might share with others?

**M L Smith**

END

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AFOR 151



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## SCREENTEST

# Omnis Quartz

***Omnis Quartz is a powerful relational database for the PC available from Busiware in Sydney. Quartz can be heavily customised, and runs under Microsoft Windows — the first database to do so — in a multi-tasking environment. Derek Cohen and Nick Walker tackled its comprehensive facilities.***

Back in 1982, an Apple dealership, Blyth Software, decided to apply its expertise in building turn-key systems to developing its own product. Thus was born Omnis — a database management system for the Apple II. Later came Omnis 2 and, two years ago, Omnis 3 for the Macintosh. Omnis 3 Plus, the latest Mac version, has for a long time been outselling all the other Mac database products put together.

Omnis 3 Plus is available in a multi-user version and is the basis of Blyth's multi-user accounts system, Omnis Accounting, for networked Macs. Omnis 3 for PC-compatibles was launched in 1986, but was a poor text-based shadow of the Mac product, although it shared many of the same capabilities. It has, however, spawned the vertical market Blyth Craftware range of applications.

Now Blyth has produced the first fully programmable relational database to run under Microsoft Windows. Omnis Quartz bears many similarities to its Mac predecessor, but has the added advantage of being able to use the multi-tasking capabilities of Windows including running in the background.

### ***System requirements***

Omnis Quartz is designed to run on an 80286 or 80386-based PC with a minimum of 640k of RAM and a hard disk.

During this review, Quartz was run mainly on an AT compatible but was also tried on an Amstrad PC with 512k RAM. The reduction in speed was quite noticeable and, while Quartz will

run on much less well-endowed machines, it is wise of Blyth to specify such as a minimum-desirable configuration.

Additionally, Quartz needs a full version of Microsoft Windows installed for your particular machine and printer. A mouse is desirable, as using Windows-based applications totally from the keyboard is possible but tiresome. A colour monitor is not essential but colour does improve the organisation of the application.

Windows cannot at present make use of extra memory operating under the Lotus/Intel/Microsoft standard, but when it does Blyth claims that Quartz will use it too.

### ***General description***

Quartz operates totally within the Windows environment, using the pull-down menus, overlapping windows, scalable fonts, scrollable lists and dialogue boxes common to all Windows applications.

A Quartz application consists of a number of different elements, all of which are under the programmer's control. The end-user will interact with the finished program through pull-down menus, entry layouts, reports, lists (which are in effect onscreen summary reports) and dialogue boxes. In conjunction with a set of file formats which define the fields for the various record types, the user can process the information held in a separate data file. One application library of file formats, layouts, menus, and so on, can be ap-

plied to an unlimited number of different data files.

Quartz is also accessed by means of these Windows elements. Entry layouts, pull-down menus and scrollable list windows are used to make selections, build up sequences of commands in the Quartz programming language, and define the functions of the finished database application. Because the programming environment and the resulting product share a common interface, Quartz itself becomes a model application from which to learn.

Anyone used to the multiplicity of disk files common to databases like dBaseIII will find the Quartz organisation slightly alarming at first. Quartz consists of just two files: QUARTZ.EXE, the 420k program; and QUARTZ.INF, a 512-byte file which holds the product registration details, system defaults and the name of the last application used.

Each application will typically produce only two disk files. The first, with an extension 'QAP', holds all the fixed information such as layouts, file and report formats, and menus. All the data is held in another file with the extension QD1; this can hold up to 2560Mbytes of data. And if this is not enough (though it's not clear where at present you'd hold files this big), you can chain on further data files with the extension QD2, QD3, and so on.

Quartz organises the information within the single data file, and up to 60 separate or related sets of records can be stored with their indexes. Nonetheless, it is useful to be able to describe



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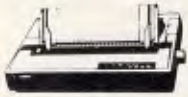
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### Entry Layout

The two boxes on the right of this entry screen contain radio buttons with each box linked to a particular field. The central box is a list field and, in use, a list of distributor names will be displayed with scroll buttons in the red bar. The programmer can determine the effect of clicking on a line in a list field. When any of the push-buttons at the bottom are clicked, they activate procedures stored in the menus.

In this application, the 'Record' button was designed to perform two functions: to start editing a record; and to indicate that the edit had been completed. A conditional loop in the connected sequence changes the value of the button's label variable — #5 — as the process takes place and tests this variable to determine whether to start editing or save the edited record



### Amend Menu

The sequences of commands or procedures which drive Quartz are stored inside the menus. The menu line names are defined on the left, and the commands which are executed when that line is clicked or called are defined in the right-hand window. Leaving two blank lines in a menu defines the end of the visible part of a menu, and the rest of the lines can be used to store procedures called by number, by pushing buttons or other sequences. 'New tapes' has been associated here with a hot-key — control-N.

Creating a sequence of commands involves clicking on a series of available commands from the bottom right-hand list. Any parameters expected (such as the parent menu and number of a sequence called as a subroutine) are prompted for bottom right

each set of records as belonging to an imaginary file, even if this is a logical rather than a physical entity. Up to twelve fields can be indexed within each file format, and indexes are automatically selected and maintained whenever the file format is used.

Each pull-down menu can display up to 20 items, with the option of separator bars to group the choices. There can be up to twelve menus installed at once, and commands are available to add or remove menus, to place a check mark against particular choices, and to 'grey out' certain items which are either not applicable or require an access level the current user does not have. All Quartz windows and menus can be password-restricted with up to eight access levels available.

Selecting a menu item can lead to further menus being installed or, more frequently, the opening of layouts on the screen carrying entry layouts or the production of printed reports.

Unlike most databases, where the programming instructions are stored in a file of their own, Quartz stores these

instructions, known as 'sequences', within the menu structure.

Each menu can contain 100 items, though only the first 20 can be displayed. Associated with each menu line can be a sequence of commands, with each sequence holding up to 5000 bytes, and a total limit of 30,000 bytes of storage available per menu. Each line has a number, and can be given a name which will appear on the menu bar if that line is visible. A window alongside shows the sequence of commands attached to that line; and the lines below 20 — or below those visible if this is less than 20 — are where the programmer enters and stores the sequences of commands. These sequences may be called by other sequences, or by clicking on menu choices or push buttons on any entry layout.

Entry layouts can each consist of up to twelve separate, sizeable and positional windows. On each layout window the programmer can position fields of the following types: entry or display fields; check boxes for setting the logi-

cal value of a field; lists, complete with a vertical scroll bar; radio buttons; and push buttons. In addition, free text and box rules can be used to annotate and organise the layout.

Radio buttons take their name from the channel selectors on car radios — only one button can be selected at any one time, and choosing one (by clicking on it with the mouse) de-selects the current choice.

Push-buttons are a feature common to most WIMP environments — they are the buttons the user clicks to initiate some activity. Standard push buttons are available for moving forwards and backwards through a file, and for finding, adding or deleting records.

However, push-buttons can be linked to the programmer-defined sequences which are stored in the menu formats. Thus a push-button marked 'New Title' could invoke a sequence that opens a fresh window with the cursor in the first field ready to accept data for a new record, checks the data, adds the record, and then returns to the original window.

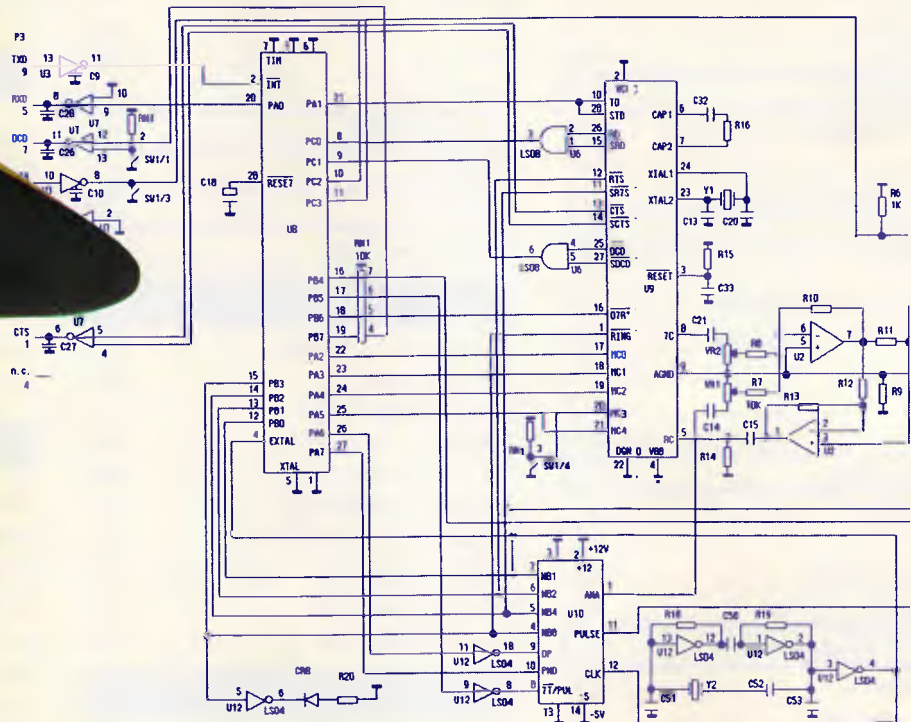


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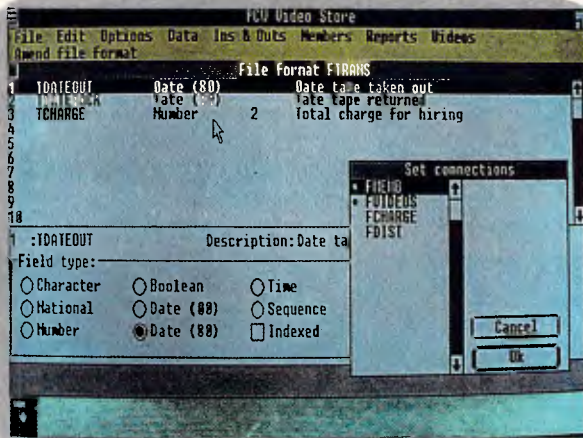
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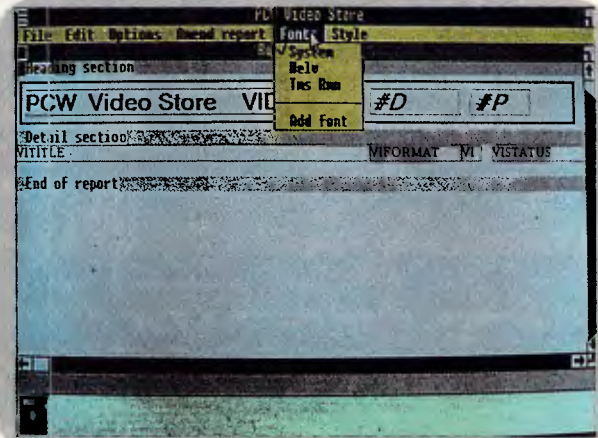
# SCREENTEST



## File Formats

Among the field types available in a file format are two date options — one starting at 1900, the other at 1980. National fields are sorted in a different way to character fields to cope with accented characters. To set the connections between records in FTRANS and other files, the file format names in the Set connections box are double-clicked.

The maximum length of each field is defined here, though on an entry or report format, the amount of data displayed can be stretched or shrunk using the mouse



## Amend Reports

Reports can consist of a number of different sections including headers and footers, and sub-total headings. Any number of records can be printed across a page, which is useful for printing labels; and the report destination can be changed at print time between the available ports, the screen or a file. Text and fields can be printed in various fonts and font styles and these attributes are shown on the report design screen. As well as fields, system variables such as the date (#D) and page number (#P) can be included

Lists are one of Quartz's most novel features. Up to eight lists can be current at any one time. Each is defined by a series of commands which specify the list number, the fields which will form one line of the list, and how the list will be made up. Lists can be used as a 'window' onto the records of another file, or as a way of displaying the options available to the user — for example, which reports are available.

Reports can be printed to screen, to printer or to a parallel or serial port. This latter option allows a Quartz application to make use of serial links or modems to send data down the line at the click of a button. Commands are available to set serial port parameters like baud rate, and to send a pre-determined string of characters to the port. This could be an auto-dial sequence to a modem, or a set-up string to initialise a printer.

A range of different fonts and font styles can be incorporated in a report, and the report design window shows these onscreen — very WYSIWYG, indeed. Sort and search formats can be included either automatically, or by being selected at print time by the user.

## In use

To test Quartz APC designed a simple

video rental store application. We set up file formats for membership, video tapes and distributors. The tapes file was connected to the distributors' file: we limited each tape to one distributor, and had only one copy of each title.

Throughout Quartz, options are nearly always of the multiple choice type. The most typing we did was in specifying the text for the menus and entering textual descriptions.

Quartz does not support many-to-many linking of files, so we added a transaction file which would connect members with the video tapes they had rented. Having set up the basic file formats, we clicked the menu choice to set the connection between the transaction file and the membership and video tape files. Quartz opened up a window listing the other existing file formats, and creating the links involved merely double-clicking on the required file names. This file list was in fact an ordinary Quartz list that can be created for use on an ordinary layout window.

We next designed the menus. Each has a name and a description, the latter being what actually appears on the menu bar. If a menu is given the name 'Startup' it will be automatically installed when an application is opened. Additionally, the commands stored as menu line zero will be automatically executed.

Line zero of the start-up menu was as follows:

- Set Quartz window title (PCW Video Store)
- Install menu (MMEMBS)
- Install menu (MREPORT)
- Install menu (MVIDEOS)
- Set 'About . . .' sequence 10 (About PCW . . .)
- Call sequence 23 (make disk list)

This command sequence was created with very little use of the keyboard. A window at the bottom left of the screen displays a list of all the available commands or group of commands. Clicking on an item with three dots after it opens up — outline processor fashion — further options. Double-clicking any line copies it into the current sequence. Where a command requires parameters, check boxes or further lists of valid options will appear on the bottom right of the screen. Therefore, selecting the command to set the main data file will open a list of the existing file formats, and clicking the required file name copies the completed command line into the sequence.

To call another sequence, it is necessary to specify it by number, or menu format and number if it is not within the current menu. Names cannot be used, unfortunately. However, the actual name of the sequence is entered, and

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## SCREENTEST

if the 'sub-routine' sequence is later edited and renamed, this change will be reflected in the name shown in the calling sequence. In the aforementioned menu, sequence 23 was referred to by number, and the description added automatically by Quartz.

This may all sound quite convoluted, but it is possible to establish a complex sequence of commands quite quickly once you become familiar with where the command you want is in the list. When a menu has been set up, printing the entire set of sequences provides not just a fully commented program listing, but a note of how much space has been used and how many errors have been found.

A 'find' facility will locate where a particular string is in your own sequence of commands or menus, but, unfortunately, it cannot be used on the command list to help you find the particular command you want which somehow isn't in the place you expect it to be. For example the commands to open and close a window are in the group called 'Select . . .' — there is no group called 'Windows' which would have seemed obvious. And the report-printing commands are scattered between the 'Print . . .' and 'Select . . .' sections.

As there is no way that a command can be typed in — it must be clicked on — there is no way you can make a syntax error (as opposed to a logical error caused by placing the commands in an incorrect or nonsensical order.) But, conversely, there is no way to enter the command line you want directly. The reason is that the command lines don't exist as text, but as pointers to the routines in Quartz. The other consequence is that sequences cannot be created in a text editor and imported as ASCII files. You may work out the structure of an application on your word processor, but you will have to click your way through the lists to enter it up.

Entry layouts consist of one or more windows containing fields, buttons and lists. There are four window types available, from the simple window used for warning messages to the ornate with a title bar containing a combination of fixed information such as a heading, and possibly variable information such as the date, or the user's name or some other locally calculated information. At any one time, a main data file must be specified, and it is only records in this file that can be edited. Data from connected files can only be displayed. However, it is a simple matter to change the main data file upon some user action such as clicking a button.

To place a field on a layout, you double-click where you want its first character. This opens up another window where there are choices for field type, name, calculations and range checks. Fields on one layout can be from any number of different file formats, and fields from connected files can be specified as auto-find. When data is entered into such a field, Quartz will fetch the matching record — assuming the field is an index one. Thereafter, any data from that record can be displayed automatically.

The size of the data displayed can be set independently of the actual file format, though this does not affect the file format itself and data is subject to the constraints of the original format. A character field can be up to 2400 characters long, and will automatically word-wrap within a rectangle specified as part of the entry layout. If the rectangle is smaller than the text, the use of the mouse or cursor keys will scroll the text within the rectangle. This is a great improvement over the memo fields of dBaselll.

If a list is chosen as the field type, then you can determine the format of each line in the list, adding text or other variables to the fields that were used to build the list. List boxes can be sized on the layout, and can be as small as just one line. The sequences attached to the entry layout determine the consequences of double-clicking on a list line, but could be used to establish a link with a record in a connected file.

Cut and paste and drag options allow for the tasteful or ergonomic layout of the entry form, and seven different rectangle types can be used to group together related fields. Any field or box can be coloured, though strangely, text entered onto the layout window itself, such as field descriptions, must be black.

A check box associated with a particular field returns a value of 1 or 0 depending on whether it is checked or not. While there is text associated with the box — for example, 'IN STOCK' — this text is not passed to the current record; only the number is. This seems a pity as a constant translation between number and text has to take place. In practice, you would probably store the data as numbers, but it means that whenever the field is used, the same translation has to be done.

The same is true for radio buttons. In our video store application we used a set of radio buttons for tape format — VHS, Beta or Video 8. Radio buttons are useful when the number of options

is fixed for all time, so to speak. If the choices were changing, a list would have been better, with the tape formats stored in a data file of their own and the list created each time the application was run or a format-editing layout used.

The three buttons we used were all linked to the same field. During data entry, Quartz returns a number which specifies the location of the radio button which has been pressed: thus VHS would return a '0', Beta a '1' and Video 8 a '2'. While it might have been better if the associated text had been stored in the record, Blyth argues that this causes difficulty when the record is called from the file for editing. Quartz has to show one of the radio buttons as being selected and would have to evaluate the text on the screen to choose a button. Using numbers, if the field in a record has a value of 1, then Quartz checks the second button in the group.

Push-buttons, as has been mentioned before, can be used to invoke standard record management functions like edit, insert, find, next, and so on, or they can be customised to call any of the sequences contained in the menu formats. The text on the buttons and their size can be changed, though the buttons can only be stretched horizontally and not vertically. Buttons can be designed to disappear during data entry or when there is no current record. Therefore, the 'Edit' button could be hidden while there is no current record, and the buttons to move through the records need not be seen while the user is editing a record. The text which is displayed on a push-button can be variable and can be changed as the user progresses through an application.

Quartz provides a range of system variables, but no user-defined ones except as fields in a file format. There are 60 numeric variables, five string variables, and others representing the system date and time, the state of a logical 'flag', the current workstation number on a multi-user system, attributes of the current list, and the status of various aspects of the data entry process currently taking place.

There is no way that names can be assigned to the variables, which is a pity. A formula #6=(#3-#2)\*#4 makes a lot less sense than RENTAL=(DATEIN-DATEOUT)\*DAYRATE, and variable names could be assigned dynamically through sequence commands.

All of these variables can be displayed onscreen and manipulated under sequence control. To include

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them in a calculation or layout, they are selected from the file format list which is always invoked by pressing F10. Again, in keeping with the click approach, calculations can be built up by clicking on the variables and field names in the lists popped up by Quartz. If, on checking, an invalid variable or field name has been entered by hand, it is highlighted and the options presented for clicking into place.

While building a Quartz application, shortcut keys can be used to activate certain functions. Thus Control-M will bring up an editing window for the current menu; Control-W will toggle between editing the current layout and using it; and Control-R will allow you to edit the current report, with the same key being used to start it printing.

Such shortcuts can also be assigned to menu lines, so we assigned Control-N to the 'Add a new member' option, and Control-V to the 'Add a new video' line. For frequently used choices, such shortcuts would speed up a user's operation considerably.

Reports are designed by painting a screen. Each report consists at a minimum of a detail section which is repeated for as many records as satisfy the search criteria, if any, in force at the time. Additionally, headers and footers, sub-totals and sub-total headings are available.

Any item on a report, be it a field or fixed text, can be assigned a font, font size and style such as bold or underlined. Quartz printer handling is determined by Windows and, annoyingly, we had to run Windows' Control program to change printers.

Quartz was run with an Epson LQ800 24-pin dot matrix printer and a Kyocera 1010 laser printer. Using the Epson, Quartz insisted on printing in graphics mode, which would be very time-consuming except for the most elaborate but short report. Long reports containing much data need to use a printer's fastest draft mode, but the only way to use this is to change the default Windows printer to a text-only device, in which case we lost the box rules.

When a snazzy, stylish report was required, Quartz turned out some good work with the different fonts and sizes reproducing well. The penalty is speed, but that is a problem for printer manufacturers, not database designers.

On the Kyocera speed was less of a problem, though even there it would have been useful to be able to turn off the fancy fonts and run off a quick draft without relying on Windows' ability to run two programs at once and invoke the Control program.

## Quartz vs dBaselll

*(the 'biased' views of a dBaselll user)*

It took me approximately three months of sporadic working, from knowing nothing to developing the basic structure of a working application using dBaselll. The video shop system we developed under Quartz, although somewhat less complex, took around a week to get into a similar semi-operational state. At first sight this twelve-fold increase in speed seems nothing more than amazing, but then I started to reflect on the process of database creation under Quartz.

Quartz is incredibly easy to use because everything is interactive: creating a procedure under Quartz consists of literally pointing at the statement you want and then pointing at the arguments you want to use with it. This is great fun and a very quick way to create procedures or 'sequences', as Blyth calls them. It's also a very dangerous way of performing any kind of programming — it tempts you into making hasty alterations without considering their repercussions. It is very difficult to sit down and write all the sequences on paper in true top-down fashion.

The majority of programmers spend their time maintaining the source code of existing programs, and my experience suggests that the same is true for database designers. A large Quartz program could be many times more difficult to maintain than its equivalent in dBaselll; not only because of the problems generated by its interactive nature, but also because of other problems. When the sequences are printed, they are printed purely sequentially and so cannot reflect the structure of the overall system; it isn't possible to give meaningful names to variables; and there is no way to build up a library of general-purpose routines (although I am told that an additional Quartz toolkit will make this possible).

Despite these reservations, there is no doubt that Quartz is an immensely powerful package capable of creating applications that are many times more friendly than anything created with dBaselll. All the power of Windows is fully utilised, for example: creation of entry forms, producing reports and utilising pull-down menus are all exceedingly easy. There were

times during the course of this review when I could have cried, as a feature that took me weeks to create under dBaselll took less than five minutes using Quartz.

The most difficult concept for a dBaselll programmer to get used to with Quartz is that of sequences, and the fact that they are hidden away among Windows' pull-down menus. I still find it peculiar to have to examine the depths of a menu in order to find a system's source code. Once you accept that sequences are roughly equivalent to subroutines in dBaselll, things become somewhat easier. But even then the process of converting a dBaselll program would not be a simple line-by-line translation, because so many of the features of Quartz are tied up in interactive set-up screens. Building a Quartz application involves creating all the components of the system (input forms, menus, reports, and so on) and glueing them together with sequences. dBaselll applications are created from the ground up, as in the source code (discounting The Assistant, Ashton-Tate's rather feeble attempt at a friendly application development environment).

I was expecting one of the trade-offs of the Quartz environment to have been speed. Surely, as Quartz has Windows to support, it would be abysmally slow in comparison with dBaselll. When developing applications this is definitely true — running Quartz on anything less than an AT is painful, but when running an application the difference is less noticeable.

My initial (non-scientific) experiments suggest that dBaselll is the quicker of the two programs but not by much. Of course, dBaselll developers have one major advantage in the search for speed — for extra cost they can purchase a dBaselll compiler.

Will I be using Quartz for my own applications? Not right away, no, but I suspect that when the pressure is on and I need a prototype up and running within a week, that I might succumb. Eventually the superior quality of an application generated under Quartz will decide for me, providing of course that the hefty \$1500 price tag is within my budget.

**Nick Walker**



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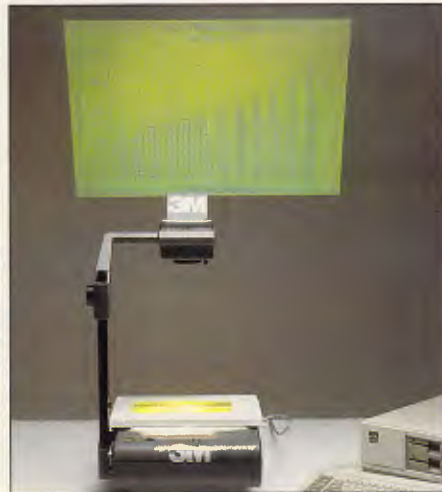


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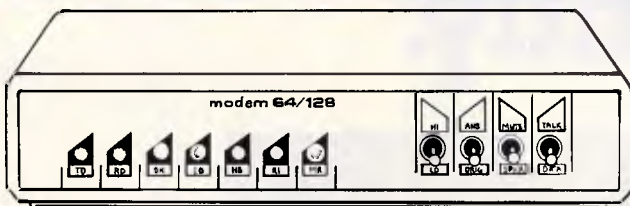
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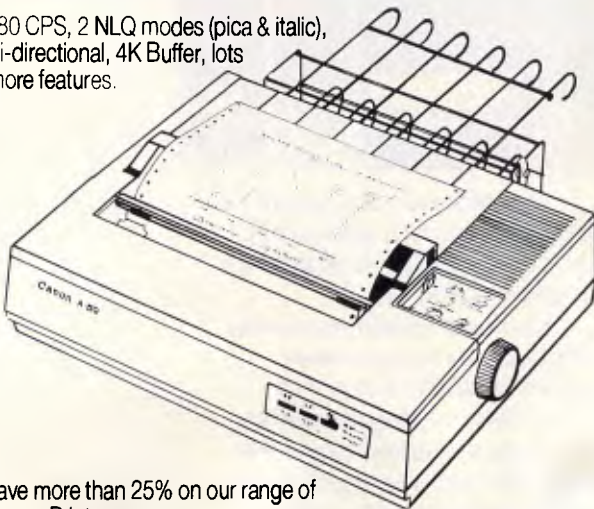


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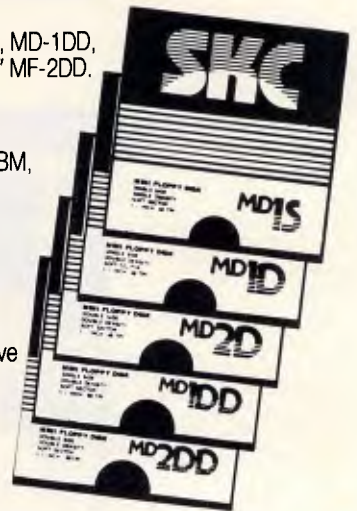
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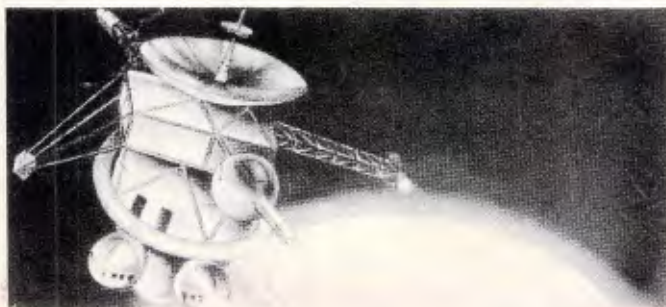
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## SCREENTEST

Additional features available include an import and export facility using industry-standard formats such as DBF, SYLK and WKS.

### Documentation

We worked with a pre-production version of Quartz and the documentation was not finished. However, we did have a fairly complete reference guide and this included a brief description of the function of every command and option, often with brief command listings.

The retail version will include an introductory tutorial manual and an advanced programmer's manual. This will include sections on database development and design. A quick reference guide will be in loose-leaf format so that updates can be easily inserted.

Quartz will also be supplied with a full sample application of a project management system. This will manage files of people and tasks.

### Price

Omnis Quartz will retail at approximately \$1500. Blyth has decided not to include Microsoft Windows with the pack-

age on the basis that an increasing number of manufacturers are bundling Windows with *their* machines. This decision is questionable, and if you don't have Microsoft Windows it will set your back an extra \$256.

Blyth will be marketing run-time modules for Quartz at around \$350 each, and a full multi-user version will be available later this year, although existing applications will need minimal or no modification to run multi-user.

### Conclusion

This review has only provided a taste of what Quartz can do. There is no doubt that it is an extremely powerful programmable database, both in its data-handling capabilities and in the tools it gives the programmer to design applications.

The point and click approach of Quartz to programming, and the use of menu lines rather than separate program files to store sequences, will seem strange to most existing programmers. But when the habit has been acquired, it is possible to set up the bones of a slick-looking application very quickly.

Quartz doesn't lend itself easily to a

top-down approach to database design either. Ideally you would start with the visible pull-down menus. But, having designed the file formats, lists and entry layouts, you have to go back to the menus to do the nitty-gritty work of programming. Fortunately it is easy to hot-key between the layouts and the menus, but the process does seem rather circuitous.

Finally, you have to question whether a graphics environment is ideally suited to all data applications. Certainly the screens can be designed well, and push-buttons and scroll bars can prevent users from making mistakes. But in a heavy-duty data entry system, an operator doesn't want to have to keep taking his or her hand off the keyboard to use the mouse, and greater opportunity to design in hot keys would be essential in this situation. Nonetheless, these are small criticisms compared to the power and ease of use of the finished applications.

END

*Omnis Quartz is due for release in November from Busiware. Tel: (02) 281 1300.*

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# Kurzweil Discover

*The Discover 7320 text and graphics scanner from Xerox subsidiary, Kurzweil, 'learns' typefaces as it goes, and incorporates templates and dictionary to improve its pattern-matching performance. David Tebbutt describes the workings of this impressive, 'intelligent' product.*

A scanner which teaches itself to recognise most text fonts has got to be worth investigating, even if it does cost \$23,900. Unlike other text-recognition scanners, Kurzweil's Discover doesn't hold images of a series of fonts in its memory. Instead, it applies rules relating to the general appearance of letters and uses dictionaries, both embedded and user-defined, to try to make sense of what it's reading.

Again, unlike other scanners, this approach gives Discover the ability to read proportionally spaced text. Where it falls down is that it cannot read draft dot-matrix characters, because the lines and curves of the letters are not continuous.

Discover also handles graphics, producing files in PCX, TIFF and RES formats. These graphic images may be captured as straight black and white — fine for line art — or as continuous tones, for photographs and the like. These tones are encoded in 'dithered' form where the sixteen levels of grey are represented by either random or spiral patterns of dots.

Textual information is encoded according to either IBM's Document Content Architecture (DCA) format or in an ASCII-based, user-defined format. This means that the output files can be read by any word processor and, if a user-defined format is used, will contain control character sequences pertinent to that program. These sequences look after such things as the treatment of tabs, indents, line centring, paragraph ends and page breaks.

## System & set-up

The Discover system comprises a scanner, a PC-compatible plug-in board, a connecting cable and the Discover



software. The scanner is a badged Ricoh SS30 which feeds sheets (up to ten) from a hopper on top, out through a slot in the bottom front edge. This gives the machine the advantages of multiple document handling but the disadvantage of not being able to handle books and periodicals unless they are sliced up.

The processor card is driven by a 68020 processor, controlled by a custom logic array, and carries its own

2Mbytes of memory. An optional 2Mbytes, for faster throughput, may be added as a 'piggy-back' at the non-slot end of the card. The slot end is already taken up with its own piggy-back card containing the scanner logic. This suggests that other, more sophisticated scanners might be in the offing.

Kurzweil has covered the outside face of the piggy-back card with a mylar panel, which is just as well since it only



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just squeezes in between neighbouring cards.

The nice thing about this single-slot approach is that Discover can scan documents in background mode since all its processing is done on the card, independent of the PC and its bus. Within limits (no resident programs) you may run DOS applications or other parts of the Discover software suite while scanning and analysing your document.

Hooking the system up is so easy that it doesn't warrant description, and installing the 1Mbyte of software is simply a case of copying it to your hard disk.

## Discover software

The Discover software looks crude at first glance but turns out to be a gem to use. Kurzweil has used the Lotus menu bar approach and then added what I'd call 'route maps and signposts'. This way, you always know where you are among its 150-odd options. Because the screen's only job is to control the Discover hardware and software, it can be dedicated to displaying the options available and how to access them, even if they're not part of the current menu bar. Most programs are forced to compromise between putting user information on the screen (words, graphics, numbers and so on) and giving operating guidance.

Discover lists in the body of the screen, all the things you might want to access while in a particular section of the program. Thus, if you choose the 'Settings' option within 'Text scanning', the screen will list 'Contrast', 'Units of Measure', 'Page Height', and so on (see the box for a full list). Alongside each entry is the name of the key you have to press to get nearer to that option.

Similarly, alongside Page Height will be the letter 'P' which selects the 'Page' option from the menu bar. Having pressed this, the menu bar changes and the letter alongside the option will change to 'H' for 'Height'. If you find yourself down the wrong branch of the program, an up arrow alongside the option tells you to press <ESC> to go back up. As you move from level to level and branch to branch, a display on the top line shows the path you followed to get to the current option. For example, when you reach Page Height this path will read:

Main—>Scan—>Text—>Settings—  
>Page

This combination of route map and signposts makes Kurzweil's Discover

## Text scanning settings

Main—>Scan—>Text—>Settings

Scanner contrast  
Units of measure  
Page height  
Page width  
Next page number  
Page number increment  
Assurance level  
User lexicon  
Language  
Lexical context  
Text type  
Scanning window

## Graphics scanning settings

Main—>Scan—>Graphics—>  
Settings

Graphics file name  
Graphics file extension  
Scanner contrast  
Units of measure  
Page height  
Page width  
Scanning window  
Graphics resolution  
Tones  
Output format

## Conversion settings

Main—>Convert—>KCP—>  
Detailed settings

Vertical space  
Horizontal space  
Horizontal tab  
Decimal tab  
Centre begin  
Centre end  
Block indent begin  
Block indent end  
Questionable characters  
Illegible characters  
End-of-line hyphens  
Underline begin  
Underline end  
Soft page end  
Hard page end  
End of line  
End of paragraph  
Beginning mark-up  
Ending mark-up  
Prefix file name  
Suffix file name

one of the easiest programs I have ever come across.

## Scanning

Whether scanning text or graphics, you have to input the page measurement and, if appropriate, the window within the page you wish to scan. The window facility can be a great time-saver when scanning graphics because Discover won't waste time scanning outside the window. But when you're trying to scan a page of a magazine, it can be a real pain. You have to describe the position of each rectangular area of text or graphics before scanning it — one rectangle per scan. The Newsprint section in *APC*, for example, changes from page to page, which means a lot of measuring and reloading the document. Not to put too fine a point on it, this can be very tedious.

Minor gripes apart, though, scanning is a breeze. You simply feed the document into the scanner and press 'Go'.

If you're scanning graphics, a file of the page or window is created in one of the three formats. You may set the resolution of the scan to 180, 200, 240 or 300 dots per inch. Dithering is a function of the Ricoh scanner and works just fine. I scanned some photos of my children and found that the spiral dither worked best.

Text scanning is similarly straight-forward once the windows have been defined. Unlike graphics, a multipaged document may be scanned and, assuming single-column text, you may stack double-sided pages and teach Discover to collate pages read into a correctly sequenced file. This is done by making the page increment '+2' on pass one, then turning the stack over and making the increment '-2' on pass two.

You may vary the level of assurance you find acceptable, and also the way in which the system will flag characters it is unsure of. A 'highlight the next character' sequence is ideal, though you have to experiment to find the right balance between Discover being overconfident and unduly nervous.

You may give the name of one of your own dictionaries; so, for example, if you were to scan names and addresses, you might find it helpful to use a town and country name list. If you are reading unintelligible text, it would help to feed a page or two of normal words first so that Discover can get the hang of the typeface before starting real work. Although Discover theoretically treats each document as a brand new challenge, you can fool it into remem-



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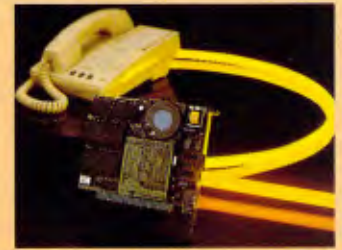
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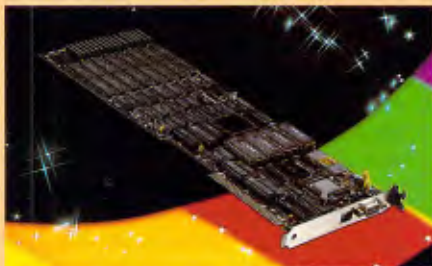
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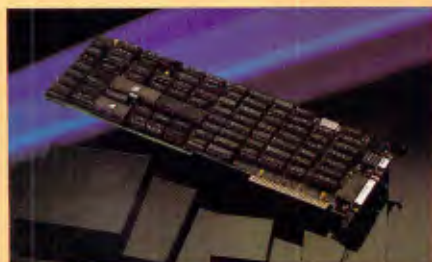
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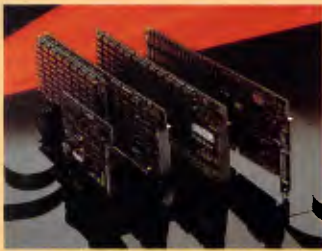
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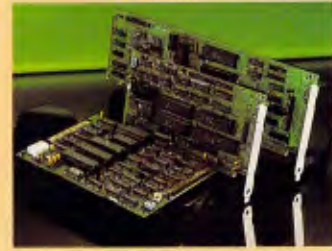
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Excelerator



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## How the Kurzweil Discover works

The most intriguing aspect of Discover is its intelligent character recognition (ICR) system. How on earth does it learn to understand text without any help from the operator?

Firstly, it tries to break the scanned text up into lumps that look like lines, or parts of lines, of text. This can be likened to your standing a few feet away from a document — you can easily see which bits are text lines and which are pictures.

When Discover has stripped out the graphics and general noise from the document, it focuses on the text lines and strips away obvious clutter such as underlines and boxes around the text. In the case of the underline, this information is stored with other details of the current text fragment.

Now Discover analyses the fragments to find word breaks and parcels them into word-like objects called clusters. These tend to be the most active structures in Discover. A cluster manager keeps sending them off for analysis until it finally discovers what they are.

The cluster manager has access to a number of recognition experts, each of which is able to return information about the cluster. When the cluster manager has a number of opinions, it calls on a team of resolvers to help choose between the guesses of the various experts.

The main expert is a topological, or geometric, recogniser. This looks for the number, position and size of loops, identifies concavities, convexities, whether a perimeter reaches certain points in the image, and assesses symmetry. Most of this work is organised as trees of experiments.

One of the key tasks is to identify the baseline. When one or two characters in a word have been recognised, the baseline becomes obvious and greatly simplifies the recognition of other characters.

The trickiest things to recognise are broken and touching characters. A fragmentation expert has to figure out what the broken character is closest to in the one case, and decide where to split characters in the other. Some of the results can be quite bizarre.

The 'P' in Prolog, for example, came out as 'l' followed by an apostrophe when I scanned an APC page. Common ligatures, where two letters are always joined in typesetting, are easily handled because Discover is programmed to expect them.

Ambiguities are handled by the resolvers. For example, it is darned difficult for Discover to differentiate between 'e', 'c' and 'o'. Some 'e's, for example don't have closed loops. This is where statistical information about letter frequencies and common sequences come into play.

When the lexical resolver is given a 'word', it looks it up in the dictionary and passes the result up to the main resolver. A successful match will then spread the good news around, reinforcing the shape recognition expertise of the program.

But, if the lexical resolver fails to find a match, the main resolver will try other, less likely, possibilities. If it still draws a blank, it might decide to change decisions made by lower-level experts. For example it may decide that word breaks should be altered, either by merging two 'words' into one, or by splitting one into two.

As you can see, the whole process is recursive and, as each new piece of information is discovered, old unresolved clusters are re-examined until, hopefully, the whole page makes sense. Discover does this analysis on a page by page basis, accumulating its findings for the duration of a document.

You can, however, fool Discover into remembering information between documents by 'interrupting' work on a document. This creates three temporary disk files: one contains the page format analysis; another contains the parameters set by the user; and the third contains the important stuff — the character descriptions discovered so far. Judicious deleting and renaming of files enables you to use them on a new document but, since it usually only takes half a page or so to train Discover, you would need a special reason for doing it.

Discover knows the difference between numbers and letters and will arrange numbers into columns if ap-

propriate. It also knows that '1st', for example, is acceptable and doesn't try to turn it into 'lst'. This means that it will also accept '2st' which perhaps isn't so smart. When scanning mixtures of numbers and letters it can sometimes have problems with '1' and 'i'. January i makes more sense to Discover than January 1, for example, though it should know not to accept the word 'i'.

Recognising words is only part of the Discover story, though. The program also analyses the layout of the page so that it can approximate this layout in the output document. To keep track of the page, Discover maintains a network of paragraph hypotheses. For example, an end of paragraph after the second line leads to an expectation of an end of paragraph after the fourth or fifth line. As the analysis proceeds, it uses earlier discoveries to help it decide the likelihood of its new hypotheses.

The system is far from foolproof. The text in one ordinary letter I scanned had an exceedingly ragged right edge. Discover decided that the first line actually constituted a paragraph and tucked a double-line feed at the end. The program then had a high expectation that each line was a paragraph, so the actual paragraph it was analysing ended up double-spaced.

The system already has the logic necessary to make it interface well with desktop publishing systems. Because it can recognise indents and vertical spacing, it clearly has the potential to help build DTP style sheets. But, since Discover works on general character shapes, it is unlikely to help much when it comes to identifying fonts or distinguishing between bold and normal type.

Don't get the wrong idea. Discover is clever and useful, and, by fiddling with the user parameters, you can get it to produce quite good results. I think we can expect to see regular improvements to the product, though, especially in the areas of text formatting, DTP interfaces and the ability to scan existing graphic image files for textual content.

bering what it has learnt and applying this knowledge to any subsequent documents.

As well as trying to read the words on

the page, Discover also attempts to assess page layout and embed the appropriate format codes in the text. It doesn't always work — I ended up with

some quite exotic line spacing and tabs at times. It was a great improvement on getting a string of continuous text, though. Tabs, especially, can be a

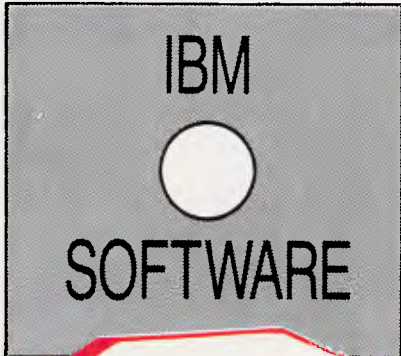


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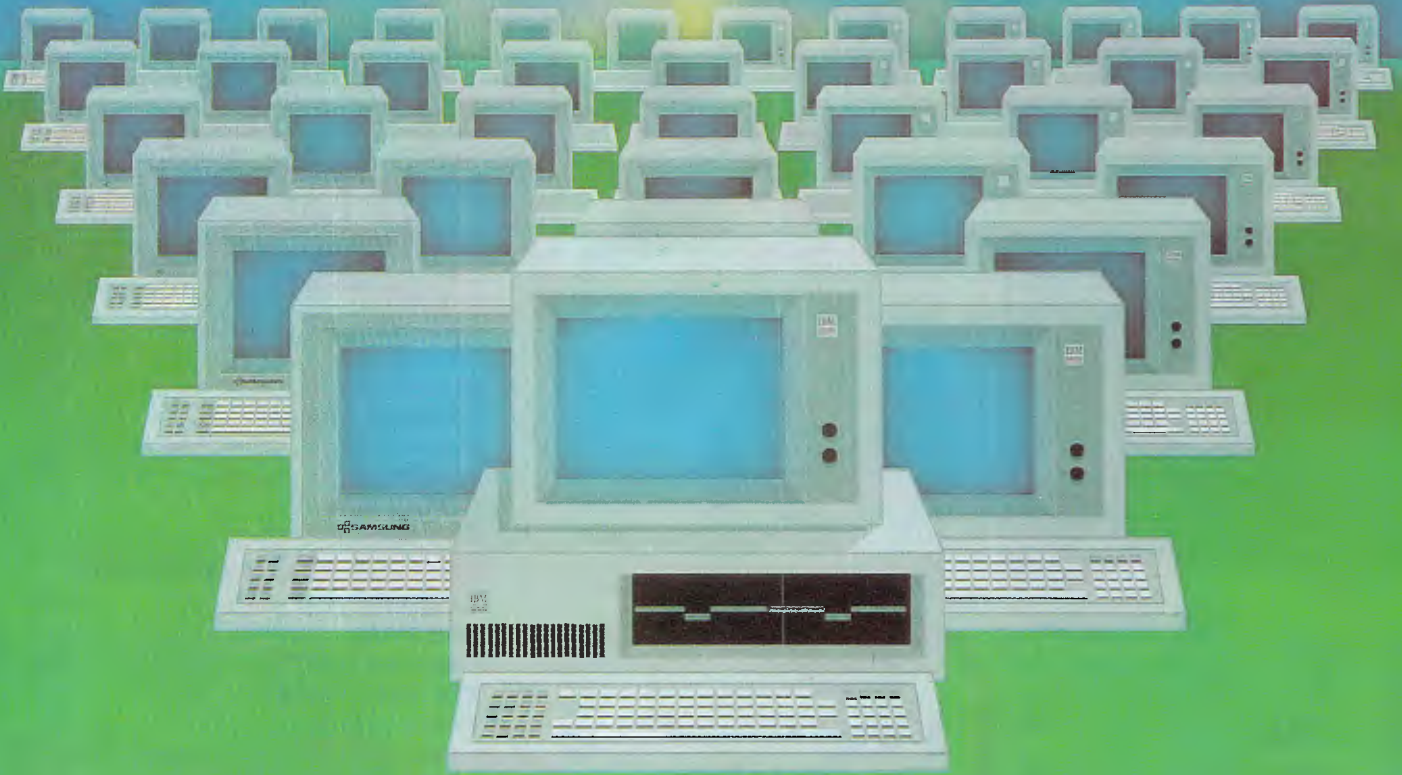
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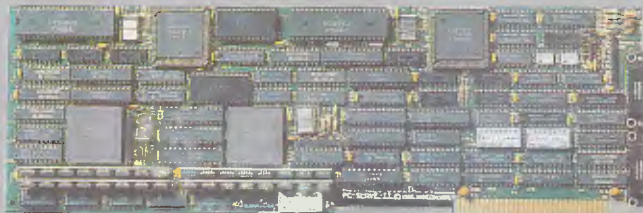
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## CHECKOUT

nightmare because Discover hasn't a clue where they will be set on the target word processor.

### Conversion

When Discover has finished reading a document, you have to convert it into DCA or your own defined format by running it through the associated CONVERT program. One of the nice things about Discover is that you can do this while processing the next document on what Kurzweil calls its Lamprey board. (Lamprey, incidentally, was the code name cooked up by the development team. They wanted to use the name of an animal which formed a symbiotic relationship with another. Too late, the team found out that a Lamprey eventually kills the fish on which it is a parasite.)

Once converted, you can access your word processor, a further conversion program (DCA to something else, perhaps) or a comms program directly from the Discover menus. It will automatically pick up the last file converted for further processing. You may also use a 'back door' to DOS, but don't try to load resident programs because you might not get back again.

I had problems with some resident programs but SideKick seemed to hold up all right provided I loaded it first. Kurzweil seemed doubtful when I mentioned this so I'd suggest you take great care. Again, processing can take place on the Lamprey board while you are performing any of these activities.

Finally, you can run Discover from a command line in DOS by providing a document name and, optionally, the name of the parameter file you wish to use. In the event of a paper jam or other mechanical problem, jobs can be restarted from the current DOS application by pressing a hot-key combination.

### Conclusion

At a price of \$23,900 (2Mbytes system) and a 16 month maintenance agreement for \$2380 (2Mbytes system) or \$2720 (4Mbytes system), this machine has been priced beyond the reach of most single PC users. It is targeted at those work groups who can't justify the \$59,000 needed for big brother, the Kurzweil 4000.

The scanner scores over flat-beds and the DEST because it can read up to ten pages at a time, but it loses

points because it can't handle books and magazines. Discover scores over conventional OCR systems because it isn't limited to a rigid set of typefaces but can learn most things you give it in reasonable time, and can handle proportionally spaced text. On the other hand, it can't read draft dot matrix material.

My guess is that the most likely buyers are going to be those who need to share the device in a work group which requires relatively straightforward data capture from single-column typeset material. Those who can tolerate a high degree of operator intervention might consider using it for more complex work.

My view on the price is that if it's the only machine that can do your job, then you don't have a lot of choice. And if, as I suspect, the sales volume is going to be quite low, then Kurzweil would be mad to pitch it at the kind of price more common in the PC market place.

END

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# XPress

***Described as a truly professional, if pricey, page make-up system for the Mac, XPress from the US company Quark Incorporated offers unprecedented typographic control over page layout, and has set a new standard for desktop publishing software. Graham Jones gives his verdict.***

When the vogue for desktop publishing really began to take off last year, one program stood head and shoulders above the rest as the 'Rolls-Royce'. That program was PageMaker, from Aldus, and it was used as a yardstick by developers hoping to gain a slice of the rapidly expanding desktop publishing market.

However, PageMaker has some limitations, especially for professional users who have become increasingly frustrated by them, and by the slowness of Aldus in introducing upgrades. Enter Quark, a US company, with a new desktop publishing package called XPress (distributed here by PICA).

## *New standards*

Quite simply, XPress is the best desktop publishing package available for the Macintosh. It outshines the old yardstick of PageMaker — even the new version — and sets new standards of its own.

There are two main advantages to XPress. Firstly, it has a degree of typographical control which is so fine that it will allow you to alter the spacing of type to within 0.00014 of an inch, or 1/100th of a point — that is, one fifth of a dot even on a 1270 dots-per-inch typesetting machine! Secondly, XPress allows you to wrap text

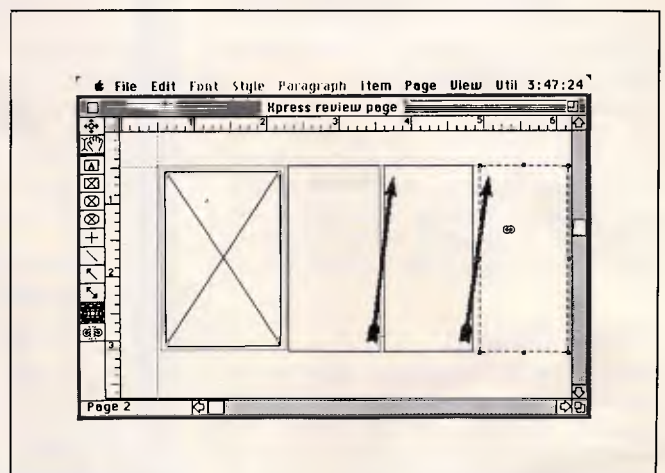
around complicated graphics simply, efficiently, and quickly. To date this has only been possible on the Macintosh with extreme difficulty using PageMaker, or by programming in PostScript.

XPress has a number of advantages over PageMaker and another page make-up program, Ready, Set, Go! 3; it combines the best of both of these and provides a truly professional page make-up package.

The program comes on three disks. One contains the application itself, a second has the system folder and a few examples of XPress documents on it, while the third disk contains two



*Pages in XPress can be viewed in a variety of sizes. The toolbox always appears on the left of the work area, and is not movable. Rulers can be in a variety of units and can be removed if not required*



*The three text boxes are linked (shown by the onscreen arrows) by using the chaining tool, highlighted bottom left in the tool palette. Other tools allow picture boxes to be drawn, and lines and arrows to be positioned*



utilities to allow the program to be copied to floppies or to a hard disk. (To run the program efficiently a hard disk is necessary.) The program is copy-protected, but you are allowed to make up to three copies for personal use. Also included with the program is a utility called 'Frame Editor' which allows users to construct borders to surround pages, text, or illustrations.

*In use*

Once the program has been loaded you have the usual option to open up an existing document, or start a new publication. When choosing a new document from the 'File' menu a dialogue box asks you to decide on the size of the page, the number of columns, and margins, and so on. The page can be any size from three inches square to a poster-sized 36 inches by 36 inches.

Once you have decided on your basic page size you can open up the first page. However, you do need to enter the paper size in the 'Page Set Up' dialogue box before printing anything you work on. This is an annoying little problem with some Mac programs. Why the paper size cannot be included in the new document dialogue box is a mystery!

Nevertheless, the Page Set Up dialogue box does contain quite a bit of information, and even allows users to determine the grey level, in lines per inch, of PostScript laser printers such as the Apple LaserWriter. By adjusting this value you can get improved grey tones. The default is 60 lines per inch, which in my view is too low. A value of 80 or greater achieves much better grey resolution on the LaserWriter and avoids the coarse-looking tints of other desktop publishing programs.

Once the page has been set up as you want it, you can set to work. The document always opens at the top left of the first page — no matter where you stopped working. This is not too much of a problem since travelling around the pages is fast and efficient.

*Page design*

XPress, unlike PageMaker, asks you to define areas of text or graphics prior to entering any copy onto the page. This is similar to Ready, Set, Go! 3 and, at first sight, has always seemed to me to be an unnecessary additional step which PageMaker cleverly avoids. However, it does provide a much greater degree of design flexibility, allowing you to simply move items

# XPress — the best page make-up package for the Mac?

Xpress enables you to perform a number of tricks which are not easily possible with the most popular Macintosh page layout program, PageMaker.

It is very easy to make text run around irregularly shaped objects such as the picture on the right, something which PageMaker has not been able to do without a lot of effort.

The next version of PageMaker should be able to do this, but the US version I have seen does not cope with such sophistication, and by the end of June the update had still not been made available, despite months of speculation.

Running text around complicated

graphics is not the only advantage of XPress when compared to PageMaker. XPress also possesses a unique feature in its ability to be able to control the grey levels of PostScript printers such as the LaserWriter. This means that it is possible to achieve much less

coarse tints than are available with many other programs. XPress also includes a printer driver to run a Linotype

electronic typesetting machine or a Data Products laser printer. It is highly likely that XPress will find widespread use as a front end typesetting solution in many graphics orientated publishing houses.

XPress provides a much greater degree of typographic control which is necessary in such situations.



## Frame editor allows design flexibility

The XPress package also includes a program called 'Frame Editor'. This is a utility which allows you to design and modify borders for text, pages, and pictures, just like the one around this page.

Most of the examples included with the XPress package are pretty horrible, including this one!

But the Frame Editor utility does allow you the flexibility to produce

your own borders from any kind of graphics you care to import.

Such a system is not available with other leading page make-up programs for the Mac, such as Ready, Set, Go! 3 or PageMaker 2.0.

Fancy frames are not widely used in publishing, but there will always be a day when producing something and a frame editor will be required.

Another simple utility provided within the

XPress package is the ability to truly change the horizontal scaling of fonts.

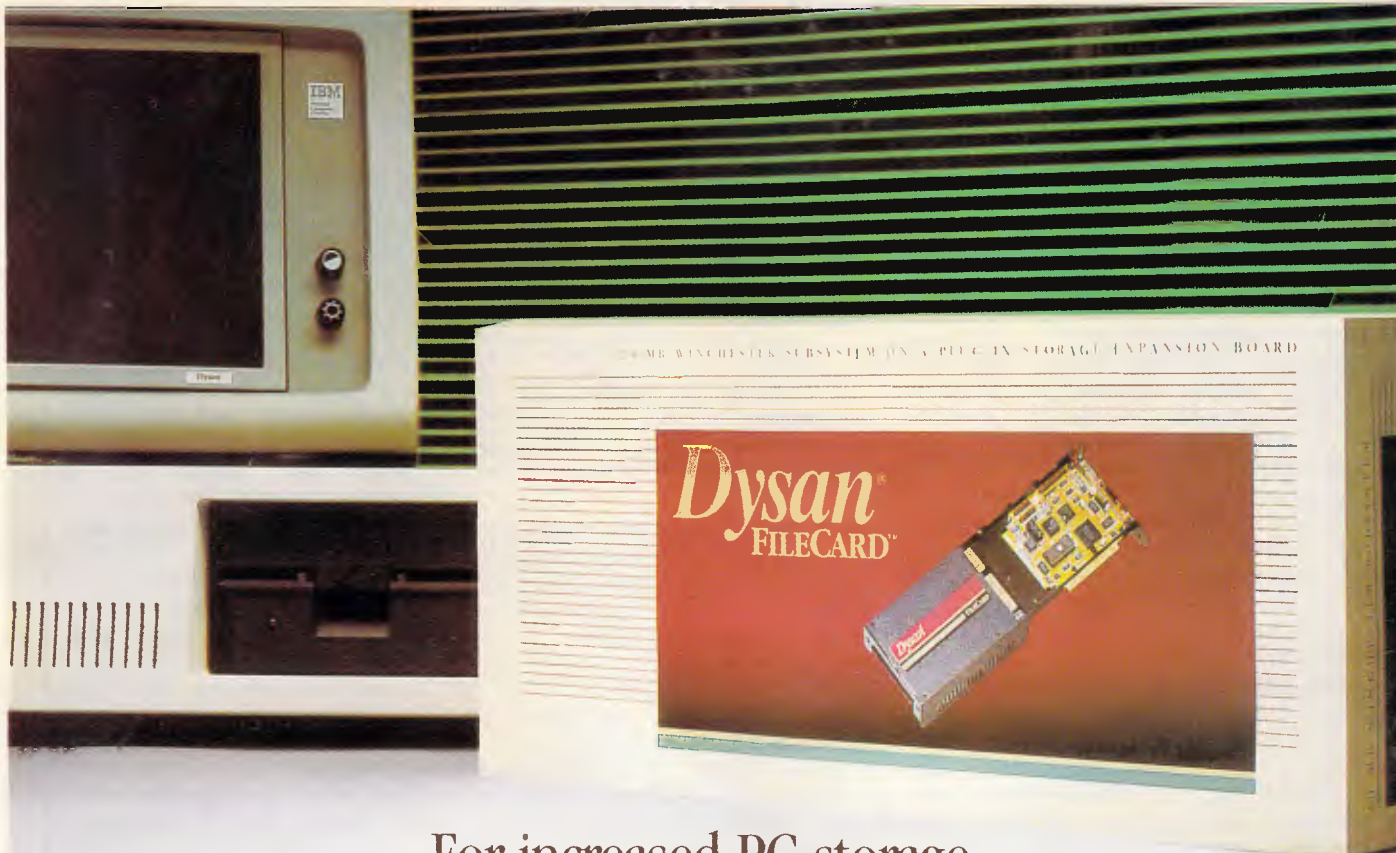
So it is possible to stretch type to achieve some pretty unusual effects, some of which will, nevertheless, have a use, especially in magazine work.

Graham Jones

around the page to redesign any aspects you don't like.

You can define text boxes, or three

types of picture boxes in XPress. Each text box can be altered by using the 'modify' command from the 'Item'



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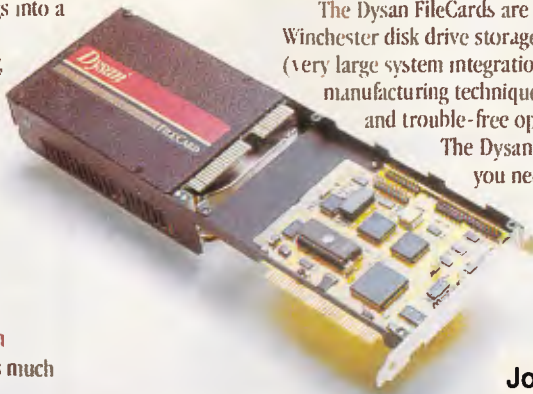
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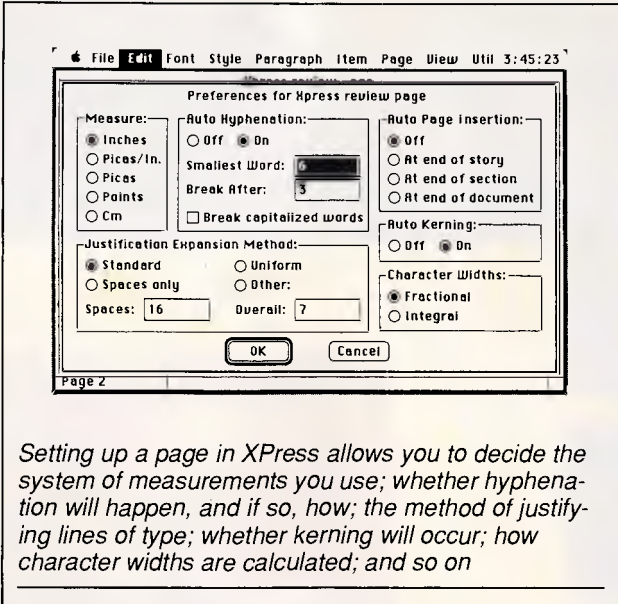


# SCREENTEST

menu. This allows precision control over the position of the text box, allowing you to move it around the page if you have not drawn it exactly where required. You can change text box positions to within an accuracy of 1/1000th of a point! The modify dialogue box also allows you to specify the number of columns in a text box, alter the gutter (space) between them, and to request the 'text offset' — the space between the outer edges of the columns and the start of the text. This is very useful if the text has a rule around it, thus ensuring that there is a space between.

You can also make text boxes transparent by using the modify command. This means that you can place other text or illustrations behind these boxes and they will be seen through the text. The default is for opaque text boxes. Should any other material, such as a picture box, be included inside, then the text runs around this. Text boxes can also be chained together so the text will flow automatically from one to another. This is a very useful facility, especially in magazine work where text may be split between pages which are a long way apart.

The three types of picture boxes available are those which are rectangular, oval, or rectangular with rounded corners. Pictures can be included



*Setting up a page in XPress allows you to decide the system of measurements you use; whether hyphenation will happen, and if so, how; the method of justifying lines of type; whether kerning will occur; how character widths are calculated; and so on*

within these boxes from MacPaint, PICT, or Encapsulated PostScript files, such as those created in Illustrator. Like text boxes, picture boxes can be modified for accurate positioning. You can also change the radius of corners for rectangular boxes with rounded corners, and you can decide how far text outside boxes will be offset when it is to run around them. Like text boxes, picture boxes can be transparent. You can also make picture boxes transparent but make the text run around the picture itself.

All boxes, whether for text or graphics, can have background

shades, and you can specify the colour of such shades. This is very useful in professional publishing since XPress will print off each colour item separately, thus allowing you to produce colour separations for litho printing. Incidentally, XPress also provides other useful printing luxuries, such as the ability to produce wrong-reading negative film, thus saving additional cost and time at the printers. The colour option, which also allows you to specify colours for text, will work with colour ImageWriters — though anyone who has bothered to buy XPress will almost certainly never use an ImageWriter. The colour flagging will also be useful when colour laser printers start to appear sometime within the next year.

When you have placed your boxes precisely, flagged them for shades and colour, and so on, you can then place a 'frame' around them if necessary. Basically, an XPress frame is a rule around the box which can be one of a wide variety available, or one you have constructed using the Frame Editor utility. Like everything else, frames can be flagged for colours, and size can be precisely controlled.

## Entering text and graphics

With a page designed with boxes for text and pictures, and shades, frames, colours, and so on, having been decided upon, you can begin entering text and graphics. Naturally, you can alter all of the specifications set for the items on the page at any stage in the production of the publication, but it is often useful to set them all initially since this is more professional and it does save time in the long run.

Text can be entered directly in XPress, much faster than in Page-Maker, though it is still slower than standalone word processors. Text can also be imported from the standard Macintosh word processors, MacWrite and Microsoft Word, as well as text only or ASCII files. Before entering text it is a good idea to alter the default settings under the 'Preferences' option of the 'Edit' menu. The default is for no hyphenation, and for no kerning. Considering that XPress allows such a degree of typographic control, to leave these two options switched off seems ridiculous!

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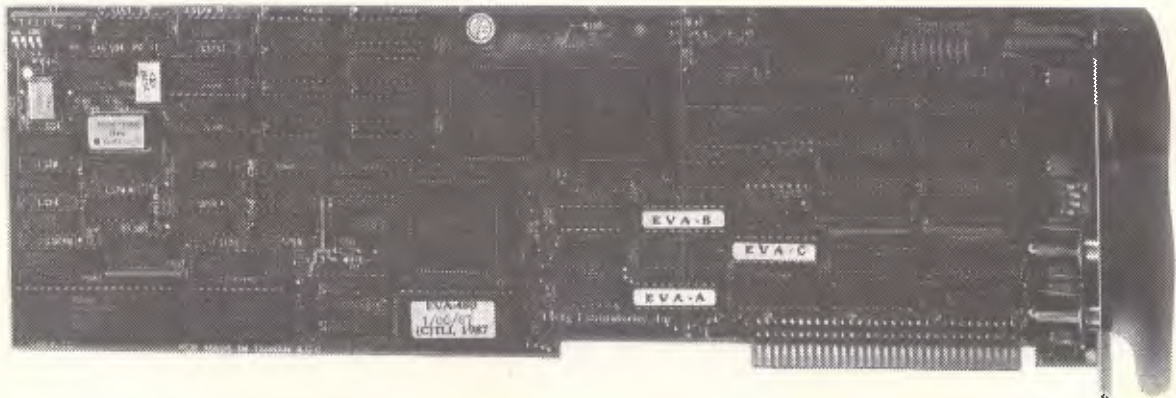


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# SCREENTEST

Hyphenation and kerning can also be manually controlled, even overriding the automatic feature if required. Kerning can be controlled to 1/100th of an em, thus providing control suitable even for high-resolution typesetting machines.

Leading (the spacing between lines of type) can be controlled very finely, and the parameters of each paragraph, such as indenting the first line, and so on, can also be fine tuned. Text can be in any size from the smallest you can read up to 500 points. Cleverly, XPress also allows you to precisely alter the horizontal scale of text. You can compress the text to 25 per cent of its original width, or expand it fourfold.

Pictures in XPress can also be precisely altered in either width or height to within one per cent of their original size. This is a much more accurate method of changing the size of illustrations than allowed for by the manual resizing in PageMaker.

Using XPress is a delight. Features like the horizontal text scale adjustments, the accuracy of positioning items, and the ability to run text around complicated graphics, mean that it places design much more in the hands of the operator who is less at the mercy of the program.

## User image

The program is fairly easy to learn, but its range of features means that it demands a few weeks of fairly regular use before you become truly proficient, rather than the few days of less ambitious programs.

Without a doubt, XPress will have given the PageMaker developers at Aldus a few sleepless nights. It is considerably more sophisticated than PageMaker 1.2, and even gives version 2.0 a run for its money. XPress allows precision control over typography which would please even the fussiest typesetter. Consequently, XPress is likely to be the program of choice for professional publishers, and for many

*Graham Jones is a freelance journalist and author of The Desktop Publishing Companion (Sigma Press, \$53.85 and available from Jacaranda Wiley. Tel: (02) 816 2758). He uses his Mac and LaserWriter Plus to produce a variety of desktop publications for commercial clients.*

people entering desktop publishing for the first time.

## Documentation

The manual is well put together, though it does not cover everything the program is capable of doing, such as the ability to produce well-fitting 'drop caps' (large capital letters) at the beginning of articles.

## Price

At \$1600 XPress is a very pricey program; but despite the high price, it is exceptional value. Two years ago such precision control would only have been available in some front-end typesetting solutions, at a cost of around \$15,000.

## Conclusion

For anyone involved in desktop publishing on the Macintosh, XPress is well worth investigating, especially if you need to produce material with a great deal of typographical control, or if you want to have the output typeset. It is particularly valuable in magazine design, as well as, say, for advertisement production. XPress has set new, very high, standards for desktop publishing software.

END

*XPress from Quark Incorporated is available in Australia from PICA Pty Ltd. Tel: (03) 370 3566. Watch for a head-to-head comparison of XPress and PageMaker in a forthcoming DTP feature — Ed.*

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# Constructing an associative memory

*This simple nonlinear neural network runs on your PC.  
Bart Kosko explains.*

From the earliest days of behaviourist psychology, scientists have believed that the associative structure of learning resides in the neural microstructure of organisms. But where do memorised patterns reside? Do we encode *Gone with the Wind* in a cell or do we somehow superimpose it on or between several cells? How is the ability to fix a flat tyre or to play the *Moonlight Sonata* stored in memory? How do we learn the colour green from green things, or triangularity from triangles? How do asynchronous neurons keep any pattern, such as a phone number, reverberating in short-term memory long enough for us to learn it?

An associative memory is a mapping from data to data, a mathematical abstraction from the familiar associative structure of human and animal learning. We associate behavioural responses with sensory stimuli, effect with cause, like character with like faces, breakfast with sizzling bacon. An associative memory is parallel distributed — as in a neural network, for example — when it memorises data by superimposing it on the same memory medium.

I will show you how to construct the simplest nonlinear neural-network associative memory — called a BAM (bidirectional associative memory) — that recalls or content-addresses stored associations  $(x, y)$  by minimising a system 'energy' (which I will define mathematically later). The BAM is a two-layer feedback network of interconnected neurons. Each neuron  $a_i$  in layer or field  $F_A$  is totally connected by

'synapses' to every neuron  $b_j$  in field  $F_B$ , and vice versa, and no neurons are connected within a field. Associations  $(x, y)$  are stored by placing them at local energy minima. Input patterns tend to map into the most similar stored association as the input 'rolls' into the nearest energy minimum.

In a BAM, and in most neural networks, patterns are stored in the edges, or synapses, between the neurons. The stable reverberation of patterns across fields of neurons — produced by a BAM energy minimum or other network mechanism — constitutes short-term memory. STM reverberations gradually seep pattern information into long-term memory (LTM), the synapses between the neurons.

Modern computers store everything in single 'cells'. Brains almost certainly do not. Computers learn by rote, not by example. Computers excel at high-speed serial computation but fail at real-time pattern recognition. Brains do the opposite. Computers implement precise algorithms through the synchronous operation of their cells. Brain cells operate asynchronously as a nonalgorithmic dynamic system, which presumably can be approximated with a system of nonlinear difference or differential equations. In short, a computer is a breed of adding machine. A brain is more akin to a market economy, a galactic system, or a swarm of atomic particles.

Now we have hardware devices, called neurocomputers, that behave like brains but look like computers or coprocessors. Neurocomputers are

electrical or optical implementations of neural networks. Neural networks are programmable dynamic systems. Neurocomputers are the engineering by-product of the science of artificial neural systems (ANS), which seeks to explain mind and brain as programmable dynamic systems and rests on the mathematical information-processing principles of neural-network models. Associative memories are fundamental computing structures of ANS and can be naturally implemented on neurocomputers. You can simulate small-scale associative memories, such as BAMs with few neurons, on digital computers with little effort.

## *The benefits*

Associative neurocomputing has two major benefits that underlie the current surge of ANS interest in industry, academia, and government. First, ANS devices can store large numbers of complex patterns — speech templates, visual scenes, robot movements, spatiotemporal behaviour, social behaviour, and so on. Second, ANS devices can classify new patterns to stored patterns quickly. Roughly speaking, neurocomputing devices classify patterns at a speed independent of the number of patterns stored. They immediately map input patterns to the nearest stored patterns. However, if they store too many patterns, classification accuracy degrades.

These two properties of neurocomputing resemble our ability to recognise familiar faces, aromas, and melodies at



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age 5 and at age 50 with roughly the same rapidity. We say the lawyer is quick on her feet if she accurately associates live testimony with obscure case precedents. We frequent the mechanic or physician who accurately diagnoses problems on the spot. We marvel at the cocktail-party pianist who plays from memory any tune upon request.

On the contrary, computer search time always depends on the number of stored patterns or templates. Computers suffer from an inherent direct relationship between pattern number and search time: more patterns, longer search. This is why they fail at real-time pattern recognition. And it is arguably why artificial intelligence researchers, after more than 20 years, have failed to build real-time pattern recognisers and sensory processors on serial or parallel computers.

## *Bidirectional associative memories*

A BAM stores and recalls associations  $(A_i, B_i)$  that are learned by summing correlation matrices. This procedure superimposes the patterns to be learned on the same memory medium, much as data pairs can be superimposed on a hologram (as in optical BAMs). Recall that the encoding procedure places the associations  $(A_i, B_i)$  at or near system energy minima. Each set of associations sculpts its own energy surface over the BAM state space. Associations are placed on the energy

surface like rocks on a rubber sheet. Geometrically, it is clear that the number of energy minima does not affect the speed with which an input pattern rolls down the surface into a particular local minimum. Hence, no matter how big the BAM (whether it consists of 10 neurons or 10 billion neurons), it immediately converges to the nearest minimum.

*'Computers suffer from an inherent direct relationship between pattern number and search time: more patterns means a longer search.'*

The BAM is a two-field network of symmetrically interconnected neurons, as shown in Fig 1. There are  $n$  neurons in  $F_A = \{a_1, \dots, a_n\}$  and  $p$  neurons in  $F_B = \{b_1, \dots, b_p\}$ .

Each neuron is a simple nonlinear function. It transforms the sum of weighted input signals into a single output signal. In the simplest case, the output is binary, 1 or 0 (in general, a neuron's output signal continuously varies from 0 to 1). Stephen Grossberg of Boston University in the US has proven mathematically that to accurately store and process distributed information in a neural network, this signal function must be a sigmoid or S-shaped function, such as  $(1 + e^{-x})^{-1}$ ,

and, indeed, the average firing frequency of real neurons is sigmoidal. The threshold function of a binary neuron is the limiting case of a steep continuous sigmoid function. This article assumes that the neurons in  $F_A$  and  $F_B$  are binary.

Each neuron turns on or off according to a threshold law. If the input to a neuron is positive, it turns on; if negative, off. When the input equals zero (threshold), the neuron maintains its current state; it stays on if it is on, and off if off. The larger the threshold, the fewer the neurons that can turn on. Increasing the threshold of all neurons in a field in effect increases the competition within the field for activation.

If all neurons in a field apply the threshold law to their inputs simultaneously, the BAM is operating synchronously. Otherwise, it operates asynchronously, simulating a collection of independent, randomly operating neurons. For simplicity, you can assume synchronous operation. For instance, if six neurons in  $F_A$  receive the vector of inputs  $(6 \ -4 \ -1 \ 8 \ -3 \ 10)$ , then the new  $F_A$  state is  $(1 \ 0 \ 0 \ 1 \ 0 \ 1)$  — only neurons  $a_1$ ,  $a_4$ , and  $a_6$  turn on.

## *BAM encoding*

Encoding is learning. A neural network learns by modifying the synapses between its neurons. In a BAM, all synaptic information is contained in an  $n$ -by- $p$  connection matrix  $M$ . Every matrix  $M$  between  $F_A$  and  $F_B$  produces a stable BAM. All inputs quickly map to a pattern of stable reverberation. But different connection matrices encode different  $(A, B)$  associations as stable reverberations.

A BAM encodes a particular set of associations  $\{(A_1, B_1), \dots, (A_m, B_m)\}$  by summing bipolar correlation matrices. This is an example of Hebbian, or correlation, learning. You can also interpret this method of encoding as Grossberg reciprocal outstar coding, in that each neuron in  $F_A$  and  $F_B$  fans out its output along modifiable pathways. The encoding scheme tends to place distinct associations  $(A_i, B_i)$  at or near local energy minima — provided you don't encode too many associations. You cannot reliably encode (store) and decode (recall) more patterns than the number  $n$  of neurons in field  $F_A$  or the number  $p$  of neurons in  $F_B$ , whichever is less; that is, given that you have  $m$  patterns,  $m < \min(n, p)$ . One way or another, the number of neurons in every neural network, artificial or biological, limits its stored capacity.

Bipolar vectors or matrices are binary

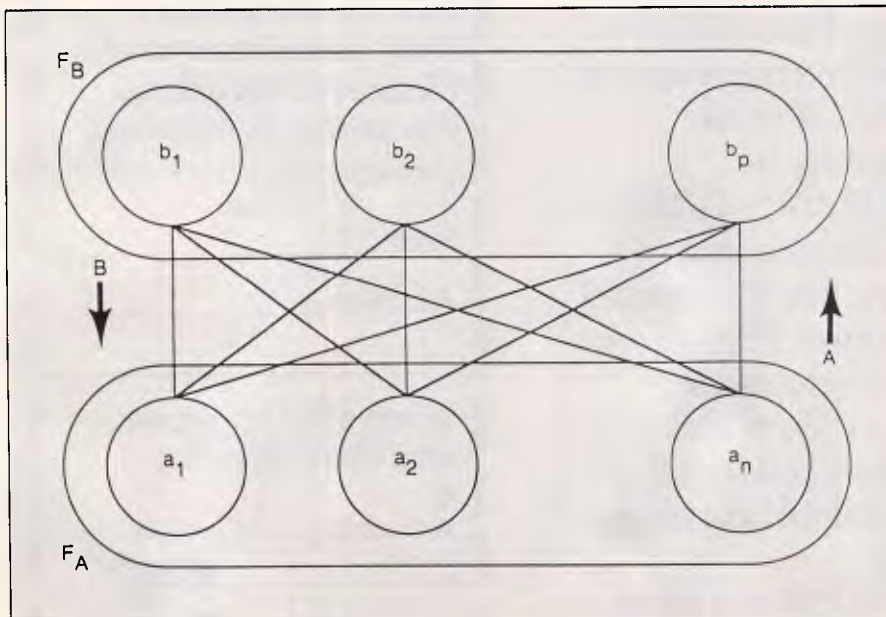


Fig 1 Topology of a BAM, showing the two fields of neurons connected by synapses

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vectors or matrices with -1s replacing 0s. The bipolar versions of the binary patterns  $A_1 = (1\ 0\ 1\ 0\ 1\ 0)$  and  $B_1 = (1\ 1\ 0\ 0)$  are  $X_1 = (1\ -1\ 1\ -1\ 1\ -1)$  and  $Y_1 = (1\ 1\ -1\ -1)$ . In general,  $X$  and  $Y$  will denote the respective bipolar version of the binary vectors  $A$  and  $B$ . It can be shown that BAM correlation encoding improves if bipolar vectors and matrices are used instead of binary vectors and matrices.

The BAM encoding scheme converts each binary pair  $(A_i, B_i)$  to a bipolar pair  $(X_i, Y_i)$ , converts each bipolar pair to a bipolar correlation matrix  $X_i^T Y_i$ , and then adds up the bipolar correlation matrices  $M = X_1^T Y_1 + X_2^T Y_2 + \dots + X_m^T Y_m$  where the column vector  $X_i^T$  is the vector transpose of the row vector  $X_i$ . For example, if  $X = (1\ -1)$ , then

$$X^T = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

A special case of the BAM occurs when  $F_A = F_B$  and all  $A_i = B_i$ . Then  $M = M^T$  and the BAM collapses to symmetric unidirectional associative memory that stores the single patterns  $A_i$  in local energy minima. (The general continuous version of the symmetric unidirectional associative memory is known as the Cohen-Grossberg autoassociator; the special binary version is known as the Hopfield model.) Let's assume the general case where  $F_A$  and  $F_B$  are distinct.

Suppose you want to find the BAM that encodes the two binary associations

$$A_1 = (1\ 0\ 1\ 0\ 1\ 0) \quad B_1 = (1\ 1\ 0\ 0), \\ A_2 = (1\ 1\ 1\ 0\ 0\ 0) \quad B_2 = (1\ 0\ 1\ 0).$$

Note that this example does not strain the memory capacity, since  $2 < \min(6, 4)$ . Convert these binary pairs to bipolar pairs:

$$X_1 = (1\ -1\ 1\ -1\ 1\ -1) \\ Y_1 = (1\ 1\ -1\ -1) \\ X_2 = (1\ 1\ 1\ -1\ -1\ -1) \\ Y_2 = (1\ -1\ 1\ -1)$$

Convert these two bipolar vector pairs to two bipolar correlation matrices:

$$X_1^T Y_1 = \begin{pmatrix} 1 & 1 & -1 & -1 \\ -1 & -1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ -1 & -1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ -1 & -1 & 1 & 1 \end{pmatrix}$$

$$X_2^T Y_2 = \begin{pmatrix} 1 & -1 & 1 & -1 \\ 1 & -1 & 1 & -1 \\ 1 & -1 & 1 & -1 \\ -1 & 1 & -1 & 1 \\ -1 & 1 & -1 & 1 \\ -1 & 1 & -1 & 1 \end{pmatrix}$$

Note that the  $j$ th row of the  $i$ th correlation matrix  $X_i^T Y_i$  is simply  $Y_i$  multiplied by the  $j$ th element of  $X_i$ , and that the  $j$ th column is simply  $X_i$  multiplied by the  $j$ th element of  $Y_i$ . So correlation matrices can be written down directly when given bipolar associations. Then  $M$  is given by  $M = X_1^T Y_1 + X_2^T Y_2$ :

$$M = \begin{pmatrix} 2 & 0 & 0 & -2 \\ 0 & -2 & 2 & 0 \\ 2 & 0 & 0 & -2 \\ -2 & 0 & 0 & 2 \\ 0 & 2 & -2 & 0 \\ -2 & 0 & 0 & 2 \end{pmatrix}$$

This synaptic matrix encodes my particular computational problem; namely, storing  $(A_1, B_1)$  and  $(A_2, B_2)$  in a parallel distributed network. The matrix element  $m_{ij}$  indicates the symmetric (distance-dependent) synapse between neurons  $a_i$  and  $b_j$ . The synapse is excitatory if  $m_{ij} > 0$ , inhibitory if  $m_{ij} < 0$ . (Try drawing the BAM network topology obtained with this matrix  $M$ .)

You can erase association  $(A_i, B_i)$  from  $M$  by adding  $-X_i^T Y_i$  to  $M$ . This is equivalent to encoding  $(A_i^c, B_i^c)$  or  $(A_i^c, B_i)$ , where the superscript  $c$  denotes complement. The complement of  $(0\ 1\ 1\ 0\ 0)$ , for instance, is  $(1\ 0\ 0\ 1\ 1)$ . This is true because you obtain the complement of a bipolar vector by multiplying the vector by -1. A little thought then shows that when you encode  $(A_i, B_i)$  in  $M$ , you encode  $(A_i^c, B_i^c)$  in  $M$  as well, and vice versa.

The BAM energy  $E$  of association or state  $(A_i, B_i)$  is  $-A_i^T M B_i^T$ . In the example,  $E(A_1, B_1) = E(A_2, B_2) = -6$ . (In upcoming examples, you'll see that the BAM encoding algorithm placed  $(A_1, B_1)$  and  $(A_2, B_2)$  in local energy minima.)

## BAM decoding

BAM decoding is associative recall. Say an input pattern  $A$  is presented to BAM field  $F_A$ . The  $n$  neurons across  $F_A$  are turned on or off according to whether the corresponding binary values of  $A$  are 1 or 0. Each neuron  $a_i$  in  $F_A$  fans out its binary value across the  $p$  pathways as if pouring water into a pipeline system. The synaptic value  $m_{ij}$  multiplies, or 'gates', the binary value  $a_i$ . Each neuron  $b_j$  in  $F_B$  receives a fan-in of input products  $a_i m_{ij}$  from each of its  $n$  synaptic connections;  $b_j$  then behaves as an OR gate, since any neuron in  $F_A$  can activate it. Neuron  $b_j$  sums its input across all connections,  $a_1 m_{1j} + a_2 m_{2j} + \dots + a_n m_{nj}$ , then thresholds this sum to

- ```

Step 1. For all i,j clear M(i,j), A(i), B(i). This is an initialization step.
Step 2. Get input into A() and B() for an association to be learned.
        The input will have only two possible values, 0 or 1.
Step 3. Learn the desired input association.
        a. Build X(i) for A(i) where X(i)=-1 if A(i)=0
           and X(i)=1 if A(i)=1;
        b. Build Y(i) from B(i) where Y(i)=-1 if B(i)=0
           and Y(i)=1 if B(i)=1;
        c. For all i,j, build M(i,j) = M(i,j) + X(i) * Y(j).
Step 4. If there is another association to learn, go to step 2.
Step 5. Input a new A() and B() to be run on the network.
        The input for each element will have the values 0 or 1.
Step 6. Run the A to B iteration of the network.
        a. The new B(j)=1 if the sum of A(i) * M(i,j) for all i
           is greater than the 0 threshold;
        b. The new B(j)=0 if the sum of A(i) * M(i,j) for all i
           is less than the 0 threshold;
        c. The new B(j) is unchanged if the sum of A(i) * M(i,j)
           for all i is equal to the 0 threshold.
Step 7. Run the B to A iteration of the network.
        a. The new A(i)=1 if the sum of B(j) * M(i,j) for all j
           is greater than the 0 threshold;
        b. The new A(i)=0 if the sum of B(j) * M(i,j) for all j
           is less than the 0 threshold;
        c. The new A(i) is unchanged if the sum of B(j) * M(i,j)
           for all j is equal to the 0 threshold.
Step 8. Repeat steps 6 and 7 until there are no changes in A() and B().
Step 9. Display the results.
    
```

Listing 1 Pseudocode for a BAM demonstration program written in Basic

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generate its output binary signal. If the input sum exceeds  $b_j$ 's threshold, which I assume is 0, then  $b_j$ 's output is 1. If it is less than threshold,  $b_j$ 's output is 0. If it equals threshold,  $b_j$  maintains its current state. Neuron  $b_j$  then fans out its output signal across the  $n$  pathways  $m_{ji}$  to each neuron  $a_i$  in  $F_A$ . This means  $F_B$  uses the transpose memory  $M^T$  to send information, while  $F_A$  uses  $M$ .

Each  $a_i$  then generates its binary signal from all its summed inputs and sends it back to  $F_B$ . And round and round the BAM goes. Fortunately, it is a mathematical theorem that the BAM always rapidly converges, so it will not oscillate chaotically forever. (Exercise: Show that a state change in  $F_A$  or  $F_B$  and the threshold signal law forces the

energy  $E$  to decrease, and that  $E$  cannot decrease forever. This is sufficient to prove that any matrix  $M$  produces a stable BAM.)

BAM decoding is easier done than said. Returning to the example, let's see if the memory matrix  $M$  actually stores the pairs  $(A_1, B_1)$  and  $(A_2, B_2)$ . You do this by presenting  $A_1$  to the BAM and observing whether  $(A_1, B_1)$  is recalled. If it is, then either  $A_1$  or  $B_1$  will recall  $(A_1, B_1)$ . Repeat this test for  $A_2$  and  $B_2$ .

Vector-matrix multiplication summarises BAM forward and backward information flow. Forward flow proceeds through  $M$ , and backward through  $M^T$ . The row vector  $A M = (4 \ 2 \ -2 \ -4)$  is the vector of fan-in inputs received by  $F_B$ . The threshold-signal law then yields  $(4$

$2 \ -2 \ -4) \rightarrow (1 \ 1 \ 0 \ 0) = B_1$ , since you are synchronously updating all neurons in  $F_B$ . So  $A_1$  evoked  $B_1$ .  $B_1$  then sends an  $M^T$ -filtered vector of signals back to  $F_A$ :  $B M^T = (2 \ -2 \ 2 \ -2 \ 2 \ -2) \rightarrow (1 \ 0 \ 1 \ 0 \ 1 \ 0) = A_1$ . If you now push  $A_1$  through  $M$  again,  $B_1$  results, which again evokes  $A_1$ , and so on forever. Thus, the short-term memory pattern  $(A_1, B_1)$  reverberates across the BAM. It is a stable equilibrium point of the dynamic system. Put another way, both  $A_1$  and  $B_1$  recall the stored association  $(A_1, B_1)$ . Similarly,  $A_2 M = (4 \ -2 \ 2 \ -4) \rightarrow (1 \ 0 \ 1 \ 0) = B_2$ , and  $B_2 M^T = (2 \ 2 \ 2 \ -2 \ -2 \ -2) \rightarrow (1 \ 1 \ 0 \ 0 \ 0) = A_2$ . So  $(A_2, B_2)$  is also stored as a stable point. An instructive exercise would be to see how many synapses in  $M$  you can remove or change without affecting these stable



Fig 2 Asynchronous recall in a BAM consisting of two fields of neurons, one containing 140 neurons and another containing 3 neurons



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reverberations.

The BAM is error-correcting. Partial or noisy patterns tend to recall complete patterns. For example, the input  $A = (0\ 1\ 1\ 0\ 0\ 0)$  is just  $A_2$  perturbed by 1 bit. Then  $A M = (2\ -2\ 2\ -2) \rightarrow (1\ 0\ 1\ 0) = B_2$ , and thus  $A$  evokes the resonant pair  $(A, B_2)$ . Note that  $(A, B_2)$  has energy  $E(A, B_2) = -4 > -6 = E(A_2, B_2)$ , evidence that the BAM encoding procedure placed  $(A_2, B_2)$  at a local energy minimum.

Suppose you add the new association  $(A_3, B_3)$  to the BAM memory  $M$ , where  $A_3 = (1\ 1\ 0\ 0\ 1\ 1)$   $B_3 = (0\ 1\ 1\ 1)$ . This strains the BAM's storage capacity but does not exceed it. Geometrically, when you store only a few association patterns  $(A, B)$ , each forms a large basin of attraction in the BAM state space. As you add more patterns to the BAM, the basins increase in number but shrink in diameter and depth. The BAM recognises fewer input patterns by stored associations. Worse, spurious attractor basins can emerge, causing misclassification. When this happens, the BAM experiences a type of déjà vu, since it remembers something it never learned.

In this case, the new memory  $M = X_1^T Y_1 + X_2^T Y_2 + X_3^T Y_3$  is given by

$$M = \begin{pmatrix} 1 & 1 & 1 & -1 \\ -1 & -1 & 3 & 1 \\ 3 & -1 & -1 & -3 \\ -1 & -1 & -1 & 1 \\ -1 & 3 & -1 & 1 \\ -3 & 1 & 1 & 3 \end{pmatrix}$$

When you retest to see if  $(A_1, B_1)$  and  $(A_2, B_2)$  are still stable points, you'll find that they are, since  $E(A_1, B_1) = E(A_2, B_2) = -6$ . To test  $A_3$ ,  $A_3 M = (-4\ 4\ 4\ 4) \rightarrow (0\ 1\ 1\ 1) = B_3$ , and  $B_3 M^T = (1\ 3\ -5\ -1\ 3\ 5) \rightarrow (1\ 1\ 0\ 0\ 1\ 1) = A_3$ . So  $(A_3, B_3)$  is also a resonant stable point, but with energy that's twice as small, namely,  $E(A_3, B_3) = -12$ . Since  $(A_3, B_3)$  is a deeper basin, you can expect it to attract and classify more patterns. The unit input  $(1\ 1\ 1\ 1\ 1\ 1)$ , which is 1 bit closer to  $A_3$  than to  $A_1$  or  $A_2$ , recalls  $(A_3, B_3)$ . But if you flip the last bit, the new input  $(1\ 1\ 1\ 1\ 1\ 0)$  misclassifies to a spurious association  $(A, B)$ , where  $A = (1\ 1\ 1\ 0\ 1\ 0)$  and  $B = (1\ 1\ 1\ 0)$ , also with energy  $E(A, B) = -6$ . Such misclassification reflects that you have almost overstuffed the BAM memory matrix  $M$ .

If you'd like to experiment with the above algorithm, Duane DeSieno, Rod Taber, and Joel Davis have provided programs in Basic, Pascal, and C. [Editor's note: these programs are available for downloading from Microtex on Telecom's Viatel, page \*6663#.] Listing 1 shows pseudocode for the Basic program.

## Asynchronous BAM recall

Fig 2 illustrates asynchronous BAM recall. Field  $F_A$  contains  $n = 10 \times 14 = 140$  neurons.  $F_B$  contains  $p = 9 \times 12 = 108$  neurons. Both vector fields are arranged as binary matrices to help the eye detect interesting spatial patterns. The BAM stores the three alphabetic associations:  $(M, V)$ ,  $(S, E)$ , and  $(G, N)$ . A 40 per cent noise-corrupted version (99 bits randomly flipped) of  $(S, E)$  is presented to the BAM. Fig 2 shows 11 snapshots of the asynchronous recall process. At each clock cycle, roughly six randomly chosen neurons are allowed to make update (state-change) decisions. This is a cross-section

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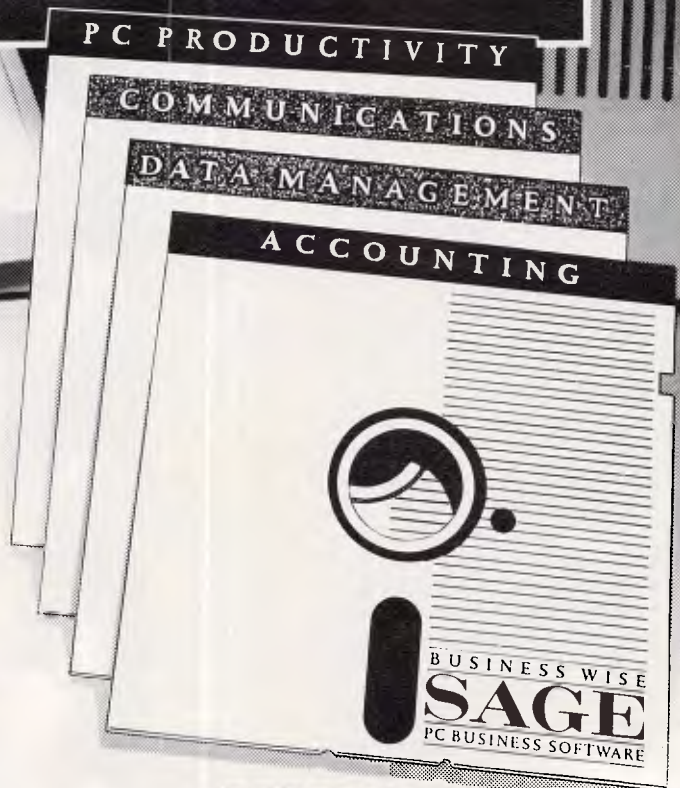
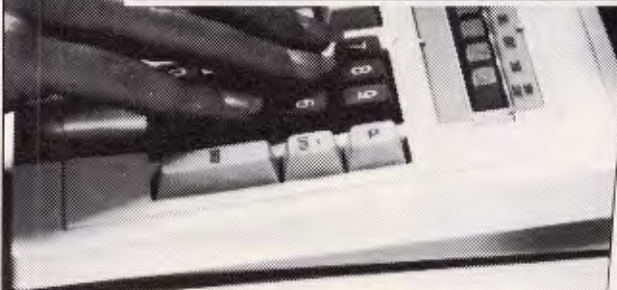


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tional approximation of a stochastic neural process — a set of independent neurons, each randomly updating in time.

Different random-update choices produce different asynchronous-recall trajectories. In this BAM, most trajectories recall the desired nearest stored association, since the memory capacity is not strained and the spatial patterns all differ significantly. In Fig 2, (S, E) is perfectly recalled, as the neurons independently proceed from local chaos to global order — without any neuron aware of its global effects. The anarchical neurons are guided as if by an invisible hand to correct global system errors without knowing that such errors

have occurred and need to be corrected.

Finally, BAMs are perhaps best implemented in optics, with photons instead of electrons. Neurons in fields  $F_A$  and  $F_B$  can be totally interconnected to each other with simple lenses. Using resistors to interconnect amplifiers is much more difficult, space consuming, and expensive. Unlike electrical pathways, optical-interconnect beams can pass through one another without interference.

END

## For more information

Associative-memory literature is mathematical, interdisciplinary, and vast. McCulloch and Pitts introduced the first Boolean switching-function neurons in 1943. Kohonen largely pioneered the study of correlation-matrix memories. His 1984 book is a standard in the field. Steinbuch put forth the idea of stable points in crossbar associative networks in his 1961 'learning matrix.'

Amari et al first made the rigorous connection between associative networks and thermodynamics. Hopfield next made the connection between stable points and energy minima by establishing an isomorphism between symmetric binary networks and the Ising spin-glass model of ferromagnetism in statistical mechanics. Grossberg et al have proven all of the above and more with rigorous mathematics. With Carpenter, Grossberg developed the adaptive resonance model that, in some sense, an adaptive BAM approximates.

Grossberg's 1982 and 1987 volumes are the Old and New Testaments of neural networks — read them. I developed the BAM and have extended it to real-time unsupervised learning. The 1986 volumes of Rumelhart and McClelland provide an accessible introduction to neural networks from a cognitive-science perspective.

## For further reading

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Hard Drives Futuresound

Memory Expanders

## Digiview 2.0

THE Amiga video digitiser. Produce high quality images in colour or black & white in low, high or medium resolution. Uses all of Amiga's 4096 colours with the HAM option. Save images for use in other programs and more

## Digipaint

The advanced drawing program utilising Amiga's HAM mode to the full. Uses Amiga's 4096 colours. Combine images with different palettes on the one screen, or work on Digiview images.

## ProVideo

The character generator that is the ideal partner to Genlock. Up to 100 screens of animated text in different fonts, colours, sizes and shading can be queued for automatic display. Excellent promotional tool. (PAL version requires extra drive and 1Mb RAM.)

## Hard Drives

ACME distribute the entire range of C-Ltd. Hard Drives. Capacities range from 20Mb for under \$1900.00. Turns your Amiga into Super Amiga. Very fast drives that connect directly to the Amiga bus. A real winner in a recent price/performance comparison.

## Futuresound

The ultimate sound digitiser for the Amiga. Digitises with NO background noise. Collect samples from your video, stereo, CD or your own voice (microphone included). It's t-t-t-errific!

## Genlock

Turns your Amiga into a video production studio. Overlay Amiga graphics/text over a video signal. Chroma-key and fade as well. Very versatile, lots of professional and educational uses. Australian PAL system.

## Memory Expanders

Expand your Amiga's memory without expanding your budget. Half, one and two megabytes of 'fast' RAM available with Auto-Config circuitry and pass through bus. An extra slot is provided so an additional 2Mb card can be added, or even a hard-drive controller. Great value and tops in quality.

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# Online databases

*All it takes is a micro and a modem and anyone can be information rich. The range of information just waiting to be tapped is staggeringly diverse. Robin Howells has been reviewing major Australian hosts to report on database developments.*

The big 'buzz words' of the 1980s are 'information' and 'information-rich' and Australia is a mine of information for business, professional and hobby people who want to seek it using a computer and a modem. Figures compiled by the Australian Database Development Association show that from 1984 to 1986 the number of online databases increased from 108 to 217. Norbert Wiener, a US pioneer in computing who died in 1964 before the beginning of the PC revolution, recognised the importance of information in 1954. He said: "To live effectively is to live with adequate information."

Eight major hosts dominate the local industry and offer an array of databases which cover

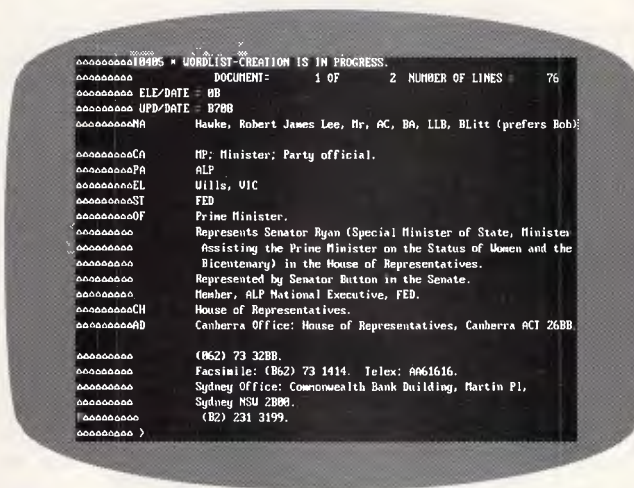
a spectrum of major, minor and esoteric interests. They are, in alphabetic order, ACI Ausinet, CLIRS, CSA InfoNet, CSIRO Australis, Elders FarmLink, Information Express, I.P. Sharp and Viatel.

## ACI Ausinet

The core of the Ausinet offerings is the 'Executive Information Service' which is a collection of databases emphasising business, finance, economics and domestic and international affairs.

Five areas make up the service:

- Ausinet
- Statex
- World Reporter
- World Exporter
- Magic



*Australian Consolidated Press publishes the Australian Political Register on Ausinet*

Ausinet is a good place to start if you are looking for Australian information, because it is built up from over 30 databases. Some of these databases are bibliographic, giving you the references to the source of the information while others present you with the full text of the article you are looking for. Full text examples include The Bulletin, Australian Business, The Australian Financial Review, Business Review Weekly, The Australian Political Register and other valuable business sources.

Statex provides instant access to financial and shareprice information on over 1300 public companies listed on all Australian Stock Exchanges. It originates from the Sydney Stock Exchange and because the information is numeric

you can put in values to generate financial reports. For investors, portfolio managers and takeover tycoons it is a quick way of having, within three or four minutes, financial up-to-date comparisons of four or five companies.

With Australian businesses being implored to seek out more export business, demand for the World Reporter database is likely to rise. It is a source of international information spanning international and national events, business, economics, government, commerce, current affairs and politics. There are 36 different sources currently in the World Reporter database gathered from around the globe. They include the Dow Jones News Service, The Financial Times, Wall Street Journal extracts, Tenders Electronic Daily, BBC Summary of World Broadcasts, TASS newswire, Keesing's Record of World Events, Asahi News and the World Bank International Business Opportunities Service.

World Exporter is a rich source of intelligence on international investment opportunities and risks. Users of World Exporter will have advance notice of real market opportunities, worldwide in-depth assessment and analysis of economic, political and security risks, trade finance and currency briefings. The information is sourced from the Euromoney Trade Finance and Currency Reports, International Risk Data, Sales Leads International, and others.

World Exporter is a rich source of intelligence on international investment opportunities and risks. Users of World Exporter will have advance notice of real market opportunities, worldwide in-depth assessment and analysis of economic, political and security risks, trade finance and currency briefings. The information is sourced from the Euromoney Trade Finance and Currency Reports, International Risk Data, Sales Leads International, and others.



Magic is a service targetted at marketing organisations, advertising agencies, public relations firms and the advertising, PR and marketing departments of large and medium firms. It is based on original research carried out by Mintel and the Henley Centre for Fore-casting. It offers rapid access to reports on products, industries, markets, buying patterns, consumer spending, advertising and marketing trends.

Six business directories on the Ausinet service should be of interest to astute business people. The Australian political register (APOL) is packed with current information on each State and Federal parliament, political parties, diplomatic representatives in Australia and our own abroad. Details of over 8000 Australian public and private companies, updated quarterly, is on Business Who's Who of Australia (BWWA). Tenders for public contracts in Japan and the EEC are in Tenders Electronic Daily (TED). In World Bank International Business Opportunities (IBOS) are details of all projects seeking World Bank funding. Details of forthcoming large scale development projects around the world are in Plans and Projects Monitor (PPM). In the Metra National Development Plans (NDP) are summaries of the development plans of over 70 countries.

Index and other business databases on Ausinet include the Australian Business Index (ABIX), which is an index to business items from publications including The Sydney Morning Herald, The Age, The Australian, The Australian Financial Review, Australian Business, Rydges, BRW, The Bulletin, Personal Investment and others. Business Brief and Hansard Service (BBHS) is an index to parliamentary bills, questions, proposed legislation, policy statements and ministerial press releases. Australian Public Affairs Information Service (APAI) provides an index to Australian social, cultural, political and economic affairs from periodical articles, newspaper material, books and conference papers.

In research and bibliographic databases you can choose from the Australian Art Index, Australian Databases, Australian Education Index, Australian Architectural Database, ARTS Documentation Service, Australian Transport Literature, Cumulative Abstracts of Defence Readings, National Criminological Holdings, Directory of Educational Research, Australian Energy Research and Development, Road Safety Retrieval System, Great Barrier Reef Marine Park or Australian Software Locator.

## Online review

Searching online for information through Ausinet produces a wealth of facts during every search. Using the powerful search techniques it was an easy job to locate all the articles which appeared in a national financial daily from December 1, 1986 to the day of the search which pertained to 'Media Ownership.' There were 25 documents found. However an earlier search, in which I told the program to find every occurrence of 'media' adjacent to 'ownership' discovered 4346 documents which mentioned 'media', 2345 with 'ownership' and 167 with the two adjacent. All that was reported in seconds. Try doing that with 4346 documents or see how long your staff take to do it.

A precis of each document's contents, with the issue date, page number and the approximate number of lines can then be called up. The headlines came pouring across the screen: 'Media barons slam decision to oppose current ownership bill', 'Media rule may mean only five TV owners: Macphee'. Next I decided to search APOL, the Australian Political Register which is maintained by the electronic publishing division of Australian Consolidated Press. APOL was able to tell me a mind-boggling array of information about all Federal and State parliamentarians. Electorate and Ministerial office addresses, phone, telex and fax numbers, names of staff and their positions. Everything the determined lobbyist would want. APOL is

usually updated twice weekly and major political events such as an election or ministry reshuffle should be made within four days.

A short search through the CCH: Australian Tax Index under the subject headings of 'Journalist', 'Writer' and 'Author' made me so depressed that I decided another search area was needed. My attention went to APAI, the Australian Public Affairs Information Service maintained by the National Library of Australia. With coverage going back to 1978 I was able to rapidly search 111,909 documents for 'media adjacent to ownership.' The quick-fire results were 'media' only found in 1565 documents, 'ownership' in 227 and 'media ownership' in 38.

The time spent on Ausinet convinced me that online database searching can save time and money when you consider the results achieved in a short time. All the information I located, a lot of it unreported here due to space constraints, would have taken hours of work searching through newspaper files etc. Yet it was all located at a terminal in under one hour.

## CLIRS

CLIRS is an acronym for Computerised Legal Information Retrieval Service and it provides the full text of Commonwealth and State legislation, Case Law and a vast range of other useful information for the legal fraternity. CLIRS has the electronic publishing rights for the Commonwealth and all States legal information. In about two months the full text of all rulings by the Taxation Office will come online.

Case Law is the most popular information accessed, with information on New South Wales cases being most studied followed by High Court decisions. The second most popular database is Legislation. Commonwealth and State Legislation online at CLIRS is more up-to-date than the latest printing.

CLIRS is a series of around 50 databases for the legal profession which aims to give instant access to the law. In addition to the Case Law and Legislation databases, it has databases dedicated to land and property information, legal reference materials, legal practice papers, company financial and taxation services, corporate information, political monitoring and directories, Australian Resources Industry and newsletters and library services.

CLIRS can also provide gateways to three internationally recognised databases. LEXIS is Butterworths' UK

## Database file

**Host: ACI Computer Services, Ausinet**

**Cost: Two parts: a subscription fee (or account maintenance fee) plus a connect time fee.**

**Depends on the level of service and databases you choose to use. Monthly subscription varies between \$50 and \$250 for level one to five. Connect time is between 50 cents and \$2.92 per minute**

**Speed: V21, V22, V23 (via Austpac)**

**Protocol: 8 N 1**

**Language: STAIRS**

**Security: A Username and a Password is allocated**

**Enquiries: ACI Computer Services, 310 Ferntree Gully Road, North Clayton, Vic 3168 or phone (03) 541 5600**



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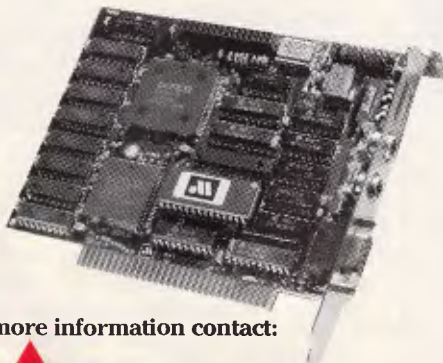
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- 132 characters across the screen when using WordStar and WordPerfect.
- Display colour graphics programs, including games in 640x400 resolution, even games that boot from floppy.



# INFORMATION

```
Question is satisfied by 65 cases
>c all
1.
RYAN v HARRISON (1957) UR 218
*****
trial could be had before a Ballarat jury. That, however, was a political
libel action arising out of a letter published during a hotly contested
parliamentary election in which the plaintiff was one of the candidates. In
*****
he removed the cause from the place where it ought naturally to be tried, and
by that I understand him to mean at Ballarat where the libel was published.
He, however, said, at p. 442: "I do not think it is reasonably probable that
*****
2.
RONSON PRODUCTS LTD v JAMES RONSON PTY LTD (No 1) (1957) UR 421
*****
plaintiff in consequence of the defendant's representations. "Here annoyance
is not enough, nor libel, nor being trade libel; nor is a shadowy possibility
of actions being brought enough." The defendant here has been selling his
*****
3.
DAVISH v ASSOCIATED NEWSPAPERS LTD (1959) UR 57
Here? Enter Y (Yes), N (Next) or X (Exit)
```

```
#RESULT 5 OCCURRENCES 2 DOCUMENTS
1 B 1 A#
#I
10495 = WORDLIST-CREATION IS IN PROGRESS.#I
PAGE = 1 OF 3
TELECO886 DOCUMENT= 1 OF 2
TI Security of computer communication systems and telematic services.
ORGN Telecon Australia, Customer Services and Systems Branch (Access
Control) and Authentication Section, PO Box 249, Clayton, Vic. 3168)
PL Share:JL Mr ((83) 5416791)
Domytho:N Mr
CL CC2B: CD4B
OBJECT To monitor and participate in the work of ISO/TC68/SC28 concerning
data cryptographic techniques;
To monitor and participate in the work of ISO/TC97/SC21 concerning
the security architecture for the Reference Model of Open Systems
Interconnection;
To monitor and participate in the work of CCITT SG-VIII concerning
security measures for telematic services; and
To monitor and participate in the work of ISO/TC68/SC2 concerning
security procedures for communicating banking applications.
These activities will involve a study of basic cryptographic
METHODS techniques including algorithms, key management strategies and
systems, and communication protocol requirements.
DE Communications security, standards; Cryptography, communications
```

## CLIRS: a libel search on Victorian reports

and European law libraries and Pergamon Infoline is one of Europe's leading online information services. Pergamon Infoline is an international database with coverage of world resources. These include International Petroleum Abstracts, Geomechanics Abstracts and Waterlit. ABN is the Australian Bibliographic Network which is a co-operative cataloging project co-ordinated by the Australian National Library. Earlier this year over 500,000 catalogue cards were held. ABN records cover books, serials, projected media, music, cartographic materials, sound recordings, pictorial materials, realia, government reports, newspapers, standards, conference papers and theses. The database is dominated by material from 1970 onwards with earlier records being added.

Cityscope — the commercial property guide is also available online. It contains land and property details of the Sydney and Melbourne CBDs, including full property descriptions with official land value, assessed annual value, ownership, boundaries, tenancies, sale prices, development applications and historical notes.

Lawyers, accountants and other professional advisers will also be interested in Business News Law on CLIRS. It covers new legislation, changes in the direction of government policies, changes in government practices, court decisions which result in major shifts in emphasis in legal interpretation and changes in legal, accounting and business practices.

## Online review

Everyone is affected by the law at some time during their lives and the

public's continuing fascination with the law is shown by the number of TV programs like 'Rumpole of the Old Bailey', 'LA Law' and 'Learned Friends' which regularly appear on our screens.

That's why I welcomed the opportunity to peek under the black gown and wig to see the way in which the legal fraternity can use CLIRS, the computerised information retrieval service. After log-on the opening menu allows you to select from:

- CLIRS Text Databases
- Land Titles Final Search
- Commonwealth & ACT Materials
- LEXIS Connection Information
- COMPUCAST
- PERGAMON INFOLINE
- CLIRS Direct Access
- Business Law News
- Australian Resources Industry Database

## Database file

Host: CLIRS Ltd

Cost: Subscribers contract to use two, four or eight hours monthly online. The Level Two, providing two hours monthly, is \$3360 per year  
Speed: V21, V22, V23. V22bis will be available when Austpac starts offering it later this year

Protocol: 7 E 1

Language: Status

Security: A Username and a Password is allocated

Enquiries: CLIRS Ltd, Level 39, MLC Centre, Martin Place, Sydney NSW 2000 or phone (02) 233 1955. Branch offices in all States

## A search for CRYPTOGRAPHYS\$ on CSIRO's Australis

At this point I decided to search the decisions of the Administrative Appeals Tribunal, using the command 'AAT-DEC'. With the search instruction 'q freedom/2/information+telecom' I discovered six articles in which Freedom of Information and Telecom were mentioned.

My companion was surprised to see that the details of the first AAT decision to come up on the screen related to 'Re: ROBIN F. HOWELLS And: AUSTRALIAN TELECOMMUNICATIONS COMMISSION.' The report summarised my appeal to the AAT some months ago when I argued that my Freedom of Information request to Telecom was in the public interest and that Telecom should not charge me for the documents I was seeking as a journalist. The matters were summarised in the AAT report using the following catchwords: 'freedom of information — imposition of charges — discretion to impose — whether public interest test applies — freedom of information — remission of charges — whether decision reviewable.' The report certainly included all the essential information of the appeal, including the fact that I lost.

The next search was in the Federal Political and Government Directory. This database is provided by The Political Reference Service Pty Ltd. It is packed with political information and is a goldmine for people wanting to find out anything about any politician in the land.

To ensure that CLIRS users know what is happening in the information retrieval industry, they offer INFOPAC as one of their databases. INFOPAC is run by Harker's Information Retrieval. A quick browse showed that it is a

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| PcTurbo 286-8mhz  | \$1675 |
| PcTurbo 286-10mhz | \$2095 |
| Tiny Turbo 286    | \$795  |

## Graphic Cards

|            |        |
|------------|--------|
| Orchid EGA | \$595  |
| Turbo EGA  | \$1095 |
| Turbo PGA  | \$2445 |
| Dbus EGA   | \$835  |

## Multifunction Cards

|                 |        |
|-----------------|--------|
| Conquest (XT)   | \$545  |
| Eccell (AT)     | \$825  |
| Ramquest (PS/2) | \$1675 |

## Network Products

|                                          |        |
|------------------------------------------|--------|
| Pcnet card                               | \$655  |
| Advanced Netware 86 Licensed from Novell | \$1495 |

## Hard Disc Drives

|                                    |         |
|------------------------------------|---------|
| Fuji 3.5" 20Mbyte w DTC controller | \$695   |
| Fuji 3.5" 32Mbyte                  | \$ call |

## SKAI TECHNOLOGY Video Collection

|                         |       |
|-------------------------|-------|
| Mono-graphics card/Ptr  | \$135 |
| 5" EGA card w 256k mem  | \$325 |
| 5" D/EGA card dual scan | \$395 |
| Color graphics card     | \$135 |

## Multifunction Family

|                              |       |
|------------------------------|-------|
| 384k Multifunction (no RAM)  | \$215 |
| 5" Multi I/O (XT)            | \$135 |
| 5" Multi I/O (AT)            | \$195 |
| 5" I/O card 2x ser (2nd opt) | \$135 |

## Memory Expansion Solution

|                          |       |
|--------------------------|-------|
| 5" 640k memory card (XT) | \$87  |
| 5" 16bit 128k card (AT)  | \$135 |
| 1 Mbyte ram card (AT)    | \$115 |

## Disk Controller Line

|                              |       |
|------------------------------|-------|
| Floppy controller 4 drives   | \$80  |
| 5" Hard Disk Controller (XT) | \$135 |
| FDD/HDD controller (AT)      | \$475 |

## Floppy Disc Drives

|                         |       |
|-------------------------|-------|
| National Panasonic 360k | \$175 |
| N.E.C. 1.2Mbyte         | \$199 |

### Product of the Month - Turbo EGA



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**SPEED:** • Supercharges a PC or XT to run faster than an IBM-AT  
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## INFORMATION

specialist newsletter that provides a comprehensive coverage of online information developments in Australasia, South East Asia and the South Pacific Regions. INFOPAC looks at all the local changes and 'happenings' within the industry and also records any major international developments.

TAX DIGEST is intended to keep users abreast of current taxation developments and is provided by leading accountant Coopers & Lybrand. A quick search in this database for 'partnership' located 92 articles faster than the Tax Office can issue a refund cheque. A subsequent search coupling 'agreement' with the earlier request, quickly located 21 articles on the subject of 'partnership agreement'. Using the command 'q journalist,author,writer' found nine articles with interesting taxation advice pertinent to a struggling scribbler.

The area of unreported judgments is one where CLIRS is proving to be invaluable to the legal profession. In Victoria, as in most other States, there is often a delay of 18 months before judgments are available in printed form. With the Commonwealth Law Reports the delay is about three years. It is so much easier for the CLIRS user to locate important cases which are not yet in printed form.

### CSA Infobank

Infobank Australia is a total data resource available throughout Australia on Computer Sciences of Australia's international network, Infonet. Until recently it maintained many large databases on CSA's Univac mainframe which were accessible online over the telephone by Infobank customers. Included were the full 1971, 1976, 1981 ABS Censuses of Population & Housing, ABS Economic time-series going back to the 1950's, NIF-10 the Treasury developed model of the Australian economy, AMIS — The Australian Municipal Information System which included six databases on Local Government social and economic statistics, ABS Annual Agricultural Census, ABS Grouped Enterprise statistics giving financial data by industry sector and various motor vehicle registration databases.

Currently only the 1981 ABS Census of Population & Housing is available to online Infobank customers. Those wanting online access to any of these databases or to any public dataset should discuss their individual requirements with Chris Howell on (02) 489 6632 or Maria Thomas (02) 439 0033

in Sydney or a CSA representative in any of the other capital cities. This reduction in directly accessible online databases reflects a change in emphasis by CSA to increased personal service.

"The volume of public datasets has increased dramatically in recent years," Chris Howell CSA consultant says. "We recognise the increasing complexity of available data and the increasing sophistication of requested information. We also believe that there are many people who require data less regularly, in smaller more usable quantities and need it in the most convenient form with the easiest possible access. And of course at reasonable cost."

"So we offer customised tables of requested data on IBM compatible floppy disks ready for use by our customers on their own personal computers using their choice of software. The unimaginably large mass of data stays on CSA's mainframe. We will write the programs to extract what's needed and download the resultant small manageable files over dedicated high speed lines to IBM PCs. If necessary we then convert these files into formats most convenient for the customer. All this is done to an agreed budget."

An interesting part of CSA business is the statistical comparison of the client's own data (customer numbers byproduct type by postcode) with population and housing data to define customer profiles and identify new target markets.

Also of interest are the CSA motor vehicle databases. These give full details of every registered vehicle in NSW, Victoria, South Australia and Queensland. About 10 million records

or an estimated 85 per cent of all vehicles in Australia. So if you want to know how many five year old Ford utilities there are, where they are — even what colour they are — CSA can help.

### CSIRO Australis

If an online service had an aroma you could almost smell the billy tea and gum leaves on Australis. That's probably because this impressive CSIRO information retrieval service is jam-packed with uniquely Australian information. There are 27 individual databases on Australis in three categories: general databases, research in progress databases and CSIRO databases.

"The main emphasis of Australis is in the area of Australian science and technology," manager Sue Harvey says. "However, this year we have added a number of databases from other disciplines. For example: HERA — Heritage Australia, IREL — Industrial Relations and FAMI — FAMILY from the Australian Institute of Family Studies."

"The Leisure database, providing information on Australian recreation and sport will be available shortly. One of the databases which is creating a great deal of interest is the Conferences file."

She points out that the unique features of the Australis databases are the Research in Progress information. Unlike most databases, which provide essentially historical information, these provide information about current research activities in Australia in the areas of agriculture, marine sciences, computing and telecommunications, energy, and CSIRO's research programs. This could be very valuable information for planners, business people, academics etc.

Australis is in the forefront reporting news vital to computer buffs. Its database CRIP is devoted to Australian Computer Research in Progress. CRIP contains details of Australian computer research projects as collected from organisations carrying out the research.

Included is research on computer architecture and software, components, circuits, peripheral equipment, image/graphic systems, communication control systems, and environmental and social issues are included.

The Australian Bibliography of Agriculture (ABOA) has the highest level of usage on Australis. ABOA is accessed by all the State Departments of Agriculture and lists documents related to agriculture and rural development,

### Database file

**Host: Computer Sciences of Australia — Infobank**

**Cost: Depends on the data requested and the time taken to extract it**

**Speed: V21, V22**

**Protocol: 8 N 1**

**Language: Database query language**

**Security: A Username and a Password is allocated**

**Enquiries: Computer Sciences of Australia, 460 Pacific Highway, St Leonards NSW 2065 or phone (02) 439 0033. Branch offices in all States except Tasmania**





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|---------------------------|----------------------|----------------------|
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| Plus                      | \$2,595              | \$3,950              |
| 512K/800                  | \$2,895              | \$4,395              |
| 512K                      | \$3,150              | \$4,650              |
| 512K(Up/g)                | \$3,250              | \$4,750              |
| 128K                      | \$3,495              | \$4,980              |

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forestry, fisheries, food science and technology and human nutrition.

Wine industry people will find plenty to interest them in the WINE database with its comprehensive coverage of Australian and New Zealand wine industry information. WINE also includes European research papers listed in the West German database VITISVEA, as well as some South African and American material on wine and viticulture published since 1980.

Another unusual one on Australis is RED the Renewable Energy Directory. Energy conservation and management, solar, wind, water, ocean and geothermal energy, and renewable energy are among the topics covered. It also contains the names of experts on, and products related to, renewable energy and energy management available in 19 Pacific and Asian countries.

## Online review

What is happening in the area of computer research in Australia? That was the question I wanted answered as soon as I logged on to Australis. I am one of those people who remember when Australia was a world leader in computing with the CSIRAC first generation computer designed in 1947 by Maston Beard and Trevor Pearcey of CSIRO. Australian Computer Research in Progress (CRIP) has the answers for research which is being disclosed.

Surprisingly, cryptography and its application in computing is one of the major research areas. There were five occurrences found searching 'CRYPTOGRAPHY'. Illegal hackers will probably not be surprised to know that my search showed that research into the security of computer communication systems and telematic services is being undertaken right now by the Telecom Australia, Customer Services and Systems Branch, Access Control and Authentication Section, at Clayton, Victoria.

Among the objects of the research is to monitor and participate in work concerning data cryptographic techniques and to monitor and participate in work concerning security measures for telematic services. Telecom is also working on monitoring and participating in work concerning security procedures for communicating banking applications.

The methods to be used in this research will involve a study of basic cryptographic techniques including algorithms, key management strategies and systems, and communication protocol requirements.

At the University of Tasmania, Department of Mathematics in Hobart, Professor R Lidl is carrying out another fascinating piece of research. The object is to develop new cryptosystems and improve existing cryptosystems for applications in secure communications. It is planned to evaluate security and improve performance of RSA type cryptosystems, to connect cryptosystems with algebraic codes and to test security of public-key cryptosystems based on pseudo-random sequences or on discrete logarithms!

Setting up a search under 'Security' produced 25 occurrences in eight documents. Email Limited, Computer Systems in Mooroolbark, Victoria states the object of its research as being: "To investigate the application of gate arrays in Australian electronic computer equipment as a means of reducing cost and improving product security."

After evaluation of its product range a certain section of a product will be chosen as being applicable for gate arraying. By using the newly established CEMA facilities a small number of prototypes will be produced. Detailed testing will be carried out. After detailed testing, a cost benefit analysis

will be carried out to determine the quantities required to make gate arrays economic in Australian products and the types of product to which gate arrays are most appropriate.

CRIP then told me that at the Monash University, Department of Computer Science in Clayton, Victoria Dr KJ McDonnell's research project has the objective of 'Investigation and prototype implementation of a distributed network directory system in accordance with the CCITT standardisation proposals.'

Next, it was on to the Conferences database which is creating a great deal of interest. It is a conference announcements file and is used in a variety of ways. Public relations personnel can use it to identify promotional opportunities. Conference organisers find it useful to ensure that their conference does not clash with another. People wishing to plan both work and holiday itineraries can refer to it. It is also a valuable aid to obtaining copies of conference papers, as the records of conferences held since 1984 remain in the file.

If you are looking for a conference to attend in Queensland in December 1987 I can now recommend the Fourth Australian Workshop on Oil Shale. Telephone Dr Peter Bell, Department of Chemical Engineering, University of Queensland, St Lucia, Queensland on (07) 377 2333 and tell him you found out about the workshop to be held from 3-4 December on Australis.

How about attending the First National Conference on Government Publishing in Australia, scheduled to be held from 29-30 October, 1987 at the Lakeside Reception Centre, Royal Melbourne Zoological Gardens? Workshop sessions likely to be of interest to *Australian Personal Computer* readers will be held on Desktop editing/publishing, creating databases for publicity and promotion, servicing the customers and online access to Government publications. Contact Mr Jeff Prentice, Convenor, CSIRO Bookshop, 314 Albert Street, East Melbourne, Victoria 3002 Telephone (03) 418 7392.

Back to nature types will find plenty to interest them in RED the Renewable Energy Directory. Searching for 'WIND' produced 128 occurrences in 62 documents giving details of experiments and applications harnessing wind power. Narrowing the search to 'VICTORIA' found nine occurrences in seven documents.

The database Australian Rural Research in Progress (RRIP), has 2464 records. Because I believe that the freshwater yabby is a gourmet

## Database file

**Host: CSIRO Australis**

**Cost: CSIRONET account maintenance fee \$100 per year.**

**Dial-up access surcharge \$3.50 per connect hour.**

**Database connect time rates, which vary between \$30 and \$85 an hour, are then added.**

**Offline printing network charges — first page 60c, subsequent pages 6c.**

**Database charges vary from nil to 40c per page**

**Speed: V21, V22. V22bis will be available in the near future, in some States**

**Protocol: 7 N 1 Some comms software may require 8 data bits**

**Language: STAIRS**

**Security: A Project Identifier (PID) and User Identifier (UID) are needed. Password protection is available at both the PID and UID levels**

**Enquiries: CSIRO — Australis, Information Resources Unit, 314 Albert Street, East Melbourne, Vic 3002 or phone (03) 418 7333. Branch offices in all States**





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delight, I decided to see whether its food potential is being researched. A rapid search of RRIP for 'yabbies or yabby' hooked four occurrences of 'yabbies' in three documents and one 'yabby' in one document. Battery culture of freshwater crayfish is being undertaken at the Western Australian Institute of Technology (School of Biology). Dr J Kowarsky is carrying out research to optimise survival, growth and food conversion efficiency of freshwater crayfish of the genus *Cherax* while minimising resource usage under conditions of intensive battery culture.

Over at the Warrnambool Institute of Advanced Education in western Victoria, Dr BD Mitchell is investigating a practical, cost-effective scheme for commercial culture of fresh water crayfish under intensive field-scale tank culture.

Among other documents found by this search were the proceedings of the first freshwater aquaculture workshop, organised by the New South Wales Department of Agriculture, Division of Fisheries held at Narrandera, NSW on February 21, 1983.

Searching for 'salmon and atlantic' landed a fascinating report on the establishment of Tasmanian Atlantic salmon brood stocks by the Tasmanian Department of Sea Fisheries. Its research aims to produce a brood of 10,000 Atlantic salmon fingerlings for sea-cage culture trials with private enterprise groups.

Did you also know that Salmon Enterprises of Tasmania is researching the development of a commercial Atlantic salmon sea cage farming industry? Feasibility studies commenced in 1983, followed by project planning, establishment of a quarantine hatchery to import eyed Atlantic salmon ova and development of a model seafarm.

## Elderlink

In mid-1983 Elders Pastoral recognised the need to find a more appropriate means of communicating to its vast number of clients. After studying the English Prestel service they conducted trials late in 1983 to determine the viability and effectiveness of the service in Australia.

Elderlink, Australia's largest privately run videotex service was released to the rural community in 1984 under the name of Farmlink. This gave the Australian farmer access, for the first time, to an extensive range of marketing and management information backed by the resources of Elders Pastoral. Since the launch, Farmlink has con-

## Database file

**Host:** Elderlink

**Cost:** Annual subscription \$149, if using your own equipment.

**Communication charges for country areas via Aus!pac are \$6.50 per hour during business hours. Off-peak, from 6pm to 8am is \$4 per hour. In metropolitan areas the comparable rates are just \$4 and \$2 per hour. Computer connect charge during business hours is \$10 per hour with \$7 per hour off-peak. There is no page surcharge or mainframe storage fee**

**Speed:** V23

**Protocol:** A videotex communications software program will be needed

**Security:** Security of access is closely controlled in Elderlink. The system is accessed via a six digit user number. A user's password of four characters can be a combination of letters or digits. As soon as a password is assigned to a new user it must be changed after initial access to Elderlink is gained. Elderlink has also instituted a further security system requiring passwords to be changed every 30 days as a further protection for the system and the user

**Enquiries:** Information is available at all Elders Pastoral branches, State offices or by ringing toll free (008) 888 390. If you want to write with a thumbnail dipped in tar, the address is Ms Anna Candler, Elderlink, 27 Currie Street, Adelaide SA 5000

tinued to expand to match the growing demands for more technical and business data.

In 1986 Sharelink was developed to complement the growing financial database. This section provides a feed from the Australian Stock Exchange, including the second boards, and covers the daily trading data of all Australian shares and securities. To reflect the increased diversity of the Elders Pastoral videotex service, Farmlink and Sharelink have been gathered under the umbrella of Elderlink.

A wide range of databases provide diverse information through Elderlink. Subscribers can choose from :

- Rural news provided by the Rural Press Group
- Taxation and Management from Price Waterhouse
- Future Trading direct from the Sydney Futures Exchange
- Canberra news, reporting the latest happenings on the political front
- A wide selection of games
- First Aid, including a service by the Royal Flying Doctor Service
- National and international sports results
- Teleshopping for wines, computers, building products etc.
- Company reviews and Stock Exchange news on the Top 200 companies
- Rural information covering every aspect of Australian rural industry
- Weather — direct information from the Bureau of Meteorology covering all regions and localities in Australia
- Telex facilities enabling users to send and receive telexes from around the globe
- Electronic mailbox allowing users to send a message to one person or a hundred and one people

The most popular information accessed on Elderlink are the shares, livestock and telex areas. There are two points that make Elderlink unique. One is the up-to-the-minute livestock reports and special information providers which enable Elders to give their users a head start over the rest of the market. The other is the interactive applications programmed into the system. Elderlink claims to have pioneered new uses for the videotex terminal. Innovations designed by Elders Videotex include two-way telex which allows the user to send and receive telexes around the world and management calculators designed to address specific agricultural and business applications.

Elderlink is also the home of Australia's first electronic cashbook. Designed in conjunction with Price Waterhouse, Cashbook recognises the need to be more up-to-date in recording cash transactions, so that more time can be spent analysing opportunities and less on basic book-keeping.

## Information Express

Are you looking for a service which will give you access to business, finance and agricultural databases coupled with a state-of-the-art instant business communications service? Then Information Express is a source to investigate because it provides Australian and worldwide market information.





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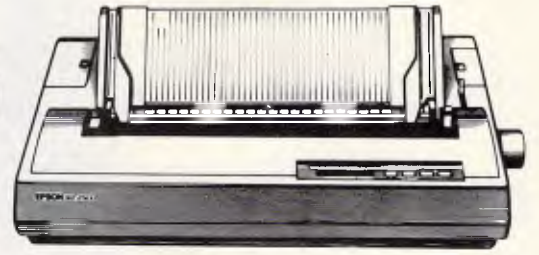
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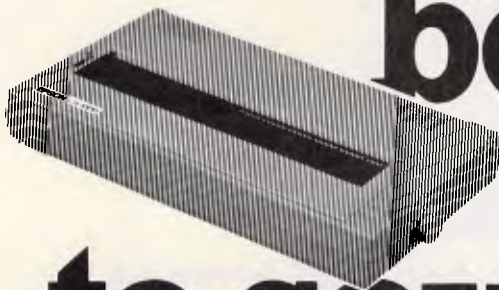




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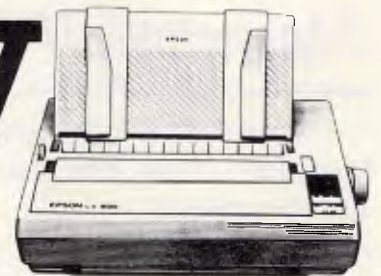
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The logo for Rob's Computer Centre, featuring the word "robs" in a stylized, red, lowercase font with a dotted pattern.

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## INFORMATION

am 52,400 were sold on the Sydney Exchange at \$10.55.

Since a friend took up Rupert Murdoch's convertible notes offer at the time of the takeover of the Herald & Weekly Times Ltd, it seems time to check on their performance. Information Express reports that the price has fluctuated from a low of \$19 on May 1 in Melbourne, to a high of \$21.50 in Sydney on April 23.

Still in the Stock Exchange area, a search for 'active media' selects seven securities ranging from Advertiser Newspapers to Universal Telecasters. Another command gives a table packed with information on all the shares nominated. Fairfax shares have been active with 189,000 being sold at 10:15 am for \$4.70. Pro-Image Studios have traded at \$2.40 for 20,700 shares.

As another test of this global searching via a keyboard, I decided to check out the prices on the New York Cotton Exchange. These reports are becoming increasingly popular with local cotton growers. A table quickly tells the opening, high, low and last price and the change for a number of months.

Back now to local finance news and I set up the search for 25 news items. The item 'Fairfax Backs FM Licence Push' catches the eye. Key in the code number and I find it is a report from that day's Brisbane Courier Mail (although the keyboard operator has re-located the paper to Melbourne...very confusing.) Fairfax, through Universal Telecasters, are among the heavy-weight media groups backing applicants for a Gold Coast FM licence. Their involvement is through the aptly named Shine on FM Pty Ltd.

Entering the command 'Lambs' produces a report menu offering a choice of 21 market reports from around Australia. They range from Katanning and Dalby through to Gunnedah or Dubbo. Choosing Homebush, I discover that rain disrupted the supply of lambs to yesterday's market and new season's lambs were firm to 50c dearer. A table presents average prices and a range for five categories of lambs by weight and the skin value.

This visit has shown me that Information Express lives up to its claim of being Australia's dynamic dial-up business information and communications service.

### **I.P. Sharp Associates**

The I.P. Sharp data collection began in Toronto, Canada in 1970. Now it spans the globe with 60 million time-series of data available in four major areas:

economic, financial, energy and aviation.

### **Economic**

About 50 different economic databases are available. These include the Reserve Bank of Australia's monthly bulletin statistics; Australian Bureau of Statistics time-series data on economic and financial statistics; several databases on Australian and international trade with statistics on imports, exports and re-exports. Economic data is also sourced from the United Nations, the International Monetary Fund (with trade flow statistics from 225 reporting countries) and the Organisation for Economic Co-operation and Development trade information, dating back to 1960 and updated monthly.

### **Financial**

In financial data, I.P. Sharp can deliver a collection of international and Australian information on stock markets, corporate financial informa-

tion, futures and commodity markets, money market and financial rates, and currency exchange rates for several world markets, plus Euro-currency rates. Equity prices for over 50 exchanges around the world are also available. There are nearly 30 databases to choose from.

### **Energy data**

Its online information on international energy data gives the latest crude oil, petroleum product and petro-chemical prices from around the world. Over 110 databases offer such diverse information as Australian Major Energy Statistics to the Seismic Crew Count from the Society of Exploration Geophysicists.

### **Aviation**

The eight aviation databases are a unique feature of the I.P. Sharp service. There are details on about 400 airlines and 300 airports worldwide. Here you will find the official Airline Guide which offers the operating schedules for regularly scheduled North American and international certificated carriers or the US International Air Travel Statistics.

Robyn McConnell, I.P. Sharp's national database manager, reports that international database usage is growing rapidly each year. She attributes this in part to the accuracy and timeliness of the data, and to the fact that I.P. Sharp can provide individual solutions for specific problems. Downloading data into Lotus 1-2-3 and Symphony opens up extended possibilities for spreadsheet analysis.

More than 95 per cent of the I.P. Sharp data is in the form of numeric time-series, such as monthly consumer price indices, daily stock prices or weekly jet kerosene production figures, which all undergo constant changes. Daily data updates from more than 100 sources are received and are fed immediately into the databases to ensure accurate and timely information.

I.P. Sharp provides some unique analytical capabilities for the end user, with tools on hand to report, graph, manipulate and download data, and to create individual solutions for specific problems. You can follow market prices, plan strategies, analyse industry, prepare budgets, investigate the competition or seek out new business opportunities.

### **Infoservice**

I.P. Sharp markets its online access to one of the world's largest collections of

### **Database file**

**Host: I.P. Sharp Associates**

**Cost: Charges vary depending on which Infoservice package is used. On Infomagic the charge is \$75 per connect hour at 300 baud and \$150 at 1200 baud.**

**Charges for searching most databases using the standard command language, the Infomagic service, range between \$75 and \$450 per hour. There is also a complicated data item charge. Other rates apply to other parts of Infoservice. A \$125 joining fee entitles you to a database catalogue with regular updates, half day introductory course and user documentation**

**Speed: V21, V22**

**Protocol: 7 E 1**

**Language: A.P.L.**

**Security: A security code number and a password are issued**

**Enquiries: I.P. Sharp Associates Pty Ltd, 8th Floor, 55 Elizabeth Street, Sydney 2000 or Margaret Rogers phone (02) 232 6366, Melbourne, Romanus Obialor (03) 614 1766; Canberra, Scott Evans (062) 733 700; Brisbane (agent) Steve Tucker (07) 229 8330**



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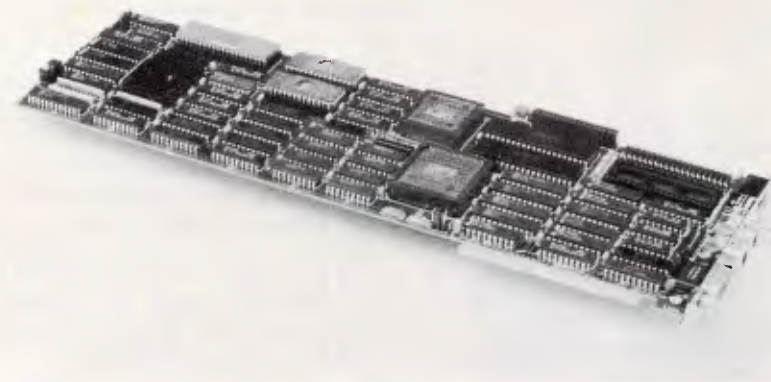
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# INFORMATION



*Microtex, a database for PC users on Viatel*

*I.P. Sharp's Official Airline Guide (Electronic Edition)*

publicly available business information under the name Infoservice. Infomagic, a system for accessing more than 500 pre-formatted reports on finance, economics, energy, aviation and world news is one customers can then choose from. The most frequently requested data I.P. Sharp supplies is in the range of information available through Infomagic.

The Analyst is aimed at investment analysts, brokers, bankers, investment advisers, portfolio managers, researchers and private investors. It provides a quick way to search, access, select and manipulate a comprehensive range of the data most popular with a broad cross-section of the financial community.

Compu Trac is a PC-based system for historical tracking of stocks and commodities for analysis in trading, investing and financial planning.

Magic, which I.P. Sharp claims is widely used in government departments and the finance industry, is a most comprehensive system for retrieval, manipulation, analysis and report formatting of the entire range of data available through Infoservice.

## Viatel

The Telecom videotex system, based on the Prestel system of Britain's Telecom, now has over 20,000 subscribers to this information source. Telecom reports that there are now over 200 organisations supplying information and services as providers.

The Viatel database contains over 85,000 frames of information and is the medium used to transmit over 75,000 messages in transit per month. While

Viatel manages to cover an extraordinary range of subjects, you can't help thinking as you look at the small amount of information on each frame, that it is the Reader's Digest type approach to a true database. However, if you want to know a little bit about subjects ranging from accommodation, through family history, national news to zoology, a Viatel subscription might interest you. There are 506 entries in the subject index listed in the latest issue of the Viatel directory and magazine. This probably explains why Viatel is the fastest growing videotex service in the English speaking world.

Viatel offers subscribers an extensive selection of information from news, lottery results, weather, travel information, latest figures from the Australian Bureau of Statistic, sports results to Stock Exchange reports. In many subject categories there are a number of service providers vying for the chance to charge you to read their frames. Airline timetables or advice on courses available from nine universities or colleges are all included on the plethora of product information being promoted.

Major services available on Viatel include Money Watch, a stock, share and financial information service operated by John Fairfax/David Syme; Commonwealth Bank — electronic banking, Western Australia TAB — Electronic Teletexting and Microtex 666 — computer programs and information.

Money Watch brings the latest share prices from the Sydney and Melbourne stock exchanges within minutes of sales being recorded. Every half hour, it also shows how the Dow Jones industrial index is moving. Key US fu-

tures and commodities market information appears almost as it happens.

Because over 75 per cent of Viatel users access the system using a personal computer there are a lot of businesses aiming their sales pitch at them. Communications equipment and software, books, clubs, courses, hardware, news, peripherals, repairs and service are all among the subject indexes containing well-known names like Apple, Dick Smith Electronics, Hewlett-Packard, Microbee, Microtex 666, Nashua, NetComm.

Games are also big news on Viatel with adventure games, logic games, multi-user games and sporting games all competing vigorously for the attention of the keen player. Late last year Viatel achieved the distinction of running the Atlantis International Great Galactic Conflict, the largest computer game in the world. Run by Microtex 666, the game is the largest multi-user computerised game, with the ability to enable up to 1000 players to join in.

Teleshopping is another important part of the Viatel service with a wide range of goods and services available for instant ordering. Users can choose from items including agricultural equipment, the euphemistically named 'adult products', alarms, books and magazines, car accessories, satellite receivers and typewriters.

The range of activities covered by a diverse group of new service providers who have come online in recent months, seems to indicate the increasing acceptance of Viatel. There's the Australian Psychological Society offering general and professional information about psychology and psychologists. Age Info Services is a one-stop



## Database file

**Host: Telecom Viatel**  
**Cost: Subscription fee —**  
*Business \$12.50 per month,*  
*non-business \$3.50 per month*  
**Access charge — Local call fee**  
*each time you dial up*  
**Connect time : (charge per**  
*minute or part thereof)*  
**Monday — Friday 8am — 6**  
**pm EST 9c, all other times 6c**  
**Charge per page : applies at the**  
**discretion of service**  
*providers. Indexes and many*  
*information pages are free but*  
*many pages, including*  
*messaging, are chargeable*  
**Speed: V23**  
**Protocol: A videotex**  
*communications software*  
*program will be needed*  
**Security: A customer identity**  
**number and a personal**  
**password are issued**  
**Enquiries: Contact your nearest**  
**Telecom Business Office listed**  
**in the White Pages Telephone**  
**Directory. Or you can phone**  
**Viatel on (008) 033 342 for the**  
**cost of a local call**

newsbank backed by the resources of The Age, offering summaries of the most recent Age articles on business, educational and general topics of high public interest. ACER is the Australian Council of Educational Research. Its service lists council members and describes current research and development projects and areas of education with which ACER is involved. Celebrity Sports is a catalogue of videos and books for sale on popular Australian sporting and business subjects.

## Keylink

Keylink is the new national and international electronic mail service and communications system. It has been made up by the merging of the OTC Minerva and Telecom Telememo services. Through being part of the Dialcom network it can provide links to the USA and Britain. Keylink also enables two or more users to have direct links and provides access to a bulletin board.

## Major OS databases

BRS Online is the Bibliographic Retrieval Service and it can give you access to databases covering a wide range of interests. The software used

by BRS/Search has rapid and flexible search capabilities. The range of databases available range from AIDS Update through Magazine Index to Sport. The company has been one of the major providers of databases to businesses, libraries and universities in the USA. Its address is BRS Information Technologies, 1200 Route 7, Latham, NY 12110, USA.

The CompuServe Information Service is another popular host for a big collection of databases. If you absolutely have to have access to the A-Z Worldwide Hotel Database, the Las Vegas Hotline, Shareholder Freebies or The Tardis Times then you sound as if you need to join up with CompuServe. Its address is CompuServe Information Service, 5000 Arlington Centre Blvd, Columbus, OH 43220, USA.

DIALOG is another large USA host which offers a wondrous choice of hundreds of databases. It has an Australian office and you can contact it by writing to Insearch Ltd/DIALOG, PO Box K16, Haymarket NSW 2000 or phone (02) 212 2867. Choose from topics including Agri-business, Child Abuse & Neglect, Computer Database 1983+, Coffeline 1973+, Online Chronicle 1981+ or World Affairs Report 1970+.

The oldest national online host aimed at the general public in the USA is The Source. It was the first American service to go online in 1979 and was developed by the Telecomputing Corporation of America. The Readers' Digest Association purchased it in 1980. You'll find databases as diverse as Artificial Intelligence Network, Comp-U-Store, Donoghue, Newsbytes and The Kaypro Knews on The Source. Write to it at Source Telecomputing Corporation, 1616 Anderson Road, McLean, VA 22102 USA.

Another USA based host with Australian representation is ORBIT from the Systems Development Corporation. The SDC range of databases includes Chemdex, Corrosion, Enviroline, Forest and US Patents. You can write to ORBIT Search Service at PO Box 439, Milsons Point, NSW 2061 or phone (02) 692 8565 or Toll Free on (008) 22 6474.

## Database database

Whether you are seeking information on a popular or rare subject, it is almost certain to be covered in a database somewhere in the world. Knowing where to start searching is the key to acquiring information.

The Australian Database Development Association was formed in 1982.

## Database file

**Host: OTC/Telecom Keylink**  
**Cost: Introductory registration fee**  
**\$25. Minimum monthly fee per**  
**mail-box \$33. To keep the same**  
**number for domestic and**  
**international telex you need a**  
**Premium Telex Subscription**  
**costing \$33 per month. From**  
**Monday to Friday 7am — 6 pm**  
**EST the online connect charge**  
**is 20c a number. All other times**  
**15c. A usage charge of 2c**  
**/1000 characters from 7 am — 6**  
**pm and all other times 1c/1000**  
**characters. A storage charge of**  
**1c per /2000 characters per day**  
**at all times. Sending of national**  
**telex between 7 am — 6 pm is**  
**40c per minute, all other times**  
**30c per minute. Normal**  
**international rates apply for**  
**international telex**  
**Speed: V21, V22, V22bis and V23**  
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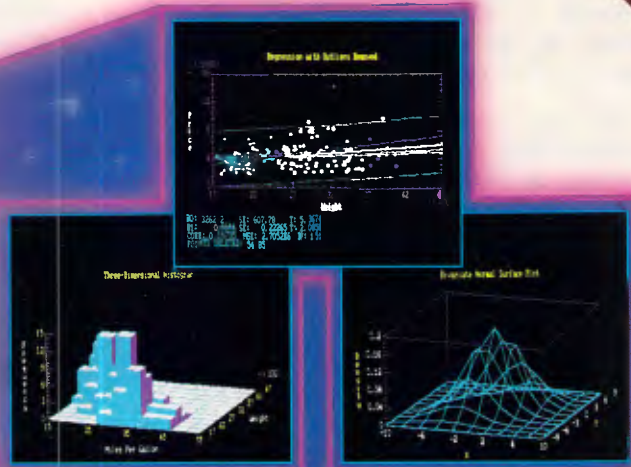
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# The ideal bridge

**Users who must extend the reach of their networks may discover it's not so easy to find the appropriate bridge that will link two networks. There aren't many bridges available for specific local area networks (LANs), because bridges are usually developed by the LAN developer: they're specific to that LAN.**

When trying to choose the right bridge, it's best to consider the LAN for which the bridge is intended.

Part of the challenge facing network managers is deciding what constitutes a bridge. The definition of network bridge has evolved. It used to mean any method of connecting two or more networks. Today, that definition is too general. A more precise one would be: a network bridge is a method of connecting two or more discrete, like networks, allowing nodes on one network to communicate with nodes on the bridged network.

'Like' is the key word in that definition. It means that each network runs the same network protocol, such as NetBIOS-to-NetBIOS, Novell IPX-to-IPX, 3Com-to-3Com. It does not necessarily mean that the bridged networks are using the same network-interface boards or hardware protocols; it is perfectly possible, for example, for a bridge to link a network based on Ethernet hardware to one based on Token-Ring hardware, so long as they both use the same software protocols. A bridge does not address the lower levels of the open systems interconnection (OSI) model that deals with hardware and hardware drivers, except that the bridge itself is a functioning node on each network.

A bridge usually consists of a computer or dedicated device with network interface cards to both networks. The bridge software resident in the bridge computer handles the transfer of network data packets from one network to the other.

To connect two or more networks of dissimilar network protocols — such as IPX-to-SNA and NetBIOS-to-TCP/IP — a gateway is needed. A 'gateway' is a connection between dissimilar devices, and combines the functions of a network bridge and those of a protocol

converter between the different network protocols.

There are a number of reasons for bridging two independent networks rather than merging them into one large network. The most obvious one is different hardware configurations. One large network cannot be formed by connecting a collection of PCs running Novell network software (IPX protocol) and equipped with IBM Token-Ring hardware directly to a Novell network running on AT&T StarLAN hardware. These networks must be bridged.

## Limitations

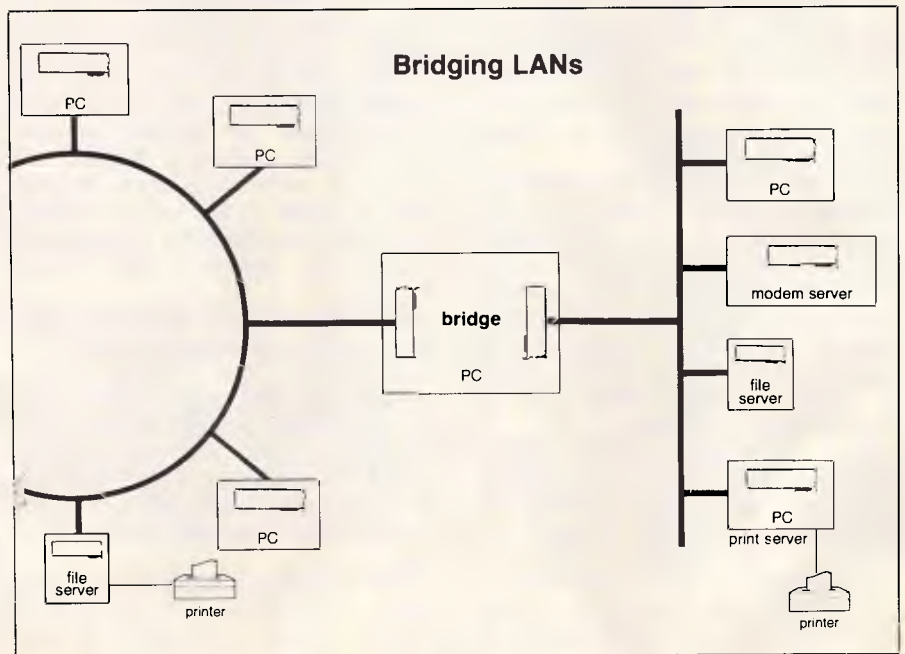
Another important reason is to overcome the many physical limitations. An IBM Token-Ring Network can only have 260 devices on a ring. A Gateway G-Net network can only ex-

tend 4,000 feet with coaxial cable. Once a network has reached any such physical limit, additional nodes cannot be added. The only way to expand it is to break the network down into smaller networks.

Functionality at times dictates the use of a bridge. Large organisations often use many discrete networks having independent functions.

IBM call these networks 'affinity groups'. Sometimes independent affinity groups need to share expensive or limited resources between networks, a mainframe gateway or a PC-based facsimile-transfer system, for example. Rather than duplicate these resources on each network, the networks can be bridged, giving workstations on one of the networks access to the resources attached to the other.

Even if such affinity group networks have not reached their physical limits





in terms of workstations or cable length, their performance may deteriorate. As networks grow in physical size or are put into more use, the amount of data flowing over them increases and the demands of each user are responded to more slowly.

Networks using CSMA/CD (carrier sense multiple access/collision detect) technology, such as Ethernet networks, are subject to more collisions and retransmissions. Nodes on token-passing networks are subject to longer and longer delays in receiving the 'token' as the number of stations on the network increases.

Therefore, an important reason for bridging networks is to increase performance. A bridge can make a large network into several smaller networks. Within each network, the amount of traffic is low enough for response time to be acceptable, and since most of the communication is between the workstations and network resources of members of the affinity network, there is little data that needs to cross the bridge.

There is some speed lost in crossing a bridge, due to the overhead of the bridge itself. But data crosses the bridge only rarely, on those occasions when a user on one side of the bridge needs a resource or data that is on the other.

Consequently, if the network designer splits the networks along the lines of affinity groups, where devices that communicate frequently are on the same network, then a considerable performance increase can be expected by bridging.

Geography is yet another factor dictating the use of bridges, when two groups of users in two separate locations want to be able to communicate with one another as if they were nearby. Remote networks can be bridged using intermediate media.

One form of intermediate media is a backbone network. In this case, the backbone network is a LAN without any workstations as nodes. The only nodes are bridges to other networks (see chart). The backbone is usually a network capable of long distances such as AT&T's ISN acting as a media to connect bridged LANs such as AT&T's StarLan network.

Other intermediate media include telephone lines or the higher speed T-1 carriers. Compared to a direct, network-speed connection between the networks, using telephone lines (either synchronously or asynchronously) significantly reduces throughput through the bridge. Even a T-1 carrier subchan-

nel at 56k bits per second (bps) is much slower than the 1M bps of the slower LANs. Using telephone lines for remote bridging is therefore effective only for limited uses, such as network administration or electronic mail.

Besides choosing an appropriate telecommunications link, network managers must also consider what type of hardware is needed to perform the bridging function.

Performance dictates the type of machine necessary to function as a bridge. A bridge between Novell networks can be anything from a simple, single-disk 4.77MHz PC on up. IBM requires an AT or a 7530-series Industrial Computer as its bridge on its networks. Companies like 3Com or AT&T offer a dedicated 'black box' as the bridging device with hardware and

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*'...users on one side of a bridge may not be able to gain access to an unlimited number of resources on another LAN on the other side of the bridge.'*

---

software bundled in one package. These boxes have network interfaces built in.

## *A question of dedication*

The necessity to constantly monitor traffic on both networks, and pass internetwork packets through as quickly as possible, dictates that bridges tend to be dedicated devices; that is, they only function as bridges, and are not used simultaneously as network workstations. These dedicated bridges are known as external bridges. Another type of bridge is an 'internal' bridge, which functions the same as dedicated bridges, but resides in the network server.

Novell and its OEM distributors offer both internal and external bridges. One advantage of the internal bridge (created by configuring a network server with multiple network interface cards and device drivers, each dedicated to a different network) is that, in addition to acting as a bridge, the server can directly 'serve' multiple networks as well.

When choosing a bridge, price is always a consideration. Some vendors sell the bridge software at a fixed

price. Others determine the bridge price by the number of networks connected by a single bridge. Novell includes their internal bridge in the price of the network, while charging for external bridge software.

All multiple-bridged networks (that is, more than two discrete networks linked together by bridges) have either a hierarchical or mesh topology. The hierarchical topology provides only one path, via intermediate networks, between the source and destination networks. Each network is linked only to the network adjacent to it. If three networks are bridged together, a network data packet from network 1 must pass across a bridge to network 2, then through that network and across another bridge to get to network 3. Only one route is possible, and network 2 will always be the intermediate media.

On the other hand, a mesh network allows for alternative paths for network traffic, giving a packet from one end to the other more than one possible data path. The packet from network 1 can pass to network 3 as described in the hierarchical scheme, or through an alternate path if there are other bridges between networks 1 and 3 — directly or through yet another intermediary network. Where performance and fault tolerance are important factors, the mesh topology is the solution. Where internetwork traffic is not heavy and the application can tolerate some downtime if the bridge malfunctions, then the less-expensive hierarchical topology is the answer.

Single bridges, the building blocks of either hierarchical or mesh topology, come in three types: simple, simple-multiple and parallel. The simple bridge consists of two networks joined by one bridge. This is an effective way of joining two networks that exchange limited information or share limited resources. The networks should be configured so that most of the network traffic remains on the originating network, rather than crossing the bridge.

Simple-multiple has all the features of the simple bridge, but allows more than two networks to be spanned by a single bridge.

A parallel bridge consists of two bridges, connected to the same networks, providing for redundancy, hence greater reliability, in networks with higher traffic and need for fault tolerance. Should one bridge fail to function, the other bridge is still available. Network managers could also split the traffic between the two bridges to smooth the flow of data exchange.

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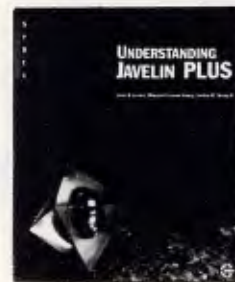
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There may be limits to the number of parallel bridges that network topologies allow. IBM Token-Ring, for instance, allows a maximum of 16 parallel bridges between any two rings.

## Software-sensitive

In addition to topology, performance and price, there are other factors to be aware of when selecting a bridge. Although bridges connect networks of like protocol, they may be sensitive to versions of the network software. For example, while the IBM bridges on both Token-Ring or PC Networks can effectively connect networks running PC LAN version 1.1 and version 1.2, Novell's bridges cannot connect a network running Advanced NetWare version 2.0 or version 2.0a to version 1.0 or the soon-to-be-released 2.1.

Another important factor in selecting a bridge is the type of traffic that may cross the bridge. Not all networks allow all devices on the network to access bridged networks.

In some NetBIOS bridges, the bridge itself maintains a table of node names for each bridged network. This table

has a limited size and, therefore, there is a limit to the number of devices that may be reached across it. Thus, users on one side of a bridge may not be able to gain access to an unlimited number of resources on another LAN on the other side of the bridge.

Besides the limit on the devices that may span the bridge, certain software may not span it. For example, most applications on a 3Com network may cross the bridge, but 3Com's SNA gateway software works only with gateway hardware attached to its resident network. The software is unable to make use of SNA gateway hardware that is located on another 3Com network across a bridge. The same limitation is true for IBM's bridge, with its 3270 gateway.

Although most networks allow network nodes to redirect or spool output to printers on the other side of the bridge, it is necessary to examine application software to determine if they can. Packages such as Lotus 1-2-3 or dBase III Plus that write directly to the LPT or PRN devices work fine when these ports are redirected to a network device, and the redirected output crosses the bridge.

On the other hand, many 'network' applications, such as those of WordPerfect or MultiMate word processing software, redirect their own printer output by placing the appropriate network software calls. Because these packages were not written with bridges in mind, they cannot make use of printers that are on another network across a bridge. One way to solve this problem is by avoiding the use of these packages' network printer features and directing the output to an LPT or PRN device that has itself been redirected across the bridge.

If a LAN is already in place, the bridge selection is limited to the bridge compatible with the installed network. If the network installation is new, the bridge should be one of the factors affecting the selection. Determine the ideal bridge based on performance, geography and cost. Determine the number of devices and type of applications that will cross the bridge. Finally, make sure that the LAN purchased has a bridge that will serve these needs.

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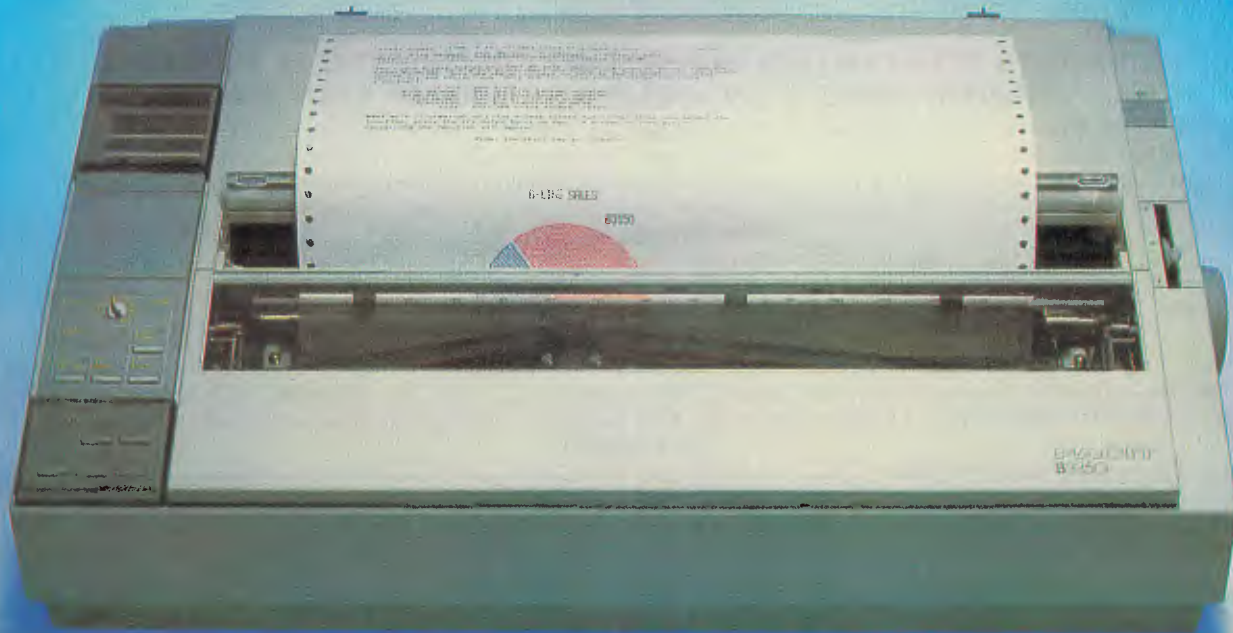
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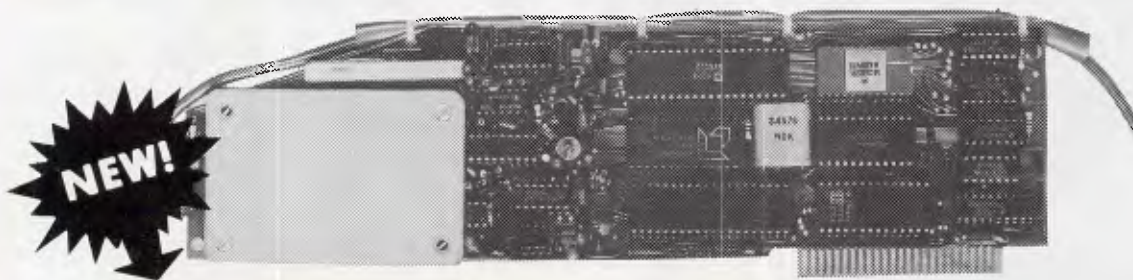
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- Select "(S) END A FILE" option
- Answer the prompt "FILENAME?:"

The modem will search the disk for the file, make all the decisions (e.g. binary, basic, textfile, DOS 3.3 or ProDos) and transmit it in the correct format. <CR> transmits the file in memory. Similarly to receive a file select "(R) RECEIVE A FILE" option.

\* AUTO ANSWER — AUTO DIAL. Senses true dial tone, ring tone, busy tone and acts intelligently, returning status messages. Characters can be included in the phone number to set baudrate, pause, "await dialtone" and multiple redial on busy. On answer, it selects the incoming baudrate by precision frequency measurement. This is much more reliable than the normal autosearch using carrier detect which is often confused by voice and phone tones. A reliable autosearch is a must for bulletin board operation.

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\* Main menu option "(V)IDEOTEXT" shows the VIATEL menu. It becomes a full graphics VIATEL terminal, automatically dialling and transmitting the user ID stored in the battery backed ram. When online, a keypress will immediately save pictures to memory. These can be reviewed later and selectively saved to disk or printed (requires a graphics printer card). Pictures can be loaded from disk and printed out. The modem can act as a videotext host and can be programmed to act on frame information. e.g. — use the clock to ring "MONEYWATCH" hurly and dial you at the office if your shares move outside a given range.

\* TELESOFTWARE DOWNLOAD facility to purchase programs over VIATEL from suppliers such as MICROTEx 666 and TANGO.

\* A full wordprocessor in EPROM for pre-composition of text before transmission. It can also be used to edit or print received files as well as for general wordprocessing.

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# Bridging LANs

**As users implement larger and more complex local area networks (LANs), a number of limitations have become apparent. Ian Davies explains. Next month's connectivity column will feature a chart showing specifications and prices of networks capable of forming bridges.**

Two of the greatest limitations in LAN implementation are the number of devices connected to the LAN and the physical distance the LAN may cover. As the number of devices connected to a network increases, the percentage of potential throughput consumed by network overheads starts to increase at a higher rate. This imposes a practical limitation on the number of active devices, and may make system performance extremely variable.

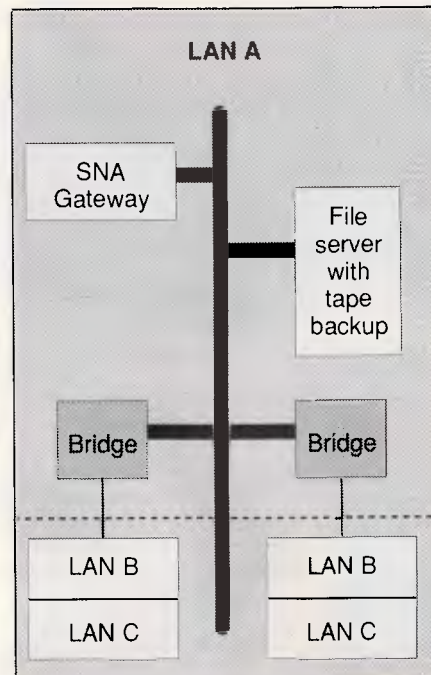
Traditional cabling imposes a restriction of several hundred metres, or at best, a little over a kilometre on the distance from one node to another. The wide area network (WAN) approach, presents its own problems, and is not always appropriate as user populations may be clustered in small communities physically removed from one another. Alternatively, it may be that within an organisation several LANs have grown within separate groups, and a need arises to share resources. These LANs may even be based on different technologies.

A solution to these problems lies in the area of 'bridged LANs', where the user community is served by a number of smaller LANs which are then interconnected via a series of bridges. Each component LAN is configured to be well within the distance and node limitations of the LAN technology being used, and traffic planning is done to ensure an evenly distributed load.

Bridges are conceptually a 'black box', although may physically consist of a normal PC with two network adaptor cards installed and appropriate control software. The two network adaptor cards may even be of different types. Other bridges are standalone units

based on custom hardware. The bridge monitors the network traffic on each LAN and is responsible for passing data from one LAN to another.

It sounds like one of those ideas which looks great on a white board but presents all sorts of problems when it comes to physical implementation.



However, user experience indicates that the bridged LAN approach works well.

One of the largest LANs in Australia is implemented by Telecom for its own internal use. Based on the Ungermann-Bass products distributed in Australia by Data Bridge, the network consists of twelve separate LANs in twelve dif-

ferent buildings. Each building's LAN is interworked to the others via an Ungermann-Bass bridge. The entire system spans the Melbourne CBD, from Spring Street through to William Street, and involves more than several kilometres of cable. British Telecom apparently has a similar network, involving the use of 60 bridges.

The Telecom network is around twelve months old, and is still in its embryonic stage as far as user population goes. Yet, according to Col Browett, a member of the Telecom Business Terminals Branch project team responsible for installation and user liaison, the system is already working well with around 100 users in total. A baseband Ethernet system is used within each building, running at the rate of 10Mbps. The UB bridges provide a 2Mbps link between each LAN, active at ISO layer five and providing intelligent routing. This means that traffic is passed outside of the local LAN only when really necessary, maximising the throughput of the 2Mbps link and insulating the interworking from high volume local traffic.

Telecom says that the performance so far is 'virtually instantaneous', but acknowledges that the user population is currently quite small. It is planned to eventually support over 1000 users in total. Although some degradation is expected, the ability of the bridges to perform intelligent routing leads Telecom to expect reasonable performance even with that user load.

Ungermann-Bass Buffered Repeaters are used to extend the physical scope of the network. These repeaters sit between the more distant bridges and relay packets of data over lengthy







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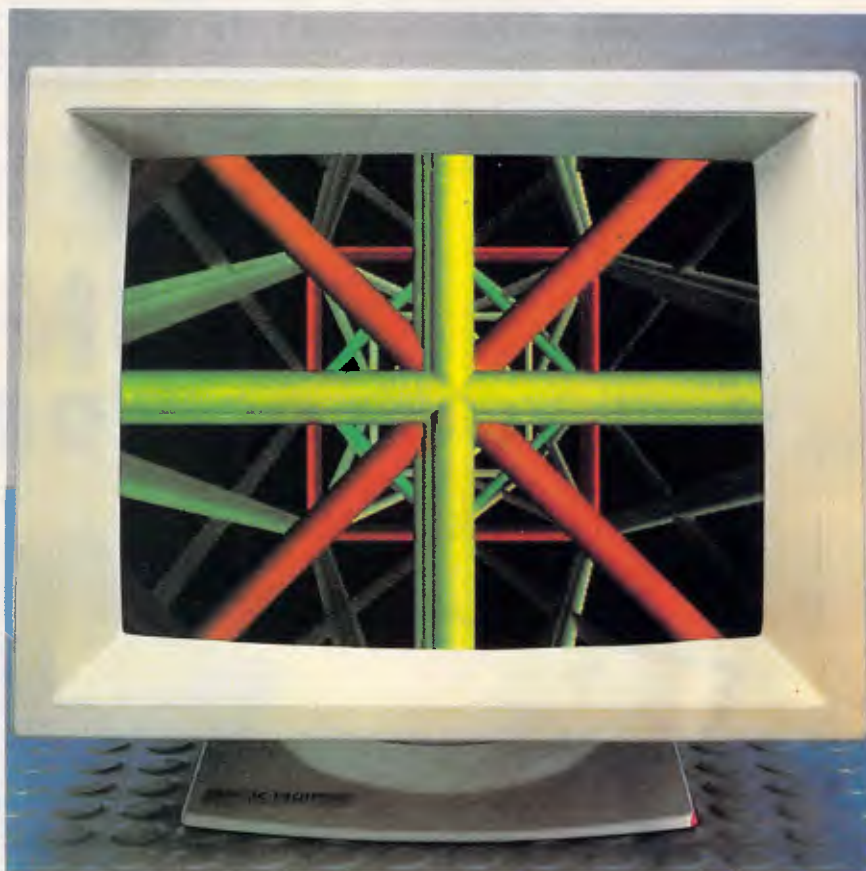
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## CONNECTIVITY

stretches of cable. The repeaters also have a degree of intelligence, verifying packet integrity automatically.

Col Browett finds the network very easy to use, and says their biggest headaches to date have merely been ones of logistics. He adds that Telecom started out with virtually no in-house experience of this technology, and the entire process has been on a learning curve. This has resulted in a number of small scale problems, but all due to the learning curve and not the technology itself.

Telecom's need for bridged LANs becomes obvious when related to its organisational structure. Telecom occupies over 35 buildings in and around

the Melbourne CBD. An individual group of users may be scattered throughout these buildings, depending on what other groups they interact with. In addition, most groups have a need to access the Facom and Honeywell main-frames, as well as a bevy of minicomputers.

The bridge allows any PC user to access any host facility, security permitting, via protocol converters built into the bridge units. This not only reduces costs, but eliminates a complex tangle of interconnection between PCs, LANs and hosts.

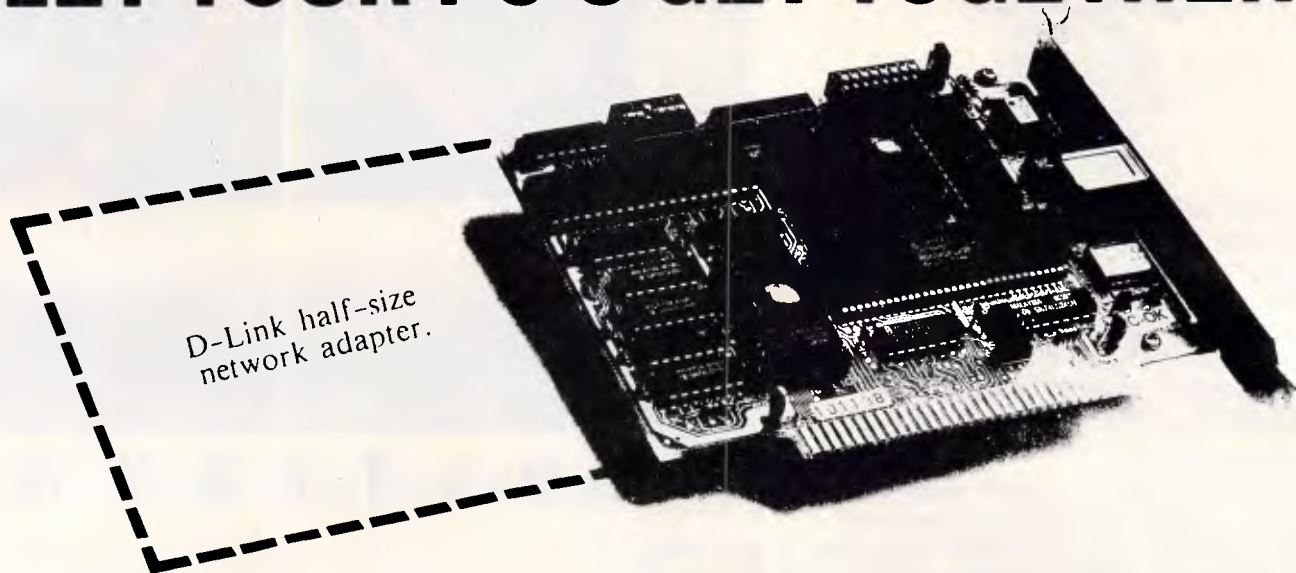
Through the bridge, users may engage in file sharing, electronic mail, bulletin boards, host access, printer

sharing and Austpac access through an X.25 link. Users do not need to know the physical location of a resource, merely its name. The bridge recognises remote resource names and broadcasts the requests throughout the external net. The entire system is administered by a Sun minicomputer running UB network control console software under Unix.

Although the Telecom project team was originally set up as a temporary entity to manage the installation of the bridged LANs, it now looks as if the growing user population and diverse requirements will demand a full-time support group.

END

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# DESQview

**Now that multi-tasking is finally becoming a reality, DESQview's innovative form of 'partitioning' will appeal to anyone who wants it now — rather than later, in the shape of OS/2. Owen Linderholm assesses the product's capabilities.**

Quite possibly you are sitting reading this article in front of your PC waiting for a long operation to be performed, like recalculating the accounts spreadsheet or compiling your newest program. Naturally, since you can't use the PC while this is going on, you pick up *APC* to keep up with the industry and you start to read and dream about OS/2. If that were available, then you could switch to a new task and carry on working on something else.

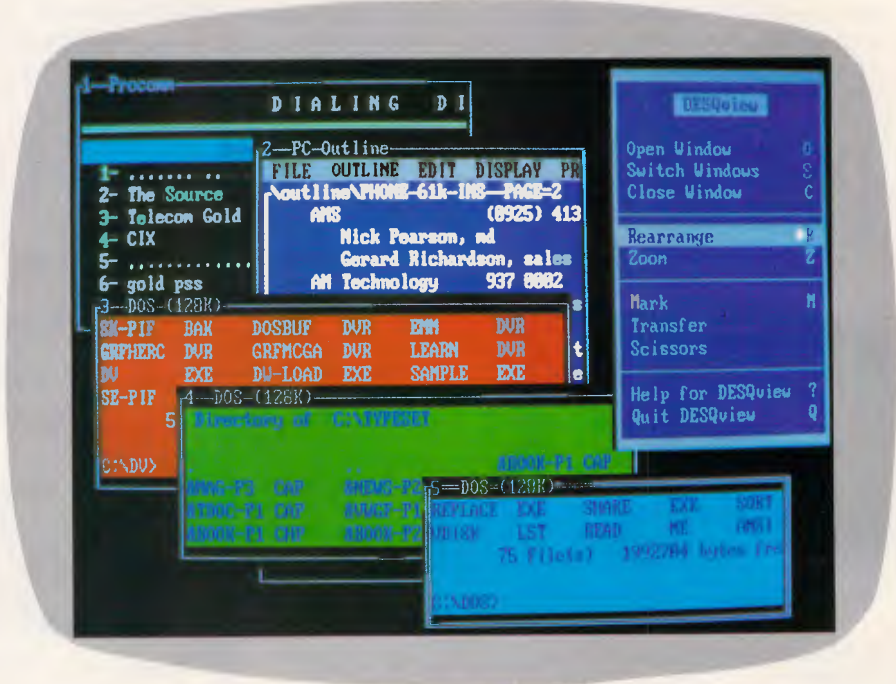
Here's some exciting news; you could be working *now* even with a humble 8088-based PC. The program that allows this is DESQview 2.0 from Quarterdeck, an American software house.

## The view from the round window

DESQview is essentially a resource manager for your PC. It starts from the assumption that you want to use a number of programs on the computer *simultaneously*. Normally this would be completely impossible since both programs would need to use the same bit of memory at once or write to disk at the same time. If you imagine trying to watch two programmes on TV simultaneously, then you will get some idea of the difficulty. The two TV programmes will both be trying to send conflicting information to the screen and speaker at the same time and the result will be a real mess.

Trying to get two computer programs to run on a PC at the same time is even more complicated since there are far more things that the two programs will need access to.

DESQview must manage all of the resources like the screen so that such conflicts do not arise. It does this by



*DESQview 2.0 in action. There are several ordinary DOS windows open in the background, each with 128k available to it. Other open applications are available after a couple of keystrokes and include WordStar and ProComm. The main DESQview menu is at the top*

partitioning each program in its own area of memory which it is not allowed to break out of. If programs need to write to the same part of the screen, then DESQview only allows one of them to display at any time and the user has to switch between them. With many programs, this is the only way they can be run under DESQview. In this case, DESQview is simply switching the programs about and the user sees this as something like switching channels on TV; just switch over and you are immediately back in the middle of another program.

However, DESQview *can* be cleverer than this. Let's get back to the TV analogy for a fuller picture. There *is* one way that two TV programmes can be shown at the same time on a TV set. This is to put one (or more) pictures in a box within the full screen. Although this obscures part of the main screen, if carefully placed, the boxes can let you see two things at once without losing any important parts of the picture. Some of the more recent TV pop programmes do this quite a lot and I have seen up to five inset boxes on the screen at once. New digital



televisions actually manage to have a postcard inset near the top right hand corner of the screen which can display a different channel or perhaps a video player input. So you can watch *Gone with the Wind* with the Adelaide Grand Prix playing in the postcard size inset (it actually produces a remarkably clear image — at least on the demonstration version I saw in Grace Bros). Back to the subject . . .

DESQview does something similar with computer programs. As long as a program is known to be 'well-behaved' and one that won't try to break the operating system's rules, then DESQview can display it in a window on the screen. This window can be any size, from one character to the whole screen. Information inside the window can be scrolled around and the window can be resized and moved about.

DESQview can also actually have more than one program running and operating at the same time as long as it can fit them both into memory. It can have lots of programs ready to run, but if they don't fit in ordinary memory then they need to be swapped in and out from disk or extended memory.

To do all this, DESQview needs to be

able to manage the processor and memory very carefully. It is a fairly simple matter to shove programs into separate areas of memory and even to prevent them writing data to other areas of memory where other programs have been stored. This is done by having DESQview take over most of the operating system. It intercepts all the calls that a program makes to the processor and data bus and decides whether to let them through, stop them or to modify them to go where DESQview wants them to.

Obviously memory management is an important function of DESQview, but even more important is processor control and multi-tasking. DESQview is essentially a sort of parasitic control program that squats on top of the operating system and controls it so that more than one program can run at once. DESQview also dynamically determines how much of the processor time each program running under it gets. It monitors the passage of time and every now and again — every few hundredths of a second — it switches control from the current program to another on its list. This is known as time-slicing and allows a single proces-

sor to run several programs by giving each one a short turn to run.

When DESQview switches between tasks, it needs to save the status of the processor, registers, stacks and other areas of system memory. If there is insufficient memory when it starts a new task, it also needs to switch one of the old tasks out of main memory and save it somewhere in temporary storage. This can either be expanded memory or a cache on disk that DESQview manages itself. This process is almost instantaneous when swapping to or from expanded memory, and very quick when swapping out to a hard disk.

Even allowing for the huge overheads involved in switching whole programs back and forth, managing and saving memory, registers, program stacks, and so on, the processor can manage quite well at performing several tasks. As a simple test, I set my HP Vectra AT compatible to work downloading a large file from The Source using ProComm, then set it printing an equally large file from WordStar and finally opened up another copy of WordStar and bashed away at the keys as fast as I



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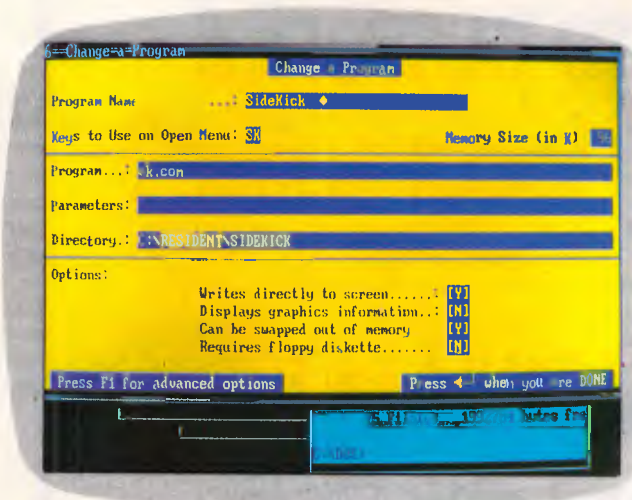
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# SCREENTEST



Setting up a program to run under DESQview is a critical operation. Although there are only a few choices to make, the answers much be right for the program to work properly with DESQview

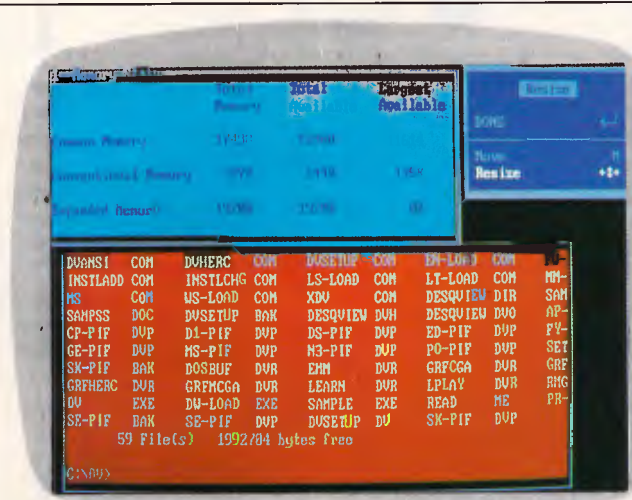
paste information to and from any window on the screen. As well as simple cut and paste, these operations can be buffered so that different sections from within one application or several applications can be run together. DESQview also provides a wide range of options for pasting information back in so that it will remain aligned in the same way as it was in the original window from which it was taken.

## Features

DESQview 2.0 is considerably changed from the previous version DESQview 1.3. This allowed multi-tasking and windowing of up to ten programs at a time as long as they were well-behaved and were text mode only. DESQview 2.0 allows multi-tasking and windowing of up to 250 programs at once and these may include graphics programs as well. Support for the 80386 processor has been added and, in addition, DESQview 2.0 works properly with the new IBM PS/2 range. Many programs are now claiming PS/2 compatibility because they are shipped in 3.5inch disk versions as well as 5¼inch. However, DESQview 2.0 and Turbo Basic are the only two programs I know of that support the VGA graphics modes of the PS/2.

In addition, the range of 'badly-behaved' programs that DESQview can work with (such as GEM or Windows) has been enlarged. It does this by providing a special loader for them that lets it control them rather than be controlled by them. Unfortunately, the list of applications supported in this way is still too small. Many of my favourites were not on the list, although a large number of standard business programs such as Lotus 1-2-3, were.

Graphics programs can also be run, but unless you are using an 80386 machine with Quarterdeck Extended Memory Manager 386 (QEMM386), then they will need to be run as full-screen applications. The graphics screen can be put in a window, but the application will be frozen. With QEMM386 and an 80386 processor, however, you can have as many CGA graphics mode screens in windows as you like, all still running. Also, using enhanced expanded memory (EEMS) rather than other forms of extended or expanded memory is an advantage. EEMS is a proper virtual memory system and allows programs residing within the expanded memory to be actually running, so you can have several megabytes of programs all running at once.



DESQview has a few applications available immediately before any new ones are installed. Shown here are the memory display (being resized), a DOS window and the rearranged sub-menu of DESQview



This screenshot shows the disk manager program, DOS Services, that comes with DESQview. It is a fully-fledged disk manager similar in function to products like X-Tree. It can call up DESQview menus or run its own multi-tasking sub-programs

could — no attempt to write properly, just enter letters as fast as possible. Even at about 200wpm typing speed, I could detect no slowdown in the word processor and both the file

download and printout performed beautifully.

Since DESQview controls the programs and windows running under it, it is also possible to use it to cut and



## SCREENTEST

DESQview 2.0 also comes with a built-in DOS 'Services' manager. This lets you get directories and mark, copy, delete and move files around. Besides this, you can also open a DOS window at any time with 128k of memory available. This can be used for simple DOS functions or running short, simple and well-behaved programs.

One other major facility of the program is its ability to learn 'scripts'. These let the user assign any sequence of operations in DESQview or in any set of programs running under DESQview to a single key. For example, you could set DESQview up so that it automatically started your word processor and loaded in (or even typed from scratch) a business letter template, then paused while you entered in a name and, finally, continued by filling in all the greeting part of the letter at the start, leaving you to type in the main paragraphs in the middle to produce a complete business letter with no fuss. Or DESQview could be used to open up your monthly accounts on the spreadsheet, mark the relevant figures for a regular report and paste them into a word processor document ready for you to add some final notes to complete the report.

Many of the ordinary operating parts of DESQview 2.0 have been considerably improved since DESQview 1.3. A particular example is that communications tasks have been optimised. If you are using a communications program under DESQview 2.0 — even as a background task — it runs as smoothly as if it were the only program running on the machine. The only noticeable change is that large chunks of text appear to come in bursts rather than steadily from the communications program.

Another nice touch is that any window on the screen can be scrolled — as if the window were looking through a frame onto a full-sized screen underneath. Also DESQview automatically scrolls the window when anything is printed in it so that the printed information appears in the visible part of the window.

Finally, DESQview comes set up in such a way that a programmer can easily write his own applications to make full use of DESQview windows, menus, sub-tasks and message-passing between tasks. Some of these functions are only available to programs specially written for DESQview; hooking your own programs into DESQview in this way can help you to produce extremely powerful and useful multi-tasking

programs. For example, DESQview specific applications can perform proper inter-task communication, so that a DESQview communications program could be set to send parts of any received information to a DESQview word processor automatically; or a program could be downloaded from a remote database and automatically installed and run under DESQview.

### In use

DESQview may all sound a bit too good to be true, but it *is* true except for some details: there are problems with the amount of available memory for extremely large programs, and it may not be possible to run more than one copy of some programs with I/O problems. Also, there are a few programs which when run require the operator's attention continuously and, if paused, might as well be removed from the machine. (Games programs are a good example of this.) Once these limitations are understood, it's easy to tell what will and what won't work well.

Installation of DESQview is critical to its correct operation, so Quarterdeck has made the set-up program simple and easy to use and, more importantly, it can be rapidly re-installed at any time. To install the program, simply run the set-up program and follow the instructions. You are given the option to perform a simple or advanced set-up. The simple set-up is enough to get you going and get used to the program, after which you will need to run the advanced version.

As soon as DESQview has been installed, you will need to install different applications under it; this is a more complicated process. Many applications are listed on the install menu and, with these, installation is merely a matter of telling DESQview where to look for the applications program. Any programs not on the list must be manually installed and this can be a difficult business. The hardest part is allocating the amount of memory a program will need. Too little and it won't work; too much and you will waste space that could be occupied by another application. For those applications for which I did not know the amount of memory needed, I found it best to start with too little and kept testing and allocating more memory until the program worked properly. (It is very important to experiment properly since if an application does run out of memory under DESQview, it will try to grab more and it is sometimes not possible for DESQview to prevent this.

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The result is that the whole machine freezes or crashes spectacularly.)

DESQview can be installed for use with either a mouse or the keyboard. The keyboard tends to be quicker, but the mouse feels better in use since it can be used, Mac-like, to size, scroll and move windows on the screen. It is probably a good idea to try both and see which you find more useful. It is important to realise that if DESQview is installed for the mouse, it may well not work properly in your application program. If you set DESQview to use the keyboard, however, then the mouse will work properly in the application.

Using DESQview is a little odd. It is exactly the opposite of using a memory-resident pop-up program. Memory-resident programs pop up over any current application and disappear when no longer needed. DESQview pops the application up and is always there lurking in the background, monitoring. All your ordinary applications become pop-up and memory-resident; available at the touch of a key and shoved away in windows. Only the one you are currently working on seems to be active, even though other tasks may be running quietly in another window. It is a very strange environment to work in and I am still accustoming myself to it.

In DESQview it is also very easy to zoom an application up to full window size and forget about other open applications. If you then quit DESQview, you will have lost work in other windows. Fortunately, DESQview can be set up so that it won't close unless all the windows have been shut down separately.

One thing that is hard to do is to 'get lost'. The whole program is controlled by menus accessed either entirely with the mouse or using the 'CTRL', 'ALT', 'SHIFT' and 'cursor' keys. Short-cuts using initial letters from the pop-up menus are available but you don't have to use them. I found this side of the program extremely easy to use, and a sheer delight.

DESQview makes use of EGA and even VGA modes properly and I was able to get displays of up to 43 lines using EGA. This meant that I could have one 80x25 application and one 80x14 application at once, which could be very useful. However, graphics didn't seem to work so well. Although the program worked with graphics, it would only do them full-screen. If the application is frozen, then the graphics screen could be put in a window, but not while it was working. The manual says that CGA screens can be freely put in windows on 386 machines while continuing

to work, but I was unable to try this.

The application I found DESQview most useful for was transferring information and files via various online services in the background while continuing to work on editing a document in the word processor or outline processor in the foreground. This operation worked perfectly the first time I tried it; it was also useful for continuing to work while sorting my phone list in the database. The only thing to watch out for is clearly indicated in the manual: communications programs must be run only when held in the computer's normal memory.

The other main use I found for DESQview, and the one that would make me seriously consider buying it, was keeping several applications open at once and ready to use. This may sound a little unnecessary, but I found it very convenient to have my communications program, word processor, phone list, disk manager and a programming language all available at the touch of a key.

## Problems

There were, however, a few problems, but most of them were of my own making when I tried to do ridiculous things in order to push DESQview to its limit. The worst problem was with printer conflict. I tried to get three different versions of WordStar to print different files at the same time on the one printer. I set DESQview up to manage printer conflicts and let the three programs start. DESQview seemed to manage okay, but when I came to look at the output it had only partly succeeded. All three printouts were printed in large contiguous chunks, but DESQview had decided to switch between the applications halfway down a page. This meant that I got five and a half pages of one document, then five and a half of another, and so on. Unfortunately, half-pages aren't very useful. Printing one document while doing other non-printer tasks worked fine, so I recommend not doing anything silly like trying to do lots of printing with DESQview all at once.

Subsequently I discovered that installing DESQview to manage printer conflict caused problems even when printing a single WordStar file. This is to do with WordStar's inability to properly manage sending all the information to the printer. WordStar pauses once the printer buffer has been filled and has to manually be told to restart. When WordStar pauses, DESQview does something to manage task-switching that messes up the printer.

By resolving printer conflicts, DESQview ensures that only one application can print on any one page, but because of the PC's hardware idiosyncrasies it is unable to tell when an application has reached the bottom of a page. This means that if an application such as WordStar pauses halfway down a page, DESQview detects the pause and switches to a new application — which starts on a new page. Of course, everything will work fine if the application that is printing only pauses at the end of pages.

Another problem I deliberately created with WordStar was to have four different versions of WordStar editing the same file. Not surprisingly, WordStar got very confused (but not DESQview). It occurred to me that programs which can do file-locking for network access would probably not mind this, but I hadn't set my WordStar to do this and every single one of them refused to save the file. On quitting I discovered I had lost it — fortunately, I used a test file rather than something I needed.

One area in which I expected to encounter problems was in using large numbers of applications; I didn't have any. I got up to forty programs open at once before I got bored, but none of them had any problem running. However, swapping applications in and out of memory took a while. Expanded memory in the form of a Quadram Quadboard-AT helped, but forty applications easily fills up expanded memory too.

Although DESQview works fine on floppy-based systems, problems can arise if you use too many applications since swapping memory out to disk takes much longer. However, using only two applications at the same time worked well.

## Conclusion

If all you want is to run several of your current MS-DOS applications at once, then DESQview is a convenient and cheap solution. Remember, though, that DESQview works better on hard-disk systems and even better with extended or expanded memory. Also, watch out for those problems with allocating memory and printer clashes!

END

*Sourceware, the Australian distributor of DESQview, expects a retail price including sales tax of \$249. It should be available around the time you read this. Sourceware is on (02) 411 5711.*



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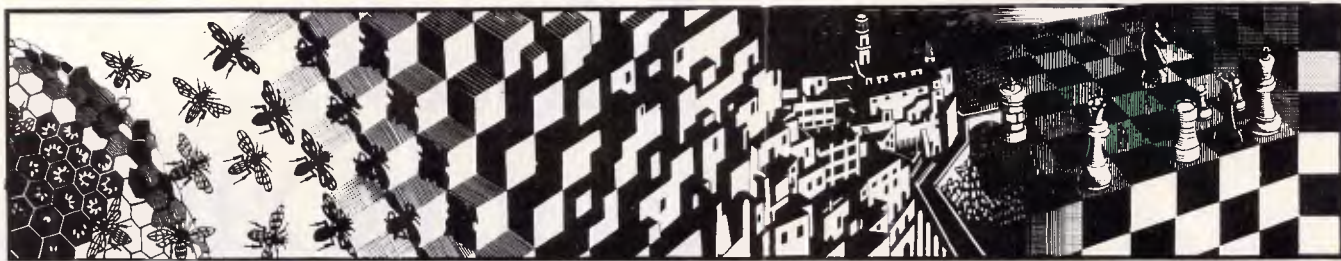
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*In a brave attempt at self improvement, Stephen Applebaum joins the ranks of snivelling thieves and tries to recapture his youth. No luck there, though, as he reviews the best of this month's games releases.*

## How have the mighty fallen

**Title:** Guild Of Thieves

**Computer:** ST; Amiga; Commodore 64/128; Apple

**Supplier:** ISD

**Price:** \$79.99 (ST, Amiga); \$59.99 (Commodore 64/128); \$69.99 (Apple)

The Guild Of Thieves, Magnetic Scrolls' long-awaited follow-up to *The Pawn*, has arrived at last. Full of wit, accomplished artistry and a plethora of puzzles, this new graphical adventure looks set to emulate, perhaps even surpass, the success of its forerunner.

Once again the action takes place in the mythical world of Kerovnia; a land where anything and everything can, and usually does, happen. The place has changed so much for the worse since the halcyon days of *The Pawn*, that veterans of that first adventure will hardly recognise it.

What is more, it is not only Kerovnia that has gone steadily downhill but your character, too. No longer are you the magnanimous knight in shining armour but a snivelling little thief, and an apprentice one at that.

Yes, times are hard. Not even your past exploits are suitably impressive credentials to gain you honorary membership of the Guild Of Thieves. Only by passing the guild's assiduously monitored initiation test can you hope to gain entry to its corrupt ranks.

Unlike *The Pawn*, which has a very nebulous scenario, *The Guild Of Thieves* is much more defined in terms of what is expected of you.

You know, right from the start, that you are supposed to gather numerous treasures from various locations in Kerovnia. What you have to discover is the most efficient — not to mention the safest — way of obtaining them.

The game begins with you and the Guildmaster sitting in a small wherry,



moored alongside a rickety jetty. Handing you a swag bag containing a lamp, the Guildmaster warns you that he and other Guild members will be watching you throughout your novitiate.

Leaving the Guildmaster, you come across a frail old man dragging a large, heavy-looking trunk. Offering the old man your services, you are led to a vast mansion, one of the adventure's likeliest sources of expensive booty.

Wandering through the mansion's many rooms and corridors not only rewards you with a number of important clues, but also provides a treat for the eyes in the form of several, very detailed graphic displays. In keeping with the high standard set by *The Pawn*, *The Guild Of Thieves* features graphics of a quality that would make programmers of lesser games weep.

Just as in *The Pawn*, the graphics occupy the top three quarters of the display, and can be pulled up and down the screen with the mouse like a roller blind.

Amazing as the detail in many of the pictures is, it does not always follow that because something is depicted graphically, it is actually present in the location. This discrepancy between the text and the graphics can sometimes be offputting. But if you remember to rely solely on the text for location descriptions, you will save yourself a

lot of typing and be able to enjoy the pictures for what they are: a pretty device to create the atmosphere lacking from the adventure's often drab text.

Movement, and interaction with your surroundings, is made all the easier by a powerful parser which enables the program to understand statements containing more than one action. Another more useful feature allows you to return to a location already visited, just by entering its name. Unless there are any major obstacles between you and your desired destination, the computer moves you directly to it.

The depths you must plumb in order to join the Guild Of Thieves stretch far beyond the bounds of good taste. Apart from simply robbing the mansion, you also have to rob a grave, steal money from a funeral parlour and prise a casket from the bony grip of a skeleton. I am sure there are worse things, though I have still to find them.

The Guild Of Thieves' greatest strength is its accessibility. Everyone, no matter what their adventuring experience, will be able to reach the game's most extreme locations with very little difficulty. Being able to cope with what you find when you get there, on the other hand, is a different matter altogether.

If you don't like puzzles you are unlikely to enjoy *The Guild Of Thieves*, as it's full of them. An apparently un-



climbable slippery rope; an ice snake which threatens to strangle you unless you act quickly; a screeching macaw; and a multi-coloured floor that can only be traversed in a certain way, are just some of the many conundrums you have to grasp and solve.

With regard to the macaw, it is strange that both *The Guild Of Thieves* and *Bureaucracy* should contain such a character. Or perhaps it isn't. According to reports, Infocom allowed *Magnetic Scrolls'* Anita Sinclair to play

*Bureaucracy* while it was under development in the US. Who, I wonder, thought of the macaw first?

In fact, both *Magnetic Scrolls* and *Rainbird* seem to have learned a lot from Infocom, especially where packaging is concerned. Not only do you get a game disk, but also a copy of *What Burglar?* magazine complete with spelling mistakes and ciphered clues, a sealed parchment, a dice with the number three missing, and a plastic credit card courtesy of the Bank of Kerovnia.

*The Guild Of Thieves* is an excellent

package all round. Easier in some respects than *The Pawn*, it does not exclude relatively inexperienced adventurers by being overly complex. Graphically outstanding, it puts most other ST programs in the shade. However, as I have mentioned, the graphics have been included at the expense of the text. I am not saying there should be less pictures, but that more time should have been spent on making the text more atmospheric rather than leaving it to the artist to make up for the author's lack of detail.

## The key to break the spell

**Title:** Golden Path  
**Computer:** Atari ST  
**Supplier:** ISD  
**Price:** \$79.99

*Golden Path* at first sight seems just like a simple arcade adventure, but gradually unfurls into an amusing odyssey that traces your development from benighted monk to enlightened spirit.

In the game you take the part of Y'in Hsi, a young man whose youthful impetuosity has made him the unwitting victim of an ancient spell. Donning a ring bequeathed to him by his late father, Y'in Hsi released a strong magic which sapped him of his youth and turned him into the enfeebled form of his father as an old man.

For Y'in Hsi to shake off his progenitor's withered body, he must tread the Golden Path to wisdom; knowledge and insight being the key that will break the spell.

Although *Golden Path* is a graphic adventure, it relies heavily on arcade-style action rather than the text/graphics combination of *The Guild Of Thieves*. However, this does not mean you simply switch off your brain and leave everything to your reflexes: *Golden Path* is actually like a massive jigsaw puzzle whose pieces are obtained by passing aptitude tests of increasing degrees of difficulty.

The game's display consists of a number of boxes and icons. At the top of the screen is the playing area, a large window containing the current scene or location and the characters present there. Below is an animated book called the Book of Knowledge; alongside this are four small compartments representing pockets of your character's clothes; and finally, at the bottom right of the display, is a small representation of the playing area, indicating the direction or directions the Golden Path takes as it trails off the screen.



Squeezed between the playing area and the boxes underneath is a crawling vine that blooms and withers depending on Y'in Hsi's current state of health. When something is eaten or a puzzle is solved, tiny flowers open along the vine's length. During periods of inactivity, the flowers become discoloured.

Y'in Hsi is depicted as a large, animated figure who totters around the playing area under your control. Despite his age, he can still punch like a young man, and even kick when necessary; two actions which come in handy for dealing with some of the more unsavoury characters who live along the Golden Path.

In the ST version, Y'in Hsi is controlled by moving a pointer consisting of a Chinese character to either his left or right side, and then holding down the left mouse button. While the mouse button is depressed, Y'in Hsi walks towards wherever the cursor is pointed. If you press the right button instead of the left, Y'in Hsi throws whatever he is holding in his hands.

He can also be made to pick up or drop an object by placing the cursor over a part of his body and then pressing the left button. Although Y'in Hsi can only hold one article in his hand at a time, he can store four others in his pocket, no matter what the size of the objects.

I have briefly mentioned the Book of Knowledge. Each time you enter a new location, the book turns to a new page

which can be read by clicking on the book icon at the bottom of the screen. The graphic display is then replaced with a written description of your current location, including a list of the objects lying there.

Another book that comes in useful is the Book of Law. This appears at different intervals in the game, and can be read for the clues it contains. When the Book of Law has been opened, it disintegrates, only to reappear in another location with a new clue.

Though not nearly as sophisticated as those in *The Guild Of Thieves*, *Golden Path's* graphics are still a delight — and a lot better than in most other arcade adventures. Ones which I found particularly good, and which came as a pleasant surprise when I first played the game, are a detailed underground cavern bedecked with flaming torches, and a raging waterfall.

Apart from graphics, *Golden Path* contains some of the best digitised sounds I have heard on any micro other than the Amiga. For example, there is a lion that actually roars; a female demon who cackles; a dog that barks; a goat that bleats; and an imprisoned boy who cries 'Help me'.

*Golden Path* is a piece of light relief compared to the likes of *The Guild Of Thieves*. Because it is so easy to get into, it is highly enjoyable, and I find myself returning to it time and time again.



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# Importance of style

*It is every programmer's dream to write clear, well-designed programs but good programming style takes practice. In this article Mark Burgess explains the significance of 'structured' programming with a working example to guide you through.*

It is a sad but certain fact that the general standard of programming today, both in popular press and in the industry, is diabolical and that the quality of its presentation is even worse.

The underlying problem has its roots in the way in which computing is taught. It is only too common to read articles extolling the virtues of structured programming; it is less common to read an article explaining precisely what this means! This article is intended to remedy this oversight, by explaining the significance of structure and then by offering some simple guidelines for developing and presenting program text.

Two totally independent skills are involved in computer programming. These are:

- (1) solving problems (of structuring); and
- (2) writing down problem solutions in a particular programming language.

The more difficult of the two is the former.

## Structure

Structure is a very simple and elegant idea, but one which has far-reaching implications. Its real importance derives from the fact that it is a major simplifying tool for solving problems and hence writing programs. Problems are most clearly understood when they can be viewed as a list of things to be done, and structuring is a way of ordering the individual tasks to be performed in a coherent way. The ordering of tasks is what distinguishes a program from gibberish and it is, therefore, something which must be ad-

ressed seriously in programming. It is almost impossible to save a difficult problem without first planning a strategy.

Consider the simplest possible structure: a *numbered list*. No-one would consider writing out such a list of things to do in a random order. It would be absurd to do so and would obscure the object of the list. Computer programs *are* just lists, however, although slightly more complicated than simple numbered lists, but in almost every published instance their procedures are ordered in a quite random way, making a mockery of very fundamental program logic.

Consider the structure of a computer program, then. Just as a simple list can be written out in point form (1..10), a computer program can always be drawn as what one might call a *structure diagram*: this is a generalisation of the list, with a very simple form, and it imitates the very operation of the computer program. Structure diagrams are excellent tools both for helping to design programs and for keeping them sound and logical, and thus they are described in some detail in this article.

A computer program naturally generates many patterns; the simplest and most important ones are considered here. By recognising and welcoming these patterns, programming can be made almost trivial, even in the most insidious cases. It is possible to distinguish, for instance, between large-scale and small-scale patterns and structures: a program which is very logical in small areas may in fact be a complete mess when taken as a whole (a randomly ordered list of clear tasks). It is not good enough that programs

merely be made up of more than one procedure or function: this in itself is not structuring. The procedures and functions of a program must themselves be logically ordered so that a program has a true logical structure which reflects exactly what it does.

What then are the simple patterns which make programming so easy? They are called *hierarchies* and *trees* in the jargon and they permeate programs in an extreme way. Two other words which appear in connection with the two above are *nesting* and *levels*; these will become more apparent as things proceed. Loops, for example, are said to be nested when one loop is executed inside another loop, which is executed inside another loop, and so on, a given number of times. The idea of a hierarchy can be understood with the help of the following analogy:

Consider an artist who is making a drawing of an object which lies under his/her microscope. The artist has the power to zoom in and out by altering the magnification of the microscope and can, therefore, examine as large or as small an area as is necessary. To begin with he/she uses the lowest possible magnification in order to sketch the general shape (or structure) of the object. Next he/she proceeds by zooming in on a small part of the object and fills in the general details. This is repeated until the original general shape is filled with general detail. Having done this, the artist goes back and adds the very finest details at the highest magnification and keeps on doing this until the picture is finished.

The connection with programming is straightforward. Each part of the draw-



# PROGRAMMING

ing process is actually a procedure to be carried out. The magnification relates to the *level* at which the artist is working (hence the terminology) and so the structure diagram for the drawing process also splits up into levels. Low magnification is called *high level* because one looks down on the object as a whole; high magnification is called *low level* because it is down among all the detailed working parts. The value of the structure diagram shown here is that it shows how the low-level parts of the drawing (the details) are related to the high-level parts, hence showing the overall scheme of the program in as much or as little detail as is desired. In this respect, structure diagrams are far superior to old-fashioned flow diagrams, which are actually steps in the wrong direction, encouraging the programmer to think at the low level first.

This approach to problem-solving is called 'Top Down analysis' for obvious reasons. Its significance is that it reflects the way that we think most efficiently. We see outlines first and fill in details afterwards, rarely the other way around.

Each procedure in a program (or its structure diagram) branches out into other procedures which lie in the level below. The procedures in a particular level actually serve the root procedures in the higher level which use them, like the slaves of the Roman households. A structure diagram manifestly displays the chain of command and neatly pieces together a task as the sum of its parts. It is quite possible to follow exactly what the artist (or computer) does merely by tracing the diagram.

To summarise the form of structure diagrams (and, therefore, the form of well-structured programs): a structure diagram consists of one main procedure at 'LEVEL 0', which branches out into a new LEVEL called 'LEVEL 1' and contains all those procedures which are contained by (used in) LEVEL 0. All the procedures used in LEVEL 2 are found in LEVEL 1, and so on, until there are no more procedures left. (There are no procedures left when a particular task can be easily performed, using only the functions offered by the programming language.) While it is obviously not possible for programs written in a language, using a normal screen editor, to look exactly like their structure diagrams, they can retain the essential features (see the example program). The structure diagram can be squashed sideways so that the levels are preserved and the tasks or procedures are listed, one

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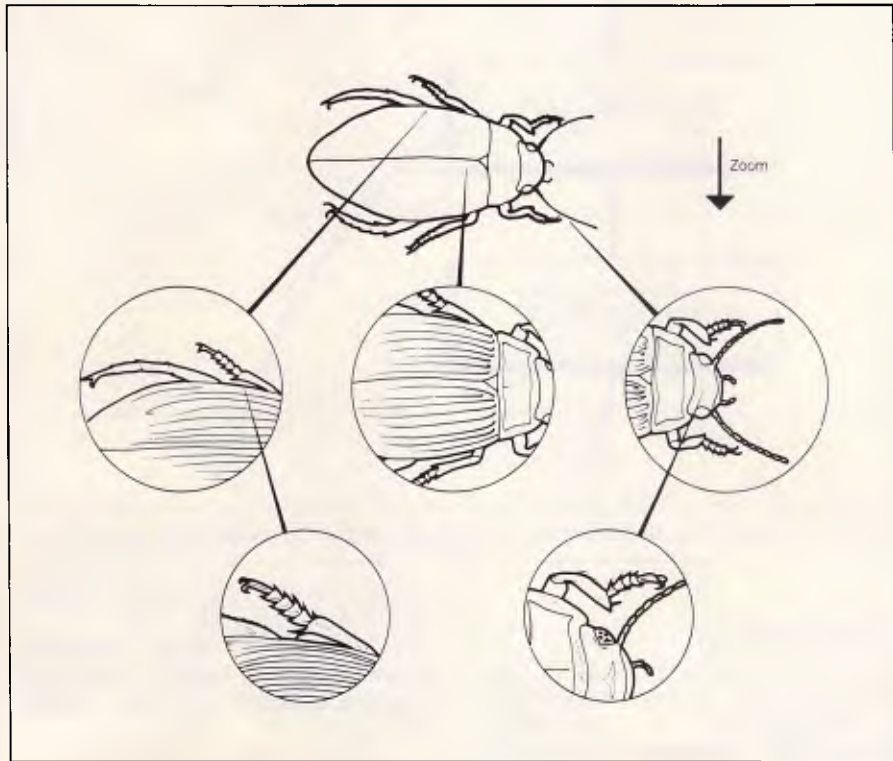


# PROGRAMMING

after the other, inside their respective levels. This shows, at least, the status of every procedure in the hierarchy and means that procedures can be found very easily: any procedure which is called in LEVEL 1 would be found in LEVEL 2 and, conversely, any procedure defined in LEVEL 2 would only have been called in LEVEL 1.

The above scheme is not quite complete, it turns out, and must be appended slightly in order to work faithfully in all instances. The question natural-

ly arises as to what happens to procedures which are used throughout all the levels, such as special printing routines or graphics routines to draw certain shapes: some logical scheme has to be found for these.



Each level of magnification reveals new complexity

ly arises as to what happens to procedures which are used throughout all the levels, such as special printing routines or graphics routines to draw certain shapes: some logical scheme has to be found for these.

The key to this lies in the reusability of such procedures. With a little consideration it can be seen that they are routines of a very general nature, which behave as basic tools for the main procedures. This motivates their inclusion in a special level, or set of levels called 'toolkits'. A good reason for doing this is that toolkit routines are a type of routine which come to be needed again and again, in many different programs perhaps, and can subsequently be isolated and re-used. Toolkits automatically result in routine libraries, some of which hold details relating to particular computers only.

an operating system, for instance. They could also be an alternative to the use of object languages.

The writing of a computer program is identical to the construction of a structure diagram. Indeed, a program is just a structure diagram which has been written down in a programming language, rather than as an annotated picture.

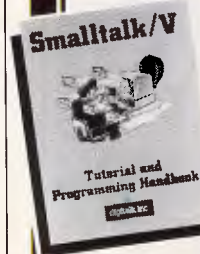
This, in fact, is the crucial point. It means that, by understanding structure diagrams, programs can be written without the need for a particular language: they can be written by simply drawing a picture. A structure diagram is nothing to do with language and can be written down in any language at all (provided it has a sufficient vocabulary); each language is as good as the next and learning new ones is a trivial matter of looking up equivalent words in the manuals.



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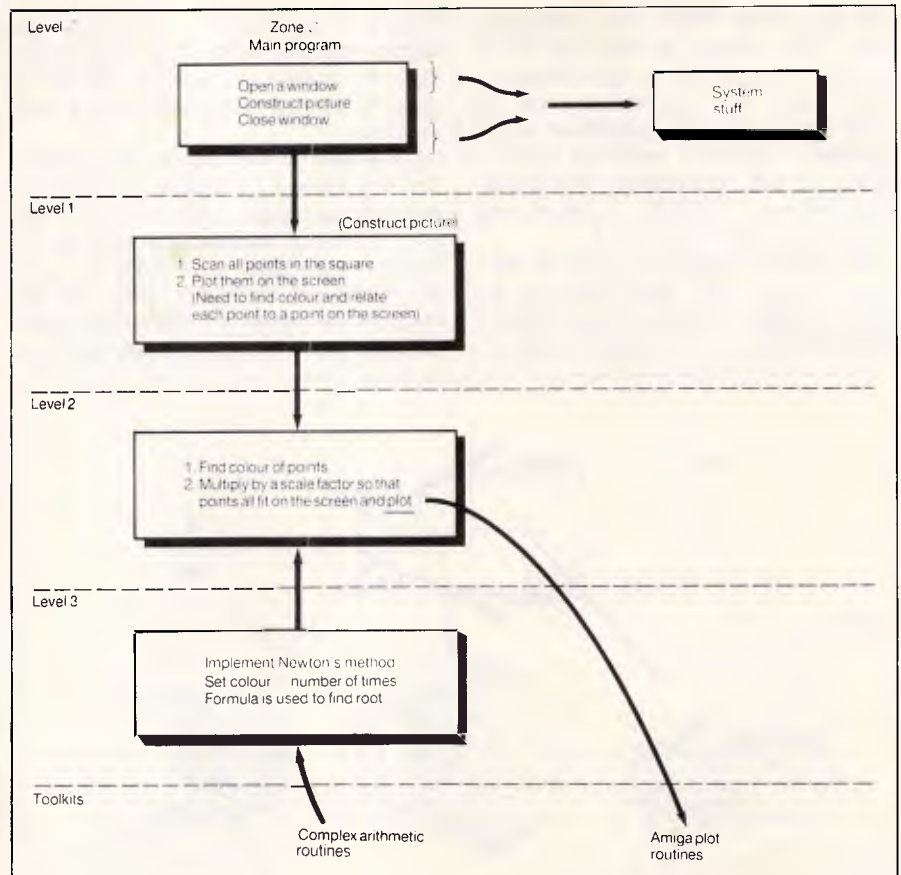
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## Presentation

So far only tidiness and clarity have been discussed. Another crucial facet of programming is *presentation*. Programming languages are as much for communicating ideas to people as they are for communicating ideas to computers. In the next section, some rules are described which can be illustrated with the help of an example program (see the program listing). The chosen program is a graphics demonstration (to be written in C, for the Commodore Amiga) and will be developed with the aid of the guidelines given. You should try to convert it to run on other computers — and in other languages.

## Guidelines for presenting programs

These guidelines essentially say: be neat and take a pride in programming; be consistent and write clearly! The examples given are for Algol-like languages (Pascal, Algol, Modula2 . . .) and C, but they are simple to implement in Basic, BCPL . . . in fact, any

language at all which allows comment to be included in a program file.

The first step is always: **solve the program problem with the help of a structure diagram** and some sound planning.

## LAYOUT & USE OF SPACE

All procedures and functions must be written down in their correct levels (as described in the main text). A procedure should never be longer than a page of A4 (that is, about 70 lines) and should rarely need to be that long. Both the levels and the procedures themselves should be clearly segregated, with a banner heading each level/toolkit. An area should be reserved on the right-hand side of the page (or screen) for comments and notes (see more under Comments). Each new program statement should be on a new line. Don't make programs nebulous by hiding statements in among comments.

## NAMES AND IDENTIFIERS

The names of procedures should clearly reflect their functions. The names of variables should clearly reflect their usage. *Never* choose names without good reason. *Never* use GOSUB if

## PROGRAMMING

PROC or a procedure will do instead.

Take advantage of actual/formal parameters (permitted in all good language implementations) to make the labelling of variables consistent and sensible: that is, when variables are passed as arguments to several different procedures, make sure that a consistent name is given to particular quantities, throughout the whole program. In other words: try not to confuse the reader.

### Examples

(a) If a procedure works out the total of a list of figures, call it something like FIND TOTAL or TOTAL or FIND TOT or something short and descriptive.

(b) If a variable stands for the total value of something, call it TOTAL, not X.

### COMMENTS & DOCUMENTATION

Each procedure should have at least one brief comment describing its function. Any further comments should also be brief. Do not lecture: this obscures the program code. Procedures ought to be self-explanatory anyway if the names of variables and procedures have been chosen judiciously. Further comments should be written in the documentation to the program. Documentation must include a specification of the program: it must describe exactly what the program does and does not do and should contain notes of any known instances when the program will fail to work sensibly, either bugs or limits of the program specification.

### Example

```
find_total (array : a);  
begin
```

```
... {Comments should be separate  
from program code}  
end;
```

### LOOPS AND NESTED LOOPS

Loops and their surrounding brackets should be indented and should be clearly visible. Always put a block bracket (that is {, }, begin, end ...) on a line of its own. For example,  
for n:= 1 to 10 do  
begin  
writeLn ('...');  
end

When loops are *nested* (that is, when there are loops inside other loops), indent for every loop and make the *level of nesting* clear.

Write:

```
for ( n=1; n <= 10; n++)  
{  
while (a < b)
```

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```

{
printf ("...");
printf ("...");
}
printf ("...");
}

```

in preference to

```

for (n = 1; n <= 10; n++)
{ while (a < b) {
printf ("...");
printf ("..."); } }

```

### GOTO

It is never *necessary* to use GOTO. If the need ever *seems* to arise, it is a sign that the program is either poorly constructed or inappropriate for the given language.

### FINAL POINT ABOUT BLOCK BRACKETS

Block brackets (like begin, end and C's { and }) are essential punctuation in a program. It is best to adopt a consistent practice in their use so that a program looks the same all over. This means that every time such brackets are used, the same structure should be adopted: for example, write:

```

complex = record
real : x, y;
end;
in preference to:
complex = record real : x,y; end;

```

Perhaps the clearest use of brackets is the method which has been adopted here.

### SPECIAL NOTE FOR USERS OF PASCAL/ALGOL...

In Algol-based languages, a program-

mer is required to define every variable, procedure and function before it is used.

This makes the appearance of the final program slightly odd: the main program lies at the end of the text and the toolkits are all found at the top. In other words, the structure diagram in Pascal/Algol is upside down. This doesn't really matter: the rules still apply — and in fact they reveal their usefulness in a very obvious way. If the levelled structure is adhered to strictly, then the requirement that everything be defined before it is used, is automatically satisfied.

## The example program

### (1) The problem

The example program is deliberately complicated, to illustrate as many of the ideas as possible. It follows a theme which has been explored recently in many of the popular computer magazines and lends itself neatly to the illustration. The objective is to plot out a diagram in the complex number plane. (For the benefit of non-mathematicians, this is just a flat square, with coordinates traditionally called (z) where z is actually made up of two parts, labelled by x and y like: (z.x,z.y) — instead of the more usual (x,y) coordinates. They are, in effect, the same.) The diagram is based upon finding the cube roots of 1, which are complex numbers.

For every point in the square region from bottom left (X0, Y0) to top right (X0+range, Y0+range), the program will use Newton's method of finding the cube root, starting with that point as a first guess. Newton's formula for obtaining a better approximation (z) to the

cube root of 1, starting with a random guess (zp) is:

$$z = \frac{2z^3 + 1}{3z^2}$$

where  $z^3 = zp$  cubed and  $z^2 = zp$  squared. The rule for multiplying the  $zp$ 's is part of complex-number theory and must be defined in the program. Since z and zp are complex numbers, they have two parts, and this is subsequently two formulae:

$$zp.x = \frac{2^*3.x + 1}{3^*z2.x}$$

and

$$zp.y = \frac{2^*z3.y}{3^*z2.y}$$

The program must obtain quite a good estimate of the cube roots, and so it should reapply Newton's formula to z in order to obtain a new z, and keep doing this until z doesn't change very much (the formula has reached the actual value of the root and can't get more accurate). The diagram will be made up of points of colours (1 . . . numofcolours) which show how many times the process had to be repeated in order to get close to the answer. (The resulting pattern is pretty, if not interesting).

### (2) The solution/structure diagram

To implement this process, a structure diagram is drawn. It is worth remarking that one purely practical thing which must be done in a graphics program is to make a window or define a screen mode in which graphics can be drawn. This is nothing at all to do with the main problem so it ought to be kept apart from the main core of the program.

## Example program to plot a diagram in the complex number plane

```

...../
/*          3          */
/* Roots of Z + 1 == 0 */
/* (M Burgess 1986 / Lattice C for Commodore AMIGA) */
/*          */
...../
/* Program plots a rectangle in the complex plane, starting at */
/* (X0,Y0) and ending at (X0+range,Y0+range). Colours are given */
/* to each pixel to indicate the number of iterations of Newton */
/* Raphson method required to reach the cube roots /* a const. */
/* called "toobig" with (z) as a starting estimate */
...../
/* Include some library files for linking */
...../
#include "stdio.h"
#include "math.h"
#include "limits.h"
#include "zonal.c"
...../
/** Manifest Constants / Macros */
...../
#define range      4.0          /* square box centred on 0,0 */
#define toobig     0.01
#define Xn         2.0
#define Yn         -2.0
...../
#define numofpixels 100.0      /* choose resolution */
#define numofcolours 16       /* maximum no of colours */
...../
#define screensize 160.0      /* max resolution */
#define divbyzero  0          /* for readability */
#define pixsize screensize/numofpixels /* size of one pixel */
...../
/** Structures */
...../
typedef struct                /* Define a datatype called complex */
{
long float x,y;
}
complex;
...../
/** LEVEL 0 : Main Program */
...../
main ()
{
open_graphics_window ();
create_picture ();
wait_for_window_close ();
}
...../
/** LEVEL 1 */
...../

```



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# PROGRAMMING

The scheme above for structuring allows us to use a new zone for this. The simplest way to see the usefulness of doing this is to just look at the listings and observe how this keeps the irrelevant detail out of the way of the main program logic. (Imagine how messy the program would look if it were included in the middle of the main logical structure.)

Try to follow the structure diagram and relate it to the listing. Points to notice in the listing are:

- the rules for multiplying and dividing z's (that is, complex numbers) are defined in a toolkit, so that they can be used again in later programs;
- logically separate parts of the program are separated either by blank lines, separate procedures or different zones; and
- the program contains very few comments, but variable names are clear and relate to what is happening.

Finally, notice how the structure of the program relates to the structure diagram.

### (3) Program documentation

Here is part of a summary of each procedure. This is rather shorter than

ideal, for the sake of brevity in this article.

#### ZONE 0

**main ()** Trivial

**create picture ()** This scans through every point in the square and calls PlotArgandPoint at each point. It passes the point z so that it can be used in Newton's formula. It also passes a parameter called 'scale' which adjusts the values of the complex numbers, so as to fill the screen. To do this it makes use of the 'constants' 'screen-size' and 'range' as defined in the program. These device-dependent (or computer-dependent) constants are defined at the start of the program.

**PlotArgandPoint ()** This accepts a complex number z and the scale factor relating the numbers to the points on the screen. It then calls 'num-of-repetitions-to-root ()' to find out what colour it should plot, and multiplies z so that the points all fill the window size. It then passes the adjusted coordinates to an actual plotting routine for the screen.

**num of repetitions to root ()** This repeats Newton's method of finding the

roots and counts the number of times it must repeat the process in order to get close to the root. The technical details of this are not really relevant to this article, but would be included here otherwise.

The toolkit routines and Zone 1 can also be described, either separately or collectively, depending upon the clarity of their coding.

### Conclusion

The example program shows the way in which a program can be structured. The structuring is not only a matter of pride and professionalism but is extremely important in keeping control of programs, especially when they become large and complex. The rules are not only aesthetically pleasing in this respect, but are an important tool for coping with the increasingly complex operating environments which are now being developed.

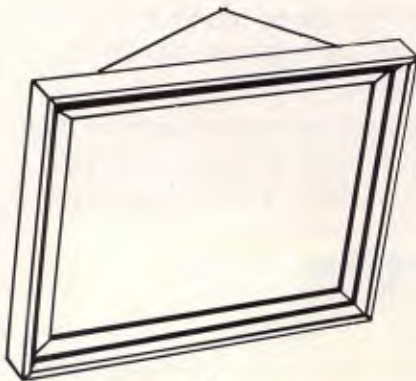
It is to be hoped that something akin to these rules will become a standard of practice and will improve the rather low programming standards which exist now.

END

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# Doing what DIR doesn't

**DR.COM lets you sort files by extension, size, date, time, and DOS order — and view, rename, move, and delete them — without ever typing DIR again. Courtesy of Michael Mefford.**

As a file management tool, DOS is a dull knife. When you spot an unfamiliar filename in a DIR listing and stop and TYPE filename to examine it, you lose your place. If the file is okay after all, you have to hit DIR again. If not, it's DEL filename or, to move the file to another directory, you must type COPY filename\dirname, followed by DEL filename. And another DIR. Little wonder no one has the time and patience to keep their hard disk in order.

DR.COM will change all that. When you simply enter DR at the DOS prompt, you'll quickly get an alphabetically sorted, DOS-format listing of your current directory, and on the right of the screen you'll find a menu full of the file functions you'll need. A movable highlight bar controlled by the keypad cursor keys lets you thumb forward and backward through the directory. Park the bar on a file of interest, hit the appropriate function key from the menu list, and DR will either pop up the file for viewing, delete it, or rename it.

By adding parameters, you can sort the initial DR directory display in five different ways. Its full syntax is

DR [d:] [directory] [/E] [/S] [/D] [/T] [/O]

The switch characters (a slash followed by a letter) tell DR which way it should sort your directory. DR defaults to sorting by filename, essentially alphabetising the listing. The /E switch instructs DR to sort by Extension. /S sorts by Size and either /D or /T sorts by DaTe. If you want to see a directory's filenames listed in the DOS DIR order, just put /O on the command line.

Don't worry if you can't remember the switches. All the sort functions (except O) are also listed in the DR menu.

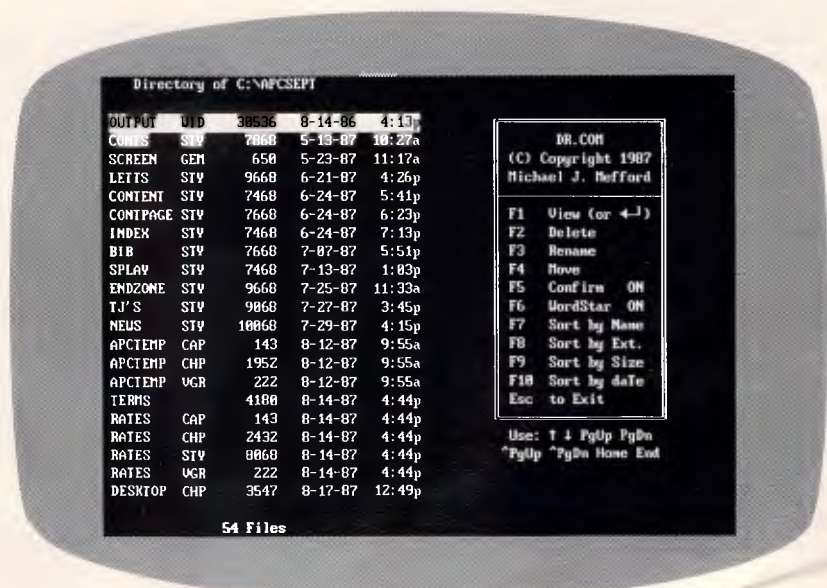
Unlike DIR, which scrolls off into never-never land, DR gives you complete control over the directory listing display. The Up and Down Arrow keys scroll the highlight bar a line at a time, while PgUp and PgDn flip to the next group of 21 filenames that DR displays at once. Ctrl-PgUp and Ctrl-PgDn take you to the top and bottom of the current page, and the Home and End keys take you to the beginning and end of the directory.

DR has an additional search feature that quickly puts the highlight bar on

the first filename that starts with a particular character. With a DR display on the screen, pressing 'P' will take you to the first filename that begins with the letter 'P', for example. Successively pressing 'P' will take you forward through all the filenames that begin with that letter. If you've sorted by anything but the default alphabetised listing, this can be a quick way to find a particular file.

## Fully functioned

DR takes advantage of all ten function keys. F1 through F6 control the action taken on the highlighted filename. If



The DR screen menu with a typical page of directory listings



you press F1 (or the Enter key), the currently highlighted file is instantly brought on-screen for viewing. Once inside the file, the Up and Down Arrows continue to scroll the display one line at a time, and PgUp and PgDn move you to the previous or the next page. Either Ctrl-PgUp or Home takes you to the top of the file and, as you would expect Ctrl-PgDn or End puts you at the bottom of the file.

When you're through viewing, another tap on F1, or the Enter key or the Esc key, exits back to the menu. Indeed, as it should in all applications, each press of the Esc key takes you back one step in each DR module. Pressing Esc from the directory listing returns you to the DOS prompt. You can thus pop in and out of files for perusal with a minimum of keystrokes and never again have to resort to the DOS TYPE command or, for that matter, be bothered with typing the name of the file.

If you decide the file you just viewed is ready for the bourn of no return, press F2 to delete it. As a check, before deleting the highlighted file, DR requests verification — 'Y' to confirm that the file should be deleted, 'N' or Esc to cancel your delete command. If you don't want to be queried each time, you can press F5 to eliminate the confirmation step. (F5 is an on-off toggle; the default is Confirm ON.) If you turn Confirm OFF and press F2, the deletion is instantaneous. After deleting a file, DR tidies up by removing the filename from its listing and decrementing the file count it displays.

F3 lets you Rename a file and F4 is to Move a file to another directory. When you press F3, you are prompted for a new name for the highlighted filename. Your response cannot contain the path characters ':' and '\' nor the wildcard characters '?' or '\*'. Once you have entered the desired new name, press Enter. If you have christened the file with a valid name, the new name will replace the old one both on the disk and in the DR listing. Otherwise, you probably entered an invalid filename character such as space and DR will complain with that annoying beep. If you pressed F3 and wish to change your mind in midstream, hit the dependable rip cord, the Esc key.

F4, Move a file to another directory, is particularly useful if you use one directory as a dumping ground for files that must later be sorted into their appropriate cubbyholes. When you press F4, you are prompted for a new directory for the highlighted file. Note that you cannot move a file to another

drive, nor can you move to a directory that already has a same-named file. The latter entails copying, a function that is not included in DR. If you want to move a file to another directory and also give it a new name, first press F3, Rename the file, and then F4, Move. Confirmation of a successful move is the same as when you delete a file. The name will be removed from the directory listing. Don't panic. Your file is not lost, just in the new directory, where you wanted it.

F6 is the WordStar toggle. WordStar and some other word processors set the high bit of an ASCII character on to control page formatting, causing a normal text character to be displayed as a graphics character. DR by default strips this high bit so that even these text files will look normal when using the View function. However, if the file you wish to view has graphic characters you wish displayed as graphic characters, press F6 and the 'ON' next to the WordStar will be toggled 'OFF'.

---

*'You can pop in or out of files for perusal with a minimum of keystrokes and never again resort to the TYPE command or be bothered with typing the name of the file.'*

---

and DR will leave the high bit alone. The WordStar toggle does the same thing as Ctrl-QG in SideKick's Notepad.

The last four functions of DR control the different ways you can Sort the directory listing. These functions are F7, Sort by Name; F8, Sort by Extension; F9, Sort by Size; and F10, Sort by DaTe. Unlike the DOS SORT.COM, the Date sort correctly handles the old problem of sorting by year as well as month, date, and finally time. You might use F8, Sort by Extension, if you were just interested in your .BAK files, for example.

The Sort functions can be used in combination with other functions. For example, if you want to see the latest file updates, press F10, Sort by DaTe, and immediately press End to take you to the end of the listing. Or if you want to see all your .COM files sorted by size, press F7, Sort by Size, and then F8, Sort by Extension.

All the DR functions except Confirm

will also accept a Ctrl-letter command entry. This means that while depressing the Ctrl key you have the option of pressing V (or Enter) to View, D to Delete, R to Rename, M to Move, W to toggle to WordStar high bit, N to sort by Name, E to sort by Extension, S to sort by Size, and T to sort by DaTe. Confirm was omitted from the Ctrl-letter alternative to help protect against accidental deletion.

An additional touch I think you'll appreciate is that the Delete, Rename, and Move functions work directly while you are Viewing a file. For example, if while in View mode you decide that the file should go, instead of returning first to the menu with Esc, just press F2 and you will be automatically returned to the menu's confirm deletion prompt. (This assumes the Confirm toggle is 'ON'. If 'OFF', DR will not pause before deletion.)

## Getting DR

If you haven't yet bought a modem, DR.COM should push you to the decision point. At roughly 3k, it's considerably the largest utility APC has presented to date, and accurately typing in either DR.ASM (Fig 1) or DR.BAS (Fig 2) may prove rather difficult. The .COM, .ASM, and .BAS versions of DR are easily downloaded by modem from Microtex on Telecom's Viatel (page \*6663#) or by sending a stamped self addressed package containing a blank disk marked DR.COM, C/- APC, 124 Castlereagh Street, Sydney 2000.

## Application notes

I think you will find many other everyday uses for DR aside from cleaning up a directory. First of all, you will probably want to use DR as a replacement for the DOS DIR command — and you know how often you enter that. The two main advantages DR has over DIR are its speed and the ability to scroll forward as well as backward through the listing.

Finding a file from an alphabetised list is faster and easier than ploughing through a DOS DIR listing. DR also comes in handy for quick perusal of .DOC and README files that often come on a new disk. Browsing through a whole directory of files may be the handiest use of DR.

DR uses an 80-column line wrap format to display files. What that means is that DR keeps displaying one line until it either encounters a carriage return or gets to the last column of an



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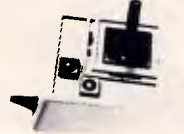
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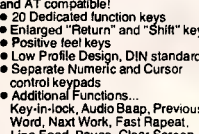
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## RS232 BREAK OUT BOX

A simple way of monitoring RS232 interface lead activity. Interface powered, pocket size for circuit testing, monitoring and patching. 10 signal powered LED's and 2 spares. 24 switches enables you to break out circuits or reconfigure and patch any or all the 24 active positions.

**SPECIFICATIONS:**  
Connectors: DB25 plug on 80mm ribbon cable and DB25 socket.  
Indicators: Tricolour LED's for TD, RD, RTS, CTS, DSR, CD, TC, RC, DTR, (ETS).  
Jumper Wires: 20 lined end pieces.  
Power: Interface power.  
Enclosure: Black, high impact plastic.  
Dimensions: 85 x 95 x 30mm  
X15700 ..... \$94.95



## RS232 FAST CABLER

Makes RS232 interface configuring fast and simple. 3 slide switches enable line swapping functions, positive and negative voltages are displayed on 8 tricolour LED's.

**SPECIFICATIONS:**  
Connector: DB25 plug on 100mm cable and DB25 socket on 100mm cable.  
Indicators: Tricolour LED's for pins 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DSR), 20(DTR).  
Switches: 3 Slide switches to swap leads.  
Power: Interface power.  
Enclosure: Black, high impact plastic  
Dimensions: 85 x 95 x 30mm  
X15710 ..... \$145



## SEMICONDUCTORS!

Always check our prices before you buy!

| 1-9     | 10+     | 100+            |
|---------|---------|-----------------|
| 2114    | \$2.95  | \$2.75 \$2.50   |
| 2716    | \$8.95  | \$8.50 \$8.95   |
| 2732    | \$6.95  | \$8.50 \$7.95   |
| 2764    | \$7.95  | \$7.50 \$6.95   |
| 27128   | \$9.95  | \$8.95 \$7.95   |
| 27256   | \$11.50 | \$10.50 \$10.00 |
| 27512   | \$19.50 | \$18.50 \$17.50 |
| 4116    | \$3.95  | \$3.50 \$2.95   |
| 4164    | \$3.95  | \$2.95 \$2.75   |
| 41256   | \$7.95  | \$6.95 \$5.95   |
| 5558pin | \$0.50  | \$0.40 \$0.35   |
| 6116    | \$3.95  | \$3.75 \$3.50   |
| 6264    | \$7.95  | \$6.95 \$6.50   |
| 6802    | \$5.00  | \$4.00 \$3.75   |
| 6821    | \$2.00  | \$1.80 \$1.70   |
| 6845    | \$5.00  | \$4.00 \$3.75   |
| 7406    | \$0.40  | \$0.30 \$0.25   |
| INS8250 | \$29.95 | \$27.95         |

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| 1-9    | 10+    | 100+   |
|--------|--------|--------|
| \$1.95 | \$1.85 | \$1.75 |

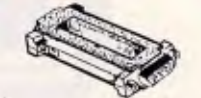
## WORLD MODEM CHIP

Cat. U21614 ..... Normally \$49.50  
Save \$25, SPECIAL \$24.95

## MEL9501

Have you blown up your Apple drive by plugging it in backwards or not turning off the power while changing boards? We have the MEL9501 chip! SPECIAL, ONLY \$29.95

**8587**  
Genuine Intel chips with manual and data sheets packed in boxes!  
8087-3 (4.7MHz) ..... \$269  
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8087-1 (10MHz) ..... \$585  
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## DB9 GENDER CHANGERS

- Saves modifying or replacing non mating DB9 connections
  - All 9 pins wired straight through
- X15640: Male to male  
X15641: Male to Female  
X15642: Female to Female  
..... only \$14.95



## DB15 GENDER CHANGERS

- Saves modifying or replacing non mating DB15 connections
  - All 15 pins wired straight through
- X15645: Male to male  
X15646: Male to Female  
X15647: Female to Female  
..... only \$14.95



## RS232 GENDER CHANGERS

- Saves modifying or replacing non mating RS232 cables.
  - All 25 pins wired straight through
- Cat. X15650 Male to Male  
Cat. X15651 Male to Female  
Cat. X15652 Female to Female  
Normally \$14.95 each  
Only \$9.95



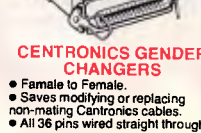
## RS232 INLINE SWITCHING BOX

- 25 pin "D" plug to 25 pin "D" socket
  - DIP switches allow easy switching of internal wiring.
- Cat. X15662 ..... \$32.95



## RS232 WIRING ADAPTOR BOX

- Male to female
  - 25 Databatchable plug on leads
  - 2 mini jumpers
  - Ideal for experimenting or temporary connections
- Cat. X15665 ..... Normally \$49.95  
Only \$44.95

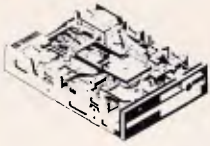


## CENTRONICS GENDER CHANGERS

- Female to Female.
  - Saves modifying or replacing non-mating Centronics cables.
  - All 36 pins wired straight through.
- Cat. X15663 Male to Male  
Cat. X15664 Male to Female  
Cat. X15665 Female to Female  
Normally \$33.95  
Only \$24.95



# ROD IRVING ELECTRONICS!



## NEC DISK DRIVES

**3 1/2" DISK DRIVE**  
 • 1 M/Byte unformatted, (640K formatted).  
 • Double sided, double density.  
 • Access Time 3m/sec  
 Cat. C11908 **\$265**

**5 1/4" SLIMLINE**  
 • Switchable 1.6 M/Byte to 1 M/Byte unformatted  
 1.2 M/Byte to 720K formatted  
 • Double sided, double density.  
 • AT compatible  
 Cat. C11908 **\$295**

**8" SLIMLINE**  
 • Double sided, double density.  
 • 1.6 M/Byte unformatted.  
 Cat. C11908 **\$795**



## IBM\* COMPATIBLE DISK DRIVES

Tired of paying out more for Japanese Disk Drives? These "direct import" Hong Kong disk drives are the solution! They feature Japanese mechanical components, yet cost only a fraction of the price!  
 Cat.No. Description Price  
 C11801 500K ..... Normally \$199  
**SPECIAL, ONLY \$179**  
 C11805 1.6 M/Byte ..... **\$259**



**20 M/BYTE HARD DISK DRIVE FOR IBM\* AND COMPATIBLES**  
 Drive with DTC controller card.  
 Cat. X20010 ..... WAS \$850  
**SPECIAL, ONLY \$750**  
 \*IBM is a registered trade mark.



**APPLE\* COMPATIBLE SLIMLINE DISK DRIVE**  
 Compatible with Apple 2+  
 Cat. X19901 ..... Normally \$225  
**SPECIAL \$179**

**APPLE\* IIC COMPATIBLE DISK DRIVE**  
 (including cable ..... **only \$199**  
 (\*Apple is a registered trade mark.)



**SWIVEL BASE**  
 Make file easier with these quality, swivel and tilt bases, complete with rubber fittings!  
 Cat. D11100 **\$24.95**



## IBM\* XT COMPATIBLE CARDS

**NEW! NEW! NEW! NEW!**  
**20M/BYTE HARD DISK CARD**  
 XT compatible, simply plugs straight in to your computer!  
 Cat. X20020 **\$1,095**  
**Colour Graphics Card**  
 Cat. X18002 **\$109**  
**Mono Graphics/Printer Card (Hercules compatible)**  
 Cat. X18003 **\$119**  
**Floppy Disk Drive Controller Card (2 Drives, 16 Bit)**  
 Cat. X18005 **\$52**  
**Floppy Disk Drive Controller Card (4 Drives, 16 Bit)**  
 Cat. X18006 **\$57**  
**High Resolution Mono Card**  
 Cat. X18007 **\$199**  
**Colour Graphics & Printer Card**  
 Cat. X18010 **\$119**  
**768KB RAM Card (without memory)**  
 Cat. X18012 **\$79**

**Printer Card**  
 Cat. X18017 **\$34.95**  
**Game I/O Card**  
 Cat. X18019 **\$37.95**  
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 Cat. X18020 (without memory) **\$189**  
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 Cat. X18030 (without memory) **\$199**  
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 Cat. X18024 **\$57.50**  
**RS232 Card (without cable)**  
 Cat. X18026 **\$52.50**  
**RS232 & Clock Card**  
 Cat. X18028 **\$95**  
**Multi I/O & Disk Controller Card**  
 Cat. X18040 **\$169**  
**I/O Pin Card**  
 Cat. X18045 **\$129**  
**788K Multifunction I/O Card (includes cable but not 41256 RAM)**  
 Cat. X18050 **\$199**  
**Hard Disk Controller Card**  
 Cat. X18060 **\$195**  
**Enhanced Graphics Adaptor Card 256K RAM on board**  
 Cat. X18070 **\$295**  
**64K Printer Buffer Card**  
 Cat. X18070 **\$139**

**(AT COMPATIBLE)**  
**Enhanced Graphics Adaptor Card (Award Bios)**  
 Cat. X **\$495**

**Enhanced Graphics Adaptor Card 256K RAM on board**  
 Cat. X18070 **\$295**  
**64K Printer Buffer Card**  
 Cat. X18070 **\$139**



## APPLE\* COMPATIBLE CARDS

**PRINTER CARD**  
 Cat. X17029 **\$89**  
**DRIVE CARD**  
 Cat. X17019 **\$79**  
**80 COLUMN CARD**  
 Cat. X17025 **\$85**  
**SUPER SERIAL CARD**  
 Cat. X17035 **\$119**  
**RGB CARD**  
 Cat. X17039 **\$79**  
**PAL COLOUR CARD**  
 Cat. X17027 **\$95**  
**280 C/M CARD**  
 Cat. X17041 **\$59**

**APPLE\* IIe COMPATIBLE CARDS**  
**80 COLUMN/84K CARD**  
 Cat. X **\$99**  
**64K/128K CARD**  
 Cat. X **\$99**

**PRINTER LEAD FOR IBM\***  
 • Suits IBM\* PC XT and compatibles  
 • 25 pin 'D' plug (computer end)  
 • Centronics 36 pin plug  
 Cat. P19029 1.8 metres **\$17.95**  
 Cat. P19030 3 metres **\$22.95**



## SAMSUNG 12" 20MHz COMPOSITE MONITOR ONLY \$149

**FEATURES....**  
 • High contrast, non-glare screen  
 • High resolution, 80 or 40 character display

**SPECIFICATIONS....**  
**Picture tube:** 12" diagonal and 90° deflection  
**Phosphor:** Available in Green (P39) or Amber  
**Video input signal:** Composite  
**Signal:**  
 Polarity: Negative Sync.  
 Level: 0.5V-2.0Vp-p  
**Scanning frequency:**  
 Horizontal: 15.734 KHz ± 0.1%  
 Vertical: 60Hz  
**Video bandwidth:** 20MHz  
**Active display area:** 216(H) x 160(V)mm.  
**Display character:** 80 characters x 25 rows.  
**Input terminal:** RCA Phono Jack  
**Controls:**  
 Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size, Incline: H-Width, H/V hold, H/V linearity, Focus.  
**Power supply:** 110/120V 60Hz, 220/240V 50Hz  
**Dimensions:**  
 308(W) x 307(H) x 297(L)mm  
 Weight: 7.3 Kg  
 Shipping weight: 8-3 Kg

| Cat.No. | Description | Price |
|---------|-------------|-------|
| X14514  | (GREEN)     | \$149 |
| X14516  | (AMBER)     | \$149 |



## SAMSUNG TTL 12" MONITOR

• High contrast, non-glare screen  
 • Excellent value for money!

**SPECIFICATIONS:**  
**Picture tube:** 12" diagonal 90° deflection  
**Mode:** TTL  
**TTL input signal:**  
 Polarity: TTL Positive  
 Level: 4V p-p + -1.5V  
 Impedance: 75ohm  
**Video bandwidth:** 16MHz (-3dB)  
**Scanning frequency:**  
 Horizontal: 18.432 ± 0.1KHz  
 Vertical: 50Hz ± 0.5%  
**Active display area:** 216(H) x 160(V)mm  
**Display characters:** 80 characters x 25 lines  
**Input connector:** 9 pin connector  
**Controls:**  
 Front: Power ON/OFF, Contrast.  
 Rear: V-Hold, V-Size, Brightness Internal: Vertical Linearity, Horizontal Linearity, Horizontal Width, Focus.  
**Power supply:** 110/120V 60Hz, 220/240V 50 Hz  
**Dimensions:**  
 308(W) x 297(H) x 307(L)mm  
 Weight: 7.3Kg  
 Shipping weight: 8-3Kg

| Cat.No. | Description | Price |
|---------|-------------|-------|
| X14500  | (GREEN)     | \$189 |
| X14502  | (AMBER)     | \$189 |



## SAMSUNG 12" TTL/COMPOSITE MONITOR

**FEATURES....**  
 • At last a monitor with both TTL and Composite modes!  
 • High contrast, non-glare screen  
 • High resolution, 80 or 40 character display  
 • Swivel/Tilt base

**SPECIFICATIONS....**  
**Picture tube:** 12" diagonal and 90° deflection  
**Phosphor:** Green (P42)  
**Video input signal:** Composite/TTL Switchable  
 Polarity: Negative/Positive  
 Level: 0.5-2.0Vp-p/4.0+ -1.5Vp-p  
 Impedance: 75ohm, more than 6.8K ohm  
**Scanning frequency:**  
 Horizontal: 15.734 KHz ± 0.1%  
 Vertical: 50-60Hz  
**Video bandwidth:** 20MHz  
**Active display area:** 216(H) x 160(V)mm.  
**Display character:** 80 characters x 25 rows.  
**Input terminal:** Phono Pin Jack, 9 pin D-Sub Connector.  
**Controls:**  
 Outside: Power Switch, Contrast, Brightness, Signal Select, V-Hold, V-Size, Incline: H-Width, H/V linearity, Focus, H/V-Shift  
**Power supply:** 110/120V 60Hz, 220/240V 50Hz  
**Dimensions:**  
 308(W) x 297(H) x 307(L)mm  
 Weight: 7.3 Kg  
 Shipping weight: 8-3 Kg

| Cat.No. | Description | Price |
|---------|-------------|-------|
| X14509  | (GREEN)     | \$239 |



## SAMSUNG 12" FLAT SCREEN COMPOSITE MONITOR

**FEATURES....**  
 • Flat, high contrast, non-glare screen  
 • High resolution, 80 or 40 character display  
 • Tilt swivel base  
 • Compatible with Apple\* and IBM\* colour composite signal

**SPECIFICATIONS....**  
**Picture tube:** 12" diagonal and 90° deflection  
**Phosphor:** Available in Green or Amber  
**Video input signal:** Composite Signal  
 Polarity: Negative Sync  
 Level: 0.5-2.0Vp-p  
 Impedance: 75ohm  
**Scanning frequency:**  
 Horizontal: 15.734 KHz ± 0.1%  
 Vertical: 50-60Hz  
**Video bandwidth:** 20MHz  
**Active display area:** 216(H) x 160(V)mm.  
**Display character:** 80 character x 24 rows.  
**Input terminal:** RCA Phono Jack.  
**Controls:**  
 Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size, Incline: H-Width, H/V hold, H/V linearity, Focus.  
**Power supply:** 110/120V 60Hz, 220/240V 50Hz  
**Dimensions:**  
 310(W) x 307(H) x 300(L)mm  
 Weight: 8-1 Kg  
 Shipping weight: 9-6 Kg

| Cat.No. | Description | Price |
|---------|-------------|-------|
| X14510  | (GREEN)     | \$249 |
| X14512  | (AMBER)     | \$249 |



**ANTI GLARE SCREEN**  
 Half the price of other brands!!  
 Relieve eye strain and headaches and increase productivity with these Anti Glare Screens. Suitable for 12" monochrome.  
 Cat. X99995 **\$24.95**



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**SUPER 5 EP-1201 DOT MATRIX PRINTER**  
 • 120 C.P.S.  
 • Pica or Elite character set  
 • Print Modes: NLQ, Dot Graphics, Proportional Font, Draft.  
 • Proportional Printing  
 • Reliable and Compact  
 • Proportional Printing  
 • Logic Seeking  
 • 1K Printer Buffer  
 Cat. C20035 **only \$595**



## SAKATA 13" RGB COLOUR MONITOR

High quality IBM\* compatible monitor, great with VCR's too!  
**SPECIFICATIONS:**  
**CRT:** 13", 90° deflection colour  
**Input Signal:**  
 Video Signal: Separate video signal  
 Video: Positive  
 Sync: Positive  
**Input Level:** TTL Level  
**Scanning Frequency:**  
 Horizontal: 15.7KHz  
 Vertical: 60Hz  
**Display Size:** 245(H) x 182(V)mm  
**Resolution:**  
 Horizontal: 640 dots  
 Vertical: 200 lines  
**Size:** 343(H) x 362(W) x 421(D)mm  
**Weight:** 11.6kg  
 Cat. X14530 **\$695**



**CANON A-50 PRINTER**  
 • Serial Impact Dot Matrix  
 • 180 C.P.S  
 • Near Letter Quality Mode  
 • 1.4K Buffer  
 Cat. C20045 **\$595**

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**FREE POSTAGE FOR ORDERS OVER \$75 & UNDER 1KG!!**

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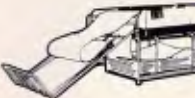
All sales tax exempt orders and wholesale inquiries to: RITRONICS WHOLESALE, 56 Renner Rd, Clayton, Vic. (03) 543 2166 (3 lines)

Errors and omissions excepted  
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**PRINTER RIBBONS**  
 CP80, BX80, DP80, BX100, MB100  
**ALL A CRAZY LOW \$9.95**

**PRINTER RIBBONS TO SUIT EPSON MODELS...**  
 MX100, FX100, RX100  
 Cat. C22002 **\$19.95**  
 MX70/80, FX70/80, RX70/80  
 (Cat. C22031) **\$10.95**



**PAPER TAMER**  
 • Restores order to the top of your desk or work area  
 • Made of white plastic coated steel  
 • Stores up to 900 continuous sheets  
 • Allows perfect paper feed  
 • Allows easy examination of print out

**COMPUTER PAPER**  
 Quality paper at a low price! 2 500 sheets of 80 gsm bond paper.  
 Cat. C21003 11 x 9 1/2" **\$49.95**  
 Cat. C21005 15 x 11" **\$67.95**  
 (Printer and paper not included)



# PRODUCTIVITY

```

; DR.asm
; Format: DR [d:][directory][E][S][D][A][D]

CODE SEGMENT
ASSUME CS:CODE,DS:CODE
ORG 100H

START:    JMP    BEGINNING

;-----
; DATA AREA
;-----
DB 'Copyright 1987 Ziff-Davis Publishing Co.'
DB 'Michael J. Mefford'

CURRENT_DISK DB ?
STATUS_REG  DW ?
VIDEO_SEG   DW 0B000H
NORMAL      DB 07H
INVERSE     DB 70H
BAR_ATTRIBUTE DB 70H
CURSOR_TYPE DW ?

SDRT_OFFSET DW 0
SORT_TABLE  DW 0,12,9,3,13,0,29
SORT_FLAG   DB 0
CUR_OFFSET  DW BUFFER
CUR_FILE    DW ?
END_OFFSET  DW ?
PAGES       DW ?
PAGE_END    DW 21*160+323
COUNT      DW 1
LINE        DW 323
STAR_DOT_STAR DB '*.*',0
VERIFY_FLAG DB 1
WDRDSTAR_BIT DB 7FH
SEARCH_COUNT DW ?

DISPATCH_KEY DB 1,11h,12h,13h,14h,1Ch,1Fh,20h,2Fh,31h,32h,3Bh,3Ch,3Dh,3Eh
                3Fh,40h,41h,42h,43h,44h,47h,48h,49h,4Fh,50h,51h,76h,84h

DISPATCH_TABLE DW EXIT, WORDSTAR, SORT_EXT, RENAME, SORT_DATE, VIEW
                DW SORT_SIZE, DELETE, VIEW, SORT_NAME, MOVE, VIEW
                DW DELETE, RENAME, MOVE, VERIFY, WORDSTAR, SORT_NAME
                DW SDRT_EXT, SORT_SIZE, SORT_DATE, HOME_BAR, UP_ARROW
                DW PG_UP, END_BAR, DN_ARROW, PG_DN, BOTTOM_BAR, TOP_BAR

VIEW_TABLE      DW HOME_FILE, UP_LINE, UP_PG, END_FILE
                DW DN_LINE, DN_PG, END_FILE, HOME_FILE

DISPLAY_FLAG   DB ?
ROW            DB 0
FILE_END       DW ?
FILE_HANDLE    DW ?
LAST_PAGE     DW ?
NOT_ENOUGH     DB 'Not enough memory$'
INVALID        DB 'Invalid directory$'
TOO_MANY       DB 'Too many files$'
LOADING        DB 'Loading and Sorting directory.',0
LOAD_ONLY      DB 'Loading directory.',0
DIRECTORY      DB 'Directory of ',0
                DB ' Files',0
DELETE_MSG     DB ' will be deleted.',0,' Do you wish to delete it? Y/N',0
RENAME_MSG     DB 'Enter new name for ',0
MOVE_MSG       DB 'Enter new directory for ',0
ON             DB 'ON',0
OFF            DB 'OFF',0
BS             DB 8,32,0,0

FILE_BUFFER    EQU 32767-256
SIXTEEN_K     EQU 16384

MENU LABEL BYTE
DB 201,20 DUP (205),187,186,' DR.COM ',186
DB 186,' (C) Copr. 1987 ZD ',186,186,' Michael J. Mefford ',186
DB 199,20 DUP (196),182,186,' F1 View (or ',17,196,217,') ',186
DB 186,' F2 Delete ',186,186,' F3 Rename ',186
DB 186,' F4 Move ',186,186,' F5 Confirm ON ',186
DB 186,' F6 WordStar ON ',186,186,' F7 Sort by Name ',186
DB 186,' F8 Sort by Ext. ',186,186,' F9 Sort by Size ',186
DB 186,' F10 Sort by date ',186,186,' Esc to Exit ',186
DB 200,20 DUP (205),188,' Use: ',24,32,25,' PgUp PgDn
DB ' PgUp PgDn Home End '

;-----
; Some housekeeping first. Since we will be changing the default drive
; and directory to the requested drive and directory, we need to save the
; current defaults, so they can be restored. If less than 64K, exit.
;-----

;-----
; CODE AREA
;-----
BEGINNING:  MOV    AX,3381H    ;Turn Control Break off.
            MOV    DL,0
            INT    21H

            CLD                ;String moves forward.
            MOV    AH,19H      ;Get current drive.
            INT    21H
            MOV    CURRENT_DISK,AL    ;And save.

;-----
; More housekeeping. We will be writing directly to the screen buffer
; so we need the display card address and the status register.
;-----

DISPLAY:    MOV    AX,40H      ;Point to the ROM BIOS data area
            MOV    DS,AX      ; and get base address of active
            MOV    AX,DS:[63H] ; display card.
            ADD    AX,6        ;Add six to get status register
            PUSH   CS          ;Done there, so restore data segment.
            POP    DS
            MOV    STATUS_REG,AX ;Store status register.
            CMP    AX,3BAH     ;Status port of MOHO card is 3BAh.
            JZ     MONO        ;If that's what we got, it's MONO
            MOV    VIDEO_SEG,0B000H ; else COLOR so add 800h.
            XOR    BH,BH      ;Get current attribute
            MOV    AH,0        ; of display page zero.

            INT    10H
            MOV    NORMAL,AH    ;Store it.
            XOR    AH,1110111B ;Flip color bits.
            MOV    INVERSE,AH   ;Save it.
            MOV    BAR_ATTRIBUTE,AH

MONO:       MOV    BAR_ATTRIBUTE,AH
            XOR    BH,BH
            MOV    AH,3        ;Retrieve cursor type.
            INT    10H
            MOV    CURSOR_TYPE,CX

;-----
; Do we have 64K?
;-----
CMP    SP,65533
MOV    DX,OFFSET NOT_ENOUGH
JA     PARSE
JMP    ERROR_EXIT ;if no, exit.

;-----
; Parse the command line for parameters.
;-----
PARSE:      CMP    BYTE PTR DS:[00H],0 ;Any parameters?
            JNE   GET_SWITCH ;If yes, parse.
            JMP   MESSAGE ;Else, skip.

GET_SWITCH: MOV    SI,01H ;Else, point to first character.
            LODSB ;Get a byte.
            CMP    AL,13 ;Carriage return?
            JZ     GET_PARA ;If yes, done here.
            CMP    AL,'/' ;Is it switch character?
            JNE   NEXT_SWITCH ;If no, get next character.
            LODSB ;Get switch character.
            AND    AL,5FH ;Capitalize.
            CMP    AL,'E' ;If "E", sort by extension.
            JNE   CK_SIZE ;If "S", sort by size.
            MOV    SORT_OFFSET,4
            CMP    AL,'S'
            JNZ   CK_DATE ;If "D", sort by date.
            MOV    SORT_OFFSET,8
            CMP    AL,'D'
            JZ   GOT_DATE ;If "T", sort by date.
            CMP    AL,'T'
            JNE   CK_ORIGINAL
            MOV    SORT_OFFSET,12
            GOT_DATE:

CK_ORIGINAL: CMP    AL,'O' ;If "O", don't sort at all.
            JNE   GET_PARA
            MOV    SORT_FLAG,1

GET_PARA:   MOV    SI,01H ;Point to first character.
            NEXT_PARSE: LODSB
                    CMP    AL,13 ;Carriage return or slash?
                    JZ     MESSAGE ;If yes, done here.
                    CMP    AL,'/'
                    JZ     MESSAGE
                    AL,32
                    CMP    JBE    NEXT_PARSE ;Leading space?
                    ;If yes, get next byte.
                    PUSH   SI ;Save start.
                    LODSB
                    CMP    AL,32 ;End of parameter?
                    JBE   END_PARA ;If yes, done here.
                    CMP    AL,'/'
                    JZ     END_PARA
                    CMP    AL,':'
                    JNZ   NEXT_PARA ;Drive request?
                    MOV    DI,BYTE PTR [SI-2] ;If no, get next byte.
                    AND    DI,5FH ;Else, retrieve request.
                    SUB    DI,'A' ;Capitalize.
                    MOV    AH,0EH ;Convert to DOS format.
                    INT    21H ;And change drive.
                    JMP    SHORT NEXT_PARA ;Find end of parameter.
            END_PARA: MOV    BYTE PTR DS:[SI-1],0 ;Convert parameter to ASCIIIZ.
                    MOV    BL,BYTE PTR DS:[SI-2]
                    SI,OFFSET CURRENT_DIR ;Get current directory.
                    CALL   GET_DIR
                    POP    DX ;Retrieve start.
                    DEC    CX ;Adjust.
                    CMP    BL,'/' ;Is it a drive request?
                    JZ     MESSAGE ;If yes, skip directory change.
                    CMP    BL,32 ;Is it a delimiter?
                    JBE   MESSAGE ;If yes, skip.
                    MOV    AH,3BH ;Change directory.
                    INT    21H
                    MOV    DX,OFFSET INVALID
                    JC     ERROR_EXIT ;If error, exit.

MESSAGE:    CALL   CLS ;Clear screen.
            CALL   CURSOR_OFF ;Cursor off.
            MOV    SI,OFFSET LOADING
            DX,8C19H ;Display loading message.
            MOV    CX,SORT_FLAG,1 ;Unless not sorted.
            JNZ   DISP_MSG
            MOV    SI,OFFSET LOAD_ONLY
            DX,8C1FH ;Then display loading message.
            DISP_MSG: CALL   DISPLAY_TEXT

            MOV    DI,OFFSET BUFFER ;Put space character
            MOV    CX,16000 ; in directory listing
            MOV    AX,2020H ; buffer.
            REP

;-----
; Read all the directory filenames and store as records in buffer.
;-----
READ_DIR:   MOV    DX,OFFSET STAR_DOT_STAR
            MOV    CX,1
            MOV    AH,4EH ;Find first matching file.
            INT    21H
            JC     EXIT ;If empty directory, exit.

STORE_NAME: MOV    DI,OFFSET BUFFER ;Point to buffer.
            MOV    BP,FILE_BUFFER-200 ;Reserve 32K for file read buffer

            CALL   BUFFER_NAME ;Convert to directory format.

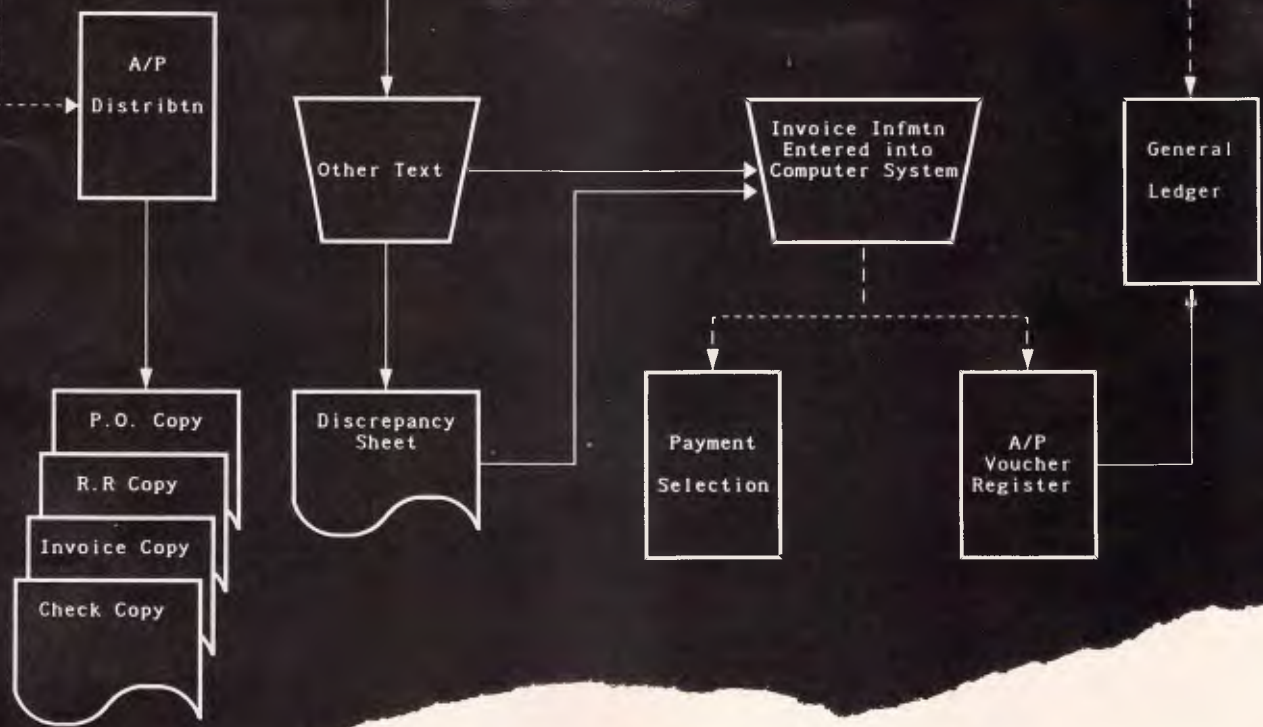
FIND_NEXT:  MOV    AH,4FH ;Find next matching.
            INT    21H
            JC     STORE_COUNT ;if carry, no more names.
            INC    COUNT ;Increment count of names.
            CALL   BUFFER_NAME
            CMP    DI,BP ;Are we encroaching file buffer?
            JBE   FIND_NEXT ;if no, find next.
            MOV    DX,OFFSET TOO_MANY ;Else, exit with message.

;-----
; This is the exit routine. Restore the defaults the way we found them.
;-----
ERROR_EXIT: MOV    AH,9 ;Display error message.
            INT    21H
            JMP    SHORT RESET

EXIT:       CALL   CLS ;Clear screen.
            XOR    DX,DX ;Set cursor top left.
            CALL   SET_CURSOR
            CALL   CURSOR_ON ;Turn cursor back on.

```

Fig 1 The assembly language source code for DR.COM



# Flow Charting II+

## FLOW CHARTING II+

This is the only way to produce flowcharts. Don't spend hours designing and drawing flowcharts, and then have to redraw the whole thing because you want to add one small step in the middle. With Flow Charting II+ you save your flowcharts to disk and should you need to make an alteration, just call it back, make the changes and reprint.

## Created Specifically for Flow Charts

Flow Charting II+ is a precision instrument specifically designed for flowcharts and organisation charts. Flowchart construction is not just a sideline on a graphics program that has other things to do. Flow Charting II+ lets you:

Type inside or outside shapes, on line or free area.

Define pieces of your chart to save in special image files for later use in other charts; define pieces or sections anywhere on the chart, to move, copy, or even delete.

Zip across your charts with an accelerated cursor or use the cross hairs on the shrink screen at a faster pace.

## Organisational Charts:

As well as process and program flow, Flow Charting II+ can be used to produce new or organisational charts, every time you reshuffle the deck chairs, with charts produced at will, everyone can know their place in the order of things.

## 10 Font Styles:

You can choose from normal, bold, high, wide, fat, Greek, superscript, subscript or title.

## A Wide Variety of Shapes:

26 shapes available. Shaded boxes available. Perfect for organisational charts.

## Presentation Quality Charts with Flow Charting II+:

Using Flow Charting II+ you can either print out draft quality charts for quick evaluation, or presentation quality for your moment in the spotlight.

## Print Multiple Files Without Interruption:

Charts are constructed for standard paper sized, 8 1/2" x 11", 8 1/2" x 14" or 11" x 14". Select charts to be printed and the computer can print them without interruption.

## Undo Lines:

If you draw a line in the wrong place, your backspace key in line mode will erase it right back to its origin, redoing connectors and bypasses as it travels.

## Text Functions for Quick Editing:

Blocks of text, words, or even just letters can be moved, deleted or inserted quickly and neatly. Select Auto Centering and let the program do the placement within shaped - or turn Auto Centering off and put comments alongside the chart.

## Comfortable User Interface:

Function keys or alpha keys to select options. Full mouse support for the non-typists.

## Disk Files:

Supports DOS paths and directories

## Three Screen Views:

Flow Charting II+ gives you a flexible screen ensemble that makes chart construction and editing a pleasure.

- 40 Column viewing screen - on blue or black background helps you with detailed editing.
- 80 Column viewing screen - still detailed - gives you twice the information.
- Shrink Screen - gives a complete 14" x 11" chart on a 200 Column by 120 line screen. Do major editing, such as relocating, deleting and inserting shapes, while viewing the entire chart.

## Hardware:

Flow Charting II+ is compatible with IBM\*, PC, AT, or compatibles. IBM\* Mouse Utility available. 192K RAM memory required for 200 Column Charts. A minimum of one 5 1/4" floppy drive and screen graphics capability is required.

## Used by these major companies:

FLOW CHARTING II+ is used by IBM\*, Hewlett-Packard, U.S. Postal Service, Hughes Aircraft, CRA, Bank of America, McDonnell-Douglas, Price Waterhouse General Motors, Blue Cross and Blue Shield, among many other companies.

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# PRODUCTIVITY

```

RESET:    MOV    DX,OFFSET CURRENT_DIR ;Reset the directory.
          MOV    AH,3BH
          INT    21H
          MOV    DL,CURRENT_DISK      ;Reset the drive.
          MOV    AH,8EH
          INT    21H
          INT    28H

;-----;
; Store buffer end address and page ;
; end then sort the filenames.     ;
;-----;

STORE_COUNT: MOV    END_OFFSET,DI ;Store ending offset.
             ADD    DI,48
             MOV    PAGES,DI       ;Also, address for page storage.

             MOV    BX,COUNT       ;Retrieve file count.
             CMP    BX,21          ;Enough to fill one page?
             JAE    DO_SORT        ;If yes, use default setting.
             ADD    PAGES,800      ;Else, adjust page storage.
             MOV    AX,160         ;Calculate last record.
             MUL    BL
             ADD    AX,323         ;Add bar offset.
             MOV    PAGE_END,AX
             MOV    SORT_FLAG,1

DO_SORT:   CMP    SORT_FLAG,1
           JZ    READY
           CALL  SORT

```

```

;-----;
; Now, we are ready to get target directory and display it and the menu. ;
;-----;

READY:    MOV    DI,OFFSET PURGE_DIR ;Point to storage.
          MOV    AH,19H
          INT    21H                ;Get drive.
          ADD    AL,'A'             ;Convert to ASCII.
          STOSB
          MOV    AL,':'             ;Add colon.
          STOSB
          MOV    SI,DI              ;Get directory.
          CALL  GET_DIR
          CALL  REFRESH_DIR         ;Display drive, directory, menu.

```

```

;-----;
; We are ready for business now. We will ;
; loop here, waiting for user keystrokes. ;
;-----;

GET_KEY:  CALL  UPDATE_SCREEN
          CALL  READ_KEY            ;Get a keystroke.
          MOV    BX,AX              ;Save returned key.
          CMP    AH,1              ;Is it Esc or below?
          JBE    FUNCTION          ;If yes, function.
          CMP    AH,36H            ;Is it right shift or above?
          JBE    FUNCTION          ;If yes, function.
          CMP    AH,1CH            ;Is it CR?
          JZ    FUNCTION           ;If yes, function.
          MOV    AH,2              ;Get shift state.
          INT    16H
          TEST   AL,4              ;Is Ctrl depressed?
          JNZ   FUNCTION           ;If no, check function request.
          CALL  SEARCH             ;Else, search for first letter.
          JMP   SHORT GET_KEY

FUNCTION: MOV    DI,OFFSET DISPATCH_KEY
          MOV    AL,BH
          MOV    CX,29              ;29 valid commands.
          REPNZ SCASB
          JNZ  GET_KEY             ;If no match, get another.
          MOV    DI,OFFSET DISPATCH_TABLE+56
          SHL    CX,1
          SUB    DI,CX
          CALL  DS:[DI]            ;Else do subroutine.
          JMP   SHORT GET_KEY

```

```

;-----;
; SUBROUTINES ;
;-----;

;-----;
; These six subroutines control the bar and page of the directory listing. ;
;-----;

```

```

UP_ARROW: MOV    BP,-160           ;Move bar up one line.
          JMP   SHORT BAR_MOVE

DN_ARROW: MOV    BP,160            ;Move bar down one line.
          CALL  SCROLL_BAR
          RET

PG_UP:    MOV    BP,-40*21         ;Move up 21 lines.
          CALL  SCROLL
          JMP   SHORT BOTTOM_BAR

PG_DN:    MOV    BP,40*21          ;Move down 21 lines.
          CALL  SCROLL
          JMP   SHORT TOP_BAR

HOME_BAR: MOV    CUR_OFFSET,OFFSET BUFFER ;Move listing to beginning.
          MOV    SI,323
          CALL  MOVE_BAR
          RET

END_BAR:  MOV    BX,END_OFFSET     ;Move listing to last page.
          SUB    BX,21*40
          CMP    BX,OFFSET BUFFER
          JBE    BOTTOM_BAR
          MOV    CUR_OFFSET,BX
          MOV    SI,PAGE_END
          SUB    SI,160
          CALL  MOVE_BAR
          RET

```

```

;-----;
; This subroutine searches for a filename with a specific first letter. ;
;-----;

SEARCH:   CMP    BL,'a'            ;Capitalize if lower case.
          JB    SEARCH_IT
          CMP    BL,'z'
          JA    SEARCH_IT
          AND    BL,5FH

SEARCH_IT: CALL  GET_NAME
           XOR   CX,DX
           MOV  DI,SI
           MOV  SI,OFFSET BUFFER
           CMP  BYTE PTR [DI],BL
           JNE NEXT_SEARCH
           INC  DI,40
           CMP  SI,DI
           JBE FIND_START

FIND_START: INC  DI,40
            ADD  SI,DI
            JBE FIND_START

NEXT_SEARCH: CMP  BYTE PTR [SI],BL
             JZ  FOUND_IT

```

```

INC_SEARCH: ADD    SI,40           ;Else, point to next record.
            INC   CX
            CMP   BYTE PTR [SI],32 ;End of listing?
            JNZ  NEXT_SEARCH      ;If no, keep searching.
            CALL  BEEP            ;No matches, so beep.
            RET

FOUND_IT:  MOV    CX,COUNT         ;Retrieve file count.
           SUB    CX,DX            ;Subtract search count.
           MOV    SEARCH_COUNT,CX ;And store.
           MOV    CL,NORMAL
           MOV    BAR_ATTRIBUTE,CL ;Turn off bar for now.
           CALL  END_BAR          ;First move to end.
           JMP   SHORT FIND_IT
           CALL  UP_ARROW         ;Move up to matching filename.

NEXT_FIND: DEC  SEARCH_COUNT
           JNZ  NEXT_FIND
           MOV  CL,INVERSE        ;Turn bar back on and display.
           MOV  BAR_ATTRIBUTE,CL
           MOV  BP,BP
           CALL SCROLL_BAR
           RET

```

```

;-----;
; This subroutine displays the highlighted file for viewing. ;
;-----;

```

```

VIEW:     CALL  GET_NAME           ;Get the file name.
          MOV    DX,OFFSET FILE_NAME ;Open the file.
          MOV    AX,3D00H
          INT    21H
          MOV    FILE_HANDLE,AX   ;Save filehandle.

          CALL  FIRST_READ
          MOV    LAST_PAGE,OFFSET FILE_BUFFER+SIXTEEN_K
          MOV    BP,PAGES         ;Initialize page pointer.
          MOV    ROW,0            ;And row pointer.
          CALL  CLS               ;Clear screen.

GET_VIEW: MOV    SI,LAST_PAGE     ;Get top of current page.
          MOV    BH,ROW           ;Get row offset into page.
          CMP    BH,0
          JZ    NEXT_VIEW        ;Is it row zero?
          MOV    DISPLAY_FLAG,0   ;If yes, skip.
          CALL  LINES             ;No display.

PAGE_OFFSET: CALL  LINES
             DEC  BH
             JNZ PAGE_OFFSET

NEXT_VIEW: MOV    BH,25           ;Now display 25 lines.
           XOR   DI,DI
           MOV    DISPLAY_FLAG,1 ;Start at top left corner.
           CALL  LINES            ;Display.

VIEW_DISPLAY: MOV    DISPLAY_FLAG,1
              CALL  LINES
              DEC  BH
              JNZ VIEW_DISPLAY

VIEW_COMMAND: CALL  READ_KEY      ;Get a keystroke.
              CMP    AH,1          ;Is it Esc?
              JZ    VIEW_END      ;If yes, exit view.
              CMP    AH,1CH       ;Is carriage return?
              JZ    VIEW_END      ;If yes, exit view.
              CMP    AH,3BH       ;Is it F1?
              JZ    VIEW_END      ;If yes, exit.
              CMP    AH,20H       ;Is it "D"?
              JZ    VIEW_DELETE   ;If yes, go to delete function.
              CMP    AH,3CH       ;Is it F2?
              JNZ  CK_RENAME      ;If no, check if rename request.
              CALL  VIEW_REQUEST  ;Else, close file.
              JMP   DELETE        ;Go to delete function.

CK_RENAME:  CMP    AH,13H         ;Is it "R"?
           CMP    AH,3DH         ;If yes, go to rename function.
           JNZ  CK_MOVE          ;Is it F3?
           CALL  VIEW_REQUEST     ;If no, check if move request.

VIEW_RENAME: CALL  VIEW_REQUEST
             JMP   RENAME

CK_MOVE:    CMP    AH,32H         ;Is it "M"?
           JZ    VIEW_MOVE        ;If yes, go to move function.
           CMP    AH,3EH         ;Is it F4?
           JNZ  VIEW_MOVE        ;If no, get dispatch table.

VIEW_MOVE:  CALL  GET_DISPATCH
           JMP   MOVE

GET_DISPATCH: MOV  DI,OFFSET DISPATCH_KEY+21
              MOV  AL,AH
              MOV  CX,8
              REPNZ SCASB
              JNZ  VIEW_COMMAND  ;If no, match, get next stroke.
              MOV  DI,OFFSET VIEW_TABLE+14
              SHL  CX,1
              SUB  DI,CX
              CALL DS:[DI]
              JC  VIEW_COMMAND    ;Do subroutine.
              JMP  GET_VIEW       ;Carry indicates no screen update.
                                   ;Else, update and get next command.

VIEW_END:   MOV    BX,FILE_HANDLE ;Close the file.
           MOV    AH,3EH
           INT    21H
           CALL  REFRESH_DIR      ;Restore menu.

VIEW_REQUEST: CALL  VIEW_END
              CALL  UPDATE_SCREEN ;If request of another function,
                                   ;close file and update screen.

```

```

;-----;
; These six subroutines control the page and starting row of the view. ;
;-----;

```

```

UP_LINE:   CMP    ROW,0           ;Are we at row zero?
           JNZ  DEC_ROW          ;If no, decrement one row.
           CMP  BP,PAGES         ;Else, are we at first page?
           JZ    UP_LINE_END
           JZ    UP_LINE_END
           UP_LINE_END: JZ    UP_LINE_END
                       JZ    UP_LINE_END
                       CALL  UP_PG
                       MOV    ROW,25 ;Else, move up one page.
                       DEC  ROW ;And move starting row to 25.
                       CLC ;Decrement row.
                       RET ;Flag to update screen.

DEC_ROW:   DEC  ROW
           CLC
           RET

UP_LINE_END: CALL  CK_FILE_END
             JNC  CK_ROW
             RET
             ;Are we at end of file?
             ;If no, check row.
             ;Else, return.

CK_ROW:    CMP    ROW,24
           JZ    INC_ROW
           CALL  DN_PG
           MOV    ROW,-1
           INC  ROW
           CLC
           RET
           ;Are we at last row?
           ;If no, increment row.
           ;Else, page down.
           ;And move row to top.

INC_ROW:   INC  ROW
           CLC
           RET

DN_PG:     CMP    BP,PAGES
           JNZ  DEC_PG
           CMP  NOW,0
           STC
           JZ  UP_PG_END
           MOV  ROW,0
           JMP  SHORT UPDATE_PAGE
           ;Are we already at first page?
           ;If no, decrement page.
           ;Are we at first row?

UP_PG_END: JZ    UP_PG_END
           MOV  ROW,0
           JMP  SHORT UPDATE_PAGE
           ;If yes, no update.
           ;Else move to first row.

DEC_PG:    MOV    SI,LAST_PAGE
           ;Get current page.

```



# PRODUCTIVITY

```

SUB SI,DS:[BP] ;Subtract difference to prev page.
CMP SI,OFFSET FILE_BUFFER ;Beyond top of buffer?
JAE UP_PG_RET ;If no, page up.
CALL BACKWARD ;Else, read in previous 16K
JMP SHORT DEC_PG ;Try again.
UP_PG_RET: DEC BP ;Decrement page pointer.
DEC BP ;Store new starting position.
UPDATE_PAGE: MOV LAST_PAGE,SI
UP_PG_END: CLC
RET

DN_PG: CMP BP,65535-256 ;Out of room for page storage?
JAE NOUPDATE_PG ;If yes, skip.
MOV SI,LAST_PAGE ;Else, retrieve current page.
MOV DISPLAY_FLAG,#0 ;No display.
MOV BH,25 ;Move up 25 lines.
NEXT_PAGE: CALL LINES
DEC BH
JNZ NEXT_PAGE
CALL CK_FILE_END ;End of file?
JNC NOUPDATE_PG ;If yes, no update.
MOV DX,LAST_PAGE ;Else, save current offset.
MOV LAST_PAGE,SI ;Store new offset.
MOV AX,SI
SUB AX,DX ;Get difference between pages.
INC BP ;Increment page storage.
INC BP ;And store.
MOV DS:[BP],AX
DN_PG_END: RET
NOUPDATE_PG: STC
HET

HOME_FILE: CALL UP_PG ;Page up until top of file.
JNC HOME_FILE
CLC
HET

END_FILE: CALL DN_PG ;Page down until end of file.
JNC END_FILE
CLC
RET

```

; This subroutine checks to see if end of file has been reached. ;

```

CK_FILE_END: CMP SI,FILE_END
JB NOT_FILE_END
CMP FILE_END,OFFSET FILE_BUFFER+(SIXTEEN_K * 2)
JAE NOT_FILE_END
STC
RET
NOT_FILE_END: CLC
RET

```

; This subroutine formats the text into lines. A line is marked ; by either a carriage return or reaching the last column (80). ;

```

LINES: MOV CX,#80 ;80 columns.
NEXT_LINES: CMP SI,FILE_END ;if end of file, pad with spaces.
JB GET_LINES
JMP FILE_END,OFFSET FILE_BUFFER+(SIXTEEN_K * 2)
JB PAD_SPACES
PUSH BX ;if end of buffer, save
PUSH CX ;our pointers and
PUSH DI ;read next 16K.
CALL FORWARD
POP DI
POP CX
POP BX

GET_LINES: LODSB ;Get a byte.
AND AL,WDRDSTAR_BIT ;Strip high bit for WordStar?
CMP AL,13 ;Carriage return?
JZ PAD_SPACES ;if yes, pad balance of line.
CMP AL,9 ;is it tab character?
JZ TAB ;if yes, tab.
CMP AL,10 ;is it linefeed?
JZ NEXT_LINES ;if yes, skip.
PUSH CX ;Save counter.
MOV CX,1 ;else, display one character.
CALL CK_DISPLAY
POP CX

NEXT_BYTES: LOOP NEXT_LINES ;Get next byte.
CMP BYTE PTR [SI],13 ;is this a eighty column line?
JNC END_LINES ;if no, skip.
INC SI ;else, bump pointer past CR.

END_LINES: RET

TAB: PUSH CX ;Save counter.
DEC CX ;Adjust column counter.
INC CX,7 ;Get bottom three bits.
PUSH CX ;Adjust.
CALL PAD_SPACES ;Move to next tab position.
POP AX
POP CX
SUB CX,AX ;Adjust counter.
JNZ NEXT_LINES ;Next byte if not column 80.

PAD_SPACES: MOV AL,32 ;Space character.
CK_DISPLAY: CMP DISPLAY_FLAG,1 ;Are we to write it to screen?
JNZ BL,AL ;if no, return.

WRITE_VIEW: CALL WRITE_SCREEN ;else, write CX spaces.
LOOP WRITE_VIEW
CK_DISP_END: RET

```

; These six subroutines control the page and starting row of the view. ;

```

FORWARD: SUB LAST_PAGE,SIXTEEN_K ;Adjust current page offset.
XOR CX,CX ;Move file pointer
MOV DX,SIXTEEN_K ;forward 16K.
CALL MOVE_POINTER

FIRST_READ: MOV SI,OFFSET FILE_BUFFER+SIXTEEN_K
MOV DI,OFFSET FILE_BUFFER ;Move second half of buffer
CALL MOVE_BUFFER ;to first half and read 16K.
MOV CX,-1 ;Move file pointer back.
NEG DX
CALL MOVE_POINTER
RET

BACKWARD: ADD LAST_PAGE,SIXTEEN_K ;Adjust current page offset.
MOV CX,-1 ;Move pointer back 32K.
MOV DX,-(SIXTEEN_K * 2)
CALL MOVE_POINTER
MOV SI,OFFSET FILE_BUFFER ;Move first half of
MOV DI,OFFSET FILE_BUFFER+SIXTEEN_K ;buffer to second
CALL MOVE_BUFFER ;and read 16K.
RET

```

```

MOVE_POINTER: MOV BX,FILE_HANDLE
MOV AX,4201H ;Move file pointer.
INT 21H

MOVE_BUFFER: MOV DX,SI ;Save pointer.
MOV CX,SIXTEEN_K / 2 ;Move 8K words (16K bytes).
REP MOVSB
MOV BX,FILE_HANDLE ;Read 16K.
MOV CX,SIXTEEN_K
MOV AH,3FH
INT 21H
MOV SI,DX
MOV DX,AX
ADD AX,OFFSET FILE_BUFFER+SIXTEEN_K
MOV FILE_END,AX ;Store end of buffer offset.
RET

```

; This subroutine deletes the highlighted file. ;

```

DELETE: CALL GET_NAME ;Format the name for DOS.
JC DELETE_ERROR ;if yes, skip.
CMP VERIFY_FLAG,#0 ;Are we to warn before deleting?
JZ DELETE_FILE ;if no, skip.
MOV SI,OFFSET FILE_NAME ;Else, display warning message.
CALL DISPLAY_TEXT
MOV SI,OFFSET DELETE_MSG
CALL GET_TEXT
MOV DX,172DH
CALL DISPLAY_TEXT

QUERY: CALL READ_KEY ;Get a keystroke.
CMP AH,31H ;is it "N"?
JZ DELETE_END ;if yes, exit delete.
CMP AH,1 ;is it Esc?
JZ DELETE_END ;if yes, exit delete.
CMP AH,15H ;is it "Y"?
JZ DELETE_FILE ;if yes, delete
CALL BEEP ;else, beep.
JMP SHORT QUERY ;And get another keystroke.

DELETE_FILE: MOV DX,OFFSET FILE_NAME ;Delete the file.
MOV AH,41H
INT 21H
JC DELETE_ERROR
CALL REMOVE_FILE ;Remove the file from the listing.
CALL CLEAR_MSG ;Remove warning message.

DELETE_END: RET
DELETE_ERROR: CALL BEEP ;Beep if error.
CALL CLEAR_MSG
RET

```

; This subroutine renames the highlighted file. ;

```

RENAME: CALL GET_NAME ;Format name for DOS.
JC RENAME_ERROR ;Display rename message.
MOV DX,162CH
MOV SI,OFFSET RENAME_MSG
CALL DISPLAY_TEXT
MOV SI,OFFSET FILE_NAME
CALL GET_TEXT
MOV DX,172CH
CALL CLEAR_GLD ;Remove last entry.

NEW_NAME: CALL READ_KEY ;Get a character.
CMP AL,27 ;is it Esc?
JZ RENAME_END ;is yes, exit rename.
CMP AL,'.' ;Ignore ".?*"
JZ NEW_NAME
CMP AL,' '
JZ NEW_NAME
CMP AL,'?'
JZ NEW_NAME
CMP AL,'.'
JZ RENAME_IT ;is it carriage return?
JZ RENAME_IT ;if yes, rename it.
CMP AL,8 ;is it backspace?
JNZ NOT_BSI ;if yes, backspace.
CALL MOVE_BS ;is it space or above?
JMP SHORT NEW_NAME ;if no, ignore.
CMP DI,8CH ;End of entry field?
JZ NEW_NAME ;if yes, ignore.
STOSB ;else, store byte.
CALL WRITE_TEXT ;And write it to screen.
JMP SHORT NEW_NAME ;Get next keystroke.

RENAME_IT: CALL RENAME_FILE ;Rename the file.
JC RENAME_ERROR ;Beep if illegal.
MOV DX,8BH ;else, place new name in listing.
MOV CX,7
MOV AH,4EH
INT 21H
MOV DI,CUR_FILE
CALL BUFFER_NAME

RENAME_END: CALL CURSOR_OFF ;Turn cursor back off.
CALL CLEAR_MSG ;And clear rename message.

RENAME_RET: RET
RENAME_ERROR: CALL BEEP ;Illegal entry exit.
CALL CURSOR_OFF
CALL CLEAR_MSG
RET

```

; This subroutine moves the highlighted file to a new directory. ;

```

MOVE: CALL GET_NAME ;Format the name for OOS.
JC MOVE_ERROR
MOV DX,162BH ;Display the move message.
MOV SI,OFFSET MOVE_MSG
CALL DISPLAY_TEXT
MOV SI,OFFSET FILE_NAME
CALL GET_TEXT
MOV DX,172BH
CALL CLEAR_GLD ;Remove previous entry.

NEW_DIR: CALL READ_KEY ;Get a keystroke.
CMP AL,27 ;is it Esc?
JZ MOVE_END ;if yes, exit move.
CMP AL,'.' ;is it "."?
JZ NEW_DIR ;if yes, skip
CMP AL,13 ;is it carriage return?
JZ MOVE_IT ;if yes, move it.
CMP AL,8 ;if it backspace?

```

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# PRODUCTIVITY

```

JNZ NOT_BS2
CALL MOVE_BS ;If yes, backspace.
JMP SHORT NEW_DIR
NOT_BS2: CMP AL,32 ;Is it space or above?
JB NEW_DIR ;If no, ignore.
CMP DI,0A4H ;Is it at end of entry field?
JZ NEW_DIR ;If yes, ignore.
STOSB ;Else, store the byte.
CALL WRITE_TEXT ;And write it to screen.
JMP SHORT NEW_DIR ;Get next keystroke.

MOVE_IT: CMP BYTE PTR DS:[80H],32 ;No entry?
JZ MOVE_ERROR ;If yes, error.
MOV SI,OFFSET FILE_NAME ;Point to filename.
MOV AL,' '
CMP DS:[DI-1],AL ;Did user add "\"?
JZ ADD_FILENAME ;If yes, skip.
STOSB ;Else, we have to add it.
MOVSB ;And filename to path.
ADD_FILENAME: CMP BYTE PTR DS:[SI],0
JNZ ADD_FILENAME
CALL RENAME_FILE ;Rename it.
JC MOVE_ERROR ;BEEP if illegal.
CALL REMOVE_FILE ;Else remove from listing.

MOVE_END: CALL CURSOR_OFF ;Cursor back off.
CALL CLEAR_MSG ;Clear move message.
RET

MOVE_ERROR: CALL BEEP ;Illegal move exit.
CALL CURSOR_OFF
CALL CLEAR_MSG
RET

; This subroutine toggles the delete confirm and WordStar message on and off. ;
VERIFY: XOR VERIFY_FLAG,1 ;Toggle flag.
MOV DI,OFFSET MENU+(9*22)+16 ;Point to menu.
MOV SI,OFFSET ON ;Assume "ON".
CMP VERIFY_FLAG,1 ;Is it on?
JZ TOGGLE ;If yes, store.
MOV SI,OFFSET OFF ;Else, store "OFF".
JMP SHORT TOGGLE

WORDSTAR: XOR WORDSTAR_BIT,00H ;Toggle flag.
MOV DI,OFFSET MENU+(10*22)+16 ;Point to menu.
MOV SI,OFFSET ON ;Assume "ON".
CMP WORDSTAR_BIT,7FH ;Is it on?
JZ TOGGLE ;If yes, store.
MOV SI,OFFSET OFF ;Else, store "OFF".

TOGGLE: MOV CX,3
REP MOVSB
CALL REFRESH_MENU ;Display.
RET

; These four subroutines control in which column the sorting will start. ;
SORT_NAME: MOV SORT_OFFSET,0
JMP SHORT SORT_MSG

SORT_EXT: MOV SORT_OFFSET,4
JMP SHORT SORT_MSG

SORT_SIZE: MOV SORT_OFFSET,8
JMP SHORT SORT_MSG

SORT_DATE: MOV SORT_OFFSET,12
SORT_MSG: MOV DX,1633H
MOV SI,OFFSET LOADING+12
CALL DISPLAY_TEXT

; This subroutine does the actual sorting. ;
SORT: CMP COUNT,1
JZ SORT_RETURN
MOV DX,END_OFFSET ;End of filenames in DX.
SUB DX,40
MOV BP,SORT_OFFSET
MOV SORT_FLAG,0
MOV BX,OFFSET BUFFER ;Point to start of buffer.

NEXT_PASS: MOV SI,BX
ADD SI,SORT_TABLE[BP]
MOV DI,SI
ADD DI,40
CMP BP,12 ;Is it special case of date?
JZ DOL_DATE ;If yes, go do it.
MOV CX,SORT_TABLE[BP+2]
REPE CMPSB ;Compare filenames.
JBE END_SORT ;If already in order, skip.

SWAP: MOV SI,BX ;Else, recover pointers.
MOV DI,BX
ADD DI,40
MOV CX,20
MOV AX,[DI]
NEXT_SWAP: MOV [SI-2],AX
MOV NEXT_SWAP
MOV SORT_FLAG,1 ;Flag that exchange was made.

END_SORT: ADD BX,40 ;Point to next record.
CMP BX,DX ;End of top?
JB NEXT_SORT ;If no, bubble sort next.
SUB DX,40 ;Else, move top down one record.
CMP SORT_FLAG,0 ;Was there exchange made?
JNZ NEXT_PASS ;If yes, another pass.

SORT_RETURN: CALL CLEAR_MSG
RET

DO_DATE: MOV CX,2 ;Compare year first.
REPE CMPSB
JA SWAP ;If above, swap.
JNZ END_SORT
SUB SI,8 ;Else, adjust and do month/day.
SUB DI,8
MOV CX,5
REPE CMPSB
JA SWAP ;If above, swap.
JNZ END_SORT
ADD SI,10 ;Else, adjust and do meridian.
ADD DI,10
CMPSB
JA SWAP ;If above, swap.
JNZ END_SORT
SUB SI,6 ;Else, adjust and do time.
SUB DI,6
MOV CX,5
MOV WORD PTR [SI],3231H ;Is it special case "12:"?

```

```

JZ CK_MERIDIAN ;If yes, see if same.
CMP WORD PTR [DI],3231H ;Is destination "12:"?
JNZ CDMFARE ;If no, normal compare.
JMP SWAP ;Else, swap.
CK_MERIDIAN: CMPSW ;Are both "12:"?

JNZ END_SORT ;If no, next record.
MOV CX,3 ;Else compare minutes.
JMP SHORT COMPARE

; This subroutine gets the highlighted file and converts it to DOS format. ;
GET_NAME: MOV SI,CUR_OFFSET ;Get top of page.
MOV AX,LINE ;Get location of bar.
SUB AX,323 ;Adjust.
MOV CL,2 ;Convert to byte pointer.
SHR AX,CL
ADD SI,AX ;Add to current offset.
MOV CUR_FILE,SI ;And save pointer.
PUSH SI
MOV DI,OFFSET FILE_NAME ;Store the first eight characters.
MOV CX,8
CALL STORE_BYTES
INC SI
CMP BYTE PTR DS:[SI],32 ;End of name?
JZ END_NAME ;If yes, done here.
MOV AL,'.' ;Else, add dot.
STOSB
MOV CX,3 ;Three possible characters
CALL STORE_BYTES ;as extension.
MOV WORD PTR DS:[DI],0 ;Convert to ASCII12.
END_NAME: MOV SI
CMP BYTE PTR [SI+39],'H' ;Is it a hidden file?
STC ;If yes, indicate so.
JZ NAME_ERROR
CLC
RET

NAME_ERROR: LODSB ;Get a character.
CMP AL,32 ;If it's space, skip.
JZ SKIP_STORE
STOSB
SKIP_STORE: LOOP STORE_BYTES
RET

; This subroutine moves and turns the cursor on and removes ;
; the last user entry in preparation for new input. ;
CLEAR_OLD: CALL SET_CURSOR ;Move cursor.
CALL CURSOR_ON ;Turn it on.
MOV DI,80H ;Write spaces over old entry.
MOV AX,2B20H
MOV CX,18
REP STOSW
MOV DI,80H ;Initiate pointer for entry.
RET

; This subroutine backspaces. ;
MOVE_BS: CMP DI,80H ;At beginning of field?
JZ MOVE_BS_END ;If yes, skip.
DEC DI ;Else, decrement pointer.
MOV SI,OFFSET BS ;Erase last character.
CALL GET_TEXT

MOVE_BS_END: RET

; This subroutine renames or moves the file. ;
RENAME_FILE: MOV BYTE PTR DS:[DI],0 ;Convert to ASCII12.
MOV DX,OFFSET FILE_NAME ;Point to old name.
MOV DI,80H
MOV AH,56H ;Rename.
INT 21H
RET

; This subroutine removes the filename from the directory listing. ;
REMOVE_FILE: MOV DI,CUR_FILE ;Point to filename.
MOV SI,DI
ADD SI,40 ;Move all the records
NEXT_RECORD: MOV CX,20 ;that follow up one.
REP MOVSW
CMP DI,END_OFFSET
JB NEXT_RECORD
SUB DI,40
MOV END_OFFSET,DI ;Store new end.
XOR BP,BP
CALL SCROLL ;Update the screen.
DEC COUNT ;Decrement file count.
JNZ MORE_FILES ;If empty, exit.
JMP EXIT

MORE_FILES: CMP COUNT,21 ;Full page?
JAE REMOVE_END ;If yes, skip.
SUB PAGE_END,160 ;Else, adjust page end.
MOV SI,PAGE_END
SUB SI,160
CMP SI,LINE ;Is bar below directory listing?
JA REMOVE_END ;If no, skip.
CALL MOVE_BAR ;Else, move bar up one line.
CALL FILE_COUNT ;Update file count on screen.
RET

; This subroutine displays the count of files. ;
FILE_COUNT: MOV DI,OFFSET FILES ;Blank out previous count.
MOV AX,2B20H
STOSW
MOV AX,COUNT
MOV BL,10 ;Convert to decimal.
STB ;Reverse direction.
DIV BL
XCHG AL,AH
ADD AL,'0' ;Convert to ASCII.
STOSB ;Store the remainder.
XCHG AL,AH
XOR AH,AH
CMP AX,0
JNZ NEXT_COUNT ;Are we done?
CLD ;Back to forward direction.
MOV DX,100EH ;Row 24; column 13.
MOV SI,OFFSET FILES ;Display file count.
CALL DISPLAY_TEXT
RET

```



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- U148. SIMULTANEOUS EDIT** of multiple text files. Lets you make the same text changes to several files at once.
- U149. WORD LENGTH ANALYSER.** Checks the length of words in text and compares with readers' level of schooling.
- U150. TEXT CHECKER.** Examines Wordstar files for typing errors such as missing brackets and quotes.
- U151. TEXT FILE SORT.** Fast and works with very large files.
- U152. LIST NON-ASCII BASIC FILE** without loading Basic. Also helpful for listing if you don't have Basic/GWBasic.
- U153. PAUSE LISTING** so that printer will produce 55 lines on a page.

## EQUIPMENT HANDLING

- U406. CONTROL BACKGROUND/ FOREGROUND COLOURS** as displayed on your monitor.
- U407. HARD DISK PERFORMANCE TEST.** Checks the running of hard disks.
- U408. COMPUTER LOG** to keep track of amount of time of computer usage, how time spent.
- U409. ELECTRIC TYPEWRITER.** Converts computer into electric typewriter (for notes, envelopes, etc.).
- U410. KEYBOARD OPTIMISER** that will set cursor size, give type ahead buffer, more. Easy to use command line editing.
- U411. MAP RESIDENT PROGRAMS.** Shows program addresses, possible conflict.
- U412. TRACK MEMORY** as programs are running. Has windows and more.
- U413. MEMORY ORGANISER.** Determine, mark, release, allocate, display memory. Shows how files are loaded in memory.
- U414. MULTI-SCREEN.** Allows output to be directed to more than one screen. Needs CGA. Multitasking features.
- U415. NEW ANSI.SYS** that may aid screen presentation and allow faster execution of many functions.

- U416. BLACK & WHITE MODE** can be switched on colour graphics card.
- U417. TIMEPARK HEAD** of hard disk after a specified time has elapsed.
- U418. SET 40 or 80 screen columns** BW mode on colour systems.
- U419. STATUS REPORT** on system, including information about drives, memory available.
- U420. SPEED TEST (1)** checks processor speed and compares with IBM-PC. Similar to Norton test.
- U421. SPEED TEST (2)** checks computer speed in two areas, including Sieve calculation and track to track access time, and compares with IBM-PC.
- U422. SPEED TEST (3)** comprehensive checks on processing, including block write, register/memory, multiply, divide, stack operations, far jumps, etc. and compares with IBM-PC.
- U423. RAM TEST.** Tests and tests and tests ram. Identifies faulty memory.
- U424. DOS ENVIRONMENT VARIABLE EDITOR.** Make changes to edit path, prompt, etc.
- U425. EXPAND DOS ENVIRONMENT SPACE TO 1K.**
- U426. FLIP ON/OFF (TOGGLE) DOS PARAMETERS.** Works on several standard Dos parameters.
- U427. WHAT PROCESSOR?** Examines and identifies the processor/s being used, such as 8088, 8086, etc.
- U428. WHAT DEVICE DRIVERS?** Examines and reports on devices (eg ports) installed in your computer.
- U429. WHAT DOS CONFIGURATION?** Examines and reports on memory, vector addresses, and statistical information about version of Dos you are using.
- U430. WHAT EQUIPMENT?** Examines your equipment and reports on the installed drives, type of cards (eg, printer, colour, mono, RS232) etc.
- U431. EDIT RAM STORAGE** in your computer.
- U432. DRIVE STATUS.** Reports on no. of bytes, sectors, clusters-whose capacity is and how much is free.
- U433. DIAGNOSTICS.** Performs large number of computer diagnostics and reports on serial, parallel ports, video, etc.
- U434. DRIVE TEST.** Floppy disk test drive utility.
- U435. SLOW AMSTRAD 1512** Programs e.g. games that run too fast.

## FILE MOVING

- U511. HARD DISK UNERASE.** Exceptional features. Most unerase utilities don't work on hard disk - this one does!
- U512. DELETE ALL BUT** those programs you identify.
- U513. INTELLIGENT COPY PROGRAM** that creates sub-directories as part of the transfer. Also renames rather than over writes.
- U514. SUPERIOR COPY PROGRAM** that checks and evaluates target before copying. Eg, copies last dated version.
- U515. UNIQUE COPY PROGRAM** with same function as f.l. but does not copy those already on target disk.
- U516. TREE SURGERY.** Prune files unwanted/ duplicated on hard disk. Has source code and compares files with the same name.
- U517. KILLDIR.** Delete a branch of a directory. Reduces steps and saves time.
- U518. MOVE DIRECTORY** around if you prefer it stored in different location.

## FILE ORGANISATION & CHECKING

- U611. BOMB ALERT.** Examines new files for malicious intent and reports on possible danger to other files.
- U612. BASIC MENU GENERATOR.** Better access to your Basic files through a menu. For Basic/GWBasic.
- U613. UNSQUEEZE ARC FILES.** Small, efficient utility that occupies less space and is simpler to use than Arc.Exe.

- U614. HARD DISK OPTIMISER.** Related group of files that optimise hard disk usage and eliminate file fragmentation. Helps pack the disk.
- U615. FILE RE-ORGANISER.** Regroups a fragmented file into contiguous sectors on a disk for more efficient disk access.
- U616. RECOVER BAD SECTORS.** Records data on disk. Does 12 retries and thus may recover bad sectors.
- U617. COLLECT BAD SECTORS.** Marks bad sectors for collection into a separate file that will not be used. Works with floppies and hard disk.
- U618. ADVANCED COMPARE** facility that can save as edit script, generate and update deck.

## SPECIAL FEATURES

- U805. PREPROCESSOR FOR "C" COMPILERS.** Has "C" source and helps organise coding into efficient form for compiling.
- U806. VOICE EMULATION.** Compiled with Basic source module which allows extensions, revision or use as tutorial.
- U807. DEMONSTRATION OF COMPUTER GRAPHICS** for those who have CGA.
- U808. DAYS SINCE JAN 1ST.** Calculate no. of days elapsed since beginning of year. Needs Basic/GWBasic.
- U809. BINARY FILE CONVERTER.** Converts files from machine language to hex equivalent for examination and modification.
- U810. CAPTURE BIOS** contents and store in a separate file.
- U811. EXPLORE FAT (FILE ALLOCATION TABLE).** Shows the table entries, starting clusters of files, etc.
- U812. MINICALC.** A small, easy to use spread sheet with 11 x 22 cells for quick every day use.
- U813. PROGRAMMER'S CALCULATOR** which does special hex and other calculations for those writing programs.

## ORDERS:

The service charge for each programme is \$3. There is a minimum charge of \$15 (five programmes). Add 20% Sales Tax plus \$3 for postage and packaging.

ORDERS MUST BE PREPAID.

**PAYMENT BY MAIL TO:**  
SELECT SOFTWARE, Box C343,  
Clarence St, PO, Sydney NSW 2000  
(Office: 3 Barrack St., Sydney, NSW)

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Pay by Bankcard, Mastercard or Visa.  
(02) 29 2866, (02) 29 3810, Fax (02) 262 1290.

We cannot guarantee the suitability of programmes for users needs or equipment.

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|     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  |
| 23  | 24  | 25  | 26  | 27  | 28  | 29  | 30  | 31  |
| 32  | 33  | 34  | 35  | 36  | 130 | 131 | 132 | 133 |
| 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 |
| 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 |
| 152 | 153 | 406 | 407 | 408 | 409 | 410 | 411 | 412 |
| 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 |
| 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 |
| 431 | 432 | 433 | 434 | 511 | 512 | 513 | 514 | 515 |
| 516 | 517 | 518 | 611 | 612 | 613 | 614 | 615 | 616 |
| 617 | 618 | 805 | 806 | 807 | 808 | 809 | 810 | 811 |
| 812 | 813 |     |     |     |     |     | 435 |     |



# PRODUCTIVITY

```

;-----;
; This subroutine displays the current directory, menu, and number of files. ;
;-----;

```

```

REFRESH_DIR: CALL CLS ;Clear the screen.
REFRESH_MENU: MOV SI,OFFSET MENU ;Point to menu position.
MOV DI,(2*160)+98 ;And to screen position.
MOV BH,19 ;Display 19 lines of menu.
NEXT_REFRESH: MOV CX,22 ;22 characters per line.
NEXT_MENU: MOV LODSB
MOV BL,AL
CALL WRITE_SCREEN
CALL NEXT_MENU
ADD DI,116 ;Next line.
DEC BH
JNZ NEXT_REFRESH

MOV DX,4
MOV SI,OFFSET DIRECTORY ;Display "Directory ".
CALL DISPLAY_TEXT
MOV SI,OFFSET PURGE_DIR ;Display working directory.
CALL GET_TEXT
CALL FILE_COUNT ;Display file count.
MOV BL,INVERSE ;Put up cursor bar.
CALL BAR
RET

```

```

;-----;
; This subroutine scrolls the screen. ;
;-----;

```

```

SCROLL: MOV SI,CUR_OFFSET ;Get current offset.
ADD SI,BP ;Add requested direction.
CK_LOWER: CMP SI,OFFSET BUFFER ;If above start check upper limit.
JAE UPPER_LIMIT
MOV CUR_OFFSET,OFFSET BUFFER ;Else, make it start.
JMP SHORT SCROLL_RETURN ;And update screen.

UPPER_LIMIT: MOV BX,END_OFFSET ;See if beyond end of
CMP BX,OFFSET BUFFER+21*40 ; directory listing as well.
JA CK_UPPER
MOV CUR_OFFSET,OFFSET BUFFER
JMP SHORT SCROLL_RETURN

CK_UPPER: SUB BX,21*40
CMP SI,BX
JBE END_SCROLL
MOV SI,BX

END_SCROLL: MOV CUR_OFFSET,SI ;Update current offset.
SCROLL_RETURN: RET

```

```

;-----;
; This subroutine scrolls the bar if between start ;
; and end of page. Otherwise the page is scrolled. ;
;-----;

```

```

SCROLL_BAR: MOV SI,LINE ;Get current line.
ADD SI,BP ;Add requested line.
MOV BP,-40 ;Assume below beginning.
CMP SI,323 ;Is it?
JB SCROLL_PAGE ;If yes, scroll page instead.
MOV BP,48 ;Do the same for end of page.
CMP SI,PAGE_END
JAE SCROLL_PAGE
CALL MOVE_BAR
RET

SCROLL_PAGE: CALL SCROLL
RET

```

```

;-----;
; This subroutine does the actual moving of the bar. ;
;-----;

```

```

MOVE_BAR: MOV BL,NORMAL ;Remove old bar.
CALL BAR
MOV LINE,SI ;And move bar to new line.
CALL BAR
RET

BAR: MOV DI,LINE ;Retrieve line.
MOV CX,39 ;Bar length 39.
NEXT_BAR: CALL WRITE_SCREEN
LOOP NEXT_BAR
RET

```

```

;-----;
; This subroutine displays the directory listing. ;
;-----;

```

```

UPDATE_SCREEN: XOR BP,BP
MOV SI,CUR_OFFSET ;Retrieve starting offset.
MOV DI,2*160+2 ;Point to row two of screen.
MOV BH,21 ;21 lines to write.
NEXT_WRITE: MOV CX,48 ;48 characters per line.
NEXT_CHAR: MOV LODSB ;Get a byte.
MOV BL,AL ;Save it in BL.
CALL WRITE_SCREEN ;Write them.
LOOP NEXT_CHAR
ADD DI,88 ;Bump pointer to next line.
DEC BH ;Do all 21 lines.

JNZ NEXT_WRITE
RET

```

```

;-----;
; This subroutine displays the directory by writing directly ;
; to the screen buffer. To avoid screen noise (snow) on the ;
; color card, the horizontal retrace has to be monitored. ;
;-----;

```

```

WRITE_SCREEN: MOV DX,STATUS_REG ;Retrieve status register.
MOV AX,VIDEO_SEG ;Point to screen segment.
MOV ES,AX

HORZ_RET: IN AL,DX ;Get status.
TEST AL,1 ;Is it low?
JNZ HORZ_RET ;If not, wait until it is.
CLI ;No more interrupts.

WAIT: IN AL,DX ;Get status.
TEST AL,1 ;Is it high?
JZ WAIT ;If no, wait until it is.
MOV AL,BL ;Retrieve character; now it's OK
STOSB ; to write to screen buffer.
STI ;Interrupts back on.
INC DI ;Bump pointer past attribute.
PUSH CS
POP RET
RET ;Return

```

```

;-----;
; These two subroutines clear either the messages or the entire screen. ;
;-----;

```

```

CLEAR_MSG: MOV CX,162BH ;Row 22; column 43.
MOV DX,174FH ;Row 23; column 79.
JMP SHORT CLEAR_WINDOW

CLS: XOR CX,CX
MOV DX,184FH ;Entire screen.

CLEAR_WINDOW: PUSH BP
PUSH BX
MOV BH,NORMAL ;Clear with original attribute.
MOV AX,690H
INT 10H
POP BX
POP BP
RET

```

```

;-----;
; These subroutines display the messages. ;
;-----;

```

```

DISPLAY_TEXT: CALL SET_CURSOR ;Move cursor.
GET_TEXT: MOV LODSB
CMP AL,0 ;Zero marks end of string.
JZ END_TEXT
CALL WRITE_TEXT
JMP SHORT GET_TEXT

END_TEXT: RET

WRITE_TEXT: PUSH SI ;BIOS does not save SI.
MOV AH,0EH ;Write teletype.
INT 10H
POP SI
RET

```

```

;-----;
; These four subroutines move the cursor, get the current ;
; directory, beep the speaker or get a keystroke. ;
;-----;

```

```

SET_CURSOR: PUSH SI
XOR BH,BH ;Page zero.
MOV AH,2 ;Set cursor.
INT 10H
POP SI
RET

GET_DIR: MOV BYTE PTR [SI], '/' ;DOS doesn't preface directory
INC SI ; with slash so we must.
XOR DL,DL
MOV AH,47H ;Retrieve default directory.
INT 21H
RET

BEEP: MOV DL,7 ;Beep via DOS.
MOV AH,2
INT 21H
RET

READ_KEY: MOV AH,0 ;Retrieve keystroke via BIOS.
INT 16H
RET

```

```

;-----;
; These subroutines turn the cursor off and on. ;
;-----;

```

```

CURSOR_OFF: MOV CX,2880H
JMP SHORT SET_TYPE

CURSOR_ON: MOV CX,CURSOR_TYPE

SET_TYPE: MOV AH,1
INT 10H
RET

```

```

;-----;
; This long subroutine stores the filename in DIR ;
; format. That is, filename, bytes, date and time. ;
;-----;

```

```

BUFFER_NAME: MOV SI,150 ;Point to filename.
MOV CX,12 ;Store 12 bytes of filename.
NEXT_STORE: MOV LODSB ;Get a byte.
CMP AL,0 ;End of filename?
JZ END_STORE ;If yes, finish with blanks.
CMP AL,'.' ;Is it the period?
JNZ STORE_BYTE ;If no, store.
SUB CX,3 ;Else store 3 spaces.

MOV AL,32
REP STOSB
ADD CX,3
JMP SHORT NEXT_STORE ;Get next byte.

STORE_BYTE: STOSB NEXT_STORE ;Store byte.
LOOP AL,32 ;Get next byte.
REP STOSB ;Pad balance with spaces.

FILE_SIZE: PUSH DI ;Save pointer.
ADD DI,8 ;Move to end of bytes field.
MOV DX,DS:[154] ;Retrieve high and low words
MOV AX,DS:[156] ; of bytes.
MOV BX,10 ;Convert to decimal; divide by 10.
STD ;Reverse direction.

NEXT_SIZE: MOV CX,DX ;Low word in CX.
XOR DX,DX ;Zero in high half.
DIV BX ;Convert to decimal.
XCHG AX,CX ;Retrieve low word.
DIV BX
XCHG AX,DX ;Retrieve remainder.
ADD AL,'0' ;Convert to ASCII.
STOSB ;Store it.
MOV AX,CX ;Are we done?
OR CX,DX
JNZ NEXT_SIZE ;If no, divide again.
CLD ;Back to forward direction.
POP DI ;Retrieve pointer.
ADD DI,11 ;Move to date field.
MOV DX,DS:[152] ;Retrieve date.
MOV AX,DX
MOV CL,5 ;Shift to lowest bits.
ROR AX,CL
AND AX,0FFH ;Mask off all but month.
MOV CL,0FFH ;Flag as no leading zeros.
MOV CH,'.' ;Delimiting character.
CALL STORE_WORD ;Store it.

MOV AX,DX ;Retrieve date.
AND AX,1FH ;Mask off all but day.
MOV CL,0 ;Flag include leading zeros.

```

# C CODE FOR THE PC

*source code, of course*

## C Source Code

|                                                                                                 |       |
|-------------------------------------------------------------------------------------------------|-------|
| FSP (screen manager)                                                                            | \$400 |
| Barcode Generator (specify Code 39 (alphanumeric), Interleaved 2 of 5 (numeric), or UPC)        | \$300 |
| GraphiC 4.0 (high-resolution, DISSPLA-style scientific plots in color & hardcopy)               | \$275 |
| Vitamin C (MacWindows)                                                                          | \$200 |
| Essential C Utility Library (400 useful C functions)                                            | \$160 |
| Essential Communications Library (C functions for RS-232-based communication systems)           | \$160 |
| Panache C Program Generator (screen-based database management programs)                         | \$150 |
| PC/IP (CMU/MIT TCP/IP implementation for PCs)                                                   | \$100 |
| B-Tree Library & ISAM Driver (file system utilities by Softfocus)                               | \$100 |
| The Profiler (program execution profile tool)                                                   | \$100 |
| Entelekon C Function Library (screen, graphics, keyboard, string, printer, etc.)                | \$100 |
| Entelekon Power Windows (menus, overlays, messages, alarms, file handling, etc.)                | \$100 |
| QC88 C compiler (ASM output, small model, no longs, floats or bit fields, 80+ function library) | \$90  |
| CBTree (B+tree ISAM driver, multiple variable-length keys)                                      | \$80  |
| ME (programmer's editor with C-like macro language by Magma Software)                           | \$75  |
| Wendin PCNX Operating System Shell                                                              | \$75  |
| Wendin PCVMS Operating System Shell                                                             | \$75  |
| Wendin Operating System Construction Kit                                                        | \$75  |
| EZ_ASM (assembly language macros bridging C and MASM)                                           | \$60  |
| Multi-User BBS (chat, mail, menus, sysop displays; uses Galacticomm modem card)                 | \$50  |
| Make (macros, all languages, built-in rules)                                                    | \$50  |
| Vector-to-Raster Conversion (stroke letters & Tektronix 4010 codes to bitmaps)                  | \$50  |
| Coder's Prolog (inference engine for use with C programs)                                       | \$45  |
| PC/MPX (light-weight process manager; includes preemption and coroutine packages)               | \$45  |
| Biggerstaff's System Tools (multi-tasking window manager kit)                                   | \$40  |
| TELE Kernel (Ken Berry's multi-tasking kernel)                                                  | \$30  |
| TELE Windows (Ken Berry's window package)                                                       | \$30  |
| Clisp (Lisp interpreter with extensive internals documentation)                                 | \$30  |
| Translate Rules to C (YACC-like function generator for rule-based systems)                      | \$30  |
| 6-Pack of Editors (six public domain editors for use, study & hacking)                          | \$30  |
| ICON (string and list processing language, Version 6 and update)                                | \$25  |
| LEX (lexical analyzer generator)                                                                | \$25  |
| Bison & PREP (YACC workalike parser generator & attribute grammar preprocessor)                 | \$25  |
| C Compiler Torture Test (checks a C compiler against K & R)                                     | \$20  |
| PKG (task-to-task protocol package)                                                             | \$20  |
| A68 (68000 cross-assembler)                                                                     | \$20  |
| Small-C (C subset compiler for 8080 and 8088)                                                   | \$20  |
| tiny-c (C subset interpreter including the tiny-c shell)                                        | \$20  |
| Xlisp 1.5a (Lisp interpreter including tiny-Prolog in Lisp)                                     | \$20  |
| List-Pac (C functions for lists, stacks, and queues)                                            | \$20  |
| XLT Macro Processor (general purpose text translator)                                           | \$20  |
| C Tools (exception macros, wc, pp, roff, grep, printf, hash, declare, banner, Pascal-to-C)      | \$15  |

## Data

|                                                                                                 |       |
|-------------------------------------------------------------------------------------------------|-------|
| DNA Sequences (GenBank 48.0 of 10,913 sequences with fast similarity search program)            | \$150 |
| Protein Sequences (roughly 4,000 protein sequences with similarity search program)              | \$60  |
| Webster's Second Dictionary (234,932 words)                                                     | \$60  |
| U. S. Cities (names & longitude/latitude of 32,000 U.S. cities and 6,000 state boundary points) | \$35  |
| The World Digitized (100,000 longitude/latitude of world country boundaries)                    | \$30  |
| KST Fonts (13,200 characters in 139 mixed fonts: specify TeX or bitmap format)                  | \$30  |
| NBS Hershey Fonts (1,377 stroke characters in 14 fonts)                                         | \$15  |
| U. S. Map (15,701 points of state boundaries)                                                   | \$15  |

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# PRODUCTIVITY

```

MOV CH,'-'
CALL STORE_WORD ;Store it.

MOV AX,DX ;Retrieve date for last time.
MOV CL,9
ROR AX,CL
AND AX,7FH ;Mask off all but year.
ADD AX,80 ;Adjust to ASCII.
CMP AX,100 ;Past year 2000?
JB DISPLAY_DATE ;If no, display. Else, adjust for
SUB AX,100 ;next century. (Planning ahead!)
DISPLAY_DATE: MOV CL,9 ;Display leading zeros.
CALL STORE_WORD ;Store it.

TIME: INC DI ;Move to time field.
MOV DX,DS:[15B] ;Retrieve time.
MOV AX,DX
MOV CL,11 ;Shift to hours bits.
ROR AX,CL
AND AX,1FH ;Mask off all but hours.
PUSH AX
CMP AX,12 ;Past noon?
JBE MERIDIAN
SUB AX,12 ;If yes, adjust.
MERIDIAN: CMP AX,0 ;Midnight?
JNZ NOT_MIDNIGHT
MOV AX,12 ;If yes, adjust.
NOT_MIDNIGHT: MOV CL,9FFF ;Suppress leading zeros.
MOV CH,'.'
CALL STORE_WORD ;Store it.

MOV AX,DX ;Retrieve time.
MOV CL,5 ;Shift to minutes bits.
ROR AX,CL
AND AX,3FH ;Mask off all but minutes.
MOV DX
POP DX ;Retrieve hours.
MOV CH,'p' ;Assume PM.

CNP DX,12 ;Is it PM?
JAE PM
MOV CH,'a' ;if no, AM.

PM: CALL STORE_WORD ;Store it.
TEST BYTE PTR DS:[149],6 ;Is it a hidden or system file?
JZ NOT_HIDDEN
STOSB ;if yes, tack on an "H".
RET

NOT_HIDDEN: INC DI
RET

-----
STORE_WORD: DIV BL ;Divide by ten.
ADD AX,'00' ;Convert to ASCII.
CMP CL,8 ;Are we to display leading zero?
JZ STORE_IT ;if yes, store as is.
JMP AL,'0' ;is it a leading zero?
CNP STORE_IT ;if no, store it.
MOV AL,32 ;Else, store a space.
STOSB
RET

-----
; Approximate 788 filename buffer at end of code. ;
CURRENT_DIR DB 8
PURGE_DIR EQU CURRENT_DIR+68
FILE_NAME EQU PURGE_DIR+66
BUFFER EQU FILE_NAME+13

CODE ENDS
END START
    
```

(Figure 1 ends)

```

100 REM -- BASIC PROGRAM TO CREATE DR.COM
110 OPEN "DR.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A#
130 CHECKSUM = 0
140 FOR J = 1 TO 422
150 LINESUM = 0
160 FOR I = 1 TO 8
170 READ BYTE
180 CHECKSUM = CHECKSUM + BYTE
190 LINESUM = LINESUM + BYTE
200 IF (BYTE < 256) THEN LSET A# = CHR$(BYTE)
210 FU = #1
220 NEXT J
230 READ LINECHECK
240 IF LINECHECK < LINESUM THEN PRINT "Error in Line";280 + 10 * I
250 NEXT J
260 CLOSE
270 IF CHECKSUM = 341070 THEN PRINT "Successful Completion" : END
280 PRINT "COM file is not valid" : END

290 DATA 253, 41, 3, 0, 0, 0, 0, 176, 453
300 DATA 7, 112, 112, 0, 0, 0, 0, 231
310 DATA 0, 12, 0, 9, 0, 3, 0, 37
320 DATA 0, 8, 0, 29, 0, 9, 188, 14, 239
330 DATA 0, 0, 0, 0, 0, 0, 99, 14, 113
340 DATA 1, 0, 67, 1, 42, 46, 42, 0, 199
350 DATA 1, 127, 0, 0, 1, 17, 18, 19, 183
360 DATA 20, 28, 31, 32, 47, 49, 50, 59, 316
370 DATA 60, 61, 62, 63, 64, 65, 66, 67, 608
380 DATA 68, 71, 72, 73, 79, 80, 81, 118, 642
390 DATA 132, 105, 5, 51, 10, 89, 10, 48, 450
400 DATA 9, 105, 10, 173, 6, 97, 10, 225, 635
410 DATA 8, 173, 4, 81, 10, 169, 9, 173, 629
420 DATA 6, 225, 8, 48, 9, 169, 9, 28, 502
430 DATA 10, 51, 10, 81, 10, 89, 10, 97, 358
440 DATA 10, 105, 10, 32, 6, 4, 6, 16, 189
450 DATA 6, 45, 6, 9, 6, 24, 6, 63, 165
460 DATA 6, 38, 6, 2, 8, 104, 7, 159, 330
470 DATA 7, 9, 8, 132, 7, 207, 7, 9, 386
480 DATA 8, 2, 8, 0, 0, 0, 0, 0, 18
490 DATA 0, 0, 0, 78, 111, 116, 32, 101, 438
500 DATA 110, 111, 117, 103, 104, 32, 109, 101, 787
510 DATA 109, 111, 114, 121, 36, 73, 110, 118, 792
520 DATA 97, 108, 105, 100, 32, 100, 105, 114, 761
530 DATA 101, 99, 116, 111, 114, 121, 36, 84, 782
540 DATA 111, 111, 32, 109, 97, 110, 121, 32, 723
550 DATA 102, 105, 108, 101, 115, 36, 76, 111, 754
560 DATA 97, 100, 105, 110, 103, 32, 97, 110, 754
570 DATA 100, 32, 83, 111, 114, 116, 108, 110, 771
580 DATA 103, 32, 100, 105, 114, 101, 99, 116, 770
590 DATA 111, 114, 121, 46, 0, 76, 111, 97, 676
600 DATA 100, 105, 110, 103, 32, 100, 105, 114, 769
610 DATA 101, 99, 116, 111, 114, 121, 46, 0, 708
620 DATA 68, 105, 114, 101, 99, 116, 111, 114, 828
630 DATA 121, 32, 111, 102, 32, 0, 32, 32, 462
640 DATA 32, 32, 70, 105, 108, 101, 115, 0, 563
650 DATA 32, 119, 105, 108, 108, 32, 98, 101, 703
660 DATA 32, 100, 101, 108, 101, 116, 101, 100, 759
670 DATA 40, 0, 68, 111, 32, 121, 111, 117, 606
680 DATA 32, 119, 105, 115, 104, 32, 116, 111, 734
690 DATA 32, 100, 101, 108, 101, 116, 101, 32, 691
700 DATA 105, 116, 63, 32, 32, 89, 47, 78, 562
710 DATA 0, 69, 110, 116, 101, 114, 32, 110, 652
720 DATA 101, 119, 32, 110, 97, 109, 101, 32, 701
730 DATA 102, 111, 114, 32, 0, 69, 110, 116, 654
740 DATA 101, 114, 32, 110, 101, 119, 32, 100, 709
750 DATA 105, 114, 101, 99, 116, 111, 114, 121, 881
760 DATA 32, 102, 111, 114, 32, 0, 32, 79, 502
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1370 DATA 128, 244, 119, 136, 58, 6, 1, 136, 811
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1480 DATA 1, 12, 0, 60, 79, 117, 5, 198, 472
1490 DATA 6, 29, 1, 1, 190, 129, 0, 172, 528
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1550 DATA 228, 198, 68, 255, 0, 138, 92, 254, 1233
    
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Fig 2 A Basic program that will automatically create DR.COM

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 1570 DATA 128, 251, 58, 116, 14, 128, 251, 32, 978

1580 DATA 118, 9, 180, 59, 205, 33, 186, 181, 971  
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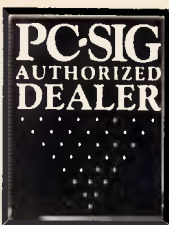
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 3490 DATA 6, 185, 5, 0, 129, 60, 49, 50, 484  
 3500 DATA 116, 8, 167, 61, 49, 50, 117, 152, 682  
 3510 DATA 235, 154, 167, 117, 174, 185, 3, 0, 1035  
 3520 DATA 235, 142, 139, 54, 30, 1, 161, 42, 804





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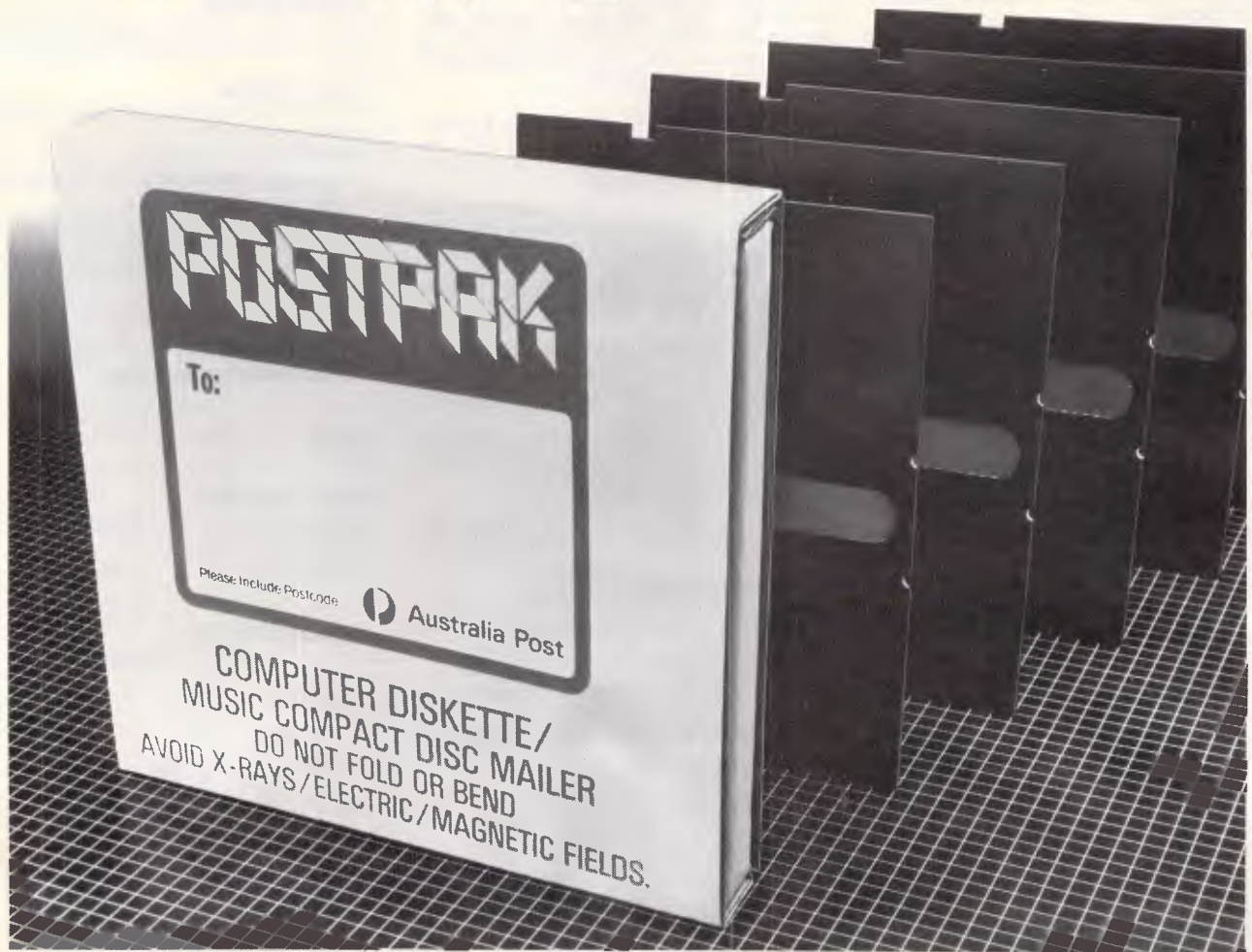
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| 3530 DATA | 1,   | 45,  | 67,  | 1,   | 177, | 2,   | 211, | 232, | 736  |
| 3540 DATA | 3,   | 240, | 137, | 54,  | 32,  | 1,   | 86,  | 191, | 744  |
| 3550 DATA | 175, | 14,  | 185, | 8,   | 0,   | 232, | 28,  | 0,   | 642  |
| 3560 DATA | 70,  | 128, | 60,  | 32,  | 116, | 9,   | 176, | 46,  | 637  |
| 3570 DATA | 177, | 185, | 3,   | 0,   | 232, | 13,  | 0,   | 198, | 801  |
| 3580 DATA | 5,   | 0,   | 94,  | 128, | 124, | 39,  | 72,  | 249, | 711  |
| 3590 DATA | 116, | 1,   | 248, | 195, | 172, | 60,  | 32,  | 116, | 940  |
| 3600 DATA | 1,   | 170, | 229, | 248, | 195, | 232, | 183, | 1,   | 1256 |
| 3610 DATA | 232, | 217, | 1,   | 191, | 128, | 0,   | 184, | 32,  | 985  |
| 3620 DATA | 32,  | 185, | 18,  | 0,   | 243, | 171, | 191, | 128, | 968  |
| 3630 DATA | 0,   | 195, | 129, | 285, | 128, | 0,   | 116, | 7,   | 830  |
| 3640 DATA | 79,  | 190, | 134, | 2,   | 232, | 134, | 1,   | 195, | 967  |
| 3650 DATA | 198, | 5,   | 0,   | 186, | 175, | 14,  | 191, | 128, | 897  |
| 3660 DATA | 0,   | 180, | 86,  | 205, | 33,  | 195, | 139, | 62,  | 900  |
| 3670 DATA | 32,  | 1,   | 139, | 247, | 131, | 198, | 40,  | 185, | 973  |
| 3680 DATA | 20,  | 40,  | 243, | 165, | 39,  | 62,  | 34,  | 1,   | 584  |
| 3690 DATA | 114, | 245, | 131, | 239, | 40,  | 137, | 62,  | 34,  | 1002 |
| 3700 DATA | 1,   | 51,  | 237, | 138, | 0,   | 255, | 14,  | 928  |      |
| 3710 DATA | 40,  | 1,   | 117, | 3,   | 233, | 178, | 249, | 131, | 952  |
| 3720 DATA | 62,  | 40,  | 1,   | 21,  | 115, | 23,  | 129, | 46,  | 437  |
| 3730 DATA | 38,  | 1,   | 160, | 0,   | 139, | 54,  | 38,  | 1,   | 431  |
| 3740 DATA | 129, | 238, | 160, | 0,   | 59,  | 54,  | 42,  | 1,   | 683  |
| 3750 DATA | 119, | 3,   | 232, | 184, | 0,   | 232, | 1,   | 0,   | 771  |
| 3760 DATA | 195, | 191, | 22,  | 2,   | 184, | 32,  | 32,  | 171, | 829  |
| 3770 DATA | 161, | 40,  | 1,   | 179, | 10,  | 253, | 246, | 243, | 1133 |
| 3780 DATA | 139, | 196, | 4,   | 48,  | 170, | 134, | 196, | 50,  | 932  |
| 3790 DATA | 228, | 61,  | 0,   | 117, | 240, | 252, | 186, | 1084 |      |
| 3800 DATA | 14,  | 24,  | 190, | 22,  | 2,   | 232, | 2,   | 1,   | 487  |
| 3810 DATA | 195, | 232, | 235, | 0,   | 190, | 138, | 2,   | 191, | 1183 |
| 3820 DATA | 162, | 1,   | 183, | 19,  | 185, | 22,  | 0,   | 172, | 744  |
| 3830 DATA | 138, | 216, | 232, | 182, | 0,   | 226, | 248, | 131, | 1373 |
| 3840 DATA | 199, | 116, | 254, | 207, | 117, | 238, | 186, | 4,   | 1321 |
| 3850 DATA | 0,   | 190, | 8,   | 2,   | 232, | 219, | 0,   | 190, | 841  |
| 3860 DATA | 109, | 14,  | 232, | 216, | 0,   | 232, | 169, | 255, | 1227 |
| 3870 DATA | 138, | 30,  | 9,   | 1,   | 232, | 105, | 0,   | 195, | 710  |
| 3880 DATA | 139, | 54,  | 30,  | 1,   | 3,   | 245, | 129, | 254, | 855  |
| 3890 DATA | 188, | 14,  | 115, | 8,   | 199, | 6,   | 30,  | 1,   | 561  |
| 3900 DATA | 188, | 14,  | 235, | 32,  | 139, | 30,  | 34,  | 1,   | 673  |
| 3910 DATA | 129, | 251, | 4,   | 18,  | 119, | 8,   | 199, | 6,   | 734  |
| 3920 DATA | 30,  | 1,   | 188, | 14,  | 235, | 14,  | 129, | 235, | 846  |
| 3930 DATA | 72,  | 3,   | 59,  | 243, | 118, | 2,   | 139, | 243, | 879  |
| 3940 DATA | 137, | 54,  | 30,  | 1,   | 195, | 139, | 54,  | 42,  | 652  |
| 3950 DATA | 1,   | 3,   | 245, | 189, | 216, | 255, | 129, | 254, | 1292 |
| 3960 DATA | 67,  | 1,   | 114, | 13,  | 189, | 40,  | 0,   | 59,  | 483  |
| 3970 DATA | 54,  | 38,  | 1,   | 115, | 4,   | 232, | 5,   | 0,   | 449  |
| 3980 DATA | 195, | 232, | 172, | 255, | 195, | 138, | 30,  | 8,   | 1223 |
| 3990 DATA | 1,   | 232, | 12,  | 0,   | 137, | 54,  | 42,  | 1,   | 479  |
| 4000 DATA | 138, | 30,  | 10,  | 1,   | 232, | 1,   | 0,   | 195, | 607  |
| 4010 DATA | 139, | 62,  | 42,  | 1,   | 185, | 39,  | 0,   | 232, | 700  |
| 4020 DATA | 33,  | 0,   | 226, | 251, | 195, | 51,  | 237, | 139, | 1132 |
| 4030 DATA | 54,  | 30,  | 1,   | 191, | 66,  | 1,   | 183, | 21,  | 547  |
| 4040 DATA | 185, | 40,  | 0,   | 172, | 138, | 216, | 232, | 10,  | 993  |
| 4050 DATA | 0,   | 226, | 248, | 131, | 199, | 80,  | 254, | 207, | 1345 |
| 4060 DATA | 117, | 238, | 195, | 139, | 22,  | 4,   | 1,   | 161, | 877  |
| 4070 DATA | 6,   | 1,   | 142, | 192, | 236, | 168, | 1,   | 117, | 863  |
| 4080 DATA | 251, | 250, | 236, | 168, | 1,   | 116, | 251, | 138, | 1411 |
| 4090 DATA | 195, | 170, | 251, | 71,  | 14,  | 7,   | 195, | 185, | 1088 |
| 4100 DATA | 43,  | 22,  | 186, | 79,  | 23,  | 235, | 3,   | 51,  | 644  |
| 4110 DATA | 201, | 186, | 79,  | 24,  | 85,  | 83,  | 138, | 62,  | 858  |
| 4120 DATA | 8,   | 1,   | 184, | 0,   | 6,   | 205, | 16,  | 9,   | 511  |
| 4130 DATA | 92,  | 195, | 232, | 18,  | 0,   | 172, | 60,  | 0,   | 770  |
| 4140 DATA | 116, | 5,   | 232, | 3,   | 0,   | 235, | 246, | 195, | 1032 |
| 4150 DATA | 86,  | 180, | 14,  | 205, | 16,  | 94,  | 195, | 86,  | 876  |
| 4160 DATA | 50,  | 255, | 180, | 2,   | 205, | 16,  | 94,  | 195, | 997  |
| 4170 DATA | 198, | 4,   | 92,  | 70,  | 50,  | 210, | 180, | 71,  | 875  |
| 4180 DATA | 205, | 33,  | 195, | 178, | 7,   | 180, | 2,   | 205, | 1005 |
| 4190 DATA | 33,  | 195, | 180, | 0,   | 205, | 22,  | 195, | 185, | 1015 |
| 4200 DATA | 0,   | 32,  | 235, | 4,   | 139, | 14,  | 11,  | 1,   | 436  |
| 4210 DATA | 180, | 1,   | 205, | 16,  | 195, | 190, | 158, | 0,   | 945  |
| 4220 DATA | 185, | 12,  | 0,   | 172, | 60,  | 0,   | 116, | 19,  | 564  |
| 4230 DATA | 60,  | 46,  | 117, | 12,  | 131, | 233, | 3,   | 176, | 778  |
| 4240 DATA | 32,  | 243, | 170, | 131, | 193, | 3,   | 235, | 235, | 1242 |
| 4250 DATA | 170, | 226, | 232, | 176, | 32,  | 243, | 170, | 87,  | 1336 |
| 4260 DATA | 131, | 199, | 9,   | 139, | 22,  | 154, | 0,   | 161, | 814  |
| 4270 DATA | 156, | 0,   | 187, | 10,  | 0,   | 253, | 139, | 202, | 947  |
| 4280 DATA | 51,  | 210, | 247, | 245, | 145, | 247, | 243, | 146, | 1532 |
| 4290 DATA | 4,   | 48,  | 170, | 139, | 193, | 11,  | 202, | 117, | 884  |
| 4300 DATA | 237, | 252, | 95,  | 131, | 199, | 11,  | 139, | 22,  | 1086 |
| 4310 DATA | 152, | 0,   | 139, | 194, | 177, | 5,   | 211, | 200, | 1078 |
| 4320 DATA | 37,  | 15,  | 0,   | 177, | 255, | 181, | 45,  | 232, | 942  |
| 4330 DATA | 114, | 0,   | 139, | 194, | 37,  | 31,  | 0,   | 177, | 692  |
| 4340 DATA | 0,   | 181, | 45,  | 232, | 102, | 0,   | 139, | 194, | 893  |
| 4350 DATA | 177, | 9,   | 211, | 200, | 37,  | 127, | 0,   | 5,   | 766  |
| 4360 DATA | 80,  | 0,   | 61,  | 100, | 0,   | 114, | 3,   | 45,  | 403  |
| 4370 DATA | 100, | 0,   | 177, | 0,   | 181, | 32,  | 232, | 75,  | 797  |
| 4380 DATA | 0,   | 71,  | 139, | 22,  | 150, | 0,   | 139, | 194, | 715  |
| 4390 DATA | 177, | 11,  | 211, | 200, | 37,  | 31,  | 0,   | 80,  | 747  |
| 4400 DATA | 61,  | 12,  | 0,   | 118, | 3,   | 45,  | 12,  | 0,   | 251  |
| 4410 DATA | 61,  | 89,  | 0,   | 117, | 35,  | 184, | 12,  | 0,   | 377  |
| 4420 DATA | 177, | 255, | 181, | 58,  | 232, | 37,  | 0,   | 139, | 1079 |
| 4430 DATA | 194, | 177, | 5,   | 211, | 200, | 37,  | 63,  | 0,   | 887  |
| 4440 DATA | 177, | 0,   | 90,  | 181, | 112, | 131, | 250, | 12,  | 953  |
| 4450 DATA | 115, | 2,   | 181, | 97,  | 232, | 13,  | 0,   | 176, | 816  |
| 4460 DATA | 72,  | 246, | 6,   | 149, | 0,   | 6,   | 116, | 2,   | 597  |
| 4470 DATA | 170, | 195, | 71,  | 195, | 246, | 243, | 5,   | 48,  | 1173 |
| 4480 DATA | 48,  | 128, | 247, | 0,   | 116, | 6,   | 60,  | 48,  | 635  |
| 4490 DATA | 117, | 2,   | 176, | 32,  | 171, | 128, | 197, | 170, | 1603 |
| 4500 DATA | 195, | 0,   | 0,   | 0,   | 0,   | 0,   | 0,   | 0,   | 195  |

80-column screen. DR isn't sophisticated enough to implement word wrap, nor can it guess the default margins of your word processor. Standard ASCII text files with margins of 80 columns or less will look just as you'd expect, but text files from word processors that either omit carriage returns for repaging purposes or format the text within specified margins will not display in the same format in which they were created. A word processor's page formatting control codes will appear as gibberish, of course, but this should present no major problem. The text will still be quite readable. If you choose to view an executable file, however, unless there are some embedded text strings such as a copyright notice or message strings, it all will be gibberish. You might find it interesting to look for all the command strings in COMMAND.COM.

If you use DR to list the root directory of your boot disk, you will find the two DOS system files, IBMBIO.COM and IBMDOS.COM, included in the list, although they are omitted by the DOS DIR command. DR lists any hidden or system files that it finds. To distinguish these from normal files, DR places an 'H' immediately after the 'a' or 'p' in the file creation date. If you have protected software installed on your system, you

probably will find a protection scheme filename in the listing you never have seen before. These files will also be marked with the 'H'. You can safely F1 (View) these hidden files, but if you try to delete, rename, or move them, the DR's only response will be a beep.

While debugging DR, I discovered an interesting thing about the DOS function 56H (rename or move a file). I wanted to see what would happen if I renamed IBMBIO.COM to TEST and then, after renaming some other test files, renamed TEST back to IBMBIO.COM. It seemed to work fine, but the next time I booted I got the awful DOS message, 'Non-system disk or disk error'. This meant that one of the three system files, IBMDOS.COM, IBMBIO.COM, or COMMAND.COM, was not found. After booting from a floppy, I discovered (with a little peeking around with DEBUG in the root directory sector of my hard disk) that IBMDOS.COM was no longer the first directory entry — which is where it belongs.

The renaming or moving process does nothing to the actual data, but it does use a new slot in the directory for the new name. You would think that DOS would use the same entry position in the directory when you rename a file, and would just write the new

name right over the old name. Not so. Instead, DOS first enters the new name for the file in its next available directory space. Then DOS deletes the old name by placing the 5EH as the first character of the filename. Operation of your system and/or protected software is not only sensitive to the filename, but also to the logical location in the directory as well as its physical location (its track and sector). Therefore, for your protection, DR refuses to operate on these special files.

I should explain why the 'bytes free' that complements 'file(s)' with the DOS DIR command was not included in DR. There is, after all, a simple DOS interrupt function that returns this information. But DR was designed with speed in mind. Most of this speed can be attributed to DR writing directly to the screen buffer. The DOS interrupt for retrieving disk free space (function 36H) is atrociously slow. To see what I mean, at the DOS prompt enter DIR and watch how long it takes for DOS to display 'bytes free' after it whips out the file count at the end of the listing, and you'll see why the disk free space did not make it past the wish list.

## Inside DR

Most of the DR code is a potpourri of



## DR at a glance

DR.COM provides an integrated set of file management facilities for sorting, viewing, renaming, deleting, and moving files to another directory. The command is entered at the DOS prompt, with the following syntax:

### DR [d:] [directory]

The default filename display (21 per page, to a maximum of 721) is sorted alphabetically. Various switches, added to the command, may be added to sort by other criteria:

/E (sort by Extension)  
 /S (sort by Size)  
 /D or /T (sort by DaTe)  
 /O (sort by DOS DIR order)

Thus, for example,

### DR \PROG /S

sorts the initial display of the PROG

directory of the default drive by size.

When a DR listing is on-screen, a menu is displayed showing further options. A highlight bar illuminates a single filename, and the Up and Down Arrow keys move the bar a line at a time. The PgUp and PgDn keys move it a page at a time, and Ctrl-PgUp and Ctrl-PgDn move it to the top and bottom of the current page. Home and End move to the beginning and end of the directory listing. Pressing (and repeating) a letter moves the bar to the first (and successive) filename(s) beginning with that letter.

The highlighted file may be brought on-screen for viewing by pressing F1 (or Enter or Ctrl-V). The Up and Down Arrows, PgUp and PgDn, and Home and End work within the file, as well. Esc, Enter, or F1 returns you to the menu and directory listing. At the

menu level, Esc terminates the program.

Within DR, these function keys or Ctrl-letter combinations are

|         |                   |                         |
|---------|-------------------|-------------------------|
| F1..... | Ctrl-V (or Enter) | View file               |
| F2..... | Ctrl-D            | Delete file             |
| F3..... | Ctrl-R            | Rename file             |
| F4..... | Ctrl-M            | Move file               |
| F5..... | (none)            | CONFIRM DELETE ON/OFF   |
| F6..... | Ctrl-W            | WordStar hi-bit ON/OFF  |
| F7..... | Ctrl-N            | Sort files by Name      |
| F8..... | Ctrl-E            | Sort files by Extension |
| F9..... | Ctrl-S            | Sort files by Size      |
| F10.... | Ctrl-T            | Sort files by Date      |

Successive sorts can be used to arrange files, eg, in order of size and then, additionally, by extension.

Files can be renamed and may be moved from one directory to another within DR, but they cannot be copied from within DR.

somewhat modified routines I've used in other programs. The viewing function, however, presented a new, challenging subroutine. Instead of rehashing the old routines, therefore, I'll focus the discussion on DR's algorithm to display files. Creating the algorithm is an easy task as long as the user is restricted to paging through the document in a forward direction. All the algorithm has to do is to keep a lookout for either carriage returns or linefeeds.

If backward paging is to be added, the simplest indexing algorithm is to count backward 25 linefeeds to find the previous page. (When I speak of 'page' here I mean the 25 lines displayed on the standard monitor, not the 66 lines of a type-written page.) This doesn't work so well if the line is longer than 80 columns or if carriage return/linefeed combinations are missing, as they are in the document files of many word processors, eg XyWrite. In such cases a paragraph will be strung out all on one line to the right and off the screen. And, of course, executable files will have linefeeds only by coincidence. If line wrap is employed to keep the text from exceeding the 80-column margins of the screen, then counting linefeeds can no longer be used as an indexing method to find the previous page.

I wanted DR to display the text in the 80-column format, so I added the criterion that line wrap would occur under two conditions: one, if a carriage return were encountered, or two, if

column 80 were encountered before a carriage return. If column 80 is reached before a carriage return, in order to keep the text in an 80-column format, DR starts the next display on the following line. This is line wrap and should not be confused with word wrap.

The 80-column format complicates matters, however. If the user enters a request to scroll back a page, DR cannot just count backward 25 linefeeds, but instead the total number of characters displayed on the screen must be counted backwards. Another problem arises in how to handle the Up and Down Arrows, requesting to move one line at a time. Let's take paging backward (moving backward 25 lines at a time) first and then I'll explain scrolling backward (moving backward a line at a time).

It may seem as simple as storing the current offset into the file buffer for each page of the file. This works fine for small files, files under the 32k buffer DR maintains at any one time for display. When a file is first opened for viewing, 16k is read into the second half of the buffer. (DR assumes that the user will find what he wants with quick peeks at the first page or so. In order to keep disk access time to a minimum, DR reads only 16k at a time.)

When page forwarding reaches the end of the first 16k of the file, this block is moved to the first half of the buffer and the next 16k is read into the second half of the buffer. We now have 32k bytes of the file buffered, with the current offset in the middle.

Subsequent paging, forward as well as backward, will not require (for a while) another time-consuming disk read.

### Relative offsets

This shuffling of the data in the buffer has changed the address of the current offset in the buffer by 16k. Not only will the current offset be off, but all the other offsets saved with paging will also be off by 16k. In order to solve this problem, DR does not save the absolute offset of the page. Instead, it stores the relative difference between pages. This is the number of bytes it took to display one screen. In this way, all DR has to do is keep track of the current offset of the last page. You will find this variable defined as LAST\_PAGE in the assembly listing. If the second half of the buffer is moved into the first half, the absolute address is adjusted by 16k and, since all the other pages are relative addresses, they are essentially adjusted as well. These page lengths are stored in a single dimensional array variable called PAGES. You can think of this as the same as the Basic variable index function used with the dimension (DIM) statement. Thus the length of page 1 is stored in PAGE(1) and page 2 in PAGE(2), etc. With each succeeding PgUp, the current offset is adjusted by this length of page and stored as the new current offset.

### Line scrolling

Now we come to the question of scroll-

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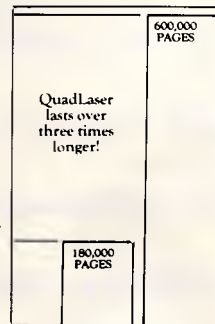
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## Type right

DR handles one special situation that the DOS TYPE command does not. If a text file is exactly 80 columns wide, followed by a carriage return/linefeed, the TYPE command, after displaying the 80 columns of text, will wrap to the next line. The first character encountered on line 2 is the carriage return, so TYPE moves down one more line. This has the effect of double-spacing a single-spaced 80-column document. DR, after displaying column 80, checks to see if the next character is a carriage return. If so, the file pointer is bumped past it, avoiding the annoying double-spacing.

DR insists on having all 64k of the space allotted to a .COM file and, if not found, it exits with a 'Not enough memory' message. The unknown string variables, current directory, request directory, and highlighted filename are all stored at the end of DR's 3370 bytes of code. This is followed by the directory listing, page lengths, and file buffer.

Excluding these variables as

reserved, defined bytes excludes those lengthy bytes of zeros from appearing in the .COM file on disk and, most importantly, the Basic listing (Fig 2).

The file buffer has an absolute starting address 32k below the 256 bytes reserved by DR from the stack, as

*'There's a constant battle between making utilities powerful and keeping their code short.'*

shown in the table, '64k Memory Map of DR'.

The space between the string space at the end of code and the file buffer at the end of the segment is dynamically allocated for the filenames and page lengths. Just below the file buffer, DR reserves a minimum of 50 words as the storage location for the page lengths.

The space between the last string variable at the end of code and the 50-

word storage for pages is used for filenames. This is room enough for 721 filenames, more than enough room for most subdirectories. If, however, you hit this barrier, DR will exit with a 'Too many files' message.

If the list of filenames is less than the 721 allocated, as will be the case with most directories, DR allocates the space from the last directory entry storage to the file buffer for the page variables, greatly increasing the number of displayable pages. This dynamic memory allocation gives DR the flexibility to meet most directory doctoring needs.

There's a constant battle between making the utilities for this column powerful and keeping their code length short, and this time the can-you-add-one-more-need-function side won. If you enter these programs at your keyboard rather than download them from Microtex, I fear you'll find this one a brute. But, considering the time-saving power you're getting, I think you'll agree the work is worth the effort.

END

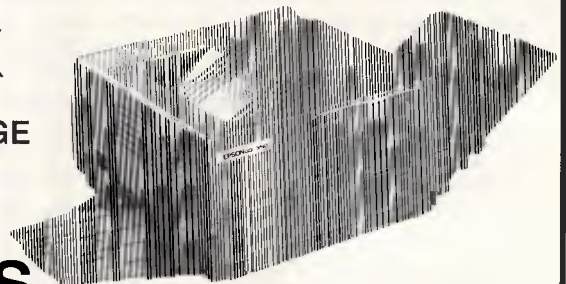
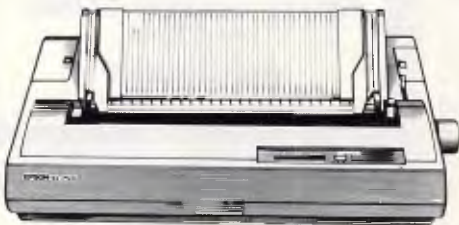
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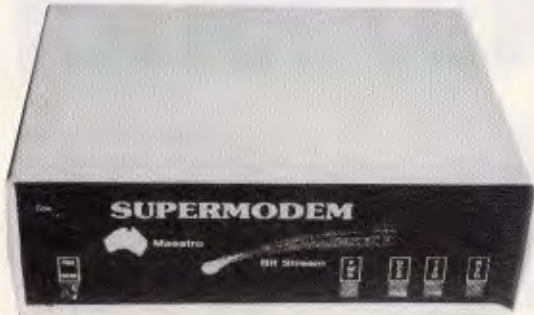
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# What every desktop publisher should know

***Desktop publishing has become the fashionable 'buzzword' in computing circles, but some fundamental printing and design conventions need to be mastered before the software can be used proficiently. Henry Budgett explains the jargon.***

In a world where, far from becoming 'paperless', our output of printed material is doubling at an alarming rate, it is hardly surprising that any attempt to increase our efficient use of paper is rapidly accepted. Just two years ago desktop publishing (DTP) was unheard of, but today we are as familiar with the term as with the spreadsheet, the word processor or the database. Sadly, we are not as familiar with its correct use.

The publishing process is not a single act as with word processing, but a long and complex undertaking. That is not to say that someone who is using word processing or a similar application will not be able to make the best of a desktop publishing package, but rather to point out that new skills will need to be learned and new concepts understood.

It is essential to realise at the outset that desktop publishing software is totally unlike any other; by itself it doesn't produce anything. It most closely resembles an infinite supply of blank sheets of paper onto which items may be attached in order to create a page, which may contain text or graphics or both. The arrangement of the text can be altered at will — as can its position

— without ever having to reach for scissors or glue. DTP acts as an integrator of the output from other office automation packages. The user creates the pages by manipulating this information so as to make it pleasing to the eye, informative, amusing, or whatever effect is required.

## *Conventions*

The need to understand design is often heavily stressed during conversations

---

*'Desktop publishing is one of the most seductive 'toys' that can currently be found on any computer system'.*

---

or articles on DTP. A rather more realistic approach would be to point out that there are certain conventions which have been imposed by traditional working methods. The freedom gained by using electronic means to create the page has already changed

those working methods and is, itself, leading to new conventions.

Desktop publishing is one of the most seductive 'toys' that can currently be found on any computer system. The sheer freedom to play around with typefaces, styles and sizes — a process impossible with conventional word processing — tends to mean that users will try all the possible combinations. While this may be 'wrong' according to the traditional school, it costs nothing apart from time — and quickly reveals what does and doesn't work in terms of presentation.

The most fundamental realisation that needs to be made is that desktop publishing uses 'real' typefaces which are proportionally spaced and not the monospaced characters of the word processing world. Because of this you will need to develop the idea of working within a 'grid'. The grid is really a set of guides which help you to produce a consistent document, and in traditional printing would consist of sheets of heavy paper pre-printed with a pattern of blue lines. (Blue doesn't reproduce when photographed for printing.) Following traditional methods, the typeset text would then be pasted down within this framework and





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Illustration by Kate Simpson



photographs and illustrations added as required. The whole sheet would then be photographed at actual size and the resulting image used to make a plate. This latter stage, the photography and platemaking, still forms a part of DTP where large numbers of copies are required.

Designing a grid for the pages you wish to produce is really a matter of common sense. With the A4 page, say, the number of options is rather restricted; one column of text is too wide to read comfortably, while four columns are often too narrow. The user's choice, therefore, rests with two or three.

Other elements of the grid — spaces for photographs and illustrations, page numbers and other items that will appear on each page — can also be added at this stage. Creating grids with desktop publishing software is a matter of moments with most of the good packages and, once created, they can be used over and over again without ever needing to be redrawn.

Choosing the typeface and style for the document is the next biggest hurdle. Because of the flexibility in DTP many users tend to over-experiment with the design of their pages, and documents can easily resemble Victorian handbills in design: there seems to be an almost universal delight in trying out all the fonts on one page! Once again, it is only the traditional approach which says that this is actually wrong. Usually the choice of typeface and style is simple to make: pick one that looks good to your eye.

A good rule of thumb is to restrict your early use of type to one or two typefaces in the document in no more than three sizes. With a word processor you might get bold and underlined with, perhaps, italics. Apart from the variations in pitch, the other typographic controls available are limited in the extreme. Now you have entered the world of desktop publishing, there are many controls to consider and many more traps for the unwary.

## Design

In general terms it is best, but not essential, to choose one typeface for the main text and a different one for headings. Traditionally, and with good reason, large amounts of text are set in a serifed face (that's the one with the little tick marks at the ends of the letters) and headings are set in a typeface that doesn't have them: a sans serif face. (APC doesn't follow this convention, so reinforcing my

point that one doesn't have to conform.)

The two other main decisions that have to be made at the design stage are the sizes of type and the style in which it is to be set. The size of the type and the amount of spacing between lines, the leading, are very much more controllable within desktop publishing than word processing. Typesizes are measured in points; one-point is 1/72nd of an inch, and can normally be controlled in at least one point increments. Just as with word processing, type can be set flush with the left-hand margin, centred or justified. In this latter case it is important to realise that we should expect true hyphenated justification (or H&J as it is commonly known). Words can be split according to a set of pre-defined rules or from a table of correct hyphenations, but in both cases you may wish to ensure that English English is being used rather than American English.

Part of the decision as to whether to justify text or not should rest on the kind of product that is being produced. The human eye and brain are much happier reading short to medium length unjustified lines, although books are conventionally justified. Once again, however, it costs nothing to try an idea out.

All the points raised so far are conceptual rather than practical and would apply to any publication method from handset lead type through to true electronic publishing. Where desktop publishing begins to score, even over its close cousin, corporate electronic publishing (or CEPS), is in its ability to integrate with current personal computer systems. While Apple was the first company to successfully market a desktop publishing system, although Xerox invented it, the business world tends to run on PC-type systems rather than Macintoshes. Early PC-based software was both expensive and fairly awful; Studio Software, which produced the first desktop publishing program for the PC, recently went to the wall as a direct result of being unable to keep up with the new leaders.

Any desktop publishing package worth considering should be able to read files from a wide range of word processors, databases, spreadsheets and graphics packages in their native format. That is to say that a word in bold in your word processor file should still be bold when it gets onto the page, even though it has changed from being a monospaced typeface to a 'real' typeface and may also be in a different typesize. Similarly, graphics files should be able to retain their formats

and display an accurate representation of their content, either when viewed on the screen or printed on the page.

Using graphics in a publication produced by traditional means is straightforward. When the drawing has been created it is measured up, and a reduced or enlarged version is pasted onto the page prior to being photographed for printing. There is absolutely nothing to stop this method being used for desktop publishing, and where the original only exists in printed form it may be the only viable method.

If, however, the lure of creating illustrations by electronic means is strong, then consider the following carefully. Before choosing a painting or drawing package it is important to realise the fundamental difference between them. A painting program creates images as a pattern of dots on the screen and the resolution of that screen determines the resolution at which that image may be printed, irrespective of the resolution of the printing device. An image drawn on, say, a Macintosh screen is stuck forever at 72 dots per inch — whether printed out on a matrix printer or a plotter.

A drawn image, on the other hand, consists of a series of coordinate points and instructions on how to join them up. Because it is the instructions which are stored, and not the pattern of dots, it is possible to reproduce them on any system, at whatever size is required. Patterns of dots from a painting program tend to fall apart when enlarged or coagulated into muddy puddles if reduced. For serious work, stick firmly to drawing or object-orientated programs.

Photographs are widely used in publications but cannot yet be successfully integrated into desktop publishing. That doesn't mean that you can't use photographs, merely that the traditional methods still produce better results than the electronic ones. Scanners convert the image they are given into a pattern of dots, typically at a resolution of 300dpi. If this is printed directly on a page printer at the same resolution the results seem reasonable, but if you attempt to reproduce the image by photocopying or traditional printing the lack of quality becomes all too apparent. A 300dpi scanner can manage to scan in line artwork but, apart from using it as a guide, photographs are best left well alone.

The problem is two-fold. Photographs consist of a continuously varying tone, hence the name 'half-tone' in the printing world. To reproduce them by traditional methods involves using a special





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camera which can reduce the photograph to the required size and, at the same time, convert it into a pattern of dots — a process called 'screening'. What makes this pattern of dots different to those that can be produced by a scanner and page printer is that they vary in size. A basic scanner can capture a dot as either being there or not; it is a binary device. More sophisticated scanners can capture levels of grey as well, but they do require more memory. An A4 page scanned at 300dpi needs just over 1Mbyte of storage; whereas the same page scanned at 16 levels of grey would need 4Mbytes. The base level for anything approaching quality reproduction would be 64 levels, and this needs over 6.5Mbytes.

The problem doesn't end there. The page printer is a binary device: it either prints a dot or it doesn't — and is, therefore, incapable of producing dots of varying sizes. The scanner manufacturers use lots of clever software to simulate halftones by a process called 'dithering'. This uses a varying pattern of dots to create the effect of varying intensities of grey but, at 300dpi, it is a pretty poor attempt. To achieve newspaper quality reproduction — the lowest we tolerate in daily life — would require a 700dpi scanner and a 700dpi page printer — devices that simply do not exist on the desktop publishing scene.

Because photographs and line artwork processed through a scanner are captured as bit-maps, all the earlier comments about painting programs apply equally when it comes to resizing them for inclusion within a page. One very significant product, Adobe Illustrator, looks set to change that for line artwork at least but it will be a year or two yet before scanned photographs become a reality.

## Page makeup

Collecting all the raw material to create the final page or document is only the beginning of the desktop publishing process, and is something that would have to have been done whatever system was being used. It is at this point that things start to change and we can add the phrase 'page makeup' to the vocabulary.

When you have completed the design process and selected the details concerning the number of columns, typeface, and so on, you will be ready to load all the prepared information into your chosen page makeup package. The choice of which package to select

## SON OF VENTURA?

As soon as you see the display you'll realise that GEM Desktop Publisher bears an uncanny resemblance to Ventura but, given the product's history, that should hardly come as a surprise. The team of programmers who began work for Digital Research on a desktop publishing product split; some going out on their own to form Ventura, the rest remaining to complete the project.

ONCE THE INITIAL FEELING OF *deja vu* has faded away one is left wondering how much or, perhaps, how little of the Ventura power is retained by the GEM product. The answer is, rather like Rolls Royce's description of their engine's horsepower, sufficient for its purpose. It would be wrong to claim that the product contained the considerable functionality of Ventura but neither would it be fair to describe it as just a 'cut-down' imitation.

### Market Positioning

Our testing of the product has been restricted by the requirements of a major project that we are currently undertaking but the first impressions are good. To begin with we would take issue with the positioning of the product; on DR's own admission it isn't playing in the same league as products like Ventura, PageMaker or Harvard Professional Publisher. What it offers is a very powerful document formatting capability with restricted typographic controls. This makes it well suited to use in the traditional WP environment as a text processing tool for, say, reports and simple documents. And, as these represent the largest volume of documents produced in the business market, DR should not find much difficulty selling it as that.

HOWEVER, DR want to position it as a desktop publishing product and here it comes up against products such as Mirrorsoft's Fleet Street Publisher for the Atari and, soon, for the PC. These contain the refinements that the GEM product lacks. Office publishing and document formatting are, sadly, phrases that don't roll off the tongue quite as nicely as

desktop publishing but that's the market that'll buy GEM Desktop Publisher. It's quite powerful enough to turn word processed reports into presentable documents



and many of the apparent limitations could well prove to be a bonus for those worried about the issues of controlling enthusiastic new desktop publishers.

### Background Details

GEM Desktop Publisher runs, as expected, under the GEM environment and operates as a WYSIWYG program with the same style of operation as Ventura. Text files can be imported with their formats intact from 1st Word Plus, GEM Write, Wordstar, WordPerfect, Multimate and Displaywrite as well as in DCA form or as plain ASCII. One clever feature is that the keyboard can be re-mapped to use command sequences that users are familiar with from their word processor. Graphics files can be imported from anything that produces GEM format .IMG and .GEM files. Don't expect to be able to do much in the way of graphics within the program, though!

Just as with Ventura, GEM Desktop Publisher uses a system of tags to control the format of the document and these can be inserted either into the plain text brought into GEM DTP or incorporated into the original word processed document. Text files can be extracted from GEM DTP pages, a slightly more controlled method of document management than

that used by Ventura. GEM DTP saves its pages in a Ventura format so, given a matching style sheet the pages could be read back into Ventura for further

enhancement.

One serious omission here is that it is not possible to tell what style sheet is currently loaded, nor is any immediate indication provided of the tag attached to a given paragraph. Both these are, in our opinion, omissions which make the product significantly harder to use. The method of copying paragraph tags has also changed, the style attached to the new tag doesn't automatically affect the selected paragraph, it has to be selected. This, actually, is not a bad idea as there has been many an occasion when we have had little accidents with the Ventura approach.

### Getting Started

SETTING UP A PAGE USES A method very similar to that found in Ready, Set, Go! or XPress; areas to contain the text are marked out using the Frames tool and then designated as containing one or more columns, the limit is four. Plus points of this method over Ventura are that it's quicker and you have the option of getting an exact read-out of the cursor position so placement can be very accurate without having to resort

*This valiant effort at a page layout displays numerous common errors:*

- *Headlines should never be justified or hyphenated — if necessary, rewrite the words to fit*
- *Uneven spacing — to give a page a coherent 'feel' make sure that the gaps between paragraphs, or between headings and paragraphs are all the same. In this case the last column has been 'stretched' vertically. Cross headings in larger typefaces should have extra space below them to prevent descenders (letters like 'g' and 'p') from crashing into the following text*
- *Practically every paragraph starts in a different way — indented or not, large capital letter or small caps. Keep to one or two styles and make sure you know why you're using them. Headings should add 'structure' to the page*
- *A single word on a line on its own (for example, the word 'enhancement' under the picture) gets lost. In this case moving the picture up a line or two might have helped; otherwise a quick bit of rewriting could have lengthened the line*
- *When using columns, make sure the lines of text line up across the page. The spacing for headings or pictures needs to be a whole number of lines*
- *If using a bit-image graphic, crop it rather than distort it to fill the shape you want. Enlarging an image too much gives a coarse blocked effect*



is usually helped considerably by a number of factors:

- Firstly, and most important, is the type of product you wish to produce. For example: is it a short document or a long one? Does it include illustrations or photographs? What methods are currently used to produce it?
- Secondly, you must consider the environment within which the work is done. Is it based on PCs or is there a free choice of machines? Will data files come from one program or many and are they the same type.
- Finally, you will need to consider the people who are going to be using the product. Are they writers or designers, or managers?

There are fundamentally two different approaches to creating pages electronically. The first method follows the conventional cut & paste concept with varying degrees of enhancement, while the second removes much of the drudgery and lets the software handle the complicated stuff. It is important to realise early on that the degree to which you can let the computer get on with producing your pages automatically corresponds exactly to the amount of control over those pages that you will be able to exert as a user.

In the good, old-fashioned days, text was sent off to be typeset and came back in long strips called galleys. When they had been proofread and corrected to satisfaction, these galleys were cut up and pasted down onto a master layout sheet using wax or gum. When an illustration or photograph was to be used, the appropriate area was opened up and the relevant item inserted. If text needed to be re-set for any reason, it was back to the typesetter again.

This process has been accepted and developed since the first typesetting systems which produced galleys were introduced. It is interesting to note, therefore, that the best-selling desktop publishing package on the market today, Aldus PageMaker, follows this process exactly.

Text from a word processor file flows onto the page as a galley of typeset material. The typeface, size and style are set before the text begins to flow, as are the margins — but any or all of these can be altered at any stage. This eliminates the traditional need to have things re-set — in PageMaker it's a trivial task, although sometimes a little tedious. PageMaker also keeps track of all the bits of the galley, so if a section is moved or deleted, all the other portions move accordingly. The

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We take a look at Digital Research's new desktop publishing package for the less typographically demanding.

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Aldus Manutius, possibly the patron saint of desktop publishers.

are marked out using the Frames tool and then designated as containing one or more columns, the limit is four. Plus points of this method over Ventura are that it's quicker and you have the option of getting an exact read-out of the cursor position so placement can be very accurate without having to resort to typing in numbers. Rulers can be displayed in either inches or millimetres with the option of picas for both. A-series paper sizes are catered for. Interestingly the grid can be set down to 1mm or 1/32" which is better than several packages we could name!

Graphics are placed in much the same way and the text automatically moves out of the way to accommodate them. The runaround is limited to rectangular shapes but at least there's a runaround. Headers and footers can be set up to repeat from page to page but, unlike any other desktop publishing program we've seen they are actually graphics files, not text. This does allow logos and similar images to be merged but seems a strange way of going about it. One good point about all these activities, though, is that they almost all have a keyboard shortcut, so making things much less laborious than they might seem.

### Missing Things

What the product lacks, especially compared with Ventura, is true H&J, kerning, automatic paragraph numbering, automatic Table of Contents and Index creation and a couple of other extremely refined functions that have little if any place in the office document market anyway. On the other hand, it gains by being straightforward to use, once the style sheets have been set up, and sufficiently competent to deliver the goods for most users. If someone gets through GEM DTP and then finds they need more, well there's always Ventura and the learning time will have been substantially reduced.

*The previous sample page much improved. Cross headings add structure by emphasising different parts of the article. The use of a narrow caption has enabled the graphic to be kept to the correct proportions. And the restrained use of typefaces and styles gives a coherent 'feel'. The cross headings have been spaced so as to clear the following text and to keep the text on a notional 'grid', lining up across the page*

benefits of this method are that it can be easily understood and it gives total control over every element at all times.

A variation on this theme is found in packages like Ready, Set, Go! and XPress. Here the galley flows into frames or boxes that have been predefined. This can be much quicker with the text running automatically from page to page, but although the control is there such packages are not so intu-

tive to use. For regularly repeated designs it can be very much faster than the 'by hand' approach of PageMaker, but some of the flexibility is lost as a result.

The other main contender is the 'stylesheet' approach as used by Ventura. Here tags are attached to sections of text which are then dropped into a template or pre-defined page layout. The tags can have meaningful



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names like 'Heading' or 'Bullet' which hide a very complex list of typographic controls. These can determine the typeface, size, style, leading, kerning, line-breaks, and so on, completely automatically. This makes Ventura ideal for publishing long, regular-format documents like books or manuals, where the main desire is to keep the style consistent.

The concept tends to fall down slightly when variations are required. It is possible to start off with just one or two tags which control the typographic elements but by the time page numbers, headers, footers, indexes, and so on, have been included the list can get unwieldy. The ideal place to add these tags is when the document is created, otherwise the process becomes even more laborious than with PageMaker. Given a pretagged document and a pre-designed template, however, Ventura can produce pages faster than anything else running on a micro.

Regardless of which product you choose and, if you produce different sorts of document you may well end up with more than one, the important thing is to select the correct tool for the job. In some cases this may even mean not using a page makeup package at all but rather a high-powered word processor like Lotus Manuscript, Word or WordPerfect. It is vital to match the software to the task, not the other way around.

It is also important to realise that the majority of design decisions are simple ones. Indeed, the best designs are usually very simple and elegant rather than cluttered or busy. Remember, above all, that the purpose of the document is that it should convey information easily.

### Conclusion

Just as the advent of the word processor allowed people to produce text more efficiently, so will the introduction of desktop publishing allow people to produce documents easily. But, just as with the word processor, the content and presentation of those documents do not necessarily reflect a similar improvement. It is often the case that the quality of the documents produced by someone adopting desktop publishing worsens rather than improves.

If desktop publishing is considered as a tool then it is important, as with any tool, to select that tool correctly and use it sensibly. Most of the techniques are simple, so don't be too ambitious at the start.

END



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## Multi-purpose modem

I recently came across the Commonwealth Bank's Phonebank service, which offers computer simulated voice information over the phone. As I was not disposed to spend \$40 for a hand held Tone-sender, but still desired the free bank data, I decided to explore the possibility of using my modem to emulate the device.

The program in Fig 1 is the result of my labour. The key feature of the program is that it dials the number in pulse mode but switches to tone mode to communicate with the bank's computer. It is recommended that a phone be hooked in parallel to allow the computer voice to be clearly understood, and of course this is essential if you do not have a speaker in your modem. The program uses the standard Hayes AT codes and should be compatible with any modem which emulates these codes.

As you will appreciate this is a poor use for an expensive modem, but for someone with an auto-dial modem who does not have Viatel and Telebank ac-

```

5 PRINT "** Connecting to Phonebank **"
6 PRINT " "
10 OPEN"COM1:1200,N,8,1,CS0,DS0,CD0" AS #1
20 PRINT #1,"ATM2DP2614144;"
40 INPUT "Input Account number & Press [ENTER] when asked":A$
41 PRINT #1,"ATDT",A$,";"
42 INPUT "Input Password & Press [ENTER] when asked":B$
43 PRINT #1,"ATDT",B$,";"
50 INPUT "Input Selection [ENTER] when asked":C$
51 IF C$="9" THEN 69
52 PRINT #1,"ATDT",C$,";"
53 GOTO 50
69 PRINT #1,"ATH"
70 CLOSE #1
80 SYSTEM
OK
    
```

Fig 1 See 'Multi-purpose modem'

|   | C  | D | E                          |
|---|----|---|----------------------------|
| 3 | 50 | 0 | +C3/D3                     |
| 4 | 25 | 0 | @IF(@ISERR(C4/D4),0,C4/D4) |
| 5 |    |   |                            |

Fig 2 A formula that turns ERR into 0

cess (at around \$85/year), this is a cheap alternative.

Please excuse the poor program structure, I did not have a manual at hand when I wrote the program, and my Basic is just that.

Ian Brightwell

## Getting rid of ERR

In 1-2-3 and in other spreadsheets, when you divide by 0 or try to calculate the square root of a negative number, you will get an ERR display. That can be useful, but it's also unsightly. In Fig 2, I have written a formula that will prevent the ERR display. The formula in E3 calls for division by 0, so it will

display ERR. The formula in E4 actually calls for the same thing but tests for the ERR condition before doing the calculation. Only if the calculation will not result in ERR will it proceed normally and its results be displayed.

J Natividad

ERR, like NA, will spread through a spreadsheet to every cell that references a cell with that condition. Mr Natividad's formula shows how to avoid that problem, since subsequent cells now refer to a legitimate number, 0 — JT.

## Managing files

It's easy to use 1-2-3 to manage disk files. Once you read a disk directory into a worksheet, you can use data commands to sort and search for filenames. The macro in Fig 3 does the hard part: reading a directory into 1-2-3 and breaking it into columns of labels and numbers.

The macro is designed to run on a two-floppy system, in which drive B: is the default data drive. (You can easily modify it to run on a system of any configuration.) Put the cursor where you want the list of files to appear, and run the macro. It begins by using the file manipulation commands {open} and {writeln} to write a batch file, EX.BAT, and then uses the /S command to exit



```

{open "A:EX.BAT",w}{quit}
{writeln "dir b: > b:LIST"}
{writeln "EXIT"}
/s
/fit
LIST.~
{down 3}|L>>>>>**L>>***V>>>>***L>>>>>***L>>>>>
~/dpri.
{end}{down}{up}~
o~g
/feoLIST.~y
/feoa{esc}A:EX.BAT~y

```

Fig 3 A macro that reads a directory from drive B: into a worksheet and then parses the file as numbers and text

to DOS. At this point, the user must type EX and hit Enter. This then runs the batch file, which redirects the output of a directory of the B: drive to a file on the B: disk called LIST. The file then runs the EXIT command to return to 1-2-3, and the macro continues execution.

It now reads the newly created file, LIST, into the worksheet as text and then uses a format line to confer the resulting column of long tables into several columns of numbers and labels. The last two lines of the macro tidy up by erasing LIST on the disk in B: and EX.BAT on the disk in A:. That happens after LIST has been created, though, so LIST appears as a file within your worksheet. Just delete it.

Now, if you sort alphabetically by filename, you can quickly see which files are duplicates and which are the most recent. If you like, you can sort by file size, date, and time since these are in separate columns, you can quickly delete any information you don't need. You can also add a column to the directory, where you can note which files to erase, move to another disk, etc. If you have many files you need to erase, sort them to the bottom or top of your list and add a column to the left containing the word 'erase' or 'del'. Save this part of the list as a print file, with the extension .BAT. Then,

once you're back in DOS, run the batch file and it will erase all the files at once.

**K Kunz**

*For purposes of explaining how this macro works, giving the newly created disk file the name LIST makes things very clear. However, LIST is a filename you could already have used for something else. You don't want to destroy that LIST when you create a new LIST, so in real life, I'd redirect the DIR results to a file called either DELETE.ME or something wildly implausible.*

*I like the way this macro exits to DOS for user input and then resumes operation as soon as the batch file returns control to 1-2-3. Short of using a keyboard macro program or wrapping the original loading of 1-2-3 into a batch file, I can't think of a way to make the batch file the macro creates execute automatically without keyboard input. Just think of the fun you could have if you could write a macro that executes batch files at the DOS level — JT.*

## Beeper

As a compiler of very large programs, I decided to make a change in TURBO.COM to cause a beep every time it finishes compiling. It saves a lot

of time if you can hear exactly when a compilation is complete.

Turbo displays the number of lines compiled when it finishes any compilation. To make it beep, I changed the 's' in 'lines' to a bell character (07H). Fig 4 shows a DEBUG session for implementing the beep in Turbo Pascal, Version 3.01A.

**R Milnes**

*I've been looking for a patch like this for my own long programs. Note that you should be able to use this patch on any version of Turbo Pascal. The 'S' (for 'Search') will find the word 'lines' (in the example Version 3.01A, the offset is 3993). Add 4 to that number to get the offset of the final 's' in 'lines' (in Version 3.01A it's 3997). Of course, you never patch the original of any program. Always make a copy and patch the copy — VR.*

## Unusual compatch

Turbo Pascal is a terrific program development environment, but, like many others, I've found it frustrating to have to reply 'Y' or 'N' to the 'Include Error Messages' prompt every time. I felt a command line parameter would be more logical, so I came up with a patch to TURBO.COM. This patch allows you to specify the Y/N answer and the name of the work file at the DOS prompt so that you need not waste time typing it once you're inside Turbo.

The DEBUG script file shown in Fig 5 works only with TURBO.COM, Version 3.01A modifications. Unfortunately, I haven't access to other versions so I wouldn't be able to suggest the necessary changes in the script for them.

Carefully type in the script file using your favourite program editor and save it as PATCH.SCR, or just enter the command

### COPY CON PATCH.SCR

and carefully type in the file. The extra spaces between some lines are deliberate: be sure you include them. Next, place a copy of TURBO.COM and DEBUG.COM in the same directory as PATCH.SCR and enter

### DEBUG <PATCH.SCR

DEBUG will whiz through all of the necessary modifications and return to the DOS prompt. The process leaves the original TURBO.COM untouched and creates the new file, TURBY.COM. This is the patched TURBO.COM.

```

debug turbo.com
-S 100 L 9AF7 "lines"
XXXX:3993
-ECS:3997
XXXX:3997 73.07 <== replace "s" (ASCII 73) with 07H
-W
Writing 9AF7 bytes
-quit

```

Fig 4 The DEBUG procedure for patching Turbo (Version 3.01A) to beep at the end of each compile







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


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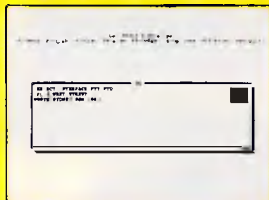


# *Les Stein's Envelope*

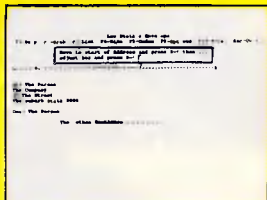
# AUTOMATICALLY

# ADDRESSES ENVELOPES

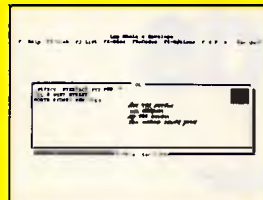
# & PRINTS LISTS OF NAMES



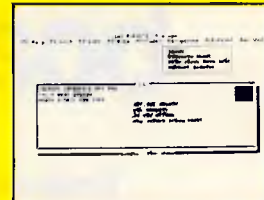
1. Hit ALT +



2. Point to the address.



3. Hit F2 — position address on envelope.



4. Hit F10 print.

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Address \_\_\_\_\_

Phone No. \_\_\_\_\_

```

{$R+}
PROGRAM Preview_Demo;
VAR
  ST : String(80);
  I,A : Integer;
CONST
  Zero = 48; { ASCII code for 0 }
  Nine = 57; { ASCII code for 9 }

FUNCTION Preview : INTEGER;
BEGIN
  INLINE(
    $B8/$40/$00/      { MOV   AX,40h   }
    $1E/               { PUSH  DS     }
    $8E/$D8/          { MOV   DS,AX   }
    $FA/              { AGAIN: CLI   }
    $8B/$1E/$1A/$00/  { MOV   BX,buffer_head }
    $3B/$1E/$1C/$00/  { CMP   BX,buffer_tail }
    $FB/              { STI     }
    $74/$F4/          { JZ    AGAIN   }
    $8B/$07/          { MOV   AX,[BX]  }
    $1F/              { POP   DS     }
    $89/$46/$04);     { MOV   [BP+04],AX }
END;

BEGIN
  WriteLn('Enter text or numbers. <Esc> to quit');
  REPEAT
    A := 0; ST := '';
    I := preview;
    IF Lo(I) IN [Zero..Nine] THEN Read(A)
    ELSE
      IF Lo(I) <> 27 THEN ReadLn(ST);
      WriteLn;
      WriteLn('Previewed ASCII code = ',Lo(I),' , Scan code = ',Hi(I));
      WriteLn('A=',A:5,' ST=',ST);
    UNTIL Hi(I) = 1;
  END.

```

Fig 6 A way to preview a key in the keyboard buffer

mal but the user can enter 'Q' to quit.

The sample in Fig 6 demonstrates the power of Preview. If the first key struck is numeric, entry goes into the Integer variable 'A'. Otherwise, it goes to the string variable 'ST'. Preview returns both the ASCII code and the scan code of the character in the buffer. To end the demonstration, I test for a scan code of 1, the Esc key.

### D Winslow

*Without this function, it's rather difficult to allow reading of different types of variables at once. The usual approach would be always to read a string variable, and then convert it to a numeric*

*type if appropriate. You may find other cases in which it's handy to read the next key pressed without first removing it from the keyboard buffer — NR.*

### Parse trick

Here's an easy way to parse a string into substrings (words) separated by blanks. It uses Turbo Pascal's ParamCount and ParamStr functions. Start by declaring the variables shown in (a) in Fig 7.

The variable SimulateCommandLine occupies the same memory space as does the command line. If you fill the variable with a string that contains

```

(a)
VAR
  SimulateCommandLine : String[127] Absolute CSeg:$80;

(b)
  SimulateCommandLine := StringVariable;
  For I:=1 to ParamCount Do
    WriteLn(ParamStr(I)); { or whatever you want to do }

```

Fig 7 The variable declarations (a) and code (b) for parsing strings

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```
{ $P1, G1, R+ }
PROGRAM Parse;
VAR
  SimulateCommandLine : STRING[127] ABSOLUTE CSeg : $80;
  I                    : Integer;
BEGIN
  WHILE NOT EoF DO
    BEGIN
      ReadLn(SimulateCommandLine);
      FOR I := 1 TO ParamCount DO
        WriteLn(ParamStr(I));
      END;
    END.
END.
```

Fig 8 A parsing filter using Turbo's command line parser

words or substrings separated by blanks, then the code fragment shown in Fig 7 (b) will parse the string.

This certainly is a lot less work and is more efficient than building a procedure or function that looks for embedded blanks and returns substrings. You can use this technique with different delimiters if you first make a pass through the string, converting them into blanks. However, the significance of having different kinds of delimiters is then lost.

**D Schenck**

*I used Mr Schenck's clever trick to create a tiny parsing filter program shown in Fig 8. The {\$P1,G1} compiler directive causes it to read from Standard Input and write to Standard Output. The input might come from the keyboard, or from a file, or even — via 'piping' — from another program. Compile the sample program as PTRICK.COM. Then the command*

**PTRICK < filename**

*will write a whole file to the screen with one word per line. That's not so useful in itself, but consider this command:*

**PTRICK < infile | sort > outfile**

*The result of this command is an output file that contains all the words in the input file in sorted order. You could compare this file to a dictionary file, or use it to generate a word-frequency count. And thanks to the ParamCount trick, the parsing program is elegant and tiny — NR.*

## Changing range names

Here is a quick and easy way to change the name of an existing range in 1-2-3. Start with /Range Name Create. When 1-2-3 displays the already-existing range names, select or

enter the name of the range you want to change. Hit the Edit key (F2), change the range name, and hit Enter. The old name has now become the new name. Watch out for one thing, however: be sure not to change an existing range name to a name that already exists. If you forget and accidentally do this, the range name you wanted to change will simply be deleted, and the one you wanted to change it to will remain unchanged.

**R Dorchester**

*This is actually not a bad little trick. While I was playing around with this technique, I rediscovered that it's possible to have range names that are composed of spaces only. If you already have range names, you can't use /rnc to make such a range name because hitting the Spacebar just cycles you through the list of names you already have. However, you can make labels that are nothing but strings of spaces and give these names to the cells to their right with the /Range Name Label Right command. As an alternative, you can use Mr Dorchester's editing technique to change any existing range name into a space or spaces. Range names that contain only spaces are perfectly legal, although seeing a formula such as @max( ) or @avg( ) is admittedly a little disconcerting — JT.*

## Simulator tricks

I have found a trick for flying an F18 in the World War 1 Ace battlefield with SubLogic's Flight Simulator on the Apple II. I used the Flight Simulator II (A2-FS2) and JET (A2-JT1). Boot the JET program and then place Flight Simulator II into the active disk drive. Next, choose modes 1, 2, or 3; any skill level; and the F18 (carrier-based aircraft). To get to the battlefield, set the throttle to afterburner and imagine

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## TJ'S WORKSHOP

you are taking off from the carrier. Press the pitch-up key several times so you don't crash. As soon as you take off, go to a heading of approximately 245 degrees, which puts the battlefield in the direction of flight.  
**J Allan**

### Cameleon cursor

If you press Control-6 on the IIGS and then type a character, the character you press will become the new cursor shape. To change the cursor within a program, you might have a line like

```
320 PRINT CHR$(30):"M"
```

which would make the cursor change into an M (CHR\$(30) is the hexadecimal number for Control-6).

**J Sintow**

### Printer master

We just bought a truckload of laser printers and had to create a whole new slate of .COM files to issue escape codes that would put them through their paces. To make creat-

ing custom printer control files easy, we whipped up two programs to do all the dirty work. The first, *PRCODER.BAT* in Fig 9, does it from DOS. The second, *PRCODER.BAS* in Fig 10, does it from Basic. To run *PRCODER.BAT*, you need to have *DEBUG.COM* in your current subdirectory or in a directory that your *PATH* knows about. To run *PRCODER.BAS* you obviously need to have *BASICA.COM* handy.

*PRCODER.BAT* reads parameters from the command line and inserts them in a *DEBUG* script (to send the hex values &H1B, &H49, and &H03 you would type *PRCODER 1B 49 3*). You can enter several dozen codes on the same command line; the *SHIFT* command reads them in and substitutes them one by one for the %1 replaceable parameter in the *ECHO MOV DL,%1 >> PR.SCR* line. *PRCODER.BAT* then loops back and uses the *IF %1@==@ GOTO FINISH* test to see if there are any more command-line parameters to process. If it finds any, it concatenates them to the existing *DEBUG* script. If it doesn't find any, it jumps to the *:FINISH* label, adds the necessary *DEBUG* instructions to write the file, redirects the script into *DEBUG* by loading a secondary command processor (with *COMMAND /C DEBUG < PR.SCR*) to create the .COM file, and then erases the *DEBUG* script.

If the user doesn't enter any parameters, *PRCODER.BAT* prints instructions and then quits. DOS substitutes the actual name of the batch file for the %0, so you can rename *PRCODER.BAT* to whatever you want (with a .BAT extension). The process will make each *PRCODE.COM* file 284 bytes long, the maximum length this process can handle. Be sure to rename existing *PRCODE.COM* files before creating new ones so the older version isn't obliterated by the new.

While some users might argue that it really isn't necessary to rewrite the *MOV AH,5* line each time, it's a good idea to do so since you can't always be sure the *AX* register will remain intact after an *INT 21*. Note also that some buggy versions of DOS have problems with an *ECHO* statement; adding a period after *ECHO* simply sends a carriage return in most versions. If you do stumble over this problem substitute *ECHO PC* for *ECHO*. and ignore the error message *DEBUG* will give you — *PS*.

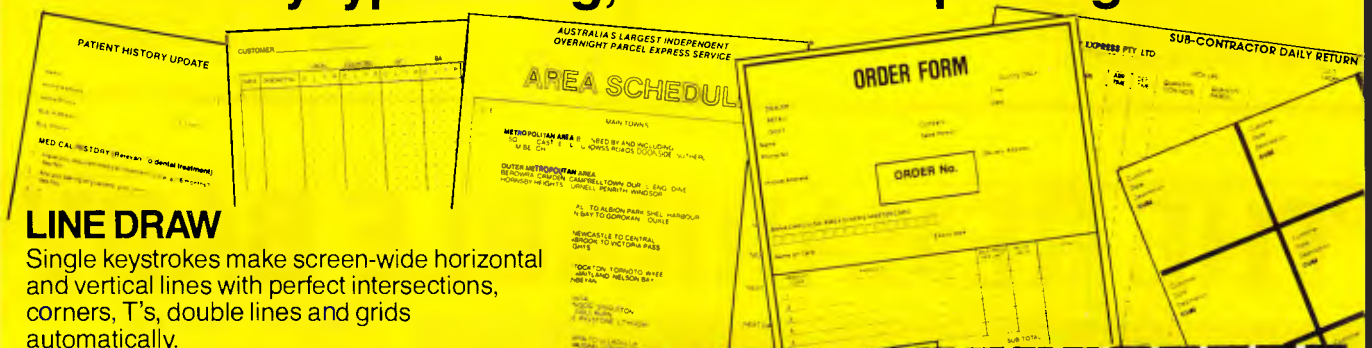
```
ECHO OFF
IF %10==0 GOTO OOPS
ECHO N PRCODE.COM > PR.SCR
ECHO A >> PR.SCR
:TOP
IF %10==0 GOTO FINISH
ECHO MOV DL,%1 >> PR.SCR
ECHO MOV AH,5 >> PR.SCR
ECHO INT 21 >> PR.SCR
SHIFT
GOTO TOP
:FINISH
ECHO INT 20 >> PR.SCR
ECHO. >> PR.SCR
ECHO RCX >> PR.SCR
ECHO 11C >> PR.SCR
ECHO W >> PR.SCR
ECHO Q >> PR.SCR
COMMAND /C DEBUG < PR.SCR
DEL PR.SCR
ECHO PRCODE.COM created
GOTO END
:OOPS
ECHO Enter %0 and then the HEXADECIMAL
ECHO values (each FF or 1ess) of the
ECHO printer codes you want to send, eg:
ECHO %0 1B 49 3
:END
```

Fig 9 *PRCODER.BAT* batch file to create *PRCODE.COM* programs that send escape codes to printers. (For this to work you need to have *DEBUG.COM* in your current subdirectory or in a directory that your *PATH* knows about.) This will create a file called *PRCODE.COM*, so be sure to rename any older version to prevent newer ones from writing over it. To run it, enter *PRCODE* and then, on the same line, the individual hexadecimal values of the codes you want to send to your printer. To send &H1B, &H49, and &H03 type *PRCODER 1B 49 3*

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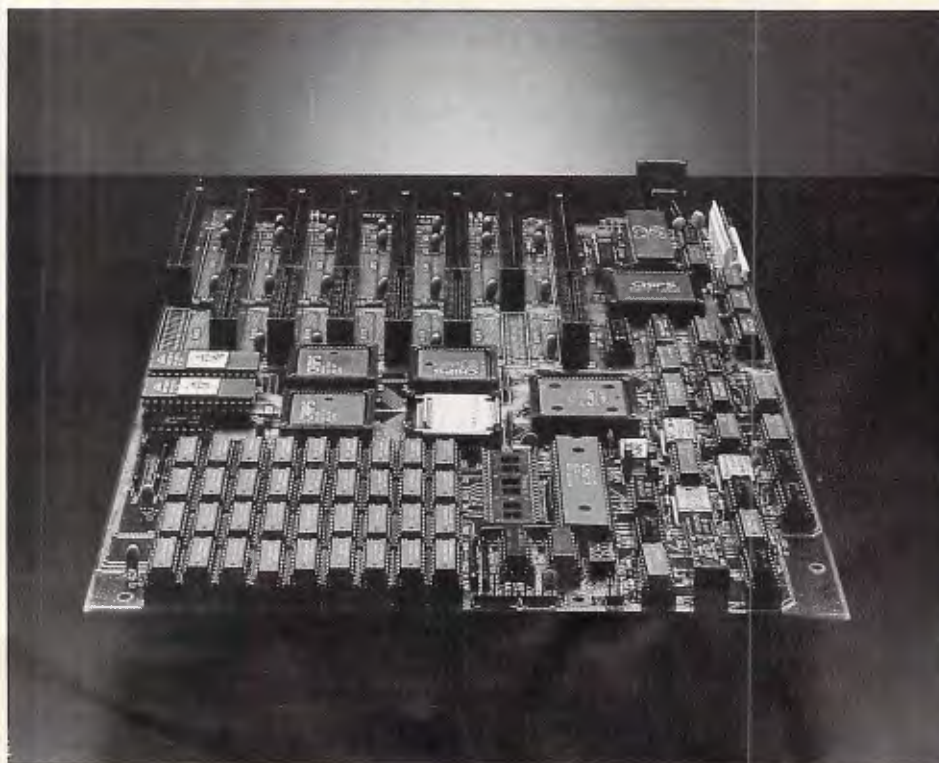


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```

100 'PRCODER.BAS -- creates printer control .COM files
110 DIM Z$(20):K=1:U$=CHR$(30)+STRING$(64,32)+STRING$(64,29)
120 KEY 9,"":KEY 10,"":DEF FNST$(Y)=MID$(STR$(Y),2+(Y<0))
130 BAD$=".,\+*?^[]=;<>" + CHR$(34):KEY OFF:CLS
140 ' === name the file ===
150 INPUT "Enter 8-character name (WITHOUT EXTENSION): ",N$
160 IF N$="" OR LEN(N$)>8 THEN CLS:GOTO 150
170 FOR A=1 TO LEN(N$)
180 IF INSTR(BAD$,MID$(N$,A,1))<>0 THEN CLS:GOTO 150
190 NEXT N$:N$+".COM":CLS
200 ' === print instructions ===
210 PRINT "Enter codes to send to your printer. ";
220 PRINT "Hit actual keys -- like <ESC> or A or 5 ";
230 PRINT "OR -- hit F9 then type a THREE-digit ";
240 PRINT "decimal ASCII code, eg <F9>255 or <F9>007";
250 PRINT "Enter up to 20. Backspace fixes errors. ";
260 PRINT "After the last one, hit <F10> to quit"
270 ' === main loop ===
280 I$=INKEY$:IF I$="" THEN 280
290 IF I$<>CHR$(8) THEN 310
300 IF K<2 THEN 280 ELSE PRINT U$;:Z$(K)="" :K=K-1:GOTO 280
310 IF I$=CHR$(0)+CHR$(67) THEN 440
320 IF I$=CHR$(0)+CHR$(68) THEN IF K>1 THEN 570
330 IF LEN(I$)>1 THEN 280
340 IF I$=CHR$(27) THEN P$="<ESC>"
350 IF I$=CHR$(13) THEN P$="<ENTER>"
360 IF P$="" THEN P$="CHR$("+FNST$(ASC(I$))+")"
370 PRINT P$;:P$=""
380 ' --- display it and fill array ---
390 IF ASC(I$)>32 THEN PRINT TAB(13);[";I$;"];
400 IF K<20 THEN PRINT TAB(20);"Enter up to";20-K;"more";
410 PRINT " -- or hit <F10> to quit"
420 Z$(K)=I$:K=K+1:IF K=21 THEN CLS:GOTO 570 ELSE 280
430 ' === direct entry ===
440 PRINT "CHR$(";
450 J$=INKEY$:IF J$="" THEN 450
460 IF J$=CHR$(13) AND C$<>"" THEN PRINT "":GOTO 550
470 IF J$<>CHR$(8) OR C$="" THEN 500
480 C$=LEFT$(C$,LEN(C$)-1)
490 PRINT CHR$(29);CHR$(32);CHR$(29);:GOTO 450
500 IF INSTR("0123456789",J$)=0 THEN 450
510 C$=C$+J$:IF VAL(C$)<256 THEN 540 ELSE S=LEN(C$)-1
520 PRINT STRING$(S,29);STRING$(S,32);STRING$(S,29);
530 C$="":GOTO 450
540 PRINT J$;:IF LEN(C$)<3 THEN 450 ELSE PRINT " ";
550 I$=CHR$(VAL(C$)):C$="":GOTO 390
560 ' === program creation ===
570 OPEN N$ AS #1 LEN=1:FIELD #1,1 AS D$:FOR A=1 TO K-1
580 LSET D$=CHR$(178):PUT #1:LSET D$=Z$(A):PUT #1
590 LSET D$=CHR$(180):PUT #1:LSET D$=CHR$(5):PUT #1
600 LSET D$=CHR$(205):PUT #1:LSET D$=CHR$(33):PUT #1
610 NEXT:LSET D$=CHR$(195):PUT #1:CLOSE:PRINT N$ " created";

```

## Preserving the environment

When I work on someone else's system, I often want to change the path or prompt temporarily. But I always want to leave things the way they were originally when I finish. The easy way to do this is to issue the command

**SET > RESET.BAT**

before I make any changes. This puts all the environment settings into a RESET.BAT batch file. When I'm done, I just type RESET and DOS puts things back the way they were.

COMSPEC and other environment variables require SET COMSPEC=xxxx phrasings, so RESET.BAT will produce a brief flurry of harmless error messages as it executes. On the rare occasions when you do need to change these, you can always customise RESET.BAT with your word processor.

**R Anderson**

*In DOS 3.3 this can also reset the APPEND string, if one were placed into the environment with an APPEND /E command. Around our offices we're always working on other systems and changing the PATH and PROMPT. This technique is a real timesaver — PS.*

## Format protection

There's a simple and effective way to stop nasty or inexperienced users from wiping out a hard disk using the FORMAT command. Just rename an internal DOS command to FORMAT, and then rename FORMAT.COM itself. After this change, typing FORMAT C: will just produce an 'invalid number of parameters' message.

Fig 10 PRCODER.BAS program to create PRCODE.COM files that send escape codes to printers

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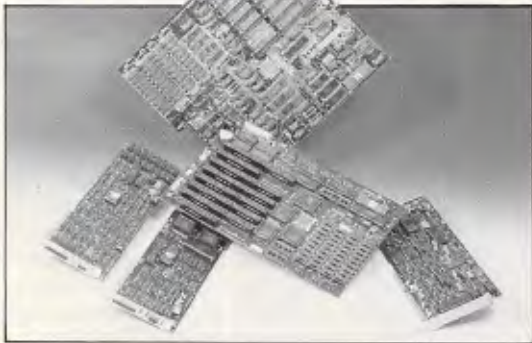


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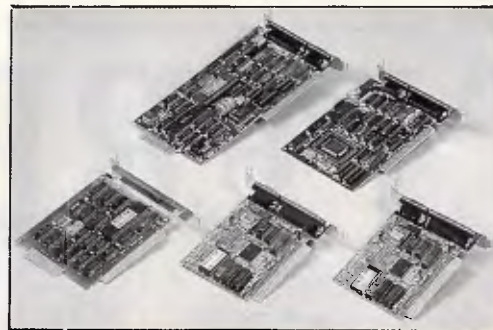
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## TJ'S WORKSHOP

COMMAND.COM won't let you run a program with the same name as the name of an internal command like TYPE, RENAME, or VER. It keeps these internal commands in a built-in table, and this technique simply replaces the six-letter RENAME table entry with FORMAT. If you replace RENAME with FORMAT, you'll still be able to use REN to rename your files, but COMMAND.COM won't recognise the longer (and former) RENAME command. And it won't let you run your external FORMAT.COM program.

If you type in FORMAT or FORMAT C: at the command line, COMMAND.COM will think you typed in RENAME or RENAME C: and will simply print out an error message.

You could use either The Norton Utilities or DEBUG to change RENAME to FORMAT. Once you've patched COMMAND.COM, use REN to rename FORMAT.COM to FORMAT?.COM (where ? stands for an ALT+255 null). To do this, type

### REN FORMAT.COM FORMAT

but don't hit the Enter key yet — hold down the Alt key and type 255 on the numeric keypad, then release the Alt key. The cursor will move over one space. Then type

### .COM

and hit the Enter key.

Finally, create a batch file called F.BAT:

```
echo off
cls
echo.
echo Insert disk in drive A: and
pause
format a: /v /s
```

Remember to type in format□ (where □ represents Alt+255) when creating your batch file, or this won't work.

One word of warning: don't keep different versions of COMMAND.COM on the same system or DOS will become confused. It's a waste of space. And that's what SET COMSPEC is for.

It's true that a power user could bypass this by booting off a disk in drive A:, but, for that matter, that someone could just pour coffee on or set fire to a hard drive to kill it. But my feeling, based on extensive experience with users at all levels, is that probably the most dangerous crowd, in terms of wiping out disks just for the hell of it, are users who do not have that much experience with PCs.

### J Sperling

To patch COMMAND.COM with DEBUG, first make a backup copy of COMMAND.COM called COMMAND.BAK so that if you make a mistake you can start again. Then type

### DEBUG COMMAND.COM

Find out how long your version of COMMAND.COM is by typing

### RCX

and hitting the Enter key twice. You'll see something like

### CX 62DB

Next, take the four-digit hex number after the CX and type the following:

### S 100 L62DB "RENAME"

(substituting the four-digit hex number if yours is different from 62DB). Then hit the Enter key and next you should see something like

### 61B2:547B

Ignore the first four digits (the ones preceding the colon). Take the right-most four digits and type

### E 547B "FORMAT"

(substituting the four-digit hex number if yours is different from 547B). Hit the Enter key. Then hit W (and Enter) to write the new version back to disk, and Q (and the Enter key) to quit DEBUG. Once you've patched COMMAND.COM, reboot your computer.

Another simple way to prevent unwanted formatting is to rename FORMAT.COM to something innocuous like DATA.COM and then insert a simple reboot routine at the beginning of your old FORMAT.COM file. Type in FORMAT and the system will reboot. Type in DATA and you can format disks. The following DEBUG will create both files. Create it with a pure-ASCII word processor, or use the DOS COPY CON command. Name the file FORMAT.SCR

### N FORMAT.COM

L

### N DATA.COM

W

### N FORMAT.COM

E100 B8 40 00 8E D8 B8 34 12

E108 A3 72 00 EA 00 00 FF FF

W

Q

Be sure to hit the Enter key at the end of each line, especially the last one (with the Q). Then type

### DEBUG < FORMAT.SCR

You could, of course, create a tiny 16-byte reboot file called FORMAT.COM, but the short length would be a tipoff to

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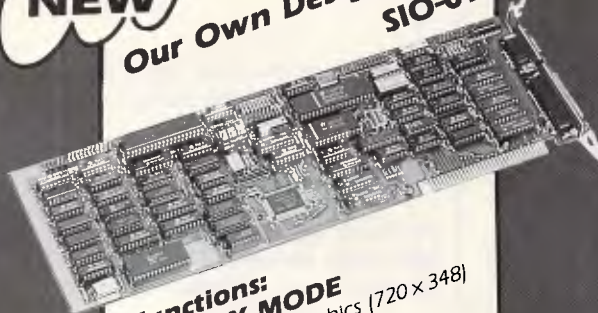
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an unauthorised user that something was amiss — PS.

## Multiple choices

Commands like COPY and DIR don't take multiple arguments. A way round this is to have DOS do the command multiple times, each with a different argument. For example, to copy all .COM and .EXE files to a floppy disk, you could type

```
FOR %F IN (*.COM *.EXE) DO
COPY %F A:
```

While this works, DOS will grind through the process one file at a time rather than ganging things up as it does with wildcards. Using a FOR loop on the command line isn't limited to just filenames. DOS commands can also be used as FOR loop variables as in

```
FOR %C IN (COPY ERASE) DO %C
A:*.EXE
```

to copy .EXE files from a floppy disk, then erase them from the disk.

**G Walsh**

Another way to do multiple copies on the same command line is to use piping. The following command will copy all your .COM and .EXE files to drive A:

```
COPY *.COM A: : COPY *.EXE A:
```

Also, if you try the above FOR . . . IN . . . DO technique, remember to use single % signs only in direct mode (at the DOS prompt); in batch files you have to use double %% signs — PS.

## Zero-byte files

I have some questions about hidden files and zero-byte files on my IBM PC.

When I use the command

```
FORMAT A:/V
```

and I later check the disk with CHKDSK, why does it show '0 bytes in 1 hidden file'? How do I delete that file? Not only can't I delete it, I can't find it using The Norton Utilities.

Also, why does the DOS command

```
REM DIR>ABC
```

create a zero-byte file called ABC? (This one I can delete.)

**B Richrath**

When you format a disk with the /V switch, FORMAT adds a volume label (simply a name of 11 characters or less) to the disk. DOS has to put this volume label somewhere on the disk, so it creates a directory entry for it. It has zero bytes because it doesn't have any data associated with it. The volume label is a special directory entry that doesn't show up in normal file listings. (DIR, VOL, and CHKDSK can, of course, retrieve the volume label and display it.)

If you don't want the volume label on the disk, don't format with the /V switch. If you want to remove a volume label from a disk, you can use the LABEL command included in DOS 3.0 and above:

```
LABEL A:
```

When the LABEL command asks what the new volume label should be, press Enter. When it asks 'Delete current volume label (Y/N)?' answer with a Y.

In your second example, when you enter the command

```
REM DIR>
```

The '>' symbol is DOS's redirection symbol. This directs display output from a command into a file. So, when DOS executes this command, it first creates a file called ABC. Then it executes the REM DIR command. But REM doesn't display any output. When REM finishes up with what it has to do (which is basically nothing), DOS closes the ABC file. The file is empty.

In DOS versions up through 3.2, there's no way around this. However, the recently introduced DOS 3.3 lets you use inactive redirection symbols in commands by enclosing the command line in quotation marks thus:

```
REM "DIR>ABC"
```

## Listing all files

Is there a way to display or print the contents of all files on an IBM PC hard disk with just a simple command? I've been using a batch file that executes a DIR command with each of my subdirectory names, but I have to edit the batch file whenever I add a new directory to the hard disk.

**C Pegler**

If you need only the names of the files and subdirectories, the CHKDSK command can do it. Enter

```
CHKDSK /V
```

The /V switch stands for 'verbose.' If you want to direct the output to the printer, simply type

```
CHKDSK /V >PRN
```

However, the CHKDSK command lists only the names of the files without the file sizes, times, and dates.

To execute a DIR command for all subdirectories on a hard disk, I often

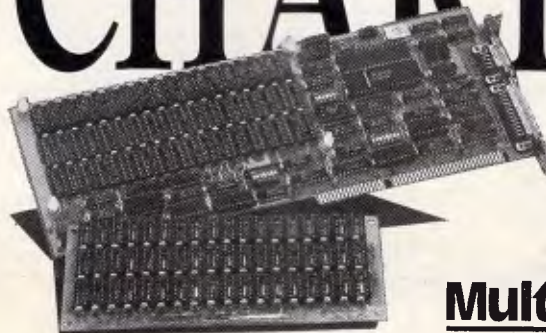
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use a program called *SWEEP* (supplied with a range of other utilities on APC's Utilities Disk to subscribers). This program repeatedly executes a command in the current directory and all nested subdirectories of the current directory.

Thus, to get a DIR listing of all your subdirectories, you enter

**SWEEP DIR**

or, to print the output on the printer,

**SWEEP DIR >PRN**

If you have a modem and communications software then you can download it from Microtex on Telecom's Viatel page \*6663# (call (03) 531 8411 for details) — CP.

## Commodore pot-pourri

(1) An undocumented feature of Basic 7.0 for the Commodore 128 is its ability to treat MID\$ as both function and command.

Try this sequence in direct mode:

```
A$ = "AAAAAAAAA"
MID$(A$,4,4) = "ZZZZ"
PRINT A$
```

The displayed result will be "AAAZ-ZZZAAA".

This feature is very useful for setting up fields in relative or direct-access disk records and is almost an emulation of Microsoft Basic's LSET command. By combining its use with that of the POINTER function, you can even store large floating-point values on disk as five-byte fields. Think about it!

(2) If, like me, you dislike the full flashing cursor in CP/M mode on the 128, you can change it, provided that you have registered your CP/M ownership and received the additional utilities disks from Commodore. Believe me, the CP/M User Guide included in this package is well worth the additional \$50 fee on its own.

The source file you must path is CX80.ASM, which you will find on Source Disk 1.

Using ED, WordStar or any other text handler, locate in CX80.ASM the comment line: 'program the 8563 for full flashing cursor'.

The line of code you must alter is the third line below that command and reads 'mvi a,40h'.

It is the argument in this line that determines the cursor's shape and attributes:

**40h = full flashing cursor**  
**00h = full non-flashing cursor**  
**47h = flashing underline cursor**  
**07h = non-flashing underline cursor**

Change the value of the argument according to your own taste, save the amended file and then follow the procedure outlined in the file MAKESYS.DOC. This will create a new CPM+.SYS file which you can PIP to all your disks to ensure that the cursor pleases your eye whenever you boot up CP/M.

(3) Why waste valuable disk space with fancy menu programs on your '64 when you can get the 1541's directory itself to do the job without sacrificing a single byte of extra storage?

Whenever you save a Basic program, add these four keystrokes to its filename before closing the quotes and typing the ".8" extension:

**SHIFTed SPACE**  
**Commodore - D**  
**Commodore - U**  
**SHIFTed -**

To run a program that has been saved in this fashion, simply load and list the directory, run the cursor up to the appropriate line and press SHIFT-RUN. Try it — you'll soon see why it works!

(4) One of the most regrettable weaknesses of the '64's Basic is the absence of the IF...THEN...ELSE construct, but you can approximate it with this coding:

**ON -(condition) GOTO**  
**XXXX:alternativestements**

By negating the test condition, you can get only two possible results: 1 (true) or 0 (false). If the condition is true, control passes to line XXXX; if not, the alternative statements in the current line are executed. This code therefore produces the same logic flow as:

**IF (condition) THEN XXXX ELSE**  
**alternative statements**

(5) If you ever inadvertently scratch the wrong Basic program, you can recover it immediately by issuing a LOAD """,8 command, provided that you do so before referencing another file or resetting the 1541.

**Kevin Riordan**

## Microsoft Basic Compiler

Every Mac program compiled by the

Microsoft Basic Compiler, when run, immediately displays a window upon start-up. A lot of the time this window differs from the main window of the program you wrote. Besides that, this window is a dead giveaway that you wrote your program in Basic. Using a disk/file editor application, you can patch your compiled program to eliminate this window.

In the resource fork of the program, search for the hexadecimal string '00 29 00 02 01 54 01 FC' and replace it with all zeros. Save the changes to your file and you're off.

**C Laudenbach**

## Excel

It is annoying to reopen a number of linked documents and be constantly presented with the 'Update Reference to Non-Resident Sheets' message. Clicking on either choice will update the worksheet or chart automatically, and that can take some time. One solution to this problem is to use the Resume Excel documents. (A Resume Excel document is created each time you choose QUIT from Excel. It contains information on what documents were open and where they were placed right before you quit.)

Before starting, remember what documents reference others, including worksheets, macro sheets and charts. Remember to include all linked files. Enter Excel and open the related documents. Activate, either by clicking or using the Windows menu, all documents in the following order. First activate all the charts, then all worksheets and finally, if you have any, all macro sheets. Now choose QUIT from the File menu.

After Excel returns you to the Finder, in the same folder (or disk) as Excel, you will find a Resume Excel document. Rename that document, so the next time you quit Excel it doesn't get replaced. Next time you want to open your linked documents, simply double-click the renamed Resume document.

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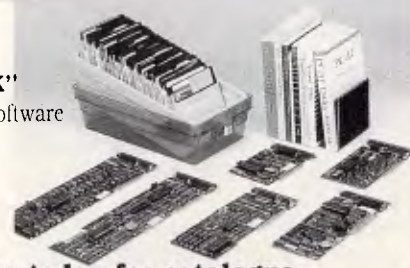
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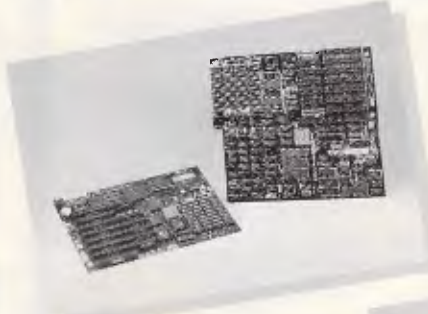
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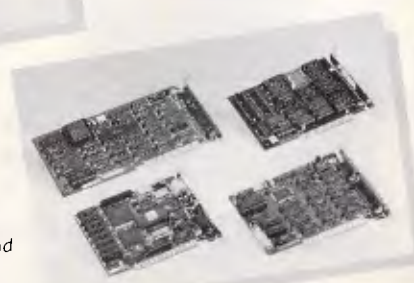
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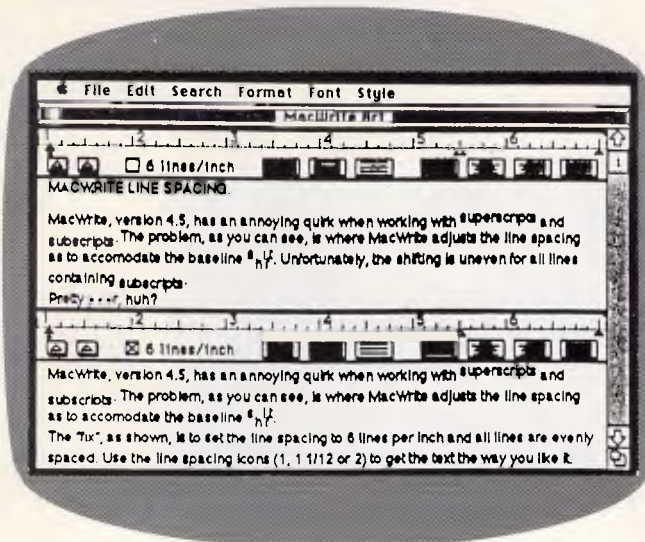
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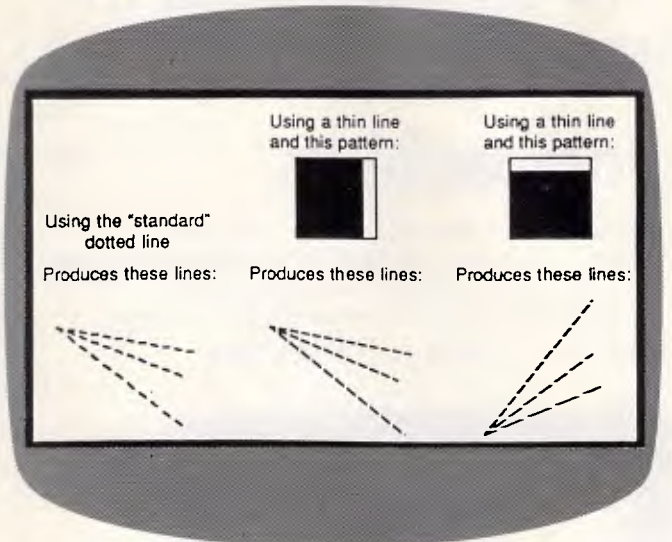
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In order to obtain even line spacing, when using subscripts in your text, specify in the ruler that the spacing is to be 6 lines per inch



Since the dotted lines in MacDraft look very poor, create a pattern as shown and use a thin line with that pattern as the line pattern to produce clearer dotted lines

## MacWrite

MacWrite, version 4.5, has an annoying habit of incorrectly adjusting the line spacing of all lines that contain subscripts. The very simple solution to this problem is to specify, in the ruler, that the text to follow is to be 6 lines per inch. When this is done, all lines will have the same line spacing. Use the line spacing icons (1, 1.5 or 2) to adjust the way you like it.

*M Prece*

## ZBasic

If, on your Mac, you're using the Edit window and make a number of changes to various, nonsequential line numbers, simply use COMMAND-E twice and all lines and line numbers will be placed in their proper locations.

*M Diehr*

## System 4.1

You can use COMMAND-PERIOD to cancel all standard dialog boxes (the dialogs you get when you choose OPEN or SAVE). This will work for all applications.

*I Donitz*

## MacDraft

Diagonal dotted lines normally print poorly on a LaserWriter. However, you can produce quality diagonal lines with MacDraft. Here's how.

Start by editing a pattern so that most

of the pattern is black, with a one or two pixel column (or row) being white. Once that is done, confirm that you are drawing with one of the non-dotted lines, and choose that special pattern you have drawn as the ink for the line. This is done by holding down the Option key while selecting the pattern.

Try drawing a few diagonal and/or dotted lines. Later, you can alter the special pattern for better control over the depth of the pattern.

*Z Chen*

## MacFile

Typing OPTION-RETURN in a field will generate a line feed at the insertion point, allowing you to create lists. This embedded character acts like a normal Return when copied and pasted into a word processing or spreadsheet application.

In addition, SHIFT-CLICK will select the entire field, thus avoiding having to scroll.

*C Laudenbach*

## Mac SE

(1) Using ResEdit, it is possible to remove a few unnecessary resources from the System file. These resources may only be removed if you are using System 4.1 and the Mac SE. The PTCH resources are 'patches' to a particular machine's ROMs. The unnecessary PTCH resources are those numbered 28927, 105, 117 and 376, which are the patches for the ROMs of the

Mac XL, Mac 512, Mac Plus and the Mac II, respectively.

In addition, now that the SANE (Apple's high-level mathematical routines) functions are found in the SE's ROM, you are able to remove them from the System file. The SANE resources are PACK 4 and PACK 5.

As always, only use ResEdit on a backup copy of your software.

*J Peskoff*

(2) Since the Macintosh SE can have two built-in floppy drives and one external floppy drive, the Command-Shift keyboard commands for ejecting disks are a little different. COMMAND-SHIFT-1 will eject the bottom (internal) drive, while COMMAND-SHIFT-2 will eject the upper drive. The new Command-Shift combination for ejecting the external floppy drive is COMMAND-SHIFT-0.

*J Liemandt*

END

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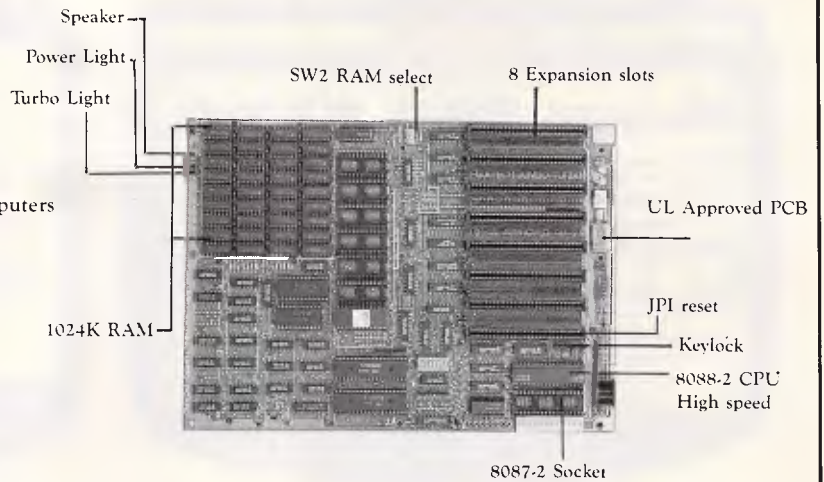
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# High speed access

*This month Steve Withers discusses V32 modems and the falling price of fast data communications.*

Having mentioned V32 modems in the last issue, I thought it would be worth describing a couple of products in this class. They are the Codex 2260 and the CDS V32 Trellis.

As you might expect, they have much in common. Both devices run at 9600 or 4800 bits per second and can be used with or without Trellis coding. Although Trellis coding is intended to allow dial-up communications at speeds previously restricted to dedicated lines, line quality is still an issue. For this reason, both modems include an 'eye pattern generator' which (when connected to an oscilloscope) allows the quality of the connection to be monitored. As you might expect, they are both auto-answer, auto-ranging devices. Echo cancellation is also provided.

The Codex 2260 also provides auto-dialling, by means of the AT command set or its own codes. An attractive feature is its 'front panel' with a 16 character LCD used to provide menu-driven configuration. Up to four configurations can be stored in non-volatile memory, along with nine telephone numbers. The 2260 costs just over \$5000, and is available from JN Almgren on (02) 406 6177.

Datacraft may be contacted on (03) 727 9111, and the price of the CDS V32 Trellis modem is approximately \$5300. An auto-dial version is available at a higher price.

## Modem prices

Last month I remarked that the price of V22 modems had fallen below \$500. Just a few days after the editorial deadline I heard about a Telecom approved, brand-name V21/V22 for less than \$400. Faster communication is becoming increasingly affordable.

## Custom Menu

Custom Menu is the name of a locally written DOS shell for IBM PCs and compatibles which has been advertised in APC in recent months. Unfortunately, the author and distributor have discovered that the package is available for downloading from several bulletin boards. They are understandably upset about the situation, as Custom Menu is neither public domain nor Shareware.

If you see it on a board, why not leave a message to the Sysop to take appropriate action? I'm sure those of you who have already downloaded it will either erase it or order a copy from Martlett Software.

The speed with which software spreads around BBSs is generally an advantage. Problems like this arise because we expect all the software on a board to be legitimate. If something sounds interesting and useful, we download it, pass it on to some friends, and perhaps upload it to another board or two.

Considerable embarrassment can be caused to Sysops and the whole bulletin board community when someone knowingly uploads commercial software, so it's fortunate it is an uncommon event.

## System news

There're quite a few new listings and updates this month, but I'll point out a couple of highlights. TNT Shuttle (Sydney) deserves a mention because as far as I know it is the first BBS to run on one of the new IBM PS/2 machines.

Tasmanians now have a second BBS with the arrival of the Hobart Users board.

It is understandable that country areas are not particularly well endowed

with bulletin boards, so I was pleased to hear about the Mudgee Connection.

Acknowledgements: Roger Atkinson, Jeff Campbell, Bill Cholakovski, Larry Lewis, Andrew Moore, Greg Noonan, and Richard Siggs.

## New systems

### NSW

*Alpha Juno* (02) 774 1543. Kevin Withnall. 6pm- 6am daily. V22 only.

*First Nice MIDline* (02) 868 4347. P. Andrew Khoo. V22, V22bis, Bell 103. FidoNet 711/805.

*Galactic Federation* (02) 233 5040. Kevin Gladwin. 5pm-9pm weekdays, 24 hours weekends. V21, V22, V22bis, V23.

*TNT Shuttle* (02) 281 2476. MV. Paul Birch. V21, V22, V22bis, V23, Bell 103, 212.

*Mudgee Connection* (063) 72 1898 P. George Rhedey. 9pm-7am daily. V21, V22, V23.

### ACT

*Canberra KBBS* (062) 88 0142. MV. 'GEO'.

### Vic

*Angler's Den* (03) 876 4118. 6pm-10pm weekdays, 24 hours weekends. V21, V22, V23.

*Maxitel* (03) 882 6188. P. Mark Micallef. *Deepseas* (03) 762 9204. P. John Drinkwater. 11pm-6am daily. V21, V22, V23. FidoNet 630/308.

### WA

*Atari Forever* (09) 342 3739. 24 hours. *Lightning* (09) 275 7900. MV. Simon



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# COMMUNICATIONS

Blears. V21, V22, V22bis, V23. FidoNet 690/903.

*Murdoch University External Studies* (09) 332 2604. MV. Roger Atkinson. 24 hours daily. Voice enquiries (09) 332 2597, (09) 332 2492.

*West Coast* (09) 445 3080. MV. Mark Gaynor.

## Tas

*Hobart Users* (002) 49 4405. MV. Denise Webber. 3pm-7am weekdays, 24 hours weekends.

## Updates

### NSW

*Adventure Line* (a.k.a. Auz Line) Off line.

*AED-Prophet* Off line

*Amstrad* (02) 981 2966. M. Riccey Schmahl. V21, V22, V22bis, V23.

*Augur* (02) 661 4739. MV. Mark James. 24 hrs daily. V21, V22, V22bis, V23.

*Ausborne* (02) 439 7072. MV. Daniel Moran. 24 hours daily.

*Australian Pick Users* (02) 631 8603. MV. Kurt Johannesen. 24 hours daily. V21, V22, V22bis, V23.

*Bounty* Off line

*Comm Link* Off line

*Commodore 64* (02) 664 2334. MV. Graham Lee. 24 hours daily. V21, V23. (Incorrect entry in July APC — sorry Graham)

*Commodore Pursuit* (02) 522 9507. MV. Warren Hillsdon. 24 hours daily. V21, V22, V23 (NetComm 123A).

*Datacomm* Off line.

*Microlink* (02) 477 7509. Tony Callahan. 24 hours daily. Formerly listed as *Zenith*.

*Omega Line* (02) 457 8281. P. Geoff Arthur. 24 hours daily. V21, V22, V23. FidoNet 59/12.

*Prophet* (02) 628 5222. P. Larry Lewis. V21, V22, V22bis, V23.

*Spring Board* Off line.

*Syntax's Error* Off line.

*Your Computer* (02) 669 1385. MV. Andy Farkas. 24 hours daily.

### ACT

*ACT Amiga Users Group* (062) 59 1137. MV. Mike Hurst-Meyers. 24 hours daily. V21, V22, V22bis, V23, Bell 103, 212. FidoNet 626/218.

*ACT Pharmacy* (062) 92 3875. MV. Michael Pye. V21, V22, Bell 103, 212. FidoNet 626/223.

*Gateway* Off line.

*Professional Computer Users Group*

(062) 59 1244. MV. Alan Salmon. 24 hours daily. V21, V22, V22bis, V23. FidoNet 626/229.

## Vic

*PC Domain* Off line.

*The Magic Pudding* Off line.

*The Real Connection* (03) 288 0331. P. Carla Miller. 24 hours daily. A FidoNet system.

## Qld

*Comtel* (077) 753 636. MV. Warren Mason. 24 hours daily. Formerly located in the ACT.

*Microlynx* Temporarily off line.

*RALF* Off line.

*Rapple-Q* (07) 284 6145. Graham Black. 24 hours daily. V21, V22, V23, Bell. Includes on-line games.

*Redcliffe City Council Library* (07) 283 0315. 6pm-8am Mon-Fri, 24 hours weekends. V21, V22, V22bis, Bell. FidoNet 640/203.

## SA

*Omen V* (08) 259 5321. MV. Richard Siggs. 24 hours daily.

## WA

*Apple Board* Off line.

*Streamline* Off line.

END

The material in this column is presented in good faith, but as it is collated from material provided by readers, APC cannot take responsibility for its accuracy. New information and corrections are always welcome (but please mention whether or not you can vouch for accuracy of the material provided), and should be sent to:

Steve Withers, C/- Computer Publications, 47 Glenhunted Road, Elwood, Vic 3184 or to Viatel mailbox 063000030.

Acknowledgements will normally be made through this column. You may also like to send a copy of the information to the Australian PAMS Coordinator at one of these addresses:

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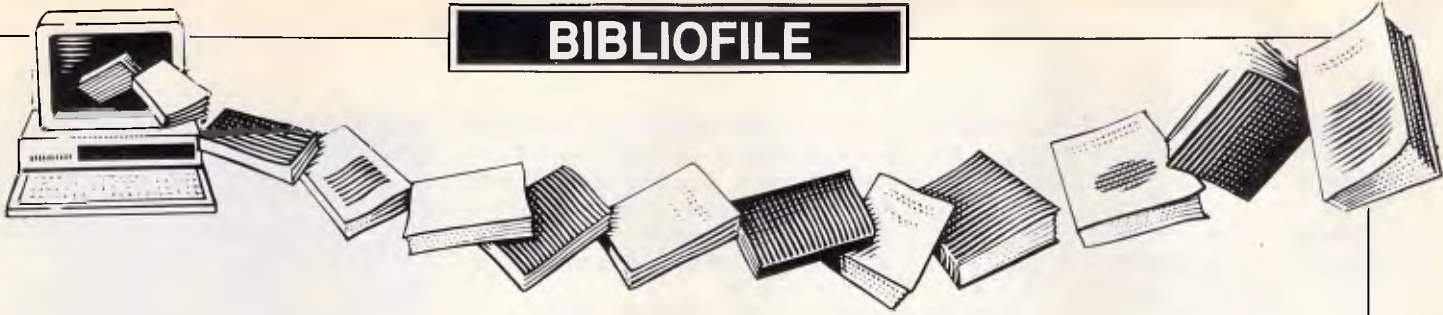
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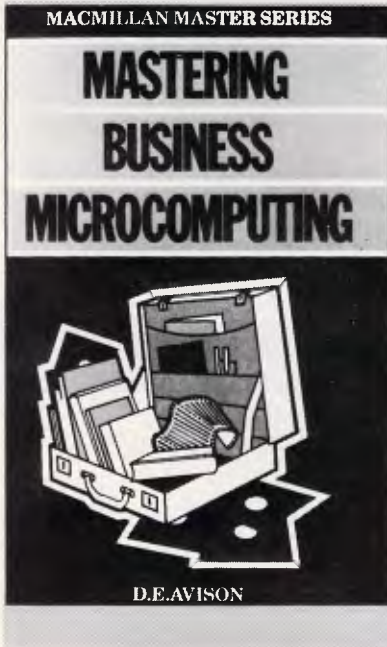
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*In our crop of books under review this month, there's something for everyone — from Electric Monks to microcomputers and children.*



## Mastering Business Microcomputing

**Author:** DE Avison  
**Publisher:** Macmillan Master Series  
**Price:** \$9.95

There is a plethora of books on the market that claim to be 'the businessman's guide to microcomputing'. Some good, some adequate, some a waste of time and money. Thankfully, DE Avison's *Mastering Business Microcomputing* does not fall into the latter category. If anything, it is among the elite of books that I have read dealing with this topic. It concentrates on applications which are of most interest to managers of small/medium-sized companies, and the author's 'aim is to keep the book readable and to avoid unnecessary technical detail'. He also keeps clear of any preferences in hardware and software.

Each chapter opens with a concise and pertinent introduction to the individual sections, informing the reader of the information to be discussed and

exactly where to find it in the chapter. Chapter 1 covers the nail-biting subject of choosing a microcomputer system and deserves to be re-read until all the salient points are driven home. I was pleased to see emphasis placed on the quality of documentation, help facilities and the availability of a disk tutorial system within a package as so often with the purchase of a microcomputer and/or application packages, the 'new' user doesn't realise until it is too late that most of his knowledge will be self-taught.

'Word processing and the electronic office' is the first application to come under close scrutiny — logical enough, as it is one of the main areas of microcomputing. Plenty of diagrams and illustrations here, showing possible screen formats and text layouts, and also the real aspects of people and ergonomic factors are discussed: 'If human factors are given the importance that they deserve, then the business stands a far greater chance of the computer system being a success.'

File management, spreadsheets, financial modelling, graphics, accounting applications and integrated systems are all treated with equivalent details in individual chapters, and the advantages and disadvantages of different systems are discussed clearly and fairly.

*Mastering Business Microcomputing* is a very useful book to learn from initially and a handy reference book for all times: a worthy addition to the Macmillan Master Series.

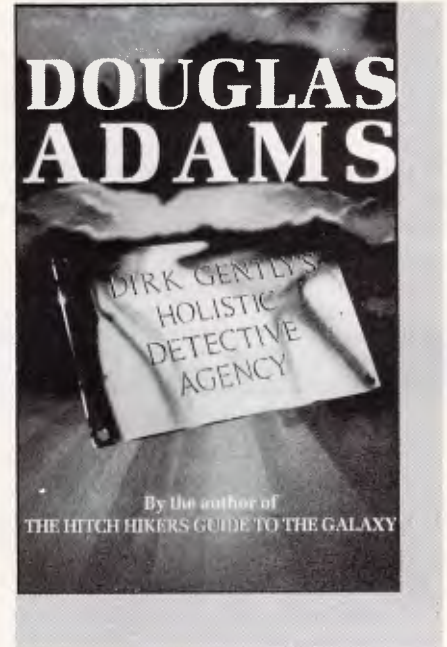
**Lorna Kyle**

## Dirk Gently's Holistic Detective Agency

**Author:** Douglas Adams  
**Publisher:** William Heinemann & Co Limited

**Price:** \$27.95 (subject to change)

There's no doubt from reading this book that Infocom has already got its hands on it. And considering that the



*HitchHikers Guide to the Galaxy*, by the same author, is the company's best-selling adventure after *Zork*, it's not really surprising.

Every event, feeling or movement is accompanied by a long description, written in pure Infocom-ese. My favourite is that of the bathroom. After a couple of dozen sentences about lavatories, basins and bathroom cabinets, the text ends: 'There was also a large horse in the room, taking up most of it.'

The story, for it is fiction and not like a normal computer book, is set in the present day. It's also set in the past and future, too, as each of the 36 short chapters takes us to a different place and time. Fans of *The Singing Detective* should feel quite at home.

Like earlier Adams books, this one gives more than a passing mention to PCs. Our hero, has a network of six Macs, as well as a Laserwriter. Most of the time, the screens show a picture of a revolving sofa stuck halfway up a staircase, though the exact reason for this is not clear.



# BIBLIOFILE

Staying with technology, my favourite character is the Electric Monk. In the same way that dishwashers perform the tedious job of doing your washing up, and video recorders watch all the boring TV programs that you don't want to watch yourself, the Electric Monk is a robot-like device that will believe anything it is told, to save you having to believe it yourself.

Although such a device is certainly useful, not many have been sold yet as everyone's waiting for the Monk Plus to be launched.

Holism, by the way, is the theory that the fundamental principle of the universe is the creation of wholes. And Dirk Gently's holistic detective agency has a brass plaque on the door that says: 'We solve the *WHOLE* crime. We find the *WHOLE* person. Phone today for the *WHOLE* solution to the problem. Missing cats and messy divorces a speciality.'

If you like Douglas Adams books

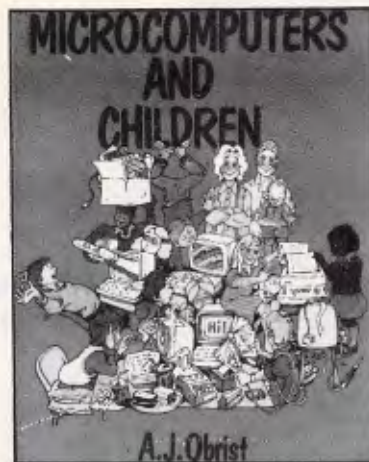
and/or Infocom adventures, you'll find this a good read. It's handy for the coffee table, too, to let guests dip into during dull moments. I'd even go so far as to say that, if you don't have a coffee table, it's worth buying one just to put this book on.

What's the plot? Oh, I've no idea.  
**Helen Rappoport**

## Microcomputers and Children

**Author: AJ Obrist**  
**Publisher: Hodder & Stoughton**  
**Price: \$19.95**

Here is a sensible and straightforward guide to microcomputers for parents and teachers alike. As the author points out, the micro is here to stay — 'its influence and importance will grow and grow' — and the sooner that schools are able to utilise it and all its encompassing advantages the better.



*Microcomputers and children* is not a massive tome — only 100-odd pages — but it covers the basic introduction to micros, what they are, how they work (we're not talking complex issues

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# BIBLIOFILE

here, just simple cassettes and television screens), how to set about buying a micro, selecting programs and choosing software. A strong emphasis is placed on micro games and how children learn through play, explaining certain popular games and illustrating how they help develop reasoning power and decision-making abilities. The author describes the games available for young children which help to teach colours, shapes, numbers and reading, while for older children he describes the more specialised games ('content-free' programs) which enable the development of games and simulation themselves. Any game or program mentioned is included in the appendix where it is also classified under subject and age group.

A very interesting chapter is included on how the micro can be used by children of different capabilities, ranging from the gifted through to those with physical handicaps or learning difficulties. There is also a short section on flow-charts and programming which mentions Logo and the turtle, Prolog and Basic.

But don't expect this book to give you

anything more advanced than that. *Microcomputers and children* is geared towards pre-school and primary education; it won't help you solve the finer details of your spreadsheet package, but then perhaps your seven-year-old may already know the answer to that one.

Lorna Kyle

## Low Cost Local Area Networks

**Author:** Stephen PM Bridges

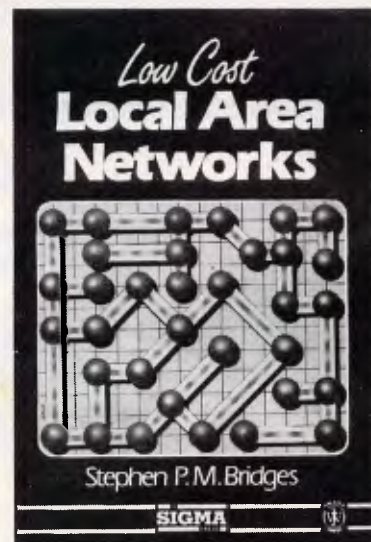
**Publisher:** Sigma Press/Jacaranda Wiley

**Price:** \$32.25

*'A LAN is a system of interconnection for computers and associated devices which allows interchange of information within a limited geographical area.'*

There you are, that's all a Local Area Network (LAN) is, in a nutshell.

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'empty slot', 'buffer insertion', 'token passing', and so on. Once again, users who initially understood the concept, application and reason may have become lost in the jargon and ambiguity.

Stephen Bridges could have gone

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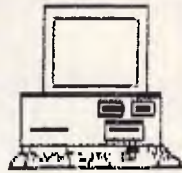
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# SALE

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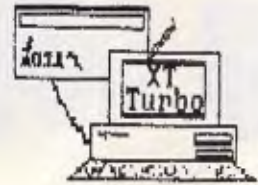
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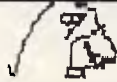
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|------------------------|-----|-----|
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| 3.50" Fuji DSDD           | \$89 | \$59 |
| IBM Series/2 3.5" Fujitsu |      | \$99 |
| Disk Box (80) -5.25"      | \$29 | \$19 |
| Disk Box (80) -3.50"      | \$35 | \$19 |

### OTHER SPECIALS

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|----------------------------|---------------------------|
| Amiga/CGA Colour Monitor   | \$599                     |
| Epson LX800-180 cps        | \$549                     |
| Citizen 128D               | \$479                     |
| Ritemann (was \$699)       | \$449                     |
| Laser Printer              | \$3200                    |
|                            | (delivery & installation) |
| Commodore PC5              | \$999                     |
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## BIBLIOFILE

some way to lifting the veil of confusion had his book been laid out differently: it is almost back to front. The technical section comes first, plunging the reader into transmission mediums and modes, and access and signalling methods; while the second section deals with the practical side — that is, what do you want from a LAN? If this book is aimed at the engineer, then Section Two isn't really relevant; if it is aimed at a user manager — that is, a novice to LANs — then I'm sure that they would never have completed Section 1.

On the other hand, the sections independently are quite concise, and when the author is dealing with practical questions such as 'Can it easily be connected to your equipment?', then you feel that he is really on your side. Also, if you are slightly technically-minded and know your broadband from your baseband, then you'll be okay in Section 1.

In conclusion, study the 'Contents' pages first and read the chapters in your defined order; all the terms used are ultimately explained but you do have to search for them.

Lorna Kyle

END

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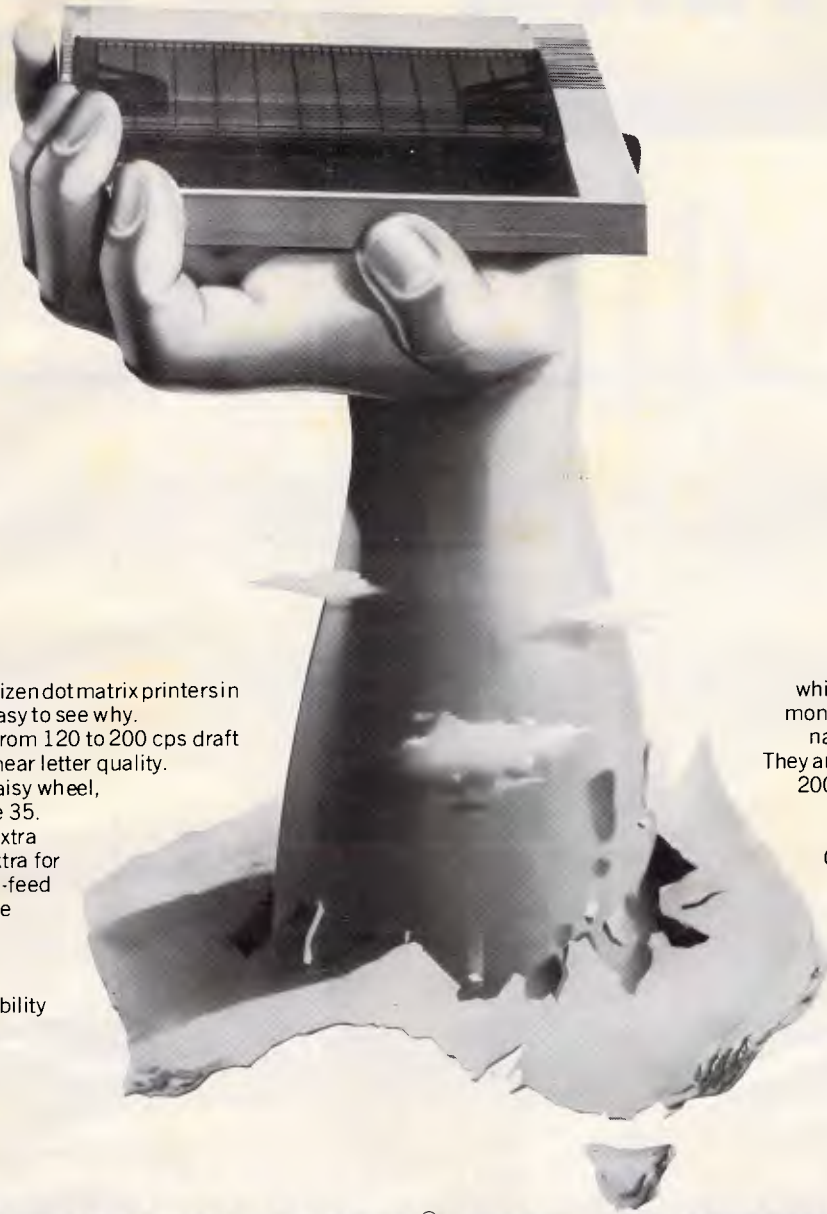
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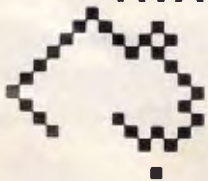
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# Printer survey

## Daisy wheel printers

| Make     | Model                   | Serial interface | Parallel interface | Speed (chars/speed) | Max paper width (in) | Min pitch (cpi) | Max pitch (cpi) | Max chars per line | Buffer size | Tractor feed | Friction feed | Sheet feed | Bi-direct print head | Bi-direct paper feed | Config kypd on pntr | Print head type |
|----------|-------------------------|------------------|--------------------|---------------------|----------------------|-----------------|-----------------|--------------------|-------------|--------------|---------------|------------|----------------------|----------------------|---------------------|-----------------|
| BROTHER  | HR-20                   | Y                | Y                  | 20                  | 14.5                 | -               | -               | 175                | 8           | N            | Y             | N          | Y                    | Y                    | Y                   | DAISY           |
| BROTHER  | HR-40                   | Y                | Y                  | 33                  | 16.6                 | -               | -               | 204                | 8           | Y            | Y             | Y          | Y                    | Y                    | Y                   | DAISY           |
| BROTHER  | TWINWRITER<br>6         | N                | Y                  | 36                  | 16.5                 | -               | -               | 203                | 3           | N            | Y             | N          | Y                    | Y                    | Y                   | DAISY/DOT       |
| CITIZEN  | PREMIERE-35             | Y                | Y                  | 35                  | 15                   | -               | -               | 132                | 8           | Y            | Y             | Y          | Y                    | Y                    | Y                   | DAISY           |
| DATAMATE | DWP2500                 | N                | Y                  | 20                  | 11                   | -               | -               | 165                | 2           | N            | Y             | N          | Y                    | Y                    | N                   | DAISYWHEEL      |
| FUJITSU  | SP320-Q                 | N                | Y                  | 48                  | 16                   | -               | -               | 163                | -           | N            | Y             | Y          | Y                    | N                    | N                   | DAISY           |
| QUME     | LETTERPRO<br>20         | Y                | Y                  | 22                  | 13                   | -               | -               | 165                | 8           | Y            | Y             | Y          | Y                    | Y                    | Y                   | DAISY           |
| QUME     | LETTERPRO<br>PLUS       | Y                | Y                  | 45                  | 13                   | -               | -               | 165                | 8           | Y            | Y             | Y          | Y                    | Y                    | Y                   | DAISY           |
| QUME     | SPRINT<br>11/40<br>PLUS | Y                | Y                  | 40                  | 15                   | -               | -               | 198                | 8           | Y            | Y             | Y          | Y                    | Y                    | Y                   | DAISY           |
| QUME     | SPRINT<br>11/40<br>WIDE | Y                | Y                  | 50                  | 22                   | -               | -               | 293                | 8           | Y            | Y             | Y          | Y                    | Y                    | Y                   | DAISY           |
| QUME     | SPRINT<br>11/55<br>PLUS | Y                | Y                  | 55                  | 15                   | -               | -               | 198                | 8           | Y            | Y             | Y          | Y                    | Y                    | Y                   | DAISY           |
| QUME     | SPRINT<br>11/90<br>PLUS | Y                | Y                  | 90                  | 15                   | -               | -               | 198                | 8           | Y            | Y             | Y          | Y                    | Y                    | Y                   | DAISY           |
| TANDY    | DWP<br>230              | Y                | Y                  | 20                  | 11*15                | -               | -               | 132                | 2           | Y            | Y             | N          | Y                    | Y                    | Y                   | -               |
| TANDY    | DWP<br>520              | N                | Y                  | 43                  | 11*15                | -               | -               | 132                | 2           | Y            | Y             | N          | -                    | -                    | Y                   | -               |

*This survey of a large cross-section of computer printers was compiled from a disk-based questionnaire circulated to printer manufacturers, importers and distributors. As you'll see, it's extensive — the total of two hundred and forty printers exceeded our expectations. So extensive, in fact, that a review of the state of laser printer technology has been held over to next month's issue.*

*Remember that the prices listed here are recommended retail prices. You may be able to better these prices by shopping around.*

## Daisy wheel printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                              | Retail price    | Distributor                  | Phone       |
|-------------|-----------------|----------------------|-------------|---------------------------------------------|-----------------|------------------------------|-------------|
| 57dB        | 365             | 132(H)x470(W)x344(D) | 8           | OPTIONAL CUT SHEET AND TRACTOR FEEDERS      | \$999           | BROTHER INDUSTRIES (AUST)    | 02 887 4344 |
| 55dB        | 365             | 196(H)x588(W)x337(D) | 15          | PAPER PARKING, RED PRINT, OPT. 2 BIN FEEDER | \$1695          | BROTHER INDUSTRIES (AUST)    | 02 887 4344 |
| 60dB        | 365             | 200(H)x590(W)x381(D) | 17          | FULL IBM CHAR SET, GRAPHICS, DRAFT PRINT    | \$2495          | BROTHER INDUSTRIES (AUST)    | 02 887 4344 |
| 60dB        | 180             | 157(H)x636(W)x382(D) | 13          | INBUILT CLOCK                               | \$1792          | DATRONICS CORP               | 887 9333    |
| 58dB        | 90              | 140(H)x330(W)x475(D) | 7           | -                                           | \$799           | DICK SMITH ELECTRONICS       | 02 888 3200 |
| 55dB        | 365             | 160(H)x550(W)x380(D) | 17          | FULL WORD PROCESSING FUNCTIONS              | \$2028<br>EXTAX | FUJITSU AUSTRALIA LTD        | 02 959 6544 |
| 59dB        | 90              | 190(H)x520(W)x360(D) | -           | 3 PLUG IN PERSONALITieS.                    | \$1499          | COMMUNICATIONS & PERIPHERALS | 02 427 4222 |
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## Line printers

| Make             | Model               | Serial interface | Parallel interface | Speed (lines/sec) | Max paper width (in) | Buffer size | Max chars per line | Config kypd on prntr | Col one cntrl chars | Print mech type |
|------------------|---------------------|------------------|--------------------|-------------------|----------------------|-------------|--------------------|----------------------|---------------------|-----------------|
| C.ITOH           | CI-300              | Y                | Y                  | 300               | 16                   | 2           | 220                | Y                    | Y                   | SHUTTLE         |
| C.ITOH           | CI-600              | Y                | Y                  | 600               | 16                   | 2           | 220                | Y                    | Y                   | SHUTTLE         |
| CENTRONICS       | E SERIES            | Y                | Y                  | 2000              | 16.25                | -           | 136                | -                    | Y                   | BAND            |
| CENTRONICS       | LW 1255             | Y                | Y                  | 1200              | 18                   | -           | 132                | -                    | Y                   | BAND            |
| CENTRONICS       | LW 400              | Y                | Y                  | 400               | 18                   | -           | 132                | -                    | Y                   | BAND            |
| CENTRONICS       | LW 800              | Y                | Y                  | 800               | 18                   | -           | 132                | -                    | Y                   | BAND            |
| GENICOM          | 4410 SHUTTLE MATRIX | Y                | Y                  | 400               | 16.54                | 2           | -                  | Y                    | Y                   | SHUTTLE         |
| GENICOM          | 4440 SHUTTLE MATRIX | Y                | Y                  | 800               | 16.54                | 2           | -                  | Y                    | Y                   | SHUTTLE         |
| GENICOM          | 4470 SHUTTLE MATRIX | Y                | Y                  | 1200              | 16.54                | -           | -                  | Y                    | Y                   | SHUTTLE         |
| GENICOM          | 4490 SHUTTLE MATRIX | Y                | Y                  | 1400              | 16.54                | -           | -                  | Y                    | Y                   | SHUTTLE         |
| MANNESMANN TALLY | MT660               | Y                | Y                  | 600               | 4-16                 | 8           | 198                | Y                    | Y                   | DOT MATRIX      |
| MANNESMANN TALLY | MT690               | Y                | Y                  | 900               | 4-16                 | 8           | 198                | Y                    | Y                   | DOT MATRIX      |

## Plotters

| Make    | Model        | Serial interface | Parallel interface | Speed (inches/sec) | Max paper width (in) | Buffer size | Config kypd on plotttr | Flat bed plotter | Automatic paper feed | Auto pen capping | HP-GL compatible | Min number of pens | Max number of pens | Pen types supported                      |
|---------|--------------|------------------|--------------------|--------------------|----------------------|-------------|------------------------|------------------|----------------------|------------------|------------------|--------------------|--------------------|------------------------------------------|
| BRUNING | ZETA 8       | Y                | N                  | 25                 | 11                   | 18          | Y                      | N                | Y                    | Y                | Y                | 1                  | 8                  | Liq. Ink,Liq. Roller,Nylon Tip,Ballpoint |
| BRUNING | ZETADRAF 900 | Y                | N                  | 45                 | 37.5                 | 40          | Y                      | N                | N                    | Y                | Y                | 1                  | 8                  | Nylon Tip,Liquid Roller,Disp.Liquid Ink  |



## Line printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                         | Retail price | Distributor                 | Phone       |
|-------------|-----------------|----------------------|-------------|----------------------------------------|--------------|-----------------------------|-------------|
| 65dB        | 365             | 330(H)x660(W)x610(D) | 53          | 85 LPM NLQ, DOT GRAPHICS, BARCODES     | \$9744       | ANITECH                     | 02 648 1711 |
| 58dB        | 365             | 365(H)x720(W)x681(D) | 85          | NLQ 170 LPM, DOT GRAPHICS, BARCODES    | \$18275      | ANITECH                     | 02 648 1711 |
| -           | 365             | --                   | 227         | -                                      | NA           | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| -           | 365             | 740(H)x840(W)x990(D) | 350         | -                                      | \$22141      | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| -           | 365             | 740(H)x690(W)x910(D) | 109         | -                                      | \$14577      | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| -           | 365             | 740(H)x690(W)x910(D) | 118         | -                                      | \$17402      | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| -           | 365             | 737(H)x635(W)x994(D) | 285         | GRAPHICS, BARCODES, IBM COAX/TWINAX    | \$17539      | IMPACT DATASCAPE, C & PA    | -           |
| -           | 365             | 737(H)x635(W)x994(D) | 285         | GRAPHICS, BARCODES, IBM COAX/TWINAX    | \$20197      | IMPACT DATASCAPE, C & PA    | -           |
| -           | 365             | --                   | -           | -                                      | NA           | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| -           | 365             | --                   | -           | -                                      | NA           | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| 60dB        | 90              | 978(H)x851(W)x571(D) | 158         | HI-RES GRAPHICS/B-CODES & OCR STANDARD | \$17447      | MICROPROCESSOR APPLICATIONS | 03 894 1500 |
| 60dB        | 90              | 978(H)x851(W)x571(D) | 158         | HI-RES GRAPHICS/B-CODE & OCR STANDARD  | \$28457      | MICROPROCESSOR APPLICATIONS | 03 894 1500 |

## Plotters

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features | Retail price | Distributor     | Phone       |
|-------------|-----------------|----------------------|-------------|----------------|--------------|-----------------|-------------|
| -           | 90              | 254(H)x610(W)x305(D) | 15          | -              | \$9995       | KENELEC PTY LTD | 03 560 1011 |
| 60dB        | 90              | --                   | 60          | -              | \$18900      | KENELEC PTY LTD | 03 560 1011 |



# Plotters

| Make            | Model       | Serial interface | Parallel interface | Speed (inches/sec) | Max paper width (in) | Buffer size | Config kypd on plottr | Flat bed plotter | Automatic paper feed | Auto pen capping | HP-GL compatible | Min number of pens | Max number of pens | Pen types supported                          |
|-----------------|-------------|------------------|--------------------|--------------------|----------------------|-------------|-----------------------|------------------|----------------------|------------------|------------------|--------------------|--------------------|----------------------------------------------|
| ENTER           | SP-1000     | Y                | N                  | 24                 | 24                   | 18          | Y                     | N                | N                    | N                | Y                | 1                  | 1                  | Fiber Tip, Rollerball, Ceramic Tip, Liq. Ink |
| ENTER           | SP-601      | Y                | Y                  | 14                 | 11                   | 1           | N                     | N                | N                    | Y                | Y                | 1                  | 6                  | Fiber Tip, Liquid Roller.                    |
| HEWLETT-PACKARD | COLORPRO    | Y                | Y                  | 16                 | 8.5                  | 1           | N                     | N                | N                    | Y                | Y                | 1                  | 8                  | Paper, Transparency                          |
| HEWLETT-PACKARD | DRAFTMASTER | Y                | Y                  | 24                 | 36                   | 25          | Y                     | N                | N                    | Y                | Y                | 1                  | 8                  | Paper, Trans, Roller-Ball, Drafting          |
| HEWLETT-PACKARD | DRAFTPRO    | Y                | Y                  | 16                 | 25                   | 8           | Y                     | N                | N                    | Y                | Y                | 1                  | 8                  | Paper, Trans, Roller-Ball, Drafting          |
| HEWLETT-PACKARD | HP7475A     | Y                | Y                  | 15                 | 11                   | 1           | N                     | N                | N                    | Y                | Y                | 1                  | 6                  | Paper, Transparency, Drafting                |
| HEWLETT-PACKARD | HP7550A     | Y                | Y                  | 32                 | 11                   | 12          | Y                     | N                | Y                    | Y                | Y                | 1                  | 8                  | Paper, Transp, Roller-Ball, Drafting         |
| ROLAND DG       | DPX-2200    | Y                | Y                  | 18                 | A2                   | 15          | Y                     | Y                | N                    | Y                | Y                | 1                  | 8                  | Roland, Staedtler, Hp, Rotring               |
| ROLAND DG       | DPX-3300    | Y                | Y                  | 18                 | A1                   | 15          | Y                     | Y                | N                    | Y                | Y                | 1                  | 8                  | Roland, Staedtler, Hp, Rotring               |
| ROLAND DG       | DXY-800     | Y                | Y                  | 5                  | A3                   | -           | Y                     | Y                | N                    | N                | N                | 1                  | 8                  | Roland, Staedtler, Hp, Rotring               |
| ROLAND DG       | DXY-880     | Y                | Y                  | 8                  | A3                   | 3           | Y                     | Y                | N                    | N                | Y                | 1                  | 8                  | Roland, Staedtler, Rotring, Hp               |
| ROLAND DG       | DXY-885     | Y                | Y                  | 12                 | A3                   | 1           | Y                     | Y                | N                    | Y                | Y                | 1                  | 8                  | Roland, Staedtler, Hp, Rotring               |
| ROLAND DG       | DXY-980     | Y                | Y                  | 9                  | A3                   | 3           | Y                     | Y                | N                    | N                | Y                | 1                  | 8                  | Roland, Staedtler, Hp, Rotring               |
| ROLAND DG       | DXY-990     | Y                | Y                  | 12                 | A3                   | 1           | Y                     | Y                | N                    | Y                | Y                | 1                  | 8                  | Roland, Staedtler, Hp, Rotring               |
| SEKONIC         | SPL-410     | Y                | Y                  | 12                 | 17                   | 2           | Y                     | Y                | N                    | N                | Y                | 6                  | 6                  | Aqueous, Oily                                |
| SEKONIC         | SPL-430     | Y                | Y                  | 22                 | 17                   | 2           | Y                     | Y                | N                    | Y                | Y                | 6                  | 6                  | Aqueous, Oily                                |
| SEKONIC         | SPL-800     | Y                | N                  | 18                 | 24                   | 18          | Y                     | Y                | N                    | Y                | Y                | 8                  | 8                  | Aqueous, Oily, Ball Point, Ceramic           |

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                                | Retail price | Distributor             | Phone        |
|-------------|-----------------|----------------------|-------------|-----------------------------------------------|--------------|-------------------------|--------------|
| -           | 90              | 216(H)x991(W)x203(D) | 20          | -                                             | \$7590       | KENELEC PTY. LTD.       | 03 560 1011  |
| -           | 90              | 81(H)x457(W)x292(D)  | 4           | -                                             | \$1650       | KENELEC PTY. LTD.       | 03 560 1011  |
| -           | 365             | 125(H)x460(W)x308(D) | 5           | -                                             | \$2824       | Hewlett Packard         | 03 895 2895  |
| -           | 90              | --508(D)             | 73          | OPT. ROLL FEED AVAIL-<br>ABLE(DRAFTMASTER II) | \$21597      | Hewlett Packard         | 03 895 2895  |
| -           | 90              | --520(D)             | 30          | PEN SORTING                                   | \$ 11740     | Hewlett Packard         | 03 895 2895  |
| -           | 365             | 127(H)x568(W)x367(D) | 7           | -                                             | \$4142       | Hewlett Packard         | 03 895 2895  |
| -           | 365             | 215(H)x670(W)x432(D) | 17          | MAX ACCELERATION OF 6<br>G'S                  | \$8528       | Hewlett Packard         | 030 895 2895 |
| -           | 365             | 692(H)x900(W)x175(D) | 26          | PROG.SPEED & PRES-<br>SURE,LEDD,ELECTRO PAD   | \$7495       | ROLAND CORP<br>AUST P/L | 03 241 1254  |
| -           | 365             | 852(H)x-175(D)       | 40          | PROG,SPEED& PRES-<br>SURE,LEDD,ELECTRO PAD    | \$11495      | ROLAND CORP<br>AUST P/L | 03 241 1254  |
| -           | 365             | 77(H)x496(W)x435(D)  | 5           | -                                             | \$1495       | ROLAND CORP<br>AUST P/L | 03 241 1254  |
| -           | 365             | 90(H)x533(W)x430(D)  | 5           | OPTIONAL 10K BUFFER                           | \$2250       | ROLAND CORP<br>AUST P/L | 03 241 1254  |
| -           | 365             | 102(H)x586(W)x436(D) | 6           | MAGNETIC BASE.ADJUS-<br>TABLE PEN PRESSURE    | \$2850       | ROLAND CORP<br>AUST P/L | 03 241 1254  |
| -           | 365             | 106(H)x535(W)x450(D) | 5           | LED DISPLAY,ELECTROS-<br>TATIC PAPER HOLD     | \$2950       | ROLAND CORP<br>AUST P/L | 03 241 1254  |
| -           | 365             | 115(H)x608(W)x452(D) | 7           | LED DISPLAY,PRESSURE<br>ADJ.,ELECTOST PAD     | \$3595       | ROLAND CORP<br>AUST P/L | 03 241 1254  |
| -           | 365             | 105(H)x575(W)x448(D) | 10          | RESOLUTION 0.025 MM                           | POA          | ANITECH                 | 02 648 1711  |
| -           | 365             | 110(H)x489(W)x302(D) | 6           | RESOLUTION 0.025 MM                           | POA          | ANITECH                 | 02 648 1711  |
| -           | 365             | 999(H)x820(W)x320(D) | 32          | RESOLUTION 0.025 MM                           | POA          | ANITECH                 | 02 648 1711  |



## Inkjet printers

| Make             | Model         | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Plain paper | Min pitch (cpi) | Maximum pitch (cpi) | Max chars per line | Bi-direct print head | Bi-direct paper feed | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportional print mode | D/loadable char set | IBM graphics compat | Epson model compat |
|------------------|---------------|------------------|--------------------|-------------------|----------|-----------------|----------------------|-------------|-----------------|---------------------|--------------------|----------------------|----------------------|--------------------|-------------|--------------|---------------|------------|-------------------------|---------------------|---------------------|--------------------|
| EPSON            | IX-800        | Y                | Y                  | 240               | Y        | 54              | 10                   | Y           | -               | -                   | 160                | Y                    | N                    | 240                | 8           | N            | Y             | Y          | Y                       | Y                   | Y                   | LX/ FX/ EX         |
| EPSON            | SQ-2500       | Y                | Y                  | 540               | Y        | 180             | 16                   | Y           | -               | -                   | 272                | Y                    | N                    | 360                | 8           | Y            | Y             | Y          | Y                       | Y                   | Y                   | LQ SERIES          |
| HEWLETT-PACKARD  | QUIETJET      | Y                | Y                  | 192               | Y        | 48              | 9.75                 | N           | -               | -                   | 170                | N                    | N                    | 192                | 2           | Y            | Y             | N          | N                       | N                   | Y                   | MX80               |
| HEWLETT-PACKARD  | QUIETJET PLUS | Y                | Y                  | 192               | Y        | 48              | 15                   | N           | -               | -                   | 281                | Y                    | Y                    | 192                | 2           | Y            | Y             | Y          | N                       | N                   | Y                   | MX80               |
| MANNESMANN TALLY | MT90          | Y                | Y                  | 220               | Y        | 110             | 4-10                 | Y           | -               | -                   | 132                | Y                    | Y                    | 240                | 3           | Y            | Y             | Y          | N                       | Y                   | Y                   | FX                 |

## Laser printers

| Make               | Model         | Serial interface | Parallel interface | Resolution (dpi) | Speed (pages/min) | Memory standard | Memory maximum | Point size minimum | Point size maximum | Downloadable fonts | Plug-in fonts | Num standard fonts | Number of trays | Feeder tray pages | Output tray pages | Collation order | Config kypd on pntr | Rec. pages/month | Doc description lang. |
|--------------------|---------------|------------------|--------------------|------------------|-------------------|-----------------|----------------|--------------------|--------------------|--------------------|---------------|--------------------|-----------------|-------------------|-------------------|-----------------|---------------------|------------------|-----------------------|
| C.ITOH             | CIE3000       | N                | Y                  | 300              | 30                | 4096            | 6144           | 6                  | 12                 | Y                  | Y             | 16                 | 3               | 500               | 500               | Y               | Y                   | -                | VECTOR DRAWING        |
| C.ITOH             | LIPS 10       | Y                | Y                  | 300              | 10                | 512             | 1200           | 6                  | 12                 | Y                  | Y             | 9                  | 2               | 250               | 250               | Y               | Y                   | 15000            | LIPS CONTROL LANG.    |
| CENTRONICS         | PAGEPRINTER 8 | Y                | Y                  | 300              | 8                 | -               | -              | -                  | -                  | -                  | Y             | 10                 | 1               | 100               | 100               | -               | -                   | -                | -                     |
| COMMODORE          | LP 806        | N                | Y                  | 300              | 6                 | 256             | 650            | 1                  | 300                | Y                  | Y             | 15                 | 1               | 150               | 150               | Y               | Y                   | 3000             | HP PLUS               |
| DATAPRODUCTS CORP. | LZR 1230      | Y                | Y                  | 300              | 12                | 512             | 2000           | -                  | -                  | Y                  | Y             | 6                  | 1               | 250               | 250               | Y               | Y                   | 10000            | LASERJET+             |
| DATASOUTH          | PAGE-WRITER 8 | Y                | Y                  | 300              | 8                 | 512             | 1200           | 2                  | 50                 | Y                  | Y             | 4                  | 2               | 250               | 250               | Y               | Y                   | 5000             | PRINTER EMULATOR      |
| EPSON              | GQ-3500       | N                | Y                  | 300              | 6                 | 512             | 2048           | 7                  | 24                 | Y                  | Y             | 7                  | 1               | 150               | 250               | Y               | Y                   | 3000             | ESC/PL                |
| FACIT              | P7010         | Y                | Y                  | 300              | 8                 | 256             | 512            | -                  | -                  | Y                  | Y             | 4                  | 1               | 250               | 250               | Y               | N                   | 10000            | N                     |
| FACIT              | P7080         | Y                | Y                  | 300              | 8                 | 512             | 2000           | -                  | -                  | Y                  | Y             | 3                  | 1               | 250               | 250               | Y               | Y                   | 10000            | OPTIONAL              |

## Inkjet printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                           | Retail price | Distributor                 | Phone       |
|-------------|-----------------|----------------------|-------------|------------------------------------------|--------------|-----------------------------|-------------|
| 54dB        | 365             | 103(H)x485(W)x302(D) | 6           | IBM EMULATION, OPTIONAL TRACTOR FEED     | \$1450       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 45dB        | 365             | 135(H)x618(W)x380(D) | 11          | SELF CLEAN,AUTO LOAD,MULTI FONTS,OP DBSF | \$2540       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 48dB        | 365             | 118(H)x395(W)x214(D) | 4           | BOLD,COMPRESSED,EXPANDED PRINT MODES     | \$1229       | Hewlett Packard             | 03 895 2895 |
| 48dB        | 365             | 118(H)x527(W)x214(D) | 4           | COMPRESSED,EXPANDED,BOLD PRINT           | \$1739       | Hewlett Packard             | 03 895 2895 |
| 45dB        | 90              | 11(H)x40(W)x29(D)    | 6           | PUSH TRACTORS/PAPER ROLL/24 NOZZLE B/JET | \$1759       | MICROPROCESSOR APPLICATIONS | 03 894 1500 |

## Laser printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                            | Retail price | Distributor                 | Phone       |
|-------------|-----------------|----------------------|-------------|-------------------------------------------|--------------|-----------------------------|-------------|
| 58dB        | 365             | 610(H)x685(W)x585(D) | 81          | 150,000 PAGES PER MONTH DUTY CYCLE        | \$49950      | ANITECH                     | 02 648 1711 |
| 55dB        | 365             | 285(H)x520(W)x490(D) | 35          | 600,000 PAGE LIFE. BAR-CODES, 4 EMULATION | \$7950       | ANITECH                     | 02 648 1711 |
|             | 365             | 292(H)x442(W)x450(D) | 32          | PRICE INCLUDES HP LASERJET PLUS           | \$ 3995      | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| 45dB        | 90              | 205(H)x417(W)x407(D) | 15          | EMULATES MOST STD. PRINTERS DIABLO/EPSON  | \$3999       | COMMODORE BUSINESS MACHINES | 02 427 4888 |
| 55dB        | 365             | 321(H)x479(W)x493(D) | 38          | DIABLO 630,FX80,3* CONCURRENT INTERFACES  | \$7780       | DATAPRODUCTS CORP           | 02 451 3533 |
| 45dB        | 90              | 276(H)x470(W)x525(D) | 24          |                                           | \$4500       | KENELEC PTY LTD             | 03 560 1011 |
| 52dB        | 365             | 405(H)x591(W)x215(D) | 16          | FONT CARDS,OPT 250 INPUT TRAY,SER I/F     | \$4500       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 55dB        | 90              | 329(H)x530(W)x420(D) | 40          | DIABLO 630                                | \$7200       | ELMEASCO INSTRUMENTS        | 02 427 3322 |
| 55dB        | 90              | 550(H)x470(W)x410(D) | 40          | DIABLO 630, IBM PRO, H.P. LASERJET        | \$9672       | ELMEASCO INSTRUMENTS        | 02 427 3322 |



# Laser printers

| Make            | Model         | Serial interface | Parallel interface | Resolution (dpi) | Speed (pages/min) | Memory standard | Memory maximum | Point size minimum | Point size maximum | Downloadable fonts | Plug-in fonts | Num standard fonts | Number of trays | Feeder tray pages | Output tray pages | Collation order | Config kypd on pntr | Rec. pages/month | Doc description lang. |
|-----------------|---------------|------------------|--------------------|------------------|-------------------|-----------------|----------------|--------------------|--------------------|--------------------|---------------|--------------------|-----------------|-------------------|-------------------|-----------------|---------------------|------------------|-----------------------|
| FACIT           | P7150         | Y                | Y                  | 300              | 15                | 512             | 2000           | -                  | -                  | Y                  | Y             | 3                  | 2               | 250               | 250               | Y               | Y                   | 20000            | OPTIONAL              |
| GENICOM         | 5010          | Y                | Y                  | 300              | 10                | -               | -              | -                  | -                  | Y                  | Y             | 64                 | 2               | 250               | 250               | Y               | -                   | -                | -                     |
| HEWLETT-PACKARD | LASERJET 2000 | Y                | Y                  | 300              | 20                | 1500            | 5500           | 6                  | 655                | Y                  | Y             | 34                 | 2               | 250               | 1500              | Y               | Y                   | 70000            | PCL                   |
| HEWLETT-PACKARD | LASERJET 500  | Y                | Y                  | 300              | 8                 | 512             | 2512           | 6                  | 30                 | Y                  | Y             | 4                  | 2               | 250               | 250               | Y               | Y                   | 4000             | PCL                   |
| HEWLETT-PACKARD | LASERJET II   | Y                | Y                  | 300              | 8                 | 512             | 4512           | 6                  | 655                | Y                  | Y             | 6                  | 1               | 200               | 100               | Y               | Y                   | 5000             | POSTSCRIPT AVAIL-OCT  |
| IMPACT          | L1500-01      | Y                | Y                  | 300              | 15                | 768             | -              | 6                  | 36                 | Y                  | Y             | 4                  | 2               | 250               | 500               | Y               | Y                   | 25000            | -                     |
| IMPACT          | L1500-02      | Y                | Y                  | 300              | 15                | 3576            | -              | 6                  | 36                 | Y                  | Y             | 4                  | 2               | 250               | 500               | Y               | Y                   | 25000            | POSTSCRIPT            |
| IMPACT          | L2000-01      | Y                | Y                  | 300              | 20                | 2500            | -              | 6                  | -                  | Y                  | Y             | 4                  | 2               | 250               | 500               | Y               | Y                   | -                | -                     |
| IMPACT          | L2000-02      | Y                | Y                  | 300              | 20                | 2500            | -              | 6                  | -                  | Y                  | Y             | -                  | 2               | 250               | 500               | Y               | Y                   | -                | IMPACT GCL            |
| IMPACT          | L2000-03      | Y                | Y                  | 300              | 20                | 2500            | -              | 6                  | -                  | Y                  | Y             | -                  | 2               | 250               | 500               | Y               | Y                   | -                | POSTSCRIPT            |
| IMPACT          | L800-C        | Y                | Y                  | 300              | 8                 | 384             | 4500           | 6                  | 24                 | Y                  | Y             | 4                  | 1               | 200               | 120               | Y               | Y                   | 6000             | IMPACT LCL            |
| IMPACT          | L800-C4       | Y                | Y                  | 300              | 8                 | 2200            | 4500           | 6                  | 24                 | Y                  | Y             | 4                  | 1               | 100               | 50                | Y               | Y                   | 6000             | IMPACT GCL            |
| IMPACT          | L800-T        | Y                | Y                  | 300              | 8                 | 640             | 4500           | 6                  | 24                 | Y                  | Y             | 4                  | 1               | 100               | 50                | Y               | Y                   | 6000             | IMPACT LCL            |
| IMPACT          | L800-T4       | Y                | Y                  | 300              | 8                 | 2200            | 4500           | 6                  | 24                 | Y                  | Y             | 7                  | 1               | 100               | 50                | Y               | Y                   | 6000             | IMPACT GCL            |
| IMPACT          | L800-W        | Y                | Y                  | 300              | 8                 | 384             | 4500           | 6                  | 24                 | Y                  | Y             | 6                  | 1               | 100               | 50                | Y               | Y                   | 6000             | IMPACT LCL            |
| IMPACT          | LP800-01      | Y                | Y                  | 300              | 8                 | 2000            | 4500           | 6                  | -                  | Y                  | Y             | 4                  | 1               | 100               | 50                | Y               | Y                   | 6000             | POSTSCRIPT            |
| IMPACT          | LS400-01      | Y                | Y                  | 300              | 4                 | 256             | 4500           | 6                  | 24                 | Y                  | Y             | 2                  | 1               | 200               | 120               | Y               | Y                   | 4000             | IMPACT LCL            |

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                          | Retail price | Distributor                   | Phone       |
|-------------|-----------------|----------------------|-------------|-----------------------------------------|--------------|-------------------------------|-------------|
| 55dB        | 90              | 550(H)x470(W)x410(D) | 40          | DIABLO 630, IBM PRO. H.P. LASERJET      | \$13600      | ELMEASCO INSTRUMENTS          | 02 427 3322 |
| -           | 365             | 386(H)x450(W)x495(D) | 38          | PRICE INCLUDES HP LASERJET PLUS         | \$ 5995      | GENICOM (AUSTRALIA) PTY. LTD. | 02 406 6411 |
| 57dB        | 90              |                      | 163         | DOUBLE-SIDED. GRAPHICS, 2000 INPUT DECK | \$ 43626     | Hewlett-Packard               | 03 895 2895 |
| 55dB        | 365             | 460(H)x475(W)x495(D) | 43          | JOB OFFSETTING. GRAPHICS, FORM OVERLAY  | \$ 10189     | HP                            | 03 895 2895 |
| 50dB        | 365             | 228(H)x454(W)x482(D) | 22          | GRAPHICS, FORM OVERLAYS                 | \$5958       | HP                            | 03 895 2895 |
| -           | 90              | 445(H)x546(W)x724(D) | 40          | 3 PRINTER EMULATIONS                    | \$11195      | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| -           | 90              | 445(H)x546(W)x724(D) | 40          | 4 PRINTER EMULATIONS                    | \$16240      | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 57dB        | 90              | 965(H)x730(W)x600(D) | 100         | DYNAMIC MEMORY MGMT, PLUG IN EMULATIONS | \$29680      | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 57dB        | 90              | 965(H)x730(W)x600(D) | 100         | GRAPHICS, BAR CODES, A3 PAPER, DUPLEX   | \$36588      | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 57dB        | 90              | 965(H)x730(W)x600(D) | 100         | DYNAMIC MEMORY MGMT, PLUG IN EMULATIONS | \$43316      | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 50dB        | 90              | 293(H)x475(W)x415(D) | 32          | IBM 3174/3274/3276 (INTEGRATED COAX)    | \$8955       | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 50dB        | 90              | 293(H)x475(W)x415(D) | 32          | IBM 3174/3274/3276 (INTEGRATED COAX)    | \$10300      | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 50dB        | 90              | 293(H)x475(W)x415(D) | 32          | IBM 34/36/38 (INTEGRATED TWINAX I/FACE) | \$8955       | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 50dB        | 90              | 293(H)x475(W)x415(D) | 32          | IBM 34/36/38, GRAPHICS, BAR CODES, OCR  | \$10300      | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 50dB        | 90              | 293(H)x475(W)x415(D) | 32          | WANG VS/OIS, WANG 5573, 5574 EMULATIONS | \$8235       | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 50dB        | 90              | 293(H)x475(W)x415(D) | 32          |                                         | \$10794      | IMPACT SYSTEMS LIMITED        | 02 969 2699 |
| 50dB        | 90              | 263(H)x454(W)x482(D) | 20          | DIABLO 630 EMULATION                    | \$3495       | IMPACT SYSTEMS LIMITED        | 02 969 2699 |



# Laser printers

| Make             | Model            | Serial interface | Parallel interface | Resolution (dpi) | Speed (pages/min) | Memory standard | Memory maximum | Point size minimum | Point size maximum | Downloadable fonts | Plug-in fonts | Num standard fonts | Number of trays | Feeder tray pages | Output tray pages | Collation order | Config kypd on pntr | Rec. pages/month | Doc description lang. |
|------------------|------------------|------------------|--------------------|------------------|-------------------|-----------------|----------------|--------------------|--------------------|--------------------|---------------|--------------------|-----------------|-------------------|-------------------|-----------------|---------------------|------------------|-----------------------|
| IMPACT           | LS800-02         | Y                | Y                  | 300              | 8                 | 384             | 4500           | 6                  | 24                 | Y                  | Y             | 7                  | 1               | 200               | 120               | Y               | Y                   | 6000             | IMPACT LCL            |
| IMPACT           | LS800-03         | Y                | Y                  | 300              | 8                 | 2200            | 4500           | 6                  | 24                 | Y                  | Y             | 9                  | 1               | 200               | 120               | Y               | Y                   | 6000             | IMPACT GCL            |
| IMPACT           | LS800-04         | Y                | Y                  | 300              | 8                 | 2200            | 4500           | 6                  | 24                 | Y                  | Y             | 11                 | 1               | 200               | 120               | Y               | Y                   | 6000             | IMPACT GCL            |
| IMPACT           | LS800-1          | Y                | Y                  | 300              | 8                 | 256             | 4500           | 6                  | 24                 | Y                  | Y             | 2                  | 1               | 200               | 120               | Y               | Y                   | 6000             | IMPACT LCL            |
| IMPACT           | LS800-D1         | Y                | Y                  | 300              | 8                 | 256             | 4500           | 6                  | 24                 | Y                  | Y             | 4                  | 1               | 200               | 120               | Y               | Y                   | 6000             | IMPACT LCL            |
| IMPACT           | LS800-D2         | Y                | Y                  | 300              | 8                 | 384             | 4500           | 6                  | 24                 | Y                  | Y             | 6                  | 1               | 200               | 120               | Y               | Y                   | 6000             | IMPACT LCL            |
| MANNESMANN TALLY | MT 910           | Y                | Y                  | 300              | 10                | 512             | 2000           | 6                  | 30                 | Y                  | Y             | 3                  | 2               | 500               | 500               | Y               | Y                   | 10000            | NONE AS YET           |
| OASYS LASER-PRO  | 1510             | Y                | Y                  | 300              | 15                | 768             | 1200           | 2                  | 50                 | Y                  | Y             | 22                 | 2               | 500               | 500               | Y               | Y                   | 15000            | PYRAMID,LASER PROSE.  |
| OASYS LASER-PRO  | EXPRESS          | Y                | Y                  | 300              | 8                 | 512             | 512            | 2                  | 50                 | Y                  | Y             | 19                 | 1               | 250               | 250               | Y               | Y                   | 5000             | PRINTER EMULATOR      |
| OASYS LASER-PRO  | EXPRESS SERIES 2 | Y                | Y                  | 300              | 8                 | 640             | 640            | 2                  | 50                 | Y                  | Y             | 19                 | 1               | 250               | 250               | Y               | Y                   | 5000             | PRINTER EMULATION     |
| OASYS LASER-PRO  | GOLD EXPRESS     | Y                | Y                  | 300              | 8                 | 1500            | 3000           | 2                  | 50                 | Y                  | Y             | 25                 | 1               | 250               | 250               | Y               | Y                   | 5000             | EXPRESS & PYRAMID     |
| OASYS LASER-PRO  | SILVER EXPRESS   | Y                | Y                  | 300              | 8                 | 768             | 1200           | 2                  | 50                 | Y                  | Y             | 25                 | 1               | 250               | 250               | Y               | Y                   | 5000             | EXPRESS & PYRAMID     |
| OKI MICROLINE    | LASERLINE 6      | Y                | Y                  | 300              | 6                 | 128             | 512            | 8                  | 14                 | Y                  | Y             | 15                 | 1               | 150               | 150               | Y               | Y                   | 3000             | PAGE-MAKER            |
| OMNI LASER       | 2015             | Y                | Y                  | 300              | 15                | 512             | 512            | -                  | -                  | Y                  | Y             | 1                  | 2               | 250               | 500               | Y               | Y                   | 25000            | NO                    |
| OMNI LASER       | 2108             | Y                | Y                  | 300              | 8                 | 2048            | 2048           | -                  | -                  | Y                  | Y             | 4                  | 1               | 250               | 250               | Y               | Y                   | 8000             | POSTSCRIPT            |
| OMNI LASER       | 2115             | Y                | Y                  | 300              | 15                | 3072            | 3072           | -                  | -                  | Y                  | Y             | 4                  | 2               | 250               | 500               | Y               | Y                   | 25000            | POSTSCRIPT            |
| QUADLASER        | LS2000           | N                | Y                  | 300              | 8                 | 1500            | 2000           | 6                  | 36                 | Y                  | N             | 8                  | 1               | 250               | 250               | Y               | N                   | 10000            | POSTSCRIPT            |



| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                            | Retail price | Distributor                         | Phone       |
|-------------|-----------------|----------------------|-------------|-------------------------------------------|--------------|-------------------------------------|-------------|
| 50dB        | 90              | 263(H)x454(W)x482(D) | 20          | 6 PRINTER EMULATIONS                      | \$5320       | IMPACT SYSTEMS LIMITED              | 02 969 2699 |
| 50dB        | 90              | 263(H)x454(W)x482(D) | 20          | 6 PRINTER EMULATIONS WITH LASERJET PLUS   | \$6664       | IMPACT SYSTEMS LIMITED              | 02 969 2699 |
| 50dB        | 90              | 263(H)x454(W)x482(D) | 20          | 6 PTRS,GRAPHICS,23 BAR CODES,HP 7470A     | \$8955       | IMPACT SYSTEMS LIMITED              | 02 969 2699 |
| 50dB        | 90              | 263(H)x454(W)x482(D) | 20          | DIABLO 630 EMULATION                      | \$3995       | IMPACT SYSTEMS LIMITED              | 02 969 2699 |
| 50dB        | 90              | 263(H)x454(W)x482(D) | 20          | DECMATE COMPATIBLE, HP LASERJET           | \$7112       | IMPACT SYSTEMS LIMITED              | 02 969 2699 |
| 50dB        | 90              | 263(H)x454(W)x482(D) | 20          | DECMATE COMPATIBLE, HP LASERJET           | \$7505       | IMPACT SYSTEMS LIMITED              | 02 969 2699 |
| 50dB        | 90              | 360(H)x464(W)x450(D) | 32          | 5 EMULAT.STAND-OPT 4 PORT IF/2 MB MEMORY  | \$8720       | MICROPROCESSOR APPLICATIONS Pty Ltd | 03 894 1500 |
| 55dB        | 90              | 400(H)x537(W)x462(D) | 40          |                                           | \$12100      | KENELEC PTY LTD                     | 03 560 1011 |
| 55dB        | 90              | 300(H)x405(W)x388(D) | 22          | HP LASER JET CARTRIDGE OPTION             | \$3670       | KENELEC PTY LTD                     | 03 560 1011 |
| 55dB        | 90              | 300(H)x405(W)x388(D) | 22          |                                           | \$3840       | KENELEC PTY LTD                     | 03 560 1011 |
| 55dB        | 90              | 300(H)x405(W)x388(D) | 22          | H.P FONT CARTRIDGE,HPGL COMPATIBLE.       | \$6370       | KENELEC PTY LTD                     | 03 560 1011 |
| 55dB        | 90              | 300(H)x405(W)x388(D) | 22          | H.P FONT CARTRIDGE.                       | \$4850       | KENELEC PTY LTD                     | 03 560 1011 |
| 52dB        | 365             | 225(H)x414(W)x410(D) | 17          | 3-PORT HP+ EMULATION 550 SHEET DUAL BIN   | \$4482       | IPL DATRON PTY LTD                  | 02 698 8211 |
| 55dB        | 90              | 444(H)x546(W)x724(D) | 40          | 1.5M COPIES LIFE TIME, PAPER JOGGER       | \$11500      | TEXAS INSTRUMENTS AUSTRALIA LTD     | 02 887 1122 |
| 55dB        | 90              | 394(H)x546(W)x597(D) | 35          | 600K MACHINE LIFE, AP- PLETALK, RS422 I/F | \$11500      | TEXAS INSTRUMENTS AUSTRALIA LTD     | 02 887 1122 |
| 55dB        | 90              | 444(H)x546(W)x724(D) | 40          | 1.5M MACHINE LIFE. AP- PLETALK, RS422 I/F | \$16675      | TEXAS INSTRUMENTS AUSTRALIA LTD     | 02 887 1122 |
| 55dB        | 90              | 330(H)x510(W)x580(D) | 37          | FORMS SOFTWARE, FONT EDITOR,600000 COPIES | \$6995       | INTELLIGENT SYSTEMS AUST PTY LTD    | 03 543 7988 |



# Laser printers

| Make                 | Model         | Serial interface | Parallel interface | Resolution (dpi) | Speed (pages/min) | Memory standard | Memory maximum | Point size minimum | Point size maximum | Downloadable fonts | Plug-in fonts | Num standard fonts | Number of trays | Feeder tray pages | Output tray pages | Collation order | Config kypd on pntr | Rec. pages/month | Doc description lang. |
|----------------------|---------------|------------------|--------------------|------------------|-------------------|-----------------|----------------|--------------------|--------------------|--------------------|---------------|--------------------|-----------------|-------------------|-------------------|-----------------|---------------------|------------------|-----------------------|
| QUADLASER            | LS2001        | Y                | N                  | 300              | 8                 | 1500            | 2000           | 6                  | 36                 | Y                  | N             | 8                  | 1               | 250               | 250               | Y               | N                   | 10000            | POSTSCRIPT            |
| QUADLASER            | LS2200        | N                | Y                  | 300              | 8                 | 2000            | 2000           | 6                  | 36                 | Y                  | N             | 8                  | 1               | 250               | 250               | Y               | N                   | 10000            | POSTSCRIPT            |
| QUADLASER            | LS2201        | Y                | N                  | 300              | 8                 | 2000            | 2000           | 6                  | 36                 | Y                  | N             | 8                  | 1               | 250               | 250               | Y               | N                   | 10000            | POSTSCRIPT            |
| QUME                 | LASERTEN      | Y                | Y                  | 300              | 10                | 128             | 128            | 7                  | 36                 | Y                  | Y             | 1                  | 1               | 250               | 250               | Y               | N                   | 5000             | -                     |
| QUME                 | LASERTEN PLUS | Y                | Y                  | 300              | 10                | 512             | 512            | 7                  | 36                 | Y                  | Y             | 1                  | 1               | 250               | 250               | Y               | N                   | 5000             | -                     |
| QUME                 | SCRIPTEN      | Y                | Y                  | 300              | 10                | 2000            | 3000           | 2                  | 127                | Y                  | Y             | 35                 | 1               | 250               | 250               | Y               | N                   | 5000             | POSTSCRIPT            |
| RANK XEROX           | 2700          | Y                | Y                  | 300              | 12                | 512             | 512            | 6                  | 24                 | Y                  | Y             | 2                  | 2               | 250               | 250               | Y               | N                   | 30000            | -                     |
| RANK XEROX           | 3700          | Y                | Y                  | 300              | 24                | 1000            | 2000           | 6                  | 32                 | Y                  | Y             | 2                  | 3               | -                 | -                 | Y               | N                   | -                | -                     |
| RANK XEROX           | 4045          | Y                | Y                  | 300              | 10                | 1000            | 2000           | 6                  | 36                 | Y                  | Y             | 2                  | 1               | 250               | 100               | Y               | N                   | 12000            | -                     |
| THE LASER CONNECTION | PS-JET+       | Y                | N                  | 300              | 8                 | 2000            | -              | 1                  | 999                | Y                  | N             | 13                 | 1               | -                 | -                 | -               | Y                   | -                | POSTSCRIPT            |
| UNISYS               | MODEL 37      | Y                | Y                  | 300              | 10                | 1000            | 1000           | 2                  | 50                 | Y                  | N             | 61                 | 1               | 250               | 150               | N               | N                   | 5000             | EXPRESS               |
| UNISYS               | MODEL 37      | Y                | Y                  | 300              | 10                | 1000            | 1000           | 2                  | 50                 | Y                  | N             | 61                 | 1               | 250               | 150               | N               | N                   | 5000             | EXPRESS               |
| WENGER               | 26/1X SERIES  | Y                | Y                  | 300              | 26                | -               | -              | -                  | -                  | Y                  | -             | 8                  | 2               | 500               | 500               | Y               | Y                   | 30000            | POSTSCRIPT            |
| WENGER               | 8/1           | Y                | Y                  | 300              | 8                 | 1500            | 2000           | -                  | -                  | Y                  | Y             | 4                  | 1               | 250               | 250               | Y               | Y                   | 10000            | -                     |

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                             | Retail price | Distributor                      | Phone       |
|-------------|-----------------|----------------------|-------------|--------------------------------------------|--------------|----------------------------------|-------------|
| 55dB        | 90              | 330(H)x510(W)x580(D) | 37          | FORMS SOFTWARE, FONT EDITOR, 600000 COPIES | \$6995       | INTELLIGENT SYSTEMS AUST Pty Ltd | 03 543 7988 |
| 55dB        | 90              | 330(H)x510(W)x580(D) | 37          | FORMS SOFTWARE, FONT EDITOR, 600000 COPIES | \$7995       | INTELLIGENT SYSTEMS AUST Pty Ltd | 03 543 7988 |
| 55dB        | 90              | 330(H)x510(W)x580(D) | 37          | FORMS SOFTWARE, FONT EDITOR, 600000 COPIES | \$7995       | INTELLIGENT SYSTEMS AUST Pty Ltd | 03 543 7988 |
| 50dB        | 90              | 380(H)x440(W)x505(D) | 38          | 6 PLUG IN PERSONALITYS                     | \$7342       | COMMUNICATIONS & PERIPHERALS     | 02 427 4222 |
| 55dB        | 90              | 380(H)x440(W)x505(D) | 44          | 6 PLUG IN PERSONALITYS                     | \$8070       | COMMUNICATIONS & PERIPHERALS     | 02 427 4222 |
| 50dB        | 90              | 380(H)x440(W)x505(D) | 39          | APPLE/HP L JET/RS232/CENT                  | \$10794      | COMMUNICATIONS & PERIPHERALS     | 02 427 4222 |
| 35dB        | 90              | ?-889(W)x787(D)      | 172         | SNA BOARD                                  | \$20000      | RANK XEROX AUSTRALIA PTY LTD     | 02 449 0449 |
| 35dB        | 90              | ?-889(W)x787(D)      | 172         | 10 OR 50 MB HARD DISK, A3 PAPER SIZE       | \$50000      | RANK XEROX AUSTRALIA PTY LTD     | 02 449 0449 |
| 35dB        | 90              | 270(H)x700(W)x550(D) | 65          | COPIER INC OPTIONAL SNA                    | \$10000      | RANK XEROX AUSTRALIA PTY LTD     | 02 449 0449 |
| -           | 365             | -                    | -           | P'SCRIPT UPGRADE FOR ALL CANON CX LASERS   | \$8120       | MEGAVISION PTY LTD               | 02 957 5797 |
| 45dB        | 90              | 340(H)x450(W)x440(D) | 29          | MULTIPLE PRINTER EMULATIONS                | \$7286       | UNISYS AUSTRALIA LTD             | 02 963 6000 |
| 45dB        | 90              | 340(H)x450(W)x440(D) | 29          | MULTIPLE PRINTER EMULATIONS                | \$7286       | UNISYS AUSTRALIA LTD             | 02 963 6000 |
| 55dB        | 90              | 408(H)x567(W)x895(D) | 80          | PAPER TRANSPORTED BY LONG OR SHORT EDGE    | \$22441      | DATATEL PTY LTD                  | 03 690 4000 |
| 55dB        | 90              | 331(H)x407(W)x534(D) | 37          | FONT EDITOR TO ALTER OR CREATE FONTS       | \$8810       | DATATEL PTY LTD                  | 03 690 4000 |



# Dot matrix printers

| Make    | Model      | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Minimum pitch (cpi) | Maximum pitch (cpi) | Max chars per line | Bi-directnl print head | Bi-directnl paper feed | Num. print pins/wires | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportnl print mode | D/loadable char set | IBM graphics compat | Epson model compat |
|---------|------------|------------------|--------------------|-------------------|----------|-----------------|----------------------|---------------------|---------------------|--------------------|------------------------|------------------------|-----------------------|--------------------|-------------|--------------|---------------|------------|----------------------|---------------------|---------------------|--------------------|
| AMSTRAD | DMP2000    | N                | Y                  | 105               | Y        | 35              | 10                   | 5                   | 17                  | 137                | Y                      | N                      | 9                     | 120                | 8           | Y            | Y             | N          | Y                    | N                   | N                   | FX-80              |
| AMSTRAD | DMP3160    | N                | Y                  | 160               | Y        | 40              | 10                   | 17                  | 5                   | 132                | Y                      | N                      | 9                     | 120                | 8           | Y            | Y             | N          | Y                    | Y                   | Y                   | FX-80              |
| AMSTRAD | DMP4000    | N                | Y                  | 200               | Y        | 50              | 16.5                 | 17                  | 10                  | 233                | Y                      | Y                      | 9                     | 120                | 8           | Y            | Y             | N          | Y                    | Y                   | Y                   | FX-100             |
| AMSTRAD | LQ3500     | Y                | Y                  | 160               | Y        | 54              | 10                   | 17                  | 5                   | 136                | Y                      | Y                      | 24                    | 240                | 7           | Y            | Y             | Y          | Y                    | Y                   | Y                   | LQ-1500            |
| BROTHER | M-1109     | Y                | Y                  | 100               | Y        | 25              | 10                   | 20                  | 5                   | 160                | Y                      | Y                      | 9                     | 240                | 2           | N            | Y             | N          | Y                    | Y                   | Y                   | FX-80              |
| BROTHER | M-1709     | Y                | Y                  | 240               | Y        | 50              | 16                   | 20                  | 5                   | 272                | Y                      | Y                      | 9                     | 240                | 24          | Y            | Y             | N          | Y                    | Y                   | Y                   | FX-100+            |
| BROTHER | M-1724     | Y                | Y                  | 216               | Y        | 72              | 16                   | 20                  | 5                   | 272                | Y                      | Y                      | 24                    | 360                | 16          | Y            | Y             | N          | Y                    | Y                   | Y                   | LQ-1000            |
| BROTHER | M-4018     | Y                | Y                  | 480               | Y        | 100             | 16                   | 20                  | 5                   | 272                | Y                      | Y                      | 18                    | 240                | 48          | Y            | Y             | N          | Y                    | Y                   | Y                   | EX-1000            |
| C.ITOH  | 1550S+     | Y                | Y                  | 180               | Y        | 22              | 15                   | 5                   | 17                  | 230                | Y                      | Y                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | MX-80              |
| C.ITOH  | 8510S+     | Y                | Y                  | 180               | Y        | 22              | 10                   | 5                   | 17                  | 136                | Y                      | Y                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | MX-80              |
| C.ITOH  | C310       | Y                | Y                  | 300               | Y        | 50              | 11                   | 9                   | 18                  | 160                | Y                      | Y                      | 9                     | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-85              |
| C.ITOH  | C315       | Y                | Y                  | 300               | Y        | 50              | 15.5                 | 9                   | 18                  | 272                | Y                      | Y                      | 9                     | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-105             |
| C.ITOH  | C715       | Y                | Y                  | 300               | Y        | 100             | 16                   | 9                   | 18                  | 272                | Y                      | Y                      | 24                    | 360                | 32          | Y            | Y             | Y          | Y                    | Y                   | Y                   | LQ 1500            |
| C.ITOH  | C815       | Y                | Y                  | 570               | Y        | 162             | 16                   | 5                   | 18                  | 232                | Y                      | Y                      | 24                    | 360                | 42          | Y            | Y             | Y          | Y                    | Y                   | Y                   | MX-80              |
| C.ITOH  | CI-3500    | Y                | Y                  | 350               | Y        | 87              | 16                   | 6                   | 18                  | 233                | Y                      | Y                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | MX-80              |
| C.ITOH  | RITEMAN 15 | Y                | Y                  | 160               | Y        | 30              | 15                   | 5                   | 17                  | 233                | Y                      | Y                      | 9                     | 125                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-100             |
| C.ITOH  | RITEMAN A2 | Y                | Y                  | 160               | Y        | 30              | 9.5                  | 5                   | 17                  | 132                | Y                      | Y                      | 9                     | 144                | 2           | N            | Y             | Y          | Y                    | Y                   | Y                   | FX-80              |

## Dot matrix printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                            | Retail price | Distributor                       | Phone       |
|-------------|-----------------|----------------------|-------------|-------------------------------------------|--------------|-----------------------------------|-------------|
| -           | 90              | 100(H)x380(W)x260(D) | 4           | SUPPLIED WITH CABLE FOR AMSTRAD CPC       | \$599        | MITSUBISHI ELECTRIC AWA           | 02 638 8444 |
| -           | 90              | 100(H)x400(W)x250(D) | 4           | -                                         | \$599        | MITSUBISHI ELECTRIC AWA           | 02 638 8444 |
| -           | 90              | 120(H)x600(W)x350(D) | 9           | -                                         | \$799        | MITSUBISHI ELECTRIC AWA           | 02 638 8444 |
| -           | 90              | 85(H)x424(W)x332(D)  | 5           | AVAILABLE IN DECEMBER                     | \$799        | MITSUBISHI ELECTRIC AWA           | 02 638 8444 |
| 60dB        | 365             | 70(H)x334(W)x195(D)  | 4           | OPTIONAL PIN FEED, OPTIONAL APPLE SPEC.   | \$529        | BROTHER INDUSTRIES (AUST) Pty Ltd | 02 887 4344 |
| 55dB        | 365             | 99(H)x490(W)x305(D)  | 8           | PAPER PARKING, OPTIONAL CUT SHEET FEEDER  | \$1195       | BROTHER INDUSTRIES (AUST) Pty Ltd | 02 887 4344 |
| 58dB        | 365             | 123(H)x512(W)x305(D) | 9           | PAPER PARKING, OPTIONAL CUT SHEET FEEDER  | \$1595       | BROTHER INDUSTRIES (AUST) Pty Ltd | 02 887 4344 |
| 57dB        | 365             | 175(H)x595(W)x402(D) | 16          | PAPER PARKING,AUTO LOADING,COLOUR PRINT.  | \$3099       | BROTHER INDUSTRIES (AUST) Pty Ltd | 02 887 4344 |
| 62dB        | 365             | 145(H)x550(W)x314(D) | 12          | CLOSE TEAR OFF, OPTIONAL COLOUR           | \$1449       | ANITECH                           | 02 648 1711 |
| 61dB        | 365             | 137(H)x420(W)x297(D) | 9           | CLOSE TEAR OFF, OPTIONAL COLOUR           | \$1249       | ANITECH                           | 02 648 1711 |
| 55dB        | 365             | 128(H)x442(W)x346(D) | 9           | BOTTOM FEED, TEAR OFF, OPTIONAL COLOUR    | \$1359       | ANITECH                           | 02 648 1711 |
| 55dB        | 365             | 143(H)x568(W)x346(D) | 14          | APPLE MAC COMPATIBLE, OPTIONAL COLOUR     | \$1759       | ANITECH                           | 02 648 1711 |
| 56dB        | 365             | 132(H)x633(W)x374(D) | 37          | AUTO PAPER PARK & LOAD, OPTIONAL COLOUR   | \$2550       | ANITECH                           | 02 648 1711 |
| 55dB        | 365             | 159(H)x580(W)x395(D) | 15          | BOTTOM FEED, DIAMOND ARRAY HEAD           | \$3995       | ANITECH                           | 02 648 1711 |
| 58dB        | 365             | 120(H)x570(W)x420(D) | 17          | BOTTOM FEED, DEC LA100 VERSION            | \$3620       | ANITECH                           | 02 648 1711 |
| 55dB        | 365             | 125(H)x595(W)x330(D) | 9           | PUSH/PULL TRACTORS, BOTTOM FEED, TEAR OFF | \$1339       | ANITECH                           | 02 648 1711 |
| 55dB        | 365             | 75(H)x350(W)x265(D)  | 5           | PIN FEED, TEAR OFF                        | \$949        | ANITECH                           | 02 648 1711 |



# Dot matrix printers

| Make               | Model          | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Minimum pitch (cpi) | Maximum pitch (cpi) | Max chars per line | Bi-directnl print head | Bi-directnl paper feed | Num. print pins/wires | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportnl print mode | D/loadable char set | IBM graphics compat | Epson model compat |            |
|--------------------|----------------|------------------|--------------------|-------------------|----------|-----------------|----------------------|---------------------|---------------------|--------------------|------------------------|------------------------|-----------------------|--------------------|-------------|--------------|---------------|------------|----------------------|---------------------|---------------------|--------------------|------------|
| C.ITOH             | RITEMAN F+ III | Y                | Y                  | 160               | Y        | 30              | 9.5                  | 9                   | 18                  | 132                | Y                      | Y                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | FX-80      |
| CENTRONICS         | 350            | Y                | Y                  | 200               | Y        | -               | -                    | 10                  | -                   | 132                | Y                      | Y                      | 18                    | -                  | -           | Y            | Y             | Y          | -                    | -                   | -                   | -                  | -          |
| CITIZEN            | HQP-45         | Y                | Y                  | 200               | Y        | 66              | 15                   | 8                   | 16                  | 136                | Y                      | Y                      | 24                    | -                  | 24          | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | LQ-1000    |
| CITIZEN            | LSP-120D       | Y                | Y                  | 120               | Y        | 25              | 10                   | 8                   | 16                  | 80                 | Y                      | Y                      | 9                     | -                  | 4           | Y            | Y             | N          | Y                    | Y                   | Y                   | Y                  | FX         |
| CITIZEN            | MSP-10         | N                | Y                  | 160               | Y        | 40              | 10                   | 8                   | 16                  | 136                | Y                      | Y                      | 9                     | -                  | 1           | Y            | Y             | N          | Y                    | Y                   | Y                   | Y                  | FX         |
| CITIZEN            | MSP-15         | N                | Y                  | 160               | Y        | 40              | 15                   | 8                   | 16                  | 136                | Y                      | Y                      | 9                     | -                  | 1           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | FX         |
| CITIZEN            | MSP-20         | Y                | Y                  | 200               | Y        | 50              | 10                   | 8                   | 16                  | 80                 | Y                      | Y                      | 9                     | -                  | 1           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | FX         |
| CITIZEN            | MSP-25         | Y                | Y                  | 200               | Y        | 50              | 15                   | 8                   | 16                  | 136                | Y                      | Y                      | 9                     | -                  | 1           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | FX         |
| COMMODORE          | MPS 1280       | N                | Y                  | 120               | Y        | 20              | 16                   | 5                   | 17                  | 233                | Y                      | N                      | 9                     | 144                | 2           | Y            | Y             | N          | Y                    | N                   | Y                   | Y                  | IBM        |
| COMMODORE          | MPS 2020       | N                | Y                  | 300               | Y        | 100             | 8.5                  | 5                   | 17                  | 132                | Y                      | N                      | 18                    | 288                | 8           | Y            | Y             | Y          | Y                    | N                   | Y                   | Y                  | -          |
| DACOS              | VP1814         | Y                | Y                  | 180               | Y        | 30              | 8.5                  | 20                  | 5                   | 154                | Y                      | Y                      | 9                     | 240                | 15          | Y            | Y             | N          | Y                    | Y                   | Y                   | Y                  | LX-80      |
| DATAMATE           | DSE-135        | N                | Y                  | 135               | N        | -               | 10                   | 17                  | 5                   | 132                | Y                      | N                      | 9                     | 240                | 8           | Y            | Y             | N          | N                    | Y                   | Y                   | Y                  | FX-80      |
| DATA-PRODUCTS CORP | 8070+          | Y                | Y                  | 400               | Y        | 100             | 15.5                 | 10                  | 17                  | 132                | Y                      | Y                      | 18                    | -                  | 4           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | MX         |
| DATA-PRODUCTS CORP | 9030           | N                | Y                  | 300               | Y        | 33              | 11                   | 10                  | 17                  | 80                 | Y                      | Y                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | FX86,FX286 |
| DATA-PRODUCTS CORP | 9034           | Y                | Y                  | 300               | Y        | 83              | 11                   | 10                  | 17                  | 80                 | Y                      | Y                      | 24                    | -                  | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | LQ800/1000 |
| DATA-PRODUCTS CORP | 9040           | Y                | Y                  | 300               | Y        | 33              | 15.5                 | 10                  | 17                  | 132                | Y                      | Y                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | FX86/286E  |
| DATA-PRODUCTS CORP | 9044           | Y                | Y                  | 300               | Y        | 83              | 15.5                 | 10                  | 17                  | 132                | Y                      | Y                      | 24                    | -                  | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | Y                  | LQ800/1000 |

## Dot matrix printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                          | Retail price | Distributor                 | Phone       |
|-------------|-----------------|----------------------|-------------|-----------------------------------------|--------------|-----------------------------|-------------|
| 60dB        | 365             | 100(H)x390(W)x290(D) | 4           | FRONT LOAD, TEAR OFF, PRINTS CARDS      | \$799        | ANITECH                     | 02 648 1711 |
| -           | 365             | 203(H)x558(W)x457(D) | 21          | 400 CPS AND IBM COAX/TWINAX AVAILABLE   | NA           | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| 57dB        | 180             | 118(H)x593(W)x358(D) | 7           | -                                       | \$1550       | DATRONICS CORP              | 02 887 9333 |
| 59dB        | 180             | 90(H)x373(W)x240(D)  | 5           | BOTTOM FEED, COM-MODORE INTERFACE       | \$586        | DATRONICS CORPORATION LTD   | 02 887 9333 |
| 58dB        | 180             | 90(H)x403(W)x344(D)  | 5           | -                                       | \$908        | DATRONICS CORPORATION LTD   | 02 887 9333 |
| 58dB        | 180             | 90(H)x575(W)x-       | 354         | -                                       | \$1138       | DATRONICS CORP LTD          | 02 887 9333 |
| 58dB        | 180             | 90(H)x403(W)x344(D)  | 5           | -                                       | \$1092       | DATRONICS CORP              | 02 887 9333 |
| -           | 180             | 90(H)x575(W)x354(D)  | 7           | -                                       | \$1552       | DATRONICS CORP LTD          | 02 887 9333 |
| 55dB        | 90              | 128(H)x524(W)x278(D) | 6           | -                                       | \$899        | COMMODORE BUSINESS MACHINES | 02 427 4888 |
| -           | 90              | 97(H)x367(W)x305(D)  | 6           | 46 TYPE FACES CAN BE UTILISED           | \$1299       | COMMODORE BUSINESS MACHINES | 02 427 4888 |
| -           | 365             | 104(H)x401(W)x337(D) | 8           | FRONT PANEL SELECTION OF PRINT MODES    | \$560        | DACOS PTY. LTD.             | 03 729 0044 |
| -           | 90              | 125(H)x384(W)x315(D) | 5           | -                                       | \$499        | DICK SMITH ELECTRONICS      | 02 888 3200 |
| 55dB        | 365             | 248(H)x584(W)x338(D) | 18          | P-SERIES/IBM GRAPHICS/IBM COLOUR OPTION | \$3612       | DATAPRODUCTS                | 02 451 3533 |
| 55dB        | 365             | 127(H)x439(W)x330(D) | 10          | PAPER PARK/IBM PROPRINTER               | \$1212       | DATAPRODUCTS CORP           | 02 452 3533 |
| 55dB        | 365             | 127(H)x436(W)x330(D) | 10          | DIABLO 630, PAPER PARK                  | \$1770       | DATAPRODUCTS CORP           | 02 451 3533 |
| 55dB        | 365             | 127(H)x584(W)x330(D) | 12          | PAPER PARK/IBM PROPRINTER/COLOUR OPTION | \$1548       | DATAPRODUCTS CORP           | 02 451 3533 |
| 55dB        | 365             | 127(H)x584(W)x330(D) | 12          | DIABLO 630/COLOUR OPTION                | \$2103       | DATAPRODUCTS CORP           | 02 451 3533 |



# Dot matrix printers

| Make          | Model       | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Minimum pitch (dpi) | Maximum pitch (dpi) | Max chars per line | Bi-directnl prnt head | Bi-directnl paper feed | Num. print pins/wires | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportnl print mode | D/loadable char set | IBM graphics compat | Epson model compat |
|---------------|-------------|------------------|--------------------|-------------------|----------|-----------------|----------------------|---------------------|---------------------|--------------------|-----------------------|------------------------|-----------------------|--------------------|-------------|--------------|---------------|------------|----------------------|---------------------|---------------------|--------------------|
| DATA-PRODUCTS | 8012        | N                | Y                  | 180               | Y        | 30              | 10                   | 17                  | 5                   | 132                | Y                     | N                      | 9                     | 240                | 2           | Y            | Y             | N          | N                    | Y                   | Y                   | FX-80              |
| DATA-PRODUCTS | 8022        | N                | Y                  | 180               | Y        | 30              | 15                   | 17                  | 5                   | 230                | Y                     | N                      | 9                     | 240                | 2           | Y            | Y             | N          | N                    | Y                   | Y                   | FX-100             |
| DATASOUTH     | DS-180 PLUS | Y                | Y                  | 180               | N        | -               | 15                   | 5                   | 16                  | 217                | Y                     | Y                      | 9                     | 72                 | 4           | Y            | N             | N          | N                    | Y                   | N                   | NO                 |
| DATASOUTH     | DS-220      | Y                | Y                  | 220               | Y        | 40              | 15                   | 5                   | 16                  | 217                | Y                     | Y                      | 9                     | 144                | 8           | Y            | Y             | Y          | N                    | Y                   | Y                   | MX80/100           |
| DATASOUTH     | DS-400      | Y                | Y                  | 400               | Y        | 108             | 15                   | 5                   | 16                  | 217                | Y                     | Y                      | 18                    | 144                | 16          | Y            | Y             | Y          | N                    | Y                   | Y                   | MX80/100           |
| EPSON         | EX-1000     | Y                | Y                  | 300               | Y        | 50              | 16                   | 5                   | 20                  | 272                | Y                     | Y                      | 9                     | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | EX /FX /LX         |
| EPSON         | EX-800      | Y                | Y                  | 300               | Y        | 50              | 10                   | 5                   | 20                  | 160                | Y                     | Y                      | 9                     | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | EX /FX /LX         |
| EPSON         | FX-1000     | N                | Y                  | 240               | Y        | 48              | 16                   | 5                   | 20                  | 272                | Y                     | N                      | 9                     | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX /EX /LX         |
| EPSON         | FX-800      | N                | Y                  | 240               | Y        | 48              | 10                   | 5                   | 20                  | 160                | Y                     | N                      | 9                     | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX /EX /LX         |
| EPSON         | LQ-1000     | Y                | Y                  | 216               | Y        | 72              | 16                   | 5                   | 20                  | 272                | Y                     | N                      | 24                    | 360                | 7           | N            | Y             | Y          | Y                    | Y                   | Y                   | LQ / SQ            |
| EPSON         | LQ-2500+    | Y                | Y                  | 324               | Y        | 108             | 16                   | 5                   | 20                  | 272                | Y                     | N                      | 24                    | 360                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | LQ /SQ             |
| EPSON         | LQ-800      | Y                | Y                  | 216               | Y        | 72              | 10                   | 5                   | 20                  | 160                | Y                     | N                      | 24                    | 360                | 7           | N            | Y             | Y          | Y                    | Y                   | Y                   | LQ /SQ             |
| EPSON         | LX-800      | N                | Y                  | 180               | Y        | 30              | 10                   | 5                   | 20                  | 160                | Y                     | N                      | 9                     | 240                | 3           | Y            | Y             | Y          | N                    | Y                   | Y                   | FX /EX             |
| FACIT         | B3100       | Y                | Y                  | 250               | Y        | 60              | -                    | 5                   | 17                  | 136                | Y                     | Y                      | 9                     | 240                | 12          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX/JX              |
| FACIT         | B3150       | Y                | Y                  | 250               | Y        | 60              | 16                   | 5                   | 17                  | 224                | Y                     | Y                      | 9                     | 240                | 12          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX/JX              |
| FACIT         | B3350C      | Y                | Y                  | 200               | Y        | 100             | 16                   | 5                   | 17                  | 224                | Y                     | Y                      | 18                    | 240                | 12          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX/JX              |
| FACIT         | C5500       | Y                | Y                  | 250               | Y        | 60              | 16                   | 5                   | 20                  | 272                | Y                     | Y                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX/JX              |

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                           | Retail price | Distributor                 | Phone       |
|-------------|-----------------|----------------------|-------------|------------------------------------------|--------------|-----------------------------|-------------|
| -           | 90              | 125(H)x425(W)x345(D) | -           | -                                        | \$895        | DATAPRODUCTS CORP           | 02 451 3533 |
| -           | 90              | 125(H)x554(W)x345(D) | -           | -                                        | \$995        | DATAPRODUCTS CORP           | 02 451 3533 |
| 59dB        | 90              | 175(H)x600(W)x400(D) | 16          | BUILT IN TRACTOR FEED,6 PART PAPER CAPBL | \$1908       | KENELEC PTY LTD             | 03 560 1011 |
| 59dB        | 90              | 175(H)x600(W)x400(D) | 16          | -                                        | \$2327       | KENELEC PTY LTD             | 03 560 1011 |
| 59dB        | 90              | 175(H)x600(W)x400(D) | 16          | -                                        | \$2895       | KENELEC PTY LTD             | 03 560 1011 |
| 66dB        | 365             | 121(H)x591(W)x388(D) | 11          | COLOUR OPTION, SHEET FEEDERS, ID & FONTS | \$1450       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 66dB        | 365             | 119(H)x420(W)x378(D) | 10          | COLOUR OPTION,SHEET FEEDERS,ID & FONTS   | \$1120       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 65dB        | 365             | 90(H)x528(W)x340(D)  | 9           | DBLE HEIGHT,AUTO LOAD,OPT;SB/CSF,SER.I/F | \$1190       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 65dB        | 365             | 90(H)x405(W)x334(D)  | 7           | AUTO LOAD,2 NLQ FONTS,OPT;SB/CSF,SER.I/F | \$950        | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 66dB        | 365             | 93(H)x596(W)x335(D)  | 8           | OPT;FONT MODULES.TRAC-TOR,SINGLE BIN CSF | \$1510       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 57dB        | 365             | 170(H)x591(W)x375(D) | 12          | AUTO LOAD,TEAR BAR,OPT;COLOUR,S&DBL CSF  | \$2250       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 66dB        | 365             | 93(H)x420(W)x335(D)  | 6           | OPT;TRACTOR,FONT MODULES,IBM,DIABLO EMUL | \$1100       | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 63dB        | 365             | 91(H)x377(W)x308(D)  | 5           | 2 NLQ FONTS,OPT; SINGLE CSF,SERIAL I/F   | \$650        | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 55dB        | 365             | 144(H)x494(W)x400(D) | 11          | COLOUR, MENU SET-UP                      | \$1650       | ELMEASCO INSTRUMENTS        | 02 427 3322 |
| 55dB        | 365             | 144(H)x622(W)x400(D) | 15          | COLOUR, MENU-SETUP, PAPER PARKING        | \$2350       | ELMEASCO INSTRUMENTS        | 02 427 3322 |
| 55dB        | 365             | 144(H)x622(W)x400(D) | 15          | COLOUR, PAPER PARK-ING, ZERO TEAR-OFF    | \$2676       | ELMEASCO INSTRUMENTS        | 02 427 3322 |
| 55dB        | 90              | 196(H)x584(W)x458(D) | 14          | ZERO TEAR-OFF, BOTTOM FEED, PARKING      | \$3864       | ELMEASCO INSTRUMENTS        | 02 427 3322 |



# Dot matrix printers

| Make    | Model               | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Minimum pitch (cpi) | Maximum pitch (cpi) | Max chars per line | Bi-directnl prnt head | Bi-directnl paper feed | Num. print pins/wires | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportnl print mode | D/loadable char set | IBM graphics compat | Epson model compat |
|---------|---------------------|------------------|--------------------|-------------------|----------|-----------------|----------------------|---------------------|---------------------|--------------------|-----------------------|------------------------|-----------------------|--------------------|-------------|--------------|---------------|------------|----------------------|---------------------|---------------------|--------------------|
| FACIT   | C7500               | Y                | Y                  | 400               | Y        | 100             | 16                   | 5                   | 17                  | 231                | Y                     | Y                      | 18                    | 240                | 4           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX/JX              |
| FUJITSU | DL2400              | Y                | Y                  | 261               | Y        | 72              | 16.5                 | 10                  | 20                  | 271                | Y                     | Y                      | 24                    | 360                | 24          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-100             |
| FUJITSU | DL2400-COLOUR       | Y                | Y                  | 216               | Y        | 72              | 16.5                 | 10                  | 20                  | 271                | Y                     | Y                      | 24                    | 360                | 24          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-100             |
| FUJITSU | DL2600              | Y                | Y                  | 288               | Y        | 96              | 16.5                 | 10                  | 20                  | 271                | Y                     | Y                      | 24                    | 360                | 24          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-100             |
| FUJITSU | DL2600-COLOUR       | Y                | Y                  | 288               | Y        | 96              | 16.5                 | 10                  | 20                  | 271                | Y                     | Y                      | 24                    | 360                | 24          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-100             |
| FUJITSU | DL3300              | N                | Y                  | 288               | Y        | 72              | 10                   | 10                  | 20                  | 160                | Y                     | Y                      | 24                    | 360                | 24          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX80               |
| FUJITSU | DL3400              | N                | Y                  | 288               | Y        | 72              | 16.5                 | 10                  | 20                  | 272                | Y                     | Y                      | 24                    | 360                | 24          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX80               |
| FUJITSU | DL5600              | Y                | Y                  | 486               | Y        | 162             | 16.5                 | 10                  | 20                  | 272                | Y                     | Y                      | 24                    | 360                | 24          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX80               |
| FUJITSU | DX2100              | N                | Y                  | 220               | Y        | 44              | 10.5                 | 10                  | 15                  | 137                | Y                     | Y                      | 9                     | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX80               |
| FUJITSU | DX2200              | N                | Y                  | 220               | Y        | 45              | 16.5                 | 10                  | 17                  | 233                | Y                     | Y                      | 9                     | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX80               |
| FUJITSU | DX2300              | N                | Y                  | 324               | Y        | 54              | 10.5                 | 10                  | 20                  | 160                | Y                     | Y                      | 9                     | 240                | 18          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX80               |
| FUJITSU | DX2400              | N                | Y                  | 324               | Y        | 54              | 16.6                 | 10                  | 20                  | 272                | Y                     | Y                      | 9                     | 240                | 16          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX80               |
| GENICOM | 1020                | Y                | Y                  | 200               | Y        | 100             | 16                   | 10                  | 12                  | -                  | Y                     | Y                      | 18                    | 240                | -           | Y            | Y             | Y          | -                    | -                   | Y                   | FX-100/FJ          |
| GENICOM | 3184T, 3304T, 3404T | Y                | Y                  | 400               | Y        | -               | 15.5                 | 10                  | 18                  | -                  | Y                     | Y                      | 9                     | -                  | -           | Y            | Y             | Y          | Y                    | Y                   | Y                   | -                  |
| GENICOM | 3210                | Y                | Y                  | 240               | Y        | 60              | 15.5                 | 10                  | 18                  | 240                | Y                     | Y                      | 9                     | -                  | 2           | -            | Y             | Y          | Y                    | Y                   | Y                   | -                  |
| GENICOM | 3310                | Y                | Y                  | 300               | Y        | 75              | 15.5                 | 10                  | 18                  | 360                | Y                     | Y                      | 9                     | -                  | -           | Y            | Y             | Y          | Y                    | Y                   | Y                   | -                  |
| GENICOM | 3320                | Y                | Y                  | 300               | Y        | 150             | 15.5                 | 10                  | 18                  | 360                | Y                     | Y                      | 18                    | -                  | -           | Y            | Y             | Y          | Y                    | Y                   | Y                   | -                  |

## Dot matrix printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                          | Retail price    | Distributor                 | Phone       |
|-------------|-----------------|----------------------|-------------|-----------------------------------------|-----------------|-----------------------------|-------------|
| 57dB        | 90              | 196(H)x584(W)x458(D) | 18          | ZERO TEAR-OFF, MENU SET-UP              | \$5250          | ELMEASCO INSTRUMENTS        | 02 427 3322 |
| 53dB        | 365             | 195(H)x570(W)x390(D) | 20          | EMULATION SELECT,AUTO SHEET LOAD        | \$1850<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 53dB        | 365             | 195(H)x570(W)x390(D) | 20          |                                         | \$2166          | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 195(H)x570(W)x390(D) | 20          | EMULATION SELECT,LCD DISPLAY            | \$2450<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 195(H)x570(W)x390(D) | 20          | EMULATION SELECT,AUTO SHEET LOAD        | \$2730<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 128(H)x238(W)x345(D) | 10          | FONT CARDS,EMULATION SELECT,SERIAL OPTN | \$1450<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 120(H)x580(W)x345(D) | 12          | COLOUR OPTION,FONT CARDS,SERIAL OPTN    | \$1650<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 186(H)x600(W)x385(D) | 20          | FONT CARDS,EMULATION SELECT,LCD DISPLAY | \$3700<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 120(H)x438(W)x354(D) | 9           | COLOUR OPTION,SERIAL INTERFACE          | \$922<br>EXTAX  | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 120(H)x580(W)x345(D) | 12          | COLOUR OPTION,SERIAL INTERFACE OPTION   | \$1195<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 120(H)x438(W)x354(D) | 9           | COLOUR OPTION,SWITCH-ABLE EMULATION     | \$1050<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| 55dB        | 365             | 120(H)x580(W)x345(D) | 12          | COLOUR OPTION,SWITCH-ABLE EMULATION     | \$1350<br>EXTAX | FUJITSU AUSTRALIA LTD       | 02-959 6544 |
| -           | 365             | 254(H)x619(W)x417(D) | 39          | COLOUR, 80 COL. VERSION, DIABLO 630     | \$2138          | IMPACT DATASCAPE, C & PA    | 02 451 3533 |
| -           | 365             | 161(H)x636(W)x409(D) | 15          | TEMPEST MODELS ONLY                     | NA              | GENICOM (AUSTRALIA) PTY LTD | 02 406 6411 |
| -           | 365             | 161(H)x636(W)x409(D) | 16          | OKIDATA 84                              | \$3211          | IMPACT, C & PA              | 02 451 3533 |
| -           | 365             | 161(H)x636(W)x409(D) | 15          | COLOUR VERSION. DIABLO 630              | \$4693          | IMPACT DATASCAPE, C & PA    | 02 451 3533 |
| -           | 365             | 183(H)x663(W)x488(D) | 16          | QUIETISED MODELS, DI-ABLE 630           | \$5229          | IMPACT DATASCAPE, C & PA    | 02 451 3533 |



# Dot matrix printers

| Make             | Model       | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Minimum pitch (cpi) | Maximum pitch (cpi) | Max chars per line | Bi-directnl prnt head | Bi-directnl paper feed | Num. print pins/wires | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportnl print mode | D/loadable char set | IBM graphics compat | Epson model compat |
|------------------|-------------|------------------|--------------------|-------------------|----------|-----------------|----------------------|---------------------|---------------------|--------------------|-----------------------|------------------------|-----------------------|--------------------|-------------|--------------|---------------|------------|----------------------|---------------------|---------------------|--------------------|
| GENICOM          | 3410        | Y                | Y                  | 400               | Y        | 100             | 15.5                 | 10                  | 18                  | 540                | Y                     | Y                      | 18                    | -                  | -           | Y            | Y             | Y          | Y                    | Y                   | Y                   | -                  |
| MANNESMANN TALLY | MT145-S     | Y                | Y                  | 120               | N        | -               | 3-15                 | 10                  | 20                  | 264                | Y                     | Y                      | 9                     | 240                | 2           | Y            | Y             | N          | N                    | Y                   | Y                   | FX                 |
| MANNESMANN TALLY | MT290       | Y                | Y                  | 200               | Y        | 50              | 3-16                 | 10                  | 20                  | 264                | Y                     | Y                      | 9                     | 240                | 3           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX                 |
| MANNESMANN TALLY | MT330       | Y                | Y                  | 300               | Y        | 150             | 3-16                 | 10                  | 17                  | 232                | Y                     | Y                      | 24                    | 240                | 3           | Y            | Y             | Y          | N                    | Y                   | Y                   | FX                 |
| MANNESMANN TALLY | MT490       | Y                | Y                  | 400               | Y        | 150             | 3-16                 | 10                  | 17                  | 225                | Y                     | Y                      | 18                    | 240                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX                 |
| MANNESMANN TALLY | MT85        | Y                | Y                  | 180               | Y        | 45              | 4-10                 | 10                  | 17                  | 137                | Y                     | Y                      | 9                     | 240                | 3           | Y            | Y             | N          | Y                    | Y                   | Y                   | FX                 |
| MANNESMANN TALLY | MT86        | Y                | Y                  | 180               | Y        | 45              | 4-10                 | 10                  | 17                  | 218                | Y                     | Y                      | 9                     | 240                | 3           | Y            | Y             | N          | Y                    | Y                   | Y                   | FX                 |
| MANNESMANN TALLY | MT87        | Y                | Y                  | 200               | Y        | 50              | 4-10                 | 10                  | 17                  | 137                | Y                     | Y                      | 9                     | 240                | 3           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX                 |
| MANNESMANN TALLY | MT88        | Y                | Y                  | 200               | Y        | 50              | 4-16                 | 10                  | 17                  | 218                | Y                     | Y                      | 9                     | 240                | 3           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX                 |
| OKI MICROLINE    | ML 183      | Y                | Y                  | 120               | Y        | 20              | 15                   | 10                  | 17                  | 132                | Y                     | N                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | N                   | Y                   | -                  |
| OKI MICROLINE    | ML 192 PLUS | Y                | Y                  | 200               | Y        | 40              | 10                   | 10                  | 17                  | 80                 | Y                     | N                      | 9                     | 288                | 8           | Y            | Y             | Y          | Y                    | N                   | Y                   | -                  |
| OKI MICROLINE    | ML 292      | Y                | Y                  | 200               | Y        | 100             | 10                   | 10                  | 17                  | 80                 | Y                     | N                      | 18                    | 288                | 8           | Y            | Y             | Y          | Y                    | N                   | Y                   | -                  |
| OKI MICROLINE    | ML 182      | Y                | Y                  | 120               | Y        | 20              | 10                   | 10                  | 17                  | 80                 | Y                     | N                      | 9                     | 240                | 2           | Y            | Y             | Y          | Y                    | N                   | Y                   | -                  |
| OKI MICROLINE    | ML 193 PLUS | Y                | Y                  | 200               | Y        | 40              | 15                   | 10                  | 17                  | 132                | Y                     | N                      | 9                     | 288                | 8           | Y            | Y             | Y          | Y                    | N                   | Y                   | -                  |
| OKI MICROLINE    | ML 293      | Y                | Y                  | 200               | Y        | 100             | 15                   | 10                  | 17                  | 132                | Y                     | N                      | 18                    | 288                | 8           | Y            | Y             | Y          | Y                    | N                   | Y                   | -                  |
| OKI MICROLINE    | ML 294      | Y                | Y                  | 400               | Y        | 100             | 15                   | 10                  | 17                  | 132                | Y                     | N                      | 18                    | 288                | 8           | Y            | Y             | Y          | Y                    | N                   | Y                   | -                  |
| OLIVETTI         | DM105/1     | N                | Y                  | 115               | Y        | 25              | 10                   | 10                  | 14                  | 137                | Y                     | N                      | 9                     | 240                | 6           | N            | Y             | Y          | N                    | Y                   | Y                   | JX80               |

## Dot matrix printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                           | Retail price | Distributor                        | Phone       |
|-------------|-----------------|----------------------|-------------|------------------------------------------|--------------|------------------------------------|-------------|
| -           | 365             | 183(H)x668(W)x488(D) | 15          | QUIETISED, BARCODES, IBM COAX/TWINAX     | \$5898       | IMPACT DATASCAPE, C & PA           | 02 451 3533 |
| 57dB        | 90              | 28(H)x47(W)x26(D)    | 10          | SPECIAL HEAVY DUTY FORMS PRINTER-9 PART  | \$2290       | MICROPROCESSOR APPLICATIONS        | 03 894 1500 |
| 60dB        | 90              | 15(H)x48(W)x24(D)    | 9           | HEAVY DUTY,CART.FOR FONTS,B-CODE & I/FAC | \$2245       | MICROPROCESSOR APPLICATIONS        | 03 894 1500 |
| 53dB        | 90              | 17(H)x61(W)x43(D)    | 23          | HEAVY DUTY,PUSH/PULL TRACTORS,QUICK TEAR | \$3954       | MICROPROCESSOR APPLICATIONS        | 03 894 1500 |
| 60dB        | 90              | 23(H)x66(W)x46(D)    | 33          | HEAVY DUTY,15 IPS,PUSH/PULL TRACTORS     | \$6884       | MICROPROCESSOR APPLICATIONS        | 03 894 1500 |
| 55dB        | 90              | 170(H)x430(W)x300(D) | 7           | PLUG IN I/F MODULES & TYPE STYLE CART.   | \$1127       | MICROPROCESSOR APPLICATIONS        | 03 894 1500 |
| 55dB        | 90              | 17(H)x590(W)x28(D)   | 10          | PLUG IN I/F MODULES & TYPE STYLE CART.   | \$1550       | MICROPROCESSOR APPLICATIONS        | 03 894 1500 |
| 55dB        | 90              | 20(H)x470(W)x35(D)   | 11          | PUSH TRACTORS,TEAR BAR,5000 HOURS MTBF   | \$1339       | MICROPROCESSOR APPLICATIONS        | 03 894 1500 |
| 55dB        | 90              | 20(H)x62(W)x35(D)    | 13          | PUSH TRACTORS,TEAR BAR,5000 HOURS MTBF   | \$1770       | MICROPROCESSOR APPLICATIONS        | 03 894 1500 |
| 55dB        | 90              | 128(H)x524(W)x278(D) | 6           | OPTIONAL 8K BUFFER                       | \$1131       | IPL DATRON PTY LTD                 | 02 698 8211 |
| 57dB        | 90              | 80(H)x372(W)x275(D)  | 4           | RS232C CLOOP BOARD AVAILABLE             | \$1123       | IPL DATRON PTY LTD                 | 02 698 8211 |
| 57dB        | 90              | 97(H)x367(W)x305(D)  | 6           | COLOUR PRINTER,32K BUFFER OPTIONAL       | \$1741       | IPL DATRON PTY LTD                 | 02 698 8211 |
| 55dB        | 90              | 80(H)x372(W)x278(D)  | 4           | OPTIONAL 8K BUFFER                       | \$725        | IPL DATRON PTY LTD                 | 02 698 8211 |
| 57dB        | 90              | 128(H)x524(W)x278(D) | 6           | RS232C CLOOP BOARD AVAILABLE             | \$1475       | IPL DATRON PTY LTD                 | 02 698 8211 |
| 57dB        | 90              | 97(H)x521(W)x305(D)  | 8           | COLOUR PRINTER. 23K BUFFER OPTIONAL]     | \$2123       | IPL DATRON PTY LTD                 | 02 698 8211 |
| 57dB        | 90              | 97(H)x521(W)x305(D)  | 8           | COLOUR PRINTER. 32K BUFFER OPTIONAL      | \$3248       | IPL DATRON PTY LTD                 | 02 698 8211 |
| 60dB        | 90              | 94(H)x270(W)x253(D)  | 5           | 4 COLOUR. TRACTOR FEED OPTIONAL          | \$689        | COMPUTERMATE PRODUCTS AUST Pty Ltd | 02 457 8118 |



# Dot matrix printers

| Make      | Model       | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Minimum pitch (cpi) | Maximum pitch (cpi) | Max chars per line | Bi-directnl prnt head | Bi-directnl paper feed | Num. print pins/wires | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportnl print mode | D/loadable char set | IBM graphics compat | Epson model compat |
|-----------|-------------|------------------|--------------------|-------------------|----------|-----------------|----------------------|---------------------|---------------------|--------------------|-----------------------|------------------------|-----------------------|--------------------|-------------|--------------|---------------|------------|----------------------|---------------------|---------------------|--------------------|
| OMNI 800  | 810         | Y                | N                  | 150               | N        | -               | 15                   | 16                  | 5                   | 132                | Y                     | N                      | 9                     | -                  | -           | Y            | N             | N          | N                    | N                   | N                   | -                  |
| OMNI 800  | 820 KSR     | Y                | N                  | 150               | N        | -               | 15                   | 16                  | 5                   | 132                | Y                     | N                      | 9                     | -                  | 1           | Y            | N             | N          | N                    | N                   | N                   | -                  |
| OMNI 800  | 850XL       | Y                | Y                  | 150               | Y        | 90              | 11                   | 16                  | 5                   | 134                | Y                     | N                      | 9                     | 144                | -           | Y            | Y             | Y          | N                    | Y                   | N                   | -                  |
| OMNI 800  | 855         | Y                | Y                  | 150               | Y        | 35              | 11                   | 16                  | 5                   | 134                | Y                     | Y                      | 9                     | 144                | -           | Y            | Y             | Y          | Y                    | Y                   | Y                   | -                  |
| OMNI 800  | 860XL       | Y                | Y                  | 150               | N        | 90              | 15                   | 16                  | 5                   | 134                | Y                     | N                      | 9                     | 144                | -           | Y            | Y             | N          | N                    | N                   | N                   | -                  |
| OMNI 800  | 865         | Y                | Y                  | 150               | Y        | 35              | 15                   | 16                  | 5                   | 132                | Y                     | Y                      | 9                     | 144                | -           | Y            | Y             | N          | Y                    | Y                   | Y                   | -                  |
| OMNI 800  | 880 AT      | Y                | Y                  | 300               | Y        | 150             | 15                   | 16                  | 5                   | 132                | Y                     | N                      | 9                     | 120                | 2           | Y            | N             | N          | N                    | N                   | Y                   | -                  |
| OMNI 800  | 880 DP      | Y                | Y                  | 300               | Y        | 150             | 15                   | 16                  | 5                   | 132                | Y                     | N                      | 9                     | 120                | 2           | Y            | N             | N          | N                    | N                   | N                   | -                  |
| OMNI 800  | 885         | Y                | Y                  | 300               | Y        | 75              | 10                   | 16                  | 5                   | 132                | Y                     | N                      | 9                     | 144                | 6           | Y            | N             | N          | N                    | N                   | N                   | -                  |
| PANASONIC | KXP-1081    | N                | Y                  | 120               | Y        | 24              | 10                   | 5                   | 17                  | 137                | Y                     | N                      | 9                     | 240                | 1           | Y            | Y             | N          | N                    | Y                   | Y                   | -                  |
| PANASONIC | KXP-1082    | N                | Y                  | -                 | -        | -               | -                    | -                   | -                   | -                  | -                     | -                      | -                     | -                  | -           | -            | -             | -          | -                    | -                   | -                   | -                  |
| PANASONIC | KXP-1083    | N                | Y                  | 240               | Y        | 48              | 10                   | 5                   | 17                  | 137                | Y                     | Y                      | 9                     | 240                | 38          | Y            | Y             | N          | Y                    | Y                   | Y                   | FX-80              |
| PANASONIC | KXP-1592    | N                | Y                  | 180               | Y        | 38              | 16.5                 | 5                   | 17                  | 233                | Y                     | Y                      | 9                     | 240                | 7           | Y            | Y             | N          | Y                    | Y                   | Y                   | FX-100             |
| PANASONIC | KXP-1595    | N                | Y                  | 240               | Y        | 51              | 16.5                 | 5                   | 17                  | 233                | Y                     | Y                      | 9                     | 240                | 15          | Y            | Y             | N          | Y                    | Y                   | Y                   | FX-100             |
| RITEMAN   | SUPER C+    | Y                | N                  | 120               | Y        | 30              | 10                   | 5                   | 17                  | 160                | Y                     | N                      | 9                     | 960                | 0           | Y            | Y             | Y          | Y                    | Y                   | N                   | GX80               |
| SAKATA    | SP-1200PLUS | Y                | Y                  | 120               | Y        | 30              | 10                   | -                   | -                   | 136                | Y                     | Y                      | 9                     | 192                | -           | Y            | Y             | Y          | Y                    | N                   | Y                   | FX-80              |
| SAKATA    | SP-5500     | Y                | Y                  | 180               | Y        | 36              | 16                   | -                   | -                   | 233                | Y                     | Y                      | 9                     | 204                | 3           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-100             |

## Dot matrix printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                          | Retail price | Distributor                        | Phone       |
|-------------|-----------------|----------------------|-------------|-----------------------------------------|--------------|------------------------------------|-------------|
| -           | 90              | 203(H)x635(W)x508(D) | 25          | 9 PART PAPER HANDLING, FAST SLEW RATE   | \$2875       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 887 1122 |
| -           | 90              | 203(H)x635(W)x508(D) | -           | 128 CHAR KEYBOARD 5 PART PAPER HANDLING | \$3438       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 887 1122 |
| 62dB        | 90              | 127(H)x411(W)x330(D) | 7           | OPT 4K BUFFER. XON XOFF                 | \$1265       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 778 1122 |
| 62dB        | 90              | 127(H)x420(W)x330(D) | 7           | OPT FONT CARTRIDGES, BAR CODE ETC       | \$1495       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 887 1122 |
| 62dB        | 90              | 127(H)x571(W)x335(D) | 9           | OPTY 4K BUFFER, XON XOFF                | \$1830       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 887 1122 |
| 62dB        | 90              | 127(H)x571(W)x335(D) | 9           | OPT FONT CARTIDGE. BUFFERS ETC          | \$2060       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 887 1122 |
| -           | 90              | 203(H)x635(W)x508(D) | 25          | OPT 4K, 16K BUFFER SNA/SDLC COAX        | \$4140       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 887 1122 |
| -           | 90              | 203(H)x635(W)x508(D) | 25          | OPT 4K, 16K BUFFERS, SNA/SDLC COAX      | \$4140       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 887 1122 |
| 65dB        | 90              | 229(H)x450(W)x450(D) | 23          | ZERO TEAR OFF LENGTH, OPT 16K BUFFER    | \$4890       | TEXAS INSTRUMENTS AUSTRALIA LTD    | 02 887 1122 |
| 66dB        | 360             | 115(H)x403(W)x286(D) | 6           | IBM GRAPHICS PRINTER COMPATIBLE         | \$495        | MULTITECH COMPUTERS PTY LTD        | 03 338 3911 |
| 66dB        | 360             | 115(H)x403(W)x286(D) | 7           | -                                       | \$545        | MULTITECH COMPUTERS PTY LTD        | 03 338 3911 |
| 66dB        | 360             | 137(H)x427(W)x350(D) | 10          | IBM PROPRINTER COMPATIBLE, 1" TEAR BAR  | \$695        | MULTITECH COMPUTERS PTY LTD        | 03 338 3911 |
| 64dB        | 360             | 155(H)x610(W)x390(D) | 14          | IBM GRAPHICS PRINTER COMPATIBLE         | \$995        | MULTITECH COMPUTERS PTY LTD        | 03 338 3911 |
| 66dB        | 360             | 155(H)x610(W)x390(D) | 15          | DIABLO 630 EMULATION.                   | \$1150       | MULTITECH COMPUTERS PTY LTD        | 03 338 3911 |
| 60dB        | 365             | 120(H)x400(W)x330(D) | 6           | COMMODORE 64/128 COMPATIBLE             | \$549        | COMPUTERMATE PRODUCTS AUST PTY LTD | 02 457 8118 |
| 55dB        | 365             | 104(H)x401(W)x337(D) | 7           | SCIENTIFIC CHARACTER SET                | \$399        | EMONA COMPUTERS PTY LTD            | 02 519 3933 |
| 55dB        | 365             | 103(H)x561(W)x341(D) | 10          | -                                       | \$680        | EMONA COMPUTERS PTY LTD            | 02 519 3933 |



# Dot matrix printers

| Make           | Model    | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Minimum pitch (cpi) | Maximum pitch (cpi) | Max chars per line | Bi-directnl prnt head | Bi-directnl paper feed | Num. print pins/wires | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportnl print mode | D/loadable char set | IBM graphics compat | Epson model compat |
|----------------|----------|------------------|--------------------|-------------------|----------|-----------------|----------------------|---------------------|---------------------|--------------------|-----------------------|------------------------|-----------------------|--------------------|-------------|--------------|---------------|------------|----------------------|---------------------|---------------------|--------------------|
| SAKATA         | SP-7000  | Y                | Y                  | 220               | Y        | 85              | 16                   | -                   | -                   | 233                | Y                     | Y                      | 24                    | 357                | 32          | Y            | Y             | Y          | Y                    | Y                   | Y                   | LQ2500             |
| STAR MICRONICS | NB-15    | N                | Y                  | 300               | Y        | 100             | 15                   | 3                   | 16                  | 222                | Y                     | Y                      | 24                    | 240                | 16          | Y            | Y             | Y          | Y                    | Y                   | Y                   | LQ-1500            |
| STAR MICRONICS | NB-2410  | N                | Y                  | 216               | Y        | 72              | 10                   | 3                   | 17                  | 137                | Y                     | Y                      | 24                    | 360                | 8           | Y            | Y             | Y          | Y                    | Y                   | Y                   | LQ-800             |
| STAR MICRONICS | NB-2415  | N                | Y                  | 216               | Y        | 72              | 15                   | 3                   | 17                  | 233                | Y                     | Y                      | 24                    | 360                | 5           | Y            | Y             | Y          | Y                    | Y                   | Y                   | LQ-1000            |
| STAR MICRONICS | ND-10    | N                | Y                  | 180               | Y        | 45              | 10                   | 3                   | 20                  | 160                | Y                     | Y                      | 9                     | 240                | 12          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-85              |
| STAR MICRONICS | ND-15    | N                | Y                  | 180               | Y        | 45              | 15                   | 3                   | 20                  | 272                | Y                     | Y                      | 9                     | 240                | 12          | Y            | Y             | Y          | Y                    | Y                   | Y                   | EX-1000            |
| STAR MICRONICS | NL-10    | Y                | Y                  | 120               | Y        | 30              | 10                   | 3                   | 20                  | 160                | Y                     | Y                      | 9                     | 240                | 5           | Y            | Y             | Y          | Y                    | Y                   | Y                   | LX-800             |
| STAR MICRONICS | NR-15    | N                | Y                  | 240               | Y        | 60              | 15                   | 3                   | 20                  | 272                | Y                     | Y                      | 9                     | 240                | 12          | Y            | Y             | Y          | Y                    | Y                   | Y                   | EX-1000            |
| STAR MICRONICS | NX-10    | N                | Y                  | 120               | Y        | 30              | 10                   | 3                   | 20                  | 160                | Y                     | Y                      | 9                     | 240                | 5           | Y            | Y             | Y          | Y                    | Y                   | Y                   | LX-800             |
| STAR MICRONICS | NX-15    | N                | Y                  | 120               | Y        | 30              | 15                   | 3                   | 20                  | 272                | Y                     | Y                      | 9                     | 240                | 4           | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-105             |
| STAR           | NX10C    | Y                | N                  | 120               | Y        | 30              | 10                   | 5                   | 17                  | 160                | Y                     | Y                      | 9                     | 960                | 0           | Y            | Y             | Y          | Y                    | Y                   | N                   | GX80               |
| SUPERS5        | EP-1201A | N                | Y                  | 120               | Y        | 24              | 10                   | 5                   | 17                  | 137                | Y                     | N                      | 9                     | 240                | 1           | Y            | Y             | N          | N                    | Y                   | Y                   | -                  |
| SUPERS5        | EP-1600  | N                | Y                  | 160               | Y        | 32              | 10                   | 5                   | 17                  | 137                | Y                     | N                      | 9                     | 240                | 1           | Y            | Y             | N          | Y                    | Y                   | Y                   | -                  |
| TANDY          | DMP 106  | Y                | Y                  | 80                | -        | -               | 11*9                 | 10                  | 16                  | 80                 | Y                     | Y                      | -                     | -                  | 1           | Y            | Y             | N          | -                    | Y                   | Y                   | -                  |
| TANDY          | DMP 130A | Y                | Y                  | 100               | -        | -               | 11*9                 | 10                  | 17                  | 80                 | Y                     | Y                      | -                     | -                  | 1           | Y            | Y             | N          | -                    | Y                   | Y                   | -                  |
| TANDY          | DMP 2200 | N                | Y                  | 380               | -        | -               | 11*15                | 10                  | 17                  | 132                | Y                     | Y                      | -                     | 240                | 4           | Y            | Y             | N          | Y                    | Y                   | Y                   | -                  |
| TANDY          | DMP 430  | Y                | Y                  | 180               | -        | -               | 11*15                | 10                  | 16                  | 132                | Y                     | Y                      | 18                    | -                  | 2           | Y            | Y             | N          | -                    | Y                   | Y                   | -                  |



## Dot matrix printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                           | Retail price | Distributor                        | Phone       |
|-------------|-----------------|----------------------|-------------|------------------------------------------|--------------|------------------------------------|-------------|
| 53dB        | 365             | 117(H)x575(W)x370(D) | 11          | MODULES: IBM PROPRINTER; FONTS; COLOUR   |              | EMONA COMPUTERS PTY LTD            | 02 519 3933 |
| 61dB        | 365             | 121(H)x580(W)x383(D) | 15          | WELL BUILT-RELIABLE DMP-PUSH TRACTOR     | \$1799 +Tax  | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 61dB        | 365             | 121(H)x400(W)x383(D) | 10          | BEST 10 INCH NLQ + GRAPHIC DMP AVAILABLE | \$1115 +Tax  | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 61dB        | 365             | 121(H)x580(W)x383(D) | 15          | BEST 15INCH NLQ + GRAPHICS DMP AVAILABLE | \$1490 +Tax  | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 62dB        | 365             | 103(H)x400(W)x360(D) | 8           | PUSH TRACTOR-TEAR BAR-INEXPENSIVE EXTRAS | \$895 +Tax   | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 61dB        | 365             | 105(H)x542(W)x360(D) | 11          | OPTIONAL RS232 & 16K BUFFER-PUSH TRACTOR | \$999 +Tax   | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 59dB        | 365             | 104(H)x400(W)x336(D) | 7           | FIVE OPTIONAL INTERFACES-PUSH TRACTOR    | \$499 +Tax   | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 60dB        | 365             | 105(H)x542(W)x360(D) | 12          | BETTER LQ THAN EPSON LQ2500-PUSH TRACTOR | \$1249 +Tax  | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 57dB        | 365             | 104(H)x400(W)x336(D) | 7           | PUSH TRACTOR-TEAR BAR-LONG RIBBON LIFE   | \$525 +Tax   | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 58dB        | 365             | 105(H)x542(W)x360(D) | 11          | PUSH TRACTOR-TEAR BAR-OPTIONAL RS232     | \$749 +Tax   | STAR MICRONICS AUSTRALIA           | 02 736 1144 |
| 60dB        | 365             | 104(H)x400(W)x336(D) | 7           | COMMODORE 64/128 COMPATIBLE ONLY         | \$599        | COMPUTERMATE PRODUCTS AUST PTY LTD | 02 457 8118 |
| 66dB        | 90              | 115(H)x403(W)x286(D) | 6           | IBM GRAPHICS PRINTER COMPATIBLE          | \$495        | MULTITECH COMPUTERS PTY LTD        | 03 338 3911 |
| 66dB        | 90              | 115(H)x403(W)x286(D) | 7           | IBM GRAPHICS PRINTER COMPATIBLE          | \$545        | MULTITECH COMPUTERS PTY LTD        | 03 338 3911 |
| -           | 90              | 8(H)x39(W)x24(D)     | 3           | 480 - 800 DOTS PER LINE                  | \$399        | INTERTAN AUSTRALIA LTD             | 02 675 1222 |
| -           | 90              | 12(H)x39(W)x27(D)    | 4           | 480 TO 1920 DOT COLUMNS / LINE           | \$599        | INTERTAN AUSTRALIA LTD             | 02 675 1222 |
| -           | 90              | 12(H)x57(W)x42(D)    | 18          | PRINTS ORIGINAL PLUS UP TO 6 COPIES      | \$2599       | INTERTAN AUSTRALIA LTD             | 02 675 1222 |
| -           | 90              | 8(H)x39(W)x24(D)     | 4           | HORIZONTAL DOT RESOLUTION:800 DOTS/LINE  | \$1299       | INTERTAN AUSTRALIA LTD             | 02 675 1222 |



## Dot matrix printers

| Make    | Model  | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Minimum pitch (cpi) | Maximum pitch (cpi) | Max chars per line | Bi-directnl prnt head | Bi-directnl paper feed | Num. print pins/wires | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Proportnl print mode | D/loadable char set | IBM graphics compat | Epson model compat |
|---------|--------|------------------|--------------------|-------------------|----------|-----------------|----------------------|---------------------|---------------------|--------------------|-----------------------|------------------------|-----------------------|--------------------|-------------|--------------|---------------|------------|----------------------|---------------------|---------------------|--------------------|
| TECO    | VP1814 | Y                | Y                  | 180               | Y        | 36              | 10                   | -                   | -                   | 132                | Y                     | Y                      | 9                     | -                  | 7           | Y            | Y             | N          | Y                    | Y                   | Y                   | FX-80              |
| TOSHIBA | P321SL | Y                | Y                  | 216               | Y        | 72              | 10                   | 10                  | 16                  | 132                | Y                     | Y                      | 24                    | 360                | 32          | Y            | Y             | Y          | Y                    | Y                   | Y                   | LQ1500             |
| TOSHIBA | P341E  | Y                | Y                  | 216               | Y        | 72              | 15                   | 10                  | 16                  | 226                | Y                     | N                      | 24                    | 360                | 2           | Y            | Y             | Y          | Y                    | Y                   | Y                   | NO                 |
| TOSHIBA | P351   | Y                | Y                  | 300               | Y        | 100             | 15                   | 10                  | 16                  | 226                | Y                     | Y                      | 24                    | 360                | 4           | Y            | Y             | Y          | Y                    | Y                   | Y                   | NO                 |
| TOSHIBA | P351C  | Y                | Y                  | 288               | Y        | 100             | 15                   | 10                  | 16                  | 226                | Y                     | Y                      | 24                    | 360                | 4           | Y            | Y             | Y          | Y                    | Y                   | Y                   | NO                 |
| WENGER  | 1/1    | Y                | Y                  | 160               | Y        | 30              | 10                   | 5                   | 17                  | 137                | Y                     | Y                      | 9                     | 240                | 10          | Y            | Y             | Y          | Y                    | Y                   | Y                   | FX-80              |
| WENGER  | 3/1    | Y                | Y                  | 480               | Y        | 150             | 17.48                | 5                   | 1                   | 233                | Y                     | Y                      | 18                    | 72                 | 12          | Y            | Y             | Y          | N                    | Y                   | Y                   | JX 80              |
| WENGER  | 4/1    | Y                | Y                  | 600               | Y        | 130             | 15.7                 | 10                  | 15                  | 236                | Y                     | Y                      | 18                    | 240                | 40          | Y            | Y             | Y          | Y                    | Y                   | N                   | -                  |

## Thermal printers

| Make             | Model     | Serial interface | Parallel interface | Draft speed (cps) | NLQ mode | NLQ speed (cps) | Max paper width (in) | Plain paper | Min pitch (cpi) | Max pitch (cpi) | Max charact per line | Bi-direct print head | Bi-direct paper feed | Max graphics (dpi) | Buffer size | Tractor feed | Friction feed | Sheet feed | Number of colours | D/loadable char set | IBM graphics compat | Epson model compat |
|------------------|-----------|------------------|--------------------|-------------------|----------|-----------------|----------------------|-------------|-----------------|-----------------|----------------------|----------------------|----------------------|--------------------|-------------|--------------|---------------|------------|-------------------|---------------------|---------------------|--------------------|
| COMMODORE        | MCS 820   | N                | Y                  | 80                | Y        | 40              | 10                   | Y           | -               | -               | 132                  | N                    | N                    | 144                | 8           | Y            | Y             | N          | -                 | N                   | Y                   | IBM                |
| EPSON            | P-40      | Y                | Y                  | 45                | N        | 0               | 4.5                  | N           | -               | -               | 80                   | N                    | N                    | 120                | 1           | N            | Y             | N          | M                 | N                   | N                   | MX                 |
| OKI<br>MICROLINE | OKIMATE20 | Y                | Y                  | 80                | Y        | 40              | 9.5                  | Y           | -               | -               | 132                  | N                    | N                    | 144                | 8           | Y            | Y             | N          | 16                | Y                   | Y                   | -                  |

## Dot matrix printers

| Noise level | Warranty length | Dimensions (mm)      | Weight (kg) | Other features                           | Retail price | Distributor               | Phone       |
|-------------|-----------------|----------------------|-------------|------------------------------------------|--------------|---------------------------|-------------|
|             | 365             | 104(H)x401(W)x337(D) | 8           |                                          | \$599        | E.M.E (SALES) PTY LTD     | 03 699 3088 |
| 54dB        | 365             | 98(H)x417(W)x380(D)  | 8           | TOSHIBA QUME SPRINT 11 EMULATION, QUIET  | \$1218       | TOSHIBA AUSTRALIA PTY LTD | 02 887 6057 |
| 59dB        | 365             | 150(H)x560(W)x380(D) | 15          | TOSHIBA QUME SPRINT 11 EMULATION         | \$1454       | TOSHIBA AUSTRALIA PTY LTD | 02 887 6057 |
| 56dB        | 365             | 150(H)x560(W)x360(D) | 14          | TOSHIBA QUME SPRINT 11 EMULATION, QUIET  | \$2294       | TOSHIBA AUSTRALIA PTY LTD | 02 887 6057 |
| 56dB        | 365             | 150(H)x560(W)x380(D) | 15          | COLOUR, TOSHIBA QUME SPRINT 11 EMULATION | \$2634       | TOSHIBA AUSTRALIA PTY LTD | 02 887 6057 |
| 48dB        | 90              | 204(H)x400(W)x328(D) | 10          | AUTO PAPER FEED TO TEAR-OFF AND RETURN   | \$2936       | DATATEL PTY LTD           | 03 690 4000 |
| 55dB        | 90              |                      | 25          | COLOUR. 3 PAPER HANDLING METHODS AS STD. | \$5173       | DATATEL PTY LTD           | 03 690 4000 |
| 48dB        | 90              | 220(H)x660(W)x520(D) | 29          | IBM 3274/76 OR IBM 34/36/38 INTERFACE    | \$13139      | DATATEL PTY LTD           | 03 690 4000 |

## Thermal printers

| Noise level  | Warranty length | Dimensions (mm)     | Weight (kg) | Other features                           | Retail price | Distributor                 | Phone       |
|--------------|-----------------|---------------------|-------------|------------------------------------------|--------------|-----------------------------|-------------|
| 30dB         | 90              | 60(H)x330(W)x190(D) | 3           | MAXIMUM NUMBER OF COLOURS IS 100 SHADES  | \$499        | COMMODORE BUSINESS MACHINES | 02 427 4888 |
| Not supplied | 365             | 46(H)x216(W)x128(D) | 1           | PORTABLE, BATTERY OPERATED, INCS CHARGER | \$330        | EPSON AUSTRALIA PTY LIMITED | 02 452 5222 |
| 35dB         | 90              | 60(H)x330(W)x190(D) | 3           | ROLL PAPER STAND                         | \$781        | IPL DATRON PTY LTD          | 02 698 8211 |



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THE INTUITIVE SOFTWARE

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*Intuitive Processing* gives the user a sense of intelligent, continuous dialogue with the machine.

## The AUSTRALIAN WP Package

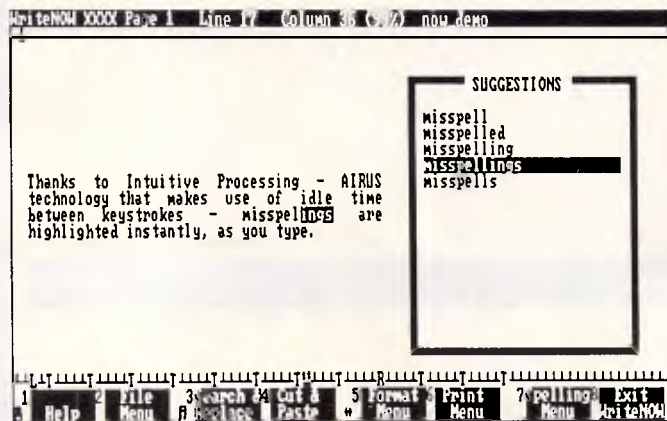
WRITE NOW has been extensively revised by OptSoft and includes an Australian Dictionary for spelling checking. The documentation has been written and printed in **Australia**.

## Easy to use? Too right mate!

Take WRITE NOW out of the box. Place it in the diskette drive and type NOW <enter>. The programme and the Australian dictionary will load into memory. You start typing *immediately*. There's no installation procedure to hold you up. No copy protection to hassle you. No bag full of floppy discs. No wait.

## Corrects Spelling As You Type

WRITE NOW highlights misspellings as you type - you don't need a separate spell-checking program. Mistakes are highlighted the instant they occur. Or, you can spell-check the entire document when you're through typing. The choice is yours.



Spelling suggestions are available. You can ask for them at any time, or have them pop up automatically the instant a misspelling occurs. Just scroll down to the correct word and it is automatically inserted the instant you press <enter>.

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If you wish, WRITE NOW will even complete words for you - a great feature if you are a *hunt and peck, find it and bit it typist*. For example, if you have just come back from a holiday in Norway and you are writing to tell a friend about your trip down a fjord, just type fj and, with Clairvoyance switched on, WRITE NOW will automatically add ord. That's *intuitive processing!*

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OptSoft have already included words like *haemorrhoidectomy* for people who know how to perform one but find spelling it a pain in the posterior region! However, if your profession has a vocabulary all of its own, OptSoft will create a dictionary for you from your word list after you have registered your copy of WRITE NOW - AT NO EXTRA CHARGE\*.

\*Free offer expires August 31, 1987. Small charge thereafter.

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WRITE NOW puts advanced word processing features at your fingertips using on-screen menus or speed key commands. Features include:

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- Micro-justification if supported by your printer
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- Automatic page numbering
- User defined page breaks
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## Mike Mudge deals with Polygonal, Pyramidal and Figurate Numbers.

**Definition I:** An 'Arithmetic Sequence' is a sequence of numbers each differing from the previous one by a constant.

**Definition II:** An 'Gnomon' is an 'Arithmetic Sequence' beginning with 1 and having a positive integer constant difference.

Thus  $G_1$ : 1,2,3,4,5,6,7,8, . . . constant difference = 1

$G_2$ : 1,3,5,7,9,11,13, . . . constant difference = 2

$G_3$ : 1,4,7,10,13,16, . . . constant difference = 3

$G_4$ : 1,5,9,13,17,21, . . . constant difference = 4

**Definition III:** To form the 'Polygonal Numbers' you add subsequent numbers from a Gnomon such as  $G_1$ . So, for example, generating the polygonal sequence  $T_1$  from  $G_1$  will work as follows:

**Take in figure**

This sequence is called 'Triangular numbers'.

Similarly,

**Take in figure**

**Note** Hypsicles gave such a definition of Polygonal Numbers around 175BC. However, he did not have a simple graphics routine to display a given Polygonal Number as an array of dots of appropriate size and shape!

**Definition IV:** The 'Pyramidal Numbers' are those formed by taking the sum of increasing numbers of terms of a sequence of Polygonal Numbers in the same way as above.

Thus  $T$ : yields 1,4,10,20,35,56,84, 120,165, . . . the Tetrahedral Numbers

$S$ : yields 1,5,14,30,55,91,140, 204,285, . . .

$P$ : yields 1,6,18,40,75,126,196,288, 405, . . .

$H$ : yields 1,7,22,50,95,161,252,372, 525, . . .

**Note** Hindu Aryabhata (476 AD) gave the formula  $r(r+1)(r+2)/6$  for the  $r^{\text{th}}$  Tetrahedral Number. However, he did not have computer graphics available to display Pyramidal Numbers! Do you?

**Definition V:** The  $r^{\text{th}}$  'Figurate Number' of order  $n$  is defined by  $F_n = (r+n-1)(r+n-2) \dots (r)/(1.2.3 \dots n)$  which many readers will recognise as the 'Binomial Coefficient'

Take in figure

readily available, for restricted  $n$  &  $r$ , on most scientific pocket calculators.

**Note**  $F_2$  is the  $r^{\text{th}}$  Triangular Number.  $F_3$  is the  $r^{\text{th}}$  Tetrahedral Number; further, Fermat called  $F_4$  the  $r^{\text{th}}$  Triangulo-triangular Number.

**Problems** From the above general theory, a sample of specific problems follows:

(i): Which Triangular Numbers consist only of repetitions of a single digit? For example: 55.

(ii): Which square numbers are also tetrahedral? For example: 1 & 4.

(iii): Which Triangular Numbers are also pentagonal? For example: 1 & 210.

(iv): Which numbers are simultaneously triangular, pentagonal and hexagonal?

(v): Which pairs of Triangular Numbers have their sum and difference also triangular?

For example: 15 & 21.

(vi): More generally, which Polygonal Numbers of a given sequence are also Pyramidal Numbers of a given sequence? For example: 22 is a Polygonal Number of the third sequence and also a Pyramidal Number of the fourth sequence.

(vii): An abstract problem! How best to represent 'graphically' the  $r^{\text{th}}$  Figurate Number of order  $n$ ? Suggestion: firstly, implement, algorithms to represent 'graphically' the Polygonal Numbers and then the Pyramids.

Readers are invited to send their thoughts, together with complete or partial attempts at the investigations of the above problems, to Mike Mudge, C/APC, 124 Castlereagh Street, Sydney 2000, to arrive by 15 October, 1987. It

would be appreciated if such submissions contained a brief summary of results obtained in a form suitable for publication in APC. These submissions will be judged using subjective criteria, and a prize will be awarded by APC to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a stamped addressed envelope is provided.

### Review: March 1987

**Problem (i):** Due to Professor Leo Alex; a number of submissions found 150 solutions. Refer to him for a proof of the finiteness of the solution set.

**Problem (ii):** Not too much progress here; although as an appetiser for further work:

The sum of two fourth powers in two different ways. That is:

$S = x^4 + y^4 + z^4 + w^4$  was completely solved by Euler algebraically.

**Take in figure**

**Problem (iii):** attracted considerable attention; the greatest success in

(a) listing solutions up to  $7094269 = 168^3 + 133^3 = 189^3 + 70^3$ .

(b) The empirical evidence up to  $10^8$  says no! But how do we prove this?

The prizewinner, Richard Tindall, used a combination of Basic on a NewBrain and Basic (Microsoft) on the Kaypro 2000: 'Pascal is even less suitable'.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or particular, for future Numbers Count articles; all letters will be answered in due course.

END



**LAZING AROUND**

*Brainteasers courtesy of JJ Clessa.*

**Quickie**

If you write down every positive 2-digit number (that is, from 10 to 99), which digit will you have written the most number of times?

**Prize puzzle**

(1) Take a 4-digit palindromic number — that is, one which reads the same from right to left as it does from left to right.

(2) Reverse the digits and add the result to give a new number.

(3) Repeat step 2 with the new number until the result becomes palindromic.

To illustrate, suppose we have the

number 3883;

$$3883 + 3883 = 7766$$

$$7766 + 6677 = 14443$$

$$14443 + 34441 = 48884$$

which is palindromic after three cycles only.

Two numbers, however, do not yield palindromic results even after 1000 cycles. What are they?

Answers on postcards, please, or backs of envelopes only, to reach APC, Lazing Around September, 124 Castlereagh Street, Sydney 2000, no later than 30 September 1987.

**June prize puzzle**

A moderate response this month. As usual there was a trace of ambiguity in the problem — does the digit zero follow the digit 9 in the definition of 'consecutive'?

We decided not, since the problem already stated '... digits 0-9 are used ...', which really precludes the ambiguity. Anyway, most entrants who realised the possible ambiguity, sent in the correct solution as well — which was 123341234. The winning solution came from Mr Kennedy of Brunswick, Victoria. Congratulations.

END

**DIARY DATA**

*Readers are strongly advised to check details with organisers before making travel arrangements to avoid wasted journeys due to cancellations, printers' errors, etc.*

**Exhibitions**

**August 31 — September 6, 1987**

Information Secesu '87

VIIIth Brazilian International Fair and the XXth National Congress of Information Systems, held at the Fair Hall, Sao Paulo.

Contact: Secesu-SP, Event Department — Information Secesu '87, 04533 Sao Paulo SP, Brazil

**September 8-11, 1987**

ACC '87

Australian Computer Society annual exhibition and conference. Major themes: manufacturing, banking, artificial intelligence, held at the Royal Exhibition Buildings, Melbourne.

Contact: ACC '87 Secretariat, Suite 7, 19-23 Hoddle Street, Richmond Vic 3121

**September 14-18, 1987**

IREECON '87

The 21st International convention and exhibition of the Institution of Radio and Electronics Engineers Australia, held at the Royal Agricultural Society Showground in Sydney.

Contact: IREE Australia, PO Box 79, Edgecliff NSW 2027. Telephone (02) 327 4822

**September 23-24, 1987**

Scanning Technology '87

First national exhibition and seminar/case study program on bar coding and other automatic identification and data entry systems, held at the

Wentworth Park Convention Centre, Sydney.

Contact: AIM PAC Secretariat (02) 958 1811

**October 20-24, 1987**

Computer Indonesia & Business Indonesia

Computer products and office technology exhibition held in Jakarta.

Contact: Australian Exhibition Services, Suite 3.3 Illoura Plaza, 424 St Kilda Road, Melbourne Vic 3004. Telephone (03) 267 4500

**November 4-7, 1987**

Queensland Computer Expo '87

A four day exhibition held at the RNA Showgrounds, Brisbane.

Contact: Robert Woodland Exhibitions, PO Box 280, Sunnybank Qld 4109. Telephone (07) 273 4066

**Conferences**

**September 6-10, 1987**

CMGA '87

The Group for Computer Capacity and Performance Management meeting will be held in Canberra.

Contact: Charlie Doherty (062) 47 2644

**September 22 - 23, 1987**

APCON

The Sydney PC Users Group's annual convention will be held at the Masonic Centre in Sydney.

Contact: APCON Coordinator, Geoff May (02) 699 3518 or the Group's President, Ron Pollak (02) 290 3655

**September 28-30, 1987**

Australian Computers in Education Conference

The conference will be held at the Adelaide Convention Centre.

Contact: Australian Computers in Education Conference, PO Box 931, Norwood SA 5067. Telephone (08) 332 1141

**October 19-21, 1987 Auckland**

**October 21-23, 1987 Sydney**

International Connectivity Symposium on Local and Wide Area Networks and Micro-Mainframe Links, organised by Digital Consulting Pacific (DCP).

Contact: Sara Mulvihill (02) 922 5532

**November 1-4, 1987**

Australian Joint Artificial Intelligence conference 1987

A four day conference covering three themes: research, applications and commercial endeavour.

Contact: AI'87 Secretariat, PO Box 929, Crows Nest NSW 2065. Telephone (02) 439 5133

**November 25-27, 1987 Singapore**

**November 30 - December 2, 1987 Sydney**

**December 2-4, 1987 Wellington**

International Computer Aided Software Engineering Symposium,

## DIARY DATA

presented by Digital Consulting Pacific.  
Contact: Sara Mulvihill (02) 922 5532

### Courses & Seminars

**September 2-4, 1987 Melbourne**

**September 9-11, 1987 Sydney**

Three day seminar on SNA — architectures for the future held at the Old Melbourne and the Boulevard Hotel.

Contact: Housely Communications (02) 498 7877

**September 7-8, 1987**

Two day seminar on X.25 and related packet network protocols held at the

Boulevard Hotel, Sydney.  
Contact: Housely Communications (02) 498 7877

**September 7-8, 1987 Melbourne**

**September 17-18, 1987 Sydney**

A two day seminar on software engineering principles presented by George Littlewood.

Contact: Management Technology Education (02) 290 3555

**September 9-11, 1987 Melbourne**

**September 21-23, 1987 Sydney**

Three day seminar on software quality assurance presented by George Littlewood.

Contact: Management Technology Education (02) 290 3555

**September 15-17, 1987**

A three day course on Unix system and shell programming organised by the Queensland Institute of Technology, Brisbane.

Contact: (07) 223 2196

END

### Notice to organisers

Please send any information regarding forthcoming exhibitions, courses, seminars etc, to: *Diary Data, APC, 124 Castlereagh Street, Sydney 2000.*

## USER GROUPS

*Below is a list of updates and additions to the full User Group listing which is available to readers on request. Please send a SSA envelope to 'User Groups', APC, 124 Castlereagh Street, Sydney 2000.*

### Vic

The Smalltalk Users Group has recently been formed. Unfortunately no information was provided regarding venue or frequency of meetings.

For more details contact Doug Duke on (03) 836 3355.

### NSW

The Sinclair QL Australia User Group was formed in February this year. The group meets on the first Thursday of each month at the Granville Library Rooms, 10 Carlton Street, Granville, commencing at 7pm. For more information contact the Chairman/Secretary, Mr Vadim Kuchin, PO Box 729, Parramatta NSW 2150.

Some updates from the Challenger User Group include a new Chairman/President — Gary Stark and a new Secretary/Treasurer — Ross Johnson. For further details contact Gary Stark on (02) 810 5118 or Ross Johnson (02) 963 4240.



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|                      | <b>Manuscript</b> for presentations even the boss will envy                     | 635                   | 930    |
| dBase III:           | <b>Clipper</b> the dBase III compiler which improves performance up to 7 times  | 835                   | 1195   |
|                      | <b>Genifer</b> the system generator which writes code like you dreamt you could | 460                   | 595    |
| Wordperfect Library: | Perfect for the advanced Wordperfect user                                       | 175                   | 225    |
|                      | <b>Timeline</b> PERT and GANT Charts for the professional                       | 285                   | 330    |
| Graphics:            |                                                                                 |                       |        |

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| Lotus 1-2-3 569                                | • VP Info 165                   | Timeline 595                        |
| Javelin                                        | • P.F.S. Professional File 299  | Harvard Project II 699              |
| Supercalc 4                                    | <b>Integrated:</b>              | MS Project (V3.0) 575               |
| Mathplan (companion for Wordperfect) 365       | Framework 975                   | Super Project Plus 565              |
| Multiplan 295                                  | Open Access II 920              | <b>Communications:</b>              |
| Silk 250                                       | Synphony 895                    | Crosstalk 170                       |
| • VP Planner 165                               | • First Choice 195              | Smarterm call                       |
| <b>Wordprocessing:</b>                         | • Ability 259                   | • Mirror (Crosstalk clone) 85       |
| Wordperfect (V4.2) 499                         | • Electric Desk 259             | <b>Accounting:</b>                  |
| MS Word (V3.1) 599                             | <b>Utilities:</b>               | Business Manager 595                |
| Multimate Advantage                            | Copywrite 77                    | Integrity call                      |
| Wordstar Professional (V4.0)                   | Norton Utilities (V4.0) 127     | Attache call                        |
| Wordstar 2000+ • P.F.S. Professional Write 260 | PC Alien 82                     | • Dac Easy call                     |
| • First Choice 195                             | Smartkey (Keyboard enhancer) 66 | <b>Publishing:</b>                  |
| • Gem Collection                               | Microsoft Windows 165           | Ventura 1285                        |
| <b>Database:</b>                               | GEM Desktop 65                  | Clickart Personal Publisher 260     |
| dBase III Plus                                 | Xtree 89                        | Harvard Professional Publisher 1130 |
| Clipper (dBase III compiler) 835               | Mace 119                        | <b>Graphics:</b>                    |
| Paradox V1.1i 835                              | <b>Training:</b>                | Harvard Presentation Graphics 499   |
| R Base System 1095                             | PC Tutorial 69                  | MS Chart 435                        |
|                                                | PC Introduction 69              | • Graph in a box 129                |
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| Macro Assembler    |             |
| <b>Peripherals</b> |             |
| MS Mouse           | 270         |
| <b>Macintosh</b>   | call        |

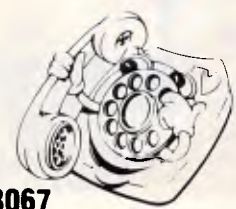
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| <b>Intel Chips:</b>      | 8087 Math Co Processor .....               | 239  |
|                          | 80287-8 Math Co Processor .....            | 610  |
| <b>Monitors:</b>         | Hi Res Colour - NEC or Phoenix IV .....    | 679  |
|                          | Hi Res Green - NEC .....                   | 175  |
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