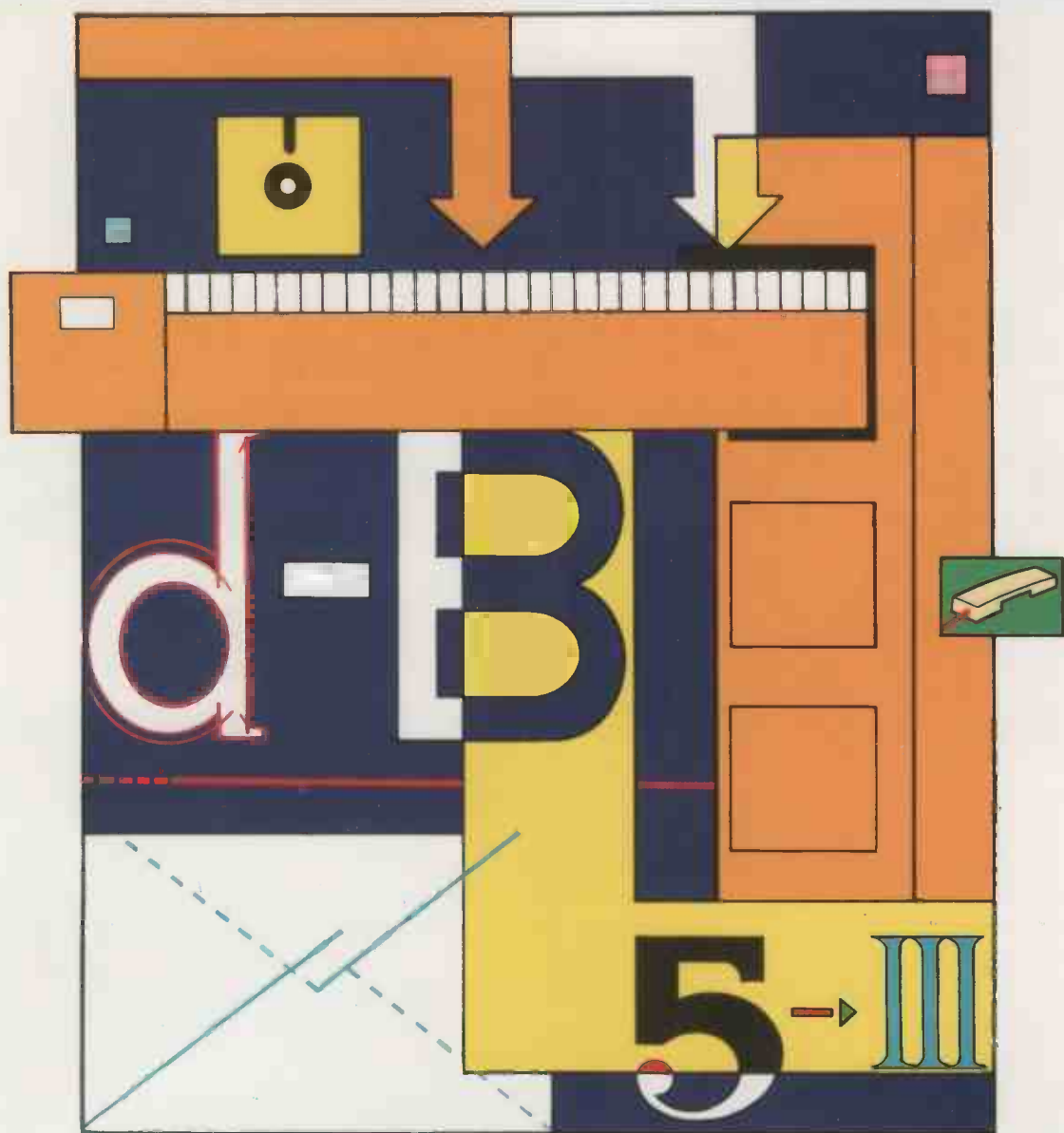


PRACTICAL COMPUTING

FOR BUSINESS AND PROFESSIONAL MICRO USERS



THE DATABASE VOGUE

HARDWARE IBM PC Convertible • Sperry Micro IT

SOFTWARE Equals 22 • Word Perfect Library

Word Wizard • Supercalc 4

FEATURES Are your discs in danger?



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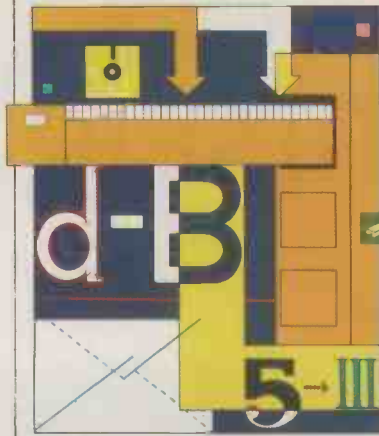
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THE DATABASE VOGUE

Once upon a time databases were boring and limited to basic filing operations. Now that spreadsheets and word processors seem to have ground to a halt, databases are leading the way with new and innovative products. Suddenly it seems that everyone is using them, but for very different applications. On page 103 *Steve Malone* looks at the simplest kind of pop-up filer which is useful for storing addresses. *Susan Curran* examines a program that allows you to pull out a database from text files on page 106. Then on page 108 *Jack Schofield* details the growing number of on-line data services available on Telecom Gold. Finally on page 111 *Mike Lewis* looks at the advanced product Intuitive Solution

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PRACTICAL COMPUTING

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In the future micros will be just one part of a total office-automation strategy. *Steve Malone* looks at the story so far

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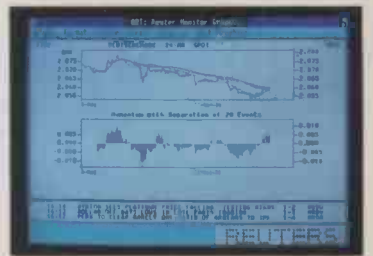
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Would-be authors are welcome to send articles to the Editor but PC cannot undertake to return them. Payment is at £35 per published page. Submissions should be typed or computer-printed and should include a tape or disc of any program.

Every effort is made to check articles and listings but PC cannot guarantee that programs will run and can accept no responsibility for any errors.

A BIGGER BANG

On 27 October the London Stock Exchange will experience the Big Bang, the dismantling of over 200 years of cherished traditions and gentlemen's agreements. In its place will come an open market where it is brute financial muscle that counts. Much of that muscle will be computerised; as a result, even greater changes may be on the way.

Deregulation is being carried out and policed by the Stock Exchange itself in return for not having the process forced upon it. The biggest changes will be that foreign firms are to be able to trade on it, and that there will be no cosy minimum commissions. The Americans and the Japanese will become as big in the London market as they are in their own, where both rely heavily on sophisticated electronic trading systems. Such systems in their turn allow keenly priced services.

Computers have been used on the London Stock Exchange for some time, notably in providing the latest share prices on systems like Epic and Topic. More recently Seaq has been developed to allow market trading via a central computer. With the Big Bang and foreign traders on the way, the emphasis is now shifting to the analysis of share prices, particularly with a view to aiding brokers in decisions about which shares to buy or sell.

Unlike the centralised systems used for providing data and settling accounts, this analysis is carried out within the individual stockbroking firms, and here micros are being used increasingly. Partly this reflects the ease with which they can be configured for each broker's particular needs; but mini and mainframe systems are susceptible to variable response times, something that is unacceptable in an environment depending so critically on time.

With new technology come new possibilities. Not only can micros help you carry out your work more efficiently, in some tasks they can even replace the element of human intervention. In the U.S., where this kind of thing is already widespread, they call it program trading. It is the computer and its associated software which observes the market, makes decisions on the basis of movements, and then acts according to a pre-defined set of options — all without any recourse to the user.

There are clear benefits. A machine can monitor information and trends far more rapidly than any human trader. It can also track many streams of input simultaneously — the human counterpart is likely to end up giddy and cross-eyed trying to do the same.

But there are problems. At the crudest level, this approach means that money is power: the more powerful your machine and the better your software, the more likely it is that your setup will strike before

the opposition. Since this merely mirrors one of the bases of free-market capitalism anyway, it could be argued that this is nothing new.

More worrying is the fact these transactions are taking place so fast that users are unable to authorise them without vitiating the whole process. In effect, the machine is out of control. Couple this with the fact that all software has bugs somewhere, and that even well-tested software has a limited accuracy, and you have the makings of a disaster.

The sums involved are so enormous that small arithmetic errors, especially if they propagate through an analysis, could wreak financial havoc on a market populated by similar machines ever-alert to twitches in the underlying trend. By using machines in this uncontrolled way, the market may be abnormally affected by them and become unstable as a result.

Such systems are here to stay; the benefits are too great for it to be otherwise. But as these billion dollar brains begin to affect every aspect of the money markets — shares, foreign exchange, futures — and hence by implication every one of us, we must learn to use them wisely. Above all, here as elsewhere, this means staying in control of the technology as its master, not its slave. If we do not, we could be in for an even bigger bang as the world's financial system collapses.

5 YEARS AGO...

The long-awaited Green Paper on copyright has been published, and many of the points raised concern micro-computer programmers.

The present position on computing is that it is generally accepted that the copyright law provides some protection for computer programs. However, there is no case law and the full extent of protection is not clear. The proposals in the Green Paper will clarify the application of copyright to computer programs and to other words stored in computers.

The Green Paper contains proposals for increasing penalties for piracy of copyright material, and to make a new criminal offence of possession of an infringing copy in the course of trade.

In civil infringement cases, the Green Paper recommends the abolition of "conversion damages" equal to the full value of all infringing copies, but proposes that the scope for the award of penal damages for flagrant infringements should be broadened.

The term of a copyright at present lasts for the life of the author plus 50 years for some cases and for differing amounts of time in others. At present, the position affecting computer programs is slightly confused, but it should be resolved by the proposal that all copyrights shall exist for 50 years.

PC Volume 4 Issue 10

GO FOR THE TOP



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Hicups

THE user group formed to support the Hitachi PC user, Hicups, is offering an expansion card for the Hitachi PC that will boost the RAM to a total of 640K, for around £200. This has happened only because a group of people have got together to enable the board to be produced.

Hicups has also increased the number of discs in its library of programs that run on the Hitachi PC to almost 120. There are, of course, hundreds of programs contained on these discs.

I would also like to draw attention to the fact that we have moved to a new address, given below.

BRUCE AINGE,
16 Nine Acres Road,
Cuxton,
Kent ME2 1EL.

Electrostatic discharge damage

I READ Martin Eccles' article "Serious Charges" in *Practical Computing*, August, with interest and as a co-author of the booklet *Static Discharge — the High Tech Gremlin*, quoted in his opening paragraph, I feel I must reply.

At the recent seminar Electrostatic Discharge Damage in Electronics, organised by ERA Technology, we learnt of systems failing due to the effects of electrostatic discharge (ESD), and of the difficulty in choosing a human-body model which accurately represents the human discharge waveform.

Bare chips can indeed be damaged by very small ESD levels, but office generated static levels can be very high. When the humidity is low, the act of walking across a synthetic carpet

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

WRITE TO:

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

TRANSPUTER PROBLEM

I WAS very interested to read Ray Coles' eulogy of the Transputer in the August issue. The hardware concept might be superb, but I question whether any software will ever satisfactorily solve the problems associated with the use of multiple computers, whether in the form of the Transputer or anything else. There are numerous examples of such systems in the United States, among which are the Butterfly computer from Bolt, Beranek and Newman and The Thinking Machine from a company located in Cambridge Massachusetts, and neither company appears to have solved the software problem satisfactorily. The result is you need an expert on the hardware to be able to deal with the software and even then some of the difficulties which arise are extraordinarily abstruse.

In any case, it has yet to be proven that these parallel machines have any real place in the computing sphere, apart from in areas such as those which involve multiplying matrices together, image processing and artificial intelligence.

We also have the example of ICL's involvement in this vexed question of parallel computing, which took place several years ago and resulted in the abandonment of the project after several abortive attempts to market it.

I wouldn't put one penny of my money into the Transputer. The problem is not hardware but hardware/software integration.

ROBERT T STREET,
Knaphill,
Woking,
Surrey.

can generate 20,000V. Even in summer, when the humidity is higher, office workers still complain of shocks from filing cabinets, suggesting potentials of at least 4,000V. Simulated ESD testing of components does not guarantee that devices will not be

damaged by even low-level real discharges.

Martin Eccles states that ESD can be a problem as far as data loss is concerned. In my experience it is the considerable nuisance value of data loss and temporary malfunction, as well as

the high cost of reworking lost material, that has led many organisations to search for preventative measures to combat ESD.

Finally, two of the solutions proposed in the article to combat ESD and provide personal comfort will not work. A statically charged operator touching a large metal object or an earthed metal sheet prior to working on the computer, will create a very fast discharge between 0.5ns. and 20ns. This will cause shocks to the operator, and in the case of the earthed metal sheet, probable damage to the system.

The optimum protection against direct discharge effects is a static dissipative surface with conductivity in the range 10^7 to 10^9 ohms per square and a much slower discharge time in the order of a few tenths of a second. Static Master Pads meet these requirements.

I R BARCLAY,
Static Control Products,
Formica Ltd,
North Shields,
Tyne and Wear.

MARTIN ECCLES REPLIES: My advice to touch a conducting metal surface was followed by a warning that the surface should not be connected to the computer. This will work. If operator shock is a problem then an anti-static bag or pencil lead and a little imagination should prevent it for a few pence.

WP training

I WAS interested to read Carol Hammond's article "A Matter Of Course?" in the August issue of *Practical Computing*, and while agreeing with much that was written, there were some omissions.

(continued on next page)

Readership survey and reader panels

THE results from our recent readership survey have proved interesting reading. The response rate was very high and over 20 percent of those who received questionnaires returned them.

The survey showed that nearly 50 percent of readers are directors or senior managers and more than half of our readers work in companies with at least 100 people. More than 40 percent claimed they used their computers for more than 30 hours a week — one person claimed he used his micro 168 hours a week. The systems you use are generally up-market and nearly 50 percent are worth over £10,000.

Practically everyone uses word processors, and most people use spreadsheets and databases. A surprisingly high percentage use or intend using comms and graphics packages: 62 percent use or intend to use comms and 58 percent graphics. Both are advanced applications, and a sign of the large number of power users among our readers.

Not surprisingly, the news and reviews features proved the most popular, followed by regular features. Less popular was the interview, which has been dropped in this issue, but which will appear in a different guise in the future.

Some 57 percent of you felt that *Practical Computing* needs no changes; those who made helpful suggestions will be pleased to know that we will be acting on many of these in future issues of the magazine.

We have found the information and comments thrown up by this survey so useful that we have decided to make it a regular feature in the form of reader panels. Enclosed with this issue is a letter inviting you to take part in the panels. This would involve very little work, but will give us even more useful feedback on what you would like to see in *Practical Computing*.

**SPECIAL SECTION
MACINTOSH & CO.**

There is life outside the world of IBM. Three machines, the Apple Macintosh, Atari 520ST and Commodore Amiga, are proof of this. But how healthy are they? We look at where these micro families are today and the business software available for them. With new machines due from Apple and Atari, we also look at where they will be going in the future.

SOFTWARE

We test two personal-publishing packages: Fantasy, a low-level program for the IBM PC, and Just Text, perhaps the most advanced product for the Macintosh currently available in this area.

HARDWARE

It's autumn, and everyone seems to be launching machines. Provided Alan Sugar finally admits to having an Amstrad PC, and it is launched at the PCW show, we hope to review it. Plus much, much more.

FEATURES

Is computer crime on the increase? Who does it and to whom? We report on this worrying new trend. We also check out the strange new world of Value Added Resellers.

TOP 10 SURVEY

Integrated packages may not be as popular as they once were, but they still offer an attractive solution. We examine the leaders.

Don't miss the November issue of

**'PRACTICAL
COMPUTING**

On sale at W H Smith and all good newsagents after 8 October.

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

(continued from previous page)

The article states that "there is no official monitoring body and there are no nationwide exams to help you assess a company's teaching proficiency." The Joint Examining Board was the first examining body to offer an examination for teachers and trainers of word processing in 1983, worldwide. Since then, over 3,000 lecturers in colleges as well as trainers and supervisors in industry have qualified for the diploma and are now running training courses for others who not only wish to teach word processing but are desirous of being fully competent in all aspects of the skill.

The board is aware of the changing market, and because of that, training is not given on one particular word-processing package. Rather a knowledge of word processing in general is taught so that students can easily adapt and apply the concept of word processing to any software or hardware.

Those wishing to train to use a particular package should have no difficulty in opting for an educational course, provided the tutors are holders of the JEB word-processing teachers' diploma. By this they are assured that the tutors not only have the knowledge but have demonstrated that they are capable of imparting it to others.

ELIZABETH ROBERTS,
Joint Examining Board,
Godalming,
Surrey.

AS A fellow of the Society of Teachers in Business Education and holder of the Joint Examining Board's teacher's certificate in word processing, and having tutored hundreds of students in the skill of word processing over a wide range of systems, I thought Carol Hammond's statement that "You can check up on the qualifications of tutors, but since there is no established way of training a trainer this may prove a waste of time" shows a total ignorance of what goes on in our teacher-training establishments.

My colleagues and I have been training staff both in colleges and on company premises in a wide range of commercial subjects, and word processing is simply an extension of our teaching skills. Some of us maintain fluency in a number of different word-processing systems and also make it our business to keep up-to-date with enhancements to enable us to teach a system in depth.

It is important that we get over

to the suppliers and purchasers of new technology that there is an enormous difference between the kind of half-day demonstration often given by salesmen or engineers who have little knowledge of the needs of a typist producing multi-paged and often complicated, prestigious reports and correspondence, and the kind of training given by those experienced in the field of business with the necessary training and experience which enables us to properly teach our subjects.

JEANNE E READ,
Camberley,
Surrey.

A portable combination

WITH reference to A L Lakin's letter in Ask PC, July, I have solved his problem for myself with an NEC PC-8201A lap-held computer. I have found it invaluable for working in libraries, trains, my club, when away from home, etc. It has a communications program in its ROM and I have had no difficulty in transferring text files to my Osborne 1 micro.


I have added a good deal to it — two extra RAM chips and the Traveling Software Ultimate ROM which has a word-processing formatting program, a database and an ideas program. I also use a Brother 3.5in. disc drive controlled by MT-DOS, which is a cassette program from Microtime International of Woolton in Bedfordshire. In addition I occasionally use the NEC cassette recorder and the tiny NEC printer for proofing data.

All this equipment fits into a small attaché case that I've had for many years, but the computer and disc drive easily drop into a briefcase or overnight bag.

I have found it very useful for drafting letters which I print out directly on a Brother HR-15 printer using the T-Writer formatting program. I also have, although I've not used it, a program to give up to 80 characters per line in the form of T-View 80, also from Microtime International.

PETER C G ISAAC,
Wylam,
Northumberland.

Telecom Gold

IN THE August issue of *Practical Computing*, the article "On-line Crime" referred to hackers gaining access to a Telecom Gold mailbox. This should have referred to a Prestel mailbox. 

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display all your desktop information. Another keystroke puts you back where you were.

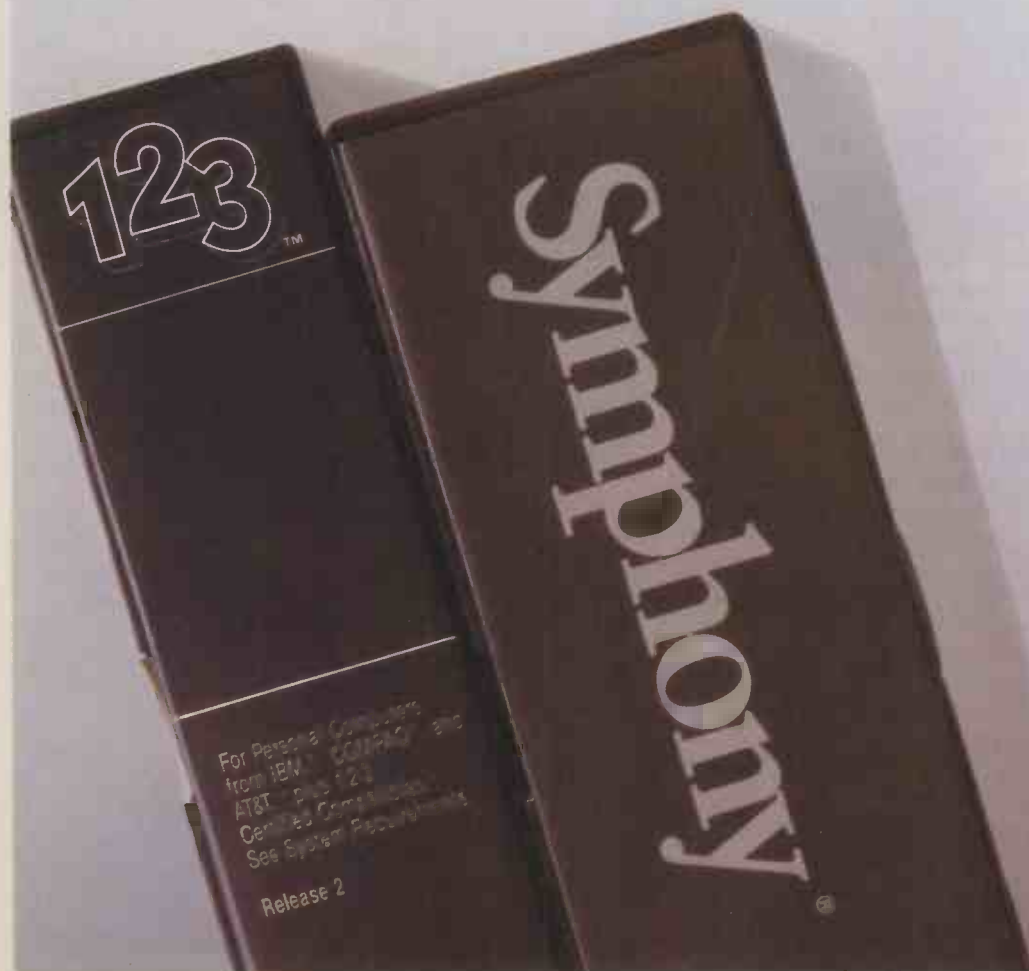
Symphony Spelling Checker.

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Electronic Reference Programmes

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Lightning Word Wizard. Development tool kit, technical reference manual for Lightning engine. Includes Turbo Pascal source code, various games.

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Olivetti M-22 delayed

OLIVETTI has postponed the official launch of the M-22 lap portable due to "a number of technical problems", according to Olivetti's U.K. marketing manager, Bob Garrett. The design is said to be under review and until it is completed Olivetti is unable to commit itself to a revised launch date.

Although Garrett declined to give details of exactly what the problems might be, we found no faults in the design of the prototype when we reviewed it in our May issue. So it seems likely that the faults lie with the manufacturing process, which is carried out by the Hong Kong firm Radofin, rather than any fault in the machine itself. If the faults cannot be rectified by altering the manufacturing machinery, it may mean that the M-22's design will have to be modified to make production simpler.

Details from British Olivetti, Olivetti House, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.

Versatile Epson

EPSON is launching a successor to the LQ-1500 dot-matrix printer. The new LQ-2500 features a built-in LCD screen and a programmable front panel which can store four printer configurations.

The LQ-2500 stores the configuration on an EEPROM, which means the data is retained even when the machine is switched off. The printer also features a 24-pin head and an 8K print buffer expandable to 40K. The LQ-2500 is priced at £995. Details from Epson U.K. Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. Telephone: 01-902 8892.

TWO TANDY PCs AND LAP PORTABLE

TANDY U.K. has launched three new machines in the U.K., two IBM-compatibles and an upgrade of the Tandy lap portable.

Positioned at the bottom of the range is the Tandy 1000EX. This is described as a "one-piece computer", which means it has the keyboard built into the system box rather like the Apple II. Based around the 8088 chip and switchable between 4.77MHz and 7.16MHz, the company claims that the 1000EX is fully compatible with IBM software; the machine will only accept proprietary expansion cards. Memory is 256K expandable to 640K and the micro has three expansion slots. Storage is supplied by a single 360K disc drive with the option of either a 3.5in. or 5.25in. external disc drive.

The full package including a monitor, MS-DOS, Tandy's own Personal Deskmate front end, one hour's training and a year's warranty comes to £449. A colour monitor raises the price to £549.

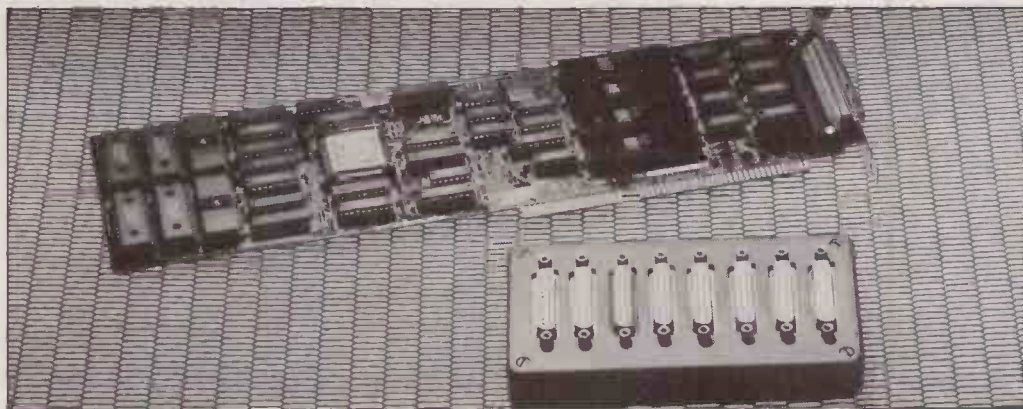
The other IBM-compatible from Tandy is the 3000HL. Despite the name, the micro is PC/XT rather than PC/AT compatible although the computer is based around the 80286 chip. The 3000HL CPU has switchable clock speeds of 4MHz and 8MHz. It has 512K memory as standard, expandable to 640K.

The basic system unit has a retail price of £995 although Tandy is promoting a complete turnkey system for £1,795. This includes a monochrome monitor, a 20Mbyte hard card, 3.1 DOS, Deskmate and a dual-display graphics card.

The Tandy 102 is the company's portable offering. It is an

enhanced version of the popular Tandy 100. The new version is smaller and lighter than its predecessor while having a bigger memory of 24K expandable to 32K. The Tandy 102's CPU is the 80C85 eight-bit chip which works together with the 32K ROM. It also has a built-in modem and diary plus WP and comms software. It will cost £299.

Tandy has also launched its own local area network, known as Vianet, which is based around Datapoint's Arcnet system. The system will run MS-DOS programs and Tandy claims it has a transfer rate of 2.5Mbit/s. A Vianet board, excluding cabling and other equipment, costs £299. Further details from Tandy U.K., Tandy Centre, Leamore Lane, Bloxwich, Walsall, West Midlands WS2 7PS. Telephone: (0922) 477778.



Nine users can share an AT

THE AT-8 plug-in board allows eight remote terminals to share the PC/AT processor, so together with the AT's own console this means you can have nine users in all. The manufacturer, Specialix Systems Ltd, claims that it is the cheapest multi-user system on the market.

The full-length plug-in board

connects to an external junction box which has eight RS-232 ports able to feed data to dumb terminals. The AT-8 has its own 80186 processor on-board which handles the I/O to the terminals, thus freeing the PC/AT's own 80286 processor for application handling.

The board costs £1,195 including the RS-232 block, leads, manuals and the drivers necessary to support Concurrent DOS and Xenix. Further details from Specialix Systems Ltd, Clareville House, 47 Whitcomb Street, London WC2H 7DH. Telephone: 01-930 1407.



More Above Board

INTEL has launched a new version of the Above Board expanded memory card. Called the Above Board PS/AT, it is the AT version of the multi-function Above Board launched for the IBM PC at the end of last year.

Two versions of the Above Board PS/AT are available: a 128K model expandable to 384K costing £480, and a 512K model expand-

able to 1.5Mbyte costing £560. Both versions of the PS/AT are equipped with serial and parallel I/O ports. As it is intended for the PC/AT the memory supplied on the PS/AT can be configured either as extended or expanded memory. Contact First Software, Intec-1, Wade Road, Basingstoke, Hampshire RG24 0NE. Telephone: (0256) 463344.

Postscript goes Dutch

QMS has introduced its QMS PS-800 laser printer into Europe. The printer is functionally equivalent to the Apple Laserwriter and is being manufactured at the company's European factory in Utrecht.

Based around the Canon LBP-CX engine, the QMS PS-800 printer supports the Postscript page-description language. On-board hardware includes a Motorola 68000 processor, 2Mbyte of memory and 500K ROM. The company claims the machine is compatible with the Macintosh and the IBM PC.

The QMS PS-800 costs \$6,995. Further details from Pragma Ltd, Radlett Road, Colney Street, St. Albans, Hertfordshire AL2 2EB. Telephone: (09276) 3411.

Commodore upgrades its PC series

COMMODORE has announced the release of its PC Series II IBM-compatible range in the U.K. with upgraded memory and graphics capabilities.

The PC Series II is available in two models each with monochrome or colour graphics capabilities. Both are simple PC clones running the 8088 processor at 4.77MHz. They come with 512K of system memory, and serial and printer ports are fitted as standard. The PC-10 II is fitted with a single 360K drive while the PC-20 II is equipped with two drives. Prices for the machines start at £1,199 for the PC-10 II and £1,799 for the PC-20 II.

Details available from Commodore Business Machines (U.K.) Ltd, 1 Hunters Road, Weldon, Corby, Northamptonshire NN17 1QX. Telephone: (0536) 205555.

Amstrad delivers at last

BY THE TIME you read this, the Amstrad PC should be official, though at the time of writing Amstrad itself refuses to acknowledge its existence. The Amstrad PC 1512 will come in four models, starting at £399 for a single-floppy version with monochrome monitor, and going up to a dual-drive version with colour monitor. Bundled software

will be included. More details will be given in next month's issue.

Another machine still unofficial at the time of writing is the blitter version of the Atari 1040ST. The blitter is a device which allows data to be moved around the screen independently of the processor, thus allowing full animation-type displays to be produced. Most existing ST software should run on

the new configuration. The only exceptions are programs where the authors have ignored Atari's recommendations to use the BIOS and have opted to address video memory directly.

Further details can be obtained from Atari (U.K.) Ltd, Atari House, Railway Terrace, Slough, Berkshire SL2 5BZ. Telephone: (0753) 33344.



SONY DISCS BUILT INTO BBC MASTER

ACORN'S BBC Master Compact comes with a Sony double-sided 3.5in. disc drive. Externally, it bears more than a passing resemblance to the Acorn Communicator. Internally, it is like a BBC Master with a few of the less important features removed to save costs.

It offers a faster version of BBC Basic with new algorithms for the transcendental functions and Acorn's advanced disc-filing system. The keyboard now supports a full eight-bit ASCII character set. Econet is available as

an optional extra using the Master daughter board. Bundled software comes on disc for loading into sideways RAM and consists of View, ABC and Logotron Logo.

The Master Compact will come in three versions: a low-cost entry-level machine plus two fully equipped models, complete with monochrome or medium-resolution colour monitor.

For further details contact Acorn Computers Ltd, Cambridge Technopark, 645 Newmarket Road, Cambridge CB5 8PD. Telephone: (0223) 214411.

HARDWARE SHORTS

● Raindrop Computers has developed a range of multi-user systems based around the Olivetti M-24 range. The systems range from a four-user 20Mbyte configuration costing £3,295 to a 12-user 150Mbyte machine priced at £11,850. Details on 01-734 1091.

● Sintrom Electronics has won the exclusive rights to market the Polaroid Palette in the U.K. The system is used to produce presentation graphics slides from a display monitor. The Palette is priced at £1,395. Ring (0734) 875464.

● Jarogate has developed an IBM-compatible Ethernet controller card and the Sprint Service Station file server. The card fitted with 512K costs £595 and the Service Station costs £6,925. Details on 01-391 4433.

● Hayes Microcomputer Products has launched a plug-in version of its Smartmodem 1200TM. It costs £465, or £525 with the Smartcom II software. Details on 01-847 5521.

● Opus has introduced an IBM PC/XT clone. The PC II range has dual speeds of 4.77MHz and 8MHz. Prices start at £499. Contact (0737) 65080.

● The Calcomp multi-colour high-resolution presentation graphics printer, Colormaster, is being distributed in the U.K. by Hal Communications priced at £3,909. Ring (0252) 547000.

● Sony is to bundle Microsoft Windows with the SMC-210. Details on (0784) 61688.

● Imagemate is a device which provides Epson compatibility for the Apple Imagewriter II. It costs £99. Details from P&P on (0706) 217744.

● Claimed to be the first plug-in-and-go multi-user system, the Quad from Comart can support up to four users and costs £4,995. Details on (0480) 215005.

● Acorn Computers is to badge engineer Olivetti's M-19. The version to be sold under the Acorn name will have twin 360K disc drives, 256K of memory and a high-resolution graphics monitor. The entry-level Acorn M-19 is priced at £1,499. Ring (0223) 214411.

DR launch with Amstrad

DIGITAL RESEARCH will be supplying DOS+ and Gem with the Amstrad 1512 PC compatible. The company will also be offering nine application programs for Amstrad PC users.

The programs are the Gem collection suite, which has been available on the IBM PC for some time, including Gem Write and Gem Draw. DR is also offering several new packages including Gem Diary and a Gem-based communications package from Vicom.

DR says that all the application programs will be priced at under £100. Details from Digital Research Ltd, Oxford House, Oxford Street, Newbury, Berkshire RG13 1JB. Tel: (0635) 35304.

Borland tops chart

BORLAND's AI language Turbo Prolog has displaced Lotus 1-2-3 as the top-selling business package in the U.K., according to software distributor Softsel.

The latest Softsel chart, published in the trade magazine *Microscope*, has 1-2-3 reduced to second place. Two other Borland products, Turbo Pascal and Sidekick, are at third and fifth respectively.

However, the Softsel chart is compiled by volume, not by value, which would still have Lotus way out in front. It also only refers to sales made by dealers supplied by Softsel.

Further details available from Softsel on 01-568 8866.

Background comms

MIRROR is a PC comms package very similar to the popular Crosstalk package. It is claimed that script and command files set up for Crosstalk will work on Mirror. Where Mirror is different from Crosstalk is that it is memory-resident; this means you can have a comms job running in the background while using your screen and keyboard for another application. Mirror costs £49 from Management Data Processing Ltd 37 Great Pulteney Street, Bath, Avon BA2 4DA. Telephone: (0225) 60491.

ASHTON-TATE AND BORLAND BACK THE MAC

ASHTON-TATE is bringing out a version of dBase III for the Mac. This is its first package for the Macintosh. At the same time Borland is extending its commitment to the machine with its own database for the Mac.

Called dBase Mac, the Ashton-Tate package is a heavyweight database aimed at both end-users and application developers. It will be launched in the U.K. at the end of October. Ashton-Tate has not revealed the price yet, but dBase Mac is likely to cost less than the corresponding IBM product.

The new Borland package is Reflex for the Mac. It is a simpler offering aimed at end-users who want to analyse and browse through data and create reports. It is going on sale immediately in the U.S., and is expected in the U.K. in October. Its price is likely to be £99.95.

dBase Mac makes full use of the fabled Macintosh mouse-driven interface. It lets you build applications using either a Mac-

style system with pull-down menus and on-screen report and input form design, or in the traditional way with a database language. Up to 36 files can be linked together through common fields. You can also store Macpaint graphic images in your database. The package is capable of reading both ASCII and dBase III files written in IBM format.

Borland's Reflex for the Mac is not identical to its IBM product called Reflex. They are both aimed at the same kind of user, but the Mac product was originally called Interlace and developed by a U.S. company called Singular Software. Borland has recently bought Singular Software, and is now relaunching Interlace with a new name and a reduced price.

Contact Ashton-Tate (U.K.) Ltd, Oaklands, 1 Bath Road, Maidenhead, Berkshire SL6 4UH. Telephone: (0628) 33123. Borland products are distributed by Altor Ltd, telephone 041-266 4211 or Softsel, telephone 01-568 8866.

Lotus backs off on copy protection

LOTUS DEVELOPMENTS has announced plans to allow selected customers to purchase software in a non copy-protected form. Lotus is now the most important software house still committed to copy protection. The slight weakening in its position applies only to certain major corporate clients, not to one-off purchases by end-users.

Under the new arrangements, called the Extended Value Programme, companies sign an agreement with Lotus. They must satisfy Lotus that they have a corporate policy against software copying that they enforce. They must also upgrade their existing Lotus software to the most recent releases.

They then will receive a Corporate Authorisation Disc for every copy of Lotus software used in the organisation. This contains a utility which removes the copy protection from the program disc and at the same time adds an identification of both the company and the individual user.

The Lotus deal is only available at the moment to companies who

buy software in volume. But many other software suppliers have already dropped copy protection for all users. Among the top packages that are not copy protected are Word Perfect, Multimate, VP Planner, Sidekick, and Turbo Prolog. Last month Software Publishing Corporation announced the withdrawal of copy protection from its entire PFS product line. Javelin Software is the latest company to join this band. Release 1.1 of Javelin will not be copy protected.

The move towards non copy-protected products is indicative of the fact that software houses are realising that copy protection can lose them sales. Users do not like copy protection as it reduces flexibility and security.

Contact Lotus Development (U.K.) Ltd, Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone: (0753) 840281. Javelin can be obtained from Ashton-Tate (U.K.) Ltd, Oaklands, 1 Bath Road, Maidenhead, Berkshire SL6 4UH. Telephone: (0628) 33123.

SOFTWARE SHORTS

- Fastback backs up a hard disc to floppies. You can also back up on a file basis. It costs £159 from Ideal Software on 01-390 6722.

- Cubit compresses disc files, freeing the space for other use. It is memory-resident, working alongside packages like dBase III, Multimate and Lotus 1-2-3. It costs £49.95 from In Touch Computer Solutions. Ring (0222) 882334.

- Letrix makes standard dot-matrix printers produce high-quality text. It works with most Epson and IBM printers, giving you a choice of 20 different typefaces. The price is £97 from Ideal Software. Telephone 01-390 6722.

- Doubledos lets you run two DOS programs at the same time. It costs £49.95. Details from In Touch on (0222) 882334.


- Zorland C is a £29.95 C compiler. Zorland says it is a full Kernighan and Richie implementation, compatible with Lattice C subroutine libraries. Contact P&P Micros on 01-769 1022.

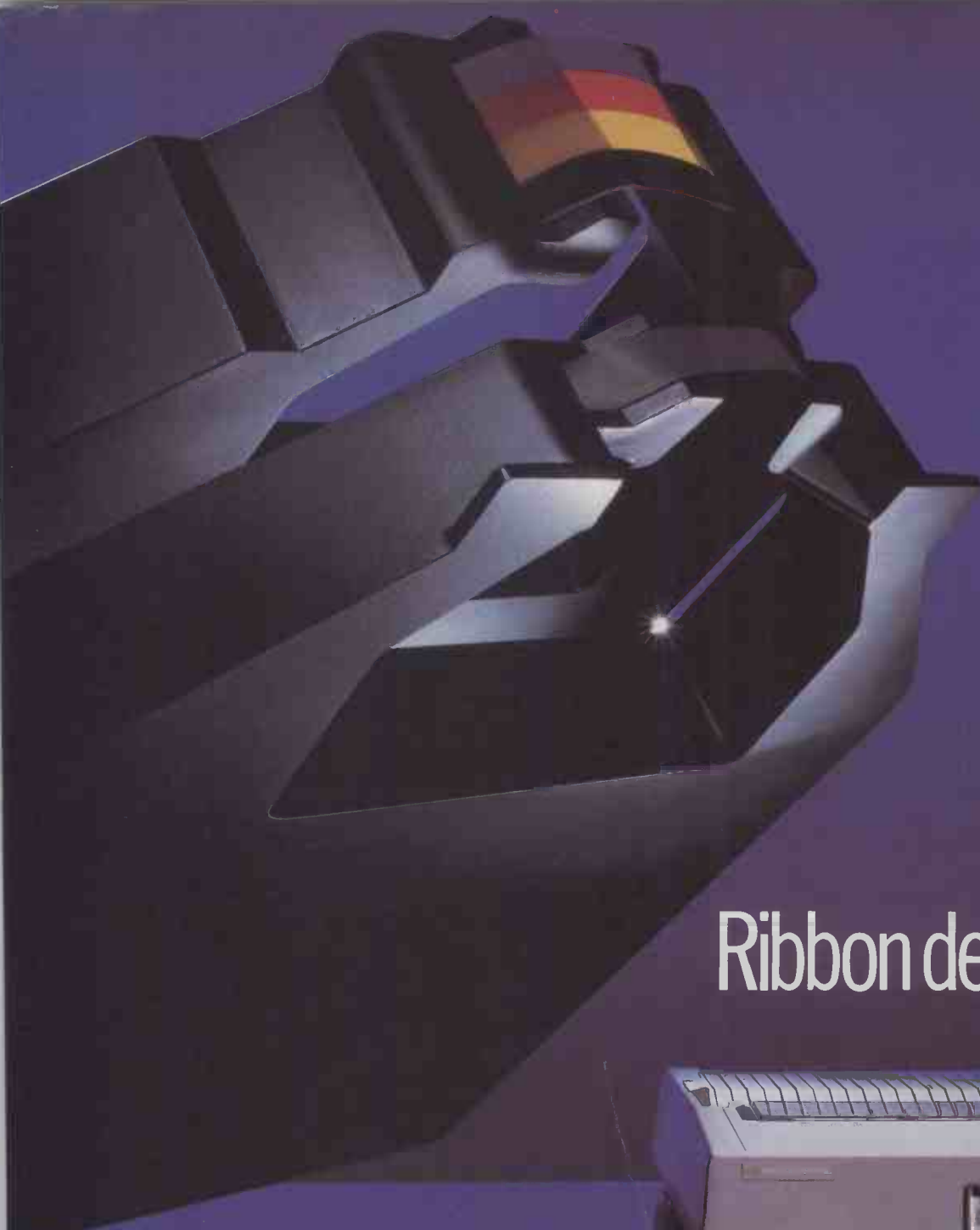
- Smalltalk-80 in genuine Xerox form is available for the IBM PC/AT for £995. provides both a development system and the end-user operating system. Contact Artificial Intelligence Ltd on (0923) 47707.

Low-cost text retrieval

AT £99, Concord is considerably cheaper than other text-retrieval packages for the IBM PC family. Text-retrieval packages are designed to help you extract information from word-processing documents or text downloaded from on-line data services.

Concord uses a powerful query language similar to that used on the Lexis on-line legal service. You can scan through text to find passages that meet your search criteria. You can then copy the information into named libraries of text data or use it to create fielded records.

Contact Bytesmiths Ltd, 12 Redden Court Road, Harold Wood, Essex RM3 0XA. Telephone: (0279) 815806. 



Ribbon development.



In 1873, Mr Sholes and Mr Glidden approached the Remington company with a design for a writing machine.

This is just one of the Pinwriter's many type styles.

If you inserted a piece of paper and worked a keyboard, the machine would print a neat row of capital letters.

Remington bought the patent, called it a typewriter and the rest is history.

Except for one part: the ribbon. For most modern printers still use a fabric ribbon much the same as the museum piece.

As the ink dries out, of course, the black turns grey and patchy.

Which hardly helps you to create a good impression on paper.

NEC's Pinwriter P5XL, however, features a plastic film ribbon densely sprayed with carbon granules.

It produces 3 million solid, all-black characters from one cassette.

[All the more solid for being composed on a high resolution, 24-pin matrix.]

But, should you still want any colour besides black, then simply use a colour ribbon on the P5XL.

Mixing colours in perfect register, it even allows you to write purple prose.

After which, you'll find that other printers simply pale by comparison.

NEC Business Systems (Europe) Ltd., 35 Oval Road, London NW1 7EA. Tel: 01-267 7000.

NEC

"We want you to show how much our new £505 printer can produce in 60 seconds," said Epson. "Oh good," we thought, "a short-copy ad." Then they told us their EX800 could print 300 characters a second - and we were as happy as two ducks in a duvet factory. "Half a minute," I said, tapping out SOS messages on a calculator, "if you think we're writing all that, I'm a monkey's uncle." "Have a banana," they said. Hmph. Such sympathy. We were moved to tears. Anyway, here we are, faced with writing War and Peace Part One and completely on our own into the bargain. Well, not completely alone - after all, you're still reading, aren't you? Of course you are. You're not the sort of namby-pamby who's put off by a bit of eyestrain when there's half a chance of some decent writing, I can tell. You don't need any of those dreadful 'hi-tech' shots with lasers, grids and dry ice wafting all over the shop to grab your attention. The riff-raff might have cleared off already in search of those ads where big, busty women suggestively stroke some product or other under the headline 'Look at the big features on our new model', but have you? No, of course not. Nor are you impressed by any of those corny gimmicks that are just second-rate substitutes for the genuine interest that only the printed word can generate. After all, does 'Animal Farm' need a scratch 'sniff card to make it live? Would 'Lady Chatterley's Lover' be any more interesting as a pop-book? (Well, come to think of it ...) No, you read to improve yourself, to learn about the world around you - and even if you don't manage either here, at least there's a chance that you'll learn something or two about computer printers. This is Epson's ad, after all, so I really should tell you about the big features on their new model ... oops. What I mean is, the EX800 has a far greater list of specifications than any other printer in its price range (which is just as well for us, given the amount that we've got to write). As we said earlier, the EX800 costs only £505 (RRP exc. V.A.T.) which just so happens to remind me of an extremely amusing and interesting fact about music. Now you really are going to learn something about the world! This could even be your big chance to improve yourself. All you have to do is casually drop this into conversation at parties, and remember the ad I mean - 'They laughed when I sat down at the piano - someone had nicked my stool.' Yes, that one. What a load of old rubbish.) Anyway, where was I? Oh yes, this extremely amusing and interesting fact. Did you know - and not a lot of people do - that the unit of currency in Vietnam is the dong? It's true, it really is! Look it up if you don't believe me. And just think for a quirk of geography, it could have been the unit of currency here. Then even our innocent nursery rhymes would have turned out completely different, e.g.: 'Said Simple Simon to the pieman, "Let me taste your wares!" / Said the pieman unto Simon, "Show me first your wares, you get the idea. We'd better get back to the printer before the Advertising Standards Commission cottons on. The most important feature of the EX800 has to be its speed. It whizzes at 300 c.p.s. in letter-quality mode, but can manage an astonishing 300 c.p.s. in Elite draft. To give you an idea of how quick that is, we'll count up what we've written and then let you know how long the EX800 would have taken to get this far. Meanwhile, name that tune. Rumpty tumpty tum, rumpty tumpty tara, rumpty tumpty tum, piddley piddley pom. No idea? Here it is: Rumpty tiddley, tumpty tiddley, rumpty tiddley tum. Rumpty tumpty tumpty tum, rumpty tumpty pom. Yep, it's the Archers. And at the third stroke, the EX800 would have been printing seven seconds ... beep ... beep ... beep. Here, hold on a minute. That means we've reached the bottom of the first page. Gordon Bennett, we're going to be here writing this rate. Still, that's all the more reason to get on with it, I suppose. The new Epson is remarkably easy to use. The new Epson EX800 is remarkably easy to use. (Yes, that's a bit of repetition, as this is an important feature - and OK, it does use up a few more characters than other printers, but that's the whole rigmarole of making software commands. (Dragsville, Arizona.) The Epson EX800, on the other hand, has a 'Selectype' panel on the front. (Freaky City, Florida.) All you have to

om the wide - or to use a longer word, extensive - range of print options (N.B. there are
 Q fonts) is push one or two of the eight backlit switches. Now that's what I call simple. It's
 y far simpler than, say, balancing a packet of frozen faggots on your head, hopping up and
 on one leg, flapping your arms and shouting, "Yib hoy, snig floy, I am an inter-continental
 c rissole," - and that's a dead cinch. In fact, I just did it right here in the office. There, I did it
 It's wild! Come on, you have a go. It'll give you a bit of a break - and if you're reading this on
 n, it certainly ought to break the ice in your carriage. "But no, enough of all this frivolity," I
 you say. "Does this new EX800 have an integral push-feed tractor and short tear-off bar as
 ard, with the option of a cut sheet feeder also available?" Wow! What a question. Are you
 you're not in the computer printer business yourself? Hmm. You sound pretty clued-up to me.
 e is an optional colour unit available. For only an extra £55 (RRP exc. VAT), you, yes you, can
 at in seven, yes seven, glorious colours. Get your reports red! Give your accounts a purple
 ch!! Send blue suggestions to your business associates!!! Well, maybe not. Still, it's about time?
 had another character-count to see how far we've got. Any requests for music this time?
 something grand and inspirational, perhaps, to lift our hearts and bear us on in triumph to the
 successful completion of our epic labour? You've got it. Here we go, here we go, here we go. Here
 ve go, here we go, here we go-o. Here we go, here we go, here we go-o, here we go. All
 together now, verse two here we go, here we ... oh all right, we'll spare you the rest. The news is,
 the Epson EX800 would have got here in forty-five seconds. Just fifteen seconds to go! (I was
 always red-hot at maths.) I'd better stick in a couple more product benefits before I finally run out
 of space. The Epson EX800 has a very large .. err .. umm .. thingy. I mean what'sit. That is to say, a
 doodah. Oh very well, a large memory - an 8K buffer to be exact, with the option of an additional
 32K also available. (The point of this is to free your computer for other tasks more quickly - but of
 course I'm forgetting again, you probably know that already.) The EX800 is IBM-compatible ...
 though why you aren't using an Epson computer I don't know. I mean, what's the point of us going
 on about how good Epsons are if people don't take a blind bit of notice?? Oh look, I'm sorry.
 Perhaps I wouldn't get so angry at having to mention a rival outfit if they had a name that took up
 a reasonable amount of space, but one that uses an abbreviation? That Is Truly Sickening. The
 final point to make is that the EX800 boasts the proverbial reliability of all Epson printers. Not that
 the word 'proverbial' means an awful lot, of course. Have you noticed how many proverbs actually
 contradict each other? There's 'Look before you leap' and 'He who hesitates is lost'. There's 'Many
 hands make light work' and 'Too many cooks spoil the broth'. Weird. It really is time some of these
 were brought up to date. How about 'Where there's a will, there's a lawyer'? Or 'A friend in need is
 a pest'? Yes, that's it. He who laughs last has no sense of humour, people who live in glass houses
 shouldn't take baths, a bird in the hand is better than one overhead, see a pin, pick it up - all day
 long you'll have a pin ... but I'm wandering again. What I should have said in the first place was
 that you can count the mistakes the EX800 makes on the fingers of one foot. But look, we're
 almost there. The coupon is looming up at last! And the great thing is, we've made it together.
 We've had our ups and downs, it's true, but you've stuck with us to the bitter end. Terrific. Can't you
 just feel that bond of comradeship, that deep empathy between us now? Of course you can. And
 now we've shared so much, we'd do anything for each other, I'm sure. For instance, if we asked you
 to fill in the coupon and send it to Epson, you'd do it for us, wouldn't you? What do you mean, no?
 To: Epson (U.K.) Limited, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. (Telephone
 01-902 8892) Please send me less information on your EX800 printer - quick.



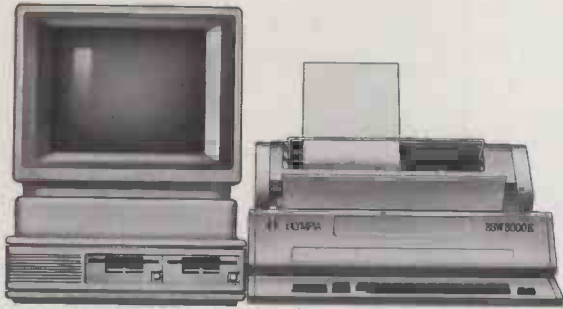
EPSON

HPC 3

Name _____ Company/Address _____
 Telephone: _____

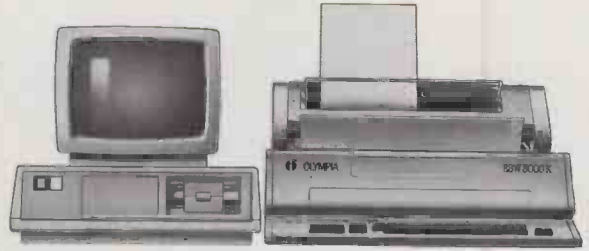
Now more widely available.

Remember us telling you about the Epson EX800, the printer that makes others in its price range look like snails on valium? Well, now they've brought out the EX1000, a printer that does everything the EX800 can, but which has a wider carriage to take paper for spreadsheets. You can get one for only £665 (RRP exc. VAT) - and you can get more information on both EX printers by cutting the coupon above.



HEWLETT PACKARD.

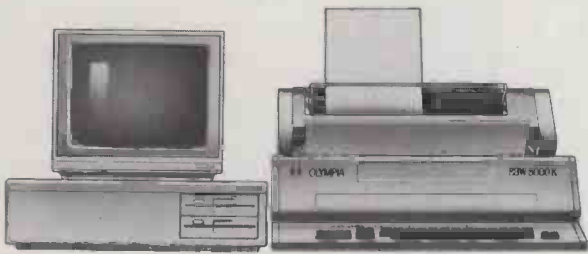
OLYMPIA.



DEC RAINBOW.

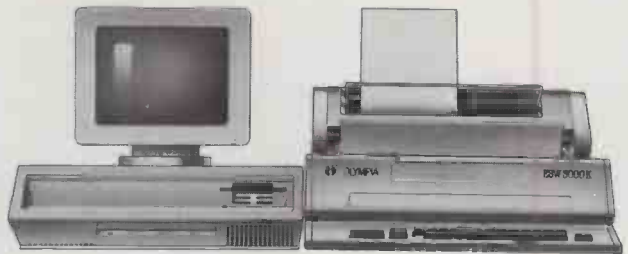
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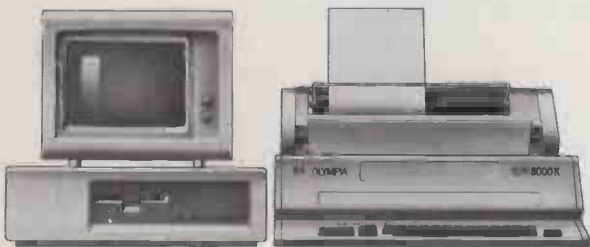
COMMODORE.

OLYMPIA.



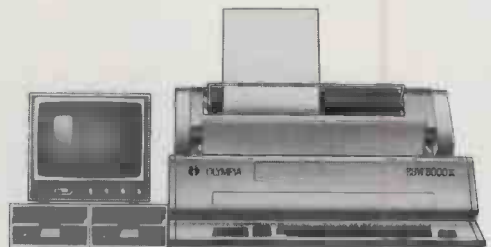
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COMPUTER ASSOCIATES MAKES TRADE-IN OFFER TO LOTUS USERS

IN A BID to end Lotus Development's dominance in the business spreadsheet market, Computer Associates is making a trade-in offer to existing users of Lotus 1-2-3 and Symphony. In return for the Lotus discs and £99.95, the users will receive a copy of Supercalc 4, which we review this month on page 66.

Users of Lotus 1-2-3 version 1A who send in one of the master discs and the box can receive a copy of Supercalc 4 in exchange. Version 2 users who do the same get a copy for £49.95, and Symphony owners who send in their discs get both Supercalc and Superwriter for £149.95.

Tony Beaken of Computer Associates claimed: "The response has been extraordinary. Lotus have really been stung by this and have been threatening all kinds of legal action." Asked about the kind of companies who have been taking advantage of the offer Beaken continued: "I have been amazed, there have been some really big international companies sending their discs in, a well-known photographic company, oil companies and City institutions."

So far Lotus's reaction has been one of lofty disdain. Company spokesman Phil Peters commented: "We are aware of the offer but we aren't reacting to it

yet. We have asked our lawyers to look at the offer. Once they report back we then have to decide whether it contravenes our licence agreement, and if so do we do anything about it."

Peters does not think that the Computer Associates offer would have a great impact on the Lotus user base. He remarked: "The campaign has been running for four or five weeks and it's too early to say what is going to happen but companies have invested more than just the price of the software. They have also invested in terms of time and training and supporting products, so we will be surprised to see a flood of takers."

ICL forms network systems alliance

BRITAIN'S biggest computer manufacturer ICL has formed two separate alliances to market its network systems. The initiatives are aimed at selling current products as well as towards developing new ones.

The first announcement concerns plans to enter the worldwide information services sector with the General Electric subsidiary Geisco. No firm details are available yet, although both companies have interests in international business networks and the expectation is that the companies will join forces in this rapidly developing area.

The second announcement from ICL is that it is forming a new company in collaboration with the Cable and Wireless subsidiary Mercury Communications. The plan is to create a wide ranging Value Added Network (Van) which will use the Mercury 5000 system for the ICL's Ospac packet-switching system for the X-25 network. The intention is to market the network to companies wanting to use data communication facilities. Details available from International Computers Limited, Bridge House, London SW6 3JX. Telephone: 01-788 7272.

Profits and losses for U.S. companies

A NUMBER of U.S. companies have announced their quarterly figures. Apple, Lotus and Motorola all report increased earnings while U.S.-based clone manufacturer Zenith has announced a loss.

Apple Computers announced that for the quarter ending June, it made a profit of £44.2 million. This compares with a loss of £11.7 million for the same period last year. Sales for the quarter reached £307 million, which the company says is a 20 percent increase over the 1985 equivalent period. Details from Apple Computer (U.K.) Ltd, Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244.

At the same time Lotus announced that profits had risen to around £8 million for the quarter ending 5 July. This profit was generated from sales of around £45 million — a 12 percent increase over the same period last year. Contact Lotus Development (U.K.) Ltd, Consort House, Victoria Street, Windsor SL4 1EX. Telephone: (0753) 840281.

On the chip front, Motorola says that it made £37 million in the second quarter from sales of around £1 billion. Following last year's slump in sales, the company reported that while sales had increased by 12 percent, new orders had risen by 63 percent. This was due to a resurgence in the market for semiconductors led by

additional demand, especially from the Far East. Further details from Motorola Ltd, 88 Tanners Drive, Blakelands, Milton Keynes MK14 5BP. Telephone: (0908) 614614.

Meanwhile, proving that not everything in the industry is rosy, Zenith Electronics lost £6.7 million in the second quarter. This is a deterioration of last year's position when the company lost around £3 million. Zenith's major problem is in the colour TV sector where the strength of the dollar and Far East imports lost the company around £26 million. However, the computer sector of the business reported sales of £97 million which is a 19 percent increase over last year but falling prices meant that the performance failed to translate itself into increased profits. Details from Zenith Electronics Corporation, 1000 Milwaukee Avenue, Glenview, IL 60025. Telephone: (U.S. area code 312) 391-8181.

Microstuf ready to sue

MICROSTUF INC, the publishers of the Crosstalk communications package is to sue Softklone over the alleged copyright infringement of the Softklone package Mirror, mentioned on page 16.

Although Microstuf admits that Softklone has not copied the code of Crosstalk, it is suing on the

SHORTS

● The Olivetti proprietary network, 10-Net, is now claimed to be fully compatible with Microsoft's MS-Net local area network. The new version is scheduled to appear in September priced at £595 per node excluding the cabling. Details on 01-785 6666.


● AST Research, best known as manufacturer of IBM expansion cards, has announced its Resource Sharing Network. The LAN claims compatibility with IBM Netbios and a number of applications such as dBase III+, Word and Multimate. The basic two-node system costs £2,750. Details on 01-568 4350.

● Commodore Business Machines has signed an agreement with Mills Associates which gives purchasers of Commodore's PC Series II and Amiga machines free on-site repair services during the one-year warranty period. For details ring (0536) 205555.

● The employment agency Manpower is opening a series of Skillcentres throughout the U.K. to teach office-automation skills — in particular word processing and personal computer use. Skillcentres have opened in Bristol, Croydon and Fareham with offices planned in Edinburgh and Dublin later this year. Details on (0753) 73111.

● Following a request earlier this year by the government, the National Computing Centre has polled its members on their views on the IT skills shortage. The NCC has published its Interim Analysis which reports that between a fifth and a quarter of companies are being held back by the skills shortage with the problem being most acute in the Midlands and South East. Contact 061-228 6333.

grounds that Softklone has copied the user interface of Crosstalk. Softklone says that software copyright only covers source and object code and therefore it has not infringed Microstuf's rights.

Softklone is not involved in the Control-C softclone technique used on the RM Nimbus. 

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BY MIKE LEWIS

WORKING TOGETHER

Memory-resident or pop-up utilities are all the rage. Now there is help available if you want to write your own.

16H, which calls the keyboard services in the ROM BIOS. In particular, it alters the address stored in the interrupt vector to point to a routine within its own resident portion. It also saves the original address.

Thereafter, whenever any program tries to read the keyboard it transfers control into Superkey, which in turn calls the real keyboard service. If the key thus read has no macro attached to it Superkey simply returns the correct code to the calling program. Otherwise it passes back the first character of the macro, the remaining characters being returned in subsequent calls.

Of course it does not have to be a keystroke which is used to wake up the background program. Any interrupt can be used, provided that the resident code is able to simulate the action of the corresponding ROM BIOS or MS-DOS routine. For example, print enhancement utilities that intercept text output to a printer and convert it to high-resolution graphics characters use a call to the ROM printer service at interrupt 17H.

Coding a co-resident application can be very tricky, and there are lots of details to watch. Disc I/O is a particularly dangerous area, especially if you try to use a file that has already been opened by the main program.

Testing is also difficult. Writing your own low-level interrupt routines is, in a sense, modifying the operating system. If your program crashes you cannot rely on other parts of the system

(continued on next page)

TURBO TASK PROGRAM CHECKER

```

program checker;
{Co-resident program to display the current drive and directory;
requires IBM PC or compatible, Turbo Pascal ver. 3, and the
TurboTask library from Tangent Technologies. The program should
be loaded by typing CHECKER at the Dos prompt. It will then
remain in RAM, where it can be invoked by pressing Alt and 1.
On invocation, it will display the current drive and directory.
Return to the main program by typing Atl-1 again.}

{$I TASK.INC}                {include TurboTask library}

const
  logged=0;                   {logged drive}

var
  Path, PrevPath: string[64]; {directory path on logged drive}

begin
  {initialisation - performed only when program is invoked from Dos}
  PrevPath:= '';
  clrscr; writeln('Checker active. Invoke with Alt-1');
  window(5,5,50,6);

  Turbo_Task($7800);         {exit to Dos; Alt-1 is invoke key}

  {set window attributes - this is done on first invocation with Alt-1}
  textbackground(magenta);
  textcolor(lightgray);
  clrscr;
  {main loop - performed repeatedly while program is invoked}
  repeat
    GetDir(logged,Path);      {get the current path}
    if Path<>PrevPath then    {display it only if it has changed}
    begin
      gotoxy(3,1); write('Current drive and directory:');
      gotoxy(3,2); write(path); ClrEol;
      PrevPath:=Path;
    end;
  until false;

end.

```

One of the more interesting of recent trends in software has been the growth of co-resident applications, also known as pop-up or TSR programs. These handy utilities patiently sit around in RAM waiting for some action or event to bring them to life. They now cover an astonishing variety of roles: you can buy background programs ranging from simple alarm clocks and calculators to full-function comms packages and outline processors.

As I write this article, my PC's RAM is alive with a spelling checker, print enhancer, keyboard programmer and command-line editor, all working more or less in harmony with my main word-processing package. They are in addition to the best known of all the co-resident products, Sidekick.

There is nothing particularly new about co-residency, even on micros. My ageing eight-bit CP/M system sports several examples, including a print spooler and an I/O redirection utility. But writing this sort of program for eight-bit machines has always been something of a struggle, even if you disregard the obvious problem of the shortage of memory.

One difficulty is that CP/M-80 invariably loads programs at the same absolute location near the

low end of RAM. The resident code must therefore physically relocate itself to the upper reaches of the transient program area (TPA) before it can give control back to the operating system. This can be a messy process, and one that can easily crash the system if you do not code it correctly.

COMMUNICATION

A bigger problem is communicating with the user. Because the background task cannot know what the main program has written to the screen it cannot output messages or prompts without the risk of spoiling the display. Similarly, if it needs a keystroke to activate itself it has only the 128 ASCII codes to choose from; it does not know which of these, if any, are not used by the main program. Both these problems can be overcome on some machines, but CP/M does not provide a hardware-independent method of doing so.

Fortunately, matters are somewhat easier on 16-bit systems, especially on IBM PCs and compatibles. One advantage — apart from the larger memory — is that MS-DOS function 27H can be used to allow a program to terminate but stay resident. Together with the use of base segment registers to modify addresses, this means that several

programs can occupy RAM at the same time, each working independently of the other within its own segments.

Even more important is the fact that a reasonably portable form of windowing is now possible, at least on the IBM and compatibles. A program can copy a portion of the current display to a buffer, use the corresponding area of the screen for talking to the user, then put things back the way they were, ready for the main program. The mechanics of this are quite easy, and were explained in *Software Workshop* in the September 1985 issue of *Practical Computing*.

The IBM PC also provides a convenient way of activating co-resident applications, thanks to the use of a standard interrupt vector table that is accessible to the program. If a keystroke is used to call in the background task, programmers can provide their own keyboard interrupt routine to filter the console input. Since this routine can test the Control, Alt and Shift toggles, a huge range of key combinations is possible.

A good example of this is a keyboard enhancer such as Superkey. This co-resident program monitors the user's keystrokes, expanding specified keys to long character strings and macros. The initialisation portion of the program doctors interrupt

(continued from previous page)

working in the normal way. For example, if your keyboard routine fails, you will probably not be able to type any further commands to DOS without first switching the computer off and on again.

One way of bypassing all these hazards is to buy a set of library routines which take care of the messy details for you. Ideally you should be able to call them from a high-level language, and they should be implemented in such a way that you can develop the application in the normal way, slotting in the co-residency later.

I have recently been trying one such product. It is called Turbo-task, and is obtainable from Tangent Technologies, 180 N. Wecker, Chicago 1160606, U.S.A. at a price of \$70. As its name suggests, it is intended for use with Turbo Pascal. It is written in assembler and is supplied as an external Pascal procedure.

Using Turbo-task could not be simpler. First your program needs a section of code, called the initialisation module, that is executed when the program is loaded from the DOS command line or batch file. It would normally initialise variables and display a sign-on message, and it may also declare a window for use

DIRECTORY USED WITH MULTIPLAN SPREADSHEET

-1	1	2	3	4	5	6
1	BUDGET 1987					
2		Jan	Feb	Mar	Apr	
3						
4						
5	FIXED COSTS					
6						
7	Rent					
8	Heating					
9	Wages					
10	Insurance					
11						
12	DIRECT COSTS					
13						
14	Materials					
15	Packaging					
16	Delivery					
17						
18						
19						
20						
COMMAND: Alpha Blank Copy Delete Edit Format Goto Help Insert Lock Move Name Options Print Quit Sort Transfer Value Window Xternal						
Select option or type command letter						
R1C1	"BUDGET 1987"	100% Free	Multiplan	TEMP		


by the current resident portion.

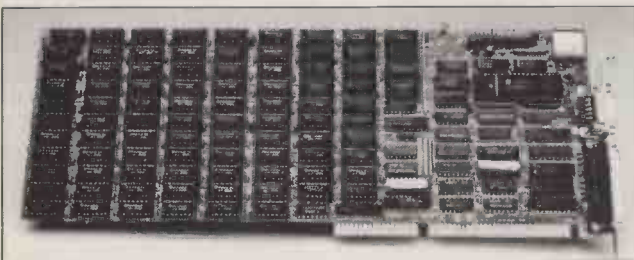
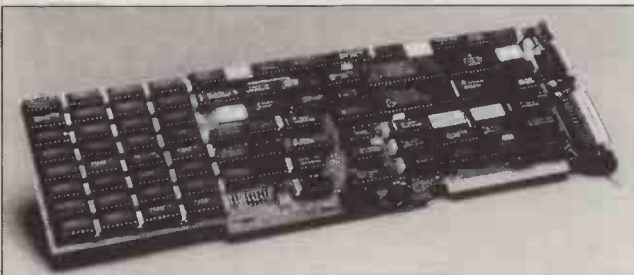
The initialisation phase returns to DOS by means of a call to Turbo-task, passing as a parameter the scan code of the key that will later be used to activate the background function. The rest of the program can now be written without any worries about co-residency. It simply performs its allotted task repeatedly, although in practice it is only executed when the user presses the designated key.

An example is shown in the listing on the previous page. While the program is active you can press Alt-1 to see the name of the current drive and directory path. Pressing Alt-1 again restores the display and allows you to continue with the main program.

A limitation of Turbo-task is that it only allows you to write background programs that are woken up — and put back to sleep again — by direct user action. You could use it to implement a

Sidekick-style notepad but it would be useless for a keyboard enhancer like Superkey. There are several similar products on the market, some of which might overcome this problem.

If you do manage to get to grips with co-residency, you will find that it can do a lot for your programming. You may be tempted to make all your existing utilities into co-resident programs but unless you have vast amounts of RAM this is best resisted. 



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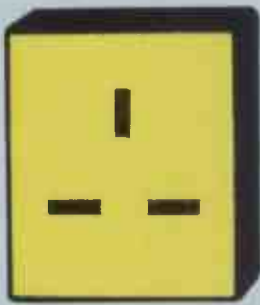
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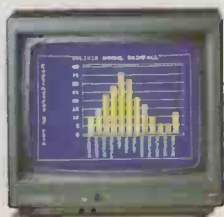
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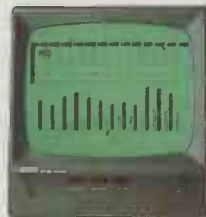
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BY RAY COLES


ENTER THE MIGHTY 80386

Intel's new 32-bit processor looks set to challenge its National Semiconductor and Motorola rivals.

An associated floating-point maths chip, the 80387, will be available soon. It promises to perform up to eight times faster than the 80287, which is an impressive performer itself.

The 80386 is totally binary compatible with the 8086 family. This means that it can run existing MS-DOS systems software and applications, but up to 18 times faster than today's chips. Of course an 80386 which just ran MS-DOS would hardly be making the best use of the 32-bit architecture and virtual-memory support features, but the ultimate 80386 system will be able to provide the best of both worlds.

A virtual-memory operating system such as Unix System V can be run on an 80386-based computer with all the big system benefits available from such an arrangement. But at the same time a virtual MS-DOS environment can be run under Unix to provide access to all of that existing software we value so highly.

So what are we to make of this mighty Wurlitzer from Intel? Having run the ruler over it I must say I am impressed by the 80386, and I imagine a lot of systems builders will be tempted by its raw power and the promise of IBM PC compatibility. On the other hand the National and Motorola bandwagons have already gained momentum and a loyal following. Many of the criticisms levelled by Intel's competitors are justified and the 80386 probably will drive some systems programmers to drink, but I suspect that IBM PC and compatible users will welcome it with open wallets. 

Now that the new Intel 32-bit micro has rumbled out of the training ground and on to the battlefield, there must be a lot of nervous nail biting going on in the Motorola and National marketing departments. Up to now, Motorola and National have had the field more or less to themselves. While they have been exchanging pot-shots in their eagerness to dominate the emerging 32-bit market, they have concentrated most of their fire on the proposed Intel device, even before it left the drawing board — see Chip-Chat, February 1986.

A lot of comment in the technical press based on papers produced by the two early birds has been aimed at discrediting the Intel design. It highlighted the architectural compromises Intel needed to make to retain compatibility with its established 8086 and 80286 forebears. Even the laboriously contrived compatibility itself has been attacked as illusory, or not appropriate to the 32-bit market. The Intel device has certainly taken its fair share of flak, but with nearly every office in the developed world sporting at least one IBM PC or compatible with an Intel 16-bit processor, and with IBM having a major stake in the company, Intel's armour plate is pretty thick.

DESIGNERS' CHOICE

Most electronics engineers and systems software designers would probably plump for the 68020 or the 32332 when given a free choice. But the people who will really decide which 32-bit processor will scoop the pool are the system buyers who do not know one end of an orthogonal instruction set from the other. It is no use telling the company accountant that the 68020 architecture is so elegant that it will bring tears to his or her eyes, or that you can use any addressing mode and data type with an instruction on the 32032.

After establishing that a system can do the job all such a person wants to know is how big the box is, how much disc storage is available, how much it is going to cost, and can you continue to use all your old software and data files? It is irrelevant that the system software writers who have been forced to face up to the idiosyncrasies of the 80386 are on 40 a day and their marriages are breaking up. As long as they manage to write the code, the company accountant need never know, still less care.

But despite some of its less than desirable features, the 80386 is a

credible 32-bit contender, and has already been shown to outperform the competition in some benchmark tests. The compatibility of existing IBM PC software and the excellent Intel track record of supplying sufficient chips to keep the production lines running, together with a high level of support for designers, may yet enable Intel to oust National from its current position as the number one supplier of 32-bit micro-processor chips.

275,000 TRANSISTORS

In semiconductor technology terms the 80386 appears most impressive. Using a 1.5 micron CMOS process compared with the 2 micron CMOS of the 68020 and the 2.8 micron NMOS of the 32332, the 80386 packs 275,000 transistors on to a chip groaning with goodies. The simpler National 32332 with its need for an off-chip memory-management unit (MMU) manages with only 95,000, and the Motorola 68020 about 180,000. A 95,000 transistor 2.8 micron NMOS chip is much easier and cheaper to manufacture than the Intel monster but Intel has had a lot of practice.

The 80386 is also impressive in terms of hardware speed. Operating at a clock rate of 16MHz, the Intel chip can turn in up to 4 million instructions per second (mips) — more than either of its competitors. National and Motorola would probably argue that their mips are worth more than Intel mips because they can do the job with fewer lines of code thanks to their optimised instruction sets.

Packaged in a square 84-contact pin-grid-array package, the 80386 has the ultimate in 32-bit processor interfaces: separate 32-bit data and address buses without the need for multiplexing. A 32-bit address bus provides 4Gbyte of direct address range, but the 80386 on-chip MMU expands this more than 1,000-fold by generating 64-bit virtual addresses.

Without a doubt, the MMU is the star feature of the 80386,

supporting both the segmentation scheme of earlier Intel processors and a paging system similar to that available on the National 32332. The segmentation scheme has been enhanced by an increase of segment size to 4Gbyte compared with the 64K used on Intel's 16-bit processors. This will allow some applications to stay with a single segment as a linear 4Gbyte address space for all purposes.

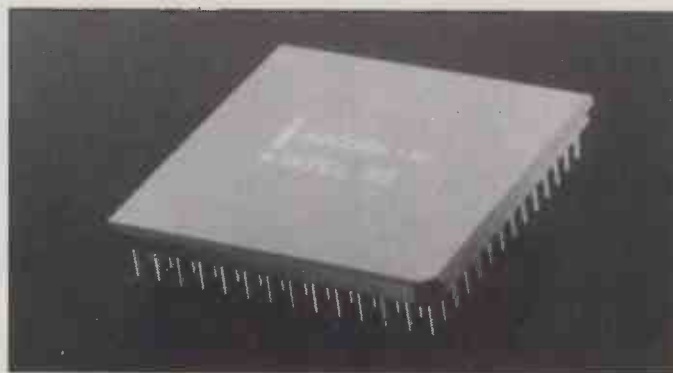
Other applications can use up to 16K separate segments to allow sophisticated multi-tasking schemes to be used, at the same time remaining largely compatible with the 16-bit generation. For the ultimate in 32-bit performance, use of the new MMU paging-unit facilities opens the door to full-house demand-paged virtual-memory operation, but at the price of a departure from direct compatibility with earlier operating-system software.

The 80386 paging unit supports the demand-paging method now preferred for virtual-memory operating systems such as Unix, and all instructions are restartable on page faults. Only Intel and National use this approach, which must be worrying for Motorola.

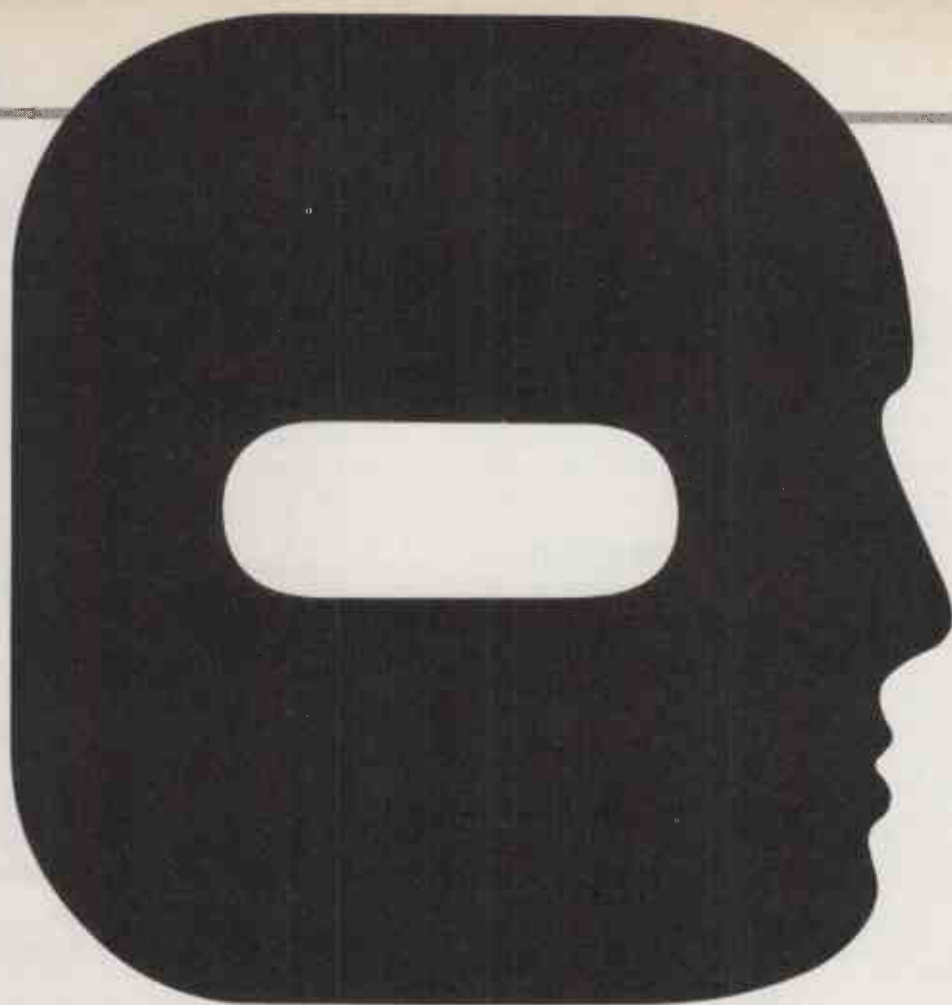
ON-CHIP MMU

Because the 80386 MMU is on-chip the address calculation and translation can take place in parallel with instruction execution, which is one reason for the 4mips performance. Other reasons include a pre-fetch unit and queue for instructions, and a 64-bit barrel shifter which can rotate a full 32-bit register in one operation. There are eight 32-bit registers in the execution unit, the first 16 bits of each providing direct compatibility with the registers of the 8086 and 80286. All the familiar 16-bit generation instructions are supported, but in addition there are instructions which make use of the expanded hardware.

A full set of bit-manipulation instructions are included, as are 64-bit arithmetic instructions and 32-bit integer multiply and divide.



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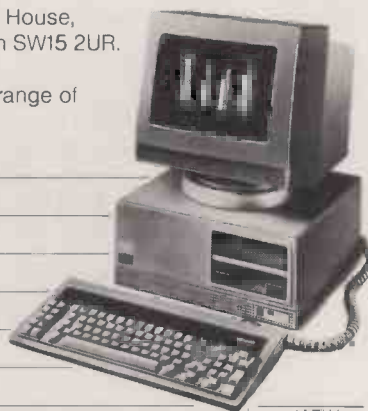
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BY BEN KNOX

A LACK OF STANDARDS

Transferring files can cause problems because of the variety of different communications packages available.

There is no doubt that one of the main bonuses of using on-line systems is the ability to take information from them and manipulate it on your own computer. So it is surprising that the process of transferring this information is complex, and differs dramatically from system to system.

The simplest form of file transfer is using the capture or log to disc facility of your software. Once this feature is activated, anything which comes down the telephone line while you are on-line is displayed on the screen and saved into a file on disc or in memory. Capture allows you to continue to use the on-line system in exactly the same way as normally. It saves all the commands you type in too.

ASCII is the standard used in computers for handling and displaying the alphabet, numbers, symbols and a few other characters. ASCII file transfer requires that the information which you are uploading or downloading — that is sending or receiving from the host computer — does not use any characters which are not in the ASCII set. ASCII file transfer is provided in almost all communications software.

The main disadvantage of using ASCII file transfer is that the data being received may have been corrupted en route. While it may be possible to decipher a corrupted part of a text file, if a program file is involved then the errors will be hard to find. This is where error-free transfer protocols come in.

An error-free transfer system works by simply checking to see

whether the data which has been received is the same as that which was sent. If it is, then it is saved on to disc. If not, then a request is made for the corrupted data to be re-sent.

There are a number of different error-free protocols currently in use. The most well known is Ward Christensen's Xmodem. It is a block-orientated protocol, which means that files are split up into blocks before being sent. It is the main protocol used on bulletin board systems and computer database services, particularly in the U.S. Xmodem can only transfer one file at a time.

There are two versions of Xmodem: the original version uses check sums to check data integrity and the latest version uses cyclic redundancy checking (CRC). The method used for checking is invisible to the user, but the CRC version does give a greater accuracy — 99.6 percent instead of about 96 percent for the check sum method.

Xmodem requires that transfers are performed with your communications parameters set to eight bits, no parity and one stop bit. Most communications software will automatically change itself over to this mode when you invoke the Xmodem facility.

MODIFICATIONS

Using Xmodem on a data network such as PSS does require some modifications to be made. PSS usually works in seven-bit mode, so you will need to tell it to switch over to eight bits when you want to do your transfer. This is done by setting PSS into command mode by pressing Control-P.

Once in command mode, you can use the Prof command to reset the profile used by PSS on your data call. I have found that the most efficient profile to use is SP,

which stands for special. To set the SP profile type Prof SP followed by Enter. You can also use PSS transparent profile, using TP instead of SP. Transparent is supposed to make PSS completely invisible to the host system or the terminal. In practice long delays appear, and echo-back of characters that have been typed in either does not occur or takes an inordinate length of time.

MORE TIME

Another problem which arises when using the Xmodem protocol over packet networks, particularly when you are linked to a time-sharing system, is that of timing. As Xmodem was originally developed for file transfer between micros, it does not expect much delay between the time a block is sent and the time the reply is received. The standard version of Xmodem stops searching for errors after about 10 seconds. It is likely that it will take as much as twice this time to receive a reply over a packet system. To get over this, some software offers a relaxed mode, where the timeout period is perhaps doubled or tripled.

There are a few other variants to the Xmodem protocol. Modem 7 allows batches of files to be transferred, as the file names are sent together with each file. This does not happen in standard Xmodem. Modem 7 also supports both check sum and CRC versions.


Ymodem is a version for use where line quality is much higher. It uses much bigger blocks of data, so if you get few block re-sends, the total transfer time is much reduced. Ymodem can take longer than Xmodem in situations where there are errors and so a lot of block re-sends. Ymodem transfers are always performed with CRC checking.

Xmodem has been around for quite a few years now, and is beginning to look a little dated. The state-of-the-art in error-free transfer protocols is Kermit. It is a packet-orientated protocol, developed by Columbia University in the U.S. It is becoming very common on bulletin board systems in the U.S. The Source, one of the large U.S. information systems, has been using it as its main protocol for some months.

Kermit has many features, including data compression, file-attribute transfer and sliding windows. A sliding-window protocol is one which uses full duplex to transmit and receive data at the same time. A full description of Kermit was given in the May and June issues of *Practical Computing*.

The Xmodem family of protocols are all half-duplex. They must wait between each block of data sent for a reply from the receiving computer to say whether or not the block has been received uncorrupted. This wastes a great deal of time. Full-duplex protocols can send a continuous stream of data while receiving replies at the same time.

Xmodem and Kermit are the two main protocols freely available for anyone to use. There is a host of other protocols currently in use. But they are usually only available on particular systems as proprietary protocols. For example, Telecom Gold uses Unicom Rap, and CompuServe uses its own A or B protocol.

It is rapidly becoming necessary for users of many different systems to use an equal number of different communications packages. Hopefully, we shall see some standardisation in protocols in the near future. 

OPEN FILE

FILE TRANSFER

USING KERMIT

In their article last month **John Lee** and **Timothy Lee** explained the principles behind this near-universal file-transfer program. Here they describe how to use it on an IBM or a BBC Micro.

LISTING 1

```
rem version for IBM-PC that runs with PC-DOS ver 2.1
rem KERMIT transfer program disk
KEYBUK
rem set serial port to 300 baud on COM1: for modem
MODE COM1:300,,,P
KERMIT
```

LISTING 2

```
rem serial set to 1200 baud on COM1:
```

Kermit, a packet-orientated protocol, is widely used on U.S. bulletin boards.

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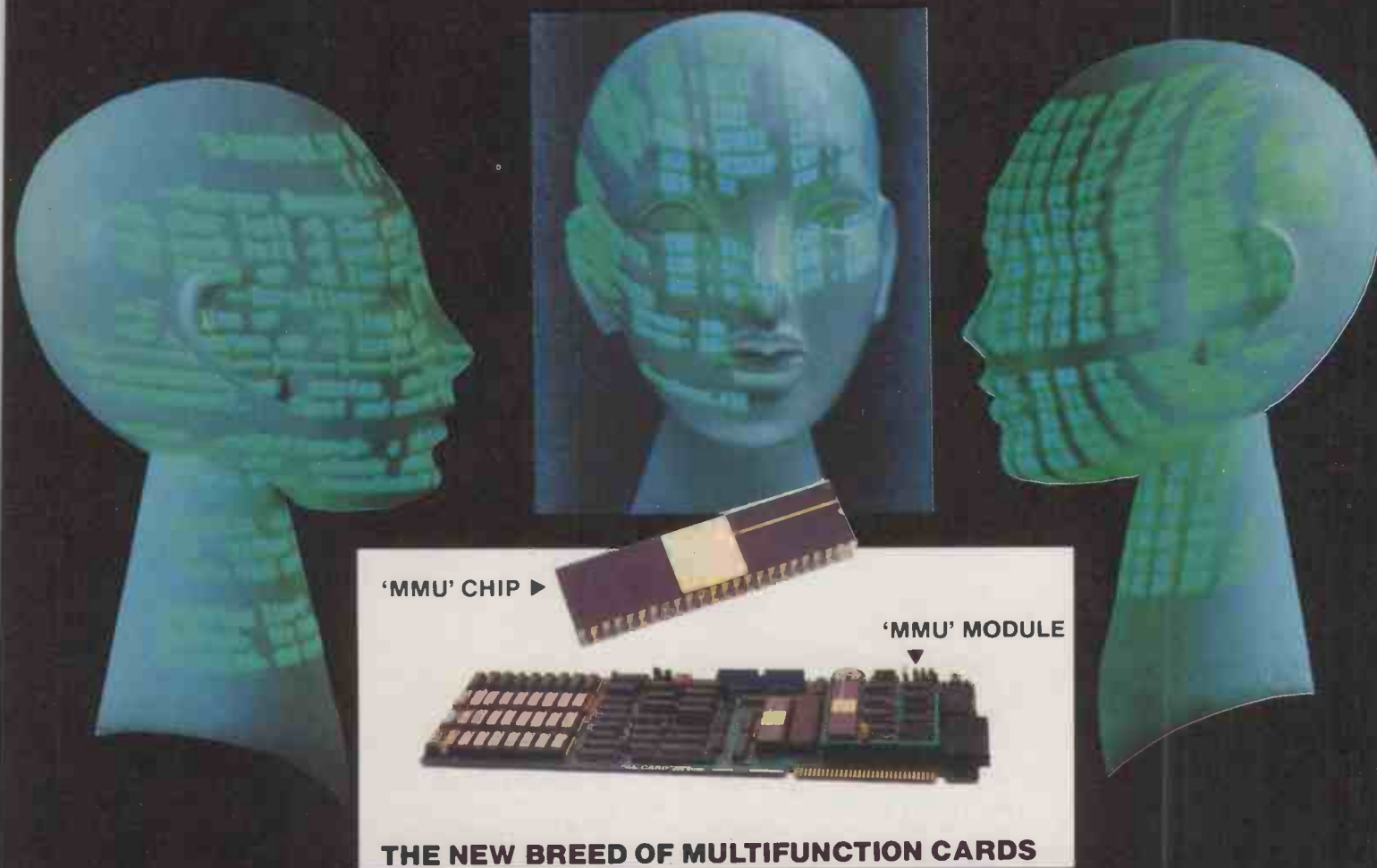
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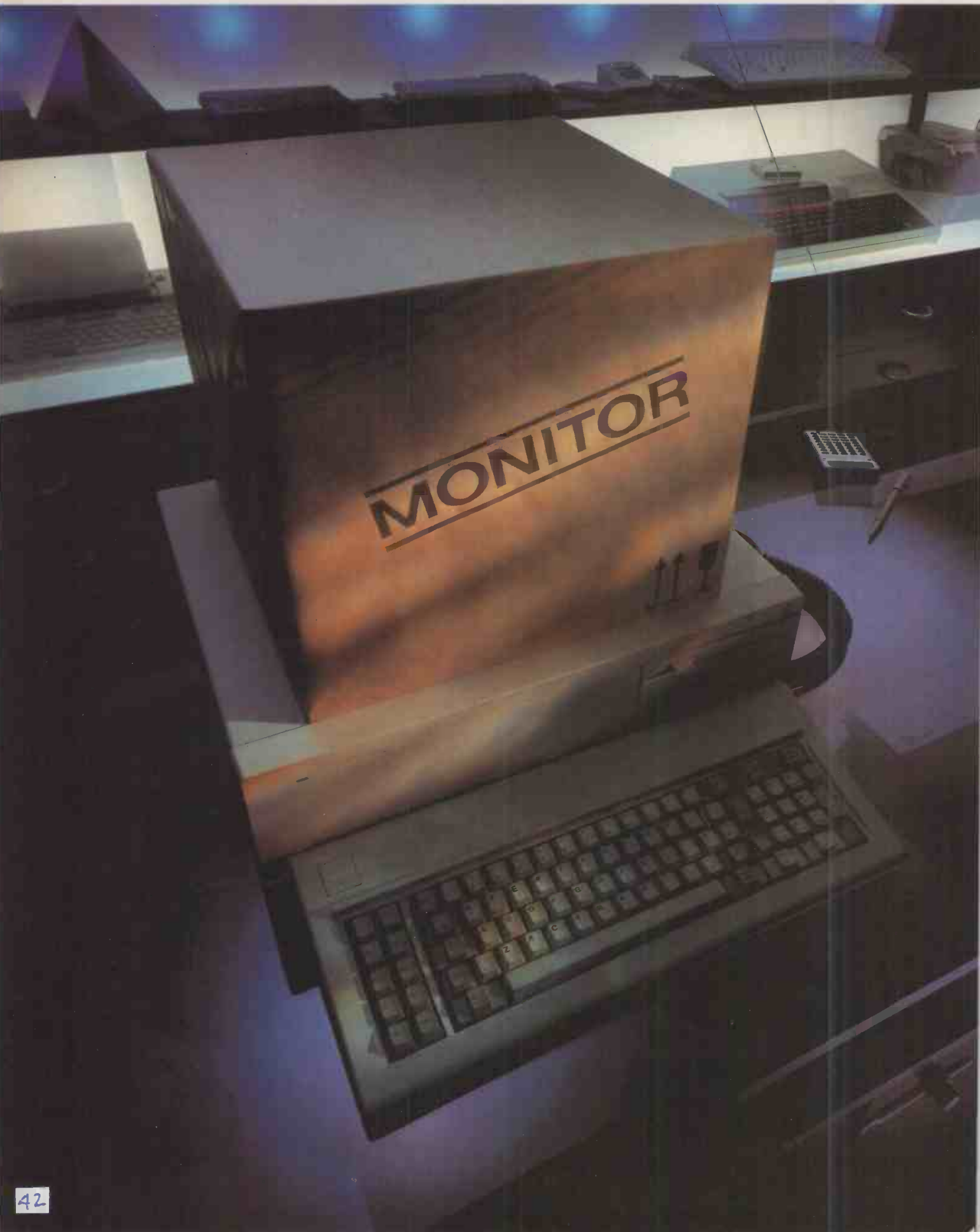
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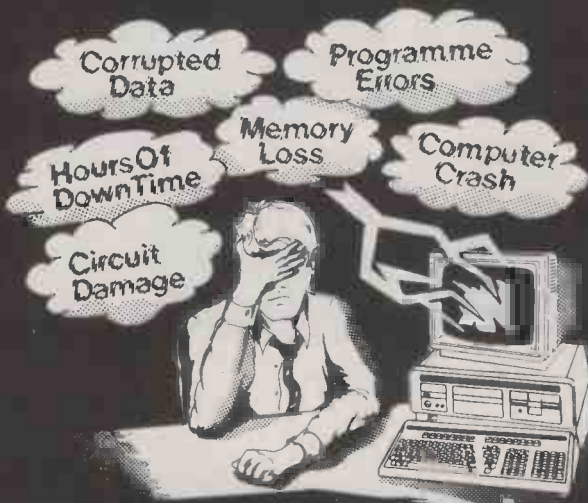
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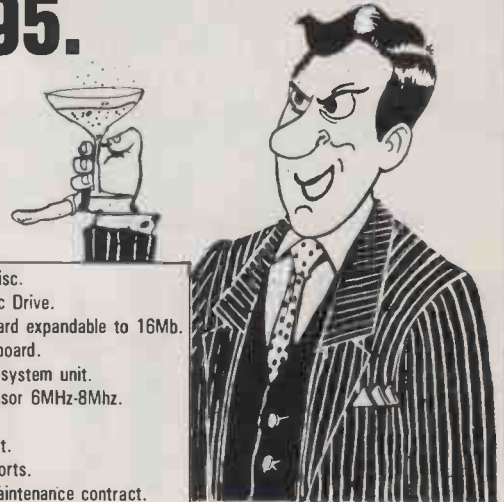
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ERICSSON, SPERRY & WYSE

QUALITY AT-COMPATIBLES

By Glyn Moody

Even the clone manufacturers are deserting the cheaper end of the market. We test out three powerful and sophisticated PC/AT look-alikes with price tags to match.

As far as the major manufacturers are concerned, the IBM PC end of the market is dead. The arrival of the £400 Amstrad PC is simply another nail in its coffin. In the AT world, there is a strong move in the direction of commodity products and several manufacturers have announced full 20Mbyte Winchester AT-alikes for less than £2,000. Even IBM is rattled: its chairman, John Akers, recently surprised observers by remarking that IBM is not interested in joining the box-shifting game. He also said that IBM would be concentrating on the upper end of the market where premium prices — and margins — still applied.

THOROUGHBREDS

This approach has been adopted by several other manufacturers, in the past most notably by Compaq, and now by Ericsson, Wyse and Sperry. The three machines reviewed here are all thoroughbreds with performances as good or even better than anything comparable we have tested before. As is common with such up-market machines, they all offer additional features over the vanilla IBM machine. They are all also quite expensive: two of them cost over £3,000 while the other tops £5,000.

One look at the Ericsson WS-286 and you can see the difference in approach between these new machines and the grey IBM box. Gone is the traditional three-box concept of keyboard in front of systems box with monitor plonked on top. As befits a Swedish company, the WS-286 offers a thoroughly

ergonomic alternative of floor-standing main unit plus fully mobile VDU. The casing is in the characteristic Ericsson livery of light ruddy-brown.

The floor unit stands vertically, and is large and heavy. The only problem with this is that you have to grope down the side of your desk to insert floppies; also it is not clear which way round they should go. The VDU supplied for review had an arm which raises the monitor above the desk, so allowing you to lift, swivel and turn the monitor. The screen had a white phosphor instead of the usual green or amber. As is often the case with high-quality units, the image on the screen was rock-steady. In fact the overall resolution of the screen was so good that the measly PC graphics looked

large power supply and plenty of space for expansion cards. In the middle there are the disc drives and behind them the fan. The fan is slightly noisy in operation and gives a credible imitation of a jet plane switching off its engines when you power down. The hard-disc unit also emits a clunking sound as it automatically parks its heads.

The Ericsson cleared all the usual compatibility hurdles like Lotus 1-2-3, Sidekick and Flight Simulator. Running the standard benchmarks, confirmed that the WS-286 is a well-engineered product. The Basic Benchmarks ran at an average speed of 3.5 seconds, just under the 3.4 seconds turned in by the Apricot Xen-i, which we reviewed last month. Both micros are streets ahead of the IBM PC/AT at 6.8 seconds, and even the Compaq Deskpro, which is beginning to get left behind with its 4.3 seconds.

SPEEDY DISCS

The Disc Benchmarks were also impressive. The hard disc took just 39.3 seconds to run them compared to 47.8 seconds for the Compaq and 60.3 seconds for the IBM PC/AT. The Ericsson floppy drive took 252 seconds, which compares very favourably with the Compaq's 250 seconds and the IBM PC/AT's 284 seconds.

Of course all these figures are only a rough guide to the machine's performance. Nonetheless, it seems clear that the Ericsson represents a real advance over the current state of the art. The basic system reviewed here with a 20Mbyte Winchester, 1.2Mbyte floppy and serial and parallel ports costs a hefty £5,095. This is not cheap, but you do get what you pay for.

The Sperry Micro IT is cheaper at around £3,250, but still very much in the top class as far as performance is concerned. This is Sperry's second AT compatible. The first was the Sperry IT, built by Mitsubishi to Sperry's specifications, which we reviewed in our July issue.

The new machine is strikingly different,

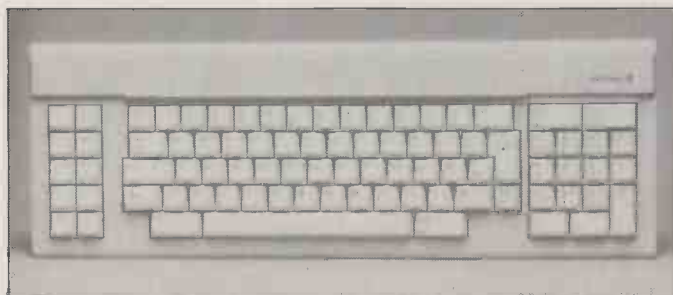
ERICSSON WS-286				
PC VERDICT	POOR	AVERAGE	GOOD	EXCELLENT
	Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A well-designed and powerful system, but slightly pricey.

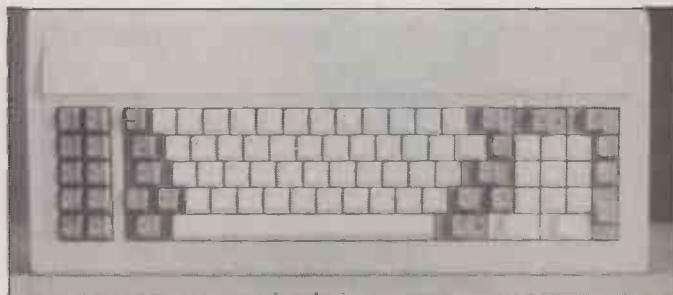
coarse when exposed in such crisp detail. This was also true of Windows, which comes bundled with the machine.

The keyboard uses the standard PC layout, which means that you are lumbered with the idiotic Backslash key between the left Shift key and the Z key. However, the feel of the keyboard is good, but nowhere near as good as the feel of the IBM PC/AT keyboard.

Opening up the sturdy main box reveals a



The WS-286 adopts a standard IBM PC layout for its keyboard.



The left Shift and Backslash keys are reversed on the Sperry.

(continued on next page)

REVIEW

(continued from previous page)

though again it has been built by Mitsubishi for Sperry. Whereas most of the heavy-weight clones have been big and hulking the Sperry is petite and graceful. Its footprint is smaller than that of most PCs, let alone ATs. Sperry says it is selling the machine as a kind of "baby brother" to the IT, with that machine moving up into the multi-user sector.

At the front of the main system box there is the lock and reset button. To use the reset button you have to poke a pen or pencil down the small recess, so it is hardly something you can use in emergencies. Underneath the reset button, hard disc and on/off lights, there is a small removable panel behind which are two sets of DIP switches. They control the clock speed, amount of memory and monitor and keyboard type. The various clock speeds available are 8MHz with one or no wait states, 7.16MHz with no wait states and 6MHz with one wait state. Fiddling around with DIP switches is not the best way of dealing with clock speed changes and the Wyse PC-286 offers a better solution.

LARGE VDU

The VDU supplied for review was a chunky colour model which tended to dwarf the unit under it. The keyboard is slightly odd. It is almost identical to the old IBM PC keyboard with the left Shift and Backslash keys reversed. It also has indicator lights on the Num Lock and Caps Lock keys.

Looking inside the machine reveals the secret of the Sperry's compact form: the expansion cards are stacked vertically rather than horizontally. However, this means that only five can be accommodated, of which three are taken up on the standard machine. This could prove to be a drawback if you want to add further cards but some may regard this as a relatively small price to pay for the greatly reduced space. A nice feature of the unit is that when you open it up the system powers down automatically.

The Sperry proved even faster than the Ericsson and Apricot Xen-i turning in a Basic Benchmark average of 3.3 seconds. This is faster than anything we have tested apart from the Pinnacle which uses the p-



Above: The Sperry Micro IT's expansion cards are laid horizontally to save space. Right: The Sperry is dominated by its VDU.





Far left: The Ericsson WS-286 flouts the conventional three-box concept; it consists of a floor-standing main unit, keyboard and VDU. The monitor is supported by a cantilever arm which allows it to be turned and swivelled.

Left: A look inside the Ericsson reveals its large power supply and plenty of room for expansion cards.

Below: The keyboard of the Wyse PC-286 is unusual with its modular layout.



System and a semi-compiled Basic. The Disc Benchmarks were not quite so fast at 91.9 seconds for the hard disc and 264.5 seconds for the floppy. The Sperry coped admirably with the standard compatibility tests.

Although it is designed to be a smaller and cheaper version of the Sperry IT, it is likely to usurp the position of its sibling except possibly for multi-user operation.

The final machine in this AT trio is the Wyse PC-286. We reviewed its stylish but slow predecessor, the Wyse PC, in April 1985. The new machine is still stylish though much larger and very heavy at 46lb., but it is fast. It costs around £3,100.

The most noticeable feature of the Wyse PC-286 is the sliding cover for the disc drives. This simple but effective idea provides additional protection from dust

SPERRY MICRO IT

PC VERDICT

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

A lot of punch packed in a compact form.

and other dangers to what is one of the most vulnerable areas of the micro. Also at the front are the standard lock, power and hard-disc indicator buttons. In addition there is a small push-button which flips the machine between its two speeds: it goes at a lightning 10MHz and the standard 6MHz. This feature is useful when running programs such as communications packages which take their timing from the internal clock. The Wyse approach is much more convenient than that adopted by the Sperry Micro IT.

Internally, the Wyse is similar to the Ericsson in that it is fairly prodigal with space. The main problem is that the Wyse is



Above: The Wyse PC-286 is solidly built. Left: The sliding cover for disc drives on the Wyse protects against dust.

(continued on page 53)



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SPECIFICATIONS



ERICSSON WS-286

CPU: 80286 running at 8MHz
RAM: 512K expandable to 6.5Mbyte
Dimensions: 444mm. (17.4in.) x 407mm. (16in.) x 179mm. (7in.)
Weight: 19kg. (41.8lb.)
Keyboard: standard PC layout
Mass storage: 20Mbyte Winchester, 1.2Mbyte 5.25in. floppy
Display: amber on brown, 640 by 400 pixels; 16 colours, 640 by 200 pixels; black on white also available; 12in. or 15in.
Interfaces: serial and parallel
Hardware add-ons: 80287 maths co-processor; 40Mbyte Winchester, tape streamer
Price: £5,095 for review system
Manufacturer: Ericsson Information Systems, 7 Gresham Street, London EC2V 7BX. Telephone: 01-606 0425
Available: now



SPERRY MICRO IT

CPU: 80286 running at 8MHz, 7.16MHz or 6MHz
RAM: 512K expandable up to 3.5Mbyte
Dimensions: 381mm. (15in.) x 381mm. (15in.) x 114mm. (4.5in.)
Weight: 11kg. (24.2lb.)
Keyboard: modified PC/AT layout
Mass storage: 20Mbyte Winchester, 1.2Mbyte 5.25in. floppy
Display: range of Sperry displays with standard IBM PC resolutions
Interfaces: serial and parallel as standard
Hardware add-ons: 80287 maths co-processor, hard disc on a card, 3.5in. disc drives
Price: around £3,250
Manufacturer: Sperry Limited, Sperry Centre, Stonebridge Park, London NW10 8LS. Telephone: 01-965 0511
Available: now



WYSE PC-286

CPU: 80286 running at 10MHz or 6MHz
RAM: 640K, expandable up to 15Mbyte
Dimensions: 537mm. (21in.) x 447mm. (17.5in.) x 162mm. (6in.)
Weight: 20.8kg. (45.8lb.)
Keyboard: standard AT layout; RT layout optional
Mass storage: 20Mbyte Winchester, 1.2Mbyte floppy
Display: Wyse range of monitors
Interfaces: serial and parallel as standard
Hardware add-ons: 80287 maths co-processor; 40Mbyte Winchester
Prices: £3,105 for review system
Manufacturer: Wyse Technology (U.K.) Ltd, 26-28 King Street, Maidenhead, Berkshire SL1 1EP. Telephone: (0628) 784037
Available: now

(continued from page 51)

designed principally as a desk-top machine but you would need to have a pretty big desk to put it on. However, Wyse does provide an option that allows it to be placed on the floor. The box itself is a dull grey.

The keyboard is unusual and much narrower than most. It follows the basic PC/AT keyboard layout, though the review model was a U.S. version. The feel of the keyboard was good, with an even resistance but without the definite click found on the IBM versions. The monitor was a large colour version which produced very clear images. However, the surface of the screen was highly reflective.

FLEET OF FOOT

As well as running the same compatibility tests as the other micros without any problems, the Wyse PC-286 proved fleet of foot. It produced an average benchmark time of 3.4 seconds when running at 10MHz, and 5.8 seconds at the slower 6MHz. The former is only 0.1 seconds behind the Sperry, which has emerged as the fastest MS-DOS machine we have tested. Disc Benchmarks were 60.7 seconds for the hard disc, and 240 seconds for the floppy, both good timings.

Like the Sperry, the Wyse comes with a very full set of documentation, which is spiral-bound. There is a slight error in the section which deals with opening up the

WYSE PC-286

PC VERDICT

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

A heavyweight performer in every sense.

machine: it omits to tell you to remove some screws at the bottom as well as the back of the unit. As with all the machines reviewed here, the overall impression is one of the quality.

The difficult question to answer is which one to buy? All are very fast and well built, all come from reputable manufacturers, and all of them are quite expensive. However, the machines' strengths and weaknesses help sort them out.

For example, the Ericsson lends itself to situations where ergonomics are important, and where it is possible to make good use of its floor-mounted position. Since it is considerably more expensive than the others, the actual cost of the machine will be less of

a consideration. The Sperry is very compact, and will appeal to those who wish to keep their AT on desk a but still want to have some desk space left. Its limited expansion capability will be a disincentive for some. The Wyse's ability to change clock speeds without taking the machine to pieces means that it will be useful in applications like comms where timing may be critical. Its ungainly bulk may put users off.

What is particularly interesting about these machines is that they show how yet more performance can be squeezed out of the 80286 — the use of a 10MHz clock rate on the Wyse is especially impressive. It also indicates how the AT market is separating into two quite distinct camps: cheap and cheerful or pedigree and pricey. The choice is yours.

CONCLUSIONS

■ The Ericsson WS-286, Sperry Micro IT and Wyse PC-286 are high-performance AT clones with price tags to match.

■ Each micro has particular virtues which may recommend it to users for specific purposes. They also all have different drawbacks which may disqualify them for some users.

■ Another drawback is the price of the three micros, above all in the case of the Ericsson. By keeping such sizeable margins the manufacturers are going against the trend for lower prices. So if you want an AT clone, and do not require the absolute top in performance, it may well be worth looking at the cheaper end of the market.

CANON IX-12 IMAGE MAKER

By Ian Stobie

Following in the wake of the personal-publishing success, this cheap input scanner may be the first of many.

Next year's star peripheral may well turn out to be the scanner. An input scanner allows you to read an image straight from a piece of paper directly into a computer, saving you the job of redrawing or rekeying it. Until recently good scanners were expensive, but several major manufacturers are now entering the market and prices are falling fast.

Driving these developments is the boom in laser printers and personal publishing. Most of the new scanners work at 300 dots per inch, which is emerging as the accepted standard for laser printers. This means that you can capture images at the same resolution that you subsequently print them out.

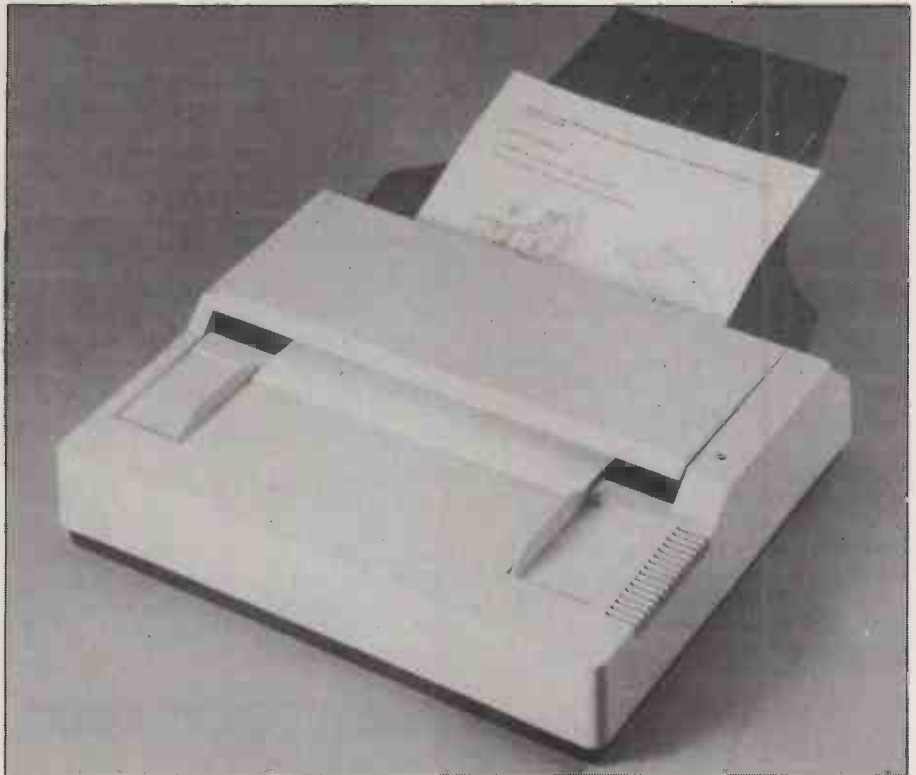
The obvious immediate applications for scanners are in personal publishing and business graphics. But the technology has still greater potential for the future when coupled with reliable optical character recognition (OCR) software. There are signs that this breakthrough is imminent.

Canon is the company that started the laser printer revolution, with the launch of its LBP-CX engine in 1984. It is now releasing two scanners. The IX-12 costs £1,450 and works at 300 dots per inch, while the cheaper 200 dots per inch IX-8 costs £950. Both scan A4 pages and are compatible with the IBM PC.

IBM itself is among the other players entering the market. It has launched two scanners for the PC in the U.S., the \$1,100 3117 and the more expensive 3118; the company has not announced a U.K. release date as yet. Both scan at 240 dots per inch, which is the same resolution as IBM's 3812 Pageprinter.

The question of resolution is important for scanners. You need to collect as much information for subsequent processing as possible, while at the same time not going over the top and burdening yourself with impossible demands on storage space. Resolution must be high enough to get good results with the size of text and type of line drawings that might be found in normal office documents.

Most of the industry seems to be standardising on 300 dots per inch in both the vertical and horizontal directions. This



The £1,500 Canon IX-12 (above) generates images with a resolution of 300 dots per inch, matching the standard for laser printers, and in 16 grey tones. Viewers of *Coronation Street* will recognise the picture (right) of Hilda Ogden, scanned from a magazine cover by the IX-12.



makes the IX-12 the more important Canon model. It also places IBM a bit out on a limb; few companies are following it along the 240 dots per inch path.

Physically the IX-12 looks just like a printer. You feed the sheet in face down at the front of the machine and a few seconds later it emerges at the back. Scanning is actually performed by an array of 2,592 charge coupled devices (CCDs) hidden inside the machine. CCD technology is well

established in cameras and facsimile machines and there are remarkably few moving parts to go wrong.

The IX-12 has a straight paper path so it will accept artwork mounted on card. It is not designed for scanning pages from books; you would have to tear the page out.

Compared to a camera-based input device, the Canon scanner is very simple to use. You do not have to worry about lighting, and contrast is easily adjusted using

MICROTEK

The next step up in the market from the Canon IX-12 is probably Microtek's MS-300A. This £2,200 machine works with both IBM and Macintosh systems; it is also sold badged up under the Abaton brand name.

Like the IX-12, the MS-300A is an A4 scanner and it operates at 300 dots per inch. The main difference is in the software which it comes with: Eystar for the IBM PC and Verscan for the Mac.

Eystar is compatible with WordStar and lets you include scanned images anywhere you like inside a word-processing document. Verscan gives you the choice of storing images in Macpaint format or as Postscript files. The Postscript page-description language is of key importance in the personal-publishing market. It is supported by the Apple Laserwriter printer and an increasing number of proper typesetting machines. Once an image is represented in Postscript it is more easily passed around between different systems and devices.

Microtek also has OCR software on the way. The pre-release IBM version we saw seemed fast and accurate, even working from photocopied material. You get a choice of different output formats including WordStar and Word Perfect as well as plain ASCII. Like Canon's OCR software for the IX-12, it works best from typed documents. It is impressively effective, but the smaller size of printed text still presents problems.

SPECIFICATION



Description: intelligent image scanner
Resolution: 300 dots per inch
Speed: maximum of 10 seconds per page at top resolution
Size: A4
Interface: parallel standard, RS-232C optional
Compatibility: IBM PC, PC/AT or compatibles, and Macintosh; generates either bit-image or Postscript files
Add-ons: optical character recognition
Price: £2,200
Other models: 200 dots per inch MS-200A, £1,700
Manufacturer: Microtek Inc., made in Taiwan
U.K. supplier: ARS Microsystems Ltd, Doman Road, Camberley, Surrey GU15 3DF. Telephone: (0276) 685005
Available: now

SPECIFICATION

CANON IX-12

Description: intelligent image scanner
Resolution: 300 dots per inch
Speed: maximum of 12 seconds per page at top resolution
Size: A4
Compatibility: IBM PC, PC/AT or compatibles; other RS-232 equipped systems; generates bit-image files
Add-ons: optical character recognition
Price: £1,450
Other models: 200 dots per inch IX-8, £950, available now
Manufacturer: Canon Inc., made in Japan
U.K. supplier: Canon (U.K.) Ltd, Canon House, Manor Road, Wallington, Surrey SM6 0AJ. Telephone: 01-773 3173
Available: October

the I-Edit software package supplied. You can use up to 16 different shades of grey to represent a continuous-tone image such as a photograph, and then alter the result using I-Edit's Paint facilities.

Scanning a full page takes 12 seconds at full density. It also takes up over one megabyte of disc space. I-Edit therefore

gives you the option of scanning at lower resolutions. You can also scan the whole page at 50 dots per inch, mark the part of the image you are interested in, and then go back and scan just that particular area at the full 300 dots per inch. I-Edit lets you save files in a compressed format.

All the same, for realistic work you still need a fairly hefty IBM system. A hard disc is essential, and if you want to keep libraries of scanned images then something like a removable cartridge system such as the Bernoulli box would probably be needed to provide storage on the scale required.

I-Edit is designed to help you capture a satisfactory image. What you can do next depends on your other software. For personal publishing you would need a compatible page make-up or word-processing program. Canon is recommending Wordcraft at the moment for word processing, with Typecraft aimed at the more typesetting-orientated user.

On the IBM PC there is no obvious standard for graphics files, so compatibility matters — everything depends on which programs you are using. The situation is much clearer on the Macintosh, which is therefore a far more suitable machine for personal-publishing work. Canon is not yet

targeting the Mac with its scanner offerings. Instead it will initially probably be offering the scanner in bundled systems based around its own PC compatible. This at least means the difficult decisions will be made for you.

With text there is a recognised data-interchange standard, ASCII, so it would be very convenient to convert scanned text into ASCII, allowing it to be used with any of a great number of IBM packages. But this is not easy; the scanner treats whatever is on the page simply as a physical image, making no distinction between text and graphics. It creates a bit-mapped graphics file. To convert to ASCII requires OCR software.

Before getting too excited about OCR it is necessary to say that it is still early days for this technology. But Canon does have an impressive product up its sleeve. The version we saw was able to read both typewritten text and output produced with matrix printers. You do not have to tell it what font your original is in; the software tries to guess what it is, and as long as you stick to standard typewriter faces like Orator or Courier the results seem to be accurate. OCR only makes sense if the process takes less time than simply retyping the document. Although we did not see a final product it looks like Canon will achieve this easily.

Several attempts have been made at producing cheap OCR devices in the past for personal computers but these have not been very successful. The reason a breakthrough is on the cards now is that scanner technology has improved. The ability to produce 300 dots per inch gives the OCR software enough information to get the identification of a character right enough of the time for it to be useful.

However, we are still a long way from picking up a copy of the *Financial Times* and reading in today's prices. This sort of typeset text comes in a great variety of fonts and is generally just too small for systems based on 300 dots per inch scanners. Even the text in *Practical Computing* is too small to convert to ASCII accurately with a system of this type.


A more readily achievable application once you have a 300 dots per inch scanner is fax. It is a fairly simple matter to convert the scanned image into one of the recognised formats and simply transmit out through a modem attached to your micro. With the right software the scanner-equipped PC can then double up as a fax machine.

CONCLUSIONS

■ Scanners have finally reached a stage where they are good enough and cheap enough to take off, and they will do so in a big way.

■ Both the Canon and Microtek machines are excellent examples of their class.

■ It seems that 300 dots per inch is likely to be the standard resolution for both input and output devices for a range of office applications.

■ Practical optical character recognition may still be a little way off, but a breakthrough is now very near. 

HERCULES GRAPHICS CARD PLUS

BEST OF BOTH WORLDS

By Steve Malone

With its ability to combine text and graphics on the same display the original Hercules card was an instant hit. Now it has been updated.

When the PC was launched IBM introduced two different types of video-display card. The first was the Monochrome Display Adaptor (MDA) intended for serious business applications like word processing. The Colour Graphics Adaptor (CGA), which supported bit-mapped displays, was intended for use in arcade-style games. Because the IBM designers assumed that these two areas of the market were mutually exclusive no overlap of features was designed into the cards. The monochrome card could not produce bit-mapped graphics, and the colour card became stuck with a rather shoddy text display.

The basis of most text displays is the character-generator ROM. It contains 256 characters each in a nine-by-14 matrix, including the alphanumerics and other symbols available from the keyboard. Because these characters are already built-in it is much easier and fast for programmers to map the ROM-based characters than build up the text pixel by pixel.

Because the shape of the characters is stored in ROM, text can be stored in main memory simply in its ASCII format. Thus only a single byte is required to store one character, and an entire screenful of text can be kept in just 2,000 bytes. The IBM monochrome display has seven attributes to

enable the user to emphasise text by printing it bold or underscored. Each character cell needs an associated attribute to describe it. For this reason the amount of memory required to support a monochrome screen is 4,000 bytes.

Many of the drawbacks inherent in the monochrome display were overcome by the intervention of two third-party manufacturers. The first of these was Compaq, whose Portable computer came equipped with a screen able to perform both text and graphics manipulations. For those who already had an IBM PC there was the arrival of the Hercules Graphics Card.

The Hercules card can work in either text or graphics mode, though not in both simultaneously. Although still a monochrome card the plug-in board has its own graphics characters in ROM, which allows users to build up bar charts and other visual representations as well as to perform bit-mapped graphics. The new Hercules Graphics Card Plus is capable of displaying bit-mapped graphics and text, yet still has the speed of ROM-based text scrolling. It does this by placing the ROM-based text characters and attributes into a 4K buffer on the card. The characters in the buffer can then be mapped on to the graphics screen to provide a combination of text and graphics displays.

The Hercules Card Plus differs from

normal bit-mapped text in that it buffers the characters in the same nine-by-14 block format used in the character ROM, and therefore is able to build the screen in a similar fashion. The text characters in the buffer can be mapped on to the screen just as if they had been taken from the character ROM, so similar speeds are achieved. It is only a small step from here to be able to put your own user-defined character sets into the buffer.

Hercules has provided facilities to do this with the new Ramfont mode. This mode allows up to 3,072 characters to be stored in a buffer. Each individual character is stored as an eight-by-eight cell which can be

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Combines the flexibility of graphics with rapid text scrolling; could be the life-saver that monochrome monitors need.

SPECIFICATION

Description: monochrome graphics display card also able to display text at the speed of a standard IBM monochrome display

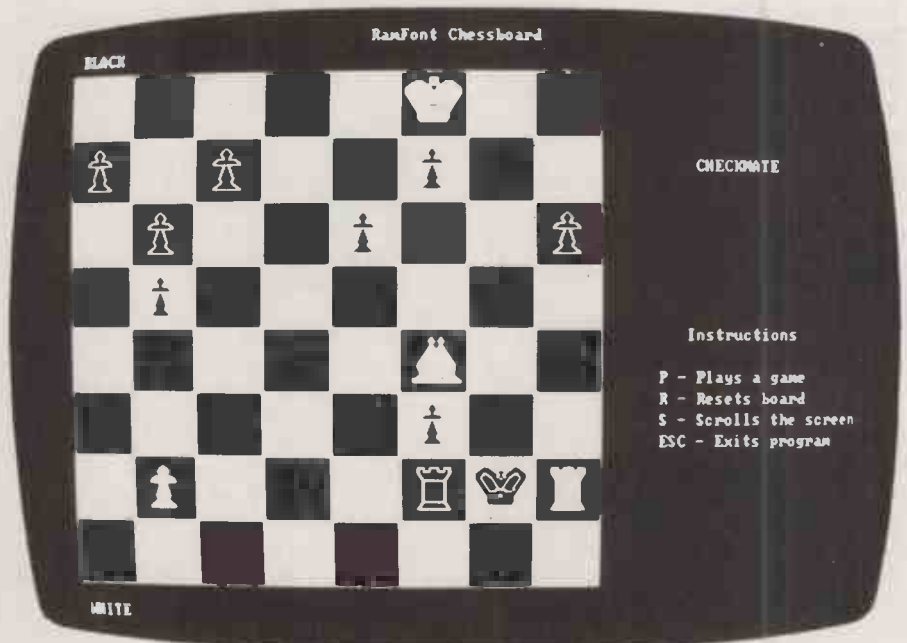
Hardware required: IBM PC, PC/AT or compatible with full-length expansion slot; compatible with all Hercules cards; runs on IBM mono display format but not colour display; requires TTL-input monochrome monitor with sync frequencies of 50Hz vertical and 18.4kHz horizontal

Price: £245

Manufacturer: Hercules Computer Technology of Berkeley, California

U.K. distributor: First Software, Intec 1, Wade Road, Basingstoke, Hampshire RG24 0NE. Telephone: (0256) 463344

Available: now



The Hercules Graphics Card Plus can display both text and graphics.

accessed by a 16-bit code. This is in contrast to the eight-bit ASCII code which is normally used for storing text characters.

The Ramfont code is divided into a 12-bit character code and a four-bit attribute code. The 12-bit character code is to give the program access to the 12 256-character founts which can be held in the 3K buffer and to allow several founts to be displayed at once. Although the four-bit attribute code is only half that used by the IBM monochrome display, it is still sufficient to hold the entire range of usable attributes.

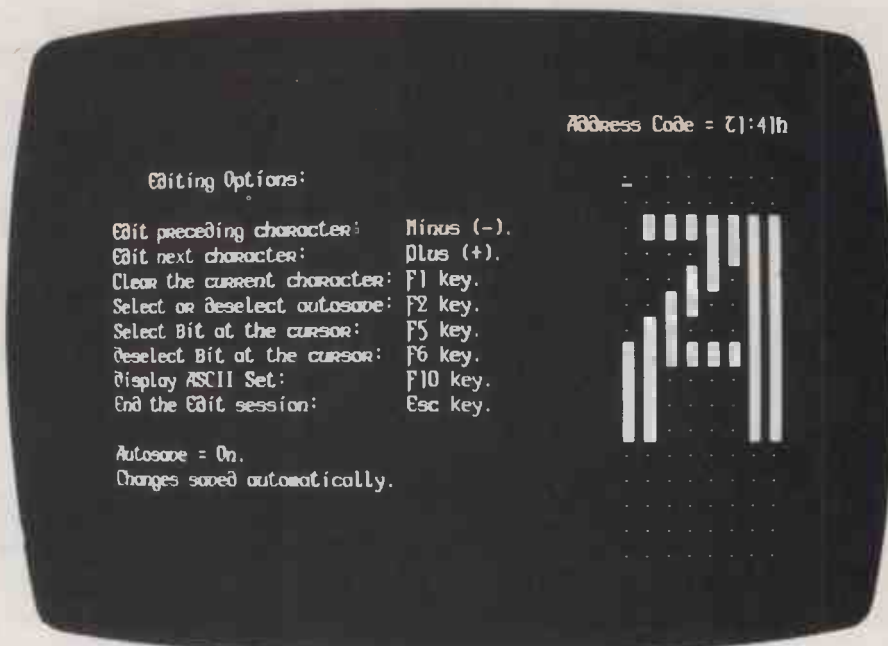
By switching the pixels on and off, the bit map within the cell can be defined in any style you want. The cells are not restricted to holding a single character, so for example a group of four nine-by-14 cells can each contain one-quarter of a letter. When displayed together on the screen they then form a completed character 18 by 28 pixels in size.

A disc containing 24 character founts is supplied with the Hercules Graphics Card Plus. They range from Medieval to Future, and although they demonstrate the versatility of the system many are let down by the character resolution and are little better than illegible.

FONTMANAGER

To allow users to create their own founts Hercules has bundled a character-construction tool with the card. It is called Fontmanager and is rather like the sprite generators used on home micros. Running Fontmanager allows you to load any one of the available founts into the card's character buffer, edit it and save it under another name.

The Fontmanager editor screen is split into two. On the left, the user can display a help list of available commands or the complete character set of the fount currently within the buffer. On the right-hand side of the screen is a grid of dots, the dimensions of



You can create your own founts using Fontmanager.

which correspond to the current character-cell resolution. You can alter the pixel dimensions of the cell via the Setmode command. In theory any resolution from eight-by-eight to nine-by-16 can be selected. But since the operating system is unable to handle anything but nine-by-14 it is impractical to use any other resolution for text-based applications.

Though you can display your customised founts on-screen it is not yet possible to dump these character sets to the printer. This is because the MS-DOS printer routines make certain assumptions about the characters they are asked to feed to the printer port. Primary among these assumptions is that the text will be in eight-bit format, not 12 as used by the Ramfounts. If the printer were asked to print the 12-bit

codes the best you could hope for would be garbage.

Hercules has been able to implement a limited amount of Ramfont printing via a version of Basic which the company calls HBasic. This facility is only available to users of a genuine IBM PC, as HBasic utilises ROM-based Basic routines that are not found on any of the clones.

Because the Hercules Card Plus is a radical departure from the accepted way of generating text, special drivers are needed to run the device in Ramfont mode. Drivers for Lotus 1-2-3 release 2, Microsoft Word 3 and Framework II are among the applications bundled with the driver disc. Hercules says that its system is with a number of software houses at the moment, and expects the drivers to be built into future releases of a number of major products.

Installing the relevant drivers is simply a matter of copying the fount and driver files from the relevant directories on the applications disc. Before you can use the application it is necessary to remove any colour card from the computer other than a Hercules Colour Card because the colour card and Hercules Card will try and grab the same areas of memory. The result is rubbish on the screen.

CONCLUSIONS

■The Hercules Graphics Card Plus adds both speed and flexibility to the monochrome display.

■The Ramfont method of generating characters is ingenious, although it does produce clashes with some hardware and software. You should check it with your configuration before buying.

■The success of the card depends on it gaining widespread adoption by software houses. It will also need to reproduce founts on the printer to gain acceptance.

■If successful, the Graphics Card Plus could prove to be the saviour of the monochrome monitor in a world increasingly turning to colour displays.

guide for someone familiar with computers and want to know what this thing is. Therefore, without dwelling too long on any subject, the book provides an overview of the bits that make up the system and how they work. The trouble is that you get to feel a bit like a coach passenger on a package tour, constantly having interesting features pointed out to you but never stopping long enough to have a closer look.

Among the subjects covered by the book are the history of Unix, its philosophy, hardware, files, kernel, shell, portability and C. Each area is explained with examples and though Unix beginners might find themselves a little out of their depth at times, Walker guides you through the complications and is never boring - he even manages to make it funny. The book is a good introduction to what the appetite for the system and provide a grounding for a deeper investigation of the subject.

For the absolute beginner who would like a more leisurely stroll around Unix, a more tutorially based explanation is provided by 'UNIX a practical introduction for users'. This book, credited to six authors, assumes the reader is approaching Unix or even computers for the first time and takes the trouble to explain terms like VLI.

As a 'practical introduction' the first chapter deals with logging on, the prompt and some simple commands. From there the book methodically explains each

The Medieval fount is one of 24 character founts supplied.



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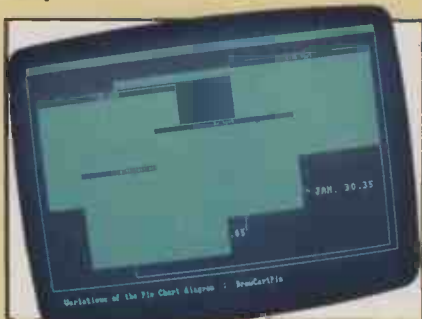
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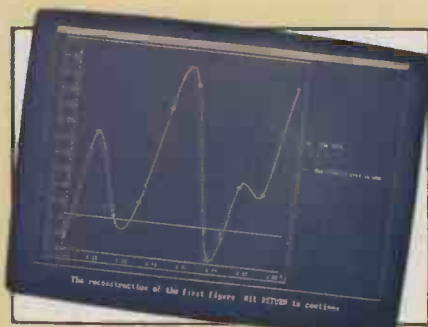
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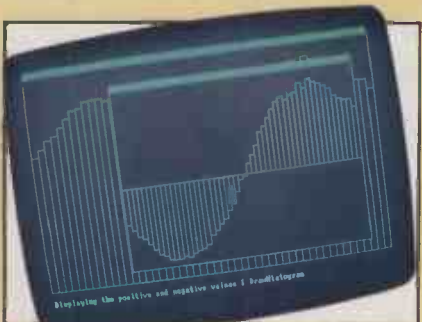
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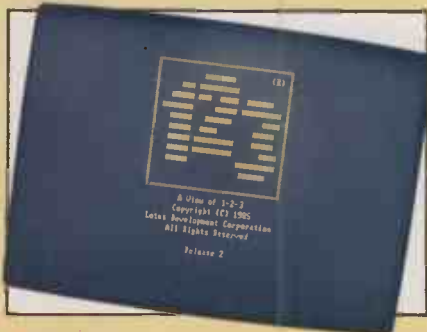
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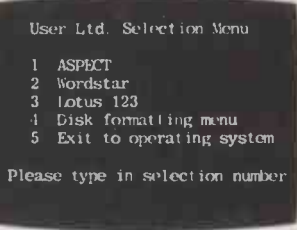
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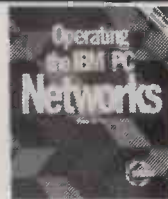
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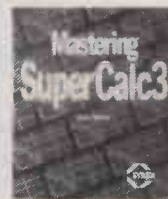
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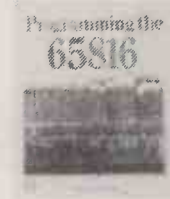
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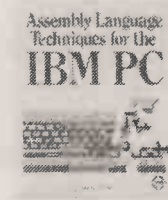
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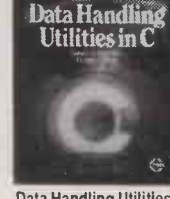
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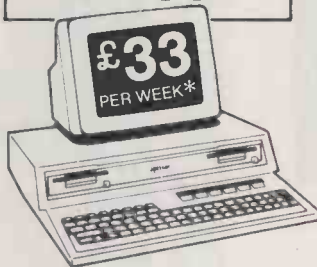
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IBM PC CONVERTIBLE & ZENITH Z-181

THE FINAL SHOWDOWN

By Jack Schofield

IBM's entry into the lap-portable market has finally made these machines respectable. But will IBM's clout be enough to help it tackle established suppliers like Zenith?

A visit to the exhibition at the National Computer Conference in Las Vegas earlier this year provided me with the opportunity to try, very briefly, two new lap-portable micros from Zenith and IBM, neither of which has yet been launched in the U.K. This could not remotely be described as a test, but the demands of PC compatibility are now so restricting that first impressions and the more obvious differences may reveal the reasons for choosing one machine rather than another.

The IBM machine is the Convertible, *née* Clamshell, which arrived about a year after it was tipped to. Looking at it, your first thought is that it must indeed have been designed in early 1984. Had the job been done later, it is hard to believe that so many things could be wrong. But the Convertible is still very much as many expected, right down to the nearly illegible screen and lack of essential I/O ports.

Zenith's new Z-181 battery or mains-powered lap portable came as much more of a surprise. This TV manufacturer and major supplier of micros to the U.S. armed forces has already established itself in the lap-portable market by winning an order for 15,000 of its Z-171 machines from the American Internal Revenue (IRS) — much to the discomfiture of IBM. To launch an improved model while the Z-171s have yet to be delivered, and while IBM is still ramping up production of the rejected PC Convertible, would seem to be rubbing salt in the wound.

The Z-171 was the IRS choice because of the 5.25in. discs and its expansion possibilities. It will still appeal to those who want to take their desk-top micro with them, and who will probably plug the Z-171 into the mains. The Z-181 and Convertible are aimed at the real lap-portable market of journalists, academics, travelling salespersons and suchlike.

The Zenith Z-181 is a 12lb. battery-powered machine with a full-size screen, keyboard and two built-in 720K 3.5in. disc drives. It uses an Intel 80C88 processor and



SPECIFICATION

ZENITH Z-181

CPU: CMOS 80C88 running at 4.77MHz; optional 8087

RAM: 640K

Mass storage: two 3.5in. 720K floppies

Display: backlit birefringent 10.5in. LCD, 80 columns by 25 lines

Ports: RGB video, monochrome, composite monochrome, RS-232C port, Centronics printer port, interface for external 5.25in. disc drive

Dimensions: 340mm. (13.4in.) x 294mm. (11.6in.) x 78mm. (3.1in.)

Weight: 5.3kg. (11.8lb.)

Price: \$2,399

Manufacturer: Zenith Data Systems, St. John's Court, Easton Street, High Wycombe, Buckinghamshire HP11 1JX. Telephone: (0494) 448781

Available: not yet announced in U.K.

is claimed to be compatible with the IBM PC software standard. Apart from having 640K of RAM it would seem to represent little advance on existing micros such as the Data General One and Toshiba T-1100. However, it is the legibility of the Z-181's screen that provides the major advance.

Until now, portables have suffered from liquid-crystal display (LCD) screens which were very hard to read, very narrow, very

The Zenith Z-181 screen is one of the most legible of its class, thanks to its new LCD.

slow to update, or all three. Examples range from the uncomfortable Epson PX-8, Toshiba T-1100 and Kaypro 2000 to the nearly illegible Sharp PC-5000 and IBM PC Convertible. Except for the Data General One, they all have a further drawback in that they are long but narrow, making graphics look horribly squashed.

LCDs normally work by reflected light, but back-lighting improves legibility. This was achieved in the Zenith Z-171 by putting an electro-luminescent panel — phosphorescent chemicals sandwiched between two planes of electrode grids — behind the LCD. Passing a current through the panel makes it glow and light the LCD but it tends to make the text appear semi-transparent, like reading something written with a felt-tipped pen on Cellophane.

In the Z-181, Zenith has solved the problem by using a new type of LCD. The result is that almost no light shines through the pixels that make up each letter in the image. This produces much clearer text, which is far more readable than any other LCD screen on the market.

Zenith claims that contrast with the new screen ranges from over 6:1 reflective to over 12:1 when back-lit, which compares with a range of 3:1 or less for ordinary LCDs. This is not up to the same standard as today's

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monitors, but you can plug a monitor into a port on the back if you wish. In addition, the Z-181 screen is full size, with 10.5in. diagonal. Graphics are reproduced the same as on a 12in. monitor, so circles are circles rather than ellipses, and so on. So the Z-181 is better than conventional 9in. screens in this respect.

However, there are some disadvantages to the Zenith model, mainly the high battery consumption, the low processing power, and the price. The rechargeable batteries provide power for only three to five hours use, which means buying a mains adaptor for office use, and probably carrying a spare battery pack in the field. The low processing power is due to matching the industry-standard IBM PC with its 8088 pseudo 16-bit chip and 4.77MHz clock speed, which is five years behind the state of the art. The price of \$2,399 seems a very large premium to pay for portability when micros that are twice as powerful can be bought for a third of the price.

ECONOMICAL OPTION

Even so the Z-181 will be very attractive to those who want to pack an office-powered micro in a briefcase. It should also appeal to executives who do not want their desks dominated by a computer: the Z-181 can be slipped into a drawer when not in use. It may even represent an economical option for people who have to have an IBM-compatible micro at home and in the office, and would value a machine that also works in a train or a car travelling between the two. The drawback is that you have to have software duplicated on both 5.25in. and 3.5in. disc formats.

The IBM Convertible has a similar specification to the Z-181, including an Intel 80C88 processor, two 3.5in. disc drives and an LCD screen. It weighs 12.5lb. and is slightly larger than a Toshiba T-1100. It only has 256K of memory as standard, but can take an internal 1,200-baud modem costing \$450, which for some inexplicable reason is not Hayes compatible.

IBM's lap-portable offering, the PC Convertible, is something of a disappointment.

The other amazing omission from the Convertible is the lack of serial or parallel or printer ports. It is impossible to fathom why any computer company should think the facility to print out from a lap portable is optional. Perhaps it is part of a ploy to bump up the superficially competitive price of \$1,995 by obliging users to buy add-ons like ports and extra RAM.

However, the most noticeable thing about the IBM model is that the screen is poor by today's standards. It is slightly better than the old Sharp PC-5000 and the original Data General One, but seems worse than established models such as the Epson PX-8 and Toshiba T-1100. However, against the high legibility of the Z-181, the Convertible is outclassed.

The Convertible screen can display IBM monochrome or graphics. However, the letter-box shape of the screen means that graphics look squashed. One good thing about the Convertible screen is that it is removable.

Where the Z-181 discs pop up, like the solitary one in the Kaypro 2000, the Convertible's two built-in 3.5in. drives are conveniently front-facing and permanently

raised for access. Along with the discs comes yet another new version of PC-DOS, version 3.2, to support the 720K 3.5in. discs. This DOS also includes two useful copy utilities Xcopy, which is fast, and Replace.

The 78-key IBM keyboard is slightly cramped, like that of most lap portables, and has the function keys along the top not down the side. It is well laid out, has a touch as good or better than that of the Z-181, and a nice click. The Convertible has a good separate cursor pad in an inverted T shape, though — as usual with portables — no numeric keypad.

BUNDLED SOFTWARE

The Convertible is bundled with a software DOS shell-cum-Sidekick type of program. This provides you with a Notewriter, Schedule, Phonenumber and Calculator. It is OK, but slightly slow. It is nothing like as good as the Polywindows Desk program you get free with the Kaypro 2000. IBM might have made its Application Selector palatable by putting it in ROM but for some reason chose not to.

Finally the Convertible can be extended by putting things on the back, as with the PC Junior. There is a unique 72-pin bus provided for the purpose, but you might want to start with a serial/parallel port module at \$195, a monitor adaptor module at \$325, and a 15 characters per second printer module at \$295. Throw in 256K of memory expansion at an amazing \$390 — these must be hand-picked chips — and you have a dreadfully slow but usable lap portable for \$3,650. You also have to pay out an extra \$95 for the DOS.


My own view is that the Convertible will soon join failures like the PC Junior and IBM Portable PC. The fact that IBM in the U.S. is apparently backordered and cannot meet demand merely illustrates that the average U.S. corporate buyer is not only ignorant about micros, but has access to more money than sense. However, yet another IBM failure will not matter to those who want a usable lap portable rather than a status symbol. The Zenith Z-181 seems to be a good machine and more than fits the bill.

CONCLUSIONS

■ The Zenith Z-181 is not unusual in delivering the power of a desk-top micro in a portable, battery-powered package. But at the moment the unique LCD screen legibility may make it the most attractive of its class. Of those I've seen, it would be the system of my choice — if I could afford it.

■ Although the Zenith is expensive compared to many of today's clones, the system is at least complete and includes a good set of I/O ports.

■ Apart from its keyboard, the IBM PC Convertible is a great disappointment in being well behind the state of the art. From a company with IBM's research funds, buying power and marketing ability we should expect something better. Only the fact that the LCD screen is replaceable offers hope for the future.

■ While the Convertible has what is, for an IBM machine, a superficially attractive price, bringing it up to a reasonable specification makes it uneconomic for most people. 

SPECIFICATION

IBM PC CONVERTIBLE

CPU: CMOS 80C88 running at 4.77MHz

RAM: 256K expandable to 512K

Mass storage: two 3.5in. 720K floppies

Display: detachable 10.5in. LCD, 80 columns by 25 lines

Interfaces: proprietary 72-pin expansion port

Hardware options: serial and parallel ports; display adaptor, colour or monochrome displays; modem

Dimensions: 325mm. (12.8in.) × 313mm. (14.7in.) × 68mm. (2.7in.)

Weight: 5.6kg. (12.5lb.)

Price: \$1,995 for basic model

Manufacturer: IBM Entry Systems Division, Boca Raton, Florida

Available: not yet announced in U.K.





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SUPERCALC 4

A MAJOR CONTENDER

By David Barlow

Both powerful and easy to use, this latest version of Computer Associates' spreadsheet looks set to give Lotus 1-2-3 some stiff competition.

Trying to topple a market leader as firmly entrenched as Lotus 1-2-3 must sometimes feel like banging your head against a brick wall. Despite some valiant attempts by the competition, Lotus Development's original spreadsheet still managed to tot up nearly 60 percent of integrated/spreadsheet package sales in the final quarter of 1985 according to Romtec.

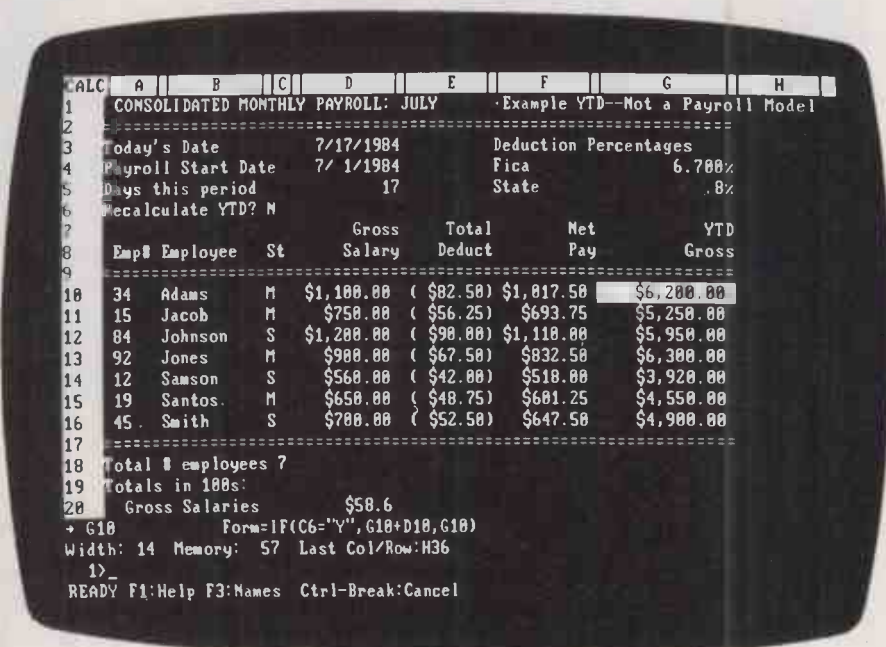
The strange thing is that when compared to the competition on a feature-for-feature basis, Lotus 1-2-3 is beginning to look weak at the knees. Neither is it necessary to pay more to get a superior product as some of the new 1-2-3 clones cost a third of the price of 1-2-3. All the clones lack is the corporate pedigree that makes 1-2-3 the automatic choice for financial-planning applications.

If there is one package that should threaten 1-2-3's supremacy at this level it is Supercalc 4 from Computer Associates. This package is nearly as old as the microcomputer itself and is now up to version 4 release 1. Its evolution can be traced from CP/M through to early versions of MS-DOS and finally to the latest versions written for the IBM PC, PC/AT or compatibles.

When it comes to cost Supercalc 4 is pitched at a pound more than the 1-2-3 asking price of £395. In fact its margin of performance superiority over 1-2-3 would justify a much greater premium but Computer Associates is trying to hit 1-2-3 where it hurts the most.

To run the latest version of Supercalc 4 you need an IBM PC, PC/AT or compatible running DOS 2.0 or later, 256K RAM and a hard-disc system if possible, although dual-floppy discs are acceptable. Supercalc 4 also supports Hercules graphics cards, IBM's colour card and IBM's enhanced graphic adaptor (EGA) system. But it is unlikely that you will encounter problems running Supercalc 4 on any of the true graphics display cards currently fitted in IBM compatibles.

This review was carried out on an Apricot Xen-i fitted with 1Mbyte of RAM and a 20Mbyte hard disc. Supercalc 4 runs in user-definable colours and fortunately the Xen-i



was supplied with a Quadram EGA and high-resolution colour monitor.

The package is supplied on three floppy discs; two cover the program files and the third holds various utilities and samples. Supercalc 4 is not copy protected and can be installed on to the hard disc in a few minutes, after which you can file away the original discs. The package supports over 70 printers plus plotters and can be reconfigured at any time without exiting to the operating system. Many hardware options such as the EGA and Intel 80287 arithmetic co-processor are automatically detected during loading, as is the memory available, so the program can adjust itself accordingly.

SPECIFICATION

Description: advanced spreadsheet with graphics and limited database facilities

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

Copy protection: none

Publisher: Computer Associates International Inc., of Garden City, New York

U.K. distributor: Computer Associates, Micro Products Division, Edinburgh House, 43-51 Windsor Road, Slough, Berkshire SL1 2EQ. Telephone: (0753) 77733

Price: £396

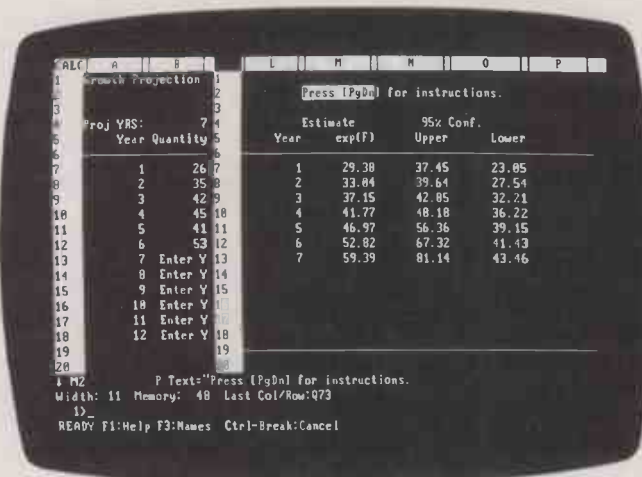
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Supercalc 4 supports a massive 8Mbyte of RAM, which is doubtless needed if the maximum spreadsheet size of 9,999 rows by 255 columns is used. Supercalc 4 also uses data-compaction memory-management techniques to ensure that empty cells do not use up valuable hardware resources, unlike 1-2-3 which uses up memory for the blank cells between rows of data.

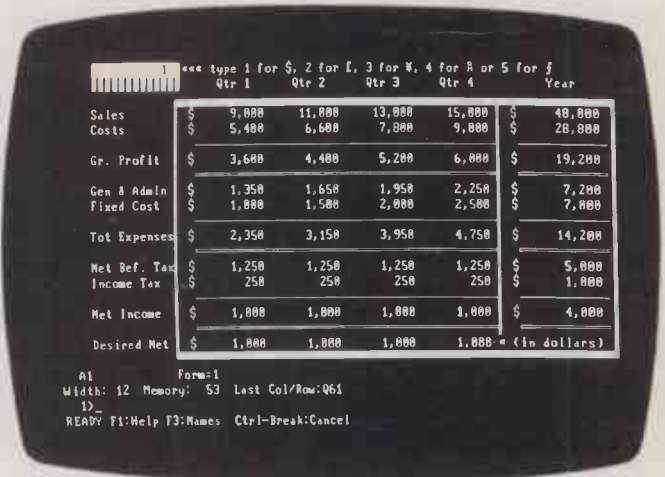
Supercalc 4's user interface is different to many other spreadsheets. The main display is dominated by part of the cell matrix but the bottom four lines are reserved for system and status information. The current active cell reference is indicated along with its contents and the current direction of travel of the cursor.

Anyone familiar with earlier versions of Supercalc will take to version 4 like a duck to water. The traditional way of typing a backlash to enter the command mode and then the initial letter of the function has been retained. The first letter entered only takes you to the first command level, so depending on the complexity of the operation involved you may have to specify several more letters. Generally, Supercalc 4 is more economical on command strokes than 1-2-3 but you may still find yourself entering strings up to five characters long. Supercalc 4 displays the command structure as it is built up from the options available at each level so you can check it before execution.

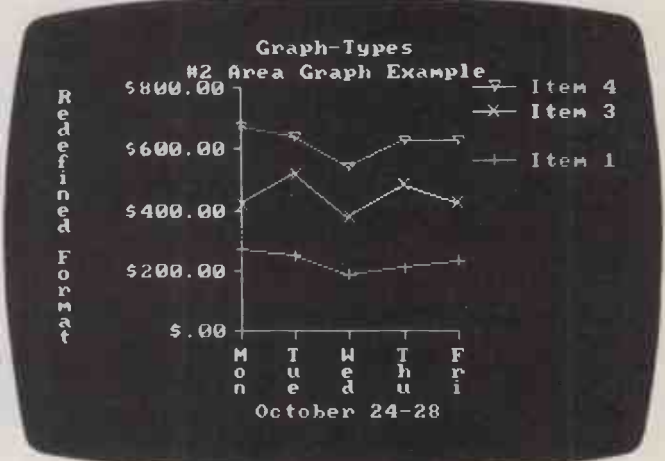
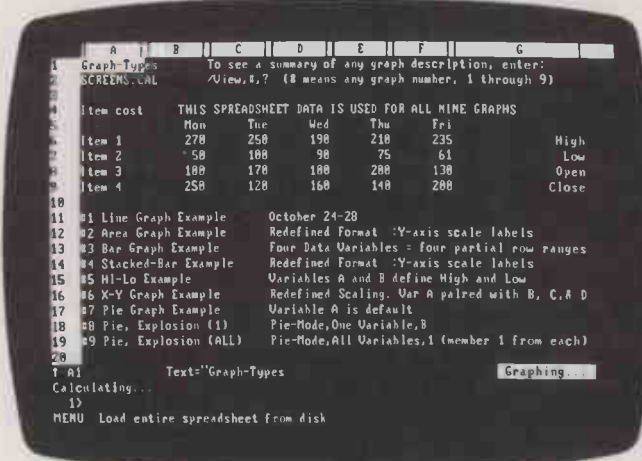
In an attempt to make it easier for 1-2-3



Above: Supercalc 4 offers the facility to have split screens. Below: There are many different kinds of graph available.



Above: You can delete the usual borders and columns. Below: Data can be displayed in graphical form.

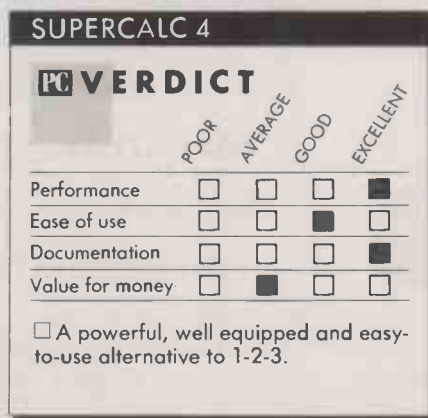


users to convert to Supercalc 4, the backslash command mode has been supplemented by a Lotus-style word menu system with cursor selection. To further aid the transition, the appendix section of the manual includes a dictionary of 1-2-3 commands and their Supercalc 4 equivalents.

Context-sensitive help is always on hand simply by pressing the F1 function key. The help screens are attractively laid out and, with a total file size of 62K, contain a lot of useful information.

As you would expect from a top-class package, all the usual spreadsheet functions can be taken for granted. But even at a basic level Supercalc 4 has some pleasing touches that make life easier. For example, you do not have to type additional characters such as '' to tell the package you are entering text rather than values or formulae. So if you are preparing a table and want to have horizontal dividing lines then entering '' followed by a — automatically creates a whole string of dashes spreading right across the matrix. Fortunately you can put a stop to this by typing in ' at the required point.

Supercalc 4's block-manipulation procedures are aided by a cell-anchoring technique that seems more natural than the rather obtuse method employed by 1-2-3 and Symphony. You can assign names to blocks and then refer to the name in other cells and formulae rather than to the cell



reference. It is also convenient to be able to delete your present worksheet and start again with a new one using the Zap command. Finding previously prepared files is made easier by the excellent file-display facility made available when you use Load command. In addition to displaying all the active file names and their extensions it can be expanded to show the contents of a cell and the graphs associated with that file.

Apart from the usual split-screen techniques, Supercalc 4 also helps you find exactly where you are in the matrix. As the cursor moves around the worksheet, in addition to the normal cell reference which appears in the command line, the relevant

blocks in the horizontal and vertical axes are highlighted in reverse video. This enables the cell co-ordinates to be read off quickly and without having to follow the cursor back to the axes.

Creating graphs with Supercalc 4 is easy. Using the system's defaults you only have to define the range of data to be captured in the graph and then display it using the Show command. You cannot split the screen and show the graph in one half and its associated data in the other, but it only takes a few keystrokes to switch back and forth between the two. Data in the captured range of the matrix can be directly modified and the effects transferred immediately to the graph.

Unless instructed otherwise, Supercalc 4 defaults to producing conventional bar graphs but it offers pie, stacked bar, line, scatter, area and hi-lo graphs too. Each graph can have a main heading, sub-heading and labels for both axes. Shading and colour keys on graphs are generated automatically, and you can have all or some of the segments on a pie chart exploded.

Where Supercalc 4 really scores over 1-2-3 is when it comes to producing hard copy of a graph. With 1-2-3 you have to save the graph as a file, exit 1-2-3 and call up the Print Graph program. With Supercalc 4 you just press F9 and the graph prints out.

Printing spreadsheets is versatile thanks to

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the Sideways print utility. This rotates the worksheet through 90 degrees so that, size permitting, it can be printed in one long strip on continuous stationery. Unfortunately, you cannot invoke it directly through Supercalc 4 so you have to save the file, exit the main program and then call up the utility. Sideways has excellent printer support and you can even select text size. Sideways can be very slow because it prints in graphics mode but Supercalc 4 can print directly in normal- or compressed-character format directly from the worksheet.

Producing professional reports from a spreadsheet is never that successful but Supercalc 4 does include slightly more sophisticated facilities than some of its competitors. Multi-line headers, footnotes, automatic page numbering and multiple copies are all supported and you can preview a report on-screen prior to printing.

DATA MANAGEMENT

As with 1-2-3 a limited data-management module is included. It enables users to find and extract data from a defined block stored in the conventional spreadsheet format. Data files can be up to 9,998 records long with up to 255 fields per record.

There is little to choose between the macro facilities of Supercalc 4 and 1-2-3 version 2. Macros are used to automate repetitive procedures such as data entry and report preparation. They can be prepared in

two ways. The first and easiest method is to use the Learn mode whereby a user's keystrokes can be memorised by the package, saved to disc and invoked later as required. The second way is to write a program in the macro language either directly into the specified spreadsheet cells or by using a word processor. Completed macros can be edited and linked together. Supercalc 4 can store a library of macro files on disc and apply them to more than one spreadsheet. Unlike 1-2-3 which is limited to one-character definers, in Supercalc 4 macros can be given names up to 32 characters long.

Supercalc 4 can also read 1-2-3 macros, and this facility extends to reading and writing 1-2-3 release 1A and 2 data files using the Import and Export commands. Supercalc 4 can read and write files from all earlier versions of the product plus ASCII and DIF files. Once again all Import and Export operations can be achieved without exiting the main program.

Supercalc 4 has an expanded list of ready-made functions covering mathematical, index, calendar, financial and statistical areas of operation. Generally, for every 1-2-3 function there is an equivalent one in Supercalc 4, but in Supercalc 4 you do not have to prefix functions with @ or +.

Supercalc 4 certainly seems fast in operation. This is partly due to the performance of the hardware, and the Xen-i is extremely quick. However, when

Supercalc 4 is run on more mundane equipment the package is still impressive. Setting up a model in Supercalc 4 is also considerably quicker than with, say, 1-2-3 or Smart.


Although Supercalc 4 will run happily on a PC network there are no integral file or record-locking procedures. This means that if two users try to access the same item of data at the same time there is a high risk of the data being corrupted. Computer Associates is planning a fully secure network-compatible version by the end of the year.

Supercalc 4 is supplied with impressive documentation contained in an A5 ring-bound manual. It includes Getting Started, Reference and Tutorial sections. Its presentation and content are hard to fault, and great attention is given to 1-2-3 users as well as those familiar with earlier versions of Supercalc.

CONCLUSIONS

■ Although Supercalc 4 is not a 1-2-3 clone it is undoubtedly aimed at enticing 1-2-3 users to desert the 1-2-3 camp. It is more powerful than 1-2-3 in almost every aspect of operation. It is also easier to use.

■ However, Supercalc 4 lacks 1-2-3's corporate pedigree and cannot boast as many third-party add-ons.

■ At £396 the package is reasonable value for money. But Computer Associates may need to drop the price if it wants to threaten 1-2-3's domination seriously. 

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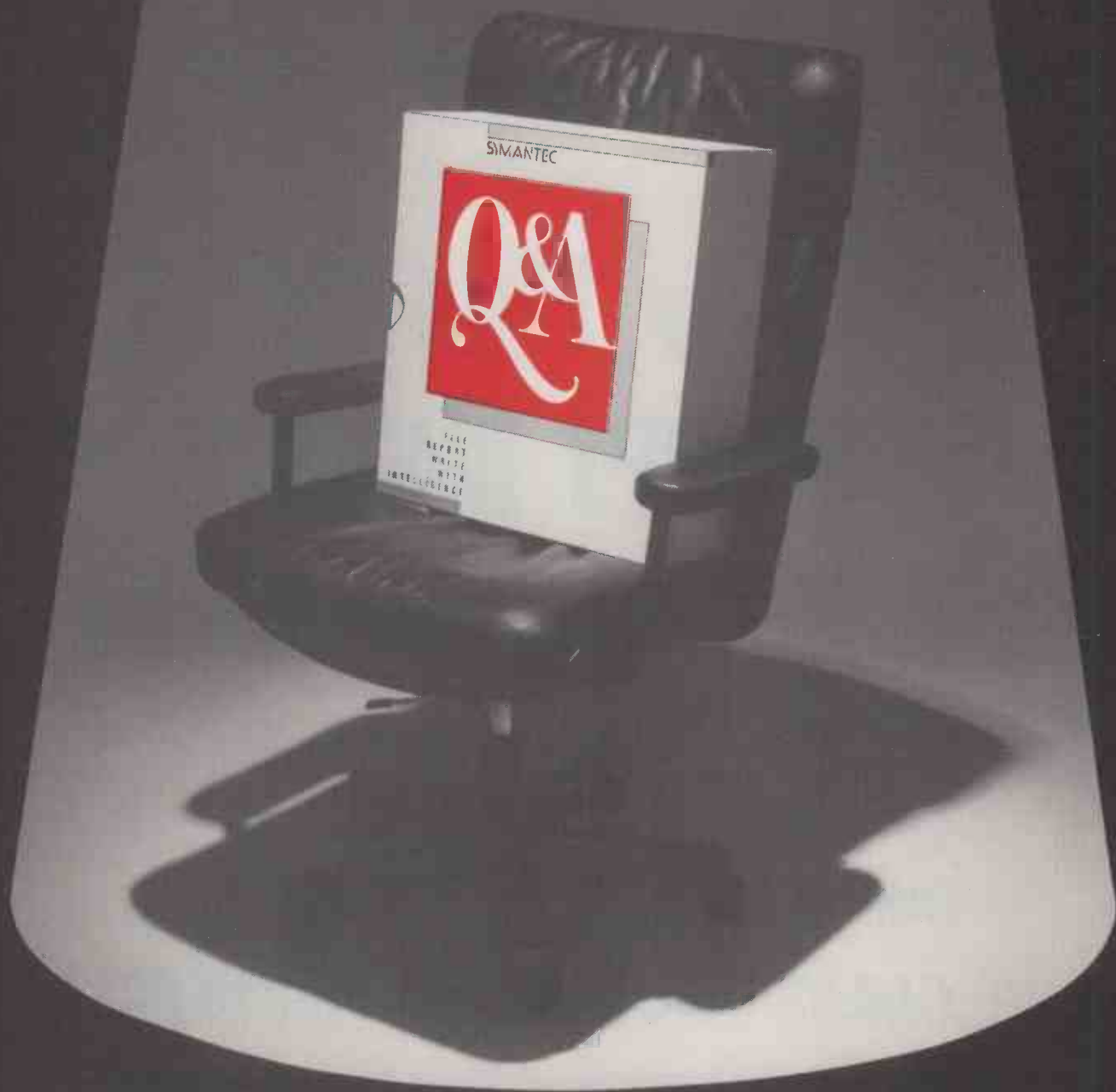
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Q. What's so special about Q&A?

A. It is a new file management system with an Intelligent Assistant capability. This means it can understand questions and instructions put to it in plain English.

Q. Correct. How does the Intelligent Assistant work?

A. By using its own built-in vocabulary and the way you talk so it can get smarter the more you use it.

Q. Correct. Anything else?

A. Yes. By being able to answer follow-up questions and make simple inferences so you don't have to explain everything.

Q. Correct. What makes Q&A the quintessential manager's tool?

A. Its sheer versatility and ease of use combined with its incredible word processing power enabling it to write, edit, merge and print at lightning speed.

Q. Correct. Who could use Q&A?

A. Anyone in business or the professions who needs to keep records, lists

and files of customers or employees, for instance, and could make use of a word processor.

Q. Correct. And is Q&A expensive?

A. No. At £250 it's about half the price of many other well-known products – so Q&A helps you manage your budget, too.

Q. Correct. What is the other big deal about Q&A?

A. The special offer whereby you give Paradigm your old "unintelligent" Database or Word Processing software and they will give you a ½ length 256K memory board to increase your PC's power – ABSOLUTELY FREE.

Beep . . . Beep . . . Beep . . . Beep . . . Beep . . . Beep . . .

Thank you Q&A. At the end of that round you have scored top marks for your understanding of English and the speed of your answers.

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ATARI ST



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520ST PACKAGES

The 520ST-M keyboard costs only £346.96 (+VAT-£399) and includes an RF modulator and cable, allowing you to connect it to an ordinary domestic TV set. The keyboard is supplied with 512K RAM, a mouse and a free set of 3 1/2" disks containing applications software. For a limited period from August 11th 1986, we have some special packs offering combinations of the 520ST-M keyboard with a 1/2 Mbyte SF354 Atari disk drive and an Atari monitor (either the Mono SM124, or Colour CM36512). These packages offer up to £200 extra discount on a system. If purchased from Silica, they also come with our free 'ST STARTER KIT'. All of the pack prices shown in the chart include VAT.

UPGRADE TO 1024K RAM

We are pleased to be able to offer a 1Mbyte upgrade on the standard 520ST keyboard to increase the memory from 512K to a massive 1024K. It has a full 1 year warranty and is available from Silica at an additional retail price of only £86.96 (+VAT-£100). Any of the five packs can be upgraded to 1Mbyte for only £100. The 1Mbyte ST offers a low price alternative to the 1040, but also gives you the benefit of an RF modulator (not normally fitted on the 1040).

DISCOUNT	ALL PACK PRICES INCLUDE VAT	PACK 1	
£100 DISCOUNT 1 DISK DRIVE	Keyboard	£399	
	Disk Drive	£149	
	Normal Price	£548	
	Discount	£100	
		PACK PRICE	
£150 DISCOUNT 2 DISK DRIVES + MONITOR	PACK 2 (MONO)		
	Keyboard	£399	
	Disk Drive	£149	
	Disk Drive	£149	
	Mono Monitor	£149	
	Normal Price	£846	
Discount	£150		
PACK PRICE	£696		
£200 DISCOUNT 2 DISK DRIVES + MONITOR + PRINTER	PACK 4 (MONO)		
	Keyboard	£399	
	Disk Drive	£149	
	Disk Drive	£149	
	Mono Monitor	£149	
	Printer (SMM804)	£199	
Normal Price	£1045		
Discount	£200		
PACK PRICE	£845		
		PACK 3 (COLOUR)	
Keyboard	£399	Keyboard	£399
Disk Drive	£149	Disk Drive	£149
Disk Drive	£149	Disk Drive	£149
Colour Monitor	£299	Colour Monitor	£299
Normal Price	£996	Normal Price	£1150
Discount	£150	Discount	£200
PACK PRICE	£846	PACK PRICE	£995
		PACK 5 (COLOUR)	
Keyboard	£399	Keyboard	£399
Disk Drive	£149	Disk Drive	£149
Disk Drive	£149	Disk Drive	£149
Colour Monitor	£299	Printer (SMM804)	£199
Normal Price	£1195	Normal Price	£1195
Discount	£200	Discount	£200
PACK PRICE	£995	PACK PRICE	£995

REDUCED PRICES

Atari's ST personal computers are now firmly established both in the USA and Europe. The main attraction of the ST range is the value for money which these computers represent, giving both private and business users a powerful asset at a very modest price. There are now several ST packages available from Silica at a reduced price, further enhancing the Atari 'Value for Money' reputation. In addition, we are giving away a FREE Silica 'ST STARTER KIT' with every 520 or 1040 ST purchased at Silica Shop. These offers will only be available for a limited period and commence on 11/8/86.

POWER FOR BUSINESS

The list below shows some of the new business products which have been recently launched for the Atari ST range. It gives an indication of the ST's potential to business buyers looking to install a powerful, low-cost system:

CP/M EMULATOR	IBM COMPATIBILITY
20Mbyte HARD DISK	VT100 EMULATOR
LOTUS 123™ CLONE	MICROSOFT WRITE
dBASE III CLONE	dBASE II

Any ST computer will provide its user with a very powerful asset, utilising a vast range of applications, particularly in the business world. Many software companies have been quick to recognise it for its business potential, and have produced programs for the ST which harness this potential. In addition, there are several peripheral and hardware products becoming available to add to the ST's 'Power For Business'. Software now available includes dBase III clone as well as H.D Base, a dBase II clone. In fact, First Software have now launched Ashton Tate's original dBase II program for the ST. In addition, PC Intercom is a VT100 emulator which enables you to use any ST keyboard as a terminal connected to a mainframe or mini. Other programs include a powerful accounts package by Cashlink and a Lotus 1-2-3™ clone called VIP Professional. Microsoft have announced that their powerful word processor 'Microsoft Write' will soon be available for the ST. Many packages are available for very specific market applications including a powerful CAD (Computer Aided Design) program called Easy Draw from Migraph. In addition, there is an engineering tool called PC Board Designer by Abacus Software which will enable the user to design printed circuit boards. For further details of how the ST can help in your business, return the coupon below. We will be pleased to send you our latest newsletter and price list.

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We hope you will find that the combination of our low prices, FREE delivery service, FREE Starter Kit and after sales support, will be enough to make you buy your Atari equipment from Silica Shop. If however, there is something you wish to purchase, and you find one of our competitors offering it at a lower price, please contact Owen Pascoe (Office Manager), or one of the telesales staff in our sales department. When you telephone us, please provide us with our competitors name, address and telephone number. Providing our competitor has the goods in stock, we promise to match his offer (on a 'same product - same price' basis) and still provide you with our normal free delivery. You will also be entitled to our full after sales service, including free newsletters and technical helpline support. We don't want you to go anywhere else for your Atari products. So shop at Silica, the U.K.'s undisputed No1 Atari specialist.

FREE SOFTWARE

When you buy a 520 or 1040 ST computer keyboard from Silica Shop, you will receive a large and varied software package free of charge. This package consists of twelve programs. Wherever you purchase your Atari ST computer, you should receive the first six software titles as standard. However, if you purchase your ST from Silica, you will also receive a further six extra titles, giving you a total of twelve. All ST's now have TOS/GEM already installed on ROM, so the list of free software you should receive is as follows:

- 1) GEM - DR Desktop environment with WIMP (fitted in ROM)
 - 2) TOS - Tramiel Operating System (fitted in ROM)
 - 3) 1st WORD - Word Processor by GST using GEM
 - 4) BASIC - Personal Basic by DR (with manual)
 - 5) LOGO - Logo language by DR (with manual)
 - 6) NEOCHROME - A powerful colour paint and graphics package (only useable with colour systems)
- If you purchase your ST from Silica, not only will you receive the standard six pieces of software as listed above, but we will also give you the following six additional programs FREE OF CHARGE.
- 7) MEGAROUNDS - Asteroids type game by Megamax
 - 8) DOODLE - Simple paint/doodle drawing package (works on mono or colour systems)
 - 9) CP/M EMULATOR - Allows use of DR's Z80 CP/M software to run on the ST range
 - 10) CP/M UTILITIES - Various utilities to use with CP/M
 - 11) DEMONSTRATION & PUBLIC DOMAIN SOFTWARE - Various games, demos and accessories
 - 12) CARDS - A unique set of card games from Microdeal
- These additional free software titles are all part of the FREE Silica 'ST STARTER KIT'. Return the coupon below for further details.

FOUR FREE MANUALS

- In addition to the free software which will be given to you when you buy your ST from Silica, you will receive four free manuals:
- 1) ST OWNERS MANUAL (80 pages): Easy access to the information you require to unpack, set-up and become familiar with the ST.
 - 2) ST BASIC SOURCE BOOK & TUTORIAL (240 pages): Gives you the information to increase your level of programming expertise.
 - 3) ATARI LOGO SOURCE BOOK (77 pages): A source book for Logo, showing how to use the language in the GEM environment.
 - 4) 1st WORD MANUAL (48 pages): Instructions for 1st Word.

ST NEWSLETTER

8 PAGES OF INFORMATION TO HELP YOU TO DECIDE RETURN THE COUPON FOR A FREE COPY

1040ST-F

For the businessman and the more serious home user, there is the 1040ST-F with 1028K RAM. This can be used in a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F keyboard with integral 1Mb disk drive costs only £699 (+VAT-£803.85). As the 1040ST-F was manufactured solely with business use in mind, it does not come with an RF modulator for use with a domestic TV. Instead, it requires a monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

- 1040 Keyboard Without Monitor - £699 (+VAT- £803.85)
- 1040 Keyboard + High res mono monitor - £799 (+VAT- £918.85)
- 1040 Keyboard + Low res colour monitor - £899 (+VAT- £1033.85)
- 1040 Keyboard + Med res colour monitor - £999 (+VAT- £1148.85)

The 1040ST-F includes 1Mbyte of RAM as well as a 1Mbyte double sided disk drive and mains transformer, both built into the keyboard to give a compact and stylish unit, with only one mains lead. The 1040ST-F is supplied with a set of software disks as well as our own FREE Silica 'ST STARTER PACK'. Call into your nearest branch of Silica Shop for a demonstration.

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117 Orpington High Street, Orpington, Kent, BR6 0LG
Lion House (1st floor), 227 Tottenham Court Rd, London, W1
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WORD PERFECT LIBRARY

SSI'S SIDEKICK

By Susan Curran

A valuable set of desk utilities is now available for users of Word Perfect and Mathplan.

Word Perfect from SSI has quickly established itself as one of the leading top-class IBM-compatible word-processing programs. Its new Library utilities add an impressive range of Sidekick-type capabilities including a card-index, a calculator, a diary and a macro/program editor. Word Perfect Library provides an integrated shell for Word Perfect, SSI Mathplan, and the utility programs.

Other programs can be added to Library's front end, but inevitably they will not have all the program-switching and data-sharing capabilities of the SSI products. Some of the utilities can be used quite separately, but many are clearly orientated to Word Perfect and Mathplan users. The program comes with a manual of over 300 pages in standard IBM slipcase format, which includes separate setup and tutorial sections for each utility.

Library starts with a shell, which loads some or all of the programs into memory. You choose which ones, depending upon the memory available and your normal preferences. The shell provides a menu — with sub-menus if you like — which makes both these and the non-resident programs available at a single keystroke. There is a good setup procedure which enables you to switch directories and to designate specific startup options, including a chance to give user input, for each program.

The manual gives very full information about the system's memory-handling and the memory requirements of each individual program. The shell itself provides a memory map, along with facilities for you to juggle the memory contents so that different programs can be co-resident at different times. It is desirable to have at least 384K of RAM to run the system. This would allow either Word Perfect or Mathplan to remain resident with the utility programs. It is also desirable to use a hard-disc system, though Library will work with floppies. The system can handle programs that together occupy more than 640K of RAM if you have a suitable expanded memory board.

The shell contains a clipboard which can hold 5K of data for direct transfer from any compatible program to another. The shell also has its own sophisticated macro features; and will allow access to the DOS

commands. It is then possible to return to the shell from compatible programs so that you can do a quick calculation or check your diary without exiting from the resident program. The utility programs replace the original program on-screen, and each one takes up the entire screen area.

It is also possible, memory permitting, to start the same program repeatedly. You might, for example, run two copies of Word Perfect simultaneously. With two documents being edited in each this would give you four documents in all, rapidly switchable.

The calculator saves all calculations to a scrolling display which can be printed, saved to disc or transferred to the clipboard and to other programs. It has one main register and

unless you specify a.m. or p.m. by using a or p suffixes or a 24-hour clock. There is a temporary buffer which makes it reasonably simple to set the same appointment or To Do at regular intervals, though you cannot directly replicate appointments, say, for each Monday morning. It is a minor niggle that the system insists on using the American month/day/year format.

Different calendars can be set up for different individuals, and combined if desired. Lists of appointments, To Dos and the rest can be printed on a daily, weekly or other basis. There is a range of printer options that includes printer setup strings, bold on/off strings, and variable page lengths. For those who find these insufficient, it is easy to transfer the data to the clipboard and thence to Word Perfect. Among the other nice touches are a word search, as well as a date search. Past appointments may be saved in an archive file.

The File Manager utility will work with any directory, including those otherwise unconnected with the Library programs. It will list all files in a directory, or any specific subset of them. Files may be selected either with wild cards or according to criteria such as specific date or before/after specific date. They can also be sorted by file name, by file extension or by date and time.

The usual Copy Delete and rename options can be carried out on individual files or on marked groups. Among the extras are a Password option and a Quick Look option. You can also do a word search through the contents of whole directories or selected files, which will cope with wild cards, and And, Or and Not multiple criteria.

NOTEBOOK UTILITY

The Notebook utility creates a database of the card-index type. It is more useful than many in that it does not use a fixed format. It will handle as many fields as will fit on a single screen. Each field may be up to 2,000 characters long, but the same 2,000-character limit applies to complete records. Fields of more than one line will scroll in their own mini-window, which is very handy; one-line fields have fixed lengths.

Depending upon record size, the program will handle a maximum of between 500 and 1,000 records. Multiple-record files can be set up for different types of record.

The records are displayed both in list and card formats. You write your own screen, complete with headings, and if you do not mind juggling between the Notebook and

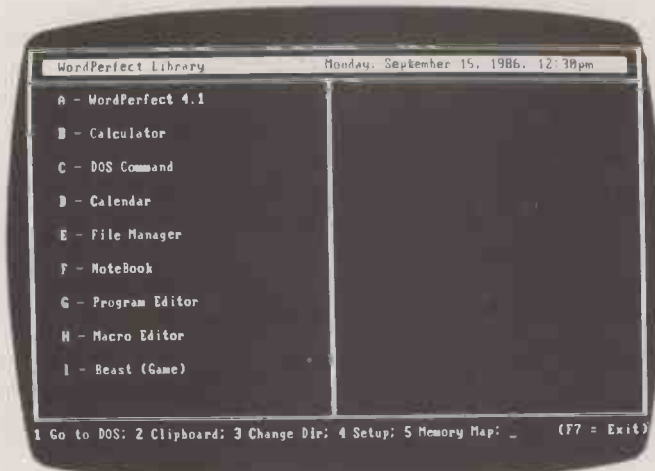
WORD PERFECT LIBRARY				
VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>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

A very desirable utility for Word Perfect and Mathplan users.

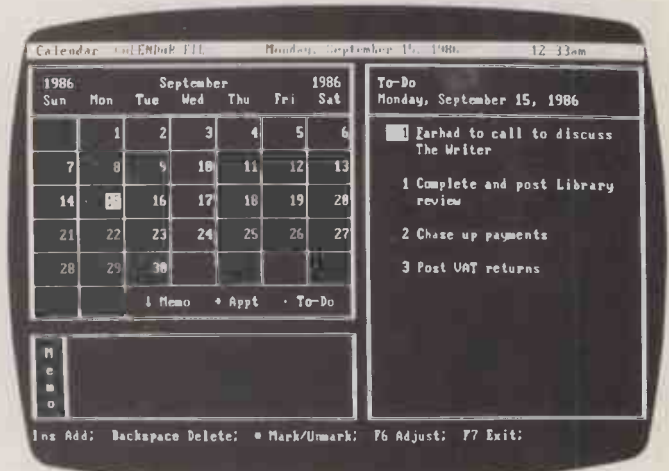
one memory register. It will display numbers in fixed- or floating-point decimal, exponential format, hex, binary or octal. Its built-in functions include financial ones such as interest rate, and present and future value; programming functions, including complements, shift and rotate, and two-variable And, Or, Xor and Mod; and logarithmic, trigonometric and other scientific functions.

The calendar displays dates month by month for the years 1600 to 2000. It shows a wall-calendar type of display, with space for each day's appointments and memos. The months and years can be paged quickly and neatly. On any individual day, appointments can be set, and there is an alarm interrupt if you need it. A To Do list can be drawn up, and a memo of up to 255 characters can be written. All entries wordwrap neatly as you type them in.

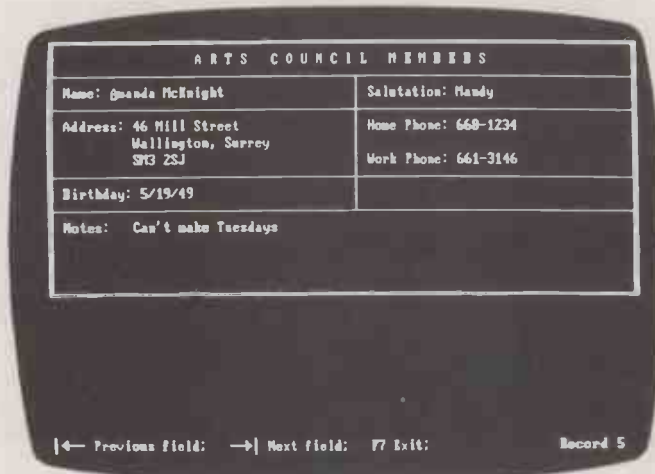
The calendar operation is well designed. It will, for instance, automatically assign appointments to within the business day



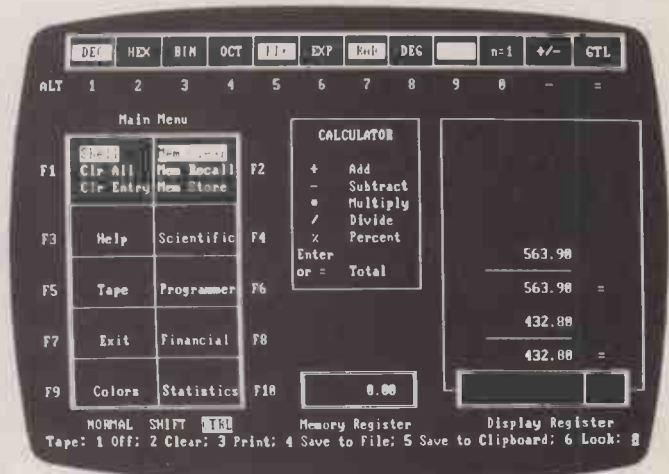
The Word Perfect Library shell contains the main menu. You can load some or all of the programs into memory.



The calendar allows you to draw up lists and flag appointments with alarm interrupts as a reminder.



The Notebook utility can display records in list or card format. Phone numbers can be autodialled from a suitable modem.



The calculator saves calculations to a scrolling display which can be printed, saved to disc or transferred to the clipboard.

SPECIFICATION

Description: utility package with menu-orientated front end, calculator, calendar/diary, file manager, notebook-type database, program and macro editors; supports Word Perfect 4.1 and Mathplan; does not perfectly support earlier versions

Hardware required: IBM PC, PC/AT or compatible with at least 384K of RAM and DOS 2.1 or later; hard disc is recommended

Copy protection: none

Price: £149
Publisher: SSI Software, Orem, Utah
U.K. distributor: Sentinel Software, Wellington House, New Zealand Avenue, Walton-on-Thames, Surrey KT12 1PY. Telephone: (0932) 231164

Available: now

Word Perfect you can add neat line drawings. In list format you see as many fields from each record as will fit on an 80-character line. Their order and their length — which is not necessarily the same as the field length — are both selectable. Lists are automatically sorted alphabetically with numbers before letters on multiple fields from left to right.

Individual records and groups of records can be selected for saving to the clipboard or file, and for printing. Notebook files are interchangeable with Word Perfect merge files. There is an all-field or selected-field search capability, and existing record formats can be amended at any time. In the same way you can add new fields or delete old ones. The program will also autodial sorted phone numbers if you have a suitable modem.

I found the Notebook less easy to use than most of the other utilities. The program depends on function-key assignments for which no keyboard template was provided. Instead you have to call up an on-screen template via the Help facility.

The Macro/Program Editor is made up of two separate utilities, but they act in a very similar way and share a section in the manual. The Macro Editor is a particularly valuable feature for Word Perfect users, since the program has a very powerful macro feature whose results have hitherto been uneditable. Editing macros is complicated by the elaborate codes with which they can be stuffed, but the Macro Editor makes the process as easy as could reasonably be expected. The incomprehensible short codes which are stored in the macro files are ex-

panded by the editor into more comprehensible ones, and you can add comments to make them clearer still.


The editing facilities are similar to normal Word Perfect editing. They include block and line Delete, Move and Copy options, dual-file facilities, and a full Search and Replace command. If you want to examine the machine code the whole file can also be converted into a split-screen ASCII/hex display.

The Macro Editor makes it possible to set up and edit very long macros. For instance, you could set out the outline of a complex memo or invoice, with chunks of fixed text, the current date, and prompts for inserting variable text.

CONCLUSIONS

■ Library is well designed and well executed. It has a neat front end, and there are many thoughtful touches in each of its sections.

■ If £149 seems a lot to pay for a Sidekick-type package, bear in mind that you can pay as much just for a database of this quality.

■ Though the Notebook, Calculator, Program Editor and Calendar are all usable as stand-alone programs, the package is really designed for Word Perfect and Mathplan users. 

EQUALS 22

PROBLEM SOLVER

By Glyn Moody

Suitable for financial and scientific applications, this tool will plot graphs from formulae and solve equations.

Irish software house Flite rather grandly calls its package Equals 22 an equation processor. What it actually does is solve and derive equations which typically might be in financial or scientific applications. In addition it will plot graphs from formulae, find their integral, work out their gradients, and solve sets of simultaneous equations. In some respects it is the inverse of a spreadsheet; where a spreadsheet combines data, to give a final result, Equals 22 splits it up and analyses it.

Equals 22 runs on the IBM PC family with graphics or colour cards and costs £199. Setting it up is very easy. Equals 22 is not copy protected, so you simply copy it across to the hard disc or to a disc with DOS on it.

The initial menu of options presents you with a choice of curve-fitting, graphs and analysis, simultaneous equations or returning to DOS. The first two options appear very similar on-screen. On the left there is a command window and on the right the various graphs. At the bottom of the screen there is an area for displaying status comments and the formula currently in use. This formula can have up to 160 characters, and is set out in a standard form.

On the left-hand side of the equation is the dependent variable, normally taken to be y, followed by an = sign. On the right there then follows a formula in the independent variable, conventionally represented by x. The formula can contain powers of x as well as functions like sine, cosine, natural logarithm and exponential.

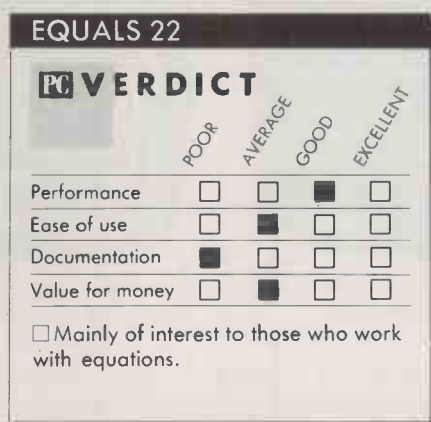
Working from the Graphing and Analysis screen, the formula is either entered manually, or pulled in from file. Both operations are initiated from the control menu, either by using the cursor keys to select the required option, or by using a letter — usually the initial one of the command. Underneath the command window there is a small help window which gives brief details about the command currently selected.

Once a formula has been entered, it can be edited by selecting the Edit Equation option. One disconcerting facet of Equals 22 is that the ordinary Delete key acts as a Backspace Delete key. Once the formula has been corrected, it can be graphed.

Equals 22 takes 1,000 points in the

independent variable and calculates the value of the function at those points, and then displays them. A running total of how far the computation has proceeded is displayed in the bottom right-hand corner of the screen.

Normally two small graphics windows containing graphs are displayed, as well as the command window. The latter can be removed by pressing f1 which toggles it on and off. From the command window menu you can merge the two graphics windows to make one large window, reduce the graph axes, and move the position of the origin of the graph. If you choose to have two windows you can move between them.



Formulae can be saved to disc for later retrieval but Equals 22 is unsatisfactory in that it does not check whether you wish to overwrite already existing files. Both saving and loading are handled from the command menu as is a command for producing the differential graph, which is a plot of how the gradient of the curve varies.

Choosing the calculator option from the command menu brings up a subsidiary menu. From here you can obtain the roots of the curve — where it crosses the y-axis — using a standard iteration method called Newton-Raphson. You provide an initial guess, and then the program uses iteration to get closer to the root. Equals 22 will perform up to 20 iterations, and works to an iteration accuracy of 0.0001. You can also obtain the integral of the curve — the area underneath part of it — and various statistical properties. It is also possible to print out a graph.

Selecting the curve fit option from the main menu takes you to a similar screen, but with only one graph. In addition to the command menu, which now contains slightly

different options, there is a box labelled with x and y as rows and numbers as columns. This allows you to feed in pairs of data points for curve fitting, which you might do if, say, you were trying to work out a trend in sales figures as the year progressed.

You have the option of feeding in both x and y sets of figures or else setting a constant x increment and feeding in only the y figures. It is also possible to bring in figures from Lotus 1-2-3 files. Once the numbers have been entered, and edited if necessary, you can choose to fit a variety of curves, from straight lines to quintic curves. Equals 22 uses best fit methods to find the coefficients which give the closest match to the data points.

Equals 22's error-trapping seemed weak here. Fitting a curve to sample data I entered produced a note that a "fatal termination has occurred" because an integer greater than Abs(32768) had been produced. I was then dumped straight to DOS. To give the program its due, it did at least save my file under the aptly named file Crisis. But for such a minor error, this is unacceptable behaviour.

LOGARITHMIC CURVES

Once a curve has been obtained, various operations can be applied to it, like finding its gradient everywhere. In addition to using ordinary polynomials like quintics, you can also enter your own functions. For example, you might be looking for a logarithmic or inverse power law, neither of which can be accurately represented by ordinary polynomials.

The final option from the command menu is to solve simultaneous equations. Typically you might have a series of equations of the form

$$\begin{aligned} 3x - y + 4z &= 2 \\ x + y - z &= 7 \\ 2x + 4y - 2z &= -3 \end{aligned}$$

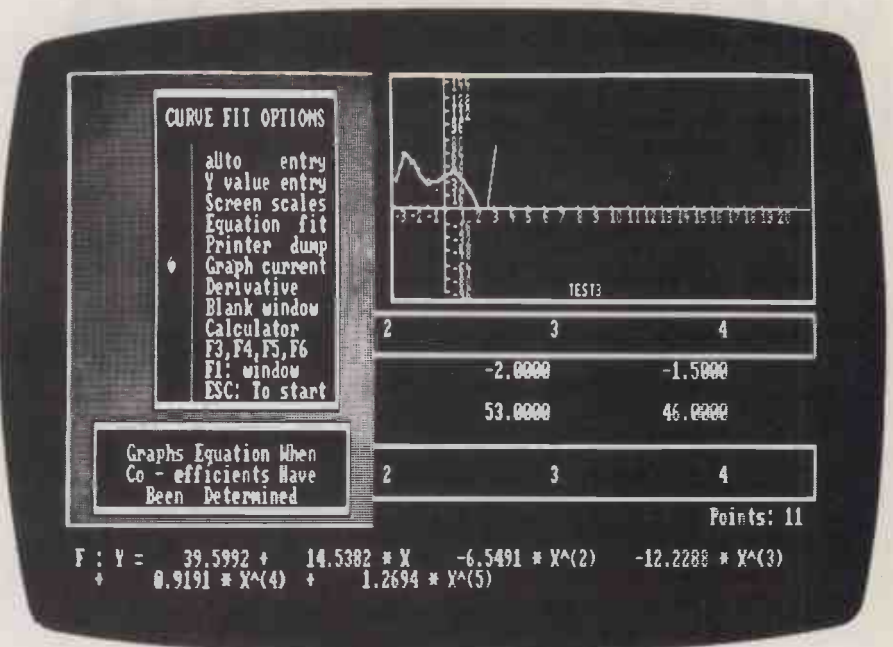
You will be looking for values of x, y, and z which satisfy these constraints. Equals 22 provides you with a spreadsheet-like grid in to which you enter the coefficients. In this case

3	-1	4	2
1	1	-1	7
2	4	-2	-3

The right-hand side coefficients are entered as the last column. You can then press C to initiate the calculation, which is performed before your eyes as the coefficients are adjusted until most of them are

SPECIFICATION

Description: a tool for plotting graphs from formulae, fitting curves, and solving simultaneous equations
Hardware required: IBM PC, PC/AT or compatible with at least 256K; graphics or colour adaptor
Copy protection: none
Price: £199
Publisher: Flite Software Ltd, Pearse Road, Letterkenny, County Donegal, Eire. Telephone: (010 353 74) 23023
U.K. distributor: General and Engineering Computer Services Ltd, Cunard Building, Liverpool L3 1EG. Telephone: 051-236 1687
Available: now



Above: The curve fit option allows you to feed in pairs of data points for curve fitting. Below: Windows contain the command menus, which can be moved around on-screen.

zero. The results are then printed at the bottom of the screen. For the example given the answers are $x = 7.9$, $y = -8.5$ and $z = -7.6$.

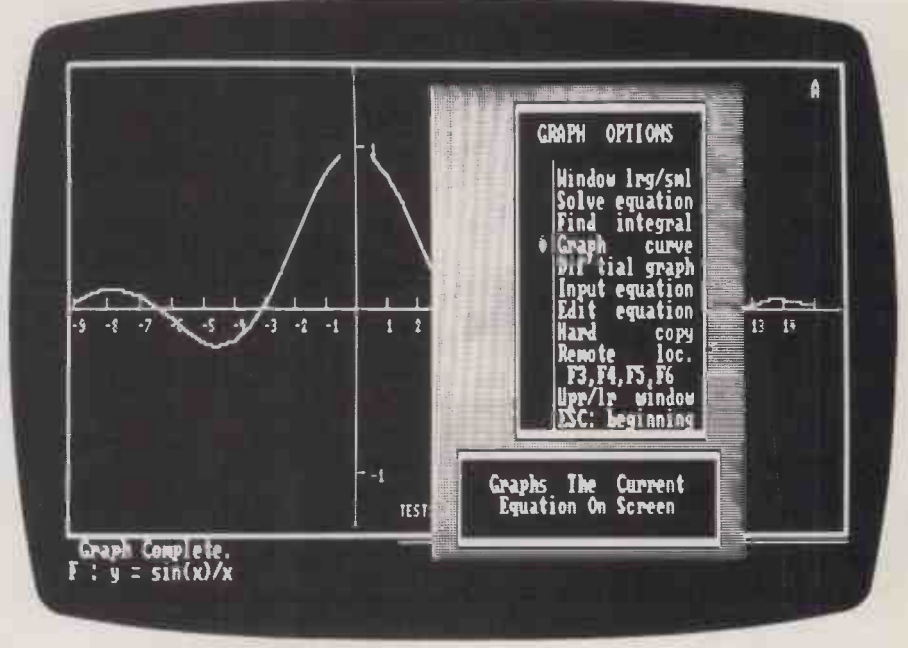
In operation Equals 22 is quite fast. When drawing a graph with its 1,000 points, it is noticeable that the speed depends on the complexity of the formula. Roots of equations are found very quickly, and the solving of simultaneous equations also proceeds at a decent rate. Where the program falls down badly is in the constant redrawing of the command menu window, complete with neat borders which take some time to draw.

Equals 22 is also let down by a slightly rough manual which looks half-finished. The explanations are not really clear enough for the layperson though there are some useful worked examples. Overall, considering Equals 22 deals with such complex subject matter more help would have been useful.

In a world overburdened with ordinary spreadsheets Equals 22 is interesting because it is different. It is likely to be of most use to the analyst and scientist rather than the ordinary executive. Some background knowledge of the maths which lies behind the product is a great help. For anyone who needs to fit curves to data points or manipulate formulae, Equals 22 is worth considering, though it might be better to wait for a later release.

CONCLUSIONS

- Equals 22 plots graphs from formulae, and fits curves to data points.
- Its window-like environment is rather slow, and more of a hindrance than a help.
- The manual is not very helpful, but the on-screen help goes some way to alleviating this.
- Equals 22's speed of operation looks good for small problems, but may deteriorate for larger ones.



Equals 22 can solve simultaneous equations. Coefficients are entered into a spreadsheet-like grid and the results are displayed on-screen.



WORD WIZARD LIGHTNING CONDUCTOR

By Mike Lewis

Borland's latest package provides access to Turbo Lightning's word-reference features from within other applications.

When Borland International released Turbo Lightning earlier this year it was billed as something far more exciting than an ordinary spelling checker. Its highly sophisticated text-handling techniques were to form the basis of a new range of word-orientated products. There was also to be a library of major reference works all accessible from within normal application programs.

Borland's newest product, Word Wizard, is the next step along that road. It is really two packages in one. First, there is a bundle of clever word games and solvers, based on the Lightning dictionary and thesaurus. Secondly, it provides the means of accessing the Turbo Lightning engine from within other applications. This second part is aimed squarely at programmers.

But no programming knowledge is needed if you just want to play the games. There are seven of them, all supplied ready to run. They range from the compulsive Akerue to a fairly simple anagram solver. What makes the games special is their use of the on-line dictionary. For example, in Akerue you have to spot all the words that can be made from adjacent letters within a grid. You could do this on paper just as easily, except that in the Word Wizard version the words are checked as you type them, with the program rejecting any attempts which it considers invalid.

The sting comes when you think you have finished and ask the software to show you the words that you missed. However many

SPECIFICATION

Description: programmers' toolbox for Turbo Lightning plus seven word games

System required: IBM PC, PC/AT or compatible, with 256K RAM; Turbo Lightning required; Turbo Pascal version 3 or later required to compile supplied source code

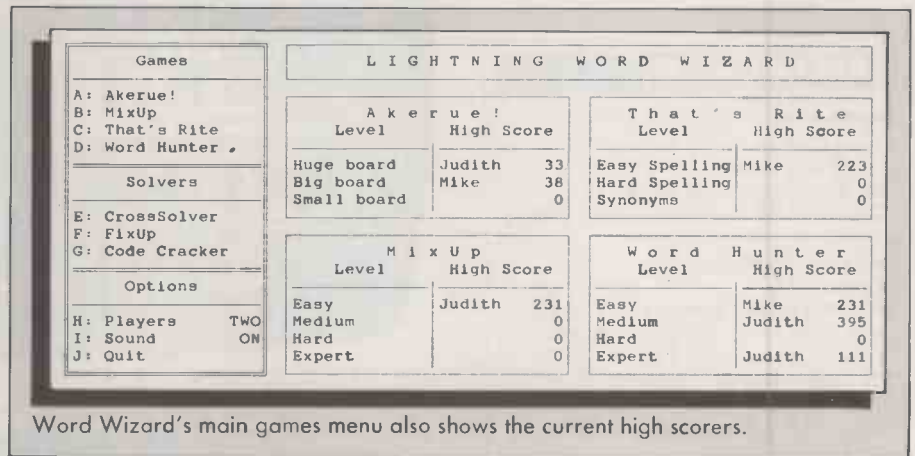
Copy protection: none

Price: £49.95

Publisher: Borland International, Scotts Valley, California

U.K. distributor: Altor, 11a Anderston Centre, Glasgow G2 7PH. Telephone: 041-226 4211

Available: now



Word Wizard's main games menu also shows the current high scorers.



you found, the program will inevitably point out dozens more. The fact that it only takes about a minute to check many thousands of combinations against the 150,000-word hard-disc dictionary speaks volumes for the efficiency of Turbo Lightning.

The games have a more serious side too. All the programs in this part of the package come with commented Turbo Pascal source code, providing a detailed example of how to call on Turbo Lightning within your own programs.

There are many reasons for wanting to do this. Borland suggests that "you could write a natural-language interface to any program's vocabulary". More realistically, you could build a specialised spelling checker into an application, or perhaps use a customised dictionary to check entries in a database. You could also produce a text-compression routine, using Lightning's three-byte word numbers as tokens.

To help you do all this Word Wizard incorporates a library of Turbo Pascal functions and procedures, of which 24 are geared specifically to Turbo Lightning. They

include functions to look up individual words, to find all words with certain characteristics, to search for synonyms and sound-alikes, and plenty more. Other routines perform more general tasks like manipulating windows.

You also get the source code of a complete ready-to-use help system. It comprises a program to index and compress a help file, and a Pascal procedure for displaying help panels in their own windows, like some other routines in the Word Wizard library, the help system can be used independently of Lightning.

You do not have to use Turbo Pascal to access Turbo Lightning as it can also be reached via a set of interrupt calls. The Word Wizard manual contains all the information you need for the calls. There are descriptions of the Pascal functions and procedures too, but unfortunately, Borland has omitted details of the data types, constants and global variables used, so this part of the documentation must be read in close conjunction with a source listing. This omission, together with a large number of misprints, are the only things that spoil an otherwise excellent product.

CONCLUSIONS

■ Only a serious player of word games would buy Word Wizard for the games alone. Still, they are well designed, moderately educational and fun.


■ The real market for the package will be software developers who want to access a dictionary or thesaurus — and eventually other reference works — from within their own programs.

■ If the idea takes off, it will lead to increased sales of Turbo Lightning; this in turn will encourage the writing of more programs which use it.





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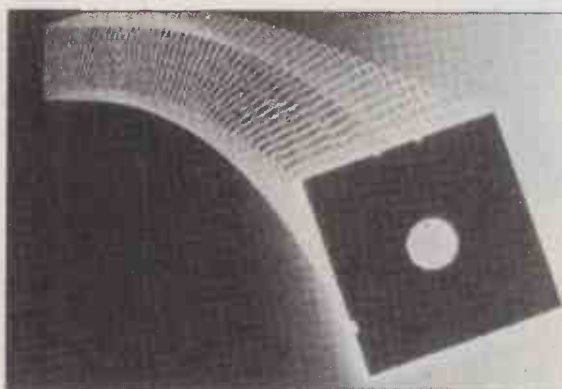
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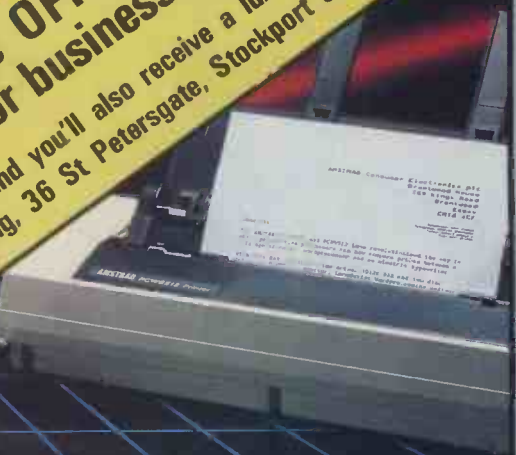
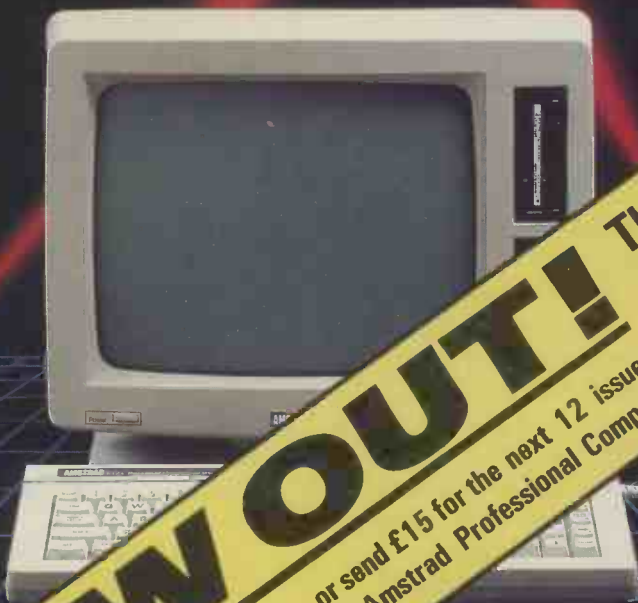


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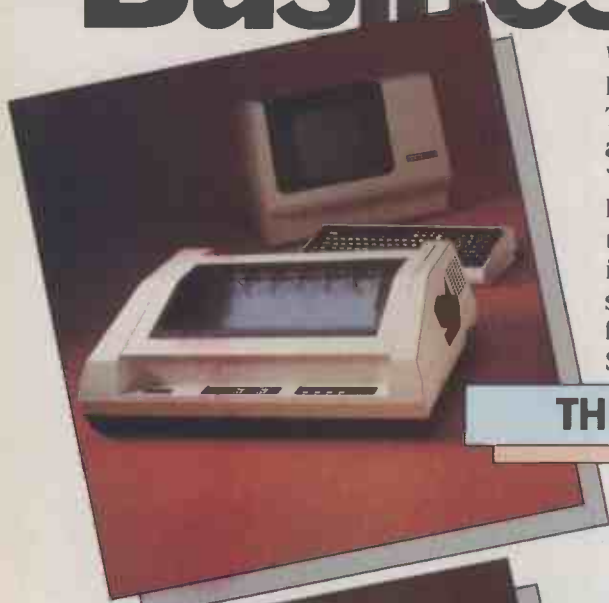
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£1449.00 + VAT

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- 2 Selectable modes (IBM PC or Epson FX compatible).
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DOS PLUS PARALLEL UNIVERSE

By Steve Malone

This multi-tasking operating system mimics Microsoft's MS-DOS and adds some useful features of its own.

Arguably the most important program for a computer is the operating system. From the beginning, the most important piece of software for the IBM PC has been PC-DOS/MS-DOS. Over the years DOS has been developed by Microsoft into a powerful if oft-criticised system.

Microsoft's great rival in microcomputer operating systems has always been Digital Research (DR). Formed in the mid-1970s by Gary Kildall to develop and market CP/M-80, DR rapidly established the operating system as the eight-bit standard for first the 8080 and later the Z-80 microprocessors.

The shift occurred at the beginning of the 1980s when an IBM team looking for a DOS for the PC were supposedly unable to see Kildall and went to Microsoft instead. Following the success of the IBM PC and MS-DOS, Digital Research has found itself in the position of trying to make up ground lost from Microsoft.

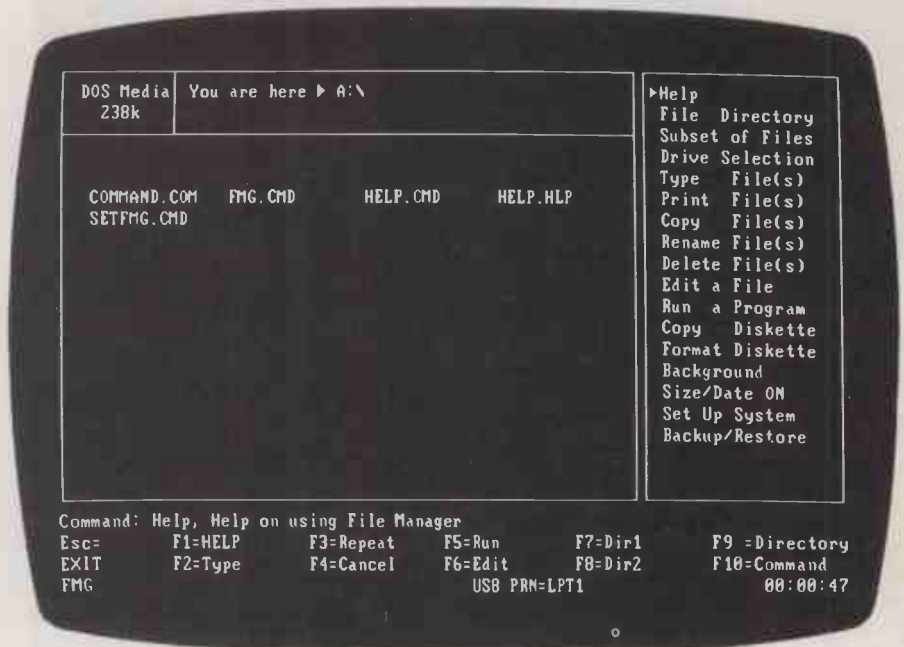
At first the company tried to establish a rival product in the form of Personal CP/M, later called CP/M-86. But like many hardware manufacturers, DR found the IBM/Microsoft axis too strong and were forced to introduce compatibility with MS-DOS in order to compete.

MS-DOS COMPATIBLE

Since the decision to become compatible with MS-DOS in 1983, various versions of DR's DOS have appeared. The latest attempt to wean users away from Microsoft is DOS Plus. Developed by a software team entirely in the U.K., it is intended to be a single-user version of IBM PC-DOS with additional functionality and CP/M-86 compatibility.

Because of its dual function, DOS Plus presents two faces. On the one hand it contains features such as paths, redirections and sub-directories that are instantly familiar to the MS-DOS user. On the other hand, DOS Plus boasts a number of facilities inherited from its Personal CP/M ancestor, including background processing and directory locking.

The first thing to be said about DOS Plus is that it is not fully MS-DOS compatible. Memory-resident programs like Sidekick did



Digital Research's File Manager front end is menu driven.

not run under the version of DOS Plus we reviewed, but Digital Research promises that the next version of DOS Plus will be able to. This is because memory-resident programs do a large amount of work in the cracks between the areas where MS-DOS resides in the hardware. The balance is very fine, and just one piece of code in the wrong place is enough to crash the whole system. DR admits this is a major obstacle which prevents DOS Plus being accepted as a realistic alternative to MS-DOS.

In terms of DOS Plus/MS-DOS compatibility it is misbehaved programs in general that cause the problems. The majority of programs we tested ran without any problem. These include GWBasic — which crashed on earlier DOS versions from Digital Research — Lotus 1-2-3 and Symphony, WordStar, and Open Access. Programs that fail are the notoriously misbehaved Flight Simulator and the Norton Utilities.

Over the years a whole range of Com files has been built around MS-DOS. These files have to dovetail precisely with MS-DOS, and we were not surprised to discover that none of the ones we tested worked with DOS Plus. The results ranged from a simple "Incorrect DOS version" message in the case of VDisk on the AT, to hanging up the keyboard after running Keybuk with no error flagged.

This presents the potential customer with another dilemma. Many of the Com files are

not luxuries; they are vital to enable the PC to work as a useful business tool. Business users want a £ sign, not #, when printing a document, and DOS Plus has no facilities to provide it.

The final incompatibility we discovered was not with software but with hardware. We tried the operating-system disc across range of machines, and found that some Taiwanese clones came up with a "Sector not found reading Drive A" error while loading DOS Plus. While this is not a criticism of DOS Plus, it indicates that the OS is not as accommodating of hardware irregularities as, say, PC-DOS 2.10, which runs happily on the same machine.

All this might seem to be unnecessary carping on the deficiencies of DOS Plus, so it is worth emphasising that the majority of applications did run with no problem on

SPECIFICATION

Description: multi-tasking single-user operating system offering compatibility with CP/M-86 and MS-DOS 2.11

Hardware required: Intel-based machines with a floppy-disc drive and 256K of system memory

Publisher: Digital Research (U.K.) Ltd, Oxford House, Oxford Street, Newbury, Berkshire RG13 1JB. Telephone: (0635) 35304

Available: now, to OEMs only; there are no plans to offer DOS Plus as a retail product

(continued on next page)

```

A>sdir *.com
Directory For Drive A: User 0

Name      Bytes  Recs  Attributes  Prot  Update      Create
-----
COMMAND  COM    26k   202 Dir RW      None  20/06/86 00:00
DISKCOPY COM    9k    69 Dir RW      None  20/06/86 00:00
FORMAT   COM    9k    72 Dir RW      None  20/06/86 00:00
MODE     COM    6k    47 Dir RW      None  20/06/86 00:00

Total Bytes   =   50k Total Records =   390 Files Found =    4
Total 1k Blocks =    50 Used/Max Dir Entries For Drive A: 24/ 112

A>_

```

USB PRN=LPT1 00:05:06

CP/M related Sdir gives more comprehensive information than the MS-DOS Dir.

(continued from previous page)

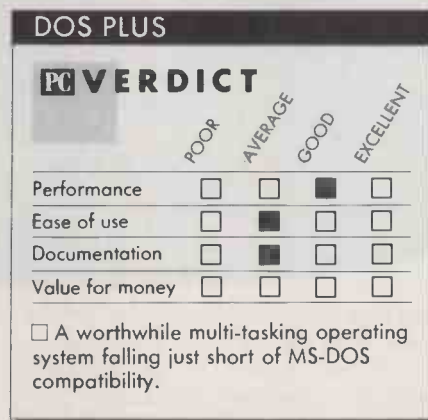
most machines. Although MS-DOS and DOS Plus may look superficially similar, the coding, interrupts, tables and timing loops may be radically different. It is therefore more surprising that DR has achieved any compatibility, than that it has failed to match MS-DOS completely.

DOS Plus includes a number of features which might gladden the heart of the veteran MS-DOS user. In the DOS Plus environment the bottom line of the screen is designated as a status line and displays the current program being executed, the time and the default printer device name. If the Num Lock is on, this will also be shown on the status line as a reminder. The same is supposed to happen with the Scroll Lock. But on all machines we tried — from an IBM PC/AT down to the humblest clone — it didn't work but instead displayed ^S at the prompt.

From DOS Plus it is possible to create your own Bat and Config.Sys files. Writing and editing these files is done with the Ed command, which contains the same functions as the MS-DOS Edlin command, although there are minor differences. Once created, the batch and Config.Sys files are executed automatically just as they would be under MS-DOS. Paths and redirections can be included in these files, allowing you to check paths on both floppy and hard discs and redirect output to files and external devices like printers.

While the built-in DOS Plus commands appear identical to those used by MS-DOS, there are subtle changes to many of the transient commands. For example, Chkdisk checks the disc, and returns the number of files and how much free space is available. It does not, as the MS-DOS version does, provide you with the amount of free RAM that is available, which often is all you really want to know.

Among the friendlier parts of DOS Plus are the commands Eraq and Delq. While



they provide the same service as the MS-DOS equivalents, each file is queried and you are asked to confirm each file before it is deleted.

The CP/M-related Sdir gives much more comprehensive information than the MS-DOS Dir. Sdir not only tells you the files, their type, size and creation date, but also displays system files, their type, size and creation date, but also displays system files, read/write attributes and which user, if any, they are assigned to.

One command file that is guaranteed to bring tears of nostalgia to the eyes of old-time CP/M veterans is Pip, which has been replaced in later versions of CP/M-80 and MS-DOS by Copy. Presumably it has been retained to maintain compatibility with CP/M-86, but it is likely to confuse MS-DOS users as its source and target devices are written in reverse order to that used by MS-DOS.

Originating as it does from a multi-user, multi-tasking philosophy, the CP/M interface brings with it a number of features you would expect in such an environment. A disc formatted for use by CP/M-86 software is automatically equipped with 16 directories, numbered 0-15. You can give them more meaningful names if you wish.

The idea behind the format is that 16 different users can be assigned their own directory which cannot be accessed by other users. The exceptions to this are Sys and Read-Only files installed on directory 0, which defaults as a common directory to allow access to applications and other general files.

More interesting is the multi-tasking capabilities of DOS Plus. Under the DR system it is possible to run a foreground application program with the console and keyboard while others run in the background. Background programs are controlled by the Backg command, which displays the names of the background programs that are available, their size and whether they are currently running or not. Although background programs can be run from the DOS prompt they can only be halted from the Backg command.

The DOS Plus multi-tasking works by allocating a fixed amount of time to a maximum of three tasks on a round-robin basis. The default parameters allocate time to the foreground process at a ratio of 16:1 to each background task. You can alter the foreground ratio via the Slice command.

Background programs can vary considerably. Two programs, called Print and Alarm, are supplied with DOS Plus. The Print command sets up a print spooler in the background, which allows printing to continue while you are getting on with other things in the foreground application. Alarm is more of a demonstration, as it simply displays a message on the status line at a preset time.

Although it is unlikely to be necessary with the bundled background packages, you sometimes have to allocate a set amount of space to the background and so restrict the amount available to the foreground application. There are two commands available for this. Comsize allocates memory to background Com files, while Addmem does the same for Exe files.


One of the central complaints about MS-DOS has always been the rather forbidding front end. DR has attempted to make it friendly by offering an optional DOS shell called File Manager. It is essentially a menu-driven front end to DOS which guides inexperienced users through disc formatting, files and searches.

CONCLUSIONS

■ DOS Plus is an attempt by Digital Research to provide compatibility between CP/M-86 and MS-DOS, so offering users an alternative to the Microsoft product.

■ Although the majority of programs we tested ran perfectly well under DOS Plus, pop-up programs and certain misbehaved software remain a problem.

■ Compatibility aside, DOS Plus is a worthwhile operating system which contains a number of features missing from MS-DOS — in particular the multi-tasking facilities.

■ It is doubtful whether DOS Plus can make much of an impact on its own, but if it is bundled with a successful machine it could change the landscape of the software industry. 

HANDLE WITH CARE

Few things are more frustrating than the unexpected failure of a floppy disc, but by taking some simple precautions you can ensure that these humdrum articles provide years of trouble-free service.

A floppy disc is a very simple piece of apparatus, typically made up of only four components. But simple as they are, floppies have been carefully engineered to match the systems they work with. For a disc to function properly it must be suitable for the drive in which it is run. For it to continue to work, day in day out, it must be treated with consideration.

At the risk of stating the obvious, the correct choice of disc for the computer and disc drive in use is imperative. Apparently slight but extremely significant differences between floppy-disc products are not always given the attention they deserve. The following characteristics must be checked before you choose a disc for your system: physical size, number of sides, recording density, track density, sectoring type, and whether a pre-formatted disc is required.

It has to be said that this complexity is likely to increase as new floppy formats are introduced into an already crowded market. Products such as high-density 8in. and 3.5in. sizes, metal floppies, Quickdiscs, and the 12in. and 5.25in. optical discs are just some examples of products already being used that could take off in the near future.

HIGH COERCIVITY

Some users consider high-density discs to be no more than go-faster versions of standard discs, but this is not the case. The magnetic coating of high-density discs has a higher coercivity than that used for normal-density discs, and this makes them unsuitable for use in normal-density drives.

Coercivity is an electromagnetic property that describes the relationship between the amount of magnetism or flux density on the floppy disc and the magnetising force required to achieve it. A high flux density is needed to enable the high-density disc to accumulate large volumes of information, and to be able to resolve these physically smaller bits of information from their neighbours. A larger magnetising force is required to achieve a high flux density, so high-capacity drives use a higher writing current

than that used in drives of the conventional type.

Another common misconception is that single-sided and double-sided 8in. discs are interchangeable between their respective drives. It can be tempting to use double-sided discs in a single-sided drive when rationalising stock, or simply when stock of the required product is not immediately available. But it is not generally understood that the index hole windows of the two products are in slightly different positions, so it should not be possible for the drives to read the index hole if the wrong product is used.

Floppy discs are now so commonplace that it is all too easy to take them for granted. It is true that if you treat a floppy disc properly you can use it over and over again. But a mistreated disc will eventually let you down, possibly depriving you of irreplaceable data.

The plastic base film of a floppy disc is a mere 75 microns thick — about the thick-



You cannot use a high-density disc in a drive that has not been specifically designed for it. The top oscilloscope trace shows the output after a sine wave had been recorded on to a double-density disc used in a 48tpi drive. The bottom trace shows the output when the same signal was recorded on to a high-density disc in the same drive. The severe distortion in the lower trace is a consequence of a mismatch between the writing current in the drive's write head and the coercivity of disc's magnetic medium.

ness of a human hair. The magnetic coating which is spread evenly over its surface is between one micron and 2.5 microns thick. As a result, discs are sensitive to external pressure, and are easily affected by dirt and dust.

Of course, each disc is sheathed in a protective jacket, but the aperture for the read/write head is a weak point. Since the disc must come into contact with the head it is impossible to protect the magnetic surface completely.

JACKET WARPAGE

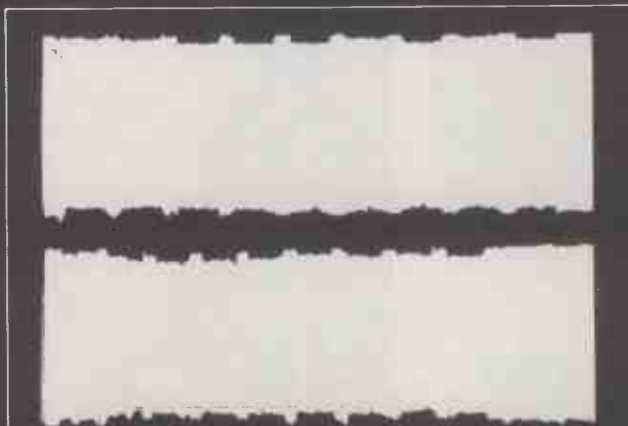
High temperature or high humidity can warp or deform a disc. This in turn can affect the amplitude — which is analogous to the volume in sound-recording terms — of the playback signal. By far the most important effect of jacket warpage is an increase in the friction between the disc and its jacket. If this becomes too great the disc will start to rotate more slowly. The data pattern recorded on each track then becomes compressed. In other words, the data bits are recorded closer together, and are more difficult for the drive to resolve when they are read.

The disc used to generate the trace on the opposite page, top left, had been left in the back window of a car during a week of sunny weather. Data that was subsequently written to the disc could not be read again. The computer could not trace the bit patterns because the disc's rotational speed was no longer correct.

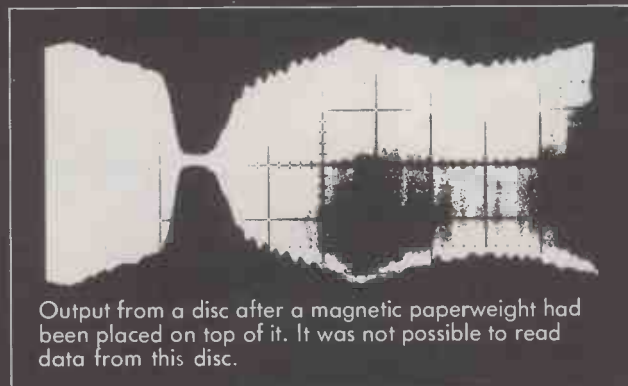
Temperature changes can be hazardous too. If you bring a cold disc into a room where the atmosphere is warm and moist it is likely that dew will form on its surfaces. So if you have a disc that has just arrived in the post, or has been brought in from outside, allow half an hour or so for it to come up to room temperature before you use it.

Fingerprints are the mortal enemy of floppy discs. Oils secreted by the skin can adhere to the magnetic head causing errors through loss of head contact with the disc surface. Moreover, the grease results in

OSCILLOSCOPE TRACES OF DISC DATA SIGNALS



The top trace shows a good nine-sector format. The bottom trace shows the same nine-sector format of a disc with a warped jacket. The rotational speed is so low that the signal is compressed towards the left-hand end of the trace with the blank area on the right, known as the post-amble, correspondingly extended.



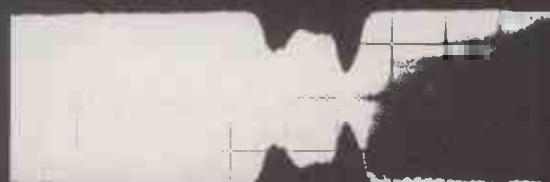
Output from a disc after a magnetic paperweight had been placed on top of it. It was not possible to read data from this disc.



A full-track trace of a good disc. The trace shows that the response to a single frequency is uniform along the track.



A trace showing the sudden loss of output caused by a scratch on the disc surface. This is known as dropout.



The output loss caused by a crease — the result of forcing the disc into a drive. The loss is not as deep as a typical short-duration dropout, but the reduction in signal strength lasts for a longer time.

permanent damage to the disc, reducing output and causing the adhesion of dust and dirt. It may even result in mildew.

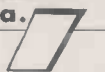
Many situations may cause the disc surface to become contaminated with foreign material. The use of erasers on or near to the disc, or smoking, eating and drinking when using discs should all be avoided. Never try to clean discs using thinners, alcohol or freon, as these substances are solvents for the binder that holds the magnetic particles in suspension and bonds them to the base film.

Other types of damage may cause failure too. Fingernail scratches on the disc surface or dust on the drive head can render a disc effectively useless. You can also damage a disc by writing on the index label.

Disc deformation may also be caused by bending or folding a disc, placing heavy objects on top of it or inserting it violently into the drive. Rough insertion may crease the disc or cause chucking errors resulting, at best, in a temporary concentricity problem. The latter may be rectified by simply rechecking the disc.

The head of the floppy-disc drive is placed against the magnetic recording surface of the disc, and magnetically imprints information on to its surface as designated by instructions from the computer. Once the magnetic

If you treat a floppy properly you can use it over and over again. But a mistreated disc will eventually let you down, possibly depriving you of irreplaceable data.



pattern has been recorded, the disc retains the magnetism in the same way as a permanent magnet would. But since one of the requirements of floppy discs is that they are reusable, any information written to the disc can be changed by remagnetising the recording surface to align the magnetic particles in a new pattern. It follows that strongly magnetised objects can damage the data which has been recorded on a disc. Beware of tools containing magnets, children's toys, magnetic door or handbag catches, electric motors, etc.

Errors can also occur while information is being written to a disc. Possible sources of error include mis-alignment of the write head, incorrect insertion of the disc, or an electrical problem in the disc-writing

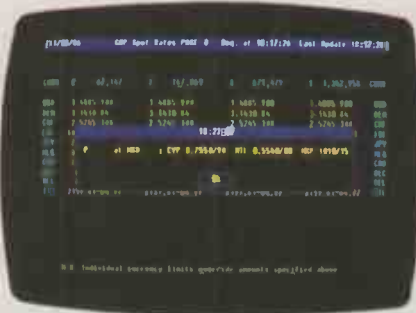
circuitry. But it is a clogged head gap that is the most common source of the problem.

In normal operation the head picks up small quantities of material from the disc surface itself or from the environment. Atmospheric moisture can react with these minute particles to form a gum which lodges in the head gap. This material can easily be removed with a proprietary cleaning product. Cleaning the disc drive should be part of a systematic maintenance program, as the head gap becomes more difficult to clean if contamination has been allowed to build up. All too often a drive is not cleaned until read/write errors begin to occur.

The data you store on your floppy disc is a valuable resource. You can safeguard it by taking sensible precautions in the way you store your discs, and by backing up data at regular intervals. Finally, you should always use discs from a reputable manufacturer. A great deal of effort goes into developing and manufacturing binders, magnetic media and jackets that will give high performance and reliability. A bargain-priced disc could cost you a lot if it turns out to be dud.

The author of this article is a member of the technical department of Maxell U.K. Ltd, who also supplied the photographs used in this article.





Midland Bank's Superdoris exploits the multi-tasking facilities of Windows.

BANKING ON WINDOWS

Microsoft's Windows seemed to be a product without an application until it found a niche in the world of finance.

Glyn Moody speculates on how this development will affect its use in the future.

Microsoft Windows was finally launched some two years after it was first announced. Some would say that this explains in part why the program has failed to take off in the way Microsoft has always hoped. Others would point out that it was an idea ahead of its time — at least on the IBM PC — and is still waiting for hardware to do it justice.

Whatever the reason, the great Wimp debate and the promised showdown between Windows and Digital Research's Gem never really materialised. Instead, both products find themselves in a catch-22 situation. Software houses are loath to rally to the standard until more users are convinced of its virtues. Meanwhile users are waiting for more programs to come through before they commit the time and effort needed to come to terms with this approach.

Microsoft has been conscious of this, and has set about trying to break the deadlock by persuading leading companies within a few key industry sectors to adopt Windows as a working standard. The recent announcement that Reuters and Midland Bank have developed products using Windows is evidence that in the increasingly high-tech world of high finance it has made a few useful converts.

But the ramifications of this go much further. The reasons why Windows was chosen over rival offerings and the way the products have been developed provide important lessons for the entire community

of business micro users, not just those in finance.

Of the two systems, the Advanced Reuters Terminal (ART), uses Windows in a more straightforward fashion. Based around an AT clone with an enhanced graphics adaptor the ART is designed to replace the multiple-screen approach currently used by many dealers in the City and throughout the financial world. All dealers depend on a constant stream of facts and figures, together with graphical analyses of trends. Before the ART, separate terminals had to be used for each source of data, and there was little provision for on-line analysis. Using Windows, pre-selected services can be piped through dynamic windows, with figures updated regularly. The distributed power of the PC/AT clone means that the ART can be programmed to watch shifts in share prices and signal important events that are preset by the user. It can also graph data in real time to show underlying trends.

RAPID DATA FLOW

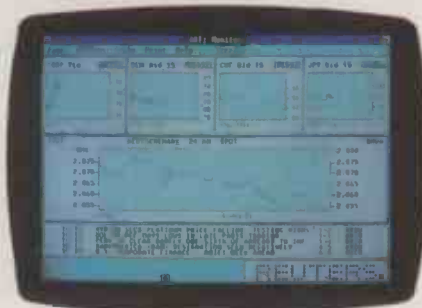
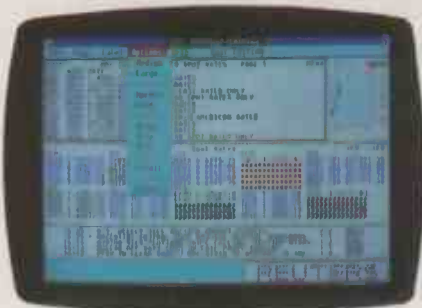
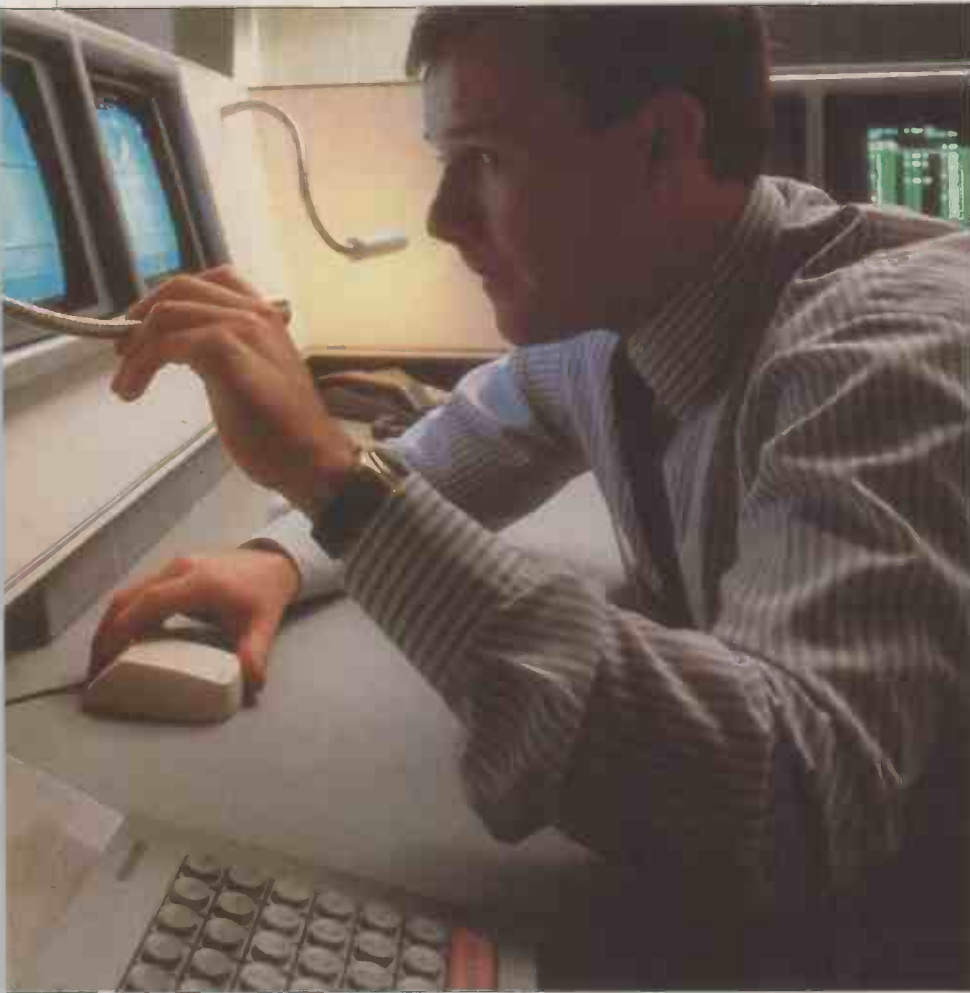
Apart from its ability to display several independent streams of information simultaneously, Windows has a strong visual interface ideal for situations where decisions must be made rapidly on the basis of a large and constant data flow. The pull-down menus and mouse approach mean that the system is easy to use and well suited to professionals who have little time to learn new and largely irrelevant skills.



Above: An analysis system under development by Midland Bank adds windowing features.

Above right and far right: Reuters' ART uses windowing to display several streams of information simultaneously in both tabular and graphic form. Information is updated in real time.

The ART is one-way only: data is fed to it from central data sources, but it is not possible to transmit data back to them for action. The Midland Bank system, which goes by the quaint name of Superdoris, does allow this. It has been developed by the Group Treasury arm of the Midland Bank, which is effectively the treasury for the bank's other activities. Typically some \$20 billion will pass through it each day — \$30 billion if it is at the end of the month. As discussed in the Editorial on page 5 of this issue, it is when dealing with such large sums that the sometimes marginal advantages derived from computers can be critical.



Superdoris is an upgrade of the Dealers' On-line Rates Information System (Doris). It is designed to provide the Midland Bank's foreign-exchange dealers who are not housed centrally with the information and means to make deals in foreign currencies. Here Windows' fancy graphics front end is less crucial than the multi-tasking facilities. Running on a PC/AT, the program not only has to receive and display up-to-the-second updates on exchange rates, along with any messages which are sent from head office, it also has to allow the distant dealer to be able to make deals at the same time.

New systems under development will make greater use of the graphical features of Windows. As with the Reuters system, much will be made of the distributed power which allows various graphs to be drawn according to each user's particular needs in real time.

In the process of developing these systems, both Reuters and Midland Bank have become far more closely involved with

Microsoft than has hitherto been the case for corporate customers and suppliers. This signals a very significant change on both sides. Suggestions from Reuters have even resulted in modifications being made to Windows as it was being developed, some of which have yet to filter through. Microsoft says that one of the reasons that the product took so long to appear was partly as a result of this kind of input.

Such careful nurturing by Microsoft goes beyond simply trying to sell a few copies of Windows. It gets selected key users receptive to the general ideas which lie behind Windows. More importantly, it prepares the way for the next generation of Microsoft application products which will be built around Windows. This is crucial if Microsoft is to break the stranglehold companies like Lotus Development and Ashton-Tate have in certain markets. The manager of the micro systems group which developed Superdoris, Graham King, said that he

would not use Microsoft's Multiplan even if it were given away free. This is simply because Lotus 1-2-3 was the supported spreadsheet, for good or for ill. But now that Windows forms part of Midland Bank's computing strategy, any future Microsoft spreadsheet built incorporating it would have a head start.


What attracted Midland Bank to the Windows approach was the portability it offered. Currently the world is very confused about what will come after the present version of DOS. Will it be DOS 5, Windows, Topview? According to Microsoft, the beauty of Windows is that it gives a guaranteed level of compatibility however the operating system changes. Once you have written to the Windows standard, you can be sure that a program will carry forward to later releases of DOS, provided that you stay with the Intel family and IBM.

It is this concern for the future which marks a new maturity in the micro business-software market and its users. Hitherto, businesses have been content to throw away their software with each new generation of machine. But as programs become progressively more complex and costly to develop, and as more effort is spent in mastering them, so the reluctance to start again each time will grow.

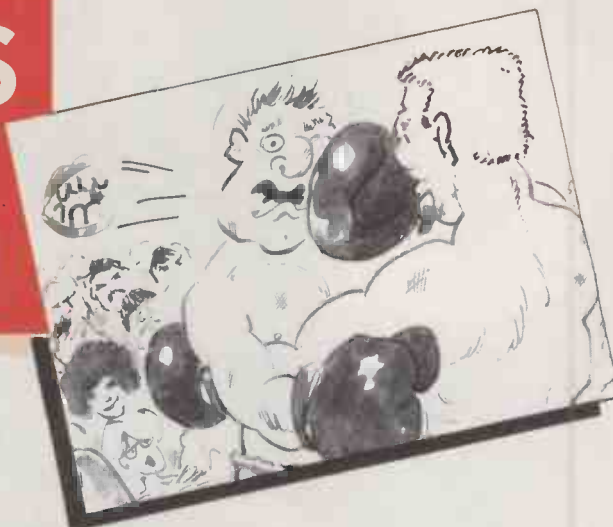
CASH TO EXPERIMENT

It is perhaps not surprising that these changes should have occurred first in the hothouse world of finance. Increasingly U.K. companies in this area are seeing technology as a way of replenishing their margins, which are being squeezed by the current bout of deregulation, and fighting off the threatened foreign invasion. Unlike most sectors, they also have plenty of cash to experiment with the latest developments. They are interested in up-market machines in particular. When it comes down to a battle of raw computing power, every extra megahertz and megabyte helps.

There is another reason why Windows is scoring so well. For financial dealers every second is precious; for them more than most, time is money. Windows allows you to add on an ultra high-resolution monitor, touch screen or voice input without having to rewrite the entire program simply by changing the driver which handles input and output devices. As well as future compatibility it offers present flexibility. Although these developments are being driven by the needs of the aristocrats of the office, once technology has been developed, and standards set, it will not be long before it filters down to the rest of us.

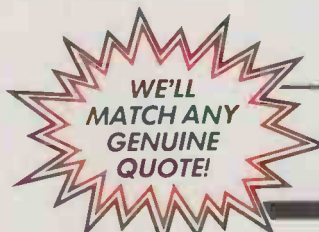
Finally, it is worth noting that both of these products use Microsoft Windows, rather than any old windowing environment. This might just be due to effective selling by Microsoft, which is starting from a position of strength in any case. But Graham King of Midland Bank goes further. In his opinion Windows is simply the next Lotus 1-2-3, the product which will shape the way micros are used for the next few years. 

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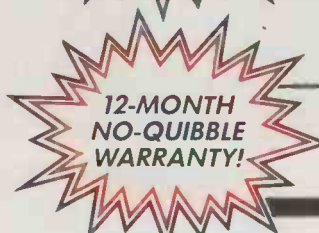


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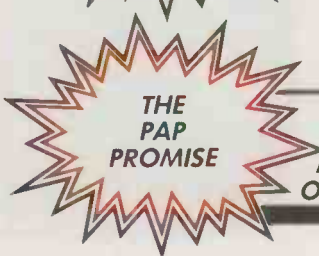
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Opus.

Predictions of an imminent boom in office automation have been around for so long that the public can be forgiven for taking them with a pinch of salt. But the promise of a \$10 billion market by the early 1990s has begun to concentrate manufacturers' minds wonderfully, especially given the depressed nature of the stand-alone PC market.

The market is undoubtedly there. A government-funded Britain Has IT roadshow in March attracted around 2,000 delegates, including over 100 managing directors, 75 percent of which came from *The Times* Top 1,000 companies. Many of those attending the seminars expressed an urgent desire for more information about office automation yet only 15 percent used information technology in their own offices.

Much of the problem stems from uncertainty as to what office automation actually is. It can be broadly defined as a business environment accessible via a terminal. The definition is necessarily vague because many of the benchmarks that have in the past defined an office no longer apply. Take for example the concept of the office itself. Traditionally this is a room within a company building with one or more people working at desks. But the introduction of PCs, modems and local area networks means that many people can work from home and keep in contact with colleagues via the telephone.

RESOURCES SHARED

Though the definition of office automation is vague, it is not hard to recognise in practice. Typically, office automation consists of a number of terminals, either networked or connected to a central processor, running the stand-alone business applications of text processing, spreadsheet and database resources shared over the network. Other office-management systems such as diary and meeting planners and electronic mail will also be included.

Undoubtedly office automation has been held back by the lack of accepted standards. You only have to look back a few years to when the IBM PC became industry standard to see what can happen to a market when there is an agreed format for hardware and software.

The major obstacle to office automation at the moment is the lack of an agreed networking standard. The multitude of different configurations is enough to confuse many within the industry let alone those outside it. The situation is not helped by the fact that many LANs have only a restricted capacity. Companies must therefore be able to predict future growth and ensure that it is built into the system, or else face the possibility of having to upgrade the whole network.

As far as communications hardware is concerned, there does seem to be some movement towards a standard based around Open System Interconnection (OSI) which allows otherwise incompatible systems to communicate with each other.

Much of the confusion is due to IBM. No

Why are we waiting?

Stand-alone micros are to be found in most businesses, but the fully automated office is still some way off. **Steve Malone** has been reading an official report which suggests how progress can be made.

standard can be made to stick without at least the acquiescence of the world leader. It is not unknown for other manufacturers to move towards a standard only to find that IBM does something different and carries the market with it.

An example here is the format in which documents are transmitted. It is obviously useless to have a hardware communications standard if the target computer cannot make sense of the data once it has arrived. In June 1985 the European Computer Manufacturers Association agreed on a standard called Office Document Architecture. In the meantime IBM developed its own system, known as Document Content Architecture. The result is that the ECMA system faces an uphill task in establishing itself as a world standard. Many people are waiting to see which way IBM jumps, and at present the company seems to be developing its office-automation strategy in a rather piecemeal fashion rather than unveiling a complete system.

In the rush for new technology it is often forgotten that there are people involved too. To gain maximum benefit from office automation everyone from typists to the managing director has to be trained in new skills. Surveys have found that there is less hostility to the idea if staff are kept informed of developments, not just presented with a *fait accompli*.

The problems involved are often not due to technology itself but to the redefinition of roles that it brings. Secretaries may start doing less shorthand and typing, and act more in the role of personal assistant, while managers may find themselves having to use a keyboard for the first time. Furthermore secretaries may carry out complex collation of information that was previously the preserve of the data-processing department. Finally, managers often find that the data-processing department attempts to annex the whole office-automation strategy to itself.

As a guide to confused managers, the Department of Trade and Industry has published a report entitled *Profiting from Office Automation — The Way Forward*. The report is based on the results of a series

of 20 pilot schemes in the public sector over a four-year period. Among the sites taking part were the Department of Industry itself, British Rail and the Greater London Council. To get the pilots off the ground, the government provided grants of up to £250,000 for each site. The final report explains the lessons learnt during the scheme and makes recommendations to companies intending to introduce office automation.

The report recommends that companies should set up a team of employees to plan and implement the introduction of the new technology. It emphasises that the team should begin by making detailed and realistic plans of what can be achieved by office automation. To minimise disruption, the introduction should be phased, with the first installations in those areas where the greatest benefits can be obtained quickly.


The report also has some valuable advice on how a company should go about investing in equipment. It recommends that it is unwise to purchase leading-edge technology, as this is unlikely to be fully debugged. Another suggestion is to buy a total system from a single supplier, where possible, rather than attempt to mix and match systems which may be incompatible.

On the subject of suppliers, the report says that companies should "buy a total system from your preferred supplier, usually an international company". Although this advice makes good sense in terms of providing long-term support and a clear upgrade path, it makes depressing reading for most British companies. ICL is the only U.K. firm with any international clout. It also has the effect of driving companies into the arms of a single supplier — never an ideal situation to be in. But at the moment there appears to be little choice.

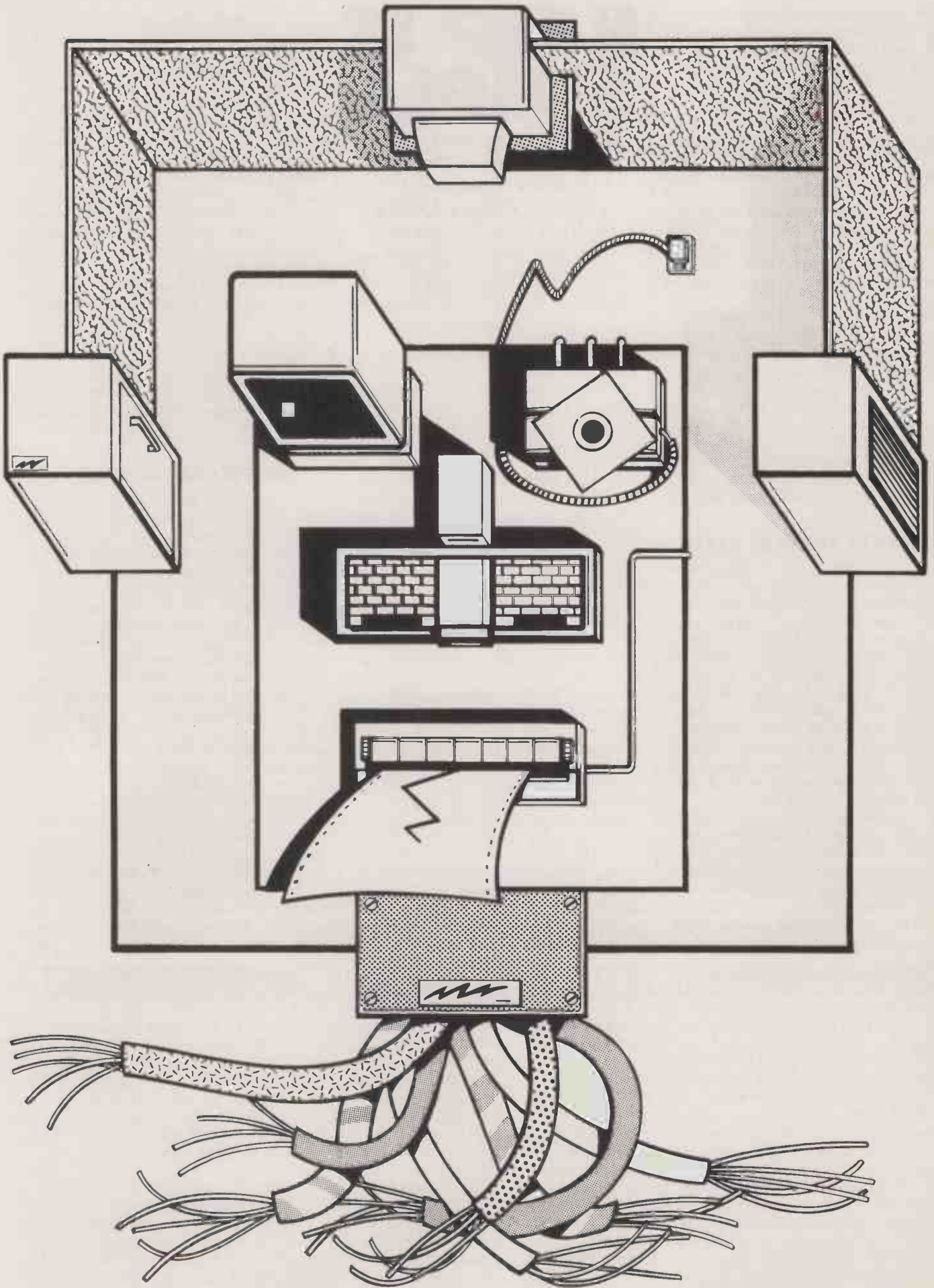
TAILORED SOFTWARE

The report has some interesting things to say to system suppliers. It suggests that suppliers should concentrate on understanding the requirements of customers rather than trying to sell them the latest kit. Suppliers should take time to identify the applications so as to ensure that the hardware and software meet the company's needs, if necessary tailoring the software to specific applications. Suppliers should also be on hand to provide training for users, not only in using application but also in simple maintenance.

Although the concept of office automation has already been around for a long time, much of the groundwork still needs to be done before the concept can attain lift-off. Standards badly need to be established, and there must be a redefinition of roles. This not only applies to secretaries and managers in their work, but also in the service provided by manufacturers and suppliers.

Profiting from Office Automation is published by the Department of Trade and Industry and is available from Colin Perry IT3C, Room 613, 29 Bressenden Place, London SW1E 5DT, price £10. 

OFFICE AUTOMATION



MIKE GORNALL

The Reduced Instruction Set Computer (Risc) was born out of the realisation that the current generation of 16- and 32-bit microprocessors do not perform very efficiently. Although their instruction sets are powerful, execution of an op code frequently consumes several clock cycles. This means that the 80286-based IBM PC/AT, for example, is not much faster than the BBC Micro, which is driven by the humble eight-bit 6502. Added to this, there is a move away from stand-alone computing. Also a fast interrupt response is essential for networking, since characters may be lost if the processor has to complete a multi-cycle instruction before it can service the interrupt request.

Acorn has developed a complete chip set based around a CPU which has only 44 basic instructions that are designed to produce efficient code which executes very quickly. Fabricated in low power consuming CMOS, the Acorn Risc Machine (Arm) has an average execution rate of four million instructions per second (mips) when used with an 8MHz two-phase clock. This makes it two-and-half times as powerful as a Vax 11/780 and over eight times more powerful than an IBM PC/AT.

64MBYTE ADDRESS SPACE

The Risc chip has 32-bit architecture with a 32-bit external data bus and a 26-bit address bus which gives a 64Mbyte uniform address space. The internal construction of the processor is optimised for fast interrupt response and efficient support of high-level languages. The chip set will be manufactured by VLSI Technology of Phoenix, Arizona, which makes the custom-array devices used in current Acorn computers. It will find application in systems that require high computing power or fast response, such as laser-printer controllers, network controllers and graphics work stations.

In comparison, the Motorola 68020, which represents the ultimate development of current processor-design techniques, is produced on a chip that contains 192,000 devices and runs at 2.5mips; the Arm, with higher performance, uses a chip with only 25,000 devices. This means that the Acorn chip can be produced for 25 percent of the

KEEP IT SIMPLE

Chips have become faster, larger and more complex, but at the same time less efficient. **Roger Cullis** explains how the reduced instruction set microprocessor may solve this problem and looks at Acorn's addition to the fray.

cost of the more complicated CPU — the Arm costs £4,500.

When designing the Risc processor, Acorn chose a 32-bit word length. This represents a compromise between opting for extra computing power and the additional complexity of the encapsulation which would be required to make provision for a 64-bit data bus. The chip has a small optimised instruction set hard wired into a programmable logic array, dedicated registers to handle interrupts and a large memory-to-processor bandwidth.

The chip uses pipelining so that all parts of the processing and memory system can be used every cycle when executing register-to-register instructions. During each processor cycle, one instruction can control the data path while the system decodes a second instruction for the following cycle and fetches a third from memory. The Arm contains 25 registers which partially overlap to support moving of processing functions from hardware to software. The overlapping removes the need to save the contents of registers and service interrupts quickly.

There are three controller devices for video and audio, memory and I/O which come with the Risc chip. The video controller incorporates a specific section for cursor injection to remove the constraints imposed by the need to generate it by means of software. Another block supervises the generation of a stereo audio signal. The


memory controller supports DMA and has an address translator for virtual-memory systems.

Evaluation systems using the Arm are being produced in two versions. The first is a second processor which follows the established format for use with the BBC Micro. Enclosed in a standard Acorn second-processor box and connected to the base processor by way of a ribbon cable and the Tube interface is a Risc CPU with 512K ROM, I/O and video controllers plus 4Mbyte of dynamic RAM. The BBC Micro based system is already available. At a presentation given to the press it was demonstrated performing fast arithmetic calculations, complex graphics displays and a real-time synthesis of an acoustic guitar. Arm also has mouse and keyboard interfaces.

An IBM PC version will be released soon. It will take the form of a standard card which can be plugged into an IBM PC or PC/AT. It will have 4Mbyte of RAM and offer a similar performance to that of the BBC Micro version.

SOFTWARE SUPPLIED

Both evaluation systems will be supplied with comprehensive documentation and a full set of software tools, including a powerful assembler and an editor, linker, debugger and utilities. The high-level languages are Fortran 77 and a C compiler, which will allow many existing applications packages to be ported across to the new environment. Cambridge Lisp and Prolog X have been provided to meet the needs of the expert-systems market. BBC Basic has also been included to complete the package.

The announcement of Acorn's Risc machine is an indication by Olivetti of its endorsement of Acorn's future role. The Arm gives users the opportunity to gain experience of the next generation of micros, as well as providing a high-performance upgrade path for existing BBC Micros and IBM PCs. However, at this stage the Arm is a solution in search of a problem. But with a comprehensive suite of software tools, a very fast processor and an adequate amount of memory and addressing capability, there is no doubt that many applications will be forthcoming. 

THE BACKGROUND TO RISC

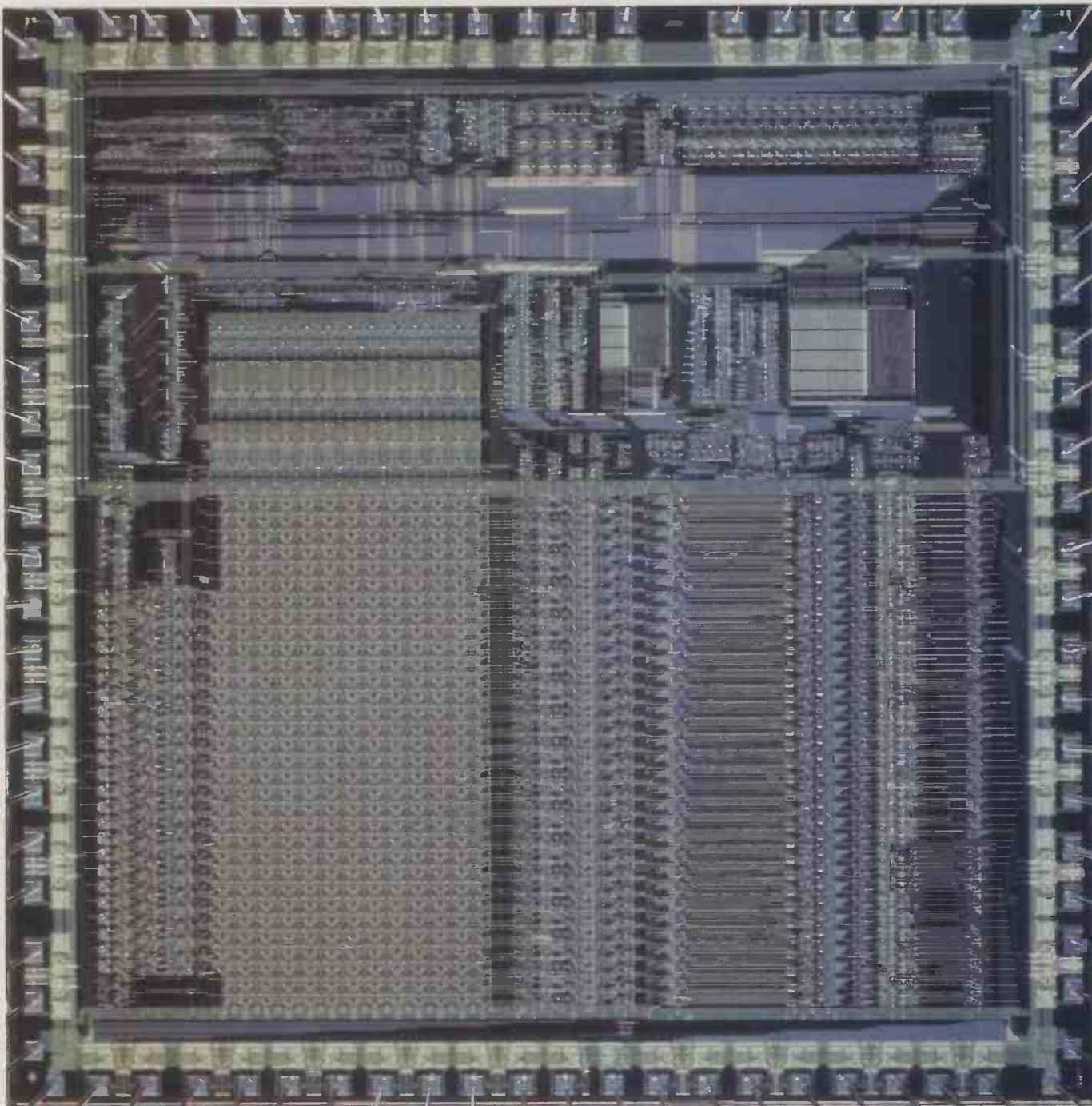
When Intel designed the first microprocessor, it set out on an inexorable path of ever faster, larger and more complex devices. It led from the four-bit 4004, to the eight-bit 8080, the 16-bit 8086 and then to the 32-bit 80386. This progress to greater sophistication is attributable both to improvements in semiconductor technology and to the investment of users in software, which dictated that the instruction set of each new processor should be a super-set of that of its predecessor.

As the chip designers were adding more bells and whistles, it became apparent that the bulk of programming used only a limited proportion of the instructions which were available. As in many other situations, Pareto's Law applied — 20 percent of the instructions accounted for 80 percent of operations. This revelation led to a complete rethink of microprocessor design and gave rise to the Risc concept, which is based on two principles: keep it simple and do it fast.

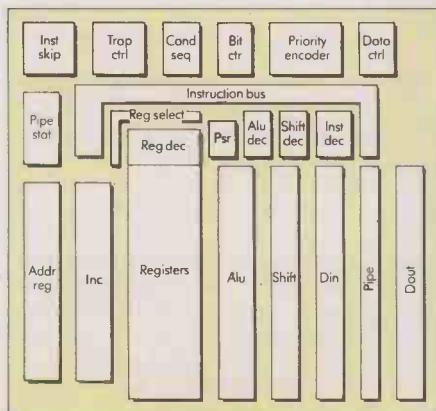
Risc processors have a small set of regular instructions, of the

same size and structure, which execute in a single cycle. This means that the interrupt response is very fast. At the design stage, the inclusion of an extra instruction needs to be justified on both cost and performance. Only the simplest ones, such as add, branch, load and save, satisfy this criterion. The typical layout of the chip is planned to enhance the speed of register transfers. Only load and save operations access memory, and pipelining techniques are employed to minimise delays. Microcode, which involves memory access, is replaced by hard wired logic.

A compact instruction set means that complex functions are assembled from smaller building blocks and consequently programs are longer. Typically, a Risc program may be 30 percent longer than its conventional counterpart and so requires a corresponding increase in memory bandwidth. On the other hand, the same program will occupy one-fifth the number of machine cycles and hence run faster.



The Acorn Risc CPU chip (above) contains 25,000 devices arranged as shown below. Since most activity is based on register transfers the layout is designed to optimise such operations.



WHO USES RISC?

It is generally accepted that the concept of a computer with a small instruction set and simple architecture was first developed by John Cocke, when he was working in the IBM Research Centre on ideas for a fast controller for large telephone switching systems. The principles were further developed at the University of Berkeley in California, where the acronym "Risc" was coined.

Other companies making devices are Inmos with its celebrated T-424 32-bit Transputer and Fairchild with a CMOS device code-named Clipper, which runs at 40MHz. The U.S. defence programme has spawned high-speed devices fabricated in gallium arsenide from McDonnell Douglas and Texas Instruments. Hewlett-Packard and IBM also make devices, but these are reserved for their own use. The company most committed to applications is Hewlett-Packard, which plans to apply the Risc philosophy to its entire product line. IBM caused a few ripples of excitement when it introduced the IBM RT PC personal computer — also known as the 6150 — in January of this year. Based on a 118-instruction CPU, the desk-top machine is attacking the technical work-station market dominated by DEC, Apollo and Sun Microsystems. At the high-performance end, Harris Computer produces the 7mips HCX-7 and Ridge Computers has its 32/100 floating-point processor.

BOOK REVIEWS

SAY "Unix" to most people and it conjures up visions of academics poring over their terminals. A Quick flick through some books about Unix seems to confirm its reputation. But despite this, Unix has slowly begun to emerge from research and educational establishments into the real world. This is largely because of the emergence of multi-user and networked systems as viable possibilities for business users.

While Unix has a forbidding reputation as not being user-friendly, the same cannot be said of Andy Walker and his book *The Unix Environment*. Walker is an obvious fan of Unix and he manages to convey his enthusiasm to the reader without ever becoming gushing.

The Unix Environment is not intended as a tutorial guide to Unix, rather it is a guide for someone familiar with computers who wants to know what Unix is. So the book provides an overview of the bits that make up the system and how they work, without dwelling too long on any subject. The trouble is that you start to feel like a coach passenger on a package tour; you constantly have interesting features pointed out to you but never stop long enough to have a closer look.

The book covers a number of subjects under headings such as History, Philosophy, Hardware, Files, The Kernel, The Shell, Portability and C. Each area is explained with examples and though beginners might find themselves a little out of their depth sometimes, Walker guides you through the complications and is never boring — he even manages to be funny. The book is a good introduction to Unix and whets the appetite for the system as well as providing a grounding for a deeper investigation.

For the absolute beginner who would like a more leisurely introduction to Unix, a tutorially based explanation is provided by *Unix: A practical introduction for users*. It assumes the reader is approaching Unix and maybe even computers for the first time and

takes the trouble to explain terms like VDU.

As a practical introduction the first chapter deals with logging on, the prompt and some simple commands. From there the book methodically explains each feature of the system. At the same time the authors introduce new commands and syntax in a painless, matter-of-fact way. The best way to get the most from the book is to sit at a terminal and follow the authors' examples. The book opens up the system in such a way that it enables the user to explore each new area of Unix as it occurs.

Unix: A practical introduction for users is credited to six authors. I usually approach books written by a number of people with caution since they have a tendency to be uneven and allow each author to ride his or her own hobby horse. But in this case the same steady style is prevalent throughout the book. The only trouble is that one bland explanation after another gets a little wearisome after a while. Still, having read and digested the book you feel competent enough to handle the complexities of the shell without the system running away with you.

If you feel happiest with a complete idiot's guide and don't mind getting your hands dirty on the keyboard then you could do worse than getting *Unix and Xenix: A Step-by-Step Guide* by Douglas Topham and Hai Van Truong. The book assumes you are sitting at a terminal typing in the examples given. Topham and Truong guide you through each

step, down to providing the computer's reply to each command as it is entered.

But what seems to be a clear and detailed guide to one person may appear to be an overexplanation to another, and at times I found the book too simple. For example, "If Dan should execute the link command from his subdirectory *letters*, then he will be able to access the file *intro* from his own subdirectory *letters*, using the same name (*intro*) — provided he has access to *intro*." This kind of belt-and-braces explanation can end up muddying the water rather than helping. But to be fair, hammering points home is useful for particularly complex operations, but you may become tempted to start skipping paragraphs.

Another beef is the guide's over-chummy Californian style. Phrases like "we'll start right off by naming the file" began to grate on my nerves after a while. On the positive side, the book does provide good hands-on experience and demystifies an operating system which has had an ivory tower reputation for too long.

A similar hands-on approach to the subject is taken by P C Poole and N Poole in their *Using Unix by Example*. Like *Unix and Xenix*, it is intended for practical users although it gives the impression that it is designed to be a course book for students.

The book is more biased towards programming in Unix than some of the other books mentioned here which are more interested in teaching the system operations.

But this is not to say that the authors drop you in at the deep end. Like other tutorial guides they begin by logging into the system and take it from there. The pace is quite quick in the early chapters in order to get on with the more complex operations. It assumes a familiarity with computer science and applied mathematics that the layperson might find a bit confusing.

Because *Using Unix by Example* is written from an academic viewpoint it deals with much of the obscure syntax most other tutorially based books do not bother with. This is valid if you intend to become a Unix systems programmer but not if you are a simple user. However, the book is a comprehensive discourse on Unix and is worth reading if you intend to do some programming with the system.

Although *Making Use of Unix* by D Budgen provides some introduction to the system, Budgen's real aim is to provide assistance to programmers wanting to make use of Unix. The book is divided into two parts, the first half of which contains a survey of the structure of Unix along with the commands most commonly used. *Making Use of Unix* goes further than most other books by attempting to explain how the commands fit in with the overall design of the system in order to lay the foundations for program development.

The main thrust of the second half of the book is to demonstrate how to program, test and develop Unix programs. As such, much of the text is geared towards Unix's programming tools and how they can be used for development and debugging. Budgen also puts great emphasis on producing reliable and structured programs, and concentrates on practical problem solving with various examples provided.

Making Use of Unix is not really a beginner's book but is aimed at the competent programmer who wants to know how to use Unix as part of a system. However, systems programmers might feel they are being given a taste of Unix without being provided with the detailed knowledge that would allow them to get deeper into the system. The book is more of a programmers' primer and most people will want to go elsewhere for in-depth analysis.

A BAD REPUTATION

Unix is notoriously difficult to use. Steve Malone samples some of the guides which attempt to explain how it works.

A BAD REPUTATION

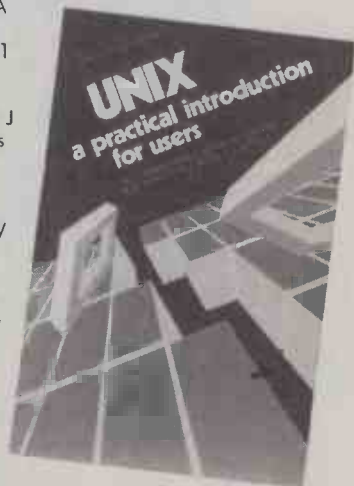
The Unix Environment by A N Walker. Published by John Wiley & Sons, £9.95. ISBN 0 471 90564 X

Unix: A practical introduction for users by R J Whiddett et al. Published by Ellis Horwood, £9.50. ISBN 0 470 20233 5

Unix and Xenix: A Step-by-Step Guide by Douglas W Topham and Hai Van Truong. Published by Prentice-Hall, £19.10. ISBN 0 89303 918 7

Using Unix by Example by P C Poole and N Poole. Published by Addison-Wesley, £12.95. ISBN 0 201 18535 0

Making Use of Unix by D Budgen. Published by Edward Arnold, £8.50. ISBN 0 7131 3519 0





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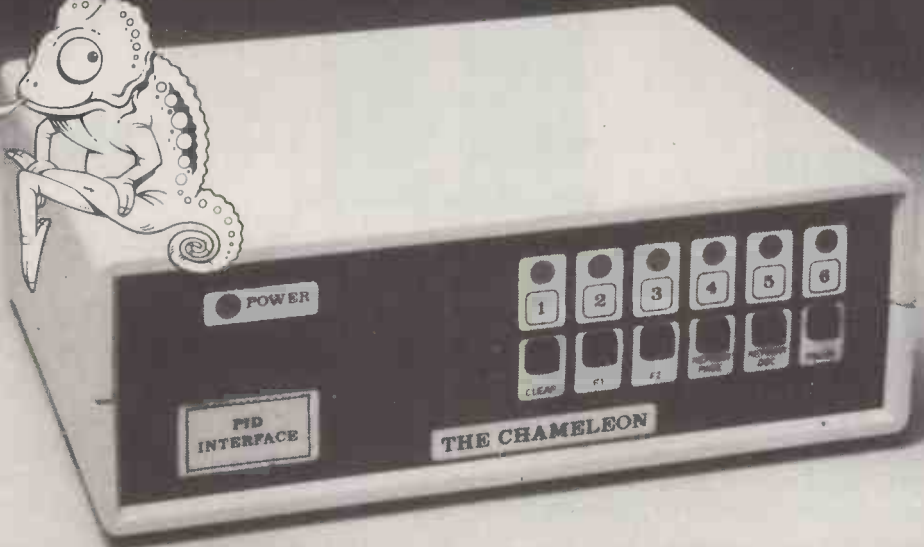
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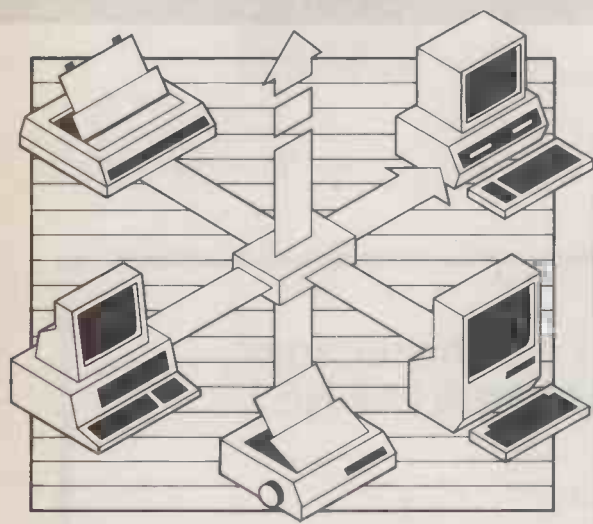
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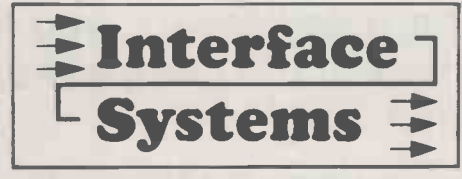
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 Surrey KT9 1FT
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TOP 10

Steve Gold gives some hints on how to choose a device to link your micro to the outside world.

Modems allow you to connect your computer to the outside world using the telephone system. The 0s and 1s used within the micro are converted to two tones, which are transmitted over the telephone lines like conventional voice information. They achieve this by a process of modulation and demodulation — hence the name of modem.

At its simplest, a modem consists of an acoustic coupler which fits over the telephone handset and converts each bit to a sound which is then transmitted. Obviously this process is prone to interference from outside noise sources. More satisfactory, and increasingly common, is the modem which plugs straight into the phone system and cuts out the intermediate stage of conversion to and from audible signals.

Since such systems send electrical signals into the telephone network, the apparatus has to be approved by British Telecom. In the past this has been a slow and costly process; more recently the approvals procedure has been streamlined, and products are now coming through more rapidly. It is important to check that direct-connect modems are approved as it is illegal to use an unauthorised device.

VARIETY

There are many different types of modem but few that I would recommend to someone who was beginning on the road to data communications. The problem with choosing a modem is that there are too many people in the computer industry who remain overly loyal to one modem manufacturer. In some ways this is good, while in others it is bad because it engenders a lack of originality of choice which forces a potential modem buyer into buying what could well be out-of-date technology.

In compiling the top 10 I looked for three qualities: ease of use, reliability and value for money. Sadly, many contenders fell at the first hurdle. The emerging de facto standard appears to be the Hayes standard, which was pioneered by Hayes in the U.S. Most personal-computer communications programs in the U.S. and U.K. conform to this standard, which uses logical AT commands as a prefix to mnemonic instructions to the modem. Thus AT100 instructs a Hayes modem to dial 100.

On the other hand, because of the relative complexity of electronics required to interpret the Hayes command set, cheaper

modems are often devoid of any intelligence. So once switched on-line they become transparent to the user and merely act as a device for converting keyboard input to modem tones, and modem tones to screen data. They work but with no frills, and despite many experienced modem users' love of the Hayes standard, a good no-frills modem can be attractive because of its simplicity.

Since the Hayes standard is in itself a set of simple commands which can be easily learned, the term ease of use is perhaps inappropriate; you have to learn to use Hayes commands, unless you use software to cocoon you from them.


So ease of use really applies to the modem's controls. They should be unambiguous and almost impossible to set wrongly. The controls of a dumb modem should be married to a good, simple manual, which should also be easy to read and understand.

Whether something is value for money is subjective. My own rule of thumb, is that a good basic modem without 1,200/1,200 baud full-duplex should cost under £150. Ideally, a standard modem in this category should cost under £100 but you really do get what you pay for, and at these price levels every extra pound counts in terms of circuit board construction, etc. Several very cheap modems are let down badly by sub-standard construction and components which have obviously been rejected by their manufacturers because they

do not have the requisite product-test marking. So if you can have a look at the open board of any modem you are thinking of buying it is well worth it. Points to watch for include unmarked components with no manufacturer markings on them, no date and/or revision markings on the printed circuit board (PCB), and poor quality of PCB tracks.

Many of the Hayes-compatible modems on the market today are just beginning to move into the advanced area of Hayes extra commands, such as intelligent-carrier and line-condition sensing. Without doubt, the next year or so will see these facilities becoming more common. Upgrades will become available, but before paying for a modem with Hayes protocol standards, ask your dealer what options, if any, there are for future upgrades. Most of the better modems have the bulk of their intelligence contained in software.

When compiling the top 10 several modems that are excellent value for money came to mind but did not have BABT approval at the time of writing. Several leading authorities in the computer field maintains that the ticket of approval merely indicates that the machine has been to the BABT approvals office. Be that as it may, any modem manufacturer with a good reputation to protect would not release a modem on to the market unless it had achieved full approval.

Modem buyers on a limited budget should be aware that the initial costs of the modem itself will often be outstripped by the running costs — the telephone charges — in the first year. A little extra spent initially on features such as 1,200 baud full-duplex will almost certainly pay dividends in lower telephone bills later. 

SUPPLIERS

Dacom Buzzbox/Dacom 2123AD

Dacom, Sunrise Parkway, Linford Wood, Milton Keynes MK14 6LV. Telephone: (0908) 675511

Dowty Quattro Dowty Information

Systems, Newbury Business Park, London Road, Newbury, Berkshire RG13 2PZ. Telephone: (0635) 33009

Hayes Smartmodem Hayes, Hayes

House, The Gate Centre, Syon Gateway, Great West Road, Brentford, Middlesex TW8 9BB. Telephone: 01-847 4471

Interlekt Portman Interlekt, DCE

Interlekt, DCE House, Bessemer Crescent, Rabans Lane, Aylesbury, Buckinghamshire HP19 3TH. Telephone: (0296) 32971

Miracle WS-2000/WS-3000

Miracle Technology, St. Peters Street, Ipswich IP1 1XB. Telephone: (0473) 216141

Pace Series Four Pace Micro

Technology, Juniper View, Allerton Road, Bradford, West Yorkshire BD15 7AJ. Telephone: (0274) 488211

Prism Modem 1000/Thorn EMI

Modem 2000 Modem House, 70 Longbrook Street, Exeter EX4 7AP. Telephone: (0392) 213355



The control codes pioneered by Hayes are now supported by most good software.

TOP 10

DACOM BUZZBOX

ONE of the smallest 300 baud hard-wired modems available. The Buzzbox is battery-powered and available in answer/originate and auto-answer versions. There is no through telephone socket, possibly due to lack of available room on the rear of the modem's case. This means you have to buy a telephone connector. Two simple push buttons on the front control the modem, making it one of the simplest V-21 modems around.

PRICE: £69

FOR: Compact, battery-powered facility makes this a natural for portable use.

AGAINST: No through telephone port.

DACOM 2123AD

THIS surprisingly compact autodial, auto-answer modem is bundled with a range of software packages that includes the Communitel bulletin board system for the BBC Micro. A host of features such as intelligent autodialling and full-speed buffering make this one of the more easy-to-use V-21/V-23 modems around. Several on-board software options such as EPAD error correction make this a good purchase for beginners. A battery-backed 32-number store is included in the standard model.

PRICE: £255

FOR: Compact. Simple Hayes command set. Failsafe reset button.

AGAINST: Overpriced.



HAYES SMARTMODEM 1200

THE first U.K. offering from the U.S.-based firm that was the originator of the Hayes standard. It is a highly priced single baud-rate modem, designed to establish a foothold for Hayes in the U.K. Available in external box and internal PC card versions, the modem features an on-board battery-backed memory and very low-noise components. Overpriced in the light of other PC card modems becoming available in the U.K. Capable only of V-22 speeds.

PRICE: £575

FOR: Blue-chip company name. As Hayes compatible as you can get.

AGAINST: Very high price. Single V-22 baud rate creates problems for viewdata access.

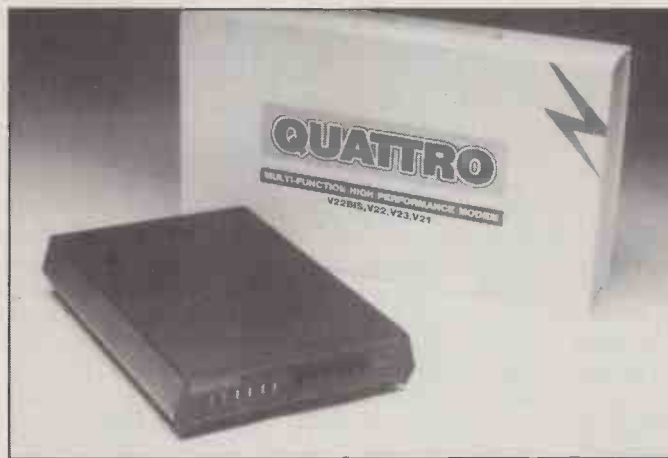
INTERLEKT PORTMAN

WHEN it was launched in 1985, many people dismissed this modem as overpriced in a competitive market. But the Portman has proved to be a reliable and sturdy modem capable of withstanding testing conditions. A cream metal case hides a neat circuit board design, with a simple and functional front panel showing the modem's main speeds of 300/300, 1,200/75, 75/1,200, and 1,200 baud half-duplex. A three-pole switch allows hardware selection of data, talk or auto-answer mode, along with a proprietary hardware 1,200 baud half-duplex system which allows Portman-to-Portman communication at pseudo full-duplex rates. Comes with a clear manual.

PRICE: £173

FOR: Rugged construction. Simple rotary switch. Hardware selectable auto-answer function.

AGAINST: Industrial looks. Bulky. Heavy case.



DOWTY QUATTRO

COMPLEMENTING the sleek looks of the rest of the Dowty/Steebeck range, this machine performs effortlessly at speeds up to V-22bis, and can handle almost any speed configuration in both auto-answer and originate modes. As well as being fully Hayes compatible, the modem also has an on-board Steebeck command set, which is invoked using a simple AT command and allows simple one-key calling of telephone numbers. Full battery backup of a multi-number store is a standard feature, along with

a Hayes extended command set. Dowty is working on several proprietary error-checking systems for the Quattro, notably for the forthcoming Vasscomm network, which will enable easy up- and downloading to PSS, Telecom Gold and Prestel at different baud rates. Available in both external box and PC internal card versions.

PRICE: £691

FOR: State-of-the-art technology. Superb after-sales backup. Assured of a long life.

AGAINST: Price. Difficult to configure for non-Hayes compatible software.

MIRACLE WS-2000

THE first major product from Ipswich-based Miracle Technology, the WS-2000 has weathered the past two years of modem wars well. Now looking somewhat squeezed by the up and coming budget market which offers autodial and auto-answer facilities for under £100. The WS-2000 is solidly constructed and capable of reliable data transmission at 300/300, 1,200/75, 75/1,200, and 600, 1,200 half-duplex. Several interfaces for non-RS-232 interfaced computers are available from Miracle, making it a very universal modem.

PRICE: £109

FOR: Proven technology. Variety of interfaces and software packages available for most micros.

AGAINST: Old-fashioned design. Overpriced and underpowered.

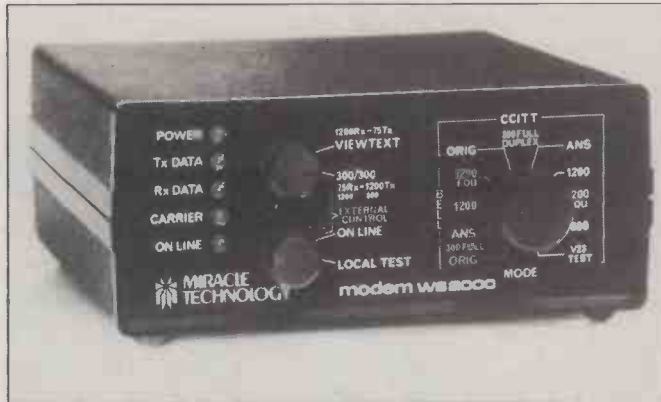
MIRACLE WS-3000

THE first of the popularly priced Hayes-compatible modems, the WS-3000 came on the market back in 1985. Early teething troubles have been overcome and with a recent price cut the V-22 model has become very competitive. The WS-3000 was the first commercial hard-wired modem to generate Bell tones and still retain BABT approval. A full on-board battery-backed 60-number store addressable via the usual Hayes command set makes this modem an industry classic. Potential modem usurpers such as the Pace Series Four have thrown the WS-3000 into the shade lately, as has Miracle Technology's decision to release a stripped-down version in the shape of the WS-4000 schools modem. All models are factory upgradable to higher speeds, and are fully speed buffered to allow access to, say, Prestel while communicating with the PC at 1,200 baud full-duplex.

PRICE: V-2123, £295; V-22, £495; V-22 bis £650

FOR: Established. Good value for money. On-board software fully debugged and fully upgradable via plug-in ROM. Speed buffering for split baud rates.

AGAINST: Not stylish.



PACE SERIES FOUR

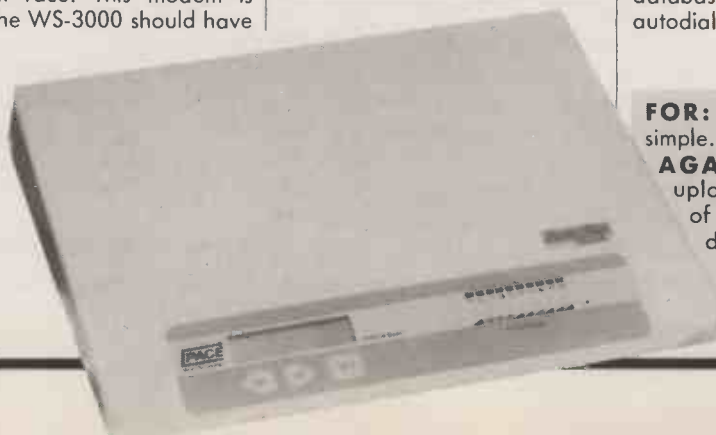
THE latest Hayes-compatible modem to hit the streets, this Pace machine was conceived around the same time as the Miracle WS-3000 but took longer to develop. Technically similar to the WS-3000, but frills such as a printer port, extended Hayes command set, and front key-controlled LCD status display put the Series Four just ahead of the WS-3000 in the modem race. This modem is what the WS-3000 should have

looked like. It has a 62-number on-board memory — two more than the WS-3000.

PRICE: V-2123, £185; V-22, £335; V-22bis, £433

FOR: Superb technical performance. Stylish good looks. Printer port. Display.

AGAINST: Unsuitable for stacking. Reliability and software unproven.



PRISM MODEM 1000

LAUNCHED in 1984 by the now liquidated Prism group as the first hard-wired modem for use on Micronet 800, it was the first cheap modem to become commercially available. Many thousands were sold to Micronet members on Prestel, for use with the BBC Micro. Can cope with 1,200/75 baud speeds admirably. Also capable of high-speed 1,200 baud half-duplex in RX and TX modes, making user-to-user communication possible. Simple design and reliable circuitry make this modem very fast in half-duplex mode, and almost transparent to computer software. Boxy black shape means a phone can be stacked on top so dialling can be done via the rear through the telephone socket.

PRICE: £50

FOR: Cheap. Proven technology. Easy to use. Good instruction manual.

AGAINST: Slow for uploading data. Original distributor in liquidation.

THORN EMI MODEM 2000

THE 1984 successor to the best-selling Prism 1000 modem, the Thorn EMI basic modem is found in many IBM PC and Amstrad PCW-8256 software packages. Only two simple controls, on-line and off-line, are necessary for this easy-to-use modem. They are selected by two red data buttons on the front of the unit. Much maligned by owners of the original Prism 1000 modem, since it cannot do 1,200 baud half-duplex; 1,200/75 baud only is available on this unit. The modem is so simple as to make it compatible with almost any micro with a serial port. Although reaching the end of its useful life as a viable seller it is still very functional at the price. A through telephone port is provided for the dialling of databases. It has no facilities for autodial.

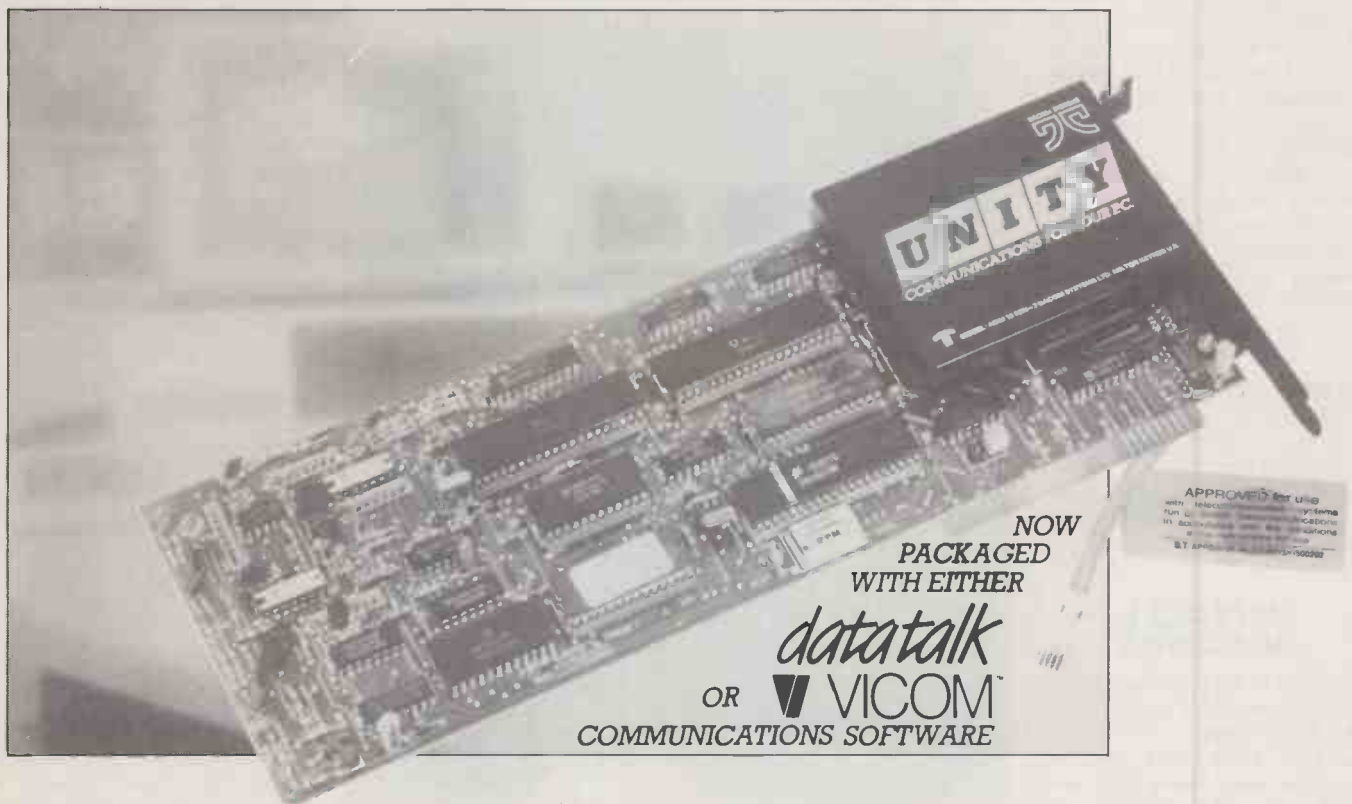
PRICE: £50

FOR: Technically very simple.

AGAINST: Slow for uploading data. Lack of 1,200 baud half-duplex makes it unsuitable for user-to-user data transmission.

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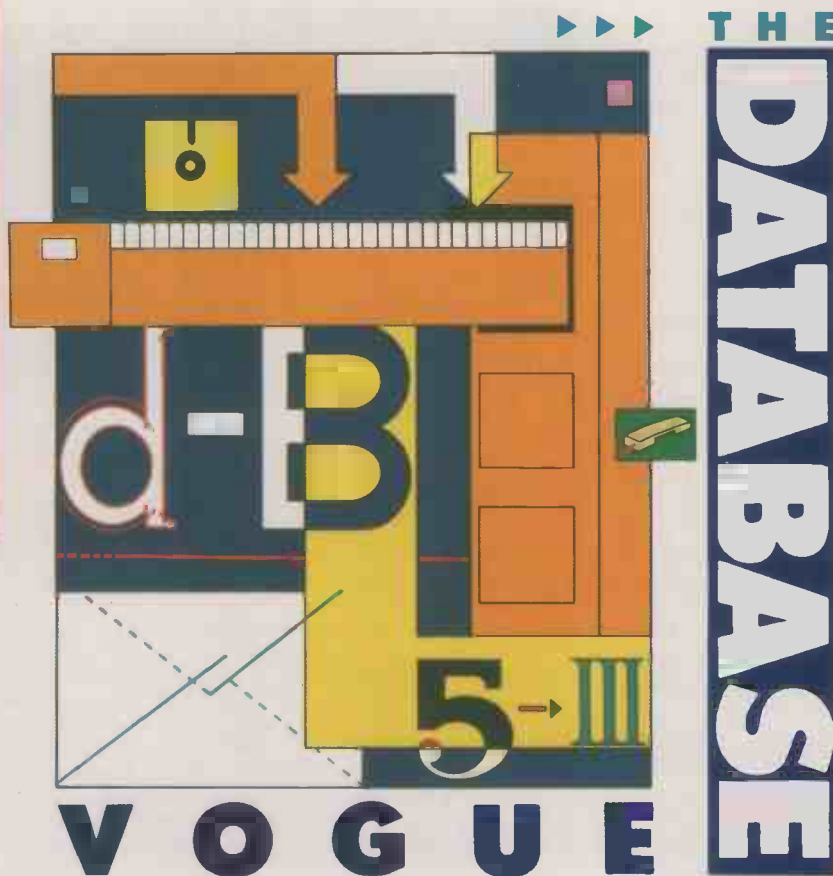
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DEALERS

As users move onwards from the simpler applications to the more sophisticated, so databases are becoming increasingly popular. **Ian Stobie** introduces our special section on the different kinds of packages that can be tailored to meet your needs.



T

here are signs of a major revival of interest in database software among personal-computer users in business. By now most people have mastered the simpler applications and are ready to move on to something a little more ambitious.

The typical business handles a much wider range of information than spreadsheets and word processors can handle. And to get the best from your computer investment, without going all the way and turning to a time-consuming programming language, means using a database software package.

At present large, powerful application generators like dBase III dominate the database market. They are not much short of a true programming language in what they let you do. However, they demand a similar commitment of time and effort, and much of the interest and excitement in the database field is being generated by far simpler and cheaper products.

We start this special 10-page feature by surveying the present state of the database market, and giving profiles of some of the major players and their products. Then on page 103 Steve Malone looks at the simplest

databases you can get in the form of the dialler and card-file functions commonly found in pop-up programs like Sidekick. These mini-databases have little power, but the information they give can be of great value because it is there exactly when you most want it.

On page 106 Susan Curran reviews Zy-Index, a program designed to unlock the information held in your existing word-processed documents. Traditional databases work on information stored in fielded records. But much of a typical user's information is stored in the quite different format used by word-processing programs. To get full value from it requires something like Zy-Index.

On page 108 Jack Schofield surveys on-line databases. They are rapidly moving beyond the domain of the specialist. An increasing quantity of information of real interest and business value is now on offer. But the real breakthrough is that you can at last get at it simply using Telecom Gold to provide the link.

Finally, we move on to an innovative product at the top end of the PC market. On page 111 Mike Lewis looks at Intuitive

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Solution, a package also sold by IBM under the name of Teamwork Solution Builder. Designed for multi-user network environments, this package returns to the original mainframe concept of the database as the central data resource around which you build all the computing applications you need in your business. But at the same time Intuitive Solution embodies lessons learned from the personal-computer industry, presenting users with a very Macintosh-like interface.

Most of the top-selling database programs are full-blown multi-file application generators. This is surprising because they are not very easy to use.

Application generators usually take the form of specialised programming languages, strongly biased towards record handling and report writing. With this sort of database language you can write quite complicated applications which involve working on several sets of data at the same time. For example, you might attempt writing a stock-control and billing system tailored to your own business.

Most business applications should take less time to develop using a database language than they would using a general-purpose programming language like Basic, which does not offer the same high-level file-accessing, screen-handling and reporting features.

The beauty of the database language is its flexibility. Once you know the language you can readily produce new ad hoc reports from your existing body of data. The drawback is most of these packages take some time to master. You come up against the old trade-off between power and ease of use.

In any relatively ambitious project just designing the file structure involves a great deal of thought. Then you have to master the syntax of the database language, which — like any programming language — will take some time. Many people hire professionals to do the bulk of the work. But if you think you might want to write your own database code at some later date to link into the same data files be sure to specify it in your contract so the application is not copy protected.

MENU OR COMMAND

The main application generators now have additional menu-driven front ends as an alternative to using the database language directly. This is quite helpful for simple jobs, but once the application gets complicated most people find they prefer to use the language rather than menus.

The best packages for the less confident user are probably Paradox or Compssoft Delta; you can get a long way with them just by using the menu system. Professional programmers are likely to stick with dBase because they know it.

However, for most people using a dBase III style database language is using a sledgehammer to crack a nut. If your task involves keeping a fairly simple set of records such products are unnecessarily complicated.

HEAVYWEIGHTS

dBASE III PLUS

The industry standard, descended from an original CP/M product but steadily upgraded to keep pace with hardware improvements. Very well supported with pre-written applications, books, training courses and a large body of skilled programmers who already know it. Reviewed *PC*, June 1986.

PUBLISHER
ASHTON-TATE
SUPPLIER
ASHTON-TATE, (0628) 33123



DMS DELTA 4

The major British contender. Claims to be easier to use than dBase, but its main asset is probably its publisher, Compssoft, which supports the package well. Good training courses and a reasonable range of pre-written British-orientated applications.

PUBLISHER
COMPSOFT
SUPPLIER
COMPSOFT, (04868) 25925

OMNIS III

The most powerful Mac database, well up with the IBM products when it comes to developing heavyweight applications. Uses menus throughout. Does not handle pictures and fonts like some Mac software but it is primarily designed for reporting and accounting. The U.K.'s only substantial recent success on the U.S. business-software market.

PUBLISHER
BLYTH SOFTWARE
SUPPLIER
BLYTH SOFTWARE, (0728) 3011

RBASE 5000

Very similar in concept to dBase but reputedly benefits from more recent design. It is distributed by Microsoft in Europe, and so is part of that company's across the board assault on the maker of dBase, Ashton-Tate. Reviewed *PC*, November 1985.

PUBLISHER
MICRORIM
SUPPLIERS
P&P MICRO DISTRIBUTORS,
(0706) 217744; SOFTSEL,
01-568 8866; FIRST
SOFTWARE, (0256) 463344

PARADOX

Strongest challenger yet to dBase. It too comes with a complete programming language, but you can get away with using its menu system with its Lotus-like interface for developing most applications. It has a powerful query-by-example system for browsing. Reviewed *PC*, April 1986.

PUBLISHER
ANSA
SUPPLIERS
P&P MICRO DISTRIBUTORS,
(0706) 217744; SOFTSEL,
01-568 8866

LIGHTWEIGHTS

CARDBOX PLUS

A British program that is probably the market leader among the simple databases in the U.K. Runs on a wide range of machines, including eight-bit CP/M.

PUBLISHER
BUSINESS SIMULATIONS
SUPPLIER
BUSINESS SIMULATIONS,
(0892) 863105



REFLEX THE ANALYST

Single-file database designed for analysing data and writing reports. It provides you with five ways of looking at your data, including a graph view and a cross-tab view. Reflex was dramatically reduced in price following its acquisition by Borland. The program is now being promoted as a data-analysis front end to programs such as Lotus 1-2-3. Mac version due shortly. Reviewed *PC*, September 1986.

PUBLISHER
BORLAND INTERNATIONAL
SUPPLIERS
P&P MICRO DISTRIBUTORS,
(0706) 217744; ALTOR,
041-226 4211; FIRST
SOFTWARE, (0256) 463344;
SOFTSEL, 01-568 8866

BUSINESS FILEVISION

A Macintosh program, Filevision can be used simply as a straightforward record-handling database. Its unique feature is that it lets you relate data to pictures. For example, you could draw the plan of a housing development and set up a data record to each plot. You could then go on to attach lower-level pictures and records to the same structure — room plans or prospect details, for instance.

PUBLISHER
TELOS SOFTWARE
SUPPLIERS
P&P MICRO DISTRIBUTORS,
(0706) 217744; SOFTSEL,
01-568 8866

PFS PROFESSIONAL FILE

Revamped program which combines the functions of PFS File and PFS Report in a more business-orientated package. PFS File is historically the brand leader in simple record handlers in the U.S., and is sold by IBM under the Filing Assistant name. Recently has come under a heavy challenge from Q&A.

PUBLISHER
SOFTWARE PUBLISHING CORPORATION
SUPPLIER
SOFTWARE PUBLISHING EUROPE, 01-839 2849

Q&A

Single-file database with built-in word processor for report writing and a neat gimmick in the form of its plain English interface. You teach it the specific terms used in your application, which it adds to a built-in vocabulary of about 400 words. You can then make ad hoc queries on your file by typing things like: "I want a house under £60,000 near a tube station". Reviewed *PC*, September 1986.

PUBLISHER
SYMANTEC CORPORATION
SUPPLIER
PARADIGM, 01-228 5008

Products like Cardbox and PFS File offer a far simpler way forward. No programming language is involved. But by the same token you have less flexibility, and tend to have to do things in the way the designers of the package think best.

These simpler kinds of database are often referred to as file managers, record handlers or flat-file databases. Generally you are limited to handling one file at a time, although some packages provide some sort of mechanism for linking more than one file together.

They usually require you to define your record layouts on-screen. Once you have entered your data you can then search for individual records or groups of them by typing in selection criteria, and then produce a range of lists and reports.

NATURAL LANGUAGE

Products in this category are getting increasingly sophisticated. The original offerings were often simple analogies with card indexes. Now Q&A boasts a natural-language interface, where you can type in requests for information in something that resembles normal English. Another recent product, Reflex, allows you to produce a whole range of cross-tabulated and graphics reports from your data.

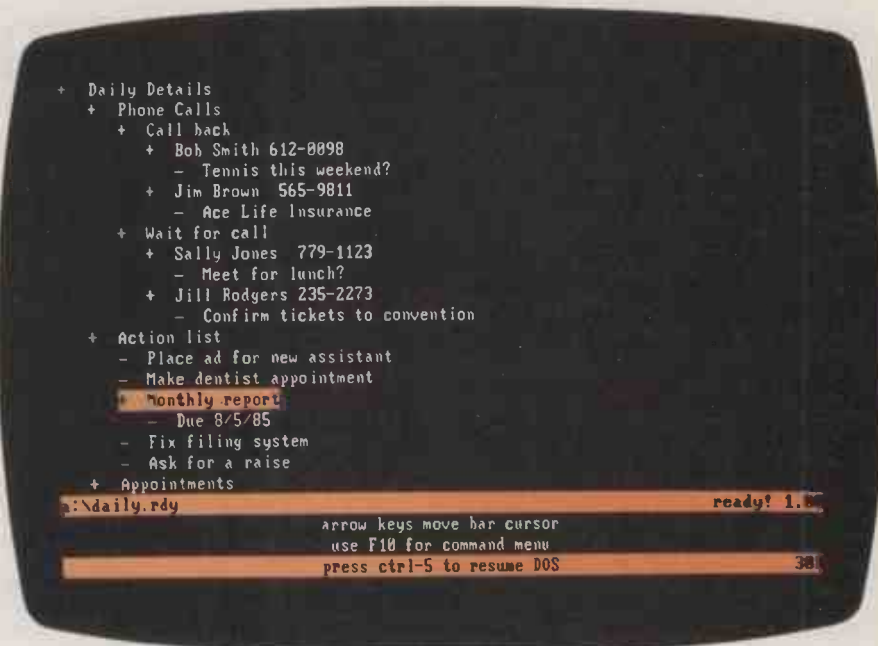
Behind this innovation is a rethink about what users want databases for. Rather than being simple-minded electronic analogues of traditional paper systems they may have a more central role in analysing data.

Not everyone feels at home with a spreadsheet. Many people would prefer to analyse data using something which more closely resembles a text environment. For this data-analysis role the ability to import data from other packages is very important. It is not much use only being able to look at data you specifically type into your database system when it comes to analysis.

Packages with good file importing and data-analysis features are perhaps best thought of as browsers rather than databases. Q&A and Reflex are both outstanding examples in their way, as is the Ashton-Tate integrated package Framework.



Several options for presenting data are built into the Reflex analysis package.



Ready's flexibility allows it to be used as a diary planner and scheduler.

Instant data

Complex database managers have their place, but for day-to-day information speed and accessibility may be more appropriate. **Steve Malone** looks at the data-storage facilities offered by memory-resident programs.

A database is usually seen as a mass of files held on disc and handled by a large and complex database manager. Yet many people find that all they need is something which can store telephone numbers and a list of names and addresses. There are a number of these mini-databases on the market, the most famous of which is probably Cardbox. The trouble arises when you are using a different application, such as a word processor, and are faced with having to quit the application to get the information you need from the database.

Of course, it is possible to buy one of the giant integrated systems like Lotus 1-2-3. But even if you can afford the package and the additional memory that is required, you may find that the database manager is far more complex than you want and the applications that come with it are not what you need.

The ideal solution is a pop-up database program which can work with any application and sits in memory until activated by pressing a combination of hot keys. Once it has provided the desired information, it can terminate and let you get on with your main application.

There are a number of such programs containing mini-databases that allow you to read information while remaining in the main application. But unfortunately there is a conflict in philosophy between databases and pop-up programs. Ideally the pop-up accessory should reside entirely in system memory and, as far as possible, remain in the background when not invoked. This

gives the main application the free run of the system to carry out whatever tasks are required — including access to the disc drives. Consequently, a pop-up program should not have to call upon overlays held on disc.

On the other hand, a database manager accesses previously stored information, and can recall it to the screen quickly. Inevitably the required information is stored on disc. In order to satisfy both requirements some kind of compromise clearly needs to be reached.

A pop-up program which makes use of stored information thus retains the ability to be called at will via the hot key, but if access to the database is required the program will go and look for it on disc. The penalty paid by the user is that there is inevitably some swapping of discs between the pop-up program and the application.

DISC ACCESS

While some facilities, such as the calculator, do not require access to disc, the telephone directory and notepad do. As an example, Sidekick reads notebook and telephone-directory files from disc. Because they both contain the user's information it is no surprise to discover that both features are written via the notebook.

This introduces a major point about pop-up databases. Unlike a standard self-contained database manager which is used to collate, store and access information, the small pop-up database is often used as a

(continued on page 106)

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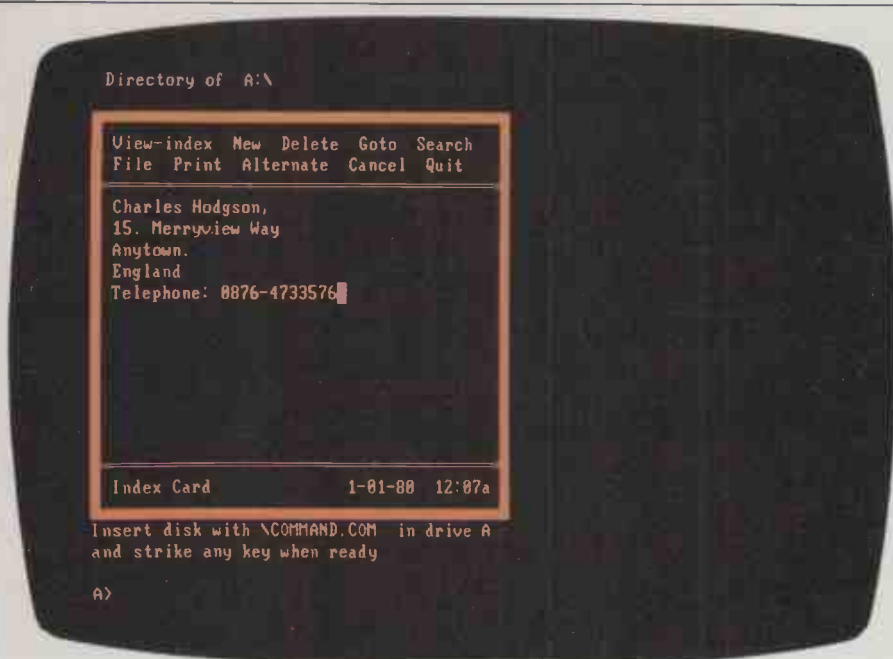
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BLYTH SOFTWARE



Spotlight's database manager can be accessed from the Card File window.

(continued from page 103)

means to an end. Telephone numbers and codes written with the Sidekick notepad must not only be able to be transferred in the user's directory, where searches can be performed, but must also be capable of exporting information to an autodial modem as meaningful data. The inverse process — the ability to import data — is also a useful tool to have available. This allows data to be taken from an application and stored inside the pop-up program's own databases.

Most of the databases used in pop-up programs are of the desk-accessory type, and include the typical Sidekick applications like autodial telephone directory, notebook, appointments, calendar and diary. But there are other pop-up programs which provide more adventurous facilities.

DATABASE MANAGER

Spotlight from Software Arts contains a full cardbox-type database as well as the more standard desk accessories. The Card Index File module can contain up to 36 different databases, which are known as lists. There can be up to 500 cards in each list. The basic requirements of a database manager — such as examining the index of a particular database, adding or deleting new cards and simple file searches — are all included, and are accessible via the top two lines of the Card File window.

The manager keeps all of the cards in alphabetical order and sorts them automatically on the basis of the characters in the first line of the card. Database managers of this kind do not contain any sophisticated key searching and matching facilities, but many programs like Spotlight and Sidekick do have a simple string-search facility. The program searches the list of records until it finds a match and then highlights it accordingly.

Beyond the simple cardbox system is Ready, published by Living Videotext Inc.

Billed as an outline processor, this package encourages you to develop your ideas by organising your thoughts in a structured fashion. For example, while writing a report you might write down the title, then subdivide it into the main headings, then sub-headings and so on.

The end result is a database organised in a pyramidal structure. On loading one of the files from disc you are presented with a list of names, files, subjects or whatever. Using the numeric keypad it is possible to examine the lower levels of the subject and move, edit or alter them. Thus a file which may have only a few lines on the top level can be opened like a concertina to reveal all of its information.

Because Ready is flexible in the way it organises data, it can be used to store information beyond the ideas processing for which it was designed. It is possible to use Ready as a diary planner, scheduler and telephone notebook. Like the other programs mentioned, Ready has autodial facilities.

The pop-up database has a range of uses beyond the simple storage and indexing of information. As well as storing data in a simple and accessible form you can swap it to and from an external application. If you have autodial facilities you can channel telephone directories direct to a peripheral. The flexibility of such programs, together with their instant accessibility, makes them small but powerful alternatives in many applications to the giant database managers.

SUPPLIERS

Ready, Sidekick, Spotlight Softsel Computer Products, Softsel House, Syon Gate Way, Great West Road, Brentford, Middlesex TW8 9DD. Telephone: 01-568 8866

Sidekick also available from Altor, Unit 11A, Anderston Centre, Glasgow G2 7PH. Telephone: 041-226 4211

Finding the right word

Susan Curran looks at alternative approaches to free-text retrieval, contrasting the performance of Zy-Index, a dedicated text-retrieval program, with the facilities offered by a full-feature word processor.

The market has woken up to the fact that many people want to search through batches of unstructured word-processor files, as well as through database files, for words or phrases. Slowly and surely the options are taking shape, though there is still room for argument about the best way to do this.

There are two basic approaches. The first is a straight search; the second is an indexed approach. The advantage of the straight search is that you do not have to fiddle around indexing files before searching, or to reindex and weed when files are updated. The disadvantage of this approach is that as the amount of material to be searched increases, so does the search time — sometimes alarmingly.

HOUSEKEEPING

The advantage of indexing is that the search time remains quite short, even with multi-megabyte file bases. The disadvantage is the amount of housekeeping that needs to be done. I reviewed one indexing program, Recall, in the June issue which we found slow and cumbersome in its housekeeping and too disc hungry for all but specialist uses. Zy-Index, though similar in approach, is less cumbersome, and it is a realistic option for applications which involve frequent quick searches of rarely changing file bases.

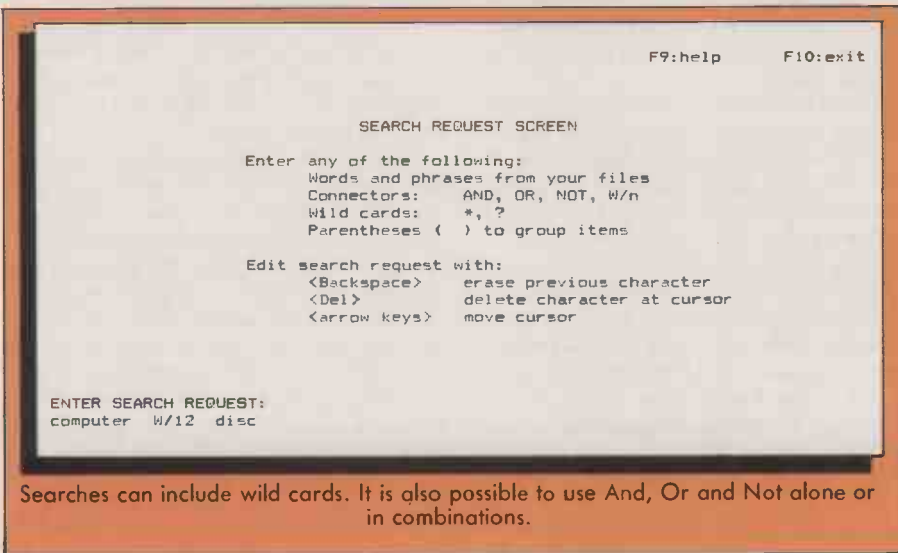
But I am still not convinced that indexing is the ideal approach for many applications, particularly when they involve less frequent searches of regularly updated file bases.

Zy-Index is a well-established American program which is newly available in this country. I reviewed version 2.1 of Zy-Index Professional. The program comes on three unprotected floppy discs. There is a tutorial disc, which is more a sampler than a step-by-step tutorial; a start disc; and an Extras disc. A manual is normally supplied, but I did not have one for this review. Zy-Index can be run from floppies or installed on a hard disc, and there is a version which will work on networks.

Zy-Index is four separate programs: Zy-



Disc directories on Zy-Index are laid out in an awkward fashion: files appear in DOS order rather than alphabetically.



Searches can include wild cards. It is also possible to use And, Or and Not alone or in combinations.

Index, Zy-Search, Zy-Util and Zy-Clean. The first and second are the most important; the others simply provide essential utilities for removing files and so on. The four must be called up separately from DOS. There are no trimmings in the form of a neat front end, and a proper menu and linking arrangement would much improve the package.

ON-SCREEN MENUS

All the programs work in a broadly similar way, with on-screen menus and selection by function key. They all have contextual facilities, though the help tends to be of an obvious kind.

First you must index your files, then you may search them. Files produced by most popular word processors can be handled, including those that generate non-ASCII files, such as Displaywrite and Multimate. It is not necessary to save the files as ASCII files before using Zy-Index.

Zy-Index works with a single index list on which all files are indexed. It is only possible to group files on separate lists by reinstalling the program, which is a little clumsy. Files can be selected for indexing individually or in bulk from any floppy- or hard-disc directory. There is a special option for

indexing only those files which have been added or updated since the last indexing session. The program displays a disc directory on-screen, but it is less than perfectly laid out: the files are listed in DOS order, not alphabetical order, and only one screenful can be seen and selected at once.

The indexing process takes a few seconds per file. It is much faster than Recall, but inevitably it takes several minutes to index a number of files. Indexing half a megabyte of files, for instance, took 45 minutes.

Unlike Recall, Zy-Index recalls the original word-processor files: it does not

SPECIFICATION

Description: indexing and text-retrieval system for use with unstructured text files

Hardware required: IBM PC, PC/AT or compatible with at least 256K RAM; hard disc is recommended

Copy protection: none

Price: £345; network version £695; site licenses available

Publisher: Zylab of Chicago
Distributor: Primary Process Software, 2 Coombe Road, Chiswick, London W4 2HR. Telephone: 01-994 6289

Available: now

create any alternate-format document files. The index files themselves seem to be very compact, so disc space should not normally be a problem. There should shortly be an option for printing out a sorted index list, but the index file is not currently text-readable.

There is no need to define an initial length for the index list, since it grows as necessary. It will hold between 125,000 and 500,000 unique words on different versions and systems, which is ample for all normal purposes. There are various internal limitations, but they would only be a problem with very specialist files containing many similar codes. Indexing and searching is not case-sensitive, and ignores accents.

There is a list of words that do not require indexing. It can be edited at will, though only before the indexing process starts. It can cope with numbers and with wild cards to remove, for example, any unusual index codes within the documents.

Searches can be cumulative and any individual search can include wild cards, though only after the first three letters. You can also use And, Or and Not alone or in combinations. It is possible to include a proximity operator in And searches, defined

ZY-INDEX

PC VERDICT

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

A competent indexing program with few frills.

by number of words. You can, for instance, search for occurrences of "index" and "computer" within 10 words of each other. It is also possible to include file names and dates in the searches.

The searches are not instantaneous, but on moderate-sized index lists they take a couple of seconds at most. The result of the search comes up as a list of file names containing the search words or phrases. Files found in this way can then be inspected or printed. Files chosen for inspection have the search words highlighted throughout, and there is a page-through option to help you find them in long files.

If your documents are in ASCII or Word Perfect format, there is another option open to you. Word Perfect introduced directory-orientated searches in version 4.1, and the new Word Perfect Library utilities reviewed on page 72 of this issue takes the process still further. This search facility uses no indexing but searches all through specified files. The trick is to specify files fairly tightly before searching.

(continued on next page)

F4:Next file F5:Find F6:Save F7:Mark F8:Unmark F10:Exit

Displaying File: c:\word\PASTCHAR

William de la Pole, Earl of Suffolk; b. 1396
 Alice Montagu, nee Chaucer, Countess of Salisbury; becomes
 Countess of Suffolk, 1430; b. c. 1405
 Thomas Chaucer, Alice's father: Oxfordshire landowner,
 merchant and politician; c. 1370-1434

William Paston, a Norfolk landowner and lawyer; subsequently
 a Judge in the King's Bench. b. 1378
 Agnes Paston, his wife b. c. 1400
 John Paston, their eldest son b. 1421
 Edmund Paston, their second son b. 1425
 Elizabeth Paston, their daughter b. 1429

William Yelverton, a Norfolk landowner and lawyer b. c. 1395
 John Heydon, a Norfolk landowner and lawyer; Recorder of
 Norwich 1431-33; servant of the Earl of Suffolk, 1430-;

Paston AND Fastolf

7 Files Retrieved

The Word Search option on Word Perfect 4.1 lets you search files using And, Or and wild cards just like Zy-Index will.

Facts by phone

The amount of information accessible via Telecom Gold has grown from a trickle to a deluge. **Jack Schofield** provides a breakdown of what's available.

The number of computer databases available to the public is now well over 2,500, from several hundred different hosts. The logistics of contacting each supplier, getting a phone number and an identity (ID), remembering a password, paying an annual minimum fee if there is one and arranging payment for usage are so tedious that few people are willing to sign on for more than a handful.

The major email suppliers such as Telecom Gold in the U.K., or Dialcom and The Source in the U.S., have a solution. They provide room on their own systems to host small databases, and offer gateways out to other, larger hosts. One phone number, one ID, one password and one set of billing arrangements can thus provide access to many different sets of information.

Obviously this can be a more expensive route to take. If you call, say, World Reporter via Telecom Gold, you have to pay the Telecom Gold usage charge of 11p per minute prime time, or 3.5p off-peak, as well. You would avoid this if you went direct. However, for the light user it is worth it, since it cuts out the overhead of dealing with an extra supplier.

MANY MORE DATABASES

Until recently, Telecom Gold concentrated on achieving dominance in the email market in the U.K. Now it is expanding into value-added services, and is greatly increasing the number of databases and other services available. The major ones include World Reporter, the Official Airline Guide, Jordanwatch and Infocheck.

There are basically three types of database service on Telecom Gold: those hosted on Gold and available to everyone, those hosted on Gold and available to a closed user group (CUG), and those accessed via a gateway and available to everyone.

Databases that are hosted on Gold use the same type of electronic-publishing software, which means once you have learned the search commands you can use them everywhere. Also you can use a Como file to keep a record of your search in your mailbox. When databases are accessed via a gateway from Gold into a different host computer, each one has its own different set of search commands. Once through the gateway it is impossible to tell that you have not dialled direct.

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My gut feeling is that for most applications this approach is entirely feasible. It is really an extension of the old manual-index business of narrowing down to a filing cabinet or a drawer or a folder before beginning to leaf through it. All it requires is that documents are kept in some kind of order in directories and sub-directories, and that this order and the document names are more or less relevant to the search. The searcher then narrows down the search area to a sufficiently small number of files for the search not to take forever. For instance, you might want to search all files beginning with C, or all *.Let files, or all files in a specific sub-directory.

SEARCH TIMES

I tried searching for a combination of words through three different sizes of directory. First I searched nine files containing a total of around 70,000 bytes. Next I searched 50 files containing around 450,000 bytes. Finally I searched the 91 files of my main word-processing directory containing nearly 1.5Mbyte. The nine-file search took about 10 seconds, the half-megabyte search took approximately a minute, and the 1.5Mbyte search took two minutes using Library and five using Word Perfect itself.

This is slower than with an index, but to make a fair comparison you need to allow for the very substantial housekeeping that is involved in setting up and maintaining an indexing program, particularly if you normally want to search current files, not archives. And this approach has the great advantage that once you have found your files, you are only a keystroke away — or two, with Library — from a word processor that gives you full facilities for manipulating, updating and printing them. There is even single-key reading of ASCII files produced by other word processors into Word Perfect.

Word Perfect 4.1 provides a neat List Files utility screen from which you can select files for retrieving, deleting, renaming, copying or printing. Files are listed in alphabetical order. It is possible to select any directory or

sub-directory and to give a file pattern — such as *.Doc — to weed extraneous files. The list gives file size and date, and long lists scroll smoothly.

The Word Search option lets you search the files themselves — not just their titles — for words or phrases. It will handle And, Or and wild cards just as Zy-Index will. When the search is complete the List Files screen is redrawn to list only the files found.

Library's File Manager produces a very similar file screen, though the files can be sorted by date or extension, as well as alphabetically. They can also be selected by date. File names alone can be searched right across a disc. This would be a handy way of narrowing down a search for files spread over several sub-directories.

It is possible to pre-select files by date or template and you can also mark as many individual files as you wish for inclusion in a subset. As well as And and Or you get Not and But Not options. Searches can be combined as often as necessary, so in almost every way this matches Zy-Index's capabilities.

Files when found are again displayed on an index screen, but this time there is a Look option which enables you to page through them before — or instead of — going back to Word Perfect. Look automatically finds the first occurrence of a search phrase; you can scroll, and you can search the file not only for a phrase involved in the search but also for any other phrase you specify. The great advantage of all these facilities is that they are well integrated with the rest of the word processor's capabilities. And it takes absolutely no advance preparation to use them.

CONCLUSIONS

■ Indexing is fine for frequent searches through a large, rarely changing file base; with a rapidly changing file base the housekeeping becomes a pain.

■ Zy-Index is plainly presented, but it indexes efficiently and has a good range of search options. It handles a very wide variety of WP files.

■ For more ad hoc searches Word Perfect 4.1 offers by far the best facilities of any word processor.

PUBLIC DATABASES

ON TELECOM GOLD the databases available to the public are *Infomatics Daily Bulletin* (IDB), Textnet and World of Lotus. IDB, the first database hosted by Telecom Gold, went on-line over a year ago. Each new issue contains about 35 to 40 stories, is about 20K in length and becomes available around noon each weekday. It can then be read as a complete issue, scanned on headlines or searched on keywords, using Re, Sc and Se respectively as the commands.

Six months' back issues are available at any time and can be searched using And and Or with keywords and wild cards in a string up to 120 characters long. The only other major commands are Help, Back, which takes you back up the tree structure one level, and Quit.

IDB carries general stories on new computer products and information technology (IT), plus capsule summaries of the latest company results. It is aimed mainly at the sales and marketing managers in computer and IT companies, but it is also of interest to investment analysts, computer journalists and others in or close to the trade.

Accessing IDB costs 56.2p per minute on top of the connect charge. People who already subscribe to the paper edition of the newsletter get a reduction, paying only 14.5p per minute.

Recently the publisher of IDB has added another of its newsletters to the same database. PC Marketing Information provides extracts from the weekly newsletter *PC News*. The stories cover marketing information and price cuts, plus dealer, advertising and public relations news. Three months' stories are on-line at present and this is being built up to six months.

Textnet started as a CUG on Telecom Gold before going public. It is a database of suppliers of services covering the whole field of text creation and manipulation. Since not all such business can be completed by email, supplier profiles usually include a list of the equipment available, including computers and software, modems, printers and plotters, facsimile machines, etc.

Services include translations from English

to or from 36 languages, transcription, word processing, typesetting, automated text capture plus writers, graphic artists and laser-printing services. PRs and market research consultants are being added. If you wanted to dictate the text of a book on to tape in Urdu, get it transcribed and translated into English, checked by a technical expert, illustrated, typeset and printed, Textnet would help you find the people to do it.

Typical users cover the whole spectrum of business including publishers, a manufacturer of air compressors and a shipping agent. It is ideal for small companies, especially if they want to export. Using Textnet adds 50p per minute to connect time charges.

World of Lotus is aimed at users of Lotus products such as 1-2-3 and Symphony. The database includes news and feature stories, listings of books and public-domain software, technical information, user forums and some software which can be downloaded, including device drivers and spreadsheet formulae. There is a help line if you have a query or problem.

The Lotus database on System 74 is the only part of Telecom Gold which offers the Xmodem protocol with access via PSS. The surcharge for using World of Lotus is only 5p per minute.

CUG DATABASES

TO ACCESS most databases hosted by Telecom Gold, you have to be a member of a special user group. Usually this means you cannot use any box you may have already. Each of the two largest databases, The Times Network Systems (TTNS) and Microlink, occupies its own Prime minicomputer in the international Dialcom network.

Agra Europe comprises two databases, Aginfo and Agnews, loaded mainly from Tunbridge Wells and Brussels and held on System 79. Aginfo is about 20Mbyte of data on the EC Common Agricultural Policy (CAP) and trade in food and agricultural commodities. It is based on the weekly publication *Agra Europe*, and topics include

politics and legislation, market reports, crop forecasts and data on specific groups of products. It is updated weekly on a Friday, and can be read, scanned or searched like IDB.

Aginfo is aimed at people who need information about CAP and the agricultural trade, not at farmers. Typical users include agriculture ministries from here to New Zealand, foreign embassies, food companies such as Nestle, and chemical companies like IDI and Monsanto.

Agnews is aimed mainly at agricultural traders and those who need the latest information. It is updated constantly throughout the day. Typical users are food companies like Rank Hovis McDougall and Rowntree Mackintosh, marketing boards and traders.

The surcharge for Aginfo is 72.3p per minute. With access at prime time, this adds up to £50 per hour. Agnews is available only on an annual subscription of £900 per year, plus normal connect charges.

Artslink is a relatively new database of artists and their agents, orchestras, and musical services such as music copyists and recording companies. There are Artists/Agents sections for the U.K., France, Belgium, Germany, Holland and Italy. You can use it to find out, say, the name and address of Yehudi Menuhin's agent or of an orchestra, where a particular musician is touring, and so on. It is hoped to add programme notes, biographical sketches, etc.

Users include the Sadlers Wells Royal Ballet, James Galway and his agent, the editor of *Gramophone* and the Scottish Baroque Ensemble. Use of the database is free to Artslink members, except for the usual connect charges.

Ashton-Tate's Service Line is an on-line user group and database for users of such products as dBase II, dBase III and Framework. It resides on System 83. You can use it for free, except for the usual Telecom Gold charges.

Electronics Post is a daily on-line electronics magazine with news, plus directories of products and suppliers, on System 74. In many respects it is similar to IDB, but the stories are longer, more technical, and tend towards chips and board-level products rather than marketing/financial-type information — "Complementary Silicon N and P channel FET Pair" rather than "Walters cuts prices of PC clones". It includes an enquiry form for you to request information about specific products.

Users of Electronics Post are major electronics companies. It is hoped to add distributors and suppliers to "close the electronic communications ring". So far Electronics Post is available on subscription only at a cost of £500 per year, plus normal Telecom Gold charges.

Global Analysis Systems (GAS) is a database of international political and economic analysis on System 79. It offers a risk monitor both daily and by country, statistics and ratings. You can fill in a form

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*****
* THE *
* TIMES NETWORK *
* SYSTEMS LTD *
*****
```

Which service would you like to use ?

TTNS INFORMATION DATABASE	- Please type in DATAB
LOCAL NEWS	- Please type in NEWS
MAIL SERVICE	- Please type in MAIL
ENQUIRE/MAIL DIRECTORY	- Please type in ENQUIRE
NOTICEBOARD FACILITY	- Please type in NOTICEBD
NON-MENU OPTIONS	- Please type in NON
SIGN OFF NETWORK	- Please type in OFF

To redisplay the TTNS Services Menu type in TTNS whenever you see the '>' prompt.

Enter your choice now > non

(continued from previous page)

to get information about a specific business risk.

A week's stories might include comment on British Gas's results, prices in Yugoslavia, Colombia's coal-development project and the elections in Malaysia. Gas is aimed at banks, large corporations, economists, planners and other executives who can afford the somewhat high prices of either £74 per hour connect time or an £85 per month standing charge.

Housefax is a property database run by Betos on System 83. So far it comprises domestic properties in the Nottingham area offered for sale by local estate agents. Searches can be made for suitable abodes. It is hoped to extend the system to other localities so that eventually it will be possible to do on-line house searching on a national basis using post codes as the key.

Housefax fees are £25 for enrolment, a £50 per year subscription, and a 5p per minute surcharge while in the database, plus the Telecom Gold charges, including storage.

Microlink is a vast database that occupies all of System 72. Database Publications sells the mailboxes. The main attraction of them is the low charge for light users; it is £5 to join then £3 per month plus usage, compared to Telecom Gold's £40 to join and £10 minimum including usage.

EXTRA INFORMATION

As well as all the usual Telecom Gold facilities, Microlink has its own bulletin board, British Rail timetable and ticket ordering, computer exhibition and magazine guides, an Interflora service, a list of BBSs, the U.K. *Newsbytes* weekly newsletter, Micronews, Theatrelink ticket ordering, Telemessages, Weatherlink — BBC satellite weather maps to download, a Who's Who in microcomputing and a downloadable software section. Later it is hoped to offer an exclusive gateway to an American database. Microlink also takes in a computer dealer network, Dealerlink, and the Epson user group, Epsonlink.

Microlink is menu-driven to a higher degree than most of Telecom Gold, which makes it easier for newcomers. The Mail Plus option provides an overlay which makes email easier.

Network for Law is a new group on System 74 using the NFL call-sign. It has a newsletter, its own directories of solicitors, barristers and legal services, and a Law Society Noticeboard. So far the Databases section is empty, except for an appeal to let the Law Society know to which external databases users would like access.

Network for Law is aimed at the legal profession, and so far is not of much interest to anyone else. But as the computer business has legal problems in the form of hacking, data protection, software copyright, service contracts and so on, and the law is becoming computerised, it could soon prove more popular.

The Times Network Systems — formerly called The Times Network for Schools — is a

TELECOM GOLD DATABASES		
	CONTENT	CONTACT
Agra Europe	agricultural and trade data	Mike Hobbs 79:AEL 003. Telephone: (0892) 33813
Aims News	EC/government business grants	Prof. Kevin Allen 81:MKD459. Telephone: 041-522 4400
Artslink	artist/agency data, music-orientated	John Beadle 74:MUS001. Telephone: 01-445 7148
Ashton-Tate Service Line	user group	Bobby Suleman 83:ATL005. Telephone: (0628) 38044
Electronics Post	electronics news	Eric Watson 74:ELP002. Telephone: (0442) 60658
Global Analysis Services	risk analysis	Mark Haynes 79:RSK001. Telephone: 01-606 7060
Housefax	property market	Leonard Gelblum, 83:BET001. Telephone: (0602) 418108
IDB On-line	computer newsletter	Lorraine Arber 83:VNU001. Telephone: 01-439 4242
Infocheck	company credit	Anne-Marie Dean 74:III001. Telephone: 01-377 8872
Jordanwatch	company financial information	Philip Holmes 74:JOR001. Telephone: 01-253 3030
Microlink	microcomputing	Colin Rogerson 72:MAG001. Telephone: 061-456 8383
Network for Law	legal information	Sales Support Dept 74:NFL2041. Telephone: 01-822 1351
Official Airline Guide	flight and price information	Mike Mullany 81:MKD451. Telephone: (0732) 352668
Textnet	text and translation services	David Rooke 84:TXT001. Telephone: 01-242 8284
The Times Network Systems	educational information	01:TCD001. Telephone: 01-837 1234
World of Lotus	user group	Phil Peters 74:LOT001. Telephone: (0753) 840281
World Reporter	news sources and marketing information	Angela Burdett 81:DAT008. Telephone: (0932) 785566

major educational supplier and takes up all of System 01. It can be accessed with the same outfit as any normal Telecom Gold system, but for the full effect a modem and special software are supplied which can switch dynamically between 80-column ASCII text TTY-type operation and 40-column colour viewdata screens. This is available for BBC, IBM and Research Machines micros.

As well as email and the standard diary and forms facilities, TTNS has a keyword-searchable national database and two dozen local databases. The national database covers the whole field of education and includes a lot of course material. The higher-education database includes sections on the universities and polytechnics, UCCA and PCAS applications services, scholarships information, City and Guilds data and much more.

Each prefix group, which in most cases is each Local Education Authority (LEA), has the facility to set up its own local database, which cannot be searched by keyword. Local databases include all sorts of information, some of it written by children. However, open access to telex and the expensive databases like OAG and World Reporter have been blocked off.

TTNS has a number of sponsors such as the Stock Exchange, BP, British Rail, the Banking Information Service plus the army and navy. The Stock Exchange provides the FT/SE 100 share index. The TSB provides school banking facilities, the Bobby Charlton Sports School, the TSB Wildlife Crusade and a Rock School.

Users are teachers and educational institutions. Every LEA has at least one mailbox, as do many tertiary colleges and educational organisations. TTNS can supply

a modem, cables, software and manuals for £152, though most schools have recently been given a suitable modem free at the instigation of the Department of Trade and Industry.

The subscription for using TTNS is £187 per year, with a reduced rate of £85 for primary schools, or £65 if they have fewer than 100 pupils. There are no usage charges, no connect-time charges and even the PSS or network costs are absorbed. TTNS will strike commercial users of email as so ridiculously cheap it is hard to understand why schools and colleges have been a little slow to take up the system. But as this seems to have been the case, a separate database of *Personal Computer World* is being built up on System 01 for that magazine's subscribers.

GATEWAY DATABASES

ALL Telecom Gold users have access to five external databases, including the Official Airline Guide held in the U.S., and World Reporter/Magic, which is based in Sunbury-on-Thames.

Aims News provides the latest information on government and EC grants available to British businesses — which amounts to some £5 billion annually. The database is compiled by the Centre for the Study of Public Policy at the University of Strathclyde, directed by Professor Kevin Allen. It is searchable by keyword and updated daily because the grants schemes change rapidly and you have to apply early to get the money. To access it, type Aims at the > prompt. The surcharge for Aims News is £1.67 per minute.

Infocheck is a massive database of limited companies, designed primarily for credit checking. It has basic information on every one of the 900,000 limited companies in England, Scotland and Wales. There is fully analysed financial information on over 150,000 companies. You can also order off-line printed reports.

A status report includes all the background details of registration, officers, capital, banker, etc., and comments on the company's performance. There is tabular data on assets, debtors, creditors, overdraft, directors' fees, profit margin, liquidity, and up to 75 financial ratios. The main users are accountants, company secretaries and other executives. Infocheck is accessed by typing Infocheck at the prompt. The surcharge is £2.50 per minute.

Jordanwatch is Pergamon Infoline's database of all 1.7 million U.K. registered companies, largely derived from records at the Companies Registration Office.

The basic details held for all companies are name, registered office, date of incorporation and notices of recently filed documents. Fuller details are held of companies which have a turnover greater than £1 million, profits greater than £50,000, or shareholder funders larger than £1 — which means all PLCs, companies on

the USM and large private companies. Trends and ratios are also being added for these.

Users include executives of many types including accountants and lawyers, plus some major banks. For access type Jordans at the prompt. The surcharge for using Jordanwatch is £2 per minute.

The Official Airline Guide is Dunn and Bradstreet's fare-based guide to the schedules of over two million flights by 750 airlines. It includes 350,000 North American fares which are updated daily, and 60,000 international ones which are updated weekly. It gives the actual journey time and other details. There are also details on 30,000 hotels.

The OAG is invaluable for U.S. travellers where, thanks to deregulation, it is possible to save hundreds of dollars by taking a particular flight. It is a bit less useful in Europe where fares are set by a cartel. OAG has a wide range of users, mainly business travellers and their secretaries. The surcharge for its use is 56.5p per minute or 38p off-peak.

World Reporter is Thorn-EMI Datasolve's full-text news database of newspapers, magazines and news services. The sources are the *Financial Times*, *Washington Post*, the *Guardian*, *Today*, the *Economist*, *New Scientist*, *Keesing's Contemporary Archives*, Associated Press, *Asabi News*, TASS, the BBC Summary of World Broadcasts, BBC External Services, Global News Analysis and Global News Letter. Files are updated constantly. Recently some marketing and media sources have been added from Datasolve's Magic advertising and marketing database: the *Marketing Surveys Index*, *Brad*, *Campaign*, *Marketing*, and *PR Week*.

World Reporter is easy to use. You have to Select one or more files to search, then use Get for a topic and Pick to refine the search. You can then read headlines only, the context lines where your search words have been found, or the full text. An excellent Quick Reference Card can be ordered on-line from Telecom Gold.

World Reporter has a wide range of users, from the executive doing research to the merely curious. Obviously, it is ideal for journalists. To use World Reporter and the files from Magic, type WR at the prompt. The surcharge is £1.15 per minute. There is a cheaper file called Learn, which you can practise on if you just want to try the system; its surcharge is only 15p per minute.

Telecom Gold has come a long way. A year ago there was only one database available, *Infomatics Daily Bulletin*. As a regular user of email even I am surprised at the range now offered. For database providers, Telecom Gold offers the chance to add a possible 45,000 occasional users to their bread-and-butter corporate clients. For ordinary users, there is the chance to get access to important information quickly without the rigmarole of taking out what is often an expensive separate account. Clearly this is only the start of something much bigger.

Intuitive Solution

Mike Lewis tests a comprehensive networking database for IBM machines that includes a full Wimp interface.

In the world of databases Intuitive Solution is something new. It is a remarkably successful attempt to put the database where it belongs: right at the centre of a company's operations. At the same time the program makes it very easy for employees to reach and update the central data. The whole thing is based on the familiar idea of a desk top on the screen.

Intuitive Solution is above all a product for networks. A worker interacts with the system by filling in forms; once completed, the form can be made to update the database. Alternatively you can pick up an envelope, write an address on it, put the form in the envelope and leave it in the out tray for despatch to a colleague in another part of the building. This is all accomplished by means of the keyboard, mouse, and a desk top full of icons.

At first sight the desk top is a carbon copy of the Macintosh Finder, but in fact the similarity is only skin deep. The Mac Finder is really only an environment for running other programs, while Solution is a self-contained application which takes over the entire system. It aims to be able to process all of a company's data through its central database by reducing all types of transactions to a simple set of forms.

The user sees the forms as icons. At first they are bundled into pads: a company might have a pad of order forms, an invoice pad, a pad of forms for recording cash sales, and so on. You can either leave the pads lying around on the desk top or you can store

(continued on next page)

SPECIFICATION

Description: database system with built-in programming language, based on a desk-top interface

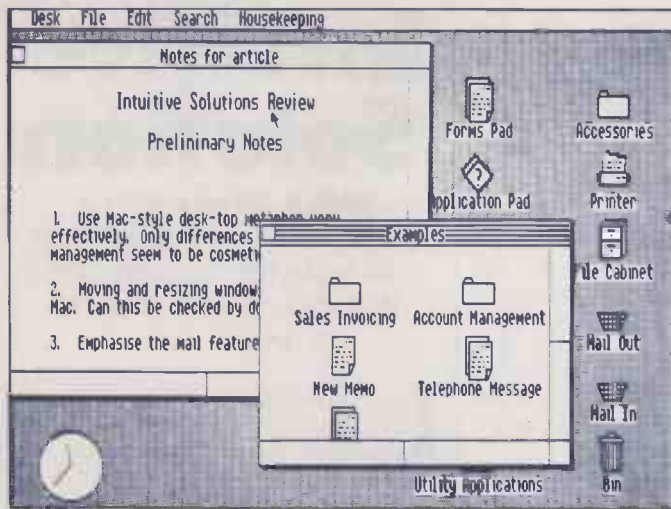
Hardware required: IBM PC, PC/AT or compatible with graphics adaptor or equivalent, 512K RAM, hard disc and mouse; supports IBM, Novell and Torus networks

Copy protection: non-copyable key disc must be present when loading the software

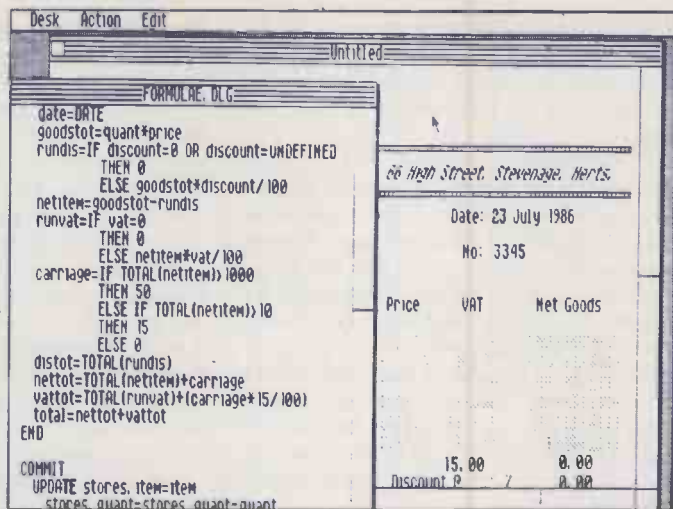
Price: £726 for single-user version; £1,440 for network version with up to eight users, then £200 per additional four users

Publisher: Intuitive Systems, 66 High Street, Stevenage, Hertfordshire SG1 3EA. Telephone: (0438) 317966. Also available through IBM dealers as Teamwork Solution Builder

Available: now



Intuitive Solution uses the familiar concepts of movable windows, icons, and pull-down menus.



The system developer can attach a program in Intuitive Solution's own language to any form. It is edited in its own window.

(continued from previous page)

them neatly in folders. If you like to keep your desk really tidy, you can put forms, pads and folders into a filing cabinet. In contrast to the strict conventions of Gem, there is nothing particularly rigid about the way the icons are used. Folders and filing cabinets are simply places for storing things until they are needed. The analogy with real life is very close.

You can freely move almost any object between desk top, folder and filing cabinet — or for that matter the waste bin. If you are a tidy person you will probably set up your own filing system, with a folder for each main area of your work. The software does not force you to do this. The only restrictions are things that you would not normally do in the physical office, like putting a filing cabinet in a waste bin.

Any of the objects on the desk top can be opened by double-clicking its icon. Alternatively you can highlight the icon by clicking it once, then specify Open from a pull-down menu. When you open a pad you get a new icon which represents a blank copy of an individual form. Opening this new icon gives you the form proper, ready for filling in.

How the form is filled in depends on how it was originally designed. It might be a fairly rigid data-entry form, or a memo or phone-message form more suitable for free text. It could even be the equivalent of a blank sheet of paper, which could be used for short word-processed documents. That said, the package's editing facilities are not adequate for heavy-duty word processing.

When you have finished filling in the form you tell the system to Commit it. The effect of this action varies according to the nature of the form. Usually it involves some type of validation check, after which the form updates the database in some pre-defined way. For example, a sales order form might update the stock figures and cause a hard-copy invoice to be printed.

A system developer has to design the forms and to specify the method of processing them. Designing the physical layout is straightforward. You start with a blank sheet and use the system's editing

INTUITIVE SOLUTION

PC VERDICT

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

The combination of central database and desk-top metaphor make this a very impressive product.

facilities to lay out the headings, captions and the like. A small list of alternative type styles and sizes is available for this. You can also draw boxes and fancy borders. These fixed parts of the form can then be protected to prevent alteration by the user, leaving other areas free for data entry.

The rest of the design process is more complicated. It involves defining the information that will appear in the form and specifying its relationship with the underlying database. This is done by writing programs in Intuitive Solution's own language.

These programs are divided into four parts. First you have to declare the database files that are relevant to the form. Then you define the individual fields in the form and how their contents are derived. The third section stipulates the processing to be carried out while the form is on-screen, and the final part defines how the form is to update the database.

Forms can be used to get information out of the database as well as for putting it in. In the second part of the program, called the Process section, you can say that the contents of a form field are to be derived from the database rather than the keyboard. You can also attach a formula to a form field, to be evaluated spreadsheet-style each time a dependent value changes. In this way it is possible for a form to serve as a report or to display the results of an enquiry.

Although Intuitive Solution is designed

to be a complete application you can run other programs from the Solution desk top. You do this by means of another type of pad, but this time it is a pad of applications rather than of forms. For example, you can create a WordStar pad simply by specifying the command that invokes that particular program from DOS. Then whenever you want to run WordStar you just click on the WordStar pad.

As a software package Intuitive Solution lives up to its name. Using it really does become intuitive after a while. The analogy with a real desk top is so well maintained that anybody who can recognise an in tray and a filing cabinet will quickly grasp what it is all about.

My only serious criticism concerns the manual. Frankly, parts of it are so badly written that it could well cost the publisher many sales of what is otherwise an excellent product. The book is sensibly divided into two parts: one for the user and one for the system developer. I have no quarrel with the second of these, despite some appalling spelling and grammar. It is the user's section that causes concern.

The writers of the manual have undone most of the programmers' good work in making the package easy to understand. The book is full of references to hierarchical filing systems, generating new instances of parent objects, application load strings and similar obscurities. Intuitive Systems is planning a new version of the product with a lot of new features and a completely rewritten manual, which might be worth waiting for.

CONCLUSIONS

- As databases go, Intuitive Solution deserves a place among the heavyweights.
- To give its best it has to be placed at the centre of your company's computing strategy; it is certainly not a product for occasional use.
- The design of the user interface is outstanding. Some effort will be needed to set up the database and design the forms, but once this has been done most people should find the software extremely easy to use.
- Do not let the appalling user manual put you off. This is one package that is probably easier to learn if you ignore the documentation.

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Position

Company

Address

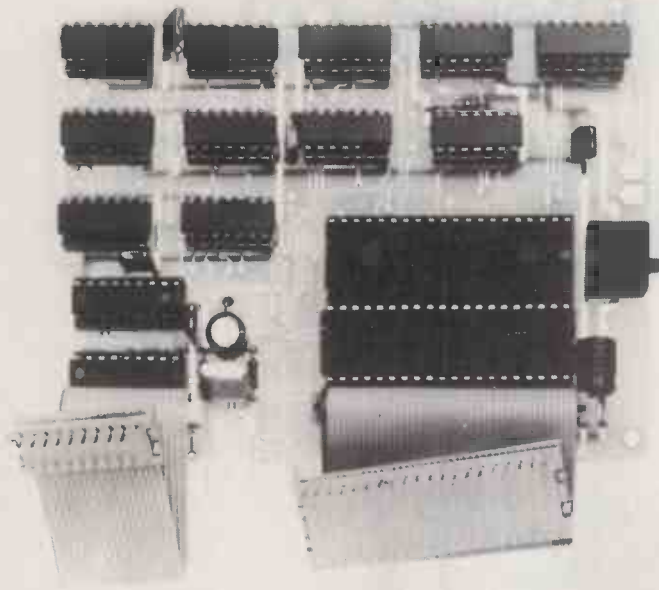
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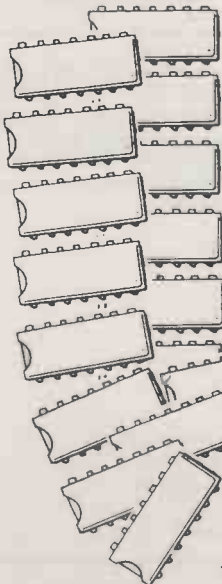
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Submissions should include a brief description which explains what your program does and how it does it. This should be typed with lines double-spaced. The program should be printed with a new ribbon or at double-intensity; the width should be between 75mm. and 90mm., or between 105mm. and 135mm. Also include a disc of your program.

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AMSTRAD PCW-8256

EXACT DIVISION

A M Tucker presents a set of programs which perform arithmetic on numbers that are too large for Basic to be able to handle in the normal way.

IT MAY occasionally be necessary to carry out exact arithmetical operations on very large numbers beyond the capacity of the computer. It is not too difficult to devise programs to hold the numbers in which strings are manipulated in an imitation of human addition, subtraction or long multiplication. Division is more difficult to reproduce.

The programs presented in this article are based on a method of mental arithmetic devised by Professor Jacow Trachtenberg and explained in *The Trachtenberg Speed System of Basic Mathematics*, published by Souvenir Press. Only the first figure of the divisor is used for the initial determination of each figure in the answer, and deductions are made to find the next working figure to be divided by the same first digit. If the result of any division is negative or greater than 9, then an adjustment must be made to the previous digit in the answer, and the subtractions for the next working figure recalculated.

In order to consider Trachtenberg's method in more detail you can set up an algebraic representation of multiplication. Multiplication of the four-digit number $abcd$ by the three-digit xyz can be expanded to $ax_5 + (ay + bx)_4 + (az + by + cx)_3 + (bz + cy + dx)_2 + (cz + dy)_1 + dz_0$ where the subscripts represent powers of 10. Each pair of letters represents a number between 0 and 81, and may be represented by a 10s part, subscript t , and a units part, subscript u . Tabulating these gives the array shown in figure 1.

Now take as an example, $8,273 \times 354$. As a guide, put in front of

multiplication by this method on the PCW-8256.

Now consider the reverse process of multiplication, which is division.

$$2928642 \div 354 = abc$$

You start by dividing the first figure of the divisor into the first digit of the dividend, or if this is too small the first two digits. This will give the first figure of the answer. However, whether this is correct depends on the size of the second figure of the divisor. The first figure in this example is 9, but it will be found to be too large and give a negative working figure at a later stage. You should therefore settle on 8 as the first figure of the answer. Now you can find some of the terms in the table.

Multiplying each digit of the divisor separately by the 8 of the answer gives 24, 40 and 32. Adding the whole 24 to the 10s of the 40 gives 28. Now take the units of 40 and the tens of 32 and subtract as shown in figure 3.

Now divide the first figure of the divisor into the new working

FIGURE 1

$$\begin{array}{r} az_u + bz_u + cz_u + dz_u \\ az_t + bz_t + cz_t + dz_t \\ ay_u + by_u + cy_u + dy_u \\ ay_t + by_t + cy_t + dy_t \\ ax_u + bx_u + cx_u + dx_u \\ ax_t + bx_t + cx_t + dx_t \end{array}$$

the multiplicand as many zeros as there are digits in the multiplier. Then form the pair-products according to figure 1, putting units and 10s in the appropriate column as shown in figure 2. Listing 1 gives a short program to carry out

FIGURE 2

a b c d	x y z	
0 0 0 8 2 7 3	x 3 5 4	
		2 8 8 2
		3 0 2 1
		0 0 5 5
		4 1 3 1
		4 6 1 9
		2 0 2 0
		2 8 12 6 25 14 2
Carrying 2 9 2 8 6 4 2 Answer		

FIGURE 3

x y z	a b c	
2 9 2 8 6 4 2	3 5 4	= 8
2 8		
0 3		
		9

FIGURE 4

x y z	a b c d	
2 9 2 8 6 4 2	3 5 4	= 8 2
9		
7		
0 2		
		2 6

FIGURE 7

az _u + bz _u	
az _t + bz _t	
ay _u + by _u	
ay _t + by _t	
ax _u + bx _u	
ax _t + bx _t	
aw _u + bw _u	
aw _t + bw _t	
av _u + bv _u	
av _t + bv _t	
r ₃ + r ₂ + r ₁ + r ₀	

FIGURE 5

x y z	a b c d	
2 9 2 8 6 4 2	3 5 4	= 8 2 7
2 6		
2 4		
1 5		
		1 1

FIGURE 6

x y z	a b c d	
2 9 2 8 6 4 2	3 5 4	= 8 2 7 3
1 1		
1 0		
1 4		
		2
		0 0 0 0

LISTING 1

```
10 DEFINT a-z:PRINT CHR$(27)"E"CHR$(27)"
H"TAB(29)"** MULTIPLICATION OF LARGE NUM
BERS **"
20 PRINT:PRINT:INPUT"Enter multiplicand:
- ",n$
30 PRINT:INPUT"Enter multiplier:- ",m$:m
=LEN(m$):PRINT
40 n$=STRING$(m,"0")+n$:n=LEN(n$):DIM a(
n+1)
50 FOR i=0 TO n-1:x=n-1:FOR j=MAX(0,i-n+
m)TO MIN(i,m-1):y=x+j:z=VAL(MID$(m$,m-j,
1))
60 v=z*VAL(MID$(n$,y,1))/10:a(x)=a(x)+INT((v-
INT(v))*10+0.01)+INT(z*VAL(MID$(n$,y+1,1))/10+0.01)
70 NEXT:IF a(x)>9 THEN a(x-1)=a(x)\10:a(
x)=a(x)MOD 10
80 NEXT:PRINT"Answer:- ";:FOR x=2-SGN(a(
1)) TO n:PRINT USING"#";a(x);:NEXT
90 PRINT:PRINT:PRINT"Another sum ? (y/n)
"
100 q$=LOWERS$(INKEY$):IF q$="y"THEN RUN
ELSE IF q$="n"THEN END ELSE 100
```

LISTING 3

```
10 DEFINT a-w:PRINT CHR$(27)"E"CHR$(27)"
H"TAB(29)"** DIVISION WITH DECIMAL PART
**"
20 PRINT:PRINT:INPUT"Enter dividend:- ",
a$
30 PRINT:INPUT"Enter divisor:- ",b$:PRI
NT:lbs=LEN(b$)+1
40 a$=a$+STRING$(lbs+1,"0")
50 DIM r(lbs),b(lbs*2):FOR n=1 TO lbs-1:
b(n)=VAL(MID$(a$,n,1)):NEXT
60 c=1-(VAL(LEFT$(a$,1))<b(1)):ans=LEN(a
$)-lbs+3-c:dp=ans-lbs-1:d=dp*(dp<0):DIM
a(ans+d)
70 pd=VAL(LEFT$(a$,c)):FOR n=1+d TO ans+
d:a(n)=pd*10^(b(1)*10+b(2))
80 nt=pd-b(1)*a(n)-(b(2)*a(n))\10:IF nt<
0 THEN a(n)=a(n)-1:GOTO 80
90 wf=nt*10+VAL(MID$(a$,n+c-d,1))
100 ut=0:FOR m=2 TO MIN(lbs,n+1):ut=ut+(
b(m)*a(n-m+2))MOD 10+(b(m+1)*a(n-m+2))\1
0:NEXT
110 pdx=wf-ut:IF pdx<0 THEN a(n)=a(n)-1:
GOTO 80 ELSE pd=pdx:NEXT
120 FOR n=ans+d TO 2 STEP-1:WHILE a(n)<0
:a(n)=a(n)+10:a(n-1)=a(n-1)-1:WEND:NEXT
130 n=ans+d:WHILE a(n)=0 AND n>ABS(dp):n
=n-1:cut=cut+1:WEND:cut=cut-SGN(cut)
140 PRINT"Answer:- ";:FOR n=1+(dp<1)TO a
ns+d-cut:PRINT USING"z";a(n);
150 IF(dp-n)MOD 3=0 AND n<dp THEN PRINT"
,";ELSE IF n=dp OR(n=0 AND dp<0)THEN PRI
NT".";
160 NEXT:PRINT:PRINT:PRINT"Another sum ?
(y/n)"
170 q$=LOWERS$(INKEY$):IF q$="y"THEN RUN
ELSE IF q$="n"THEN END ELSE 170
```

LISTING 2

```
10 DEFINT a-w:PRINT CHR$(27)"E"CHR$(27)"
H"TAB(30)"** DIVISION WITH REMAINDER **"
:PRINT:PRINT:INPUT"Enter dividend:- ",a$
20 PRINT:INPUT"Enter divisor:- ",b$:PRI
NT:IF LEN(b$)>LEN(a$)THEN PRINT"Divisor
must not be longer than dividend":GOTO 2
0
30 lbs=LEN(b$):DIM r(lbs+1),b(lbs*2+2):F
OR n=1 TO lbs:b(n)=VAL(MID$(b$,n,1)):NEX
T
40 c=1-(VAL(LEFT$(a$,1))<b(1)):ans=LEN(a
$)-lbs+2-c:DIM a(ans)
50 pd=VAL(LEFT$(a$,c)):FOR n=1 TO ans:a(
n)=pd\b(1)
60 nt=pd-b(1)*a(n)-(b(2)*a(n))\10:IF nt<
0 THEN a(n)=a(n)-1:GOTO 60
70 wf=nt*10+VAL(MID$(a$,n+c,1))
80 ut=0:FOR m=0 TO MIN(lbs,n)-1:ut=ut+(b
(m+2)*a(n-m))MOD 10+(b(m+3)*a(n-m))\10:N
EXT
90 pdx=wf-ut:IF pdx<0 THEN a(n)=a(n)-1:G
OTO 60 ELSE pd=pdx:NEXT
100 r(2)=pd:plus=r(2)>0:minus=r(2)<0:IF
r(2)>9 THEN r(1)=r(2)\10:r(2)=r(2)MOD 10
110 FOR n=3 TO lbs:wf=VAL(MID$(a$,n+c-2+
ans,1)):ut=0
120 FOR m=0 TO MIN(lbs-2,ans)-1:ut=ut+(b
(n+m)*a(ans-m))MOD 10+(b(n+1+m)*a(ans-m)
)\10:NEXT
130 r(n)=wf-ut:IF r(n)>0 THEN plus=1 ELS
E IF r(n)<0 AND plus=0 THEN minus=1
140 NEXT:IF minus THEN a(ans)=a(ans)-1:F
OR n=1 TO lbs:r(n)=r(n)+b(n):NEXT
150 FOR n=lbs TO 2 STEP-1:WHILE r(n)<0:r
(n)=r(n)+10:r(n-1)=r(n-1)-1:WEND
160 IF r(n)>9 THEN r(n)=r(n)MOD 10:r(n-1
)=r(n-1)+r(n)\10
170 NEXT:FOR n=ans TO 2 STEP-1:WHILE a(n
)<0:a(n)=a(n)+10:a(n-1)=a(n-1)-1:WEND:NE
XT
180 PRINT"Answer:- ";:FOR n=1 TO ans:PRI
NT USING"#";a(n);:IF(ans-n)MOD 3=0 AND n
<ans THEN PRINT",";
190 NEXT:m=1:WHILE r(m)=0 AND m<lbs:m=m+
1:WEND
200 PRINT:PRINT"Remainder:- ";:FOR n=m T
O lbs:PRINT USING"#";r(n);:IF(lbs-n)MOD
3=0 AND n<lbs THEN PRINT",";
210 NEXT:PRINT:PRINT:PRINT"Another sum ?
(y/n)"
220 q$=LOWERS$(INKEY$):IF q$="y"THEN RUN
ELSE IF q$="n"THEN END ELSE 220
```

figure of 9. It could go three times, but this is obviously too large in view of the size of the second figure of the divisor. Although errors can be corrected, you can reduce them by including the second figure of the divisor and dividing by 3.5, which gives an answer of 2.

Multiplying each digit of the divisor by this new figure of the answer gives 06, 10 and 08. As before add the whole 06 and the 10s of 10, giving 7; also take the units of 10 and the 10s of 08, but add to this the units of the 32,

which were unused in the previous calculation, making a total of 2, in figure 4.

Dividing the new working figure of 26 by 3.5 gives 7 as the third figure of the answer. Multiply each figure of the divisor by this new figure and obtain subtraction figures as before, as shown in figure 5. You can divide 3.5 into 11 three times, so the last figure of the answer is 3. Calculate the figures to be subtracted as before using the 3, as shown in figure 6. The last step is to subtract the dz units to give the remainder

— which in this case is 0, of course.

A further example will show more clearly how the remainder is calculated. The result of multiplying ab by $vwxyz$ and adding a remainder is shown in figure 7. Now consider the remainder resulting from the division of the result by $vwxyz$. The vertical line shows that there are two fewer columns to the right of the line than the number of digits in the divisor. It will be seen that, by the time this line is reached in the division process, all the figures of the answer will have already been found; none of the terms that lie to the right of the line contain the first two figures of the divisor.

The remainder procedure is therefore to subtract in the first column to the right of the line the terms $az_1 + ay_0 + by_1 + bx_0$, in the next column the terms $az_0 + bz_1 + by_0$, and in the last

column bz_0 . You are then left with the remainder $r_3 + r_2 + r_1 + r_0$. Note that the remainder cannot contain more digits than the divisor.

Listing 2 is the longer of the two division programs as it includes the section for finding a remainder. The variable C is set to indicate whether one or two digits are required for the first figure, and the arrays to be used are dimensioned. Lines 30 to 80 then carry out calculations in a similar way to the examples already described. Line 90 checks to see whether the answer digits just found needs amendment.

The program then moves on to the remainder calculation. In the program the figure calculated for each remainder stage is held in a separate section of the array R(N). This is subsequently sorted out so that each section contains only a single digit. Difficulties can arise

(continued on next page)

(continued from previous page)

when the remainder becomes negative, indicating that the last digit of the answer was too large, but the program corrects this. Finally, the answer and remainder are printed, divided into thousands by commas, after surplus zeros have been stripped from the remainder.

Listing 3 uses the same calculations for deriving the answer but no remainder is calculated. Instead a position for a decimal point is determined, and a number of zeros — two more than the length of the divisor — are added to the dividend. The answer is printed without more than one trailing zero. To speed up the operation, the dividing figure is based on the first two figures of the divisor.

On the PCW-8256 the integer division symbol can be typed in by pressing Extra and the $\frac{1}{2}$ key twice. The Mallard Basic expression `PRINT CHR$(27) "E" CHR$(27)`

`"H"` is equivalent to `CLS` in most other dialects. If your Basic does not include full integer arithmetic or Max and Min the alterations suggested in listing 4 may prove useful. Delete `Defint` in all listings, and substitute `CLS` for the escape codes. PC

LISTING 4. SUGGESTED PROGRAM ALTERATIONS

FOR LISTING 1


```
Line 50 - Alter parameters of loop 'j' to '(n-m-i)*(i-n+m>0)TO(1-m)
                                                (m-1<1)-i*(1<=m-1)'
" 60 - 'v=VAL(MID$(n$,y,1))/10:a(x)=a(x)+z*INT((v-INT(v))*10+0.01)
                                                +z*INT((a(x)/10-a(x-1))*10+0.01)'
" 70 - 'NEXT:IF a(x)>9 THEN a(x-1)=INT(a(x)/10):a(x)=
                                                INT((a(x)/10-a(x-1))*10+0.01)'
```

FOR LISTING 2

```
Line 50 - ..... 'a(n)=INT(pd/(b(1)+b(2)/10))'
" 60 - 'nt=pd-b(1)*a(n)-INT(b(2)*a(n)/10):.....'
" 80 - 'ut=0:j=-lbs*(lbs<n)-n*(n<=lbs)-1:FOR m=0 TO j:v=(b(m+2)
*a(n-m))/10:ut=ut+INT((v-INT(v))*10+INT(b(m+3)*a(n-m)/10)+0.01):NEXT'
Line 100 - ..... 'r(1)=INT(r(2)/10):r(2)=INT((r(2)/10-r(1))*10+0.01)'
" 120 - 'j=-lbs*(lbs-2<ans)-ans*(ans<=lbs-2)-1:FOR m=0 TO j:
                                                v=b(n+m)*a(ans-m)/10:ut=ut+INT((v-INT(v))*10
                                                +b(n+m+1)*a(ans-m)/10+0.01):NEXT'
Line 160 - ... '+INT(r(n)/10):r(n)=INT((r(n)/10-INT(r(n)/10))*10+0.01)'
" 180 - ..... 'IF(ans-n)/3=INT((ans-n)/3)AND n<ans THEN PRINT","'
" 200 - As line 180, substituting 'lbs' for 'ans'.
```

FOR LISTING 3

```
Line 70 - ..... 'a(n)=INT(pd/b(1))'
" 80 - 'nt=pd-b(1)*a(n)-INT((b(2)*a(n)/10):.....'
" 100 - 'ut=0:j=-lbs*(lbs<=n)-(n+1)*(n<=lbs):FOR m=2 TO j:v=b(m)*
a(n-m+2)/10:ut=ut+INT((v-INT(v))*10+b(m+1)*a(n-m+2)/10+0.01):NEXT'
" 150 - 'IF(dp-n)/3=INT((dp-n)/3)AND n<dp:.....'
```


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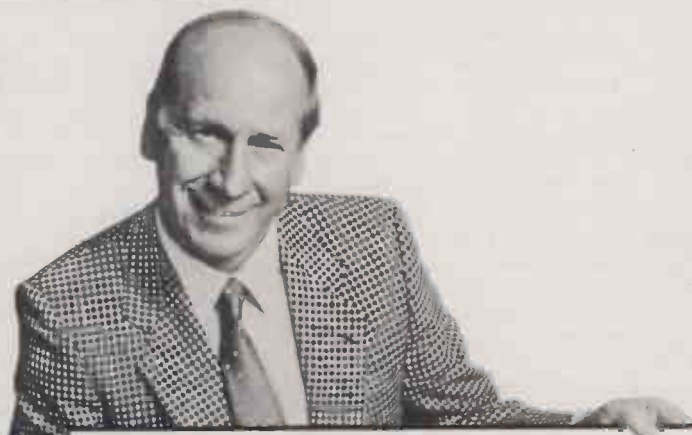
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ANALYSIS OF VARIANCE

Owen Bishop and Daniel Bishop explain how limited data can yield useful information.

LAST MONTH we described a statistical parameter known as variance and showed how it could be used to see if the spreads of two sets of data differed significantly. This month we use variance in an even more powerful way. The test is called the analysis of variance, often referred to as Anovar.

Table 1 shows the sales of chocolate bars at three different branch shops in three successive months. Our analysis could include any reasonable number of branches and any reasonable number of months, but for the sake of keeping the discussion simple the table is restricted to three branches and three months. Inspection of the table shows that the average sales at the three shops differ appreciably. The question is whether these differences are statistically significant.

Before continuing with the analysis it is worth considering whether any of the tests described earlier in this series could be used. Both the t-test and the 2-sample runs test are used for comparing two sets of data. So you could take all possible pairs of shops — comparing shop A with shop B, A with C, and B with C — and look for significant differences between the members of each pair.

Using the t-test, for example, would certainly reveal some significant differences, but there are problems in this approach. For one thing, you have to perform three t-tests. With four shops you would need six tests, with five shops 10 tests, and so on. Worse still, if you decide that a five percent level of probability is acceptable, one test in 20 will indicate a significant difference when no such difference exists. Performing so many t-tests on the same data greatly increases the risk of obtaining a misleading result.

So it's back to the analysis of variance. The first step is to calculate the total variance of the data and then to try and find out what factors are contributing to it. For example, the variance may be solely due to chance events, such as those that induce a casual customer to visit a particular shop or to choose chocolate bars in preference to mint humbugs. There may also be differences between the shops, such as their location; or one shop might have a particularly genial or persuasive assistant. It is inter-shop differences such as these that would be of particular interest to the owner of the shops.

TABLE 1. SALES OF CHOCOLATE BARS

Month	Store 1	Store 2	Store 3
1	300	240	204
2	494	405	224
3	390	336	244
Average	395	327	224

TABLE 2. ANALYSIS OF VARIANCE

Source of Variance	Sum of squares	Degrees of freedom	Mean squares
Stores	44315	2	22157
Residual	33385	6	5564
Total	77700	8	
$F = 22157/5564 = 4.0$			

The computer takes over the somewhat tedious task of calculating the statistics required for the analysis of variance. Table 2 shows the final result, as presented on the computer screen. The column headed Source of Variance lists the factors which might be contributing to the variance. The first of these is Stores, indicating that part of the variance which is due to differences between the shops themselves. The remaining or residual variance is that due to chance events.

These two sources of variance are the only ones that can be specified with this data. The values in the right-hand column, labelled Mean Squares, show the relative contribution made to variance by the two sources. The mean square due to shop differences is considerably greater than that due to chance events, and to find out whether this difference is significant you can calculate the variance ratio, F, as described last month.

The computer gives a value of 4.0 for F. The next step is to find the probability of obtaining a value of F as large or larger than 4.0 when the only differences between shops are due to pure chance. In most cases the computer would go ahead and calculate the probabilities. But in this example, there is only a small amount of data, and the algorithm used to calculate probabilities is working too near its limits of precision. You can adapt it to a greater degree of precision but it would then take hours to perform the calculation. It is quicker to use the published tables of F. Special books of statistical tables are available, or you can often find them at the back of statistical texts.

When referring to a table you need to know the number of degrees of freedom to pick out the

particular value of F required. Obviously to obtain a significant result based on data from only three shops and sales figures for only three months you need to obtain a larger F than you would if you had data from 10 shops and a whole year's monthly sales. The number of degrees of freedom is related to the amount of data available; for the data in table 2 the number of degrees of freedom for shops is one less than the number of shops, and the total number of degrees of freedom is one less than the total number of data items. The residual number of degrees of freedom is the difference between the other two.

The columns of an F table are headed with numbers of degrees of freedom referring to the column differences. There are two degrees of freedom for shops so you select the column headed 2. The rows of the table are labelled with the number of degrees of freedom for the total variance, which is 8 in the example.

In the F table for the 20 percent probability level column 2, row 8 contains the value 2.0. The calculated value for the example data was 4.0, so the shop differences are certainly significant at the 20 percent level. If on the basis of the data you were to say that some shops have better sales figures than others, there is a probability of rather less than 20 percent of being wrong.

If you refer to the table with the next lowest probability level, the five percent table, the corresponding value of F is 4.5. This is higher than the calculated value for the example data, so the shop difference is not significant at the five percent level.

The probability of the existence of an inter-shop difference lies between five percent and 20 per-

cent. This is not a high level of probability, so it would be unwise to take any drastic action as a result of the analysis. However, we shall show next month that when you continue the analysis to greater depth there is a more significant effect lurking in this rather scanty data.

The version of the analysis in this month's program requires a data table of three or more rows and three or more columns. The columns represent different treatments or situations — shops in this instance — while the rows represent the replicates of those treatments — in this case repeated sales figures from the same shops. There must be an equal number of replicates for each treatment or situation.

The program allows there to be one or two values missing from the table. It calculates suitable entries in the table to replace them, with a loss of one degree of freedom for each value missing. This would hardly be acceptable in the example as the data is so scanty to begin with. But if there were more shops, or more sales figures from each shop, the ability to calculate missing values makes it possible to carry out an analysis when one or two results are missing. Tables with more than two missing values are not accepted by the program.

First prepare a disc file of the data using the Data Maker program published in the February issue of *Practical Computing*. Load and run the program, file name Anovar1. Place the data disc in the drive and load the table for testing. There is a delay while the mean, SDS, ESDP and ESDM are calculated. The significance of these parameters is explained in the May issue. The table is displayed with these statistics. Use the cursor keys to examine the table if you wish.

To carry out the analysis, key T. The screen then displays the analysis set as shown in table 2. It calculates F for differences between columns, along with the probability associated with F. Key P to obtain a printout of the analysis, or R to rerun the program.

All the programs, along with five others, are available in BBC Basic on a single-sided 40-track 5.25in. disc. The price is £20 including postage and 15 percent VAT. Please send your order to Owen Bishop, c/o Practical Computing; cheques should be made payable to Owen Bishop.

VARIANCE ANALYSIS

```

10 REM- ANOVAR 1
20 REM- A Statistical Utility Program
30 REM- -----
40 REM- by Owen and Daniel Bishop
50 REM- -----
60 REM- Version 1.0 - 1/1/86
70 REM- For the BBC Micro Model B
80 REM- -----
90 *FX4,1
100 *TV 255,1
110 L$=STRING$(10,CHR$32):MDF=0
120 MODE7:PROCcol:PRINT"ANOVAR 1"
130 PROCbtm:PROCcol:PRINT "Enter name
of file to be loaded":PROCalpha("(max 7
letters): ",7)
140 ON ERROR PROCferror:VDU31,15,0:PR
OCcl:GOTO 130
150 FILE$=QR$:A=OPENIN FILE$
160 VDU31,15,0:PRINT FILE$
170 INPUT#A,DF$:VDU30,31,24,0:PRINT"DA
TE: ",DF$
180 INPUT#A,NC,NR:PROCcol:PRINT"COLS:
";NC;" ROWS: ";NR
190 IF NC<3 OR NR<3 THEN CLOSE#0:PRINT
TAB(1,6)"DATA TABLE TOO SMALL":FOR J=1 T
O 4000:NEXT:RUN
200 DIM SC(NC+4,NR+4),CL$(NC+4),RL$(NR
+4),DP(16),U(103,4),F(4),V(2),MV(1,2),P(
1)
210 INPUT#A,CW,LC:CW=10
220 IF LC=0 THEN LC=1:GOTO240
230 FOR J=1 TO NC:INPUT#A,CL$(J):NEXT
240 INPUT#A,LR
250 IF LR=0 THEN LR=1:GOTO270
260 FOR J=1 TO NR:INPUT#A,RL$(J):NEXT
270 FOR J=1 TO NR:FOR K=1 TO NC:INPUT#
A,SC(K,J):NEXT:NEXT
280 FOR J=1 TO NC:INPUT#A,DP(J):NEXT:I
NPUT#A,DP$
290 HI=0:FOR J=1 TO NC:IF DP(J)>HI THE
N HI=DP(J)
300 NEXT:FOR J=1 TO NC+4:DP(J)=HI:NEXT
310 CLOSE#0:ON ERROR OFF
320 NC=NC+4:NR=NR+4
330 CL$(NC-3)="MEAN":CL$(NC-2)="SDS":C
L$(NC-1)="ESDP":CL$(NC)="ESDM":RL$(NR-3)
="MEAN":RL$(NR-2)="SDS":RL$(NR-1)="ESDP"
:RL$(NR)="ESDM"
340 DIM NV%(NC-4),SV%(NR-4)
350 SW=36-7*LR:CC=INT(SW/CW):IF NC<CC
THEN CC=NC
360 CS=0:RS=0:HB=4+7*LR
370 IF LR=0 AND NR>100 THEN HB=5
380 RB=NR+4:IF NR>16 THEN RB=24
390 VDU30,31,0,2:PROCcl
400FMV=0:FORJ=1TONC-4:FORK=1TONR-4:IF
SC(J,K)=1E-29 THEN FMV=FMV+1
410NEXT:NEXT:IF FMV>2 THEN PRINTTAB(0,
6)"MORE THAN 2 MISSING VALUES":FORJ=1 TO
4000:NEXT:RUN
420IF FMV>0 THEN PROCmv
430 PROCbtm:PROCcol:PRINTSPC(5)"Pleas
e wait while calculating":PROCmean:PROCb
tm
440FORK=1TONR-1
450 RD=16:IF NR<RD THEN RD=NR-RS
460 CD=CC:IF NC<CD THEN CD=NC-CS
470 PROCcolumns:PROCrows:PROCdata
480 PROCbtm
490 *FX21,0
500 VDU30,31,39,22:K$=GET$
510 IF K$=CHR$139 AND RS>0 THEN RS=RS-
16:GOTO 450
520 IF K$=CHR$136 AND CS>0 THEN CS=CS-
CC:GOTO 450
530 IF K$=CHR$137 AND CS+CD<NC THEN CS
=CS+CD:GOTO 450
540 IF K$=CHR$138 AND RS+RD<NR THEN RS
=RS+RD:GOTO 450
550 IF K$="R" THEN RUN
560 IF K$="T" THEN 580
570 VDU7:GOTO 490
580 VDU30,31,0,2:PROCcl
590%=%0102000A+(DP(1)*%100):PRINT"So
urce          SOS      D of F      Mn Sq"

600PRINT"Columns",FNform(SOSB-SOSD),FN
formd(NC-5),FNform((SOSB-SOSD)/(NC-5))
610PRINT"Residual",FNform(SOSA-SOSB),F
Nformd((NC-4)*(NR-5)-MDF),FNform((SOSA-S
OSB)/((NC-4)*(NR-5)-MDF))
620PRINT"TOTAL",FNform(SOSA-SOSD),FNfo
rmd((NC-4)*(NR-4)-MDF-1)
630 FP=(SOSB-SOSD)/(NC-5)/(SOSA-SOSB)*
((NC-4)*(NR-5)-MDF)
640 %=%&20109:PRINT"F for columns = "
:FP

650V1=NC-4:V2=(NC-4)*(NR-5)-MDF:IF (V1
<4 OR V2<4) OR FP>9 THEN 780
660 ON ERROR GOTO 770
670%=%&20306:P=FNF:ON ERROR OFF:IF P<0
THEN 780
680PRINT"Probability is ";P
690 VDU 6,3
700%=%&90A:PROCbtm
710VDU6:WIDTH 0
720*FX21,0
730VDU30,31,39,22:K$=GET$
740 IF K$="R" THEN RUN
750IF K$="P" THEN VDU2,21:GOTO 590
760 VDU7:GOTO720
770ON ERROR OFF
780PRINT"Probability not available"
790 GOTO 690
800 DEF PROCmean
810 LOCAL J%,K%,C%,SUM,NT%
820 FOR J%=1 TO NC-4:C%=0:FOR K%=1 TO
NR-4:IF SC(J%,K%)<>1E-29 THEN C%=C%+1
830 NEXT:NV%(J%)=C%:NEXT:FOR J%=1 TO N
R-4:C%=0:FOR K%=1 TO NC-4:IF SC(K%,J%)<>
1E-29 THEN C%=C%+1
840 NEXT:SV%(J%)=C%:NEXT
850 NT%=0:FOR J%=1 TO NC-4:NT%=NT%+NV%
(J%):NEXT
860 FOR J%=NC-3 TO NC:FOR K%=NR-3 TO N
R:SC(J%,K%)=1E-29:NEXT:NEXT
870SOSB=0: FOR J%=1 TO NC-4:SUM=0:FOR
K%=1 TO NR-4:IF SC(J%,K%)<>1E-29 THEN SU
M=SUM+SC(J%,K%)
880 NEXT:SC(J%,NR-3)=SUM:SOSB=SOSB+SUM
*SUM/(NR-4):NEXT
890SOSC=0: FOR J%=1 TO NR-3:SUM=0:FOR
K%=1 TO NC-4:IF SC(K%,J%)<>1E-29 THEN SU
M=SUM+SC(K%,J%)
900 NEXT:SC(NC-3,J%)=SUM:IF J%<NR-3 TH
EN SOSC=SOSC+SUM*SUM/(NC-4)
910 NEXT
920FOR J%=1 TO NC-4:SUM=0:FOR K%=1 TO
NR-4:IF SC(J%,K%)<>1E-29 THEN SUM=SUM+SC
(J%,K%)*SC(J%,K%)
930 NEXT:SC(J%,NR-2)=SUM:NEXT
940 FOR J%=1 TO NR-4:SUM=0:FOR K%=1 TO
NC-4:IF SC(K%,J%)<>1E-29 THEN SUM=SUM+S
C(K%,J%)*SC(K%,J%)
950 NEXT:SC(NC-2,J%)=SUM:NEXT:SUM=0:FO
R J%=1 TO NC-4:SUM=SUM+SC(J%,NR-2):NEXT:
SC(NC-2,NR-2)=SUM
960 SOSA=SUM
970 FOR J%=1 TO NR-4:IF SV%(J%)<>0 THE
N SC(NC-2,J%)=SC(NC-2,J%)-(SC(NC-3,J%)*S
C(NC-3,J%))/SV%(J%)
980 NEXT
990 FOR J%=1 TO NC-4:IF NV%(J%)<>0 THE
N SC(J%,NR-2)=SC(J%,NR-2)-(SC(J%,NR-3)*S
C(J%,NR-3))/NV%(J%)
1000 NEXT
1010 SC(NC-2,NR-2)=SC(NC-2,NR-2)-(SC(NC
-3,NR-3)*SC(NC-3,NR-3))/NT%
1020 FOR J%=1 TO NR-4:IF SV%(J%)>1 THEN
SC(NC-1,J%)=SQR(SC(NC-2,J%)/(SV%(J%)-1)
) ELSE SC(NC-1,J%)=1E-29
1030 NEXT: FOR J%=1 TO NC-4:IF NV%(J%)>
1 THEN SC(J%,NR-1)=SQR(SC(J%,NR-2)/(NV%
(J%)-1)) ELSE SC(J%,NR-1)=1E-29
1040 NEXT:IF NT%>1 THEN SC(NC-1,NR-1)=S
QR(SC(NC-2,NR-2)/(NT%-1)) ELSE SC(NC-1,N
R-1)=1E-29
1050 FOR J%=1 TO NR-4:IF SV%(J%)<>0 THE
N SC(NC-2,J%)=SQR(SC(NC-2,J%)/SV%(J%)) E
LSE SC(NC-2,J%)=1E-29
1060 NEXT:FOR J%=1 TO NC-4:IF NV%(J%)<>
0 THEN SC(J%,NR-2)=SQR(SC(J%,NR-2)/NV%(J
%)) ELSE SC(J%,NR-2)=1E-29
1070 NEXT:SC(NC-2,NR-2)=SQR(SC(NC-2,NR-
2)/NT%)
1080 FOR J%=1 TO NR-4:IF SV%(J%)<>0 THE
N SC(NC-3,J%)=SC(NC-3,J%)/SV%(J%) ELSE S
C(NC-3,J%)=1E-29
1090 NEXT:FOR J%=1 TO NC-4:IF NV%(J%)<>
0 THEN SC(J%,NR-3)=SC(J%,NR-3)/NV%(J%) E
LSE SC(J%,NR-3)=1E-29
1100 NEXT:SOSD=SC(NC-3,NR-3)*SC(NC-3,NR
-3)/NT%:SC(NC-3,NR-3)=SC(NC-3,NR-3)/NT%

1110 FOR J%=1 TO NR-4:IF SV%(J%)<>0 THE
N SC(NC,J%)=SC(NC-1,J%)/SQR(SV%(J%)) EL
SE SC(NC,J%)=1E-29
1120 NEXT:FOR J%=1 TO NC-4:IF NV%(J%)<>
0 THEN SC(J%,NR)=SC(J%,NR-1)/SQR(NV%(J%
)) ELSE SC(J%,NR)=1E-29
1130 NEXT:SC(NC,NR)=SC(NC-1,NR-1)/SQR(N
T%)

```

(continued on page 123)

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VARIANCE ANALYSIS

(continued from page 121)

```

1140 ENDPROC
1150 DEF FNF
1160 DF=.1:IFFP>5 THEN DF=INT(FP)*.04
1170 FOR J=0 TO 2:V(J)=1:NEXT
1180 FOR J=0 TO 4:F(J)=0:NEXT
1190 D=2/DF:VF=V1/2-1:FQ=INT((FP+.5*DF)/
DF)*2:VG=V1/2:VH=V2/2
1200 VV=V1+V2:VN=0
1210 PROCcalc
1220 VV=V1:VN=1
1230 PROCcalc
1240 VV=V2:VN=2
1250 PROCcalc
1260 AA=V(0)/V(1)/V(2)*V1^VG*V2^VH
1270 VI=VG-1:VJ=(V1+V2)/2
1280 FORJ=3 TO FQ+3
1290 JF=J/D-DF
1300 U(J,0)=JF^VI/(V2+V1*JF)^VJ
1310 NEXT
1320 FORK=1 TO 4
1330 FU=3-K
1340 FORJ=1TOFQ+FU:U(J,K)=U(J+1,K-1)-U(J
,K-1):NEXT
1350 NEXT
1360 FORK=0 TO 4 STEP 2
1370 FORJ=3-K/2 TO FQ+1-K/2 STEP 2 :F(K)
=F(K)+U(J,K):NEXT
1380 NEXT
1390 A=DF*(F(0)+F(2)/6+F(4)/180)
1400 1-A*AA
1410 V2=V/2
1420 FORJ=1TOV2-.5
1430 DEF PROCcalc
1440 IF VV/2=INT(VV/2) THEN 1510
1450 VW=VV/2
1460 FORJ=1TOVW-.5
1470 V(VN)=V(VN)*(VW-J)
1480 NEXT
1490 V(VN)=V(VN)*1.77245
1500 GOTO 1550
1510 VW=VV/2-1
1520 FORJ=1 TO VW
1530 V(VN)=V(VN)*J
1540 NEXT
1550 ENDPROC
1560 DEF PROCmv
1570 IF FMV=2 THEN 1660
1580 MVR=0:MVC=0:FORJ=1 TO NC-4:FOR K=1
TO NR-4:IF SC(J,K)=1E-29 THEN MVC=J:MVR=
K :GOTO 1600
1590 GT=GT+SC(J,K)
1600 NEXT :NEXT
1610 TR=0:FORJ=1 TO NC-4:TR=TR+SC(J,MVR
):NEXT:TR=TR-1E-29
1620 TC=0:FOR K=1 TO NR-4:TC=TC+SC(MVC,
K):NEXT:TC=TC-1E-29
1630 SC(MVC,MVR)=((NR-4)*TR+(NC-4)*TC-G
T)/(NR-5)/(NC-5)
1640 MDF=1
1650 GOTO 1840
1660 MV=0:FORJ=1 TO NC-4:FOR K=1 TO NR-4
:IF SC(J,K)=1E-29 THEN MV(MV,1)=J:MV(MV,
2)=K:MV=1:GOTO 1680
1670 GT=GT+SC(J,K)
1680 NEXT:NEXT
1690 SC(MV(1,1),MV(1,2))=GT/(NC-4)/(NR-4
)
1700 MV=1:REPEAT
1710 EGT=GT+SC(MV(MV,1),MV(MV,2))
1720 IF MV=0 THEN MV=1 ELSE MV=0
1730 TR=0:FORJ=1 TO NC-4:TR=TR+SC(J,MV(
MV,2)):NEXT:TR=TR-1E-29
1740 TC=0:FOR K=1 TO NR-4:TC=TC+SC(MV(M
V,1),K):NEXT:TR=TR-1E-29
1750 SC(MV(MV,1),MV(MV,2))=((NR-4)*TR+(
NC-4)*TC-EGT)/(NR-5)/(NC-5)
1760 P(MV)=SC(MV(MV,1),MV(MV,2))
1770 IF MV=0 THEN MV=1 ELSE MV=0
1780 P(MV)=SC(MV(MV,1),MV(MV,2)):SC(MV(M
V,1),MV(MV,2))=1E-29
1790 IF MV=0 THEN MV=1 ELSE MV=0
1800 UNTIL ABS(P(MV)-SC(MV(MV,1),MV(MV,
2)))<10^(DF(MV(MV,1))-1)
1810 IF MV=0 THEN MV=1 ELSE MV=0
1820 SC(MV(MV,1),MV(MV,2))=P(MV)
1830 MDF=2
1840 ENDPROC
1850 DEF FNform(A)
1860 LOCAL A$
1870 A$=STR$(A)
1880 IF RIGHT$(A$,1)=". " THEN A$=LEFT$(A$,L
EN(A$)-1)
1890 =RIGHT$(L$+A$,CW)
1900 DEF FNformd(A)
1910 LOCAL A$
1920 %=0102000A:A$=STR$(A):A$=LEFT$(A$
,LEN(A$)-1):%=0102000A+(DP(1)*%100)
1930 =STRING$(CW-LEN(A$)," ") +A$
1940 DEF PROCdata:LOCAL J,K:VDU23,1,0;0
;0;0:FOR J=5 TO 20:VDU31,HB-1,J-1:PROCC
11:NEXT
1950 FOR J=1+CS TO CD+CS:HH=HB-1+(J-CS-
1)*CW
1960 FOR K=1+RS TO RD+RS
1970 IF SC(J,K)=1E-29 THEN 1990 ELSE %=
0102000A+(DP(J)*%100):A$=STR$(SC(J,K))
:IF RIGHT$(A$,1)=". " THEN A$=LEFT$(A$,LEN
(A$)-1)
1980 VDU31,HH-1,3+K-RS:PRINT RIGHT$(L$+
A$,CW):%=090A
1990 NEXT:NEXT
2000 VDU23,1,1;0;0;0;
2010 ENDPROC
2020 DEF PROCcolumns:LOCAL J:VDU23,1,0;
0;0;0:VDU31,0,2:PROCC11:VDU31,0,3:PROCC
11
2030 VDU31,0,2:FOR J=1 TO CD
2040 VDU31,(HB-1+(J-1)*CW),2:PRINT;J+CS
;
2050 NEXT
2060 IF LC=0 THEN VDU23,1,1;0;0;0;:ENDP
ROC
2070 VDU31,0,3:FOR J=1 TO CD
2080 VDU31,(HB-1+(J-1)*CW),3:PRINTCL$(J
+CS);
2090 NEXT:VDU23,1,1;0;0;0;:ENDPROC
2100 DEF PROCrows:LOCAL K:VDU23,1,0;0;0
;0;0:FOR K=5 TO 20:VDU31,0,K-1:PROCC11:NE
XT
2110 FOR K=1 TO RD:VDU31,0,K+3:PRINT;K+
RS:NEXT
2120 IF LR=0 THEN VDU23,1,1;0;0;0;:ENDP
ROC
2130 FOR K=1 TO RD:VDU31,3,3+K:PRINT RL
$(K+RS)
2140 NEXT:VDU23,1,1;0;0;0;:ENDPROC
2150 DEF PROCalpha(Q$,Q1)
2160 *FX21,0
2170 PROCCol:PRINT Q$::INPUT"QR$
2180 IF LEN(QR$)<=Q1 OR Q1=0 THEN ENDP
ROC
2190 PROCline:GOTO 2160
2200 DEF PROCline:VDU11:PROCC11:VDU7:EN
DPROC
2210 DEF PROCbtm:VDU31,0,20:PROCC1s:VDU
31,0,20:ENDPROC
2220 DEF PROCCol
2230 PRINT CHR$130;
2240 ENDPROC
2250 DEF PROCC1s
2260 LOCAL CRS%,V,H
2270 V=VPOS:H=POS
2280 CRS%=999-H-(40*V)
2290 VDU23,1,0;0;0;0;
2300 REPEAT:IF CRS%<255 THEN 2320
2310 CRS%=CRS%-255:PRINTSTRING$(255,CHR
$32);
2320 UNTIL CRS%<255
2330 PRINTSTRING$(CRS%,CHR$32);
2340 VDU31,H,V
2350 VDU23,1,1;0;0;0;
2360 ENDPROC
2370 DEF PROCC11
2380 LOCAL V,H
2390 V=VPOS:H=POS
2400 PRINT STRING$(40-H,CHR$32);
2410 VDU31,H,V
2420 ENDPROC
2430 DEF PROCferror
2440 ON ERROR OFF
2450 CLOSE#0
2460 VDU7
2470 IF ERR>44 OR ERR=6 THEN 2510
2480 CLS:VDU11:REPORT:PRINT " at line "
;ERL
2490 *FX4,0
2500 END
2510 PROCbtm:IF ERR=222 THEN PRINT"No s
uch file";:PROCCol ELSE VDU11:REPORT:PRO
CCol
2520 PRINT" error. ":PROCCol:PRINT"Pres
s SPACEBAR, when you are ready "
2530 *FX21,0
2540 REPEAT:A=GET:UNTIL A=32
2550 VDU11,11:PROCC1s
2560 ENDPROC

```



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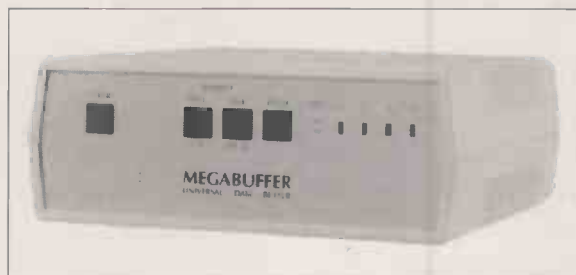
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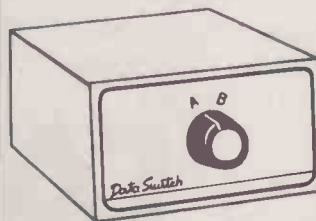
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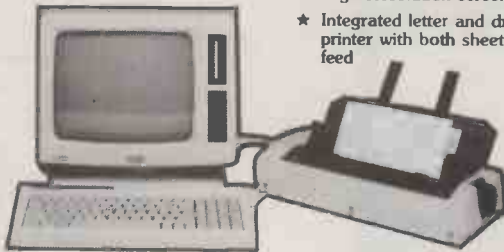
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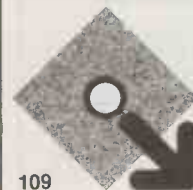


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