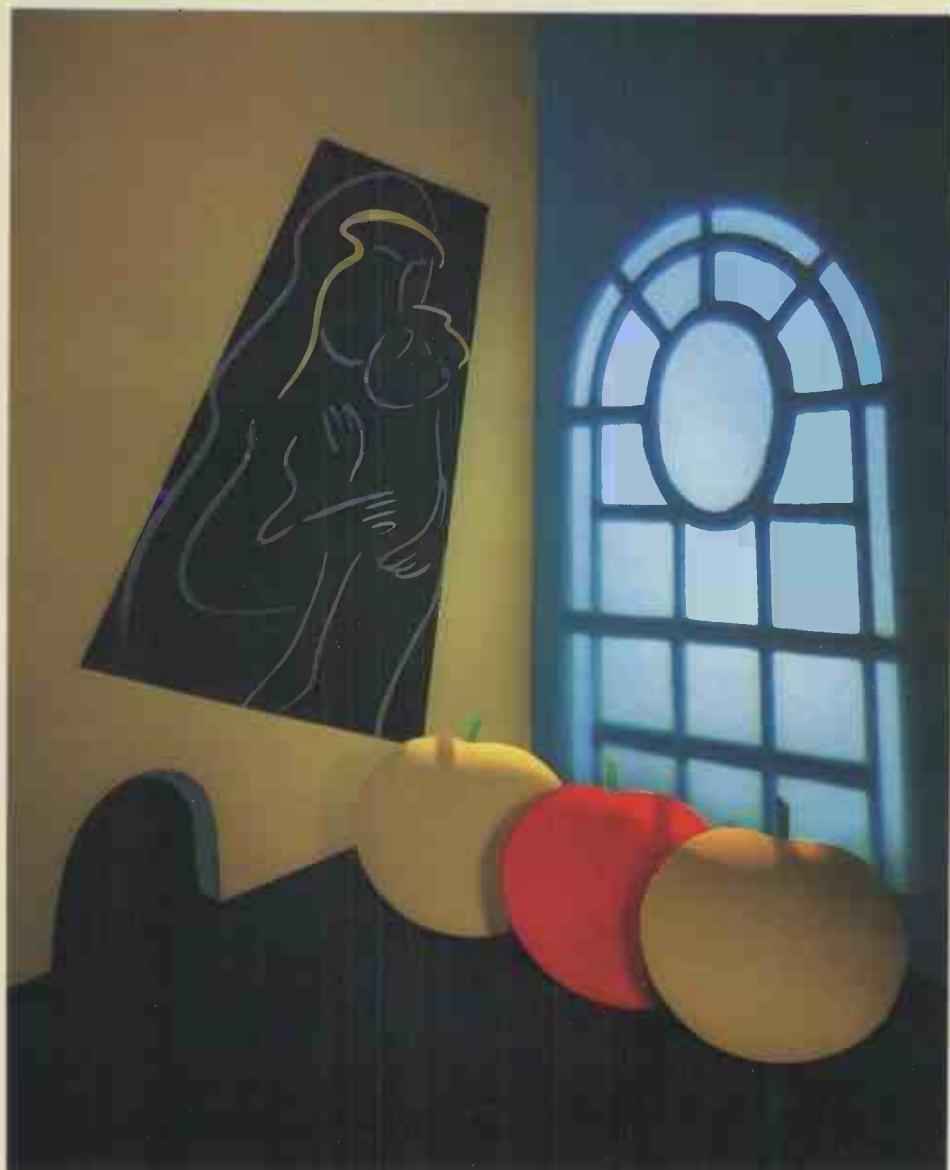


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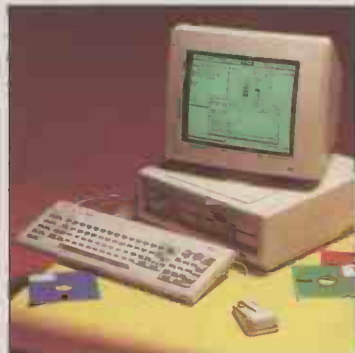
For a long time the idea of an alternative to the all-conquering IBM standard has seemed unlikely. But no longer: not only is the Apple Macintosh flourishing, but its ideas are being taken up in the world of MS-DOS. We look at where the Mac and its fellow travellers, the Atari and the Amiga, came from and are going. After an introduction on page 100, *Ian Stobie* reviews the state of the Mac. On page 110 *Steve Malone* looks at how the Atari micros are beginning to win a place in the business world. Finally *Glyn Moody* examines the Amiga and its chances for survival

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PRACTICAL COMPUTING

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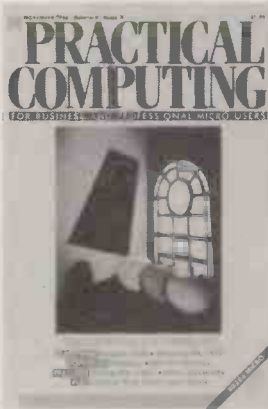


PHOTO: TONY HUTCHINGS

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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 double-spaced, and should include a 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.

POWER TO THE USER

The launch of the Amstrad PC-1512 has brought no dramatic price breakthrough. The only new element offered by Alan Sugar's latest exercise in astute bundling is respectability. Like the three letters "IBM" on the original PC, the name Amstrad on the front of the machine seems, to the mind of the business user, to spell safety in the hitherto dodgy world of cheap clones. Yet in its own way the new machine is still something of a milestone. Its arrival, and the market developments which made it possible, testify to the rise of a force which will soon outweigh both the relentless drive of technology and the manufacturers' most meticulous strategies. That force is user power.

This marks a radical shift from the situation in the early days of business computing. When IBM launched its microcomputer five years ago it did so very much on its own terms. Prices were steep and waiting lists were commonplace. Other manufacturers were equally well aware that the buying and selling equation was loaded firmly in their favour. The very success of those halcyon years sowed the seeds of its own destruction. The more micros that were sold, the more players entered a contracting market. The result has been the cuthroat price wars of the last year or so. Indirectly, they made the Amstrad PC not just possible but inevitable.

But worse was to follow for the hardware manufacturers and software houses. Not only has it become harder to find new buyers, but the old buyers who were once treated so casually have suddenly become important. Banded together as a user base of millions they have become formidable. For the hardware manufacturers, IBM included, this has meant that any future micro is locked into the DOS standard. For software houses, it has forced new releases to be fully upward compatible with key products like 1-2-3 or dBase.

The hiatus in product development during the last two years is largely explained by the huge user inertia which has been built up over that period. For example the PC/AT has been unable to escape from the DOS prison IBM constructed for itself, and is now nothing more than a souped-up PC. Similarly neither Lotus nor Ashton-Tate has launched new programs which move significantly beyond their central but ageing product lines.

Now the pendulum is swinging back even further: users are being wooed. Ashton-Tate recently announced that its inconvenient copy-protection schemes have been dropped from all its products, and that a new range of customer-support services are to be offered — all in a bid to retain the loyalty of its huge user base. This is in addition to the Ashton-Tate information service already available on

Telecom Gold. Lotus has just announced a semi-autonomous user club to complement its own on-line service, and other software houses are doubtless looking at similar ways to encourage a closer rapport with the user.

Users are no longer content to be passive recipients of manufacturers' products. Increasingly they are getting involved with the whole process of product specification. Large corporate user are being actively courted by some companies for just this sort of input. Another source of suggestions is from the energetic users groups which are springing up for particular machines and software. Independent user groups for the IBM PC and Apple Macintosh already exist, and others will doubtless develop for the best-selling software packages.

Nor will the user power revolution stop there. Once the manufacturers have capitulated — as they have begun to do by their acceptance of the de facto standards — it will extend within all business organisations where micros are found. Practically every mainframe manufacturer now recognises that it is the bottom end of the market which will eventually drive the whole computer industry. A sure sign of this has been the proliferation in computer manufacturers' promotional literature of catch phrases like "system integration", along with a host of new products designed to link micros with departmental minis and central mainframes.

Although they are unlikely to admit it in public, the wiser manufacturers know full well that it is the users of micros who will determine how this integration takes place, and that the DP department is doomed to become a mere appendage to the PC. They also realise that the democratisation of information technology brought about by the micro has given users their first taste of a power that they are not going to give up.

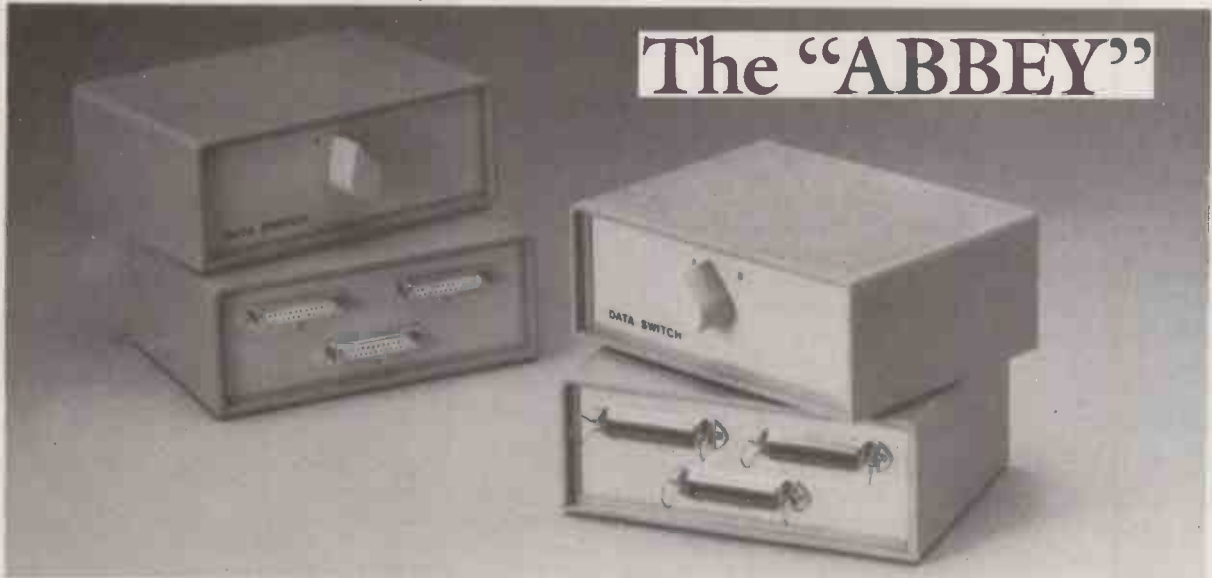
5 YEARS AGO...

Five years after the first personal computer appeared, the world's largest computer manufacturer, IBM, has entered the personal-computer market. Although available only in the U.S. and Canada at the moment, the IBM personal computer is set to become a major competitor in the personal and microcomputer markets.

The system will retail for as little as \$1,565 — about £700 — and it will be sold through IBM product centres, Computerland and Sears, Roebuck and Co. IBM has no firm date for the machine's U.K. launch. According to IBM vice-president C B Rogers, Jr.: "This is the computer for just about everyone who has ever wanted a personal system at the office, on the university campus or at home".

PC Volume 4 Issue 11

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CD-ROM longevity

WITH reference to your article on CD-ROM discs in the September issue, I would like to set the record straight. There has never been any research done on behalf of the British Library or anyone else which has shown that compact discs have only a lifespan of 10 years. Indeed tests carried out by the manufacturers, Philips, indicate that discs up to 10 years old show no perceptible degradation when examined under an electron microscope.

So all hi-fi enthusiasts and publishers can stop worrying. A compact disc should certainly last as long as it takes for the next hi-fi revolution to come around, and CD-ROM still has an important role to play in the electronic publishing industry.

The figure of a 10-year lifespan in fact rose from work done on the ageing of recordable optical discs, so-called Worm discs. These use an entirely different recording medium and so degradation figures produced for them bear no relation to those for CD-ROM discs.

STEVE RAWSTHORN,
Hatfield Polytechnic,
Hatfield,
Hertfordshire.

Turbo Prolog – an alternative verdict

I FEEL that I must take issue with you on your review of Turbo Prolog in August's *Practical Computing*. While I agree generally that Turbo Prolog is an excellent product, I feel your verdict was overgenerous.

As a computer professional, I felt that Prolog was a language that I should make the effort to become familiar with. Having dithered for a few months, and having read your review, I finally bought a copy. I reasoned that with the Borland pedigree of Sidekick and Turbo Pascal this must be a good piece of software.

My first impressions confirmed this, but the more I tried to follow the manual, the more confused I became. I am aware that the approach to Prolog is totally unlike any other form of computer programming, and after 20 years in the electronics and computing industry I did not expect instant enlightenment. However, I did expect that at least the tutorial section of the manual would provide me with some assistance. It didn't!

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

AMSTRAD COMMS

IN YOUR September issue you published an article by Glyn Moody on Amstrad comms, in which he advised against using the Amstrad for comms purposes. However, on reading this article carefully it is apparent that any difficulties in the comms area are not the fault of the Amstrad machine.

Mr Moody complained about the Telecom Gold system. This is nothing to do with the Amstrad PCW, so he can't blame Joyce for any problem with Telecom Gold.

Yes, the Joyce is a pretty basic machine, and so it is necessary to buy the RS-232 interface as an extra. But it is not worth including in the basic machine unless you are going to dabble in comms, so its position as an optional extra is an understandable one. However, you don't have to spend £60 for this interface: there are others available for half that price, and they don't necessarily bolt on to the back of the machine, thus leaving the expansion port accessible for other devices.

Mr Moody's complaints about the modem used with the Chit-Chat software imply that another modem should be used. Fair enough, but again that is not Amstrad's fault. If he doesn't like the modem, well, the obvious answer is don't use it. Use the Chit-Chat software but with a decent modem. In fact you can get around the interface situation at the same time by using an internal modem fitted in the space for the second drive.

As regards Mr Moody's actual use of the Amstrad, surely it is well known by now that the Alt key is Control, and that the Exit key is Escape? So when he complains about there not being an Escape key, does he really know the machine?

Critical reviews of computer products are to be welcomed, but surely they should lay their criticisms at the right door. The Amstrad PCW is not a perfect machine – witness its idiotic choice of a second drive incompatible with the first – but at least criticise it for its own faults, not somebody else's.

RICHARD A COOK,
London SW5.

THE EDITOR REPLIES: The Amstrad PCW-8256 has introduced many people to word processing and computing. In writing the review I tried to place myself in the position of someone who was keen to explore other areas, but who lacked the expertise which Mr Cook has evidently developed. Measured against these criteria, I felt that communications on the Amstrad still left a lot to be desired. Telecom Gold is, of course, quite separate from any of the products reviewed, but as the most popular email service it is bound to influence a newcomer's opinion of comms' ease of use or otherwise.

At first sight, the manual seems quite informative, but on closer inspection there is absolutely no logical learning sequence, and we are once again subjected to a manual written in American. The first examples are simple to the point of absurdity and an insult to any intelligence. Successive examples vary wildly between the overly simple and the totally incomprehensible,

with few giving any progress in learning the language. Indeed, some of the examples – all of which are provided on disc – will not function at all when loaded. The most glaring example of this is the test expert system – see example 51 on page 110. I spent several hours trying to find why this program produced garbage on my screen after a specific sequence of answers. By reference

to other books on Prolog, notably the one by Burnham and Hall published by Macmillan Press, I eventually discovered that certain cuts were necessary in order to prevent backtracking at particular points.

True, I learnt more about Prolog during the time spent tracing and debugging this example than from the previous 100 pages, but this is hardly the way to learn a new language from scratch. In short, Mr Moody, I think the manual stinks! Your verdict on the documentation was "Good"; my verdict is something lower than Poor.

Since a lot of the examples use columns outside the width of the editor's default window setting, and error messages also disappear out of the window, I would grade the performance as Good. I have no quarrel with your other two conclusions, and I am sufficiently impressed to persevere with Prolog. I expect to be using it professionally in the very near future.

JIM BATES,
Wigston Magna,
Leicester.

Sold as seen

WHILE reading through your letters page, it occurred to me that a number of your readers have as much knowledge, if not more, of the systems they use than many of the dealers that are supposed to service them.

London Facilities is a finance brokerage with an erstwhile policy of selling its repossessed, end-lease and ex-rental systems to the trade only.

However, it appears that end-users could make use of our remarketing division as long as they are prepared to accept the strictures of "sold as seen".

GRAEME DAVIS,
London Facilities,
147-149 Curtain Road,
London EC2A 3QE.

Basic compilers

AS AN engineer, I found Ashley Oliver's article in your May issue "Horses for Courses" very useful and illuminating. As a veteran of GE/Honeywell and Computer Sciences time-sharing Basic, I am looking for a Basic that has similar features to run under MS-DOS on an Apricot. The standard offering, GWBasic, has excellent string handling and other features, but lacks matrix operations and the facility to compile it after ironing out all the bugs with the interpreter.

(continued on next page)

SPECIAL SECTION

HOT 100

The last year has seen more happening in the world of business micros than ever before. As well as the first 80386 machines there have been new micros from Apple and Amstrad, and the burgeoning of new areas like desk-top publishing. In this special feature we look back at the recent developments, and pick out the key machines and software.

SOFTWARE

Turn your micro into a supermicro: add a Transputer. We try out the British wonder chip, which is now available as an add-on board. We also look at some powerful portables: the 80286-based Toshiba 3100 and the unusual Sony SMC-210, which we previewed in our April issue.

HARDWARE

We try out what must be the cheapest C compiler around: only £30. There is also a look at some of the comms freeware which is available for the Apple Macintosh.

FEATURES

As well as upsetting the hardware manufacturers, the launch of the Amstrad PC has sent shock waves through the software world as well. We look at the spate of cheap programs being launched for the machine, and find out whether they are a case of only getting what you pay for. We also look at the subject of micro maintenance.

TOP 10 SURVEY

Printers continue to get faster, quieter, cheaper and more intelligent. We pick out the current leaders.

Don't miss the December issue of

PRACTICAL COMPUTING

On sale at W. H. Smith and all good newsagents after 12 November

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

(continued from previous page)

Another feature which, as an amateur programmer, I miss in GWBasic is the immediate diagnosis of syntax errors as the code is being entered. With the time-sharing Basics, I found this a major asset of the interpreter to offset the slowness of execution as compared with Fortran.

E S WEBBER,
Boroko,
Papua New Guinea.

Repairs out of warranty

I NOTICE a letter in September's Ask PC which highlights the difficulty many end-users have experienced in obtaining satisfactory service for an IBM micro out-of-warranty repair.

As a national maintenance organisation, servicing computer-related equipment for more than 15 years, we have substantial expertise and handle all market-leading micros and peripheral devices. We think we are flexible enough not to say to users: "Take a contract or nothing".

Fixed-price repair/exchange on Apple, Apricot and IBM machines workshop or on-site ad hoc repairs, upgrades, installations and all engineering aspects of microcomputing, as well as full-service on-site maintenance agreements, are provided by us, offering choices to users who vary in financial resources, time-critical applications, etc. We are also approved by IBM for in-warranty service, and can therefore offer an even wider choice of repair solutions.

PAUL STANFIELD,
Nelson Computer Services,
Rawtenstall,
Lancashire.

Display Write 3

I MUST put you right on a few things you said about Display Write 3 in the top 10 word-processors feature in your September issue. I have been using it now for seven months since it is company issue in our organisation. About 50 people are equipped with IBM PCs or Olivetti M-24s so I have got to know it reasonably well.

First, there is a U.K. dictionary available. It comes on a separate disc called U.K. English Dictionary. It also contains a file called UKUser.Upr, which is "the Display Write 3 User Profile customised for the U.K."

If there is a problem from the user's point of view it is that the

program is really too clever for its own good. It is very powerful, no doubt, but it is also cumbersome to use. Some of the advanced features such as setting out tables, maths, automatic outlines, etc., are so complex to understand from the manual and sometimes to use that I don't know of anyone who has completely cracked it.

Major irritants are the need to exit, paginate and then still not see on-screen a layout which relates to the printout; the need to exit and reload a document to get at the menu that allows revision of global formats; plus the general cumbersome use of menus.

Specific faults include a bug in the print routine which causes an error message "Disk full, restart using another disk" if the printer doesn't change paper quickly enough; the only cure is to reboot the system. And it's not that the printers we use are incompatible: we use IBM Quietwriters. Finally, because I use email a lot, the biggest bugbear is that Display Writer works in EBCDIC rather than ASCII.


One WP package which never gets mentioned, but which after two years intensive use I got to like very much, is Superwriter from Sorcim. It's simple but with very powerful features: XQT execute sequences, data file merging, embedded printer directives, global reformatting, and automatic readjustment of text instead of the irritating line adjust of Display Write 3 — which puts the cursor on the wrong line, it seems, every time it readjusts.

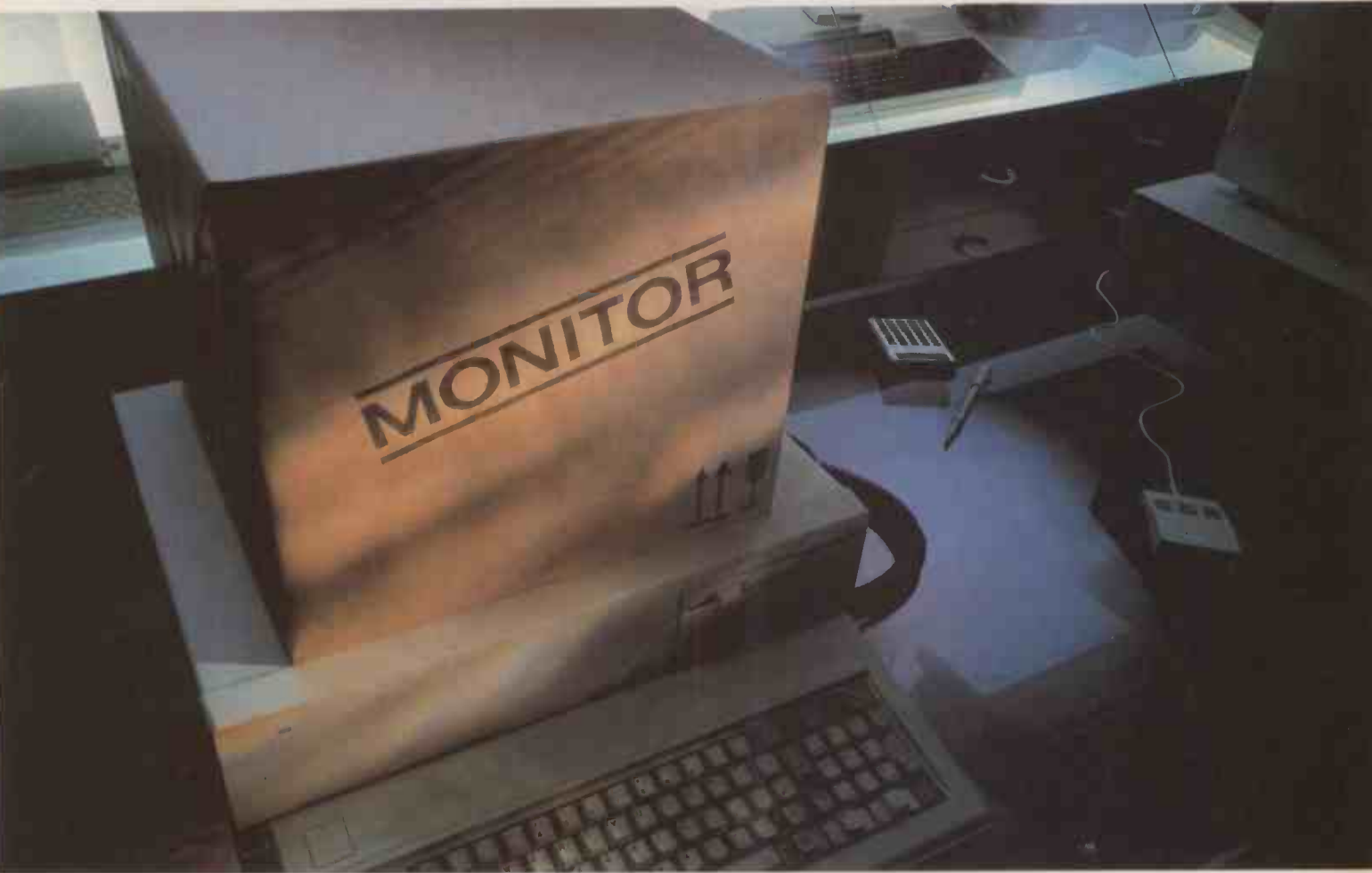
P FLETCHER,
via Telecom Gold.

Site licence for Mirror

I FELT your September article "Licensed to Copy" expressed well the need for site licensing. Softclone has appointed MDP as U.K. agent so that we can now offer site licensing on Mirror. Our scheme works similarly to the scheme for Supercalc, except that our initial fee is much lower.

Standardising on Mirror has an advantage for an organisation because of Mirror's background capability. Every PC in the organisation becomes an electronic-mail station, without intruding on the purpose for which it was bought.

GRAHAM HARRIS,
Management Data Processing,
Bath,
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System illustrated is XEN-xi 10 with optional XEN-TEL and high resolution colour monitor.

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 10Mb Tape Backup) £3442.00

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 10Mb Tape Backup) £2322.00
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RAIR AND CORVUS 80386 LAUNCHES

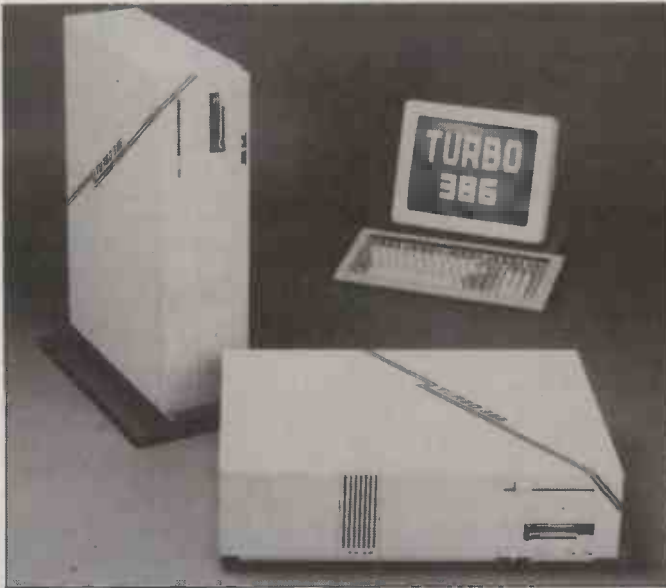
BRITISH micro manufacturer Rair has produced an 80386-based machine. The Turbo 386 is designed as a multi-user system and runs the Concurrent DOS, Unix System V and BOS operating systems.

Unusually, the Turbo 386 is also fitted with an 80287 co-processor as standard and comes with 2Mbyte of memory, expandable to 4Mbyte. Storage is provided by a 5.25in. 1Mbyte floppy drive and up to two hard discs, each with a capacity of 85Mbyte.

To support the multi-user environment, either eight, 16 or 24 asynchronous RS-232C ports and up to six synchronous ports can be supported with a data-transfer rate of between 50 baud and 19,200 baud. The Rair Turbo 386 costs £19,000.

Details can be obtained from Rair Ltd, 145-157 St. John Street, London EC1V 4QJ. Telephone: 01-250 3535.

U.S.-based manufacturer Corvus has also announced the launch of a range of 80386-based micros. Three machines are available for the range, which is



collectively known as the Series 386.

Like the Rair machine and the Compaq 386 — reviewed this month on page 53 — the Series 386 has an 80386 processor running at 16MHz. The models in the range consist of an IBM PC/AT

compatible work station, a 70Mbyte file server and a 126Mbyte file server which also includes a 60Mbyte tape streamer. Details from Corvus Systems Inc., 2100 Corvus Drive, San Jose, California 95124, U.S.A. Telephone: (U.S. area code 408) 559-7000.

IBM's enigmatic PC/XT-286

IN A surprise move, IBM has announced the PC/XT-286. The machine uses an 80286 running at 6MHz with no wait states; IBM claims that it is 20 percent faster than the old 6MHz AT.

The XT-286 comes with 640K of RAM, one 1.2Mbyte floppy, a 20Mbyte Winchester, five 16-bit

and three eight-bit expansion slots, and serial and parallel ports. The operating systems are DOS 3.2 or Xenix 2.0. Options include a 3.5in. floppy drive. The cost is £2,694.

This new machine corresponds to the product launched by Sperry last month, the Micro IT. In the

U.S., Compaq has also joined the club with the launch of its Deskpro 286 model 20. This machine offers a 20Mbyte Winchester instead of the 30Mbyte version used before, but can run at both 6MHz and 8MHz. The U.S. price is \$2,999; no U.K. price or launch date have been announced.

Upgrades announced for Apricot Xen ranges

APRICOT has made a series of announcements concerning the development of its Xen and Xen-i ranges. Two new versions of the IBM PC/AT compatible Xen-i are planned and there is the promise of an upgrade path for 1987 that includes the addition of an 80386 processor.

The Xen-xi 10 is an 8MHz version of the recently launched Xen-i with a 10Mbyte hard disc and monochrome monitor but with fewer expansion options than the original machines. The Xen-xi 10 is priced at £1,999.

The second new micro is the

Xen-xi 20, which is a 20Mbyte version of the same machine and costs £2,499. The new models also offer the choice of 3.5in. discs as used on the IBM Convertible. Although lacking a wide range of software, the discs do offer data transfer with the rest of the Apricot range.

Apricot has also reduced the prices of its 20Mbyte Xen-i XD to £2,849 and the 40Mbyte Xen-i HD to £3,849. Details of Apricot's Xen Advance Plan for IBM-compatible machines have been announced too. This enables users to upgrade their machines to a higher



specification. So a basic Xen-xi 10 could be upgraded to a 20Mbyte version for £799 or to a Xen-100 Mainframe for £6,499; 80386 processors will also be made available.

Further details from Apricot (U.K.), Apricot House, 17 Westbourne Road, Edgbaston, Birmingham B15 3TR. Telephone: 021-456 1234.

HARDWARE SHORTS

● Kuma Computers has released an add-on Transputer for the Atari ST which can be fitted in an expansion box connected to the ROM port. Details on (07357) 4335.

● Grid has improved the specification of its lap portable with the addition of an improved keyboard and the option of a hard disc. Further information on (07372) 41211.

● ASD Peripherals has launched 10Mbyte and 20Mbyte hard discs for the Amstrad PCW-8256 priced at £449 and £599. Ring (03224) 49235/6.

● NEC has increased the price of its printers by 10 percent. The company says the change is designed to maintain dealer margins. Details on 01-267 7000.

● Desklan is a low-cost networking system intended for the Amstrad PC-1512. It costs as little as £399 for a two-machine network. Details on (0602) 724264.

● Tiny Turbo 286 from Orchid Technology is said to boost the PC/XT to provide AT performance. Contact First Software on (0256) 463344.

● The PM Magnum IBM-compatible lap portable has been reduced in price by 30 percent to £895. Details on (0954) 81991.

● Codenoll Technology has introduced three expansion cards for the IBM PC which support fibre-optic networking. The company claims the system can run at 125Mbit/s. Ring (U.S. area code 914) 965-6300.

Compact terminal

MELLORDATA has launched a plasma-screen terminal. Called the 220FS, it is claimed to be suitable for those with limited desk space. The system is said to be compatible with the DEC VT-220, VT-100 and VT-51 systems although it is restricted to a maximum of 80 columns rather than the 132 columns used on a DEC VT-220.

Further details from Mellordata Ltd, 37-43 Fore Street, Ipswich, Suffolk IP4 1JL. Telephone: 01-597 5222.



DG Dasher 80286 work station

DATA GENERAL has launched an AT-compatible work station called the Dasher 286. The company claims the unit allows access to Data General's CEO office-automation software or can run in the MS-DOS environment via CEO Connection software.

Data General has fitted the Dasher with a 10MHz version of the 80286 processor and 640K RAM as standard. The entry-level machine also comes with a single 1.2Mbyte 5.25in. disc drive, two RS-232/422 ports and a parallel printer port. The Dasher 286 is also fitted with one eight-bit expansion slot and five 16-bit slots.

The entry-level machine is priced at £2,917. The price of a system with a 20Mbyte hard disc is £3,518. For further information contact Data General, Hounslow House, 724-734 London Road, Hounslow, Middlesex TW3 1PD. Telephone: 01-572 7455.

ZENITH LAP PORTABLE IN U.K. SOON

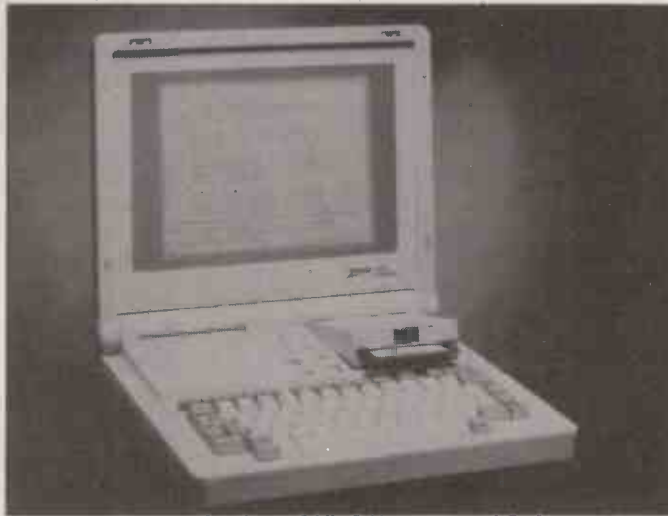
ZENITH DATA has announced that its Z-181 lap-portable PC is to become available in the U.K. This full-feature machine was reviewed in last month's issue of *Practical Computing*. Its U.K. price has now been fixed at £1,795.

The Z-181 is fitted with a single 3.5in. disc drive and 640K of RAM as standard, based around the 80C88 chip running at 4.77MHz. The company claims full IBM PC/XT software compatibility. The most interesting feature of the machine is the full 80- by 25-character electro-luminescent back-lit LCD screen which

provides a normal aspect ratio, allowing it to display graphics without distortion.

I/O is provided by a parallel printer port, an RS-232C port, and RGB and composite-video interfaces. In order to allow users access to software supplied on 5.25in. discs, Zenith has fitted the Z-181 with an external floppy-drive interface.

Further information is available from Zenith Data Systems Ltd, St. Johns Court, Easton Street, High Wycombe, Buckinghamshire HP11 1JX. Telephone: (0494) 459266.



DEC Vaxmate

DEC has launched the Vaxmate work station, which the company claims is compatible with both the IBM PC/AT and the company's series of Vax minicomputers. DEC is at pains to emphasise that the machine is not intended as a stand-alone PC but is designed to provide an AT environment within a Decnet Vax network.

Based around the 80286 processor running at 8MHz, the Vaxmate is fitted with 1Mbyte of RAM as standard, expandable to 3Mbyte. The monitor, disc drive and main CPU are contained within a single unit. Only 14in. amber or green screens are currently available but a colour version is promised for the new year.

Mass storage is provided by a 5.25in. floppy which is capable of reading 1.2Mbyte AT discs, 360K IBM discs and DEC's own RX-50 floppies. Interfaces are provided by separate RS-232C, RS-423 and Ethernet ports; no Centronics parallel printer port is provided.

Options for the machine include an 80287 processor and a 20Mbyte hard disc. An expansion box is available which supports two IBM expansion slots. Software bundled with the machine includes MS-DOS 3.1, Microsoft Windows, networking server software and DEC VT-220/240 terminal-emulation software. The basic machine costs £3,055. Further details can be obtained from DEC, Digital Park, Imperial Way, Reading, Berkshire RG2 0TE. Telephone: (0734) 868711.

Business and pleasure at the PCW Show

THE MOST striking thing about this year's PCW Show was how dull it was compared with the frenzied activity in the micro world outside. The explanation is not hard to find: most of the new launches are in the upper end of the business market, whereas the PCW Show had little to offer in that area. The business-computing section was dwarfed by the main home section.

Most of the attention was directed towards the Amstrad PC, launched the day before the show opened. Following on from that, Sagesoft chose the show to announce price reductions of up to 66 percent of its products for the new machine.

Sagesoft also announced two new products. PC Planner is a £99

1-2-3 clone while Deskset, a Sidekick look-alike, costs £69. More information on Sagesoft products from 091-284 7077.

Otherwise it was a matter of ferreting out items of interest. There was a new laser printer from Kyocera, a company hitherto best known for the lap portables it has built for Olivetti, Tandy and NEC. The eight pages per minute laser has 300 dots per inch resolution and 62 resident fonts. Its 1Mbyte of RAM allows a full page of graphics to be printed. It costs £2,595 and is available from Mekom on 021-454 2288.

The PC Scan from the Californian company Dest can cope with a variety of fonts, both typewritten and printed. It is able to produce output in a number of

word-processing formats. The unit hooks up to an IBM PC and costs £2,995. It is available from Lexisystems on (0373) 61446.

The Megascreeen is an interesting Macintosh product which saves you having to squint at a small screen. It offers 1,024 by 900 pixels on a large screen. Most software is intelligent enough to recognise that a larger screen format is being used, and expands accordingly. It costs £2,595. It is available from Computers Unlimited, which also distributes Macindexer and Machyphen. These products cost £79.95 and £89.95 respectively. More details on 01-349 2395.

The British manufacturer Comart was showing its Quad multi-user system for the first time. For £4,995 you get a four-

user system with terminals and 1Mbyte of RAM running under Concurrent DOS. Further information on (0480) 215005.

The Dart scanner works like the ThunderScan device for the Mac, turning your printer into a cheap scanner. This one works with the Amstrad DMP-2000 and costs £79.95 including VAT. It comes from Dart Electronics on (0502) 513707. There are plans for a similar add-on for the PCW-8256 printer.

Maxell was showing a range of discs, including its latest Worms. Along with the 5.25in., 3.5in. and 3in. floppies were some new 2.5in. floppies. Designed mainly with portable computers in mind, these discs may turn up in an Epson machine before long.

Lotus ready for networks

LOTUS DEVELOPMENT (U.K.) has begun shipments of 1-2-3 release 2.01 for the IBM PC, as well as in 3.5in. format for the Toshiba range. Lotus says that versions of release 2.01 for Wang Professional, Hewlett-Packard 150 and DEC Rainbow machines will be available at the end of the year. The new release is the first to allow 1-2-3 to run on a local area network.

Lotus has now revealed some of the details of the network support which should become available in the first quarter of next year. The Networker is the LAN system software which distributes the program around the network. It allows a copy of 1-2-3 to be installed in such a way that a predetermined number of users can run it simultaneously without having to have a copy of the program at each work station. Included with networker is Add-in, which supports file-level locking and protects the integrity of data.

The new release also solves many of the compatibility problems users encountered when they upgraded from versions 1.0 to 2.0. This meant, for example, that many macros written for version 1.0 would not work on release 2.0. Current users of version 2.0 can upgrade to 2.01 at nominal cost.

Lotus Development is at Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone: (0753) 840281.

New net for Nimbus

RESEARCH MACHINES has upgraded its networking software with the release of RM-Net 2. It claims that the server access is twice as fast as in the previous version.

The company has also simplified the installation of RM-Net 2, with the addition of menu-driven installation software. The software will become available in January, and will be supplied free to purchasers of network servers ordered from now on. Current users can purchase the software for £99.

Details from Research Machines, Mill Street, Oxford OX2 0BW. Telephone: (0865) 249866.

PRICES FALL IN RUSH FOR SALES

FOLLOWING the launch of the Amstrad PC-1512 there has been a wave of budget-priced software. Two major software houses, Ashton-Tate and Microsoft, have produced restricted-function versions of their flagship products.

Ashton-Tate, which has already achieved considerable success with dBase II for the Amstrad eight-bit computers, is now relaunching the MS-DOS version together with a version of Framework aimed specifically at Amstrad users.

The version of Framework for the Amstrad is in fact the release 1 of the product with the comms features removed. However, the product will retain the original spreadsheet, database, graphics and word-processing facilities.

Ashton-Tate has removed copy protection from its top-end programs, but it will be retained for Framework and actually introduced on dBase II. The company says that with the expected sales volume, it will be impossible to ensure that widespread piracy does not take place.

Neither the names nor the prices of the products have been finally decided. Ashton-Tate says it hopes to have them in the shops by

Christmas, and they will probably cost around £150 each.

Details from Ashton-Tate, 1 Bath Road, Maidenhead, Berkshire SL6 4UH. Telephone: (0628) 33123.

Microsoft is also adapting two of its major products for the Amstrad market. Word Junior and Multiplan Junior are cut-down versions of the current products. The features that have been removed are generally the power functions, which Microsoft says low-end users are unlikely to require.

Thus Word Junior will not contain the stylesheets, Document Content Architecture, spelling checker, indexing and contents generator. The Multiplan Junior spreadsheet will have a maximum of 66 by 255 cells, compared with 255 by 4,096 on the full-function version; it will also consolidate fewer worksheets.

Microsoft is also considering placing copy protection on the programs, but no final decision has been taken. Both products are priced at £69.95. More information can be obtained from Microsoft, Excel House, 49 De Montfort Road, Reading, Berkshire RG1 8LP. Telephone: (0734) 500741.

SOFTWARE SHORTS

● Redwood International has released a Xenix 5 version of its Uniplex-II office-automation suite. The system includes word processing, a spreadsheet and a database manager. Details on (0727) 40601.

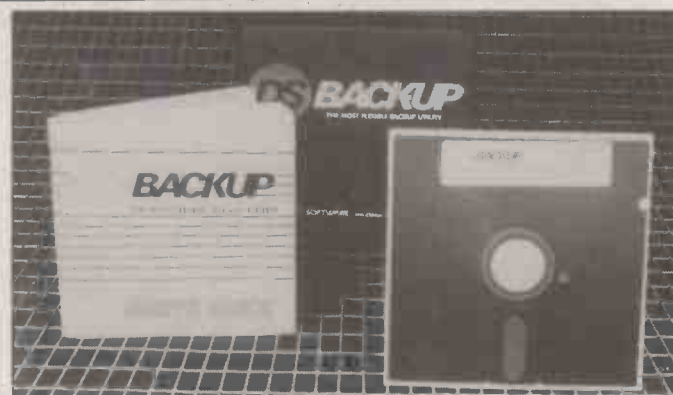
● Pasmod is a program which converts Turbo Pascal programs to Modula-2 source code. Distributor Real Time Associates claims that conversion is performed at an average 15 lines per second. For information phone 01-656 7333.

● Santa Cruz Operation Inc. has announced it is to develop a 32-bit version of its Xenix System V operating system using the Corvus Systems 80386 departmental processor. Details from Corvus on (U.S. area code 408) 559-7000.

● Timeplan is described as a "visual planner" which enables scheduling and planning charts to be created. The package is from Aberdeen-based ABZ Software, which can be contacted on (0224) 573316.

● Newswriter is a complete page-production system that ranges from text processing to finished artwork. Details on 01-221 7612.

● Ashton-Tate has announced that it has removed copy protection from its range of products. The exceptions are the low-end products designed for the Amstrad market. More information on (0628) 33123.



Backup made easy

P&P MICRO has announced it is to distribute DSBackup from Design Software. The company claims that it is up to three times faster than the equivalent MS-DOS utility as well as providing additional functionality.


Among the features provided by DSBackup are utilities to back up only those files changed since the last backup, on-screen prompts

and sector squeezing. It also allows backup to any DOS logical device. The program is bundled with the Mountain 30Mbyte Drivecard or can be bought separately for £99.

Further information from P&P Micro Distributors, Todd Hall Road, Carrs Industrial Estate, Haslingden, Rossendale, Lancashire BB4 5HU. Telephone: (0706) 217744.

Amstrad licensed products

IN ORDER to support its PC-1512 Amstrad has licensed four products from major software publishers which cover the main business applications. The four products are WordStar 1512 from Micropro, Supercalc 3 from Computer Associates, and Sidekick and the Reflex database manager from Borland International. Each of the products is priced at £69.95, and support will be provided on the Amstrad hot line.

Details from Amstrad Consumer Electronics, 169 Kings Road, Brentwood, Essex CM14 4EF. Tel: (0277) 228888. 

Amstrad activities

A NUMBER of organisations have started jumping on the still barely moving Amstrad PC bandwagon. The low dealer margins and the limited support which will be offered with the machine have led a number of people to see a gap which they could plug. For example, there is the 1512 Independent User Group, based in Sevenoaks. For £20 per annum you get a newsletter, a help-line service and access to public-domain software. For details phone (0732) 450908.

Manor House Press has announced that it will be producing *The Amstrad PC Users' Year Book*. The book is designed for both first-time users and those employing Amstrad PCs as terminals within companies. The scheduled publication date is mid-1987. More information from Newtech Books, St. Mary's Corner, 110 Frimley Road, Camberley, Surrey. Telephone: (0276) 685996.

Ashton-Tate buys into graphics

ASHTON-TATE is on the acquisition trail again after signing a letter of intent to buy Decision Resources. This Connecticut-based firm specialises in business-graphics packages such as Chartmaster, Signmaster, Diagrammaster and Mapmaster.

These programs will fit in well with Ashton-Tate's existing portfolio of products. Following on from its purchase of Multimate and the acquisition of rights to sell the Javelin spreadsheet outside the U.S., the latest move means that the company now has almost a complete set of application software for the IBM PC.

Decision Resources was founded in 1981. Ashton-Tate will be paying around \$13 million for the company, which had profits last year of nearly \$1 million.

LOTUS SETS UP USER SUPPORT GROUP

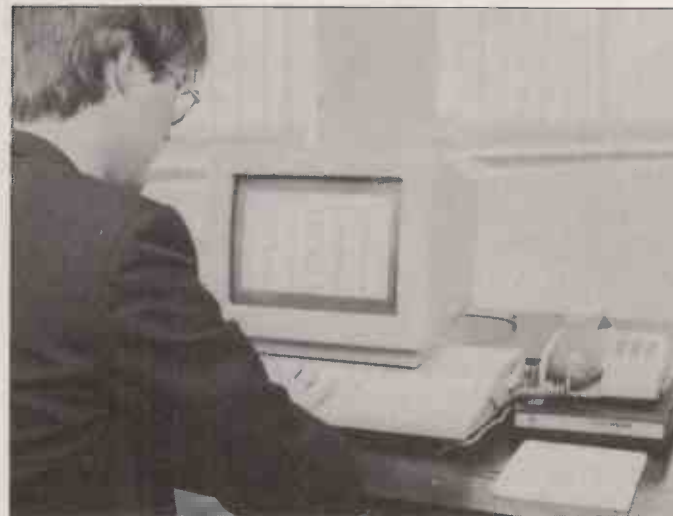
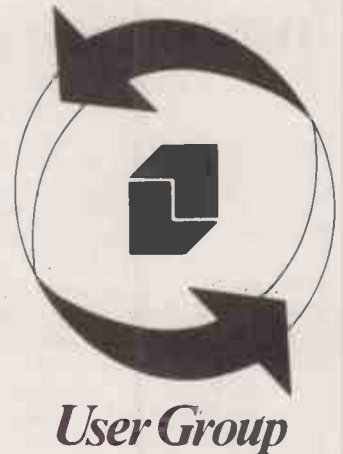
LOTUS is setting up what it terms a semi-autonomous organisation for users. Among the benefits offered are free hot-line support, a newsletter, concessions on products and services, and free subscription to Telecom Gold, including the World of Lotus service.

The cost is £95 for individuals and £350 for companies. All new members joining before 30 November will receive a free copy

of the Spotlight desk-utility program.

Although the user group is being sponsored and supported by Lotus, and is intended to serve the company as well as the users, it will be run by a separate organisation. For more details contact Simon Moores, Chairman, Lotus User Group, 79-80 Peascod Street, Windsor, Berkshire SL4 1DH. Telephone: (0753) 841686.

 Lotus™



Company data now on Telecom Gold

TELECOM GOLD has announced three more databases which are available through its electronic-mail service. Jordans Company Information provides financial information on all major U.K. companies including public limited companies, private companies, and companies quoted on the USM. Aims News gives details of U.K. government and European Communities assistance schemes available. Infocheck also

provides financial information, including analyses and details of credit available to some 150,000 companies.

Telecom Gold has also announced that it will drop the 50p previously charged for the receipt of incoming telexes. Further details on these changes from Sales Administration, Telecom Gold Ltd, 60-68 St. Thomas Street, London SE1 3QU. Telephone: 01-403 6777.


It's a hard life for dealers

ACCORDING to a survey from Romtec, dealers are having a rocky time of it. The survey claims that over one-tenth of all micro dealers go to the wall annually. Dealerships are predominantly small businesses with a turnover of less than £500,000; they are increasingly turning away from box shifting in the direction of VARs. A separate article on page 89 of this issue details this trend.

Romtec's *Business Micro Dealer Directory* costs £595 and is available from Romtec, Braywood Farm, Ascot Road, Hawthorn Hill, Maidenhead, Berkshire SL6 3SY. Telephone: (0628) 74242.

Micro software directory

TWO NEW directories have been launched. *The Directory of Computer Software*, published by the U.S. National Technical Information Service, lists 1,600 programs from over 100 U.S. Federal agencies. The directory costs £80, and is available from Microinfo, PO Box 3, Newman Lane, Alton, Hampshire GU34 2PG. Telephone: (0420) 86848.

The PC Year Book 1987 is a 700-page guide to products and services for the IBM PC and compatibles. The price is £35 and it is available from VNU Business Publications, 32-34 Broadwick Street, London W1A 2HG. Telephone: 01-439 4242. 



Coddle your floppies

INMAC has introduced a floppy-disc storage box with a built-in temperature gauge. An LCD displays the message "Ideal Temperature" provided the temperature remains between 15°C and 40°C. The box can store

up to 50 discs; models are available for both 5.25in. and 3in. sizes. The cost is £17.95. More information from Inmac, Westerly Point, Market Street, Bracknell, Berkshire RG12 1EW. Telephone: (0344) 424333.

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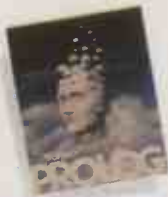
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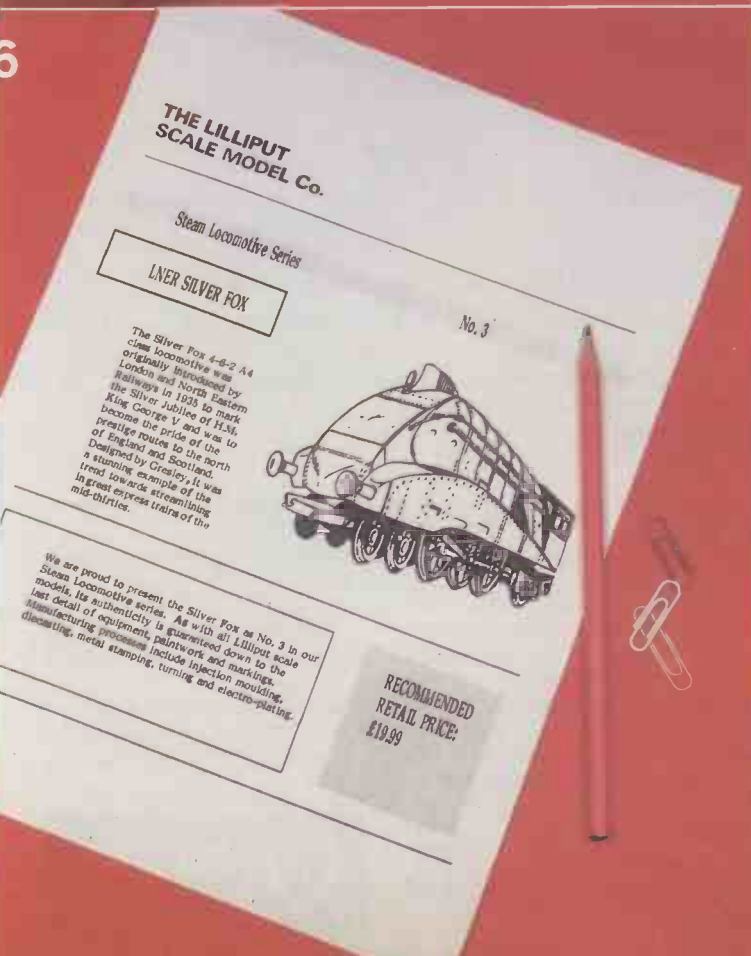
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MORE significant business micros have been launched in the last month alone than in the previous year. Partly this reflects the normal seasonal variation caused by summer holidays. The July and August doldrums mean that few sales are made, and that new machines are saved up for the autumn. But beyond this there is evidence of fundamental shifts occurring in the world of micros.

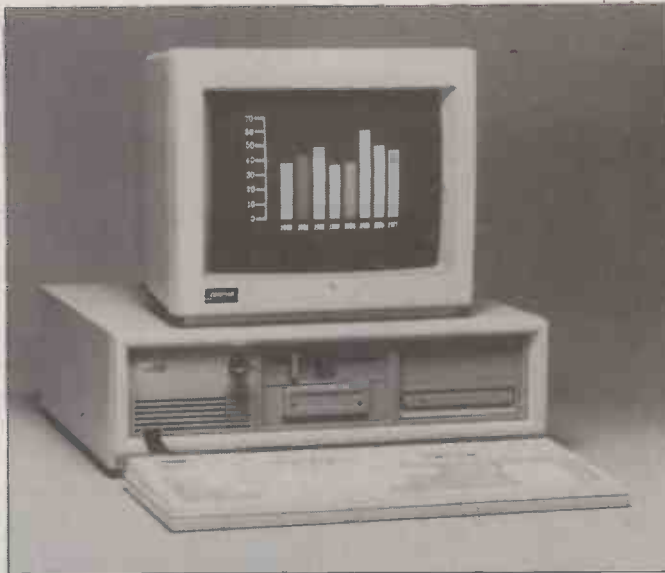
The event with the highest profile in this country has been the launch of the Amstrad PC-1512. It represents a deepening entrenchment of what is coming euphemistically to be called "the industry standard" — that is, IBM compatibility. Just as the original IBM PC signalled the start of business respectability for the whole micro concept, so it is likely that the Amstrad machine will lead to many more cheap clones finding their way on to corporate desks as an acceptable alternative to the official IBM model.

A further fillip to the standard has been provided by DEC's Vaxmate. DEC has long been the most important manufacturer to remain aloof from the IBM camp. But after the crashing failure of the Rainbow it has bowed to the inevitable and produced an AT compatible, albeit one with a difference. It would have been unthinkable to jettison the real standard which DEC controls — that of its Vax minis — and so there is full provision for linking the new micro up to departmental machines.

ALL SEWN UP?

With DEC finally lining up behind PC compatibility, standards might appear pretty much sewn up. And so they were, until Compaq announced its Deskpro 386 using the advanced Intel 80386 CPU chip. Compaq has hitherto been content to be the first and the perfect clone maker, shadowing IBM's every step. It may have added features along the way, but its whole *raison d'être* has been Big Blue's products. No longer. With the launch of the Deskpro 386 it has taken a leap in the dark. In its own words, it is trying to hijack the standard from IBM.

Compaq is undoubtedly right in thinking that the PC standard has acquired such a momentum that even IBM is unable to control it, only follow it. Whether Compaq will be able to commandeer it is more dubious. The introduction of an 80386 machine without an appropriate operating system is in itself fraught with difficulties. These are examined in greater detail in our review on page 53 of



Compaq's Deskpro 386 will put the minicomputer under pressure.

WHAT FUTURE FOR THE IBM STANDARD?

Glyn Moody assesses the implications of this month's crop of new micros.

this issue. But irrespective of the machine's success or otherwise, the questions its launch poses are enough to make the foundations of the PC standard seem less secure than the arrival of the Amstrad or Vaxmate might suggest.

As if these doubts were not enough, IBM itself has heaved a considerable spanner into the works with the launch of the PC/XT-286. Even the name is confusing: if it has an 80286 processor, why call it an XT? The official answer is that the casing is the same as that on the XT, which begs the question why use this casing and not that of the AT? The new XT-286 seems to offer most of the power of the AT for a lower cost, though not low enough to worry any clone maker of ATs or PCs.

Although it is unlikely that a \$50 billion company has completely lost its head, the new machine is certainly a confusing launch, even if not totally confused. There are some suggestions that it is only a stopgap measure before IBM brings out its real clone-killer. The fact that a new fully automated plant in Texas has been commissioned has led to speculation that IBM will turn out a machine that will out-Amstrad Amstrad, and sell for a few hundred dollars.

IBM certainly could do this, but

almost equally certainly it will not. On several occasions, top officers of the company have stated that IBM is not interested in the so-called commodity market: it aims to sell machines with decent margins and decent profits. The introduction of the IBM PC was an innovation in itself for the company; to move into High Street selling would amount to a personality change bordering on psychosis.

Much more plausible are rumours that IBM is about to launch a range of machines in the new year which represent significant moves beyond the present standard. At the bottom would be a fast 8086 machine, like the Amstrad, together with a new 80286 AT machine, with a top-end 80386 model. All would come with innovative new graphics, 3.5in. discs presumably, and would build on the sparsely populated motherboard pioneered in IBM's Convertible PC.

A key element in the new range of machines is likely to be high-quality graphics. It is no coincidence that such graphics lend themselves to applications like desk-top publishing. So far IBM has been forced to sit by and watch the Apple Macintosh colonise this new and lucrative market. The poor graphics on the IBM have made it less suitable for

the kind of on-screen page make-up with full WYSIWYG that is required. As a result, Apple has found itself a very useful niche market, and one from which it has been able to expand its base of general office use.


The new IBM machines could change all that. Apple can draw some comfort from the fact that even though it seems likely that IBM-based desk-top publishing systems will predominate in the end, the growth in this area over the next 18 months will be more than enough for both companies.

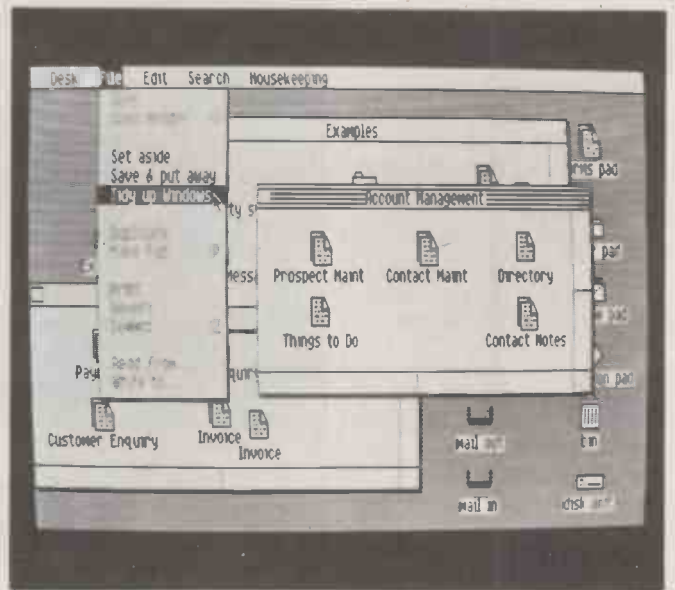
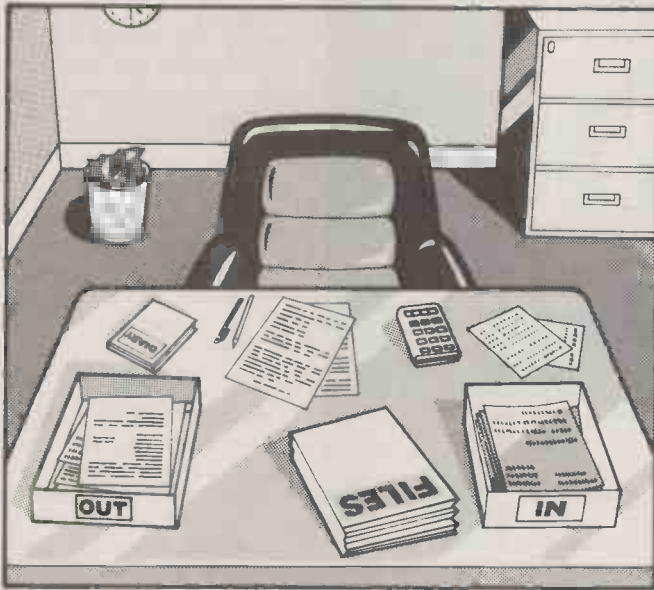
MORE FROM APPLE

Nonetheless, Apple can no longer depend too much on this area for growth in revenues. New machines are needed for it to consolidate its position as an alternative to IBM. The recent launch of the Apple II GS, reviewed on page 62 of this issue, shows how the company is bringing its disparate products into line. We can also expect some new machines in the Macintosh range in the new year. These will use the 68020 processor, and possibly offer more advanced graphics. As well as providing superior publishing systems, these super-Macs will begin to break into the fast-growing and lucrative CAD and graphics work-station markets.

Next in line for attack by new micros will be the minicomputer, now confronted by the new 80386 machines of which the Compaq will be only the first. The intrinsic power of the chip is such that machines built around it could easily replace low-end minis. This is a serious problem for IBM, which must strive to protect its System 36 and 38 minicomputers.

Specialist companies like Sun and Apollo as well as giants like DEC and Apple can survive by offering more powerful variants of their current systems. Similarly, new manufacturers will always find a fruitful way of slotting into niches and crevices left by everyone else in the expanding market.

It is mainly IBM that will bear the brunt of the latest surge of micro products. But before people begin to feel sorry for it, or write it off, it is worth bearing in mind that IBM's annual profits are about the same size as the turnover of its nearest rival. However confused things may look now, you can be sure that IBM will still be in the micro market 12 months from now. In the meantime, we are probably about to witness one of the most interesting periods in the development of micros — an area which could hardly be said to have been dull in the past. 



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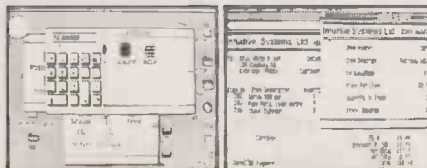
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BY MIKE LEWIS

DO IT WITH DOS

The programs that come as part of every MS-DOS disc have some powerful capabilities that are all too often ignored.

the root directory. This batch file will be invoked whenever the system is switched on, so you should use it to hold any commands that must always be performed on start-up. Examples include the keyboard driver and the Mode command, which you might need to direct printed output to the serial port. Even if you do not use any of these it is worth having a dummy Autoexec.Bat containing a single blank line which provides an easy way of by-passing the date and time prompts at the start of the session.

BATCH FILES

Batch files are one of the most useful features of MS-DOS. They are well known as a vehicle for holding often-used commands, but they really come into their own as a substitute for programming. They can contain elementary language elements for looping, testing conditions, etc. While lacking the sophistication of a real programming language, they can help you to do things that would not otherwise be practicable.

The Search.Bat file shown on the next page is a good example. It solves a problem which most users have had a some time: you want to find a particular file which you know is on a floppy disc, but you do not know which one. To use it, you type Search followed by the disc-drive letter and the file name. The batch file prompts you to load each disc in turn and displays a suitable message when it has found your file.

This small example demonstrates several important batch file

(continued on next page)

Have you ever thought how under used most software products are? A typical micro user takes advantage of only a fraction of his or her favourite package's features, with the rest often lying unnoticed beneath the surface. Possibly the most under used program of all is the MS-DOS operating system. Most people know enough about it to get through their day-to-day work, but how many take the trouble to explore its depths?

MS-DOS is certainly worth exploring. True, its Teletype-like method of operation can be frustrating and the syntax of some of its commands does nothing to endear it to its public. But it has more muscle than many people realise and can be used to perform chores that would otherwise need special programs. It can save you a lot of time and — given that it comes free with the computer — money too.

The main difficulty, of course, is the impenetrable documentation. Most — though not all — of the gems of MS-DOS are mentioned somewhere in its manual, but you need a lot of determination to find them. A good example of this is the so-called country-dependent information. Most Europeans are irritated by the use of American

date formats in the directory display, but how many know that you can do something about it?

In fact, there is a way of telling MS-DOS that you live in a European country and would therefore like to see dates shown with the day before the month rather than the other way round. You can do this simply by putting the command

```
COUNTRY=44
```

in your Config.Sys file, 44 being the code for the United Kingdom. Once set in this way, the country code can also be accessed by application programs to determine the local currency symbol and whether to use a comma or a full stop for the decimal point.

Another poorly documented Config.Sys feature is the Buffers command. If you would like to speed up your system's disc accesses, especially on a floppy-based machine, it might be worth experimenting with this. My own Config.Sys includes the line:

```
BUFFERS=20
```

which certainly improves performance, albeit at the cost of about 10K of RAM. You can find out more about this from the Software Workshop column in the March 1986 issue.

For many people the most confusing aspect of MS-DOS is probably its use of sub-directories

and paths. While the average programmer feels quite at home with the tree-like nature of directories and can cope with all those awkward backslashes, non-technical users can find it somewhat off-putting.

One solution is simply to ignore the whole issue. Certainly, if yours is a floppy-based system there is absolutely no need to worry about sub-directories. Wherever you see a reference to a path name in a manual, just read it as a file name. You can also take this attitude on a hard-disc machine if it is used for a single application, such as an accounting system.

In practice, however, most people with hard discs will use their computers for several different jobs, and will therefore want to compartmentalise their storage in some way. This is where sub-directories can be useful.

The best approach is to keep the root directory as small as possible and store all the important files in sub-directories. A common technique is to reserve a directory for all those small utilities that might be needed at any time, as well as any programs that do not need overlays or help files. You can then use a Path command to get at them from any other directory.

The Path command should be placed in the Autoexec.Bat file in

START.BAT

```
ECHO OFF
```

```
REM      This batch file is used to load memory-resident programs
REM      at the start of a session. For each program in turn, the
REM      user is asked if the program is needed. If the answer is
REM      Y, the program is loaded. The user's responses are obtained
REM      by means of the QUERY program (supplied by S&S Enterprises)
REM      and are tested via the Error Level.
```

```
ECHO      Do you want to print with Metatext in this session?
```

```
QUERY
IF NOT ERRORLEVEL=1 GOTO KEY
CD \LIBRARY\METATEXT
MT80 FONTO
CD \
```

```
:KEY
ECHO      Do you want to use keyboard macros?
QUERY
IF NOT ERRORLEVEL=1 GOTO LIGHT
CD \LIBRARY\SUPERKEY
KEY
CD \
```

```
:LIGHT
ECHO      Do you want on-line spelling checks?
QUERY
IF NOT ERRORLEVEL=1 GOTO SIDE
CD \LIBRARY\LIGHT
LIGHT
CD \
```

```
:SIDE
ECHO      Do you want to use Sidekick?
QUERY
IF ERRORLEVEL=1 SK
```

```
ECHO ON
```


(continued from previous page)

ideas. First, there is the ability to talk to the user. Three commands are available for this: Echo, Rem, and Pause. Placing Echo Off at the start of the batch file prevents subsequent commands being displayed. The Rem command can then be used for internal comments. With Echo switched on, Rems are displayed as messages to the user.

A better way to display messages is to use the Echo command itself, followed by the text of the message. This text will appear on the screen whether or not Echo is currently on. You cannot output a blank line in this way because Echo by itself prints a report of the current setting of the echo toggle. The Pause command can also display a message while Echo is on, but will always print the line "Strike a key when ready", regardless of Echo.

Another important command shown in this example is If. In this case it is being used to test for the presence of a file, and branches on the result. The command can also be used to compare two strings or to test the error level.

There is also a handy For command, which allows you to execute a command once for each item in a list. For example

SEARCH.BAT

```
ECHO OFF
REM SEARCH.BAT
REM This batch file can be used to search a pile of floppies
REM for the one that contains a specified file. Invoke thus:
REM SEARCH d: filename
REM where d: is the drive letter of the floppy drive

:LOOP
ECHO Insert disc in drive %I
PAUSE
IF NOT EXIST %I%2 GOTO LOOP

ECHO *** %2 IS ON THIS DISC ***
ECHO ON
```

For %I in (sales.dat, pay.dat, pay.mst) copy %I b:


will copy the three files in the list. One feature which the batch language badly needs is a way of getting input from the user. Apart from the drastic option of pressing Control-Break to abandon the entire batch file, there is no easy way for the operator to interact with the batch process once it has started. Authors of batch files have found some ingenious solutions to this problem which usually involve issuing a Copy Con command. This allows the user to type directly into a file. Another Copy command is then used to append this to another file, so creating a new batch file. The original file then passes control to the new one.

Inevitably this is a clumsy and error-prone technique, so something better is needed.

If you only want the user to answer a simple Yes/No question, it is worth looking at exit codes, another sparsely documented feature of MS-DOS. Any program can, on terminating, pass a code back to DOS, which can then test it using the If Errorlevel command. Thus a compiler might return a code to say that it is OK to proceed to the linking stage. Interestingly, the only MS-DOS programs which themselves use this facility are Backup and Restore.

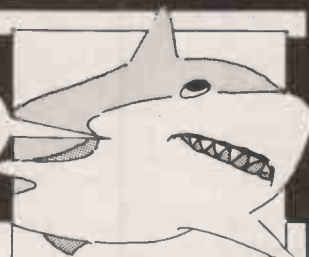
So to get user input into a batch file, you need a small program which merely reads the keyboard and sets an exit code accordingly.

For example, it could set the code to 0 if N is entered, and to 1 if Y is entered. I know of no way of doing this in Basic, but the Halt() or Exit() functions in many versions of Pascal and C do allow exit codes to be set. If you program in Assembler, DOS function 4Chex will do the trick.

If you want to avoid writing this program you can buy a utility called Query.Com which works in exactly the same way. It costs just £10 from S&S Enterprises of 31 Holloway Lane, Amersham, Buckinghamshire; telephone (02403) 4201. I have used it in the Start.Bat file listed on the previous page. It can be run at the start of the day to load the user's choice of memory-resident packages. 

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BY RAY COLES

CMOS SUPERGLUE

The fabrication technologies used for the latest processor and memory chips are now being applied to the more mundane glue-logic devices which bind together the functional elements of a microcomputer.

families with performance which betters that of ALS in every respect. This latest generation of CMOS components probably signals the final demise of TTL as the standard logic family.

Many of the names associated with this new technology are unfamiliar, which probably means that some traditional TTL manufacturers have buried their heads in the sand in the hope that it would never happen. One manufacturer which has not is Fairchild, a champion of ALS with its very capable Fast family, but now a trailblazer with its CMOS Fact family. Fact will probably replace Fast completely for the next generation of components.

Some manufacturers have gone even further with new logic families which operate at blistering speed. Using a 0.8 micron process, the aptly named Performance Semiconductor Corporation has introduced a logic family which allows clock speeds of up to 250MHz and can provide an unprecedented 64mA of line driving current.

With that kind of performance CMOS is now able to compete with the more exotic and power-hungry bi-polar technologies, such as emitter-coupled logic (ECL) and gallium arsenide (GaAs), which previously had the mainframe computer and military signal-processing markets virtually to themselves.

PC

An examination of the circuit board to be found inside any microcomputer will quickly reveal the three main classes of integrated circuit which make it work. Most easily identified are the large LSI chips, which include the microprocessor itself and some of its complex peripherals such as the floppy-disc controller and the Uart to drive the RS-232 serial interface. These complex functional devices are housed in chunky 28-pin, 40-pin, or even 64-pin packages which serve to underline their importance.

Also easy to spot are the memory chips because they do not normally appear as isolated units but in neatly arranged groups, lined up like soldiers on parade. Memory can be further subdivided into ROM and RAM, with the former in 24-pin or 28-pin packages and the latter in the 16-pin packages typical of the 64K and 256K dynamic RAM generation.

Once the major functional and memory components have been identified it becomes obvious that there is a third class of component scattered around the circuit board, apparently filling in the cracks between those important microprocessor and memory devices which normally feature so prominently in this column. These residual devices are the glue-logic packages which bind the system together. They are the unsung heroes of microcomputer design, and without them it would be very difficult to produce a working system at all.

Glue-logic devices do not contain many thousands of individual transistors like the complex microprocessor and memory chips. Instead they house simple collections of logic gates and storage latches which perform address decoding, timing generation and bus buffering. As befits their humble status, they are housed in a variety of small packages with 14, 16 or 20 pins. Despite the increasing trend towards higher and higher levels of integration, glue logic remains a necessity in the design of microprocessor systems. It has in fact been necessary for the semiconductor manufacturers to continue to develop better and better glue to keep pace with the increasing speed of the microprocessors and memories which they now serve.

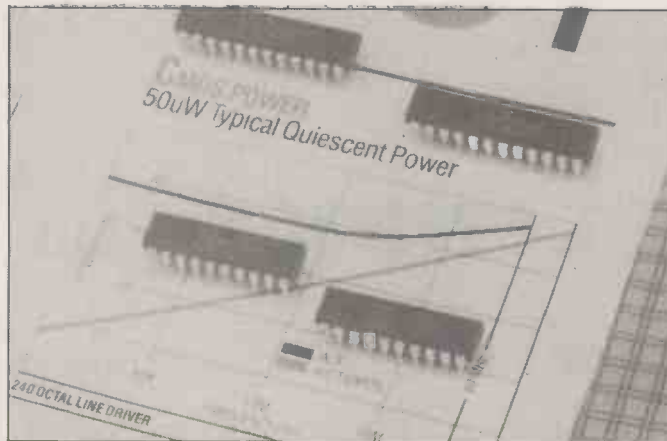
It was not always like this. At one time computers were made entirely from these simple logic circuits, and they themselves were the prima donnas of the circuit board. The first logic family, called resistor-transistor logic (RTL), was

developed in the early 1960s by Robert Noyce and his team. Noyce was later to become famous as one of the founders of Intel, and therefore jointly responsible for the first true microprocessor design, the four-bit Intel 4004.

In the days of RTL a dual two-input NOR-gate package containing four transistors and six resistors cost as much in real terms as a 16-bit microprocessor does today, and was just as revolutionary. The life of the RTL family was fairly short, however, since it was soon overtaken by the transistor-transistor logic (TTL) family developed by Texas Instruments for the American nuclear missile programme.

STANDARD PACKAGE

Thanks to a U.S. government contract, the TTL family started life with over 20 different members, all housed in the new dual-in-line package with 14 or 16 pins. Computer designers adopted it as a standard, and within 10 years there were hundreds of new variants available. Chances are, the glue logic in your machine is from the TTL family, easily identified by the 74-series part number used by all the various TTL manufacturers. Some of the devices still in use can trace their ancestry right back to the original 1960s-vintage family. But although they use the same logic arrangement, pin connections and numeric part numbers as their predecessors, they will almost certainly sport the LS suffix. This indicates that they use the more advanced low-power Shottky semiconductor technology, which has a much reduced power consumption while retaining the high speed of the original family. To keep pace with the inexorable increase in clock speed that has been the feature of successive processors, TTL manufacturers have also introduced advanced low-power Shottky (ALS) devices with even higher performance.



At high levels of integration low power consumption is paramount.

But this might be the end of the road for the bi-polar TTL technology, because the age of CMOS is now upon us. When a CMOS logic family was first introduced in the late 1960s it had the advantage of a very low power consumption. Yet because it was considerably slower than TTL it seemed unlikely to replace it in most applications. Now, after a long period as an also-ran, CMOS glue logic is poised to overtake TTL in the continuous quest for higher performance.

Already CMOS has become the technology of choice for 32-bit microprocessors and 1Mbit dynamic RAM chips. This is largely thanks to its low power dissipation per unit area and its consequent suitability for higher and higher levels of integration.

In deference to the successful 20-year track record of TTL logic, however, the latest CMOS glue chips use the same logic configurations and part numbers as their venerable bi-polar predecessors. In most applications they are also plug compatible.

The first of the improved CMOS families, called HCMOS, CHMOS and QMOS by their respective manufacturers, became available about three years ago and have made significant inroads into the glue-logic market since then.

LESS POWER

Roughly comparable to the low-power-Shottky TTL family in terms of speed of operation and drive capability, the HCMOS families dissipate much less power even at high operating frequencies. They use the HC suffix for their part numbers. But useful as these CMOS devices are, they have been incapable of providing the high drive currents for controlling the fast buses used with the latest 16- and 32-bit processors. The bi-polar LS and ALS devices have therefore remained a necessity in most designs until the recent launch by a number of manufacturers of advanced CMOS

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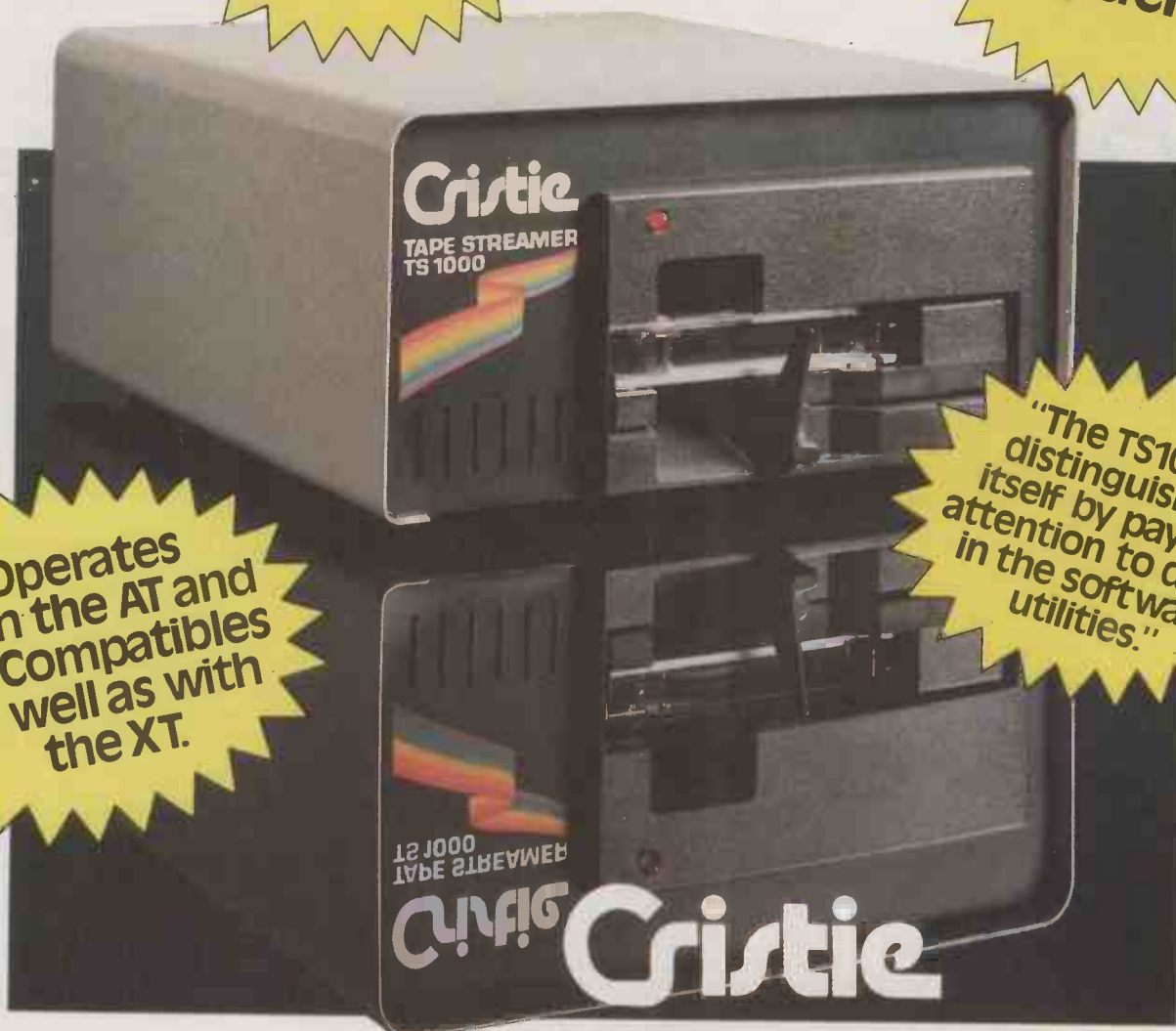
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BY BEN KNOX

ALL CHANGE

Prestel may have lost the popular Timefame Information Provider, but Microlink has gained a gateway to the Mnemetics database.

Regular users of Prestel will know that one of the most popular areas of the system, run by Timefame, has closed. Timefame joined Prestel in 1980. It gained a large following, particularly with its letter box system where letters from users were published automatically on Prestel pages under various section headings.

Current affairs and general messages went in the standard Letterbox area, Microboard was for computing messages, Cityline for business-orientated letters, Phototalk for photography enthusiasts and Thames TV/Database for television and media-orientated material. As early as 1984 the Timefame database clocked up 1.5 million accesses in a single month.

It is sad to see a company drop out of the British computer communications scene. But Timefame decided that it could not accept the new Prestel Information Provider (IP) agreement and so it left the system at the end of August.

According to the company's managing director, Roy Norman, Timefame will be back. He says: "Prestel is not without competition. We are actively considering joining the French system, and we are launching our own videotext system which includes many features hitherto unavailable on a public system."

The Timefame videotext system will make use of a set of 20 commands in addition to the usual menus available on Prestel. The commands will provide speedy access to more frequently used

```
Mnematics Videotex Ver 2.X.5DW
(C) 1986 Mnemetics, Incorporated
10:41et September 8, 1986
```

```
Welcome, MicroLink.
```

```
Last session: 09/07/86 at 17:59:18
```

```
Welcome to America's
```

```
Mnematics Videotex!
```

```
We're pleased to offer our service
to MicroLink users at low cost.
```

```
*****
```

```
We ask that you please LOG OFF
Mnematics to return to MicroLink.
Please do not use CTL-C to disconnect.
```

```
YOU CAN LOG OFF BY ENTERING AN
ASTERISK ('*') AT ANY MENU PROMPT.
```

```
Thank You!
```

```
*****
```

```
(for more: (Y) = Yes, (N) = No,
and (S) = Scroll through text.)
Continue? (Y/N/S): s
```

```
* Visit our Special Interest Groups
(SIGs) and participate in
transcontinental discussions.
```

```
* Join in our growing selection of
Multi-Player Role Playing Games.
```

```
* Chat with other users Live in
RealTime!
```

facilities. You will only need to type the first letter of a command for it to be recognised. For example, *H will go to the on-line help facility, *W will enable you to write a letter, *N will give the number of messages waiting and *L is for link-up, which will provide access to a real-time conferencing facility.

A mailbox will be provided which has no limit on the number of characters per page, unlike Prestel which is limited to about 720. You will be able to write letters in four modes: ordinary, wordwrap, insert and graphics. In graphics mode you will be able to build up graphics while on-line, using the six left-most keys on the keyboard, QAZWSX, to edit the six pixels of each character block. Currently this feature is only available on Prestel when a dedicated editing terminal or off-line editing package is used. The mailbox facility will also allow the recipient

of a message to reply directly, without having to remember the number of the person who sent the original message.

A keyword search facility is to be provided in the form of the Find command *F. You will be prompted to enter the subject to be searched for, and an index will be displayed showing what the search has found. The system will be faster in use because it will automatically work out the quickest way to fill a page. For example, if only the right-hand side of a page has information on it, the cursor on your screen will only write on the right-hand side. On Prestel, standard pages must be sent as a whole, even if they are partly blank.

Closed user group facilities will be available to all IPs at no additional charge. The IP will have complete freedom to decide who can have access to the pages. Although the new system will be

primarily aimed at the business user, Timefame says that it has not forgotten domestic users, and it will continue to provide facilities such as Letterbox for them.

However, while one database has closed on Prestel, Microlink has opened a gateway to the Mnemetics database in the U.S. Mnemetics is under a year old, and therefore is not as big as other U.S. information services such as CompuServe and The Source.


To invoke the Mnemetics gateway you enter MNE at any command prompt on Microlink. The system is split into five separate sections: Information, Communications, Entertainment, Mnemetics Mall and Feedback.

Information provides access to newswires such as the Associated Press and College Press Service, on-line magazines, user publishing, the FCC database and a general database. The on-line magazines on offer include Online Gardner, the Electronic Business Review and the Official Airlines Guide. User publishing is where members of Mnemetics can run their own magazines. New York City concert listings and book reviews are currently on offer. The FCC database provides users with press releases, details of radio stations, FCC regulations and so on. The general database is where you can find files related to the Mnemetics database itself such as hints and tips, plus any files which other users have uploaded.

The communications section provides access to the mail system, a real-time conferencing system similar to CompuServe's CB Simulator, bulletin boards and special interest groups. There is also a communications database, and a non-real-time conferencing system.

The mail system provides a Coming Soon facility whereby you can send messages which will automatically be forwarded to other electronic-mail systems such as AT&T Mail, CompuServe Easyplex, SourceMail, MCI Mail and telex.

Users can play on-line games in the Entertainment section. The Mall is the on-line shopping area. It offers facilities for commercial concerns and Mnemetics users to advertise. Users can contact Mnemetics through the Feedback area, which holds details of current access rates, what's new and answers to commonly asked questions about Mnemetics.

For further information on Microlink and Mnemetics contact Microlink, Database Publications, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY. Telephone: 061-456 8383. 

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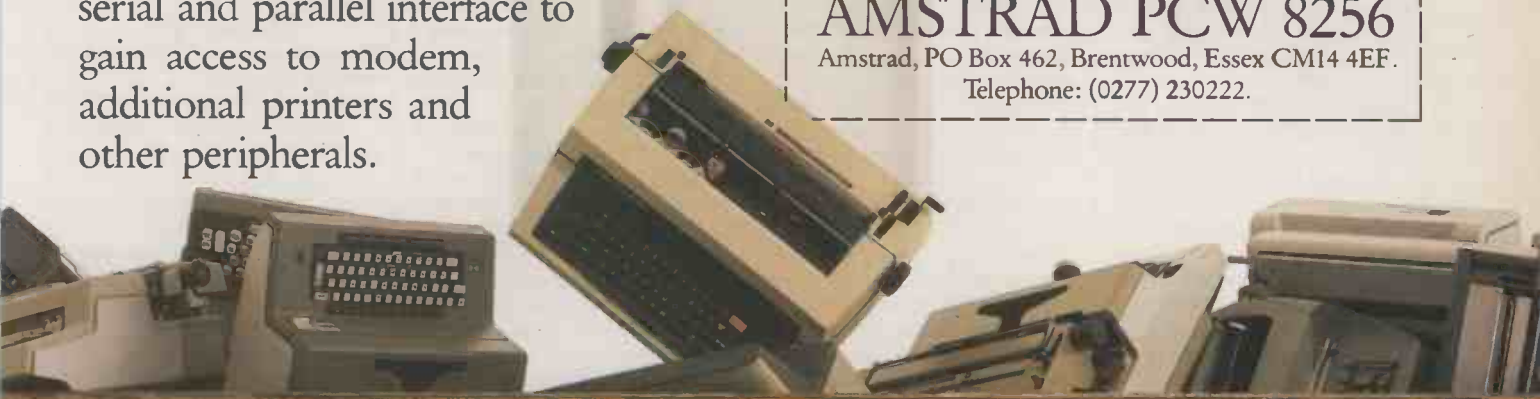
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IPC/8256

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Q I have recently bought a Seikosha SP-80 printer to go with my Apple II computer. I have read a couple of manuals for WordStar, but there are still a number of questions on my mind. The first is to do with printing on letter-headed paper. I often print on the back of the paper as well as the front. This means that the page length for the front is shorter than the back. How can I instruct the printer to print the two different sides when they are of different lengths? Secondly, I have tried to get the printer to print subscripts and superscripts properly, but they print a whole line down or a whole line up. Thirdly, I would like to use the user patches ^PQ, ^PE and ^PR. I understand that these have to be installed, but don't know how to do it. Finally, there are some very small DIP switches at the back of the printer to control features like pica, elite, proportional, italics, condensed, bold, double-strike, etc. They are in a very inconvenient place, and are obviously not meant to be used often. From this I assume there must be some other way of controlling the type font.

D LE PAGE

A Setting a different page length when printing on the front and back of a sheet of headed notepaper is the wrong approach. You should set the page length correctly for the plain side of the notepaper. When you are using the side with a pre-printed letterhead you should make a space at the top of the first page by pressing Return as many times as is required to move the beginning of your letter on to a blank area.

The problems of subscripts and superscripts appearing one whole line down or up arises because your copy of WordStar has not been properly installed. Run the Install program to reinstall your working copy of WordStar. Get to the printer menu and select a half linefeed dot-matrix printer. The subscripts and superscripts will then roll up or down half a line. If there is not space to do this because the line above or below is full, then WordStar prints subscripts and superscripts on the same line. You can usually avoid this problem if you use double spacing.

User patches can be used to hold a sequence of characters that the printer will use as a

ECONOMISING ON DISCS

Q Recently I accidentally formatted a single-sided disc for my Apricot F2 using the double-sided utility, and then filled the disc up to 700K with programs and data. All the programs run without a hitch, and all the data files can be written or accessed without error. Why? I have now tried the same thing with several other single-sided discs from different manufacturers, and have had the same problem-free results. What is going on? Have I discovered a cheap way of acquiring double-sided discs?

C R FOWLER

A In the manufacture of discs the oxide material that can be magnetised to store the data is actually sprayed on to the plastic. Double-sided discs must have oxide sprayed on both sides; single-sided discs only require the oxide on one side, but often both sides are sprayed even though only one side is to be used. If this is the case it is possible to use both sides, but we very strongly advise you not to do this.

There are two reasons for not using both sides of a disc that has been supplied as single-sided. First, many manufacturers spray both sides to make double-sided discs, but if one side is found to be faulty the disc is sold as single-sided. Secondly, the casing or envelope that surrounds the circular disc of plastic serves not only to protect the plastic from your fingers but also to wipe dust off the magnetic surface and thus protect the disc from wear. Single-sided 5.25in. discs often have the wiping surface on only one side, so the disc is much more likely to suffer damage.

If only one side has been sprayed with oxide, or if the second side is faulty, then the disc will most probably fail to format and you will discover that this is so before you fill the disc with programs or data. If one side is not wiped, then the disc is likely to fail unexpectedly after it has been used for a while.

The time it takes to write programs, prepare word-processed text or manage a database is likely to be much more valuable than the minor saving in money buying single-sided discs instead of double-sided ones. It is possible that if demand for single-sided discs temporarily exceeds supply, then the manufacturer might supply discs that are good on both sides as single-sided. You may be lucky, but the aggravation and loss of time if a disc corrupts unnecessarily outweigh any advantage in buying cheaper discs.

? ! . ? ! . ? ! . ? ! . ? ! . ? ! . ? ! . ? ! . ? ! . ? ! . ? ! . ? ! .

command, and these characters must be preceded by a byte that says how many characters are in the command string that follows. For example to send Escape-T to the printer, the sequence
2 ESC T
must be patched in hexadecimal, which is 02 1B 54.

Invoking special printing features such as italics, bold, wide and so on requires finding the appropriate Escape sequence from the printer manual. You can actually type the appropriate sequence and send it to the printer. This feature will remain set either until you switch the printer off, or you send another Escape sequence to the printer. It is probably more convenient if you intend doing this often to patch this sequence into one of the user patches.

Q I have edited programs with WordStar, and through using Document mode by mistake I have introduced control characters into the file. These characters are difficult to edit out since they do not show on the screen. Recently I have had the same problem when transferring WordStar text files to another word processor and for photo-typesetting. Can you suggest ways round this problem?

KEVIN ANDREWS

A You do not say whether you are using an eight-bit version of WordStar under CP/M, or a 16-bit version under PC-DOS or MS-DOS. The problem and solution are slightly different in the two cases. We regularly use WordStar as an

editor to produce Basic, Fortran and machine-code programs. Provided you use the N Non-document mode, you will not introduce any control characters by accident.

If you are using Document mode with an eight-bit version of WordStar a Carriage Return and a Linefeed are automatically inserted at the end of the line, and the last incomplete word is moved on to the next line. Also some soft spaces may be inserted into the line to produce a justified right margin if this is required. The necessary characters have the eighth bit set, while ASCII characters only use seven bits. Basic or Fortran object if they find a character with the eighth bit set. You could use WordStar to find and delete the offending characters but, as you say, this is difficult since they do not show on-screen.

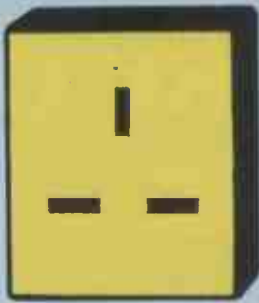
A much easier and more reliable way is to use the CP/M utility Pip to copy the program, but rather than copy all eight bits to specify the Z parameter, which copies seven bits and sets the eighth bit to zero. Leave Basic by typing System and return to the operating system. If your file was called Game.Bas, you could copy the existing file into a new file called Newgame.Bas, which is identical to the original except that any high bits that were set in the original file will not be set in the new file. The command to do this is

```
PIP NEWGAME.BAS=  
GAME.BAS[Z]  
The unwanted file Game.Bas  
may then be erased under CP/M  
with the command  
ERA GAME.BAS
```

These two steps can be shortened with the command

```
PIP GAME.BAS=GAME.BAS[Z]  
For 16-bit versions of WordStar the IBM PC User Group has a program called UNWS on its library disc 25 that converts WordStar files to ASCII characters by unsetting any high bits. You can contact the IBM PC User Group at PO Box 593, London SW1V 2PG.
```

Alternatively, if you have access to WordStar version 3.4 you will find that Micropro now provides a utility program called WSCnv to perform various conversions to and from WordStar format. Option B will convert from WordStar format with high bits set to an extended character set that is free from high bits.



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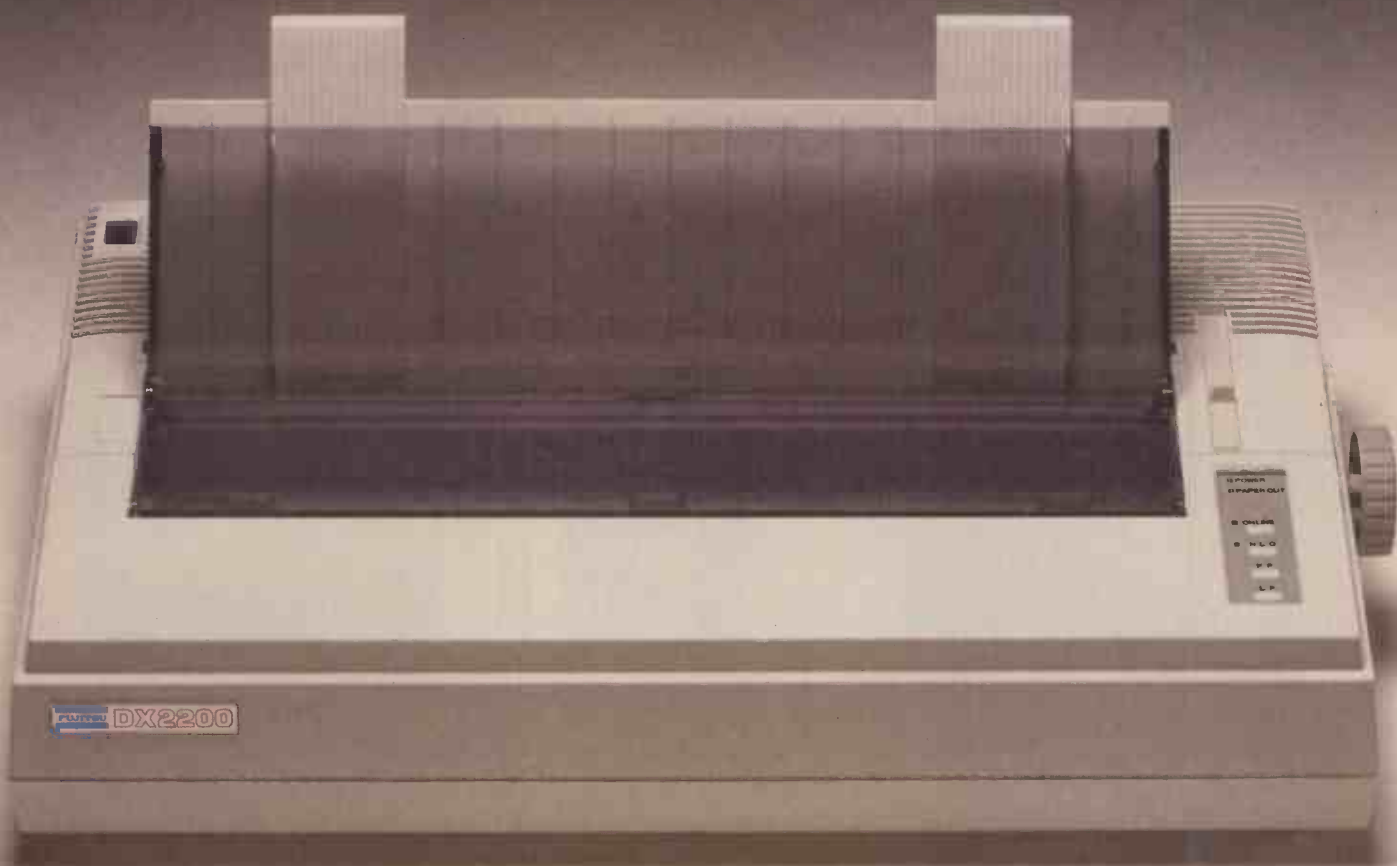
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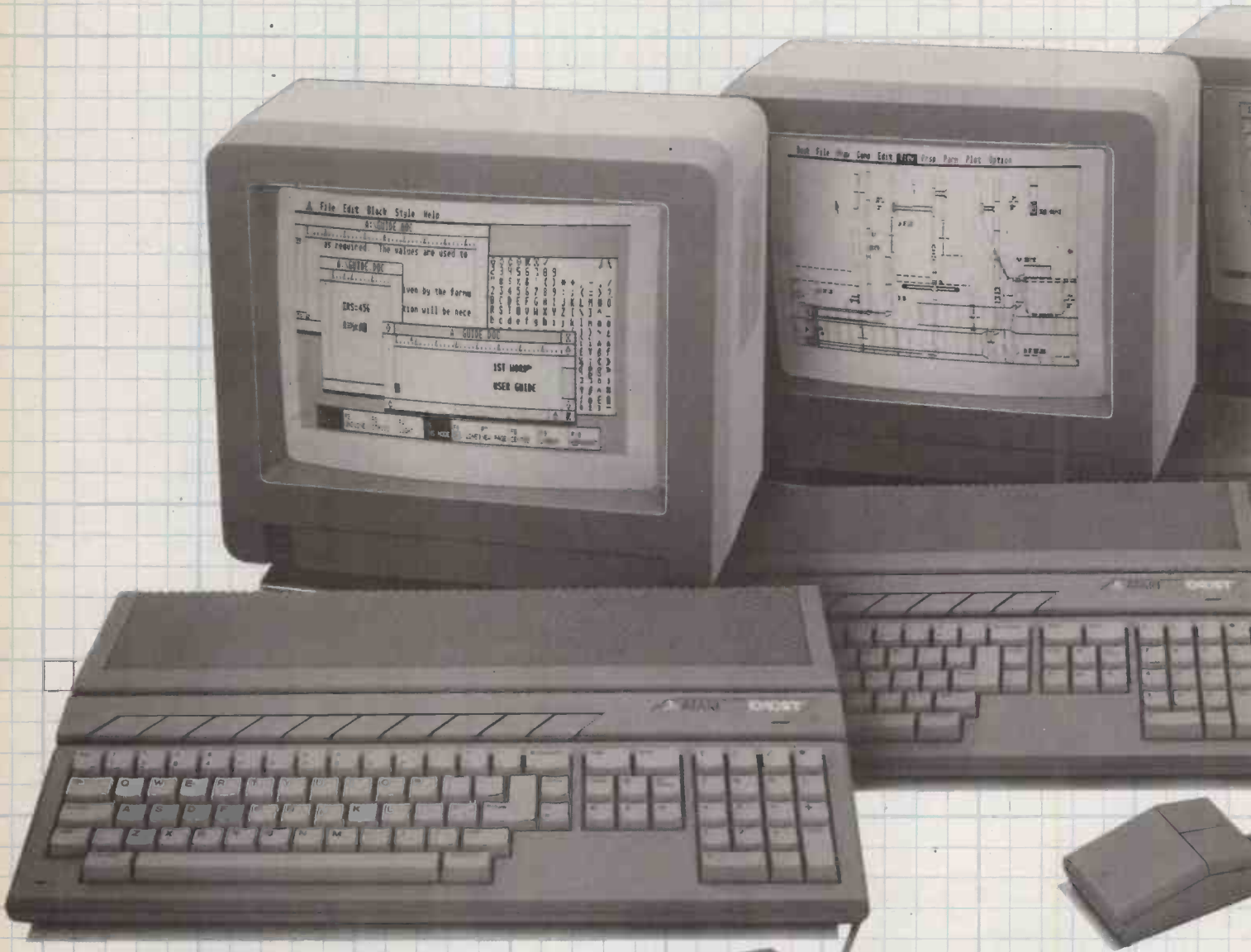
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PERSONAL COMPUTING is a journey into the unknown. Amstrad's computers are cheaper than most, which makes the computing all the more personal, as the buyer is also the user, operator, system developer and programmer. So for Amstrad users a book to offer guidance and inspiration is essential.

In an ideal world, such a book would be supplied with the computer. PCW users are duly supplied with two operator manuals, but unfortunately Amstrad's approach to documentation is one of never mind the quality, feel the width. The PCW's manuals are so badly conceived they leave even experienced users dazed and confused.

When it comes to documenting the PCW's exotic dialect of Mallard Basic, or pointing out some of the more obscure features of CP/M Plus, the bundled brace of books are adequate, if slightly unwieldy. Finding information is difficult as the manuals' many indexes are to be found scattered at various points throughout the two volumes. What's more, many of the CP/M utility programs included in the software are hardly mentioned. The sketchy outline of Logo is totally inadequate.

For the first-timer wanting some sound advice on how to get started with the PCW's Locoscript word processor help is at hand in the shape of *Practical Amstrad Word Processing* by David Lawrence and Mark England. Of all the books that aim to show new users the Locoscript ropes this is the clearest and most professional. Unlike a number of other books on the market, it sticks to the one subject. It is all the better for it.

Lawrence and England's writing is straightforward, and there are lots of illustrated examples. The book follows the tutorial format: the reader is invited to work through the book step-by-step. One advantage of following a book like this is that you can progress at whatever pace you find comfortable. The authors have a good grasp of what a new user needs to know, and although the style is gentle it is never patronising. The book's main advantage is that it passes on the kind of hints and techniques that it would take novices a long time to acquire, left to their own devices.

What makes the book even better is the way it races through the easier bits, leaving plenty of space to concentrate on the more difficult facilities of Locoscript. The sections on base layouts, templates and setting up a system are particularly useful for those wanting to do more with their

AMSTRAD APPLICATIONS

While Amstrad's new PC clone has stolen the limelight, the more established PCW machines have been attracting a steady stream of authors. **Bill Bennett** looks at what they have to offer business users.

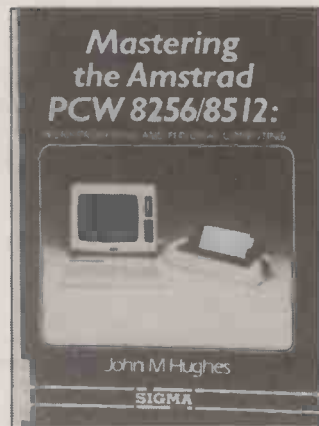
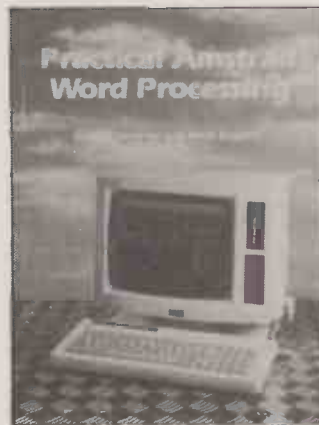


computer than send the occasional letter. The chapter on tables is invaluable for the small business user interested in producing bills and invoices. As a whole, the book is useful and readable rather than encyclopedic. Three sensible appendices and an index also make it a practical reference work once you have completed the tutorials. *Practical Amstrad Word Processing* is an essential book for the serious PCW user, and at £7.95 it is a sound investment.

Ron Hughes' book *Word Processing with Amstrad* was printed using the Amstrad's dot matrix printer. It is harder to read than a typeset book, but the extra effort required is well worth making. The book is an excellent introduction to the world of cheap word processing, especially for the novice, as the author starts with the assumption that the reader knows nothing about computers.

The first few sections get the necessary preliminaries out of the way: there is an introduction to the concept of word processing, some sound advice about how to use floppy discs and a look at the concept of filing.

At the end of the book are appendices which list available



CP/M software packages, useful addresses and a glossary of computer terms. This kind of information is a waste of space as lists become outdated even in the time it takes for a book to be printed and published. I have a theory that in the world of computer books appendices are viewed as a benchmark: the more appendices, the better the book.

To call *A Practical Reference Guide to Word Processing on the Amstrad PCW-8256 and PCW-8512* by FA Wilson a book is to bestow on it unearned dignity. Wilson's prose reads like William Burroughs - the chap who used to cut up pages of text and stick them back together at random. The first sentence of the first chapter is as good an example of the style as any: "Over the last decade so many computer techniques have been absorbed by the typewriter that with the inclusion now of microprocessors, the number of text manipulations possible has to be seen to be believed." The only positive thing I can say about this book is that it has seven appendices.

Mastering the Amstrad PCW-8256/8512 by John M Hughes concentrates mainly on the word-

BOOK REVIEWS

processing facilities of the PCW micros, but manages to cover a number of other areas as well. In addition to a fairly extensive tutorial on the use of the Locoscript program there are sections outlining the use of various third-party software packages, together with a generous helping of CP/M hints and tips.

Sharp, readable and to the point, Hughes really has the measure of the PCW and its users. He recognises the machine's shortcomings and suggests ways of overcoming them. A single appendix details a Basic program that will convert non-standard Locoscript files to ASCII. Commercial software is looked at in an intelligent way, with practical examples of the software actually being used to perform real tasks. If your interest in the PCW goes further than mere word processing but stops short of programming, this is the book for you. It is an essential item for the business-orientated user.

By comparison, *The User's Guide to the Amstrad PCW-8256/8512* by Don Thomasson is insubstantial and shallow, and does little more than skim the surface of serious computing. The PCW's trump card, word processing, is dismissed in under 40 pages. Likewise, the printer is disposed of in eight pages that add nothing to what the Amstrad manuals have to say.

Thomasson has little feeling for his subject matter and no empathy with the typical Amstrad user. Consequently, this expensive little book offers no real insight into how to use the PCW as a serious business tool. For £11 a copy, the reader is entitled to expect a good deal more than Thomasson provides.

Thomasson's book is considerably stronger than average on programming, though even here it lacks insight and content. But for the record there are sections on BIOS and BDOS calls as well as hints on CP/M and machine-code programming. A couple of business-orientated Basic pro-

(continued on next page)

BOOK REVIEWS

(continued from previous page)

grams are included almost as a consolation prize. All in all *The User's Guide to the Amstrad PCW-8256/8512* is a lightweight that does not come off well against more serious contenders.

The reigning champion for serious reading must be the *CP/M Plus Handbook - Operator's and Programmer's Guide for the Amstrad CPC-6128 and PCW-8256*. It weighs in at £25 for 480 pages that includes information on BDOS and BIOS, and a thorough description of how the machine's hardware, firmware and software link together. There are also programs, ideas for programs and lots of documentation on the utility program supplied with

AMSTRAD APPLICATIONS

Practical Amstrad Word Processing by David Lawrence and Mark England. Published by Sunshine, £7.95. ISBN 0 946408 94 7

Word Processing with Amstrad by R Hughes. Published by Macmillan, £6.95. ISBN 0 333 42792 0

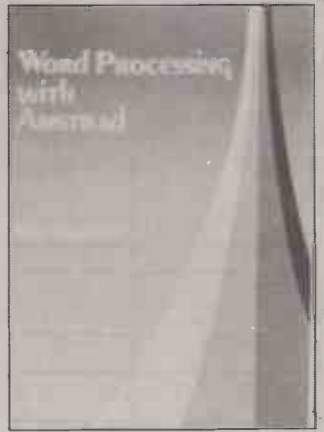
A Practical Reference Guide to Word Processing on the Amstrad PCW-8256 and PCW-8512 by F A Wilson. Published by Bernard Babani, £5.95. ISBN 0 85934 161 5

Mastering the Amstrad PCW-8256/8512 by John M Hughes. Published by Sigma Press, £8.95. ISBN 1 85058 052 9

The User's Guide to the Amstrad PCW-8256/8512 by Don Thomasson. Published by Melbourne House, £10.95. ISBN 0 86161 204 3

Operator's and Programmer's guide for the Amstrad CPC-6128 and PCW-8256 by Digital Research and Amstrad Consumer Electronics. Published by Heinemann New Tech, £25. ISBN 0 434 90320 5

Using Amstrad CP/M Business Software by Ian Sinclair. Published by Collins, £8.95. ISBN 0 00 383359 3



CP/M Plus. It is a substantial book by any standard, and an absolute must for the programmer-user. It is only a pity that you have to pay £25 for what is effectively the third part of the system documentation. The book contains everything that should have been in the manuals, and more besides.

It is not particularly well written, but it is comprehensive and authoritative, two things that cannot be said about many computer books. The *CP/M Plus Handbook* is packed with solid microcomputing muscle.

Using Amstrad CP/M Business Software by Ian Sinclair is a curious book, the bulk of which has little to do with using business software. Instead it is concerned with describing how to fiddle with some of the more obscure aspects of the operating system. The author is clearly at home with the technical and programming aspects of the computer, but sadly he has little grasp of what the business user requires. The end result is little more than a confused and poorly written mishmash.

Only three of the 12 chapters

deal with CP/M business software, and they do little more than outline what was available a few months ago. There is no real criticism of the packages mentioned, nor are there any hints as to how to use them. CP/M facilities such as Setlst and Setkey are described in great detail, but they are of more interest to the programmer or hobbyist than the business user. This betrays the truth about this book: it is a home-computer book dressed up with a business title in the vain hope of gaining some extra sales.

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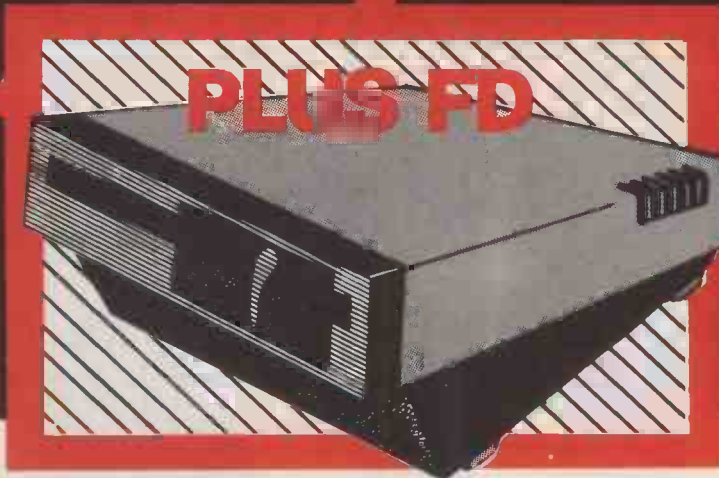


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COMPAQ DESKPRO 386

TAKING THE LEAD

By Steve Malone

With its 80386-based micro, Compaq has for the first time broken new ground, leaving IBM to bring up the rear. Does this signal the end of the IBM standard in microcomputing?

Even six months ago it seemed inconceivable that any company other than IBM could make an advance on the industry standard for business micros. Everyone knew that the next generation of PCs would be based around the 32-bit Intel 80386 processor. It was simply a question of waiting for Intel to ramp up production of the chip and for IBM to launch the new generation. What has happened is that a number of manufacturers, most notably Compaq, have beaten IBM to the punch.

Compaq's 32-bit micro is the Deskpro 386, and with it Compaq has maintained

the design philosophy that has thrust it into the Fortune 500 in a record four years. The Compaq formula is to build a machine which is entirely compatible with the IBM PC family yet outperforms the IBM product. Thus the Deskpro 386 has been designed to maximise performance while avoiding any innovations which may be opposed by the IBM 80386 machine when it appears.

There are currently two 80386-based computers in the Compaq range. The Deskpro 386 model 40 is equipped with a 40Mbyte hard disc and has room for three other half-height storage devices. The

model 130 has a 130Mbyte hard disc with facilities for supporting two more mass-storage systems. The company admits that a portable version is under development.

The model 130's hard disc has a formatted capacity of 134Mbyte. It provides a maximum of 10Mbyte/s, intelligent transfer and an average access time of 25ms, compared with 28ms for the 40Mbyte drive. For this review Compaq provided a model 40 fitted with a 360K floppy-disc drive and a 40Mbyte tape backup drive in addition to the hard disc, and 1.2Mbyte floppy which form part of the basic system.

(continued on next page)

SPECIFICATION

CPU: Intel 80386 running at 16MHz

RAM: 1Mbyte RAM held in 32-bit expansion slot, expandable to 14Mbyte

Mass storage: 40Mbyte hard disc and 1.2Mbyte floppy; space for two additional optional units including 1.2Mbyte floppy, 360K floppy and 40Mbyte tape drive; model 130 has 130Mbyte hard disc and space for two additional units

Interfaces: one RS-232C and one parallel printer port

Display: monitor and display circuitry not included in basic system; review setup included Compaq Expanded Graphics Adaptor and colour monitor

Price: £5,399; Compaq Expanded Graphics Adaptor, £495; Compaq colour monitor, £550

Manufacturer: Compaq Computer Limited, Ambassador House, Paradise Road, Richmond, Surrey TW9 1SQ. Telephone: 01-940 8860

Available: now



(continued from previous page)

The Deskpro 386 comes in the usual three-box format of keyboard, processor and monitor. The processor box is a similar size to that of the the PC/AT, although Compaq's stylists have managed to avoid the tank-like appearance of the IBM machine. At the front of the box there is a keyboard lock and an IBM standard keyboard socket.

Two types of keyboard are available from Compaq. There is the standard Compaq 85-key keyboard, and the 101-key Compaq Enhanced Keyboard. The latter has 12 functions keys running along the top as on the new IBM units, a Pause key that suspends program execution, a separate cursor-control cluster and a standard numeric keypad. One interesting feature is the addition of two Ctrl and Alt keys to provide a pair on either side of the space bar. The keyboard connects to the CPU via a coiled cable with a telephone-style jack connector on one end and an IBM-compatible DIN plug on the other. At the rear of the machine are the standard interfaces for a serial and a parallel port.

NINE SLOTS

As you might imagine, the inside of the processor box looks pretty busy. The right-hand half is entirely occupied with the mass-storage devices and the 192W power supply, with the motherboard covering the left-hand half. There are nine full-length expansion slots, three of which were filled on the review model.

The first slot was occupied by a disc-controller board which runs the floppy-disc drives and the 40Mbyte hard disc. Occupying the seventh slot was the new Compaq Enhanced Colour Graphics adaptor board, which is claimed to be fully compatible with the IBM EGA board. It is equipped with 256K of RAM as standard, allowing it to make full use of the capabilities of the EGA such as the ability to display colours from a palette of 64 and a pixel resolution of 640 by 350. On the far left of the machine was the memory board that provides the standard complement of 1Mbyte of RAM.

This configuration leaves three AT expansion slots and three eight-bit PC slots free. On machines fitted with the 130Mbyte hard disc an additional AT slot is used for the separate controller card.

The heart of the Deskpro 386 is, of course, the 80386 chip itself. This chip has been benchmarked by Intel at around four million instructions per second, a rate that was not so long ago achievable only by high-speed minicomputers. This monster sits alongside the expansion-board area and takes the form of a 35mm. square block fitted with 144 pins in three lines around its edge.

Adjacent to the main processor is an 80287 co-processor socket. Here Compaq has compromised in order to get its machine out quickly. Intel has promised an 80387 complementary maths co-processor for the 80386, but as it is not yet available Compaq

has provided the 80287 slot instead. Because the 80387 chip requires additional pins, the 80287 slot will be unusable when the new chip finally appears.

The 80386 is a full 32-bit processor which on the Deskpro 386 is clocked to run at 16MHz. Internally the chip contains eight 32-bit general-purpose registers for arithmetic, addressing or data. These registers can manage eight-, 16- or 32-bit operations. In addition, the 80386 has six 16-bit segment registers and two 32-bit status-control registers.

Memory is accessed via a 48-bit pointer which consists of a 16-bit segment selector and a 32-bit offset. The memory-addressing capabilities of the 80386 are mind-boggling. The directly addressable memory space is 4Gbyte and the virtual-memory capabilities made available by the on-chip memory management unit (MMU) mean that the processor can support up to 64 terabytes — that is, more than 67,000,000Mbyte.

Intel has promised that all members of its 80xxx series will be compatible with the 8086 family. In this respect, the 80386 is a great improvement over the earlier 80286 used on the PC/AT and compatibles. The 80286 has two modes: the so-called protected mode in which it can operate a multi-user system, and a more limited mode in which it can run 8086 software. The problem is that it cannot do both simultaneously. The vast number of 8088-based PCs out in the field meant that software developers were reluctant to write software for the protected mode which would effectively cut off 95 percent of the potential user base. The result has been that the capabilities of the PC/AT have never been exploited to the full, and the machine is simply used as a souped-up version of the PC.

While not overcoming all the problems encountered by the 80286, the 80386 goes a long way towards rectifying them. Though 8086 software cannot make full use of protected mode on the 80386 it can run as a subset of protected mode. The effect is that several 8086 programs can run in memory without the complex conjuring tricks required by multi-user versions of MS-DOS and its relatives. For the record, the processor can do the same for 80286 systems as well. This makes multi-tasking much easier and a more viable proposition for 80386-based machines than for their predecessors.

MS-DOS AND UNIX

This trick can be extended to allow the machine to run not only MS-DOS programs but also Unix System V programs simultaneously, even though MS-DOS is a 16-bit environment and Unix System V is essentially 32-bit in nature. It should even be possible to have MS-DOS programs running under Unix.

Although the 80386 has a maximum 64Tbyte virtual address space the Deskpro 386's capability has been limited to 4Gbyte. The processor's MMU accesses virtual memory by swapping programs and data between the hard disc and main memory.

The MMU on the Deskpro 386 uses just one segment of the 16,000 that are possible under the 80386 architecture, which is why only 4Gbyte of virtual memory space is available. Compaq says that the limit is imposed by the operating system rather than the result of any hardware problem. Presumably Microsoft will take notice of this and extend the limit on future versions of MS-DOS.

To maximise the effectiveness of a 16MHz processor it is necessary to equip the computer with high-speed memory. While conventional dynamic RAM is insufficient for the 80386 processor the very high-speed alternative, static RAM, is still too expensive for a commercial business machine. Compaq has taken a middle path in the design of the Deskpro 386 by equipping it with zero-wait-state devices known as static-column RAM. The design works by making the rows in the memory matrix dynamic as normal, while holding the columns static in 2K lines which do not have to be constantly refreshed. This produces speed increases of 50 percent on the rows and 300 percent on a 2K column access.

NEW ARCHITECTURE

The Compaq Deskpro 386 is fitted with 1Mbyte of RAM supplied in 1Mbit chips. Although Compaq has in general not attempted to expand the hardware standard defined by the IBM architecture, there is one small but important exception which relates to the configuration of RAM. The computer's memory is held on an expansion card, and in order to make use of the 80386's 32-bit address bus this card is fitted into a single 32-bit slot. Additional memory can be piggybacked so that the machine is capable of holding up to 10Mbyte in that one slot. If 16-bit slots are used as well, the total memory possible in the Deskpro 386 is 14Mbyte.

Of course, the piggyback capability of the 32-bit slot is also available to other board manufacturers and it is likely that 32-bit boards will begin appearing in the near future from third-party suppliers. This is the obvious place to piggyback the 80387 chip when it appears, as well as other 32-bit co-processors like the Motorola 68020 or the National Semiconductor 32032. Doubtless other devices like high-speed video boards and advanced MMUs will eventually appear too.

As users have found, it is one thing to have a machine with several megabytes of memory; it is quite another to be able to make use of it. While the extended memory provided by the MMU is accessible under Unix, this option is not open to applications based on MS-DOS, whose users are still bravely struggling on with the 640K limit.

The most favoured solution to memory limitations is at present the LIM Expanded Memory Specification (EMS) developed jointly by Lotus, Intel and Microsoft. Compaq has gone along with the LIM specification and has provided its own version, known as Compaq EMS, as standard on the Deskpro 386. This enables users to



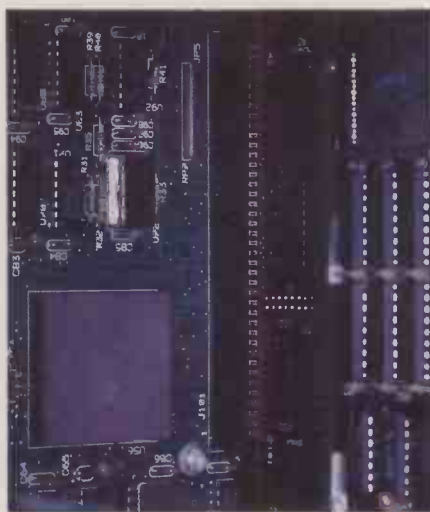
access up to 8Mbyte of data as bank-switched RAM.

The decision to implement the LIM specification appears to be an uncharacteristically shortsighted one by Compaq. The limitations inherent in the LIM specification have been roundly criticised by a number of commentators, not all of whom have axes to grind. The central criticism is that the LIM standard allows only a single 64K window for bank-switching into main memory. This effectively reduces the information which can be held in expanded memory to data only, as the window is far too small to hold modern programs where 500K of code alone is not uncommon. The Deskpro 386 is crying out to be used as a multi-user, multi-tasking engine; but without the ability to allocate sufficient memory to several applications and their data, its potential as an MS-DOS based multi-user machine is essentially ruined.

IMPROVED STANDARD

The adherence to the LIM standard would be understandable if there were no alternative. However, there is a rival system in the Ashton-Tate/Quadram/AST Enhanced EMS (AQA EEMS) which can support windows of up to 384K. Together with Digital Research's Concurrent PC-DOS XM this alternative format provides a workable multi-user, multi-tasking system. When

Above: The casing of the Deskpro 386 is large without looking clumsy. Inside most of the space is occupied by the four mass-storage devices and power supply. Below: The 80386 chip.



pressed on this point Compaq says that it is simply following the accepted standard — overlooking the fact that the AQA EEMS is fully compatible with the LIM specification.

The plot thickened when Compaq admitted that present versions of Digital Research's Concurrent DOS operating system do not run on the Deskpro 386.

Although we were unable to get Digital Research to comment on this, it seems that Concurrent DOS contains code — specifically two instructions — which is not supported by the 80386 processor. Compaq says that Digital Research is currently amending the code so that Concurrent DOS will run on 80386-based computers.

Despite all this, the mystery still remains why Compaq, having made strenuous efforts to optimise the machine's performance, saddled the Deskpro 386 with an inferior expanded-memory specification. To be fair, Compaq does say that a Rampage board or similar device conforming to the AQA EEMS specification is supported by the computer's architecture.

My personal view is that Compaq knows something the rest of us don't about the intentions, if not of IBM then of Microsoft. Bill Gates, the Chairman of Microsoft, is on record as saying that while Xenix runs markedly better on the 386, he views the machine as a DOS and Windows computer. Unless Gates's comments are entirely hot air it would seem that Microsoft has something up its sleeve that will take full advantage of the new Compaq design. Apricot has already announced that it intends to begin shipping the multi-tasking MS-DOS 4.0 for the Xen before the end of the year. Also, it is clear that Compaq expects a version of MS-DOS which overcomes the present 640K

(continued on next page)

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limit to appear in the not too distant future. In the meantime, the company is willing to stand by its non-disclosure agreement with Microsoft and take the flak until the new DOS arrives.

Compaq is currently making MS-DOS 3.1 available with the Deskpro 386, rather than the more recent version 3.2. This is because Compaq has not provided the 3.5in. drives supported by version 3.2 as an option, and says it has no plans to do so. Presumably the company will invest in the 3.5in. format if it sees a demand.

The all-important BIOS for the system is Compaq's own copyright. It was developed completely independently from the 80386 BIOS recently announced by Phoenix. The way the BIOS is positioned in the Deskpro 386 design says something about the way the IBM PC standard will affect the architecture of the new generation of machines.

The Compaq Deskpro 386 is actually two machines in one, with the two parts interfaced by duplex circuitry. On the one hand, the machine architecture is that of a standard PC/AT running at 8MHz. It is here that the 16-bit cards, the 80287 co-processor and the necessary BIOS routines logically reside.

This area allows the machine to run IBM PC software, including those programs like the Lotus copy-protection mechanisms which use timing loops. Should any problems occur with such software Compaq has provided a Mode command which allows the user to set the clock speed. For the truly perverse, it can even set the speed below that of the standard PC.

On the other side of the interface is the super-fast RAM and 32-bit architecture, timed to run at 16MHz, where the full power of the machine is unleashed. Conceptually, therefore, the Deskpro 386 can be thought of as a 32-bit machine with a PC/AT front end.

BIOS COPIED INTO RAM

In order to maximise the speed of the code, the Deskpro 386 begins its power-up sequence by copying the BIOS ROM together with its EGA and hard-disc extensions into 32-bit fast RAM. From then on, whenever the processor is asked to access the BIOS, the MMU redirects the call instruction to the relevant address, which is at the top 128K of the 1Mbyte of system memory.

As far as compatibility goes, the majority of programs ran satisfactorily, including Word 3, the Smart integrated system and Lotus 1-2-3. The only difference we noticed was that they ran a lot faster. The fly in the ointment was Sidekick version 1.56A, which could not be invoked from 1-2-3 and displayed rubbish on-screen from Word 3.

As you can imagine, this caused consternation, not to say disbelief, in the *Practical Computing* office and at Compaq's HQ. At first we suspected the EGA card was to blame, but testing the same software combination on a PC/AT with an EGA proved satisfactory. Compaq meanwhile

had also tested the software on a PC/AT and discovered this same bug. The difference turned out to be the size of the EGA RAM. Sidekick will work with an EGA fitted with 64K of RAM but not with a full-blown 256K EGA card.

As measured by the Basic Benchmarks, the Deskpro 386 outperforms its nearest competitor by a factor of nearly two. Though this should be enough for any machine, it is only part of the story. The GWBasic Benchmarks used by *Practical Computing* were written for a machine with a mere 16-bit address bus. The Basic timings for the Deskpro 386 hide the fact that the processor is fetching 32-bit words rather than 16-bit ones. A better test using 32-bit words would probably give even more impressive results.

There is, as yet, no 32-bit MS-DOS software available to run on the Deskpro 386, nor is there likely to be at least until new versions of DOS appear and IBM launches its own 80386 machine. A new version of MS-DOS which makes full use of the

COMPAQ DESKPRO 386

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 type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

An outstanding machine that leaves the competition for dead.

advances in chip technology is vital if the 80386-based machines are not to suffer the same fate as the PC/AT, and simply be used as go-faster PCs. Microsoft has announced that Xenix System V/386 is imminent; a developer's toolkit has already been made available, but it looks as though the applications may take some time to come through.

It is impossible to predict the kind of application likely to appear for the 80386 generation of machines, but a look at minicomputer software should provide a few clues. Typical applications are obviously the high-speed number crunching and data processing traditionally associated with minis. Other more advanced applications might apply artificial-intelligence techniques to collate data and provide better context-sensitive help. CAD/CAE and modelling techniques will also benefit from 32-bit technology.

However, the impact of the Compaq 386 will probably not be felt in the software industry but among hardware manufacturers — IBM, in particular. Until now IBM has managed to sell its machines simply because they were the pace setters and therefore the standard. Manufacturers of compatible computers were forced to compete either on better performance or on

price. But with the launch of the Deskpro 386 the tables have been turned, and it is IBM who will be challenging an established product.

This leaves IBM with four alternatives. First, it could try to out-Compaq Compaq and produce a machine with a better performance than the Deskpro 386. Given IBM's past track record this does not seem likely to happen. The company's entire philosophy has always been to produce a safe and reliable product rather than to take innovative leaps. Following the alternative compatible manufacturers' route of producing a cheap clone of the Deskpro 386 would be too galling for IBM to swallow. Anyway, given IBM's vast corporate overheads, it is unlikely that it could sell such machines and still make a profit.

WILL IBM CHANGE RULES?

Another strategy, which must be tempting, is for IBM to use its huge muscle to move the goalposts and change the standard. This high-risk option might work, but it would certainly alienate IBM's current user base, and it carries no guarantee of taking its customers with it. The new machine would also have to be very good to lure customers away from the existing standard. IBM has already produced a super-micro in the form of the 6150 or RT PC which has, so far, conspicuously failed to take the market by storm.

But even if IBM does manage to produce a high-performance 32-bit micro at a competitive price, its troubles are not over. IBM's System 36 and 38 minicomputers are already on a hiding to nothing against the DEC Vax minis. Producing a micro of similar performance at a third of the cost would kill its minicomputer market stone dead, and IBM knows it. Of course, manufacturers like Compaq who are based solely in the micro market have no such worries to contend with.

The final alternative is for IBM to abandon micros altogether. This may not be as inconceivable as it sounds. Much of IBM's influence in the corporate sector stems from its image as market leader and industry arbiter in every sphere. Boxed in on all sides and unable to set an alternative standard, IBM may prefer to withdraw altogether from the microcomputer market. Meanwhile another company — Compaq, for example — would take the position of innovator. A micro standard without IBM? It may come to that.

CONCLUSIONS

- The Deskpro 386 is a 32-bit machine that conforms to the IBM hardware standard.
- The machine is provided with features to induce maximum performance at a price business users will be prepared to pay.
- In order to steal a march on the opposition, Compaq has ignored the software side. Purpose-written 80386 applications software has yet to appear; users will have to make do with PC packages until it does.
- This is Compaq's bid to seize the position of market leader; IBM must know it has a fight on its hands.

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AMSTRAD PC-1512

SUGAR-SWEET CLONE

By Glyn Moody

Britain's favourite entrepreneur has come out with a PC clone that does all the right things at the right price.

The broad details of the Amstrad PC-1512 are very much as expected: the entry-level system has 512K RAM, a single floppy, a monochrome monitor, serial and parallel ports, MS-DOS and DOS Plus with Gem. It costs £399, excluding VAT. What is more interesting about the machine is its divergences from the IBM standard and its longer-term implications for the business-micro market.

Although functionally close to the IBM PC, the latest Amstrad is not a clone in the same sense as the nameless Taiwanese boxes. True to Alan Sugar's basic philosophy it uses tried and tested technology pushed to the limit in terms of performance. Gone is the creaky 8088 running at 4.77MHz, and in its place comes a full 16-bit 8086 running at 8MHz. And instead of the chip count of the IBM PC, which seems gross today, the PC-1512 uses a number of custom chips to cut costs and improve reliability.

Externally the machine is more conventional, as it employs the usual three-box configuration. The monitor, which resembles that on the Olivetti M-24, is mounted on a tilt-and-swivel stand that fits securely into a recess in the lid of the system unit. There are two models available. The monochrome unit embodies a passable imitation of a paper-white screen and can display 16 levels of grey to emulate colour. The colour version itself offers up to 16 colours with a resolution of 640 by 200 pixels. The images are steady and the characters acceptably legible — not quite up to the standard of the IBM monochrome display but better than the colour one.

BUILT-IN POWER SUPPLY

An unusual feature of the monitor is that it contains the power supply for the whole system. This means that the main unit can be slimmer and is less prone to overheating, but the price paid is a lack of an easy upgrade path. Once you have bought a monochrome version it will be hard to move on to colour.

The keyboard is remarkably professional both in look and in feel. Like the rest of the system, it is made of moulded plastic but the effect is nothing like so light as the keyboard

on the Amstrad PCW-8256 word processor. The layout is very similar to that of the IBM PC, even down to the disposition of the Shift key and the Backslash; the Control, Alt PrtScr and Caps Lock keys are placed differently. The Return key seemed slightly far away for touch-typing but otherwise I found the touch quite good.

The keyboard attaches to the left side of the system box, as does the mouse. The mouse itself is a rather bulbous beast, with two buttons and a central spine. I found the spine confusing, since by touch there is not much to distinguish it from a button. Supplying a mouse as standard is a welcome move that is likely to help increase the acceptance of these devices. Placing the port

AMSTRAD PC-1512				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> Another <i>tour de force</i> in bundling — and a winner for Amstrad.				

on the left, however, is daft since the mouse cable inevitably trails across the keyboard. Perhaps the designer was left-handed. Next to the mouse port is the volume control for the internal speaker. At maximum volume the beep is alarmingly loud.

At the back of the system unit there is a generous selection of ports. As well as serial and parallel ports, both supplied as standard, there are sockets for video out and power in. The rear portion of the top casing slides off to allow expansion cards to be slotted in. Similarly there is another cover which slides off to the back of the right-hand side to allow extra ports to emerge.

Three full-size expansion slots are provided, placed lengthways across the machine. This may sound like short shrift, but it is worth bearing in mind that the circuitry for the ports and video outputs is all present on the motherboard; many other IBM clones have three slots or fewer free once boards for these functions are in place. With a hard disc fitted one of the PC-1512's slots is required for a controller card.

Opening up the machine is not entirely easy. At the front of the casing there are the disc drives — two 360K floppies on the review machine. Amstrad claims these are not from some faceless Korean manufacturer but a reputable Japanese one. Underneath the drives lies the motherboard, notable for its sparseness and the absence of any last-minute additions. There is no fan. The basic design for the machine was done by MEG Electronics, which also designed all the previous Amstrad machines. MEG also wrote the all-important ROM BIOS. The PC-1512 is built in Korea.

The micro comes with a generous sprinkling of bundled software, including two operating systems: Microsoft's MS-DOS 3.2 and Digital Research's DOS Plus, reviewed in last month's *Practical Computing*. There is also Gem Desktop, Gem Paint and Locomotive's Basic 2. This collection comes on four discs with brightly coloured jackets.

LAST TIME OF USE

The on/off switch is at the back of the monitor. When you power-up the machine it informs you of the last time of use, and requests a system disc. The timing makes use of the internal clock, backed up by batteries readily accessible from a small cavity in the top of the systems box. The timing message is useful for letting you know if anyone has been using the micro in your absence. Inserting the MS-DOS disc causes the system to boot and initialise. If provision has been made for a RAM disc its size is displayed. RAM discs and other system parameters can be set up using the NVR utility provided on one of the discs; as its name suggests, NVR stores such parameters in non-volatile RAM.

DOS Plus boots up in a similar way as does Gem, which runs under it. The mouse works well, and the Gem graphics are more legible than on the IBM, but still nowhere near acceptable to my taste. One application running under Gem is Basic 2, the language bundled with the PC-1512. It has been written by Locomotive Software, the authors of the Basic and the Locoscript word processor on the Amstrad PCW-8256. It exploits the windowing environment well, using dialogue, editing and results windows.

The overall effect is very like the Basic on the Macintosh, Atari and Amiga. Although the constant redrawing of the windows looks slow, the standard Basic Benchmarks turned in an average time of 3.3 seconds — as fast as any machine we have tested that runs a conventional interpreted Basic, including

(continued on page 60)

SPECIFICATION

CPU: 8086 running at 8MHz

RAM: 512K as standard, expandable to 640K on motherboard

ROM: ROS firmware

Mass storage: one or two 360K floppy discs, or one floppy and a 10Mbyte or 20Mbyte Winchester

Display: monochrome or colour options with built-in power supply, maximum resolution 640 by 200 pixels with 16 colours

Keyboard: detached QWERTY layout, similar to IBM PC, with illuminated Num Lock and Caps Lock.

Interfaces: serial and parallel as standard; mouse port and monitor output; joystick port on keyboard; three full-length expansion slots

Dimensions: 372mm. (14.6in.) by 384mm. (15.1in.) by 135mm. (5.3in.)

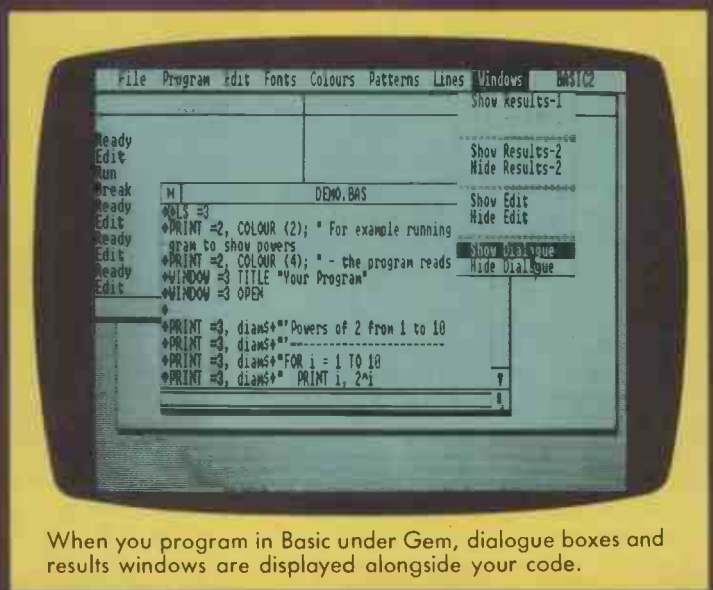
Weight: 6kg. (13lb.)

Software in price: MS-DOS 3.2, DOS Plus, Gem Desktop, Gem Paint, Locomotive Basic 2

Prices: monochrome system with one floppy disc, £399. Extra costs for alternative configurations as follows: second floppy disc, £100; 10Mbyte Winchester, £300; 20Mbyte Winchester £400; colour £150

Manufacturer: Amstrad Consumer Electronics, Brentwood House, 169 Kings Road, Brentwood, Essex CM14 4EF. Telephone: (0277) 230222

Available now



When you program in Basic under Gem, dialogue boxes and results windows are displayed alongside your code.



(continued from previous page)

10MHz AT models. However, this is not so much representative of the Amstrad machine's performance as of the tight coding achieved by Locomotive Software. A better idea of comparative speed is obtained running GWBasic. This produced an average time of 6.9 seconds; the IBM PC clocks up 16.8 seconds and the Olivetti M-24 — which uses an 8086 chip like the PC-1512 — 7.2 seconds.

Running the Bagshaw Disc Benchmarks produced a total time of 284 seconds for the floppy disc, compared with the IBM PC's 742 seconds, and 254 seconds for the IBM PC/XT's hard disc. This is obviously an excellent performance for the discs, though the drives had a disconcerting habit of continuing to rotate for several seconds after they had finished accessing the disc. Amstrad attributes this to choices made within the BIOS, or ROM operating system (ROS) as it is called on the PC-1512. Otherwise the discs are reasonably quiet.

As far as compatibility goes, the new Amstrad passed all the usual tests — Sidekick, Flight Simulator and Lotus 1-2-3 all ran properly under MS-DOS. As reported last month, Sidekick will not work with DOS Plus. The combined text and graphics card in the PC-1512 coped with 1-2-3's graphs admirably. Not surprisingly, however, the IBM Diagnostics disc was not impressed and threw up a number of errors. Evidently the ROS is markedly different from IBM's BIOS.

But while the software compatibility seems to be excellent there are some problems with hardware. For example, it is not possible to make full use of the IBM EGA card. Since both the EGA and the Amstrad graphics adaptor use the same region of RAM for colour, the EGA cannot be used except for enhanced mono, for which it would be rather an expensive solution to say the least.

MEMORY EXPANSION

We had no problem using the Intel Above Board memory-expansion card, and here the Amstrad PC-1512 even managed to go several better than simple compatibility. Whereas most IBM clones require you to go through a fiddly process of setting DIP switches to accommodate the extra memory, the Amstrad is intelligent enough to notice that it is there and install it appropriately. Amstrad says that other cards like Rampage and maths co-processors — provided they run at 8MHz — will also work without problem.

The system comes with one fat ring-bound manual reminiscent of those for the Amstrad PCW-8256. It is generally readable, with good illustrations, though the text may be too densely printed for some people. There are good appendices and an index, but the coverage of Basic 2 is skimpy; another full manual devoted exclusively to it is available at extra charge.

It is hard to fault a system which costs £450, VAT included, for a setup that takes in everything barring a printer. Alan Sugar



Ctrl, Alt, PrtScr and Caps Lock keys are positioned differently from on the IBM PC.

has carried off his customary trick and put together a deal which is pretty impressive. Although not quite cast-iron, the hardware is not flimsy either. The technology is nicely judged; apart from niggles like the positioning of the mouse port, the lack of EGA compatibility and details of the keyboard, there are few aspects of the design which could be criticised. The bundled software is a very useful starting point, and the Basic 2 could be particularly good to have.

RELIABILITY IS THE KEY

So who should buy it? Probably everyone will, or will try to. Initially there are likely to be delays as production is ramped up; Amstrad's estimate of 800,000 machines in the first year looks optimistic, if only for production reasons. There are two main classes of user who will find this machine excellent value: the first-time buyer and the corporate purchaser. As an introduction to serious computing, the PC-1512 is a good buy. Apart from the lack of a printer and applications software, it is all there. Judging by Amstrad's past performance, you would probably do better not to get its own-brand printer. Some low-cost software is already available, notably a new WP package from Micropro, the Supercalc 3 spreadsheet and products from Borland, whose low-price policy makes it a good match for Amstrad.

Assuming that reliability proves satisfactory, there is no reason why the Amstrad PC-1512 could not prove a perfect bulk buy for corporate users. The only caveat would be to do with EGA compatibility. The 8MHz clock could also cause timing problems with older comms programs. The PC-1512 would also be attractive as a backup machine in companies, and as a home micro for managers using PCs at work.

The PC-1512 is potentially a threat to sales of the Amstrad PCW-8256, though the latter was designed principally as a specialised system while the new machine is generic. Buyers will need to decide whether they will be word processing almost exclusively or want a general PC facility. In many ways the concept of the PCW is far more innovative than that of the PC-1512, even if it will be overshadowed by its new stablemate to some extent.

It is particularly interesting to speculate on the effect the Amstrad will have on the

PC scene. On the hardware front, it is bound to cause a further shake-up of the clone makers; the fact that IBM chose to launch its XT-286 on precisely the same day as the Amstrad suggests that it is not unaware of this U.K. stripling. The Amstrad will help polarise the PC world between the ultra-cheap commodity machines on the one hand and pricey value-added models on the other. Software will be hit too. As everyone points out, who wants to pay more for one piece of software than for all the hardware? We will be investigating software houses' response to the Amstrad PC in the next issue of *Practical Computing*.

The way computers are sold will also change. Loud squawks can already be heard from dealers denouncing the damage the new machine could do to their margins, and there is no doubt that many PC-1512s will be sold through High Street outlets rather than by computer specialists. This will also change the way micros are serviced. The official Amstrad maintenance contract will be administered by Dictaphone and will cost nine percent of the purchase price for the first year and 12 percent for subsequent years. A number of other help-line services are also springing up.

It is certain that after the PC-1512 things will never be the same again in the PC world. And yet in itself the machine is nothing new, simply the logical result of what has gone before. From a longer historical perspective, after the launch of Amstrad AT clones, 80486 machines and who knows what, perhaps we will come to see all the recent excitement and hype as not so much a watershed in business computing, but just another milestone.

CONCLUSIONS

- The Amstrad PC-1512 is a high-performance IBM-compatible machine at a hitherto unachievable price.
- Software compatibility is good, though there is a slight problem with hardware.
- The quality of construction is excellent considering the price, and the bundled software is useful.
- For someone who wishes to explore the world of serious microcomputing, or for corporate buyers who want a very cheap but usable machine, there is nothing to touch it at the moment. The hard-disc systems are particularly good value.



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APPLE II GS

BEST OF BOTH WORLDS

By Glyn Moody

Apple II users can now move up to Macintosh-style computing without abandoning their existing investment in software.

The Apple II holds a very special place in the history of the business micro, as well as of the company which produced it. It was the Apple II which really put the "personal" into personal computer and together with VisiCalc helped place microcomputers on corporate desks around the world. For Apple, the II series has been its lifeline: some three million machines have been sold, 120,000 of them in the U.K. Apple has continued to milk this cash cow, and during the last two rocky years it has probably kept the company afloat while the Macintosh has slowly established itself as a money earner in its own right.

With a design that has remained basically unchanged since the launch of the original Apple II nine years ago, these machines have fared remarkably well. They are still in widespread use, particularly in schools and universities, but during the intervening years technology has moved on. The time has come for Apple to bring the Apple II into the modern world of 16 bits.

The result is the Apple II GS, the two letters of the suffix referring to its advanced graphics and sound. The II GS turns out to be a kind of colour Macintosh with the sound and graphics capabilities of the Amiga. The Appletalk network is built-in, as on the Mac, allowing it to be hooked up to Macs and Laserwriters, for example. Apple also claims a high degree of compatibility with the huge existing Apple II software base. Prices start at £995 for a monochrome system with one disc drive; a full-colour system with a 20Mbyte hard disc costs £2,195.

From the outside the new machine looks like an expanded version of the Apple IIc. There is the same styling and boxy approach, though unlike both the IIc and the IIc it has a separate keyboard unit. The keyboard is linked to the main system box via a new desk-top bus which can also accommodate a single-button mouse, daisy-chained through the keyboard.

The keyboard unit is rather cramped in design, with the cursor keys placed in a row rather than in a group. There is a separate numeric keypad and a host of auxiliary keys, including the Apple Command key, an

Option key and a Reset button. To reset the machine you press the Command key together with Control and Reset. The feel of the keys is excellent: they have a very definite give and are generally firmly sprung.

Like the keyboard and mouse, the disc drives are also daisy-chained to the main unit. Both 3.5in. and 5.25in. formats are supported. The larger size lets you load old Apple II software, while the 3.5in. units are designed to give data compatibility between the II GS and the Macintosh. The 3.5in. disc drive itself is compatible with the Mac. The operating systems used is called Prodos 16, the old eight-bit Prodos having been renamed Prodos 8. Appledos 3.3 can also be used.

The main unit is generously endowed with ports. As well as Appletalk, there are interfaces for printer, modem, disc drive and monitor. A headphone socket is provided for stereo sound. The provision of these

APPLE II GS				
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 type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

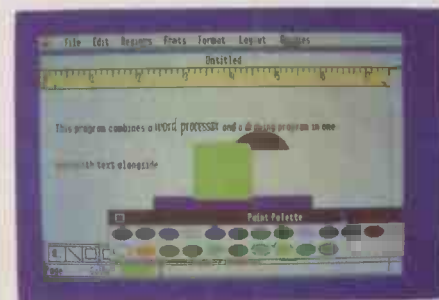
Virtually a colour Mac, but with Apple II compatibility.

connections means that the add-on cards that were such a prominent feature of earlier Apple II machines are no longer needed. Expansion slots are still provided, however; it is possible to use them instead of the standard ports, or for more exotic applications. Because older Apple II software expects to find devices connected to certain slots, each port on the II GS is nominally assigned to the appropriate slot. For example, the 3.5in. drive is assigned to slot 5, and the 5.25in. drive to slot 6, even though physically they are daisy-chained through each other. It is possible to change these assignments if you wish.

The interior of the GS is impressive for its sparseness. Gone is the welter of chips, a few custom devices being employed in their place. The most important of them is the so-



The software resembles Mac programs; one package (below) allows drawings to be placed beside text



called Mega II chip which, apart from the RAM, ROM and processor, is an Apple II on a chip. Its existence raises the possibility of a lap-portable version of the Apple II. A large number of new products are expected from Apple in the next year, and such a machine could well be one of them.

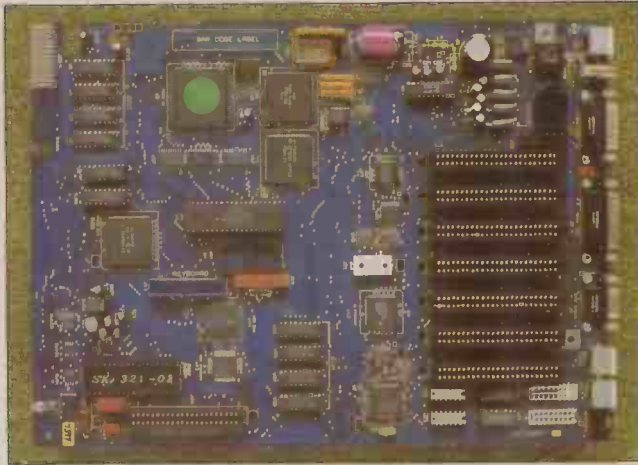
The processor on the II GS is the 65C816, a 16-bit upgrade of the 6502 which has been at the heart of the earlier Apple II micros. As well as running in true 16-bit mode, the 65C816 can operate in a 6502 emulation mode, allowing it to run all well-behaved eight-bit software. The basic system comes with 256K RAM, and this can be expanded to 4Mbyte using cards. In the 6502 mode only 128K is accessible. The seven expansion slots are compatible with the earlier designs. Extras on the new machine include a built-in battery-backed clock, and a 15-voice synthesiser.

The machine is normally booted up by placing a disc with the operating system on it in one of the disc drives. Bootable discs are first sought in the 5.25in. drive, and then the 3.5in. one. Alternatively, you can access the ROM-based Basic by switching the machine on and pressing Control and Reset together. The Basic is the ordinary Applesoft variety. Running the Benchmarks produced an average time of 10.9 seconds, against 31.9 seconds for the Apple IIe and 16.8 seconds for the IBM PC.

From within most programs you can access a range of desk accessories by pressing the Command, Control and Escape keys simultaneously. One of the programs is held in ROM and is used to alter system parameters. From this Control Panel you can change the display, the allocation of slots and modem settings. You can also alter the processor speed: the normal clock speed is 2.8MHz, but for some older Apple II programs where timing is critical it may be necessary to cut the rate down to the original 1MHz.

So far there is little new software designed specifically to exploit the power of the II GS.

(continued on page 64)



Above: The interior of the Apple II GS is impressively sparse. Below: The main unit provides ports for Appletalk, printer, modem, disc drive, monitor and headphones.



SPECIFICATION

CPU: 65C816 running at 2.8MHz or 1MHz; low-power CMOS technology
RAM: 256K as standard, upgradable to 4Mbyte

ROM: 128K, containing Applesoft Basic and utilities

Mass storage: optional 3.5in. or 5.25in. drives; 20 Mbyte hard disc also available

Keyboard: detached, full QWERTY layout with separate cursor keys and numeric pad; mouse connection

Display: monochrome or colour monitors available; 640 by 240 pixels with four colours, 320 by 200 with 16 colours from 4,096 possible colours; also supports other Apple graphics modes

Dimensions: 113mm.(4.5 in.) x 283mm.(11.1 in.) x 346mm.(13.6 in.)

Weight: 3.88kg. (8.5lb.)

Interfaces: disc, printer, modem, Appletalk, RGB monitor, composite video, and stereo headphone ports fitted as standard

Software in price: Mouse Desk

Price: £995 for monochrome system with 256K RAM and one 3.5in. disc; £1,395 for colour system with extra 256K RAM; £2,195 for 20Mbyte Winchester colour system with 256K extra RAM

Manufacturer: Apple Computer (U.K.), Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244

Available: January 1987



(continued on previous page)

Apple says that around 240 American software houses are working on products. Half of them come from an Apple II background and half from the Macintosh world, indicating nicely how the new machine forms a bridge between the two.

We were able to see a number of beta-release versions of software that is under development, some of which bears striking resemblance to Macintosh programs. Some of them include code that has been ported directly from Mac versions. One program which makes the new machine look and function like its up-market predecessor is Mouse Desk. It will come bundled with the II GS, the equivalent to the Macintosh Finder, to provide a mouse-driven environment with windows and icons to cater for all aspects of file handling. There are also several word-processing and painting packages which look almost identical to Macwrite and Macpaint, with the important difference that they are in full colour. One package even managed to combine both together, allowing drawings to be placed alongside text.

In Britain the new machine is targeted at the small business sector. Apple claims that 50 percent of Apple II users want an upgrade and it will be aiming its new machine squarely at this ready-made market. In the U.S. the machine is regarded as more of an educational model, replacing the very widely used Apple II. Business users there are likely to go straight to the Macintosh.

Whether or not the Apple II GS succeeds as a serious business machine in Britain depends crucially on what new software comes through. In the meantime there are a huge number of Apple II programs which the GS should be able to run. Apple claims that around 90 percent will run immediately and we ran several without difficulty. Only those which make direct calls to hardware are likely to be affected. As far as hardware compatibility is concerned, we found an old Apple video card which would not work simply because it needs to connect to something that is embedded in the Mega II chip.

BOOST FOR THE MAC

New areas where the II GS might find a use are in low-end desk-top publishing and as an element in Appletalk networks. One general effect of the launch of this machine will be to give a boost to the whole Macintosh philosophy. We give our assessment of the current state of the Macintosh world in this month's special section, beginning on page 100. The colour display of the II GS adds a pleasing new dimension to the mouse and icon approach, making the grey-screened Mac seem very staid and fuddy-duddy in comparison. The II GS could possibly be the forerunner of a full colour Macintosh, something that is widely rumoured to be under development for possible launch next year. A colour Mac would combine the best of the Apple world with the attractive front end of the Amiga.

Apple machines have never been particularly competitive on price, and the II GS is no exception. A basic colour system costs £1,395, which is almost £1,000 more than an equivalent Amstrad PC and roughly the same as the Amiga. Apple is presumably hoping that its loyal user base will put up with this even if new buyers prove more reluctant. To help along the sales of its new machine Apple is phasing out both the IIe and the IIc in this country, though they will remain on sale in the U.S.

The Apple II GS is an exceptionally pleasant machine to use. It manages to keep in touch with the old world while offering the possibility of moving into new ones. The technology is superb, and the performance good. The manuals we saw were only in proof form, but were well written and should be useful for the beginner.

CONCLUSIONS

- The Apple II GS is the latest in the long line of Apple II machines. It offers good compatibility with older software and hardware while moving on to the 16-bit world.
- Much of the new software we saw shows a startling resemblance to the Mac, with the addition of colour. The II GS is also compatible with Apple's top machine in terms of data and peripherals.
- The II GS is well made. The main disappointment is the uncompetitive pricing.
- The new machine is most likely to appeal to present Apple II users who wish to upgrade to newer technology.

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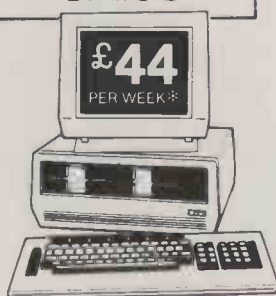
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JUST TEXT TYPESETTING FROM THE MAC

By Carol Hammond

The facilities of a full-feature typesetting terminal and the flexibility of Postscript programming are combined with on-screen page make-up facilities in this package. Used in combination with a Laserwriter it forms the heart of a top-rank desk-top publishing system; linked to a Linotronic typesetting unit it provides unusually flexible output of fully typeset quality.

The layout on this page is slightly different to that of other reviews in this month's issue. The headline, introduction, byline and first column of copy have been set in different typefaces to normal: Helvetica rather than Futura and Times rather than Garamond. This is because these parts of the text, along with the Specification box, have been set using Just Text output from an Apple Laserwriter printer in our office.

It would have been possible to do greater credit to the package if we had been able to use the typefaces we normally do, but we only had access to those fonts available on the Laserwriter. The Laserwriter's resolution is 300 dots per inch (dpi); had we been able to use more sophisticated typesetting equipment such as Linotype's Linotronic 100 with a resolution of 1,250dpi then the results would have been more refined.

Nevertheless, we were impressed by the results we obtained from Just Text; the package clearly belongs at the upper end of the desk-top publishing market. The text that has been ran in a smooth curve around the graphic in this column is just one instance of the sophisticated effects available using Just Text. It took us only a few seconds to achieve, while to get a comparable effect on the conventional typesetting system normally used for this magazine could well have taken an hour or more of a skilled operator's time.

That is not to say that Just Text is simple to use. One of the penalties you pay for the sophistication it provides is a loss of user-friendliness. Anyone used to other Mac packages could be in for a shock. For one thing, the package is not WYSIWYG; for another, it requires you to know about page layout and typesetting. To get the best from it you also have to know how to program in the Postscript page-description language, the complexities of which were described by Ian Stobie in the September issue of *Practical Computing*.

Since the look of the screen display bears little relation to the final result, you can waste a lot of time and many sheets of paper trying to get a document just right. It is not until you see a hard copy of what you have set that you realise that all your text has been centred rather than ranged left as you intended, or that you have drawn a box the wrong size. The publisher of Just Text hopes to alleviate this problem in a future version of the package, which will have a preview window to give an idea of what your page will look like.

SPECIFICATION

Description: typesetting and page make-up program

Hardware required: 512K Macintosh or Mac Plus; Apple Laserwriter, Laserwriter Plus or Postscript-compatible typesetting equipment

Copy protection: none

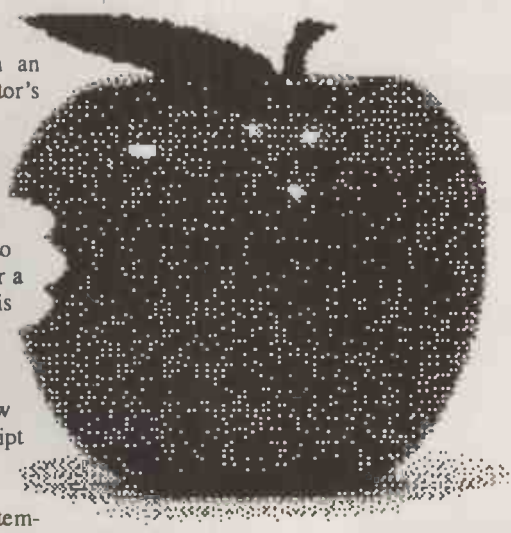
Price: £195

Publisher: Knowledge Engineering, New York

U.K. distributor: Mac Europe, 9A Lyne Court, Church Lane, London NW9 8LG.

Telephone: 01-200 3981

Available: now



The amount of typesetting knowledge Just Text requires means that you would have to be very unusually placed to be able to use it to the full right from the start. For example, in the magazine-publishing world few typesetters are used to programming or laying out pages, and few production journalists are skilled programmers or have the intimate knowledge of typesetting that Just Text requires.

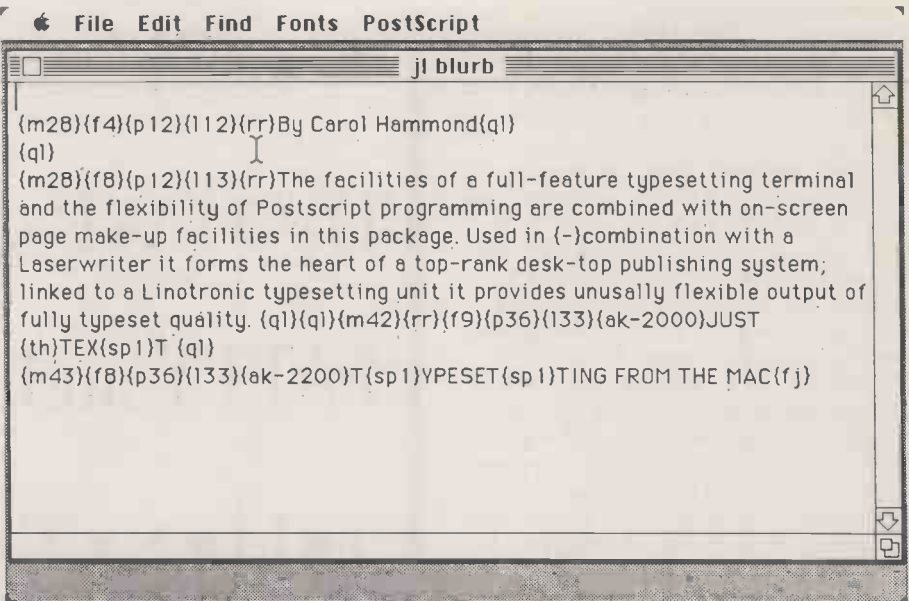
Acquiring such skills is not an insurmountable task, but it requires more effort than you will want to put in if you only produce the odd newsletter. Just Text is really most suitable for those who spend a large part of their time engaged in desk-top publishing, or who want a very flexible front end to a conventional typesetting system. For such users the effort required to master the package will be amply repaid by the control and sophistication it offers.

The first problem you encounter with Just Text is that unless you want to stick with the default settings you will have to define your page. Postscript tells the printer exactly where to mark the paper, using an x,y Cartesian co-ordinate system to specify positions. The x-axis, measured in points, runs along the bottom of a page and the y-axis runs vertically up the left edge of the paper. So the bottom left corner of the paper is point (0,0).

The package comes supplied with a transparent acetate guide to help define page positions. The vertical axis of the grid is marked from 72 to 720 points, and comparison with a printer's ruler shows that the measurements are correct. However, the horizontal axis of the grid, which is marked from 72 to 576 points, proves to be incorrect; what purports to be 72 points from the left of the page is only 50 points.

CONFUSING

This is confusing enough when you are familiar with using points as a unit of measurement, as most journalists and printers are, but if you are unfamiliar with such jargon you may well find yourself in a real mess. When measuring something on a real page you have to add 22 to any measurement from the left-hand side of the page before entering it into Just Text. Admittedly, you do have the grid to help you, but for fine measurement you really need a printer's typescale. To make matters worse I did not come across any warning or even mention of this in the manual. It arises because there are certain areas of the page the Laserwriter will not print on; the



problem has really been caused by Apple but that is no reason why Just Text could not have alerted users to it.

Once you have defined your page layout it can be saved as a macro using Just Text's so-called Smart keys. Defining pages is probably one of the first things a newcomer to the package will do, but the hassle this involves may deter them from getting to grips with the rest of the package. It is certainly Just Text's most serious flaw, and a clearer and less condescending explanation in the manual would help.

To define your page area you have to set up several lines of code, something like
 {c1,750,30,15,192}
 {c2,750,207,15,36}
 {c3,750,384,15,546}

This would give a three-column layout similar to the one on this page. A top-left and bottom-right sequence is used to define the columns that the text will flow into. The measurement of a typeset line in points should be the right page co-ordinate minus the left page co-ordinate. In this case each line is 162 points wide. The right edge of column 1 is at 192 points and the start of column 2 is at 207 points. This is to allow for a gap between each column of 15 points.

This is what appeared on-screen to set the headline and introduction to this article.

These codes can subsequently be pasted at the top of any text you want set in three columns. The curly brackets indicate that the figures inside are commands, and so they will not actually be typeset. Neither will placing this in the text preceded by the {c__} or column jump command cause it to reformat in any way. Using this method you can, theoretically at least, have as many columns as you wish. If you just want to set one long strip of text — which is what typesetters do when the type is to be laid out by hand — you simply enter {m__} plus whatever measurement in picas you wish the width of the column to be. This is fine if you are just using Just Text for typesetting but if you want to use it to lay out pages then you will need to have defined your columns.

The next step in making up a page is deciding what typeface you want to use. When you select a fount from the Font menu the appropriate command will appear at the cursor, changing the typeface of any subsequent text. Choosing, say, Helvetica will paste {f8} into the text. Again, because this is a command it will not normally appear in any output, and neither will the screen fount change. The default screen fount is Geneva, which was chosen to fit as much as possible on the small screen of the Mac. You certainly do have to fit quite a lot on-screen because the commands you have to use take up so much space. However, the default size is rather tight to read, and positioning the I-bar is particularly fiddly. One remedy is to change the screen fount by

SPECIAL EFFECTS WITH POSTSCRIPT

The ability to use Postscript is one of Just Text's most powerful features, but its full power can only be realised if you are prepared to get down to some quite intricate programming. The fragment of Postscript code in this panel shows the commands that were needed to draw the Specification box printed on the opposite page. Here matters were complicated by the reversed-out type used for the word "SPECIFICATION", which meant that a box had to be drawn around a box.

You start by drawing a box round the reversed-out lettering and then adjust the space around it to provide the right amount of black space above, below and to the left and right of the text. The code then uses the Postscript Window facility to find out where the box begins and ends. A box is indicated by

```
newpath
```

and ends

```
closepath
```

in Postscript. The code was then cut and pasted into the Just Text document, preceded by {ps} to tell the Laserwriter you are going into Postscript. The white on black effect was then achieved using the Postscript command

```
0 setgray fill
```

which makes the box black and

```
1 setgray
```

which sets the type to white. You also have to remember to reverse this process to get any subsequent text to print black.

Before drawing a box around the whole area you have to find out where it begins and ends. It obviously has to start somewhere near the black box and end after the last line of black and white text. By drawing a box around the black-on-white text you can find the co-ordinates for the end of the box using the Make Postscript window. The large box can then be drawn by entering Postscript and giving the appropriate co-ordinates.

```
m12.6}{f9}{p12}{112}{ps}
newpath
90 707 moveto
240 707 lineto
240 722 lineto
90 722 lineto
closepath
0 setgray fill 1 setgray
QQ
{sb}{i10.2}SPECIFICATION{q1}{a2}{eb}
{ps}1 setgray fill 0 setgray
QQ
{f9}{p8}{112}{xi}Description: {f8}
typesetting and page make-{p8}{19}
up program{q1}
{f9}Hardware required: {f8}512K
Macintosh or Mac Plus; Apple
Laserwriter, Laserwriter Plus or
Postscript-compatible typesetting
equipment {q1}
{f9}Copy protection:{f8} none{q1}
{f9}Price:{f8} £195{q1}
{f9}Publisher:{f8} Knowledge Engineering,
New York{q1}
{f9}U.K. distributor:{f8} Mac Europe,
9A Lyne Court, Church Lane, London NW9 8LG.
Telephone: 01- 200 3981{q1}
{f9}Available: {f8}now{q1}{lw0.1}
{ps}
newpath
84 572 moveto
247 572 lineto
247 729 lineto
84 729 lineto
closepath
stroke
QQ
```

(continued on next page)

(continued from previous page)

selecting Set Screen Font from the Edit menu. A more radical and expensive course of action is to buy a bigger screen for the Mac; one is already being made by Thames Valley Systems.

Once you have chosen the typeface you specify what size it is to be in points, using {p_}, and the leading or space between each line, using {l_}. You can change the fount, the fount size and the leading at any time, and as many times as you want throughout a piece of text. Commands can be inserted in any order.

Just Text allows for text to be indented, ranged left or right, justified and centred. Type can be expanded and condensed using the two variants of the point command {px_} and {py_} which can be used to set the width and height of the type independently of each other. For example

{px10}{py12}

tells the output device to treat the type as 10 point horizontally and 12 point vertically.

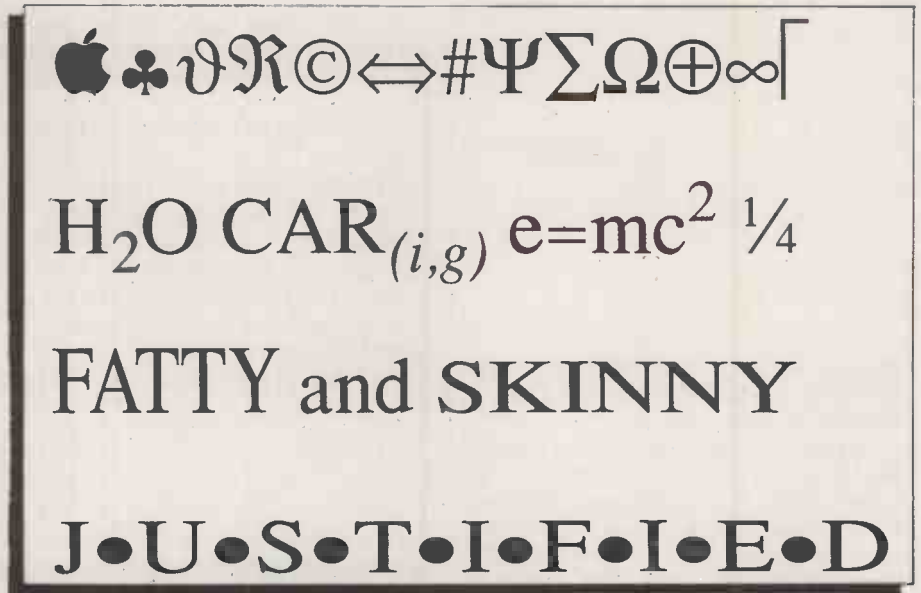
Things that are traditionally difficult to do, such as drop capitals, are simple using Just Text. The large T at the beginning of this article was created using the drop cap command {dc3T}. This tells the Laserwriter to indent the first three lines, which it does automatically. Conventional typesetting software often requires you to specify how far the lines have to be indented to make room for the drop cap.

KERNING

Just Text also allows for fine adjustment between letters, a technique known as kerning. Although kerning might be considered an optional extra for straight text, it is essential for headlines and other display setting. It also allows for fancy effects whereby you can have type overprinting, or it can be used to squeeze text into a particular space when it would not otherwise fit. The kerning feature was used in the headline for this article to adjust the space between the two words and to add a one point space between the letters X and T.

Just Text will take care of hyphenating words that have to be broken in order to fit type evenly on to a line. The rules it uses to do this can be overridden in a number of ways. You can enter the hyphenation style for specific words into the program's hyphenation dictionary. Alternatively hyphenation can be turned off altogether, or for a particular word.

Fractions, subscripts, superscripts and special symbols are all catered for. The program has the ability to display the day's date in four forms, which can be useful for date stamping. You can also incorporate tables and boxes into your text. Boxes are particularly simple: all you have to do is put {sb} where you want to start the box and {eb} where you want to finish it. The program will then draw a box around whatever text you want it to. If you want to change the thickness of the rule that forms the box you can do so using the {lw_} command. You can draw boxes around columns using the {cb_} command.



A variety of special symbols are available using the {sy_} command, subscripts and superscripts using {su_} and {if_}, expanded and condensed type using {px_} and {py_}, and text can be forcibly justified using {fi_}.

JUST TEXT

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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

More power than most professional typesetting terminals, but at the price of user-friendliness.

Just Text automatically generates the Postscript code that produces these effects on the output device. This code can be further manipulated by the user to create a range of decorative effects that would otherwise be virtually impossible. You could have your text in a spiral shape, for example, if you felt like making the effort. Postscript gives you a great deal of control over where things are on the page but the need occasionally to delve into Postscript code may put people off — particularly Mac users who are used to packages with a very user-friendly graphics-orientated front end.

Macwrite files that are imported into Just Text can be typeset straight away. There is no need to master Just Text's many commands all at once, and you do not have to go through marking every new paragraph with typesetting commands. Just Text will read Carriage Returns inserted at the end of each paragraph in Macwrite documents as the Quad Left or {ql} commands that typesetting equipment needs to set a short line. Quad Left commands can be inserted quite easily in Just Text using the Enter key, but this saves you the effort.

A file that has been transported across from Macwrite will normally be typeset using the Just Text default settings. If you wish, you can alter commands individually as you go along, or you can use Just Text's Find and Paste All facility to replace a command throughout your document. This will replace, say, any {ql} commands with {ql}{en} if you want paragraphs to indent by six points.

Files can be transferred from Macpaint to Just Text using the {pi} command. Macpaint images appear in Just Text documents in exactly the same position as they were on the Macpaint page; you cannot alter their position using Just Text unless you want it to appear on a rectangular white patch. The graphic used in this article came as a Just Text file, and to reposition it on the Just Text page we had to transfer it to Macpaint, make it smaller, reposition it and then transfer it back to Just Text. This process then had to be repeated all over again when we found we had not left sufficient room for the text to run round it — eight picas is the minimum allowed, and positioning on Macpaint is not that accurate. While doing this we found that very soon we were using up large amounts of memory on our 512K Mac. The extra capacity of a Mac Plus would be come in very handy once you start to incorporate graphics into Just Text.

CONCLUSIONS

■ Just Text provides a professional page make-up and typesetting front end very cheaply.

■ The ability to access Postscript means that you have a great deal of control over your pages, allowing for some very fancy effects.

■ The price you pay for such control is a loss of user-friendliness. Only those at the very top end of the desk-top publishing market requiring a sophisticated level of output are likely to be prepared to put in the effort necessary to master the package.

■ The inability to move Macpaint images around the page on Just Text and the lack of WYSIWYG are problems that need to be ironed out; Mac Europe says this will be done in future versions.



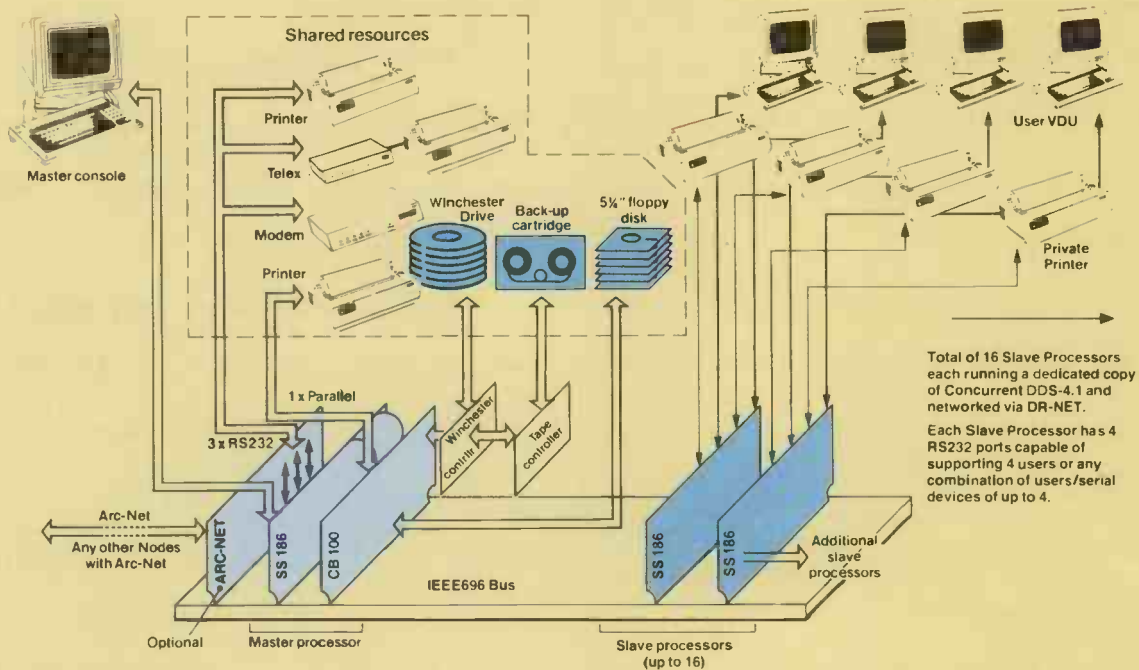
HYPER-MICRO

THREE COMPUTER ARCHITECTURES COMBINED
TO GIVE THE BEST ADVANTAGES OF EACH

MULTI PROCESSING

TIME SHARING

NETWORKING



The Bromcom system is truly a Hyper-micro with a new and innovative concept. It is the first of its kind to have *three computer architectures combined into one system* offering the best advantages of each — namely the performance of *multi-processing*, *cost effectiveness of time-sharing* and *expansibility of net-working*.

In each Bromcom system up to 16 Slave processors and 16Mbyte of RAM can be accommodated and each Slave can be allocated from one to four users. Fast 8MHz 80186 processors with up to 1Mbyte of RAM on each Slave ensure speed no less than you would expect from a high-performance system. Each work-station is provided with up to four virtual screens enabling each user to conduct four simultaneous tasks, switching between them by a single key-stroke.

High-capacity and fast Winchester, tape streamers and floppy disks are all part of the complete and integral system. Furthermore the system can be networked via ArcNet to other Bromcom systems or IBM-PC/AT and compatibles.

16-bit Master processor with 1Mbyte of RAM and:

- Four Serial and one Parallel ports
- Up to 512Mbyte Fast Winchester
- 60Mbyte Tape Cartridge

Up to 16 Slaves with:

- 16-bit processor 80186 at 8MHz
- Up to 1Mbyte of RAM & up to four Serial ports
- Slave/Master data transfer at DMA speed

Up to 32 users in one system each running:

- Concurrent DOS 4.1
- Four virtual screens/multi-tasking
- CP/M-86 and MS-DOS 2.11 compatibility

Full Networking Capability:

- Connection to IBM-PC/AT and compatibles
- ArcNet/DR-Net used
- 255 Nodes in one LAN

BROMCOM

417-421 Bromley Road, Downham, Bromley, Kent BR1 4PJ Telephone: 01-461 3993 Telex: 926012 BCOM G

→ circle 158 on enquiry card ←

As recommended by the inventor of the PC modem.

On a borrowed kitchen table in 1977 our founder Dennis Hayes gave birth to his first baby.

The Personal Computer Modulator Demodulator, or 'PC modem,' as it was to be christened.

It created a new industry overnight. With our 'AT' Command set, it set the data communications standard for the rest to follow.

And follow they did.

But as all the software in existence was written for a Hayes, they had to virtually copy our machine.

Very soon there were hoards of manufacturers claiming Hayes 'compatibility.'

Even so, seven out of every ten modems retailed in the States are still Hayes.

Why? Because our products have a hard-earned reputation for being far more reliable than anyone else's.

This isn't advertising puffery.

All our products carry a two year no quibbles, no-questions-asked

guarantee. (Extendable to 4 years for a nominal sum.)

Each modem is thoroughly tested, then switched on and off continuously for at least eight hours before it leaves the factory.

Should anything fall short of perfect, it's out on its ear. We train our dealers until they know our products inside out and back to front.

They'll then sit down and patiently explain everything to you, however long it takes.

Should you have any queries or worries after that, you can call one of our 'Agony Uncles' on 01-847 5521, Monday to Friday, nine till six.

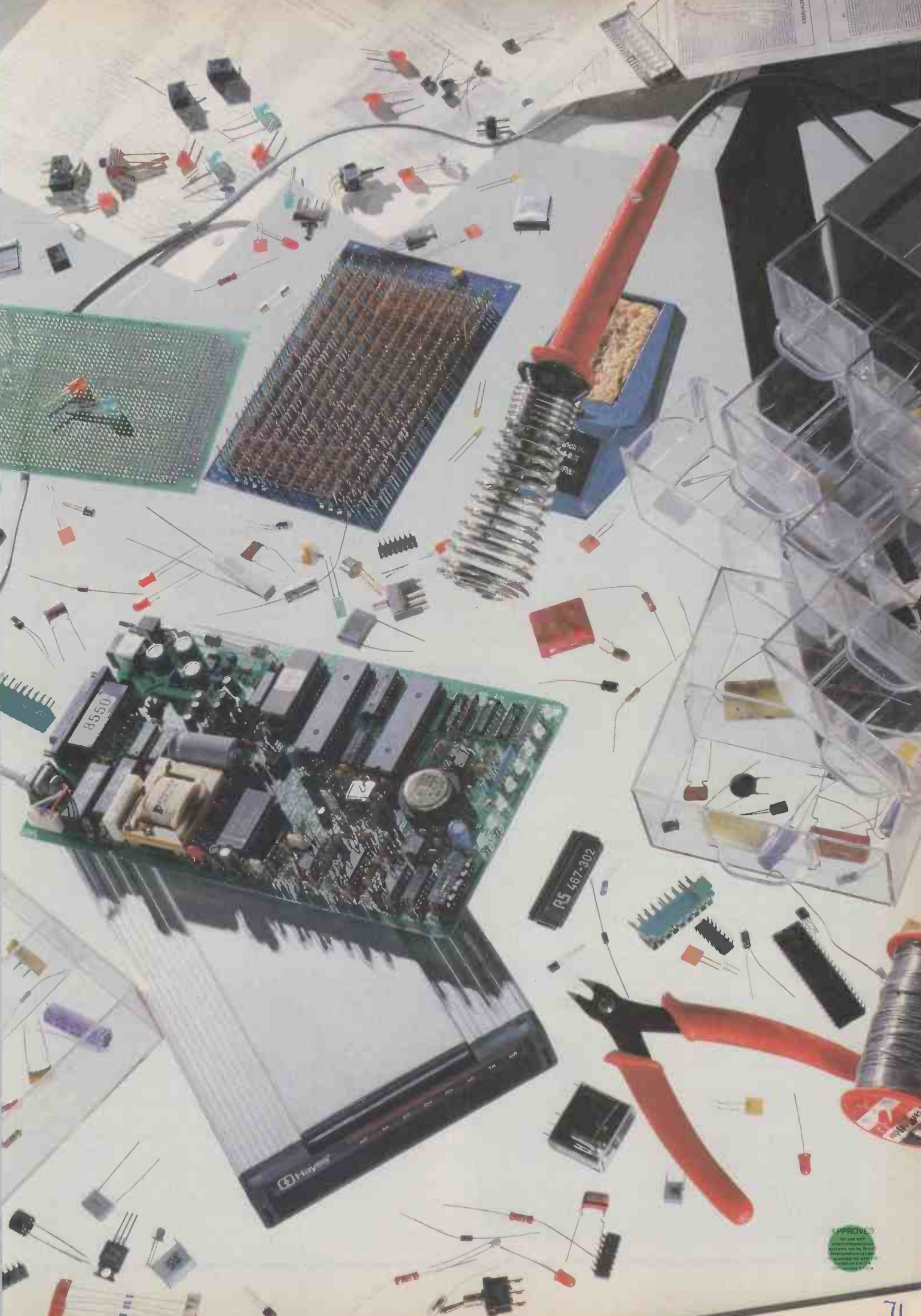
The thing we've left till last is the bottom line.

You'll be hard pressed to find a more highly priced PC modem anywhere.

But then you'd never find one that comes as highly recommended.

 **Hayes**TM





APPROVED
For use with
telecommunication
systems that are
certified in
accordance with
the standards in
this notice.

PFS FIRST CHOICE BEGINNER'S BUMPER BUNDLE

This four-function integrated package aimed at first-time users offers value for money and may signal a revival of the all-in-one software concept.

PFS First Choice combines four of the commonest business applications in one package: word processing, database, spreadsheet and communications. It lacks charting or graphics abilities, but a powerful spelling checker is thrown in by way of compensation.

All-in-one packages have been rather out of fashion recently. Overambitious products which tried to pack in too many features have given them the reputation of being hard to use and slow. However, there now seems to be a revival of interest in the idea, particularly for products aimed at beginners and occasional users. As they are unlikely to want sophisticated features the package can be kept simple.

First Choice is designed to run on the IBM PC, PC/AT or compatible machines, and is going on sale immediately at the reasonable price of £149. It is only one of several new packages from Software Publishing Corporation, the company responsible for the best-selling PFS product range and Harvard Presentation Graphics.

Users of existing PFS products will be able to upgrade to First Choice for only £70, which makes it extraordinarily competitive. In a similar way users who outgrow First Choice will be able to upgrade to the more powerful PFS Professional Series for considerably reduced prices — £40 in the case of Professional Write.

First Choice is rather similar in concept to Works, Microsoft's new all-in-one package for the Mac. Above all both products are

intended to be easy to use, but Works has the considerable advantage of running on a machine which is inherently more user-friendly than the IBM PC. All the same, Software Publishing has set out to give First Choice various Mac-like features. It has pull-down menus and a clipboard for transferring data within and between applications.

We ran our copy of First Choice on both a monochrome, floppy-based Kaypro clone, and on a hard-disc IBM PC/XT with colour display. Minimum configuration for it is two floppies and 256K of memory. First Choice uses colour to great effect, but we found you can manage without it. First Choice also supports the Microsoft and Mouse Systems mouse, but we used the package without them.

First Choice keeps information in four different types of files: word-processing documents, spreadsheets, database folders and reports. Word processing is the key application as far as integration is concerned.

STANDARD FORMAT

First Choice's opening screen shows a menu of the main options. Selecting Create a Document takes you into the word processor. All the applications have a similar screen layout, with a row of pull-down menus arranged along the top and a message line telling what to do along the bottom. You can use either the function keys or a mouse to see what is on the menus.

Hitting f1 will always get you help. This

SPECIFICATION

Description: all-in-one integrated package aimed at occasional and first-time users; comprises word processing with spelling checker, database, spreadsheet and comms

Hardware required: IBM PC, PC/AT or compatibles with two floppy drives or hard disc; mouse optional

Copy protection: none

Publisher: Software Publishing Corporation, 85-87 Jermyn Street, London SW1Y 6JD. Telephone: 01-839 2849

U.K. supplier: Softsel, Softsel House, Syon Gate Way, Great West Road, Brentford, Middlesex TW8 9DD. Telephone: 01-568 8866

Price: £149; existing PFS users can upgrade for £75

Available: now

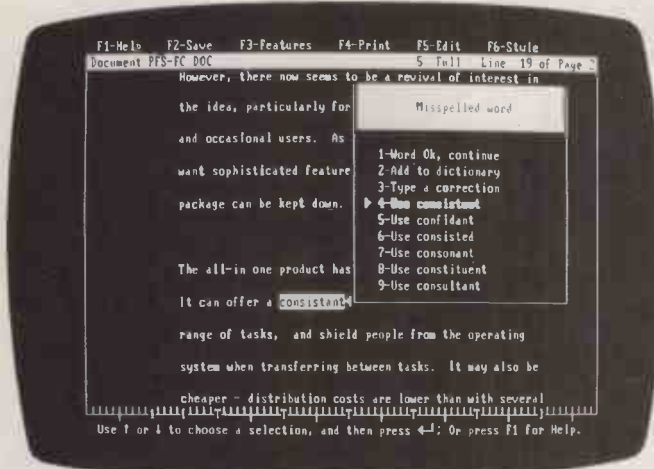
feature is very well implemented and the help is always related to what you were doing when you pressed the f1 key. First Choice is provided with over 90K of explanatory text, so the help is fairly comprehensive.

In the word processor the f5 menu controls the Mac-style clipboard functions. You first select a block of text, and then cut or copy it to the clipboard, which is just a memory buffer given a more self-explanatory name. You then move the cursor to where you want the block to go and select the Paste option from the f5 menu, which copies the block to the new location.

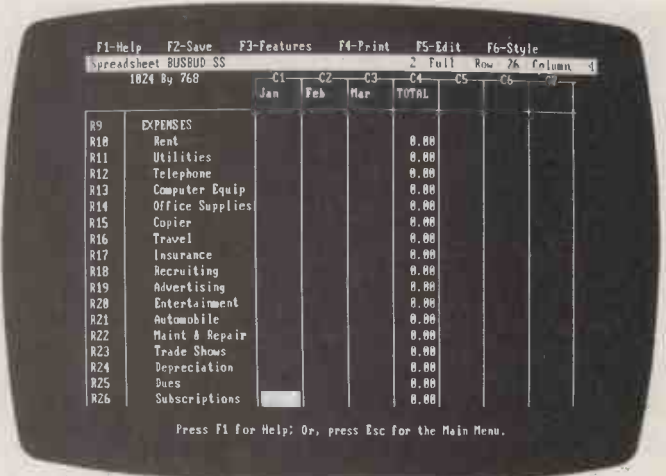
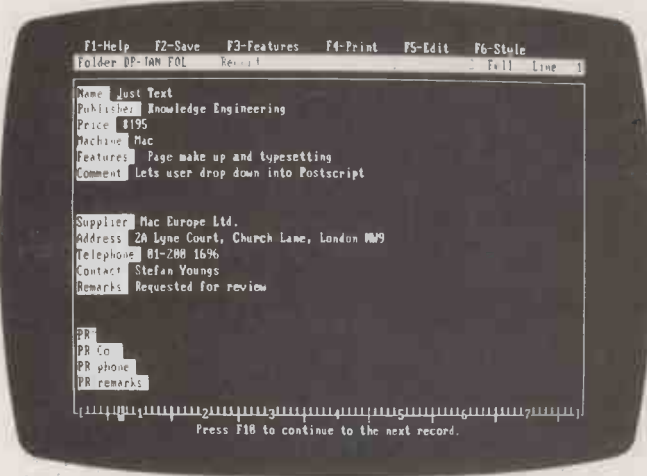
The beauty of the clipboard is that it works between documents and between applications. For instance, you can load it up with a block of data taken from a spreadsheet and move it into the word processor.

Apart from the pull-down menus the word processor is fairly similar to the best-selling PSF Write, which means it is pretty good. It will read existing PFS Write files and can both read and write files in standard ASCII format. It has some limitations. Documents can be double-spaced but not triple-spaced, and the maximum width is 132 characters.

First Choice holds documents entirely in memory, which makes the maximum document size dependent on the size of your system. We were using a 640K system, and wrote long articles for this issue of *Practical Computing* with no trouble, even with several pop-up programs loaded into memory at the same time. But on a 256K system a six-page document would probably be about your limit.



All the First Choice applications have a similar format, with pull-down menu options and a helpful message line. Here is the word processor with the spelling checker active.



For authors the flexible flat-file database is ideal.

The spreadsheet is memory-resident but lacks graphics.

The 75,000-word spelling checker is excellent. Not only does it give you sensible suggestions for detecting most spelling mistakes, but it also detects more subtle errors like repeated words or incorrect capitalisation. Checking takes places on a whole document — you cannot just check a word like in PFS Write — but we found it fairly fast.

First Choice's database is modelled on PFS File and Report and it is a straightforward card-index type of system. It lets you handle a single set of records at a time but not link several files together. You design your record layout on-screen. Everything is controlled by pull-down menus as in the word-processing part of the system.

Records can be extremely large, with up to 1,000 fields, and you can have lots of them — theoretically up to 32,000 per file. Unlike the word processor you are not confined by the available memory but by disc capacity, as the database saves each record to disc as it finishes with it. This part of First Choice has several nice features. You can alter record layouts even after you have loaded up data, and the spelling checker still works inside the database.

Selecting records works on a straightforward template system. You type search instructions into a dummy record, and First Choice then pulls in all records that match the criteria you have specified. You can look for imprecise matches using wild-card characters, and make relative comparisons on numeric fields.

DATA FOR WP

The database is particularly useful when used in conjunction with the word processor. For example, if you have created a database file with names, addresses and product details in it you can use it to prepare form letters and mailing labels. The procedure is very straightforward. You set up your letter in the word processor in the normal way, but wherever you want to pull in information from the database you just type the appropriate field name between brackets.

You then select Print Form Letter or Labels from the f4 menu and tell the program which database file to use. You can specify search criteria at this point. First

Choice will then print the letter as many times as necessary, filling in the fields from each record in turn.

First Choice can also generate tabular reports from the information contained in database files. Here you select Create a Report from the main menu and type in which file to use. You then specify which fields you are interested in, and what you want done with them. As well as printing out the information already in your file you can specify a whole range of counts, totals and computed fields.

The spreadsheet is based on PFS Plan. It is fairly powerful but does not include graphics

or save an entire spreadsheet as a word-processing document. What you cannot do is import data from Multiplan or Lotus 1-2-3. More surprisingly, you cannot export data to Software Publishing's own Harvard Presentation Graphics to chart it.

First Choice's fourth application is comms. This can handle email services like Telecom Gold, or control a direct computer-to-computer link via an RS-232. It does not support graphics services like Prestel.

For some reason the preset information in the comms service menu is in American. The rest of First Choice, such as the spelling checker, has been thoroughly anglicised. However, you can clear out data already present and enter your own logging-on information. First Choice can apparently be used with an autodial modem to ring numbers up from information kept in database files, though we did not try it.

Perhaps the most interesting question to ask about First Choice is how it compares with Works on the Macintosh. Both are very competently executed programs from software houses with a lot of experience of producing easy-to-use packages. Both are targeted at the same type of user, and both use the same all-in-one strategy. What differences there are must be down to the machines.

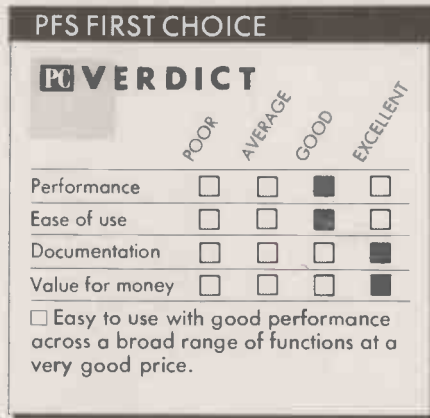
Works on the Mac wins hands down. It is easier to use, especially when you start moving data between different parts of the package. But First Choice has got as close to success in this market as is possible on the IBM PC. It is a very good product.

CONCLUSIONS

■ First Choice sets out to provide a broad range of business functions in an easy-to-use form. It succeeds very well, and at £149 represents outstanding value.

■ Experienced users with a particular application in mind would probably be better off going for a more powerful specialist package. But First Choice is a good bet for beginners, and for specialists working outside their main application area.

■ The documentation is excellent and the on-screen help relevant without being verbose. The only obvious thing lacking from the package is a graphics or charting facility.



or macro facilities. Again it is memory resident, which makes it quick but limits the maximum size of a worksheet to your available memory. On a 640K system you can have 1,024 rows by 512 columns.

Software Publishing has again managed to come up with some interesting features. You can type

JAN

or

WEDNESDAY

or

APR 86

in the headings area at the top or side of the screen and First Choice will automatically fill in the sequence. Popular headings are already set up in the system and you can create your own too.

You can use the clipboard to copy sections of spreadsheet across to the word processor,

PROCOM 20 TELEX ON A CARD

By Ian Stobie

This add-on card for IBM compatibles provides all the facilities of a dedicated telex machine and still leaves your PC free for normal applications.

Although telex seems a bit old-fashioned nowadays, as a means of business communication it still has a lot going for it. Its 1.8 million users worldwide put it well ahead of all other forms of electronic communications, including fax and the newer electronic mailbox systems such as Telecom Gold.

It is now possible to put the functionality

of a dedicated telex machine, including the telex modem, on to a single add-on card to fit in the IBM PC. At £850, Communicate's Procom 20 is the cheapest such telex card yet. In addition to a built-in modem it has its own on-board processor and memory that allows you to send or receive telexes in background mode while you use your PC for some other application.

Assuming you already have an IBM PC or clone, the only additional expense to get a working telex system is the cost of a telex line. British Telecom charges a quarterly rental of £88, and makes a connection charge, also £88. Once you start using telex you obviously also have to pay message charges to BT on telexes you send. But they will be less than a telex bureau charges, and

comparable to other forms of electronic mail.

Procom 20 consists of a single full-length IBM-style card, a disc with Communicate's own telex-management software on it, and a cable which plugs directly from the back of the Procom card into the BT telex wall socket. Any device connected to the telex network has to have BT approval, and Procom 20 is currently in the middle of the testing process. Once approved, it will go on sale immediately.

On the card is an 8D64B single-chip comms-orientated processor and 64K of RAM. This allows Procom to function almost independently of the CPU in the host machine for much of the time. Also on the card is a printer port and a serial

The screenshot displays the Procom 20 interface with a menu structure and a task status window.

TRANSMIT	FILE UTILITIES	CONFIGURATION	STATUS
SEND TELEX CONVERSATION	SELECT DELETE RENAME APPEND PRINT EDIT COPY TYPE	SAVE CONFIG LOAD CONFIG MENU PARAMS AUTO PRINT SET CLOCK INSTALL	TRANSMIT QUEUE ACTIVITY LOG HARDWARE

TRANSMIT	FILE UTILITIES	CONFIGURATION	STATUS
<pre> TASK #10 filename : A:\MESSAGE4 destination : 849861 port : BOARD[1]-PORT[A] transmit time : 86/09/02 00:00:01 to 86/09/02 12:00:00 username : MASTER retries : 0 status : ACTIVE </pre>			

Use cursor keys to move through the queue then use the following keys.	PRES. FILE MESSAGE4
A - activate entry H - hold entry	PRES. AREA A:\
D - delete entry ESC - quit	BOOT. AREA A:\
	DATE & TIME 01/09/86 18:31:32

Top: Procom 20 uses pull-down menus to show the available options; this is the full set.
Above: The transmit queue shows the status of pending jobs. Procom will wait until after midnight to send this message.

THE LIMITATIONS OF TELEX

Because of its antiquity, the telex system has several limitations which Procom cannot do anything about. It is slow, because it was originally designed to work with unbuffered electro-mechanical teleprinters. Telex operates at 50 baud, which works out at about only 60 words a minute. It cannot handle lower-case letters: messages can consist only of upper-case text and numbers.

Telex has only rudimentary error checking. The network pre-dates the widespread use of techniques like check digits or parity checking. Instead it relies on the use of an answerback code for both error detection and security. The answerback is the alphabetic code up to six letters long often found printed on things like company letterheads next to the telex number. A complete telex address might be something like

892084 BISPRS G

where the figures are the actual telex number, BISPRS the answerback, and G the area code. When you apply for a telex line BT assigns you a telex number but asks you to suggest your own unique answerback.

The answerback is not part of the telex number, but it is used at the beginning and end of every telex transmission. As soon as the calling machine establishes contact, it briefly hands over control to the answering machine, which then transmits its answerback. This lets the calling machine check whether it has got through to the right telex user before transmitting the message. At the end of the call the sending machine hands over control again and asks for the answerback. If the correct reply is received then at least you know the two machines are still connected.

As a method of error checking this is crude to say the least, but telex is probably more secure than some of the more modern mailbox systems. It relies on a direct point-to-point link between subscribers in the same way as a simple telephone call, so there is no mailbox for hackers to get at.

SPECIFICATION

Description: IBM-compatible board providing send-and-receive telex function

Hardware required: IBM PC, PC/AT or compatible; BT telex line

Modem: built-in telex modem

Processing: 8D64B single-chip processor and 64K of RAM

Printing: on-board printer port lets you use additional printer for telex

Expansion: serial expansion port

Price: £850 for standard Procom 20 card with telex-management software and cable

Options: facility for second PC to plug into same Procom board, £250; connection of second telex line via external modem, £595; additional port for standard telephone modem, £250; direct connection to PSS X-25 data line, £595

Manufacturer: Communicate Ltd, London Road, Sunninghill, Berkshire SL5 0PH. Telephone: (0990) 291294

Available: as soon as BT approval received

expansion connector. If you connect an additional printer to the port you can get Procom 20 to print incoming telexes immediately, even if you are using your main system printer for something else. The expansion port is for forthcoming products from Communicate.

Documentation takes the form of a slim reference manual. It is printed in tiny type but it is straightforward and understandable. It explains both telex itself and how to use Procom 20.

The Procom software comes on a single disc and is not copy protected. The opening screen asks you for your password. Procom divides users into two categories: the system master, who has access to all Procom facilities, and other users who can be denied the use of certain options such as viewing incoming messages by the system master. Each user can have his or her own password. This is useful because Procom keeps track of system use and will produce a report breaking down cost by user.

Most Procom activities take place from a single control screen which has a range of pull-down menus along the top. To create a message, for instance, you select Edit from the file utilities menu, while to send it you choose Send Telex from the transmit menu.

Procom comes with a simple line editor, but you can also set up the system so that selecting Edit will invoke your normal word processor. You can then use WordStar or

Multimate, for example, to create your message text. Procom automatically converts the file to telex format at the time you send the message.

Once you have created your message you can go on to select Send Telex from the transmit menu. At this point you type in a telex number, or you can hit Return to call up a directory of names and numbers. You could also type in the name of a file containing a whole batch of names; Procom will then telex them all automatically.

TIME WINDOW

You are then asked when you want the telex sent. You can just hit Return to send the message as soon as possible or enter a start and end time. One reason you may want to use this Time Window feature is to save money, as many international calls are cheaper if sent from the U.K. in the early morning. Another reason is security. Many older telex machines do not have Procom's ability to store incoming telexes, and you may not want to send a confidential telex until you know the right person will be around to receive it.

Having told Procom to send a message you can exit the comms application and go back to the MS-DOS prompt. You can then use your micro in the normal way with Procom running in background mode, dispatching messages as and when required.

Procom will also receive incoming messages in background mode, storing them automatically as disc files. You can opt to have incoming messages printed as they arrive if you wish. Procom works satisfactorily on a floppy-based IBM-compatible system, but if you anticipate a large volume of incoming traffic a hard disc is advisable.

Procom alerts you to incoming telexes by

displaying a flashing message over your foreground application. At some convenient time you can run Procom comms application and select the activity log. This details incoming messages, which are stored as straightforward ASCII text files. You can then print them out with Procom or a word processor, or in some other way.

The activity log, which is reached from the Status menu, also keeps details of outgoing calls. Procom comes with a utility to analyse them. This produces a cost breakdown showing user, destination and date. The analysis utility comes set up with the most common telex prices, but you can update it to take account of the pattern of your own telex traffic and changing tariff details.

As well as appealing to existing telex owners Procom 20 could tap the market of telex users who currently go through a commercial bureau or an intermediary such as Telecom Gold. According to Communicate the break-even point comes at quite a low level of telex usage — around 40 telexes a month for destinations in the U.K., Europe and the U.S., for example.

CONCLUSIONS

■ Procom 20 achieves an important price breakthrough; it puts the cost of a full telex facility within the reach of most businesses. It may encourage people using telex bureaux to bring this work in-house.

■ The main advantages the Procom/PC combination has over non-computerised telex equipment are its ability to send telexes at cheap rates unattended, to store incoming messages for later printing, and to produce a printed breakdown of telex costs.

■ The telex system itself has many limitations which restrict its usefulness. It is best suited for sending short text messages.



CRYSTAL NOT BRAINY BUT BEAUTIFUL

By Susan Curran

This friendly package could make expert-system building an everyday office activity rather than a job for specialists.

An expert system fundamentally makes decisions from the facts which it is given. It can do this in either or both of two ways. The first is the simplest: the system is programmed with a set of linked If-Then rules and works through them, categorising the particular situation that is presented to it.

The second way is more complex. The system may be presented with a database of previous experiences from which it learns how to categorise situations. On this basis it attempts to categorise new examples itself. A complex system may be able to learn continually from its mistakes, just as human experts correct their verdicts and reassess their rules. This process of induction involves intelligence in a very real sense.

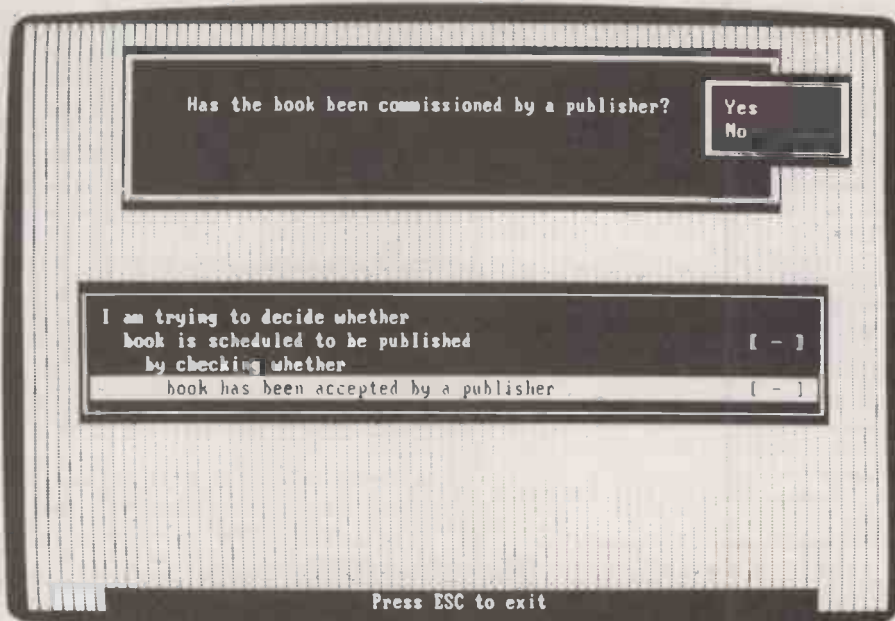
Crystal is an expert-system builder that generates systems which work primarily in the first way. They are very neat and they can be very useful, but neither they nor Crystal itself perform any induction. Crystal has more than its authors might care to admit in common with well-established authoring programs, but it is not a frontier-busting AI product.

Most expert-system builders are large, complicated and unfriendly. Crystal is unusual in the sense that it makes expert-system building a much more user-friendly process than it has even been before. It is as neat and friendly as a word processor or spreadsheet; much more so than the average database. It is moderately priced, and it runs on a PC or compatible with as little as 256K of memory. It could become the first mass-market expert-system builder — a basic tool for use in every office.

UTILITIES DISC

I tested a pre-release version of the program on an IBM PC/XT, but it should run on all close PC-compatibles as well as the AT. It works with or without colour and fancy graphics, and comes on two unprotected discs: a program disc which contains Crystal itself and a few small sample knowledge bases, and a utilities disc which contains various interfacing oddments and the like, including the code for interfacing with Lotus 1-2-3.

Crystal starts with pretty graphics and



CRYSTAL				
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 type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

A very well-designed product that could establish a new category in personal-computer software.

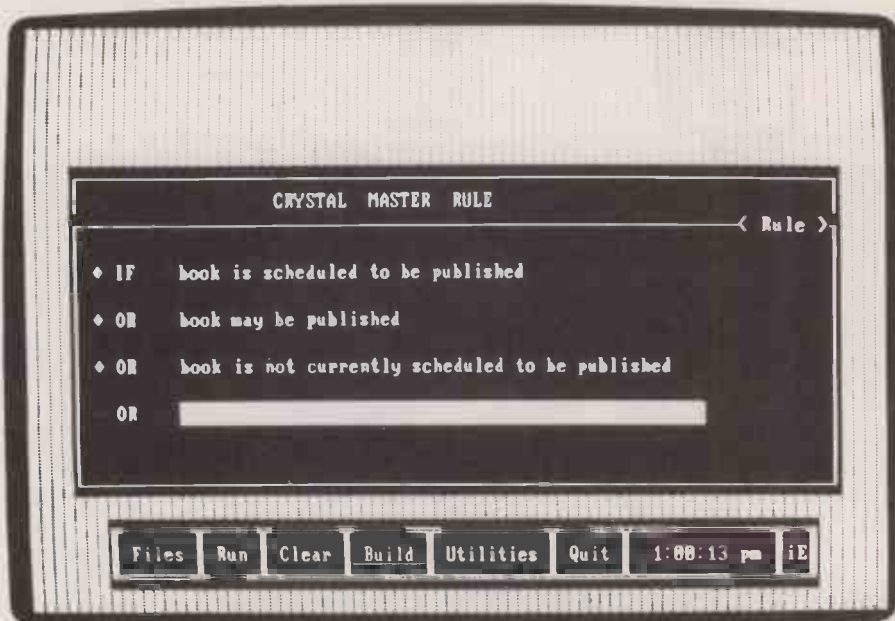
then leads into a neat bottom-of-screen menu. All choices can be made either with the cursor keys or by selecting the first letter. These initial menu choices enable you to choose between building or revising an expert system and running one. Crystal can also produce turnkey expert systems that are not open to amendment by end-users. There are also various utility choices.

A finished Crystal system asks the user a series of questions which can be answered in yes/no fashion, in numeric fashion, by selecting a choice from a menu or by typing in a string of data. Questions can be carefully worded and neatly presented on-screen. You can incorporate help screens at any stage, and give the user access to the program's decision structure.

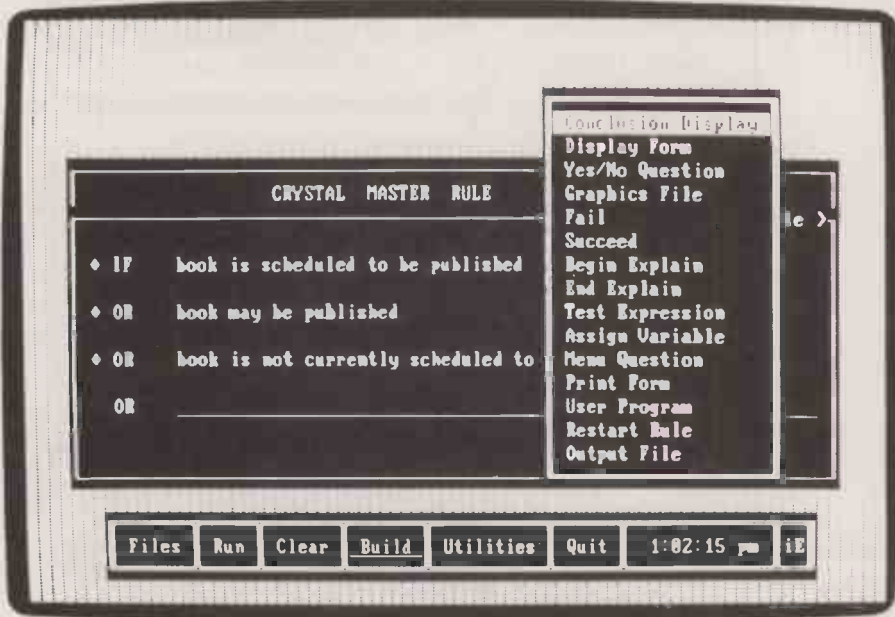
Crystal can grab both graphics and text screens from disc, including screens that have been prepared using other programs. There are interfaces to Lotus 1-2-3 and dBase as well as for ASCII files, so you could grab screens from word processors, for example. The end-user could use Crystal to gain full access to information that is required on a particular situation or problem. Alternatively the system itself could provide explanations of the type of input needed.

Writing a knowledge base from scratch obviously requires some effort, but with Crystal it is a remarkably painless operation. It is possible to produce a very simple system in an hour or two at most. The example screens illustrating this review are from a knowledge base I wrote myself on submitting a manuscript for publication. It took me an afternoon to familiarise myself with Crystal and produce a simple version; less than a day to produce a neat and reasonably foolproof system which would work in real life. Crystal systems are extendable, so it is possible to start with a simple knowledge base and extend it later.

Writing a large system is inevitably a much more demanding business which requires careful planning if it is to work well and consistently. Crystal provides a reasonable amount of help for this task. Rules once created are stored in a rule dictionary which can be searched through. When the rules are reapplied in other contexts they can be taken straight from the



When building a Crystal knowledge base you start by defining your goals (above), known as Crystal Master Rules. From a pull-down menu (below) you can then select instructions for the program to act on when a goal has been achieved. The finished system (opposite) keeps the user informed about decisions it makes.



dictionary without retyping. The system validates rules only once on each run unless you specifically decide to the contrary. Reapplied rules are normally linked, so when a change is made to the rule in one context it is a simple matter to check out all the other contexts in which it appears.

SPECIFICATION

Description: expert-system builder working on a rule basis
Hardware required: IBM PC, PC/AT or compatible with at least 256K RAM
Copy protection: none
Price: £695
Supplier: Intelligent Environments Ltd, 20 Crown Passage, London SW1Y 6PP. Telephone: 01-930 2967
Available: now

Crystal works with a goal paradigm. You start with one goal, or a set of alternative goals, which are known as the Crystal Master Rule. The system then attempts to satisfy the goals in the strict order in which they are given. In my sample system the goals I selected were:

- Book will be Published
- or
- Book may be Published
- or
- Book is not Currently Scheduled for publication

At first this seems a rather back-to-front way of working. You do not start with the first question you want the system to answer but with a prime goal you want it to satisfy. You must order goals very carefully to end up with a suitable order in which questions are asked. It helps that unless you specify a rule

as a special rule, questions are not asked again if they recur.

Crystal goals and lower-level rules are validated or invalidated by working through sets of And/Or conditions which can be combined and nested. In my system I determined that the goal Book may be Published would be satisfied

- If book has been submitted direct to publisher And book has submitted to five or less publishers
- Or Not book has been submitted direct to publisher And book has been submitted to an agent And agent has accepted book and submitted to publisher

If either of these sets of conditions are met the system ends with a suitable conclusion display; if they are not, it passes down the list and attempts to satisfy the next goal in the hierarchy, in this case Book is not Scheduled for Publication.

Features such as explanation screens are programmed in as goals which always succeed. User input can be tested to determine if a goal succeeds and any goal can be made to succeed automatically. Goals can also be failed, but the program then works up one level only; there is no easy way of failing a goal and then terminating the search. Crystal has the very useful capability to merge two existing rule bases, producing a combined system.

LEARNS FROM EXPERIENCE

The system can handle both numeric and text variables, which can be assigned values within the program or have values input by the user. With careful programming it would be possible to use this capability to produce a Crystal system which learned from prior experience. But Crystal does not have any in-built induction mechanisms; they would all need to be programmed by the user.

There is proper floating-point numeric capability, and there are a good range of mathematical functions, including Bayesian probability, present value, interest rate, depreciation and other financial functions. Crystal can also handle user functions written in C.

Pages from Crystal can be printed out. Printer support is fairly basic but does stretch to a variable definition of page length. Pages can also be sent to disc files where they could, for example, be taken up by a word processor.

CONCLUSIONS

- Just about any business could find some use for simple rule-based systems, and with Crystal somebody in just about any office could write them.
- Crystal lacks inductive intelligence, but concentrates instead on offering a well-designed front end.
- The program's capabilities are well chosen and will be perfectly sufficient for thousands of useful real-life applications.
- Crystal's usability should find it a market that more ambitious and harder to use expert-system builders simply cannot penetrate at the moment. It is sufficiently competitively priced to sell extremely well.

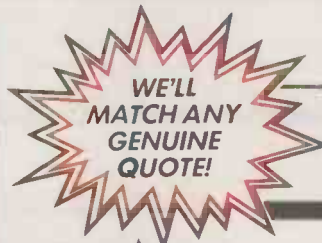
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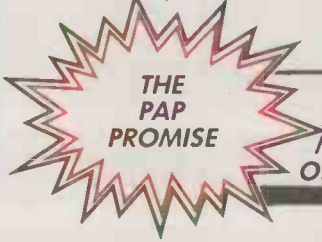
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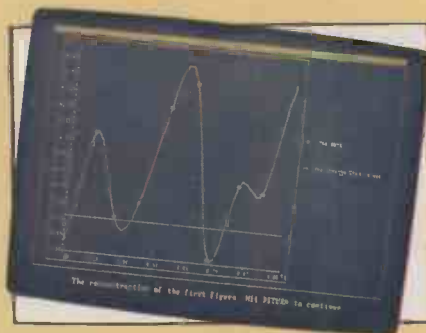
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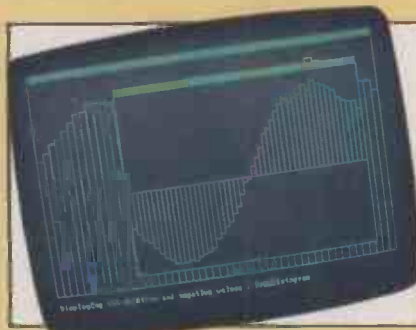
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Software

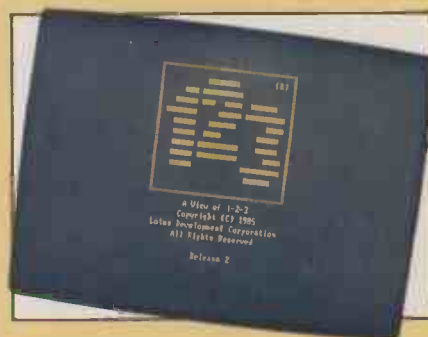
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Includes TAS-Plus developer and supports DOS 3.1 NETBIOS file and record locking.

SYSTEM REQUIREMENTS

TAS-Plus runs on IBM PC, XT, AT and all true compatibles. It requires at least two floppy discs and a minimum of 384KB RAM. The current TAS Level-1 product is available for CP/M and non-IBM compatible MS-DOS systems (including Apricot) for £199.

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CONCURRENT PC-DOS XM

FOUR INTO ONE WILL GO

By Steve Malone

Digital Research's latest multi-tasking operating system gives up to four simultaneous users a realistic amount of memory space to run MS-DOS software on a PC equipped with expanded memory.

After months of speculation Digital Research has finally released the expanded-memory version of Concurrent DOS. The new version, known as Concurrent PC-DOS XM — or CDOS XM for short — is intended to provide a multi-user multi-tasking environment within a single PC which enables up to four users, each with 384K of dedicated memory, to share the processor.

Although Digital Research has had versions of CDOS around for some time it has been hampered by the 640K limit imposed by the IBM. Once you have subtracted the memory required for the operating system itself, the remaining free memory left to each of the four users is impossibly small for today's programs.

The introduction of bank-switching techniques seemed to provide a way out. However, the original bank-switching system, the Lotus/Intel/Microsoft Expanded Memory Specification, proved inadequate for multi-user systems since it only supported a single 64K window through which expanded memory could be banked. This is sufficient for holding data but is far too small to hold an application program, effectively ruling out the possibility of having multiple users each with their own programs held in bank-switched

memory. The situation changed when board manufacturers AST and Interquadram got together with software house Ashton-Tate and came up with the Enhanced Expanded Memory Specification (EEMS) which allows multiple windows for bank switching.

Concurrent PC-DOS XM works by reserving the bottom 256K of RAM to itself. The remaining 384K of user RAM is configured as a memory bank. DR says that the top 384K of user memory should be supplied by the expanded memory board, even if this means disabling the computer's system memory above 256K. Provided that your expanded memory board is sufficiently populated this should allow each of the four

tasks available. The ability to switch between different applications at the press of a button seems almost magical at first.

The default parameters of CDOS suspend background processes when you switch to another window. This is rectified by issuing the command

SUSPEND=OFF

from the DOS screen, which activates the time slicing. Why DR did this is a mystery as most users will wish to run concurrent programs; with the default settings all you end up with is a glorified switcher.

To be able to use the expanded memory effectively you have to issue the Scepter command, which initialises the memory-management routines used to support CDOS. Without it you are in fact only running programs in the 640K area.

Most MS-DOS software that we tried running under CDOS worked happily; the only exceptions were memory-resident or pop-up programs. Digital Research says it has cracked the problem of running memory-resident programs with its versions of DOS, so future versions of Concurrent DOS XM should be able to support them.

With four applications running concurrently there is a noticeable degradation in performance. This is especially true with processor-intensive activities running on an 8088-based PC, but that is only to be expected. With a more powerful system such as an AT delays should be reduced considerably. It is unlikely that many people will seriously consider running a multi-user system on a standard PC, and Interquadram says that an AT version of the Quad EMS+ card will be available this year.

Concurrent PC-DOS XM is obviously the product that manufacturers of multi-user systems based around the IBM standard have been waiting for. It will also be an invaluable tool for power users who wish to run several large tasks in parallel.

CONCLUSIONS

■ Concurrent PC-DOS XM is an easy-to-use multi-tasking multi-user MS-DOS compatible operating system which takes advantage of the additional memory available with bank-switching techniques.

■ Up to four users or windows can run different applications independently of one another.

■ The present PC version produces a noticeably slower performance, particularly when running processor-intensive operations.

■ Digital Research has come up with a product which will at last give Microsoft a run for its money.



CONCURRENT PC-DOS XM

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 type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

The DOS we've all been waiting for.

users supported by CDOS XM to have 384K reserved exclusively to themselves.

Users are given access to the processor on a time-slicing basis. Each 1/60th of a second CDOS XM switches out the current user and switches the next one in. In theory this means that it appears that each user has sole access to the processor, but in practice there is an unavoidable delay while the processor performs the necessary operations to switch the banks in and out of accessible memory.

At present the only version of Concurrent PC-DOS XM is that bundled with the Interquadram EMS+ board; it does not work with other boards even if they conform to the EEMS standard. Other versions of PC-DOS XM should be available soon which will work with the AST Rampage.

Each of the four possible CDOS users is assigned a window. At the bottom is a command line which shows the printer allocation and what applications are running in each window. Individual windows are selected by pressing Ctrl and keys 1 to 4 on the numeric pad. If there is only one user on the system you can use all four windows to have one foreground and three background

SPECIFICATION

Description: A multi-user multi-tasking operating system for the IBM PC and compatibles

Hardware required: IBM PC or compatible fitted with expanded memory board conforming to the EEMS standard

Price: £295; available bundled with the 512K Interquadram Quad EMS+ card at £425, or £585 with the 1Mbyte version

Copy protection: none

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

Available: now

FONTASY

VERY PERSONAL PUBLISHING

By Steve Malone

To convert your PC into a full-blown desk-top publishing setup costs thousands of pounds. But if your needs are more modest this package could set you on your way for a fraction of the price.

Although personal or desk-top publishing for all is still waiting for the price of laser printers to fall below £1,000, there is a general movement towards providing the software. For this application the IBM PC has distinct disadvantages compared with the Macintosh, but that has not stopped people from trying to make a silk purse out of a sow's ear.

Fontasy from Prosoft is designed to put low-cost fount and drawing capabilities within the reach of the budget-conscious user. It makes no pretence to be a fully fledged desk-top publishing program, but at a price of only £70 the package is in a position to make large sales as the low-cost clones make headway.

The program supports both IBM colour graphics and the Hercules monochrome card. You choose the display during installation, so it cannot be swapped while the program is running. The Install program customises the file Fy.Def to the user's chosen printer and display, and according to whether or not the hardware supports a mouse. Prosoft also gives easy-to-understand details on how to install the program by hand and customise the Fy.Def file with Edlin. Such openness makes a refreshing change from the near paranoid secretiveness of many software houses.

Fontasy has 29 founts available, ranging from standard typewriter style to the stars and stripes design known as July 4. They fall into two broad categories: the small founts

which are acceptable for extensive text, and the larger display founts. Many of the latter seem more suitable for poster and banner applications than office documents — they are more fun typefaces than serious ones.

Characters can be positioned anywhere on the screen. The text cursor can be moved either via the cursor cluster or with a Microsoft Mouse or compatible. Both methods have their advantages, but for simple cursor positioning the mouse is much quicker. The default for the cursor cluster moves the cursor pixel by pixel horizontally and line by

and f10 keys emulate the mouse-button controls to fix characters in position. Function keys are also used for a number of other general utilities. Thus f1 shows the status screen, which gives you among other things an overall picture of the document currently being edited, the current fount and the exact position of the cursor.

The range of founts and a number of other features of the program are accessed via a command line, which is displayed at the bottom of the screen when you press Escape. The two-letter commands entered at the line cover a range of functions, including disc access, justification, wordwrap and printing.

Several miscellaneous commands that are also accessible via Escape allow you to change the on-screen foreground colour, switch the mouse on and off and assign new commands to the soft keys. One interesting feature of the miscellaneous commands is the ability to change between one of three available work pages. Swapping between them enables you to work on three different documents at once, or more practically to load different documents into each of the windows so that you can move designs and text between them.

In addition to these general functions, the Escape commands can alter the size of the fount both on-screen and as characters are sent to the printer. The magnification, as it is known, can be up to 100 pixels in size, or half the height of the screen.

ON-SCREEN MANIPULATION

Fontasy's on-screen tricks include the ability to set a block area of the screen and move or copy it elsewhere, which is particularly useful when manipulating drawn figures. The block movements are accessed via a combination of function and Alt-character commands. As well as the usual move and copy functions they include facilities for producing mirror images, inverting the foreground and background colours within the block, or turning it upside down.

One important feature of packages which aspire to being a useful publishing tool is the ability to create and store reusable templates. The template options allow users to set the margins at all four edges of the page, and perhaps more importantly to set the number of columns on the page. Once the template has been set it is possible to import



line in the vertical direction. To move by larger increments you have to use a range of control keys, and they take a while to learn. Pressing Ctrl with the cursor keys takes you to the left or right margin or to the top or bottom of the page.

Other cursor movements are controlled by a series of Alt-character keys, which also support insertion and deletion functions. Commands like deleting the current line are important, as the normal destructive backspace works rather peculiarly with Fontasy. Should you make a mistake while typing, like transposing two letters, Fontasy allows the destructive backspace to delete the first character, but then only deletes a single pixel column at a time. Fontasy often fails to delete the whole of the character when you expect it to because deletion only takes place underneath the cursor. As the characters are often larger than the cursor you may have to delete up to three times before a character is entirely wiped from the screen.

The function keys can be used to multiply the speed at which the cursor moves. The f9

SPECIFICATION

Description: text-formatting, design and drawing package

Hardware required: IBM PC, PC/AT or compatible with at least 256K of RAM for partial images, 448K to 640K for full-page images and 640K for full magnification and full-page composition; printers supported include Epson, C. Itoh, Star, Tandy, IBM and Oki dot-matrix models, and HP Thinkjet and Laserjet

Copy protection: none

Price: £70

Publisher: Prosoft of North Hollywood, California

U.K. supplier: Ctrl Alt Deli, 44 Brownbaker Court, Neath Hill, Milton Keynes MK14 6JH. Telephone: (0908) 662759

Available: now.

text from an ASCII file. The difficulty here is that many word-processing packages do not use the pure ASCII format, and tend to use non-standard characters for paragraph breaks and spaces, although they can usually generate ASCII files if asked.

Prosoft recommends that the best package to use with Fantasy is Borland's Sidekick. Using Sidekick as a text processor gives the user several advantages. First, the Sidekick notepad supplies text in pure ASCII format, so the document is not cluttered with obscure Escape codes and can be used directly by Fantasy. Secondly, Sidekick is able to import and export data simply and easily to and from a main application. Finally, the fact that Sidekick is a pop-up program means that you can write text on the Sidekick notepad without quitting Fantasy.

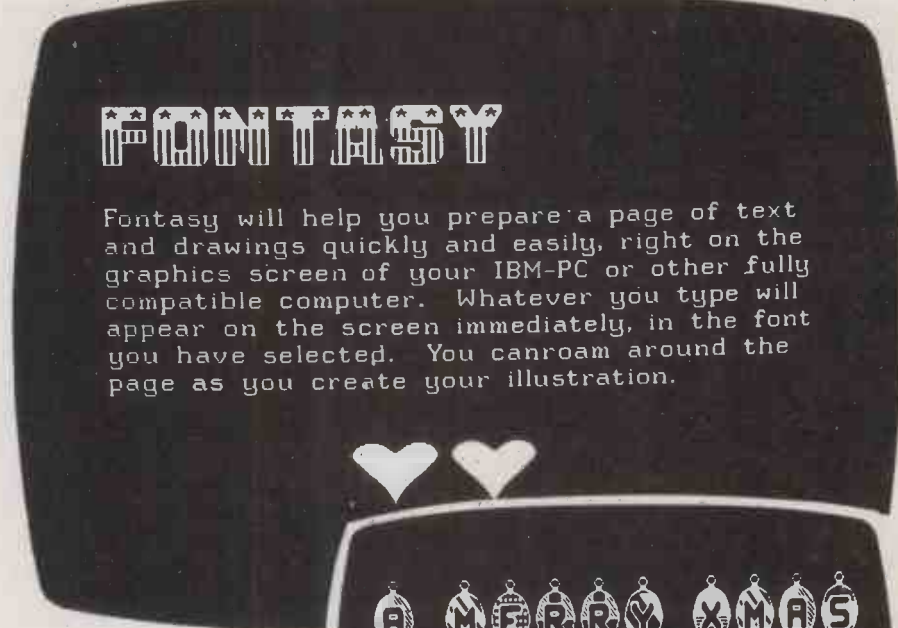
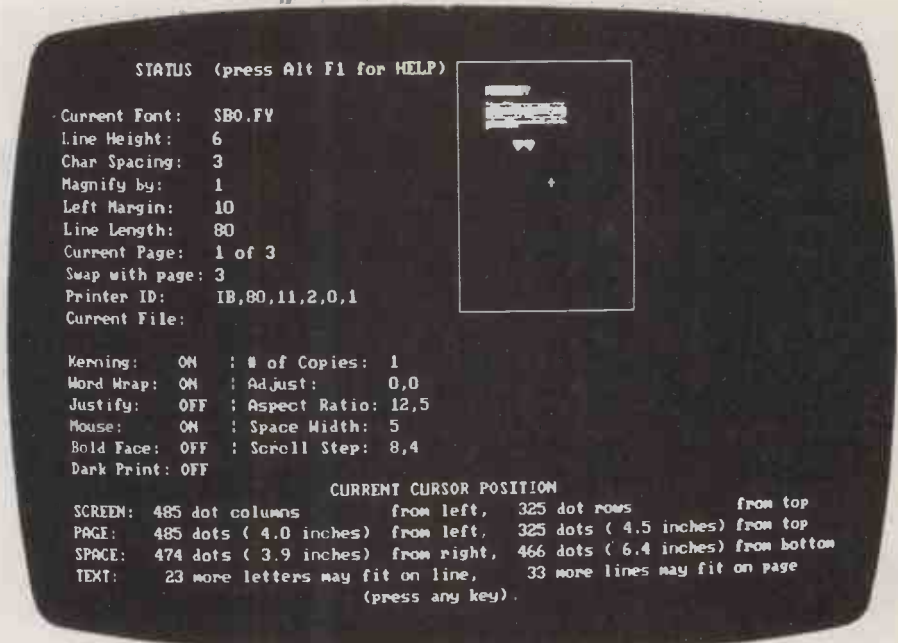
USER-DESIGNED FONTS

Should you be dissatisfied with the founts Fantasy provides it has facilities that you can use to create your own. This is done via the Letterset Design System supplied on the Fantasy Toolkit, which is sold separately. You can also buy a range of discs with additional founts and designs.

Manipulation of founts is the major part of Fantasy, but the program also supports a basic drawing facility. Like text entry, drawing can be controlled either by the cursor cluster or the mouse. In Freehand mode the cursor keys have the advantage over the mouse, which is just too fast for the program to manage. Holding down the mouse button while making a broad sweep should produce an elegant curve on the screen, but what you get is a series of scattered dots. The cursor keys are much slower, giving the program time to set the pixels on the screen and so produce a continuous line. The height and thickness of the cursor line can be adjusted.

Like most simple drawing packages, Fantasy allows you to create rubber-band lines, circles and ovals. Once created, closed shapes can be filled with one of 95 patterns supplied with the program. To get you on your way with on-screen graphics, the program has a number of small icons and other designs known collectively as Clip Art. Some of them are designed to be strung together to create a frieze or border around your documents. There is also a set of small pictures or icons — things like eagles, harps, doves and sailing ships — which struck us as looking remarkably like designs for tattoos.

Fantasy is not a serious desk-top pub-



Top: The Status screen shows the cursor position and text-format settings as well as a schematic view of your page. Above: Typefaces appear on-screen as they are printed out.

Right: Some of Fantasy's typefaces would be totally out of place in an office document.

lishing system, but it would be perfectly suitable for clubs and other small organisations that wish to distribute fairly informal notices and publicity material. On the whole the program is remarkably easy to use, though the numerous key combinations which are implemented take a while to master. Prosoft has supplied a keyboard guide, a quick-reference summary and an easy-to-understand manual in a laudable — and mainly successful — effort to make the system easy to learn.

CONCLUSIONS

■ Fantasy is a fun program which allows the user to create documents with a wide range of founts and designs.

■ It is simple to use and easy to learn. For once a program seems to have been written with the end-user in mind.

■ The quality of the on-screen and printed displays is as good as anything to be seen on the IBM PC, although the program itself lacks some of the finish that would make it a true personal-publishing program. But at the price you can hardly complain. **PC**

HIGH-TECH HEISTS

Carol Hammond reports on how new technology has opened up new opportunities for the criminally inclined.

Computer crime has hit the headlines in recent months. Both the *Daily Mail* and the *Financial Times* have carried front-page stories of computer fraud. But whether such attention indicates a sudden surge of computer-related crimes is unclear, not least because the definition of computer crime itself is hazy.

It could be that the media have just caught on to a good thing. Computer crime provides interesting news with a number of attention-grabbing ingredients: the glamorous world of high-tech; young, whizz-kid hackers; and large sums of money. Moreover, the victim is usually a rich organisation rather than a defenceless old lady, so nobody minds too much.

But despite this surge of media interest it is difficult to get hard facts about just how much computer crime is being committed. Computer crime can take many forms, and its victims are often reluctant to report it. The security consultant for PA Computers and Communications, Peter Jenner, estimates that computer owners in Britain lose between £500 million and £2.5 billion a year to those who have manipulated computerised systems for gain. Ken Wong of BIS Applied Systems' security and privacy division estimates that the annual total loss is at least £25 million.

WORTH THE RISK?

Banks and financial institutions are most at risk, particularly when it comes to electronic funds transfer (EFT). Although EFT accounts for only two percent of the volume of money transactions, it represents 83 percent of their value. Anyone who gets hold of the correct password could gain access to external networks and authorise a payment, possibly running into millions of pounds. With such large sums of money at stake the risk is often worth taking.

Over 60 percent of computer crime involves sending false data to a computer system or suppressing bona fide data. Someone familiar with a company's computer system could, say, resurrect an old account and spend on it, or create a fictitious supplier whose cheques can then be intercepted. Embezzlement of this kind was taking place long before computers were

around, but white-collar crime is on the increase, and people who might in the past have been cooking the books are now cooking the computer instead.

Proper management checks are an important safeguard, though monitoring computer staff can be more difficult than keeping track of employees in other areas. For one thing staff turnover in this field can be as high as 25 percent. Senior management may also be ignorant about computers, and therefore entrust their operation to a few key personnel.

Computer crime is usually harder to detect than traditional theft. If a thief has a key to your house it may be a while before you realise that the jewellery tucked away in the bottom drawer has gone. If the burglar has had to break locks, smash a window and overcome a guard dog it is immediately obvious that a crime has been committed. Computer criminals are more like the thief with a key than the smash-and-grab raider.

Often companies do not even realise they are vulnerable. The accountancy firm Ernst and Whinney has published a survey called *Attitudes of Companies in Britain to Fraud*. Of 401 companies interviewed, 56 percent admitted that they had experienced fraud or felt they could be vulnerable to it in the near future. Only three percent identified their computer system as a specific area which might be vulnerable.

In a follow-up investigation respondents were asked to reconsider their position, given that management consultants believe computer fraud can pose a serious problem for many companies. The majority still believed themselves safe from computer fraud, though one in three now felt their

systems might be at risk. It is not only a company's money that is vulnerable to computer crime. Designs for new products, financial information and personnel data are all routinely stored electronically.

Systems are at risk from the disgruntled and the merely curious as well as from those seeking personal gain. A programmer with a grudge, for example, could plant a logic bomb in a computer system. At its least harmful it could take the form of a rude message that appears at a pre-determined time, probably when the employee concerned is safe in another job; at worst it could crash the system or destroy irreplaceable data. Malicious damage of this kind can cause serious disruption to a company's business, particularly in organisations that rely on computer systems to provide up-to-the-minute information.

TERRORISM

The activities of hackers have been widely publicised, particularly in the U.S. Many of them are teenage computer enthusiasts who break into systems as a challenge rather than to cause any wilful damage. Although they may not cause as much harm as the disaffected employee, it is clearly not acceptable for an inquisitive onlooker to be browsing through personal files, medical records and suchlike. Hackers have penetrated systems owned by NASA and British Telecom. If such skills are ever acquired by terrorist organisations or organised crime, then far more damage could be done.

People can hack a system in a number of ways. They may have some limited authorised access to a system but be able to penetrate it further by avoiding security checks. One easy method is to get hold of someone else's password. People are often terribly lax about leaving their passwords lying around. It is also often true that an easily remembered password can also be easily guessed. It is even possible to examine data by tapping a system's communications lines, monitoring radiation from parts of the system, stealing tapes or discs containing information, or just by reading someone else's printout.

A plethora of security gadgets have arisen,

Although they may not cause financial damage, it is clearly not acceptable for inquisitive onlookers to browse through personal files, medical records and suchlike.



KEVIN FAERBER

ranging from shredders to encryption devices. User-authentication products can identify users by voice prints, retinal patterns, handwritten signatures, fingerprints, handprints and even the bumps on the head. Stray radiation that could give the game away to someone listening in can be suppressed by enclosing the whole installation in a wire grid or Faraday cage.

Even if you know that a particular individual has hacked your system it may be difficult to prosecute them. The courts will convict if they can be shown to have stolen a floppy disc, but the information contained on it is a more nebulous entity. Data may be regarded as intellectual property, and as such it is difficult to value its worth. It is impossible in law to steal an idea.

One of the problems faced by those responsible for stamping out computer crime is

that few cases are reported. Banks and other large financial organisations are reluctant to report computer fraud because such incidents cast an unflattering light on their security. In some cases they are even willing to pay those who have committed the crime, or at least agree not to hand them over to the police, in return for information on how to prevent it happening again. In Britain there is no specific legal obligation to report a computer-related fraud.

The Metropolitan and City Police company fraud department has set up a special unit, known as C6, to deal with computer-related fraud. Its officers are trained in appropriate methods of detection and of preserving evidence. Detective Sergeant Barry Donovan of C6 does not


Banks and other financial institutions are reluctant to report computer fraud because such incidents cast an unflattering light on their security.

believe that there is the problem with computer fraud that the press tries to make out. He subscribes to the view that the current scare may have arisen partly because computer crime makes for glamorous news. It also appears that more crimes may be being reported as companies realise there is a unit that can cope with such problems.

While recognising that the law has yet to catch up with the age of computers, Donovan finds that most computer-related crime can be dealt with under existing legislation. There is plenty of provision within the law to cover ordinary fraud; damage to property is covered by the 1971 Criminal Damage Act; unauthorised access to a system comes within the scope of the 1981 Forgery and Counterfeiting Act; and a recent amendment to the 1956 Copyright Act has brought computer software into line with books, records and videos, making it a criminal offence to reproduce without authority copyrighted information held on disc or tape. The situation is more tricky where information can be defined as intellectual property, as it is not covered under the Theft Act.

Someone who takes a less sanguine view is Keith Jones of GHC Financial Institutions Insurance Services. On the basis of his experience as a broker handling the Lloyd's Electronic and Computer Crime Policy (LECCP) he believes that the recent front-page stories are just the tip of the iceberg.

The LECCP provides protection against certain computer-related crime above what is traditionally provided in the Banker's Blanket Bond. The policy was first introduced by Lloyd's in 1981 but it was only in 1984 that the concept of computer fraud began to be accepted by financial institution as a potential threat.

Jones is convinced that computer frauds are on the increase, and compares computer fraud to credit-card fraud. Eight years ago credit-card fraud was rare in the U.K.; now it is commonplace and losses are high. But whether he is right, or whether computer crime is just flavour of the month with the media, it seems inevitable that we will be hearing a lot more about it as legislation and detection methods improve and computers become more widespread. 

BUYER BEWARE

Anne Staines explains what you are actually entitled to when you part with your money in exchange for a commercial software package.

If you have spent several hundred pounds on a new program you expect it to perform all the tasks for which you bought it and to live up to all its advertising claims — in short, you want as much for your money as you can get. But imagine you are a producer of software. You are under constant pressure to maximise your profits, invent new and better programs, and protect and expand your sector of the market. Above all, you must avoid arguments with your program's users and the time-consuming and expensive prospect of being sued by a dissatisfied customer.

There is nothing new here. Consumers and producers of virtually any product must come to a compromise in order to achieve a sale. The consumer will appreciate that for £400 you can't expect the earth. Equally the producer will realise that if you charge £400 for a program you cannot completely deny responsibility for any and all shortcomings. The mechanism which effects this compromise is the contract between the parties, which sets out the terms on which they have agreed to deal.

A contract is all about agreement or, in lawyers' jargon, "consensus". Contrary to popular belief, an agreement does not, in most cases, have to be written in order to be binding. The reason why programs are invariably accompanied by vast amounts of small print is convenience. Where there are a number of conditions, both parties have the opportunity to read, understand and agree to them.

In an increasing number of cases, software producers are attempting to saddle users with terms which reduce the concept of mutual agreement to pure farce. The use of so-called exclusion clauses is one example. British consumers have greater protection against the take-it-or-leave-it style of dealing than you might suppose. A number of statutory provisions imply into contracts for the sale or supply of goods and services terms designed to protect consumers.

MERCHANTABLE QUALITY

These terms impose a duty to sell or supply only goods that are of "merchantable quality", and which are "fit for the purpose for which goods of that type are commonly bought or supplied". Breach of these implied terms normally entitles the user to a refund. Many lines of small print are invariably devoted — with varying degrees of success — to the purpose of excluding their operation from individual contracts. Whether or not they can be excluded, and to what extent, varies according to the type of user.

In most normal consumer transactions the implied terms cannot be excluded at all.

This is the case where the seller or supplier is acting in the course of a business but the user is not, and has acquired a program of a type ordinarily supplied for private use. Statements such as "X-Soft excludes any and all implied warranties, including warranties of merchantability and fitness for a particular purpose and limits your remedy to return of the software and documentation to X-Soft for replacement" are meaningless and ineffective in this type of contract.

Most users of business software costing several hundred pounds will be using the program in the course of their own business. In this case, liability can be excluded as far as is fair and reasonable. But this does not necessarily apply to all users of such programs. For example, it would be inadvisable to assume that Lotus 1-2-3, dBase III and similar programs are not of a type ordinarily supplied for private use.

FAIR AND REASONABLE

What is covered by the phrase "fair and reasonable" also depends on circumstances. The following are reliable guidelines when deciding whether a particular term in a contract can be enforced.

- What was the relative strength of the parties' bargaining positions? Could the user have ordered the program from another seller, or was the seller able to say "take it or leave it", knowing that the user would have to take it?

- Was the user given an inducement to agree to the term? For instance, would the price have been considerably higher if the term had not been included?

- Did the customer realise that the term existed, or ought the customer reasonably to have realised?

- If the term restricts liability if some condition is not complied with, was it reasonable to expect that the term could be complied with? For instance, it would not be reasonable to exclude liability for faults not communicated to the seller within one day of purchase.

- If the program was specially adapted for the user, to enable it to perform an unusual function, it would be reasonable for the seller to stipulate that no guarantee is provided of the program's suitability for that purpose; this is because the goods are not normally sold for that purpose.

Also growing in popularity is the concept of a limited use licence, as opposed to a straightforward sale. Most users describing the transaction through which they acquired their software will say: "Yesterday I bought such and such." Increasingly they are mistaken. What they have bought is no more than permission to use the program according to the strict terms that the

producer or supplier has laid down. They do not own the program.

Originally this mechanism was introduced as a means of preventing unauthorised copying, but Lotus now suggests it may have a wider influence. Users of Lotus 1-2-3 version 1a are being offered an attractive trade-in deal from Computer Associates, the publisher of Supercalc 4. For only £100 they can acquire the CA program, provided they hand over their copy of Lotus 1-2-3.


Lotus users, however, do not own the software; they have a limited licence which permits use of the program for some purposes and prohibits others. Expressly prohibited are unauthorised copying; distribution, renting, sub-licensing or leasing; and adaptation, alteration or modification. There is no express mention of wiping clean and throwing away, which is presumably the fate in store for Lotus 1-2-3 at the hands of Computer Associates.

It would seem strongly arguable that Lotus's threats to sue users taking advantage of Computer Associates' offer are empty. The crucial catch-all clause in the Lotus licence agreement forbids "any other uses not included in 'Permitted Uses' which would require a license to use the copyright in the software". But copyright relates to taking copies of the intellectual property — that is, the content of the program — not to wiping discs clean.

To be absolutely safe it would seem advisable for Computer Associates to return the clean discs to Lotus, although even that may be unnecessary. In a notable conceptual confusion, the Lotus document refers to "licence" and "sale" in the same breath: "each Lotus product sold is licensed . . ." It would appear that the medium — as opposed to the intellectual property — is the property of the user.

PRESENTATION

A more general problem arises over the way many contracts are presented. It is the essence of any agreement that you cannot agree to terms of which you are ignorant. This does not necessarily mean that you cannot agree to terms which you do not understand. What it does mean is that users who have not had the opportunity to read contractual terms before handing over their money are not bound by them. Many shrink-wrap licences, particularly those printed on the reverse side, are ineffective for that reason.

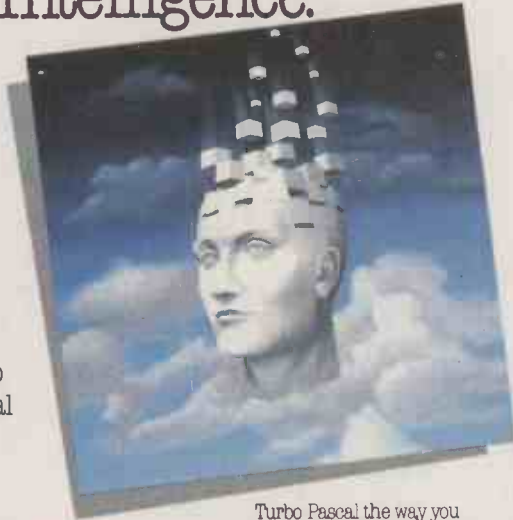
On the whole, contracts in the computer industry are not well drafted. A good contract is a sound investment for a producer. It can even act as a public-relations exercise, while offering perfect security. 

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VALUE ADDED RESELLERS

As the profit margin for standard equipment and applications software shrinks to vanishing point, dealers are turning to tailor-made systems as a way of finding new customers.

Steve Malone looks at what end-users can expect to get from these new-style suppliers.

Among the welter of computer-related jargon that has crossed the Atlantic in the past few years has been the term "value added reseller" (VAR). Already well established in the U.S. — where VARs' turnover has grown from an estimated \$4.09 billion in 1983 to \$13.33 billion in 1985 — the idea has taken root in the U.K. and is beginning to expand.

So what is a value added reseller? Essentially it is a company which takes off-the-shelf hardware and software and customises it to provide a tailored solution for the end-user. When the final product is delivered it has an added value which goes on the bill.

In order to customise the software to the users' demands, the VAR has to become much more involved with the customer, and in effect combines the roles of the consultant and the dealer. Because VARs specialise in tailoring the solution to the needs of the customer they have made the biggest impact where the need for specialised software is greatest — in the area of vertical markets.

The rise of the VAR is the result of changes in the industry. The long-term decline of the traditional computer dealer is in full swing, with many companies either going out of business or retreating from their prestigious High Street showrooms to more modest premises.

The reasons behind the decline are the ferocious price war among PC manufacturers, and the oft-blamed box shifters among dealers themselves. It was inevitable that the business market would become saturated, with the result that a larger number of manufacturers are chasing a dwindling number of customers. Many dealers believed that they could survive by offering support in the form of training and services. However, this proved to be a short-term perspective. A customer might need training and advice when buying a first PC, but not when purchasing the second, third or fourth. Established users will buy on the grounds of price rather than dealer support.

RIISING EXPECTATIONS

Although the general computer dealer looks set to succumb to the High Street chains, there is an expanding market for suppliers of systems and solutions. Many businesses are now familiar with their stand-alone PCs, but networking adds an extra dimension and companies need the services of someone experienced in the field. Also, as people become more used to the computer and what it can do, they begin to realise its potential and the way it can be adapted to suit their company.

There are a number of factors which may tempt a conventional dealer to become a VAR. First and foremost is the prospect of additional revenue. Because its customers

tend to be highly specialised, the VAR can easily become the sole supplier within a particular niche. With little or no competition, the VAR escapes the discounting that is proving so disastrous to the general business dealer. Similarly, the added value part of the package — the customisation of the software — provides the VAR with an additional profit.

Another bonus for the VAR is that of customer loyalty. Obviously if an end-user has a hardware/software configuration which is quite likely unique, it makes sense for the supplier to offer additional services and support. Thus, the VAR obtains long-term maintenance work as well as short-term sales.

Of course, there are complications to being a VAR. To begin with, the balance of the staff has to be altered more towards customer liaison. A typical VAR might have a support staff of eight people and only one person dealing with sales. This is in contrast to dealerships, where the proportions are more likely to be reversed.

Arie Kiselstein of AK Systems, a London-based VAR supplying mainly networked financial services for small- to medium-sized companies, explained: "We start absolutely from scratch by talking to the company about their needs. Programs are developed using the software house's own programming language, and we create the links between packages which automatically import and export data. To provide a system takes a minimum of two months and that's going flat out, with most of that taken up with thought process."

These thought processes involves both parties working out a user requirement survey (URS): assessing the kind of programs required, data format, numbers of potential users, etc., down to the layout of each

screen. The URS may be passed back and forth between the VAR and customer several times before both parties are satisfied with the results.

In return for the extra expenditure the customer receives those services that a VAR goes out to provide: a customised, bug-free, turnkey system and the necessary support and training. Of course, this kind of personal service does not come cheap. One garage manager we spoke to bought a stock-control system from a VAR which consisted of a 30Mbyte AT/X for around £4,000 while the customised software costs around £4,500, including the £800 that was charged for the URS.


Apart from the cost, there are other potential hazards for the customer. What the VAR sees as customer loyalty may look very different from the user's point of view. The VAR might come to regard its user base as a captive audience.

TIED TO YOUR VAR

A VAR specialising in multi-user distributed systems said recently: "Because of the uniqueness of the product, it is difficult for customers to opt out on a personal whim." It seems hard to believe that hard-headed business customers act on personal whim; it is more likely that they feel they can get a better service elsewhere, something that is denied to the VAR customer. There is also, of course, the danger of your VAR going out of business and leaving you stranded.

But there are clear benefits to the customer, apart from having a tailor-made solution. From the start the user develops a closer relationship with the VAR. The supplier, having written some of the software and worked on the installation of the system, is in a much better position to understand the nature and problems of a particular company.

While the outlook for the traditional PC dealer looks bleak, the future of the VAR appears rosy. In fact many of the VARs we spoke to said that theirs was the only future for the computer retailer. The arrival of the Amstrad PC-1512 in the High Street chains is sure to be followed by a spate of cheap software that will take away the bread and butter from specialist dealers. Increasingly the dealer will have to run towards providing a personal service which commodity retailers are unable to supply.

In the future the VAR will be supplying customised software for niche markets rather than selling off-the-shelf packages. There will also be a market for specialists in leading-edge products which have not yet been overtaken by the commodity sellers. If the VAR can keep ahead of the game, it should prove a lucrative business. 



CLEANING UP YOUR A.C.

Mains-borne interference and power failures can play havoc with your computer system. **Martin Eccles** gives a rundown on the numerous devices that are now available to keep computer equipment running, and explains how you can assess whether expensive precautions really are necessary for your setup.

In those far-off times when the miners or the power-station workers habitually brought Britain to a halt at the flick of a switch, electrical power failures were an almost everyday occurrence. Nowadays it is only the occasional equipment breakdown or storm damage that cuts off mains power completely. These risks are relatively slight, but the interference present on almost all mains circuits can still threaten the smooth functioning of your computer system.

Transient interference can be caused by switching a vacuum cleaner on or off, plant switching in a nearby factory, a fault in the mains distribution system, or even a passing vehicle. Interference problems are harder to detect than mains failures, but they are easier to cure. Ideally the interference should be stopped at its source, though this is not always practical. The alternative is to prevent the interference from entering the computer by filtering it out.

Mains-transient suppressors, also called surge suppressors, are small two-legged components that are soldered directly over the live and neutral mains inputs to the computer or peripheral. They absorb transients that cause the mains voltage to rise momentarily above a certain limit, usually about 275V for a 240V supply. I have found them very effective, and they only cost 40p each. The drawback is that they have to be fitted by an expert. A plug with a built-in transient suppressor is available from Farnell for £10.40.

EXPENSIVE FILTERS

Slightly more expensive mains filters work by absorbing any fast change in the mains voltage sine wave, including noise. They are particularly good at reducing radio-frequency interference. In theory they should offer better rejection of mains interference than transient suppressors, though I have always found the cheaper solution more effective. Mains filters can be bought in component form at around £4 for a 1A version. You can buy them built into plugs or plug/sockets for upwards of £10.

Systems running near heavy industrial plant may need what is called a high-isolation or super-isolation transformer. These devices give the best filtering, but they are much more expensive than the previous two solutions. Typical prices for

high-isolation transformers are £115 for 200W output and £195 for 630W output.

If you suspect you have a mains-interference problem it obviously makes sense to start with the simplest filter and work up. Multiple earthing is an unavoidable problem that can increase susceptibility of a computer system to interference problems. If you have a computer, printer, printer buffer and monitor, the chances are that they are all independently earthed. You can minimise the problem by plugging all the equipment into one socket using a distribution box, provided that this does not overload the supply. Avoid switching mains appliances on and off while working on the computer.

SWITCH MODE BETTER

Generally speaking, equipment using switch-mode power supplies will give better resistance to interference than equipment with linear supplies. Switch-mode supplies store more energy, and can often supply power for a few cycles during brief mains drop-outs. They can tolerate wider input-voltage fluctuations than their linear equivalents, and are also inherently better at filtering high-frequency interference.

Any computer should be capable of tolerating normal mains fluctuations, but long connecting leads and bad wiring can increase the variations. The problem can be cured by using a constant-voltage (CV) transformer.

A typical CV transformer can reduce a 15 percent fluctuation to between one and five percent while at the same time filtering a certain amount of noise and transient interference. Some hold enough energy to keep the mains supply going for a full mains cycle drop-out. A CV transformer capable of supplying 250W costs around £160, and one supplying 500W about £220.

Better isolation from noise and interference is provided by a yet more expensive device called a regulator, corrector or conditioner. Many regulators include a transformer to produce a low-voltage supply for driving an electronic converter, which then steps the output voltage back up to 240V. The shape and amplitude of the output waveform are determined not by the mains input waveform but by an electronic circuit.

Some regulators use a high-isolation transformer — which gives very good filtering but no mains-voltage regulation — with an electronic feedback circuit which keeps output constant. Around £300 will buy you a 1kW regulator.

Where computer drop-out cannot be tolerated, an uninterruptible power supply (UPS) is used. There are many types and sizes of UPS, but they all perform the same function of continuing to provide power without interruption when the mains fails. Most UPSs use batteries and an electronic converter to turn the low battery voltage into a.c. mains voltage. While mains power is available, the batteries are charged and the converter is powered from the mains. But when the mains fails, the batteries automatically provide converter power.

For the small-computer user an uninterruptible supply capable of giving an auxiliary mains supply for a few minutes is the most practical. If the mains fails it will at least give you time to store any volatile data and shut down the computer in an orderly fashion. Using large batteries, some uninterruptible supplies can run for up to an hour without mains power.

Uninterruptible supplies are expensive because of the large converter transformer and batteries they contain. For example, to supply only 300W for five minutes requires a 12V battery capable of delivering well over 25A for that time. One 250W version that gives a 10-minute hold-up costs £810; a larger version for 500W is £1,310. At the top end, a 30kW supply for an hour will cost around £25,000. With some designs increasing the auxiliary supply time is simply a matter of adding batteries.

MAINS SUPPLY FROM BATTERIES

The UPS should not be confused with an inverter, which provides a mains supply from batteries but does not necessarily include circuits for charging the batteries or switching instantaneously to battery power when the mains fails. Inverters are for use where a mains supply is not available.

There are, however, intermediate designs that use an inverter with an automatic switch that gives only a brief interruption between the mains failing and the inverter starting up. Many computer systems can withstand a

FAULT-FINDING AND REMEDIES

very brief interruption like this. Some semi-uninterruptible supplies include a CV transformer which fills in the gap between the mains failing and the inverter starting so that the computer system sees only a fluctuation in supply when a mains black-out occurs. The advantage of using a semi-uninterruptible supply is cost. A typical 200W unit is £645, and a 500W unit is £921 — almost £400 cheaper than a typical uninterruptible supply.

If you consider that no chances can be taken with the data that you handle and have never experienced a failure, the problem becomes one of insurance. If you cannot afford to lose data but do not mind having the computer out of action until the mains comes back on, a small short-term UPS will suffice. Where computer time is expensive — as will be the case with multi-user systems — a longer-term auxiliary power supply might be the only solution. But as always, by far the cheapest way to prevent lost data through mains failure is to back up your working data frequently on to disc.

Determining whether or not mains pollution is causing computer crashes is difficult to do cheaply. If you have never had a crash but want to safeguard against one the problem is even harder. It helps to know how clean your mains supply is, and you can get mains monitors and analysers to do this. These instruments sense and record mains corruptions; some even give you a printout of the type of error and the time that it occurred. As mains monitors are expensive, and are usually only needed once, it probably is sensible to hire one. Alternatively you can have a mains-monitoring survey done for about £125 by Danesbury. For that price you get not only information on the types of faults recorded, but also advice on what preventative measures, if any, are needed for your installation.

Slowly varying mains-voltage fluctuations and low voltage can be checked using a voltmeter. The reading should be within five percent of 240V, but before you start complaining to the electricity board remember to check your meter's accuracy. The board is obliged to keep your supply voltage within the five percent range, but keeping the supply stable is up to the user.

If your system continually crashes and you suspect that mains interference is the culprit, a do-it-yourself detection method might work. Plug a mains-powered AM radio into the same power outlet as the computer and listen for a loud crack or interference coinciding with the crash. Provided that the lights do not flicker at the same time, you should be able to solve the problem quite cheaply using a transient suppressor or interference filter. For slower mains fluctuations or a constantly low or high mains voltage you might need to use a special regulating transformer or line regulator. If the lights do flicker, you have a big problem as this means that the cause is not interference but a momentary complete mains failure. An interference suppressor will not help here; you will either have to make more frequent backups or use an expensive uninterruptible power supply.

SUPPLIERS

EMS Chairborough Road, High Wycombe, Buckinghamshire HP12 3HH. Telephone: (0494) 448484. Standby, UPS and mains-stabiliser systems

Farnell Electronic Components Canal Road, Leeds LS12 2TU. Telephone: (0532) 636311. Filters and suppressors

Microlease Forbes House, Whitefriars Estate, Tudor Road, Harrow, Middlesex HA3 5SS. Telephone: 01-427 3393. Hire equipment, including CV transformers and mains-analysis equipment

Inmac 16 Silver Road, London W12 7SG. Telephone: 01-740 9540. Mains filters, line conditioners and small uninterruptible supplies

Cetric Components Spinney Estate, Hoddesdon Road, Stanstead Abbots, Ware, Hertfordshire SG12 8EJ. Telephone: (0920) 871077. Uninterruptible supplies, line-conditioning transformers

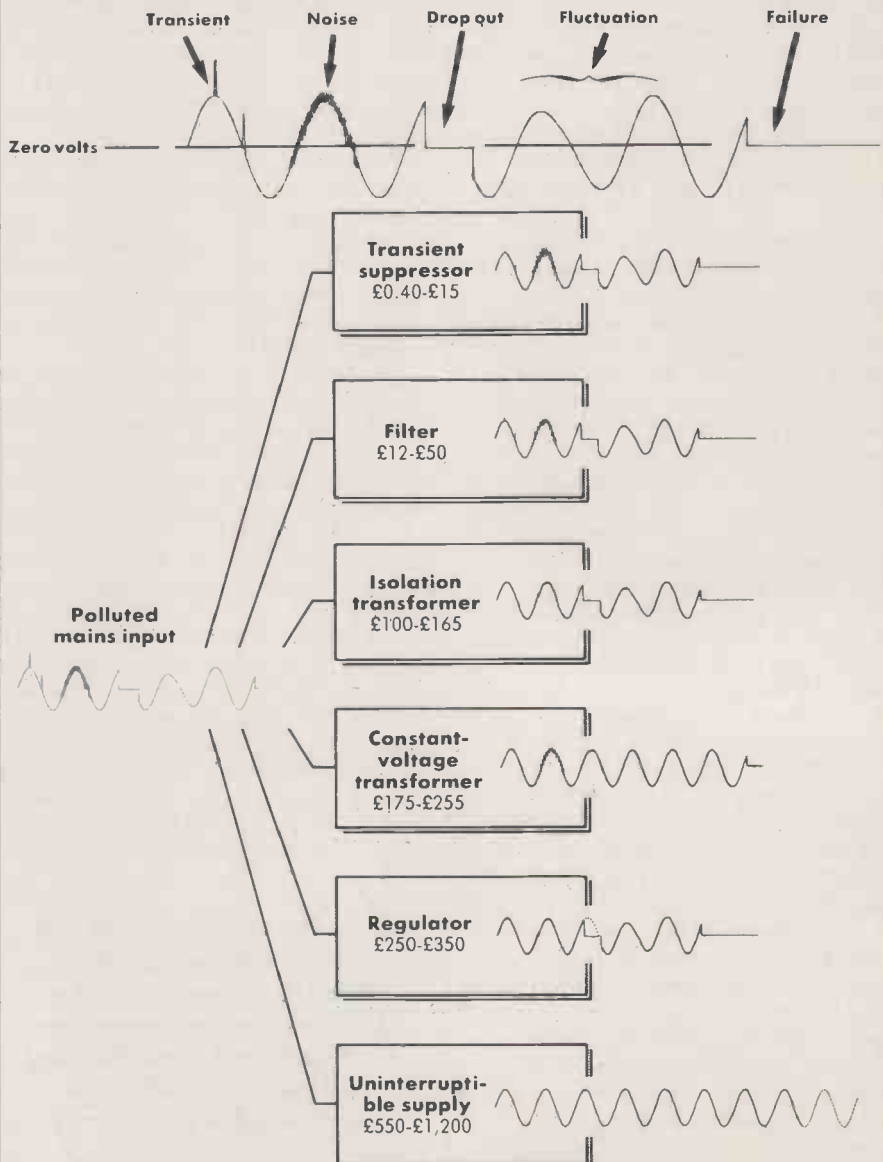
Danesbury Instruments 22 Parkway, Welwyn Garden City, Hertfordshire AL8 6HG. Telephone: (07073) 29112. High-isolation and CV transformers, electronic line regulators, uninterruptible and semi-uninterruptible supplies, mains monitors and monitoring service

Advance Electronics PO Box 230, Wrexham, Clywd LL14 3JR. Telephone: (0978) 821000. Regulators and line conditioners

Livingston Hire The Rental Centre, 99 Waldegrave Road, Teddington, Middlesex TW11 8LQ. Telephone: 01-977 8866. Uninterruptible power-supply rental

Misco Computer Supplies 4 The Western Centre, Western Road, Bracknell, Berkshire RG12 1RW. Telephone: (0344) 482121. Filters, uninterruptible supply

Electroplan PO Box 19, Orchard Road, Royston, Hertfordshire SG8 5HH. Telephone: (0763) 41171. Mains monitor, line conditioner



THE STATE OF THE ART

The IBM Enhanced Graphics Adaptor looks like setting a new standard for screen displays. **Steve Malone** explains how it fits into the hierarchy of display cards, and compares it with the clones makers' offerings.

The business market has traditionally been dominated by the monochrome display. Because of its high resolution and fast scrolling rates, it has always been seen as superior for business applications like word processing to the colour display.

This view now seems to be changing. Recently distributors have reported a surge of interest in favour of colour displays, and they expect colour systems to represent the majority of sales within two years. The reasons for this are two-fold. First, the price of colour monitors has fallen substantially in the last few years; secondly, IBM has launched the Enhanced Graphics Adaptor (EGA).

The problem with the earlier Colour Graphics Adaptor (CGA) is that it used a different screen resolution to the Monochrome Display Adaptor (MDA). Instead of the high-resolution nine-by-14 character matrix of the MDA, the CGA found itself with an eight-by-eight matrix, which made for a much cruder display. Furthermore, the ROM BIOS did not support the eight-by-eight matrix in its character set, and so the characters had to be built on-screen pixel by pixel, greatly slowing the speed at which new text could be displayed. The problem was solved with the introduction of the EGA, which could emulate both the monochrome card and colour-graphics card and even added some additional modes of its own. The result is that the EGA has gained an acceptance to the business community which has been denied to the CGA.

The Enhanced Graphics Adaptor comes supplied with its own dedicated memory, of which there are currently three configurations. The base configuration supplied by IBM is fitted with 64K of memory. Also available are 128K and 256K versions. One of the reasons for the large quantity of memory is that it determines the number of pages of text and graphics which can be stored. IBM colour cards store not one but up to eight complete virtual screens in memory, and this allows a number of screens to be switched almost instantaneously in and out of the display you actually see on the monitor.

This technique goes some way towards



mitigating the slow method of building a screen pixel by pixel. The idea is that the processor can be building one screen while displaying another. Naturally, the more pages you can have in memory the greater the variety of screens which can be swapped in and out of the display. Other features determined by the quantity of on-board memory are the number of colours visible in high-resolution mode and the possibility of accessing the additional character set — something you cannot do with only the basic 64K on board.

The EGA has been designed to be entirely compatible with the six graphics modes supplied with the CGA card. They range from a 16-colour low- or medium-resolution display to a four-colour high-resolution display and a high-resolution two-colour display. In addition, four extra modes are accessible by the EGA card.

The first of these modes, known as mode 13, is a 16-colour display with a resolution of 320 by 200 pixels. It takes up 32K of memory, so with a 64K card you can have two pages in memory, rising to eight pages for the 256K version. Mode 14 is similar but has double the width resolution, at 640 rather than 320 pixels per line, thus halving the number of storable pages in video memory.

The third new mode, called mode 15, provides compatibility with the MDA card. It has no colour facilities, but with a screen resolution of 640 by 350 pixels it produces a character resolution of eight by 14 — almost that of the MDA card — and as the missing column is unused on the MDA format anyway, no resolution is lost.

The final mode available under the EGA

 **The problem with the earlier Colour Graphics Adaptor is that it used a different screen resolution to the Monochrome Display Adaptor. The EGA can emulate both cards.** 

format, and one which is only fully accessible if you have the full 256K on board, is mode 16. This provides for a resolution of 640 by 350 pixels with the possibility of displaying all 64 available colours on-screen. This does not quite put it in the same class as the Amiga — which can display over 1,000 colours simultaneously — but it does mean that the ageing IBM PC can show a respectable amount of colour. The catch is that to gain maximum performance you need at least 164K of RAM on the board. You also need a special Enhanced Colour Display monitor able to scan at 22kHz.

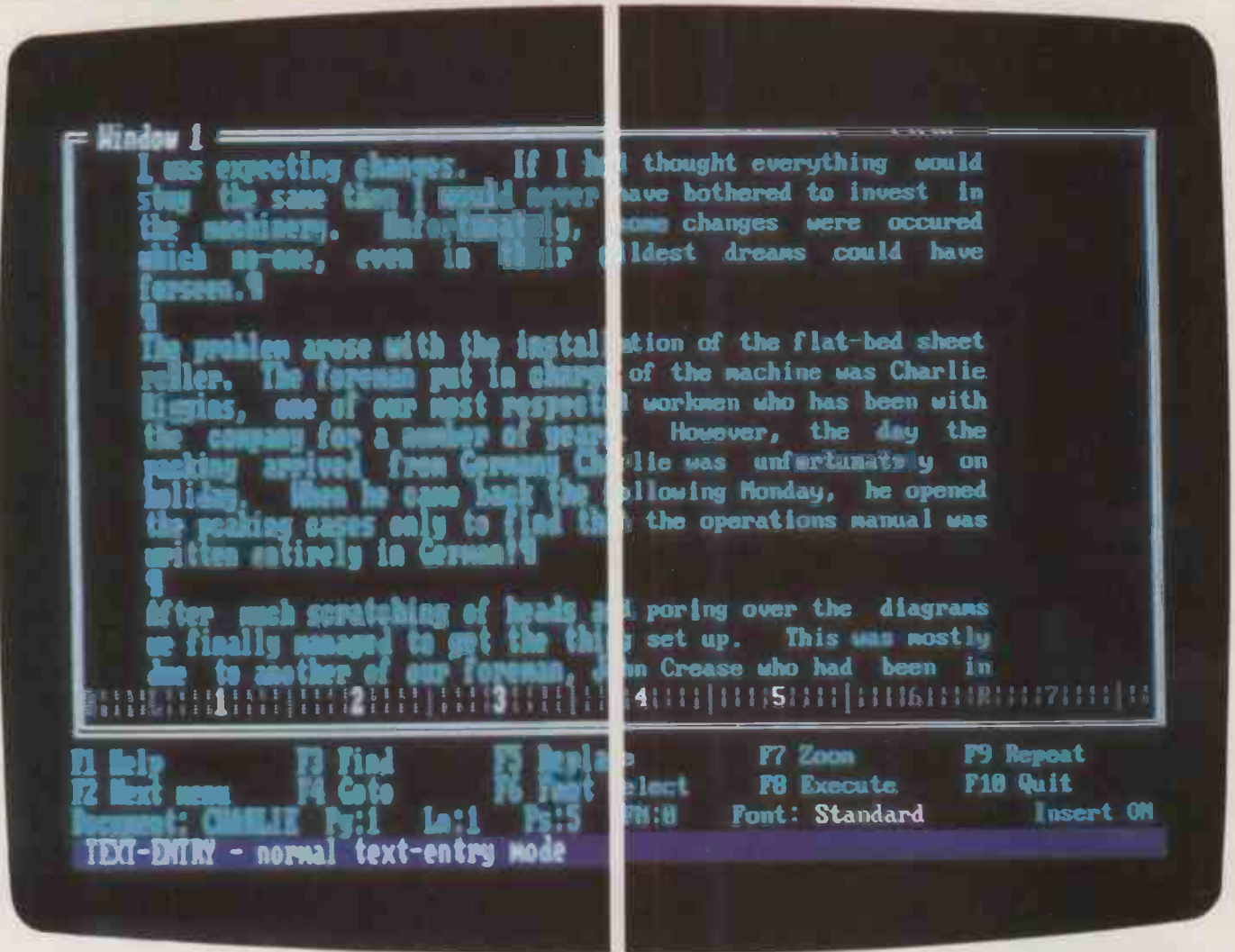
There are five basic constituents of the EGA specifications: the display memory, sequencer, CRT controller, graphics controller and attribute controller. In colour mode the display memory is divided into four planes corresponding to red, green, blue and intensity. The data stored in the four planes is mapped on to the display screen, which means that at maximum performance up to four bytes of information are required to display one on the screen. In monochrome mode four colour planes are unnecessary, so the information is stored in a continuous row of bytes.

The hub of the EGA is the sequencer. This device controls processor access to the display memory. The system is designed so that if there is a conflict between the processor and display-memory access to the screen, the memory always has priority. This has the effect of eliminating breaks in the display known as "snow". The sequencer also controls access to each of the memory planes and the character sets.

The CRT controller is the drudge of the EGA. Its task is to refresh video memory and supply the display timings for the monitor, rather like the old 6845 chip used in earlier IBM display cards. The attribute controller meanwhile governs the range of colours used. The final part of the system, the graphics controller, is based around its mode register, which supports reading and writing to the video memory. Among the functions it performs are copying data between the virtual screens and reading from the current plane and video registers.

In order to support the EGA card, the

GRAPHICS CARDS



The CGA (left) uses a matrix of eight by eight pixels. The EGA (right), with its eight-by-14 matrix, produces a more legible result.

ROM BIOS is also enhanced. The additional code allows it to manage the higher resolution, the upgraded colour palette and the extra character set introduced by the EGA.

When IBM introduces any significant hardware for the PC, the clone manufacturers are never far behind. Many have chosen the usual route of producing a similar system at a lower price, although in these days of cheap memory few offer the card with only the minimum 64K. Most of the clones now on the market offer the full-specification 256K as standard.

One such company is Interquadram, which claims to have sold over 15,000 of its Quad EGA+ cards. As well as making the full 256K of RAM available, the company has also bundled Hercules monochrome-graphics emulation — something IBM is unable to do, as it refuses to acknowledge the Hercules standard in the market.

The Quad EGA+ card is available in both long and short card format, with much of the controlling hardware lumped into large Chips ULAs. This is particularly valuable for owners of clones where long slots are not available, the Apricot Xen-i being a recent example. The trouble is that customised gate arrays are not yet available in sufficient quantities for the price to fall into line with less sophisticated chips, and

The next generation of display adaptors is already appearing over the horizon.

The IBM Professional Graphics Adaptor can display 256 colours on-screen.

you can expect to pay an additional £40 above the equivalent long-slot price. Thus the long-slot version costs £297, with the short slot version having a recommended retail price of £337.

Another path taken by a range of manufacturers is to bundle the EGA hardware with other add-ons on an all-purpose multi-function card. AST is soon to produce the 3G pack, which provides not only a fully functional 256K EGA system but also includes parallel and serial cards, a battery-backed clock and a memory-enhancement capability. As yet there is no price fixed for the 3G pack.

For those who want a really souped-up version of the EGA, there is the Orchid Turbo EGA card, available from First Software at a price of £749. This long-slot

card is a full-function EGA card fitted with an 80286 processor, which in theory should enable the PC owner to run the computer at AT speeds — although in practice this only really applies to the graphics. The snag with the board is that you have to remove the 8088 processor and fit it to the EGA board, with a ribbon cable running from the board to the empty processor slot. Orchid has been remarkably parsimonious with the cable: it barely stretches to the IBM PC processor slot when the Turbo EGA card is placed in the first expansion slot. As many clones have the processor placed further away from the expansion slots you may find that you will need to have a special cable made up. A few extra inches of cable ribbon would not have cost Orchid more than a few pence but could have saved many users a great deal of time and expense.

While the EGA looks like setting the standard for graphics displays over the next few years, the next generation of display adaptors is already appearing on the horizon. IBM has given an indication of the future in the Professional Graphics Adaptor. This system has a resolution of 640 by 480 pixels and can display 256 colours on-screen from a palette of 4,096. Although it is still expensive at £499, its price should fall and business-software support will begin to emerge.

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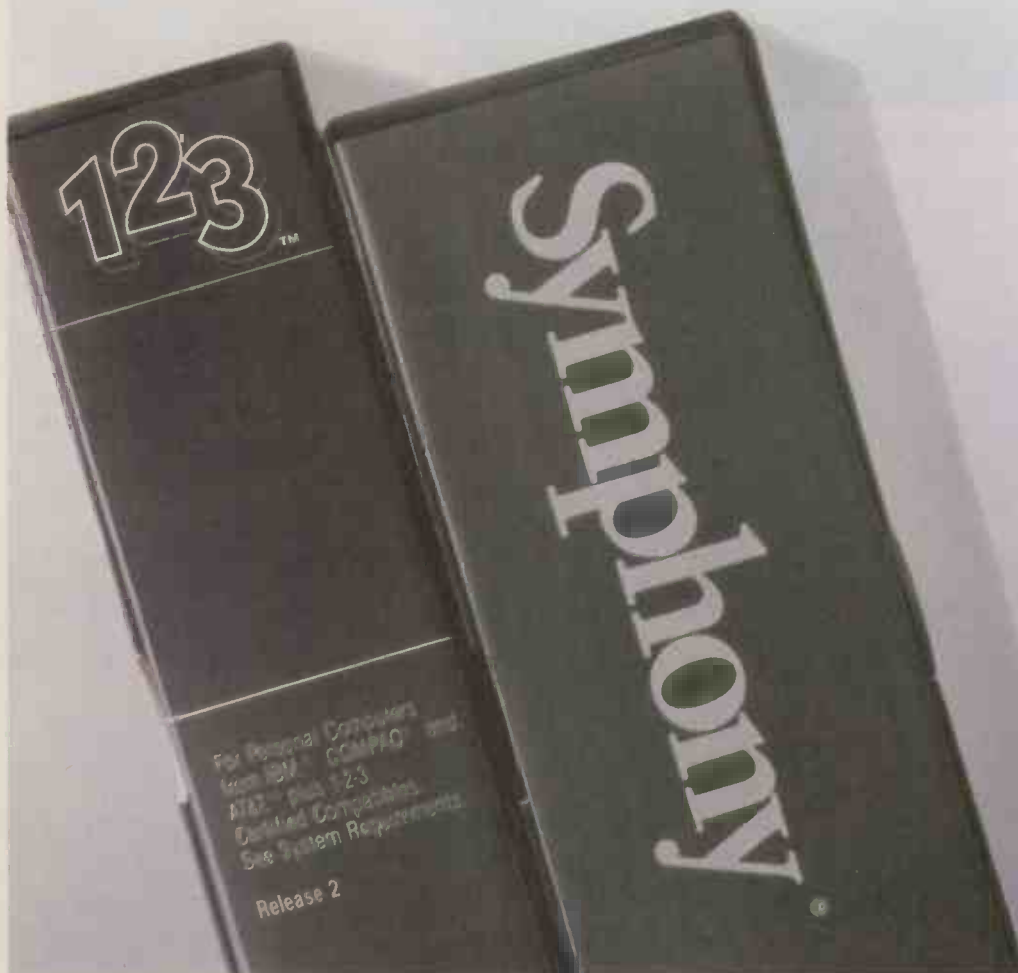
Symphony Spelling Checker.

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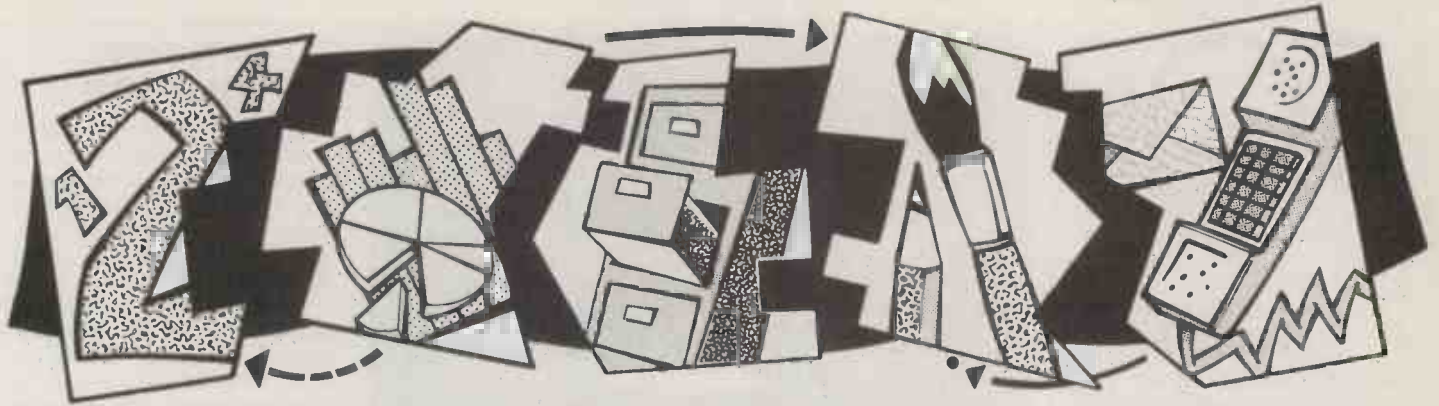
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TOP 10

David Barlow looks at the massive packages that combine the main business applications in a single program, and compares their virtues with those of more manageable single-function programs.

worlds: ease of use, integration and value for money. First Choice from Software Publishing includes all modules except graphics, wraps them up in an attractive and logical user interface and only costs £149. None of the modules bristle with state-of-the-art software gizmos, but this is only likely to concern power users.

The action at the low end of the integrated market has also been affected by the so-called operating environments like Microsoft Windows and Digital Research's Gem. As well as insulating users from the unfriendly aspects of the operating system they also offer cut-down but extremely useful mini applications packages.

At the top end of the market there are two new entrants which at first sight do not conform to the traditionally held view of the integrated package. Both Word Perfect Library and Intuitive Solution have started life as exceptionally powerful stand-alone modules. This will undoubtedly remain the prime motivation for buying them, but their usefulness is augmented by the ability to run other less critical applications, akin to desk accessories, from within the main program. In the case of Word Perfect these mini applications are memory resident at all times, and so can be called up with a couple of keystrokes.

As memory becomes cheaper and cheaper, so the 640K limit currently

Our regular title "Top 10" could almost be regarded as shamefully misleading when applied to this month's subject of integrated packages. It might be closer to the truth to refer to them as the "Only 10", as it takes quite some scratching around to find 10 integrated packages of any type, irrespective of merit.

If the Ashton-Tates and Lotus Developments of this world had had their way, all-in-one packages combining word processing, spreadsheet and database facilities would have rendered the traditional discrete package obsolete overnight. But as usual in the contrary world of micros, things have just not worked out that way. The stand-alone market is healthier than ever, and even some of the founders of the movement towards integrated software have defected by dismantling their monster programs to make a set of more manageable and cheaper chunks of software.

The trouble with integrated software relates to the massive investment it demands in the initial cost of purchase and in the time it takes users to familiarise themselves with the often obscure user interface. Thanks to the massive advertising campaigns which have backed them, packages like Symphony and Framework no doubt now have a large and satisfied user base. But it seems unlikely that more than 15 percent of such users are exploiting their power anywhere near to the full. Chances are the other 85 percent could have saved half their money and a lot of midnight oil simply by opting for a less ambitious initial sortie.

MODULAR APPROACH

The modular approach exemplified by Smart and Open Access II makes a lot of sense. These software suites allow users to concentrate on their predominant requirements without being blinded by the overall functionality and encyclopedic manuals found in the big boys. Further modules can then be bought later as confidence grows and the bank balance recovers.

Generally speaking, the functionality of modules is superior to those found in all-in-one solutions. On the other hand the ease with which data can be transferred from one module to another is rarely as good, though it is vastly better than could be expected with a completely unrelated set of applications packages.

Of course, you can combine the best of all

imposed on most PC compatibles by the MS-DOS operating system becomes more and more infuriating. Fortunately most of the current versions of integrated software support extended-memory management facilities, enabling the modules to address up to 8Mbyte of RAM in certain cases. In fact claimed capacities, especially in the spreadsheet department, are often based on the use of this absolute maximum memory.

Other hardware developments include support for enhanced graphics adaptors and the welcome fall from grace of obstructive copy-protection schemes. This should make software installation and everyday use a good deal less tedious.

In the long term the future of the all-singing all-dancing integrated package must be very much in doubt. On the other hand, the modular approach should have a smoother ride. It is easier on users and their pockets, and many of the deficiencies in their levels of integration may well be sorted out when the new generation of multi-tasking operating systems are released later this year.

SUPPLIERS

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

First Choice Software Publishing, 85-87 Jermyn Street, London SW1Y 6JD. Telephone: 01-839 3864

Framework II Ashton-Tate, 1 Bath Road, Maidenhead, Berkshire SL6 4UH. Telephone: (0628) 33123

Intuitive Solution Intuitive Systems, 66 High Street, Stevenage, Hertfordshire SG1 3EA. Telephone: (0438) 317966

Jazz, Symphony Lotus Development, Consort House, Victoria Street, Windsor, Berkshire SL6 1EX. Telephone: (0753) 840281

Open Access Software Products International, 13 Horseshoe Park Estate, Pangbourne, Berkshire RG8 7JN. Telephone: (07357) 4081

Smart Innovative Software, Southampton House, 192 York Road, London SW11 3SA. Telephone: 01-223 5008

Word Perfect Library Sentinel Software, Wellington House, New Zealand Avenue, Walton on Thames, Surrey KT12 1PY. Telephone: (0932) 231164

Works Microsoft, Excel House, 29 De Montfort Road, Reading, Berkshire RG1 8LP. Telephone: (0734) 500741

TOP 10

ENABLE

A MASSIVE program comprising the usual word processor, database, spreadsheet, graphics and communications modules. Enable is a menu-driven system with the individual modules integrated by a central Master Control Module. The spreadsheet is similar to Lotus 1-2-3 and offers up to 65,000 cells and well-integrated graphics. The database is modelled on Ashton-Tate's dBase III but with a maximum of only 65,000 records. The full-feature word processor owes little to any other WP package. Enable has powerful windowing and macro facilities but it is not straightforward to use.

PRICE: £646

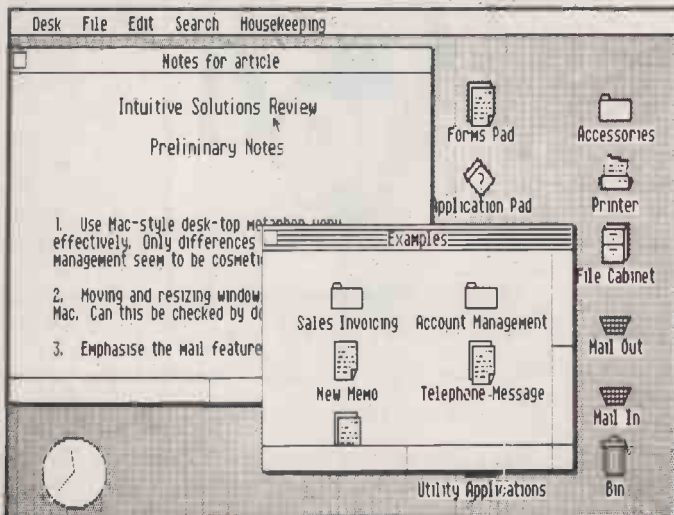
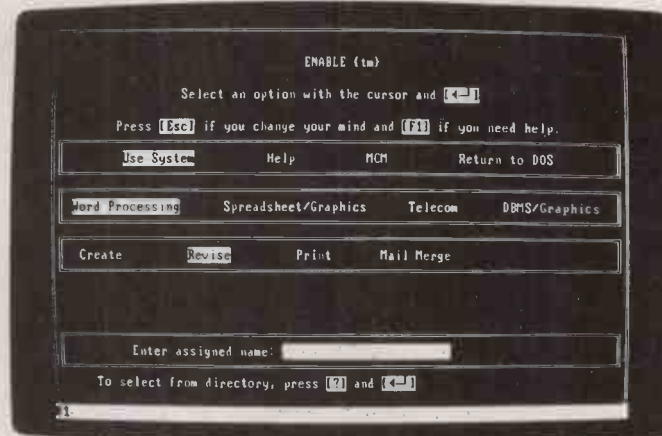
FOR: Powerful modules. Ideal for power users.
AGAINST: Expensive. Not easy to learn or use.

FIRST CHOICE

A PROMISING newcomer from the software house that brought us the no-nonsense PFS series. Now PFS Write, File and Report are all rolled into one glamorous package along with a communications module and spreadsheet. Ease of use is the keynote, and all the modules are self-explanatory; the manuals are almost redundant. The user interface is consistent and attractive, and makes full use of Mac-style concepts such as pull-down menus, clipboards and bookmarks. Some of the modules lack the wealth of features on offer from the big boys, but even so value for money is superb. The most notable omission is a graphics capability but other packages from the same stable can interface with First Choice to produce business charts.

PRICE: £149

FOR: Ease of use. Superb value. Good spelling checker.
AGAINST: No graphics. Lack of features.



FRAMEWORK II

IN MANY WAYS Framework II can be regarded as the ultimate integrated package. It has a rigorously uniform structure which uses the concepts of frames and outlining as an aid to organising ideas into a logical format. Word-processing, spreadsheet, database and graphics facilities are provided. Until you become familiar with its central concepts Framework II is hard to use, and the package is particularly demanding on hardware, 512K RAM and a hard disc being a realistic minimum spec. Version II additions include an 80,000-word spelling checker, a larger spreadsheet and a more



integrated communications facility. Installation should be a good deal simpler now that Ashton-Tate is removing all copy protection from Framework's master discs.

PRICE: £550

FOR: Powerful. Outlining facility. Large spelling checker.
AGAINST: Complex. Hard to learn. Demands expensive hardware.

INTUITIVE SOLUTION

LIKE Word Perfect, Intuitive Solution does not conform to the accepted idea of an integrated package. This time the predominant module is an icon-driven database which allows files to be manipulated on a Mac-style desk top. External applications such as WordStar can be run without exiting to DOS, and when the task is complete control returns to the desk top. Intuitive Solution is primarily intended for network environments, where users interface with a central company database. Data entry and updates have been made much simpler than with traditional command-driven programs. An eight-user network version costs £1,440, which works out to a competitive £180 for each user.

PRICE: single-user £726

FOR: Easy-to-use icon interface. Powerful database. Ideal for networks.
AGAINST: Does not include word-processing, spreadsheet and graphics modules. Integration likely to be poor.

JAZZ

LOTUS DEVELOPMENT'S Macintosh-specific package makes full use of that machine's graphics front end to show multiple founts and business charts on-screen as well as in final documents. By using Jazz's Hotview you can integrate information from any Jazz module into a document prepared by the word processor. The spreadsheet is the most impressive module, offering a large matrix of 8,192 rows by 256 columns. Like most Mac packages, Jazz is exceptionally easy to use, though its help screens are not as comprehensive as those supplied with other Lotus products.

PRICE: £295

FOR: Ease of use. Well integrated. Good spreadsheet and graphics.

AGAINST: Macintosh only. Mediocre word processing and database.

OPEN ACCESS

A LACK of marketing clout in its early days has meant that this package has fared badly against the heavily promoted competition. Although originally sold as one suite, Open Access is now available in separate modules. Version II is a worthwhile improvement, with integrated graphics supporting simultaneous display of text and charts. The database now includes a powerful programming language with English-style commands. A more comprehensive communications module is also provided. As before, the package is easy to use, with informative help screens. Open Access II is also available for use on local area networks.

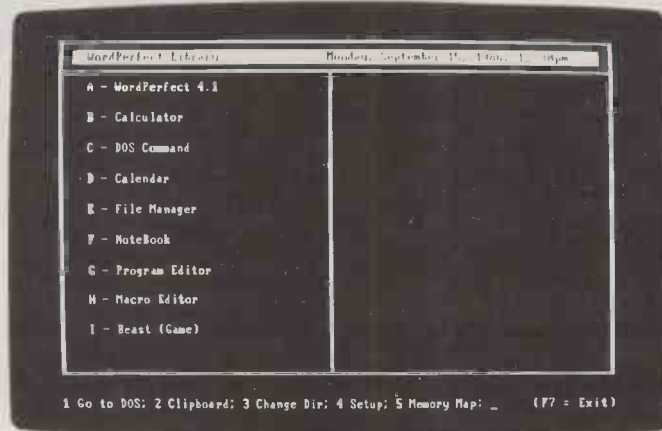
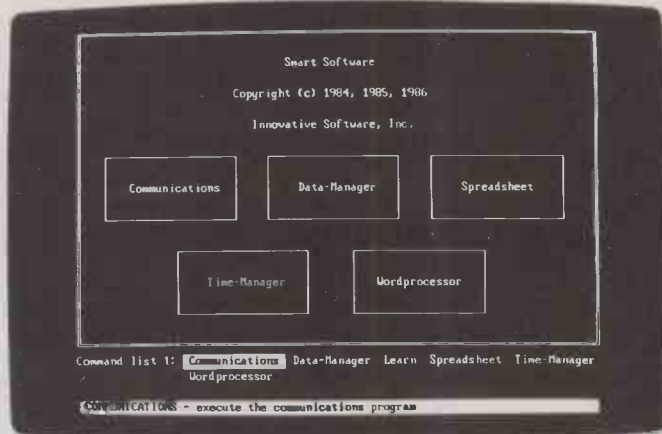
PRICE: £695

FOR: Ease of use. Modular approach. Good graphics.

AGAINST: Expensive. No spell check for WP. Not well-established in U.K.

SMART

ONE OF the first integrated packages to allow users to buy each module separately. The individual modules are more powerful than those provided within Framework and Symphony, but to a certain extent this has been achieved at the expense of overall integration. Smart's outstanding module is its database, the



power and functionality of which rivals many stand-alone packages. The word processor is also impressive and features a custom fount-generation utility and an 80,000-word spelling checker. Smart is easy to operate thanks to its use of confidence levels, which insulate users from the more complex commands until they are competent to use them. A network version is now available.

PRICE: £695

FOR: Easy to use. Modular approach. LAN version.
AGAINST: Expensive. Confused documentation.

SYMPHONY

AS 1-2-3's big brother, Symphony retains a similar style of user interface. Upgrading 1-2-3 users will find it familiar, but others may find the traditional Lotus command line a bit unhelpful. Its strong point is the spreadsheet, which can manage up to 4Mbyte of RAM. Symphony's minimum hardware spec is a dual-floppy machine with 384K RAM, but it really needs more to be of practical use. It now boasts some useful optional extras, including a spelling checker and a text outliner. It is not the easiest package to learn, especially

when compared to modular competitors like Smart and Open Access II.

PRICE: £595

FOR: Powerful Lotus-style spreadsheet. Well established. Integration of modules.

AGAINST: Copy protected. Expensive. Not particularly easy to learn.

WORD PERFECT LIBRARY

BASED around the Word Perfect word processor, the Library program adds file-manager, calculator, notebook, calendar and macro functions, all controlled from a menu-driven shell. The modules reside in memory simultaneously, allowing you to switch between them at will. Word Perfect itself is one of the most powerful word processors currently available, so the new library is ideal for applications with a predominant WP content coupled to an occasional need for other desk accessories. All programs are fully compatible so you can, for instance, take names and addresses from the notebook and transfer them directly to mail-shot letters. The shell menu enables DOS functions to be accessed without having to exit the main program.

PRICE: £574 with Word Perfect

FOR: Powerful. Memory-resident desk accessories. Network version.

AGAINST: No spreadsheet or graphics. Expensive.

WORKS

MICROSOFT'S Macintosh package due for release shortly. Like Jazz it incorporates spreadsheet, database, WP, graphics and communications modules within an interface similar to that used on Microsoft's dedicated Mac spreadsheet, Excel. The Works spreadsheet is not as powerful but still offers a commendable maximum matrix size of 9,999 rows by 256 columns. The word processor and database complement each other very well.

PRICE: £250

FOR: Ease of use. Good value.

AGAINST: As yet an unknown quantity.

When the Apple Macintosh was first launched three years ago it was clear that it represented a totally different approach to micro-computing. Apart from its neat and compact styling and its use of the 3.5in. disc format, it embodied a number of techniques which marked it out as the first of a new generation: a strongly visual approach, pull-down menus and the innovative mouse pointer. Apple claimed that the Macintosh was the computer "for the rest of us" — that is, for those who had not been benighted enough to buy an IBM PC.

In practice, this vision of micro democracy has not quite worked out that way. Rather than becoming a mass-market machine, embraced by even the most Luddite of executives thanks to its friendly user interface, the Macintosh has been largely confined to a ghetto. True, the population of that ghetto has been select. Mac users have until recently been mainly the style-conscious innovators, the trailblazers within organisations who are anxious to stand out from the herd of Big Blue users. For them, its low market penetration was a positive attraction.

Apple's Macintosh, the Atari ST series and the Commodore Amiga have in common a graphics-based user interface driven by a Motorola 68000 processor.

MACINTOSH & CO

Apple's Macintosh has now been joined by the Apple II GS, the Atari ST family and Commodore's Amiga, forming a distinct alternative camp to challenge the IBM PC and its followers. **Glyn Moody** looks at the strengths and weaknesses of the Mac approach and its future prospects.

The same could not be said for the software houses. They have by and large adopted a wait-and-see attitude. This has led to a classic catch-22 situation, with both users and software authors hoping the other would move first. Apple did not help things by selling the original Mac bundled with Macwrite and Macpaint. By providing these two high-quality programs free, Apple also

discouraged software houses from investing time and money trying to compete. Apple has now rectified this, and the software has started flowing.

Another reason why the machine has been so slow to catch on is the absence of Mac clones. When the IBM PC was launched, other manufacturers soon followed suit with machines which could run the same soft-



ware. This increased the effective user base enormously, and provided software houses with even stronger incentives for writing to this standard. Apple, on the other hand, has always come down heavily on anyone even thinking about producing copies of its machines. As a result, the Mac has existed in splendid isolation. But no clones also means a smaller user base.

The appearance of the Atari 520ST and Commodore Amiga represent the next best thing to clones. Functionally they are very similar: they all use a Motorola 68000 as the main processor and they all have similar graphics front ends. From Apple's viewpoint perhaps their most important role has been to propagate the ideas which lie behind the Macintosh.

Apple itself has recently bolstered the standard with the announcement of the Apple II GS. This 16-bit update of the Apple II uses the same front end as the Macintosh, can swap data with it and has built-in Appletalk circuitry which will allow them to communicate. This is bound to extend the influence of the Mac philosophy to new markets.

There is further evidence that these ideas are catching on. It is noticeable that many of the most recent programs for the IBM PC are offering a visual approach strongly reminiscent of the Mac and its followers. At the same time environments like Windows, Gem and Topview are slowly but inexorably gaining ground.

This trend is likely to gain in momentum in the coming months. All the manufacturers of the 68000-based machines are rumoured to have 68020 upgrades in the offing. The enormously increased computational power of the new machines is likely to be directed, at least in part, towards improved graphics facilities. For example, CAD is tipped to be an area of considerable growth where they could flourish. Here the mouse-driven approach is not just advisable, but vital. Similarly, in the world of the IBM PC the new generation of 80386 machines will also have computing power in

abundance, some of which is almost certain to manifest itself in the form of an improved graphics interface along the lines of the Mac.

Aside from the new processor, there has been talk of Apple finally opening up the Macintosh to allow it to take expansion cards in the manner of the Apple II and IBM PC. Users have been clamouring for this for some time, but so far Apple has resisted. It may well be afraid that if it opted for an open architecture, IBM PC cards would appear to turn the Mac into nothing more than a fancy front end for MS-DOS programs. But it would be ironic if Apple were to take this course just as the closed machine was finally being accepted. Perhaps the additional presence of the Atari and Amiga will be enough to ensure the continued existence of a viable and exciting alternative to the IBM PC. Provided it does, we might even look forward to the day when the IBM PC family itself joins the world of Macintosh and Co.

(continued on next page)



THE SECOND STANDARD

While the IBM and its compatibles have become the undisputed standard for mainstream business computing, the Apple Macintosh has the edge in certain applications.

Ian Stobie reports on how the Mac is building on this base to establish a comprehensive software universe of its own.

As its third birthday approaches, the Apple Macintosh is flourishing as never before. Big names from the IBM software world such as Ashton-Tate and Borland are competing with each other in bringing out packages for it. Mac sales are up, and Apple seems finally to have gained credibility with corporate users.

Things have not always gone so well for Apple. When the Mac first came out many people inside the computer industry were impressed. Its well thought-out mouse-driven interface caused the greatest stir. The Mac took ideas pioneered on expensive Xerox machines and on Apple's own Lisa, and delivered them at an affordable price.

But although it appealed to computer designers, software writers and the more pioneering kind of business user, the mass business market did not immediately respond. The unfamiliar mouse concept was not an instant hit with corporate users and their conservative DP department advisors. It has taken the advocacy of companies operating inside the IBM universe, such as Microsoft and Digital Research, to win them over to the idea.

The original Macintosh was not without flaws. For one thing it was grossly underpowered for the ambitious software designed to run on it. The 128K Mac with its 400K built-in disc drive was slow, and users found themselves continually swapping discs or running out of memory. Things improved a bit with the release of the 512K Fat Mac, but the big step forward occurred with the arrival early this year of the current main Macintosh model, the £2,295 Mac Plus. It is transformed by its 1Mbyte of memory and 800K built-in disc drive, and is easily a match for the IBM PC/AT.

Apple has also gone some way towards correcting another dubious decision embodied in the original Mac, its closed architecture. The Mac was intended to be extremely easy to use, so Apple decided to

make it basically unexpandable; its supposedly timid users would then not have to trouble themselves with hardware of any kind. But users like the flexibility of open-architecture machines like the IBM PC and the old Apple II, as it allows them to be upgraded to take account of changing needs.

The current Mac Plus is not as open as these machines, but it is at least possible to upgrade it. Apple has provided space inside the case for up to 4Mbyte of RAM, and there is a fast industry-standard SCSI port for peripherals like external hard discs. Apple is also co-operating with independent hardware vendors in the same active way it always has with software developers.

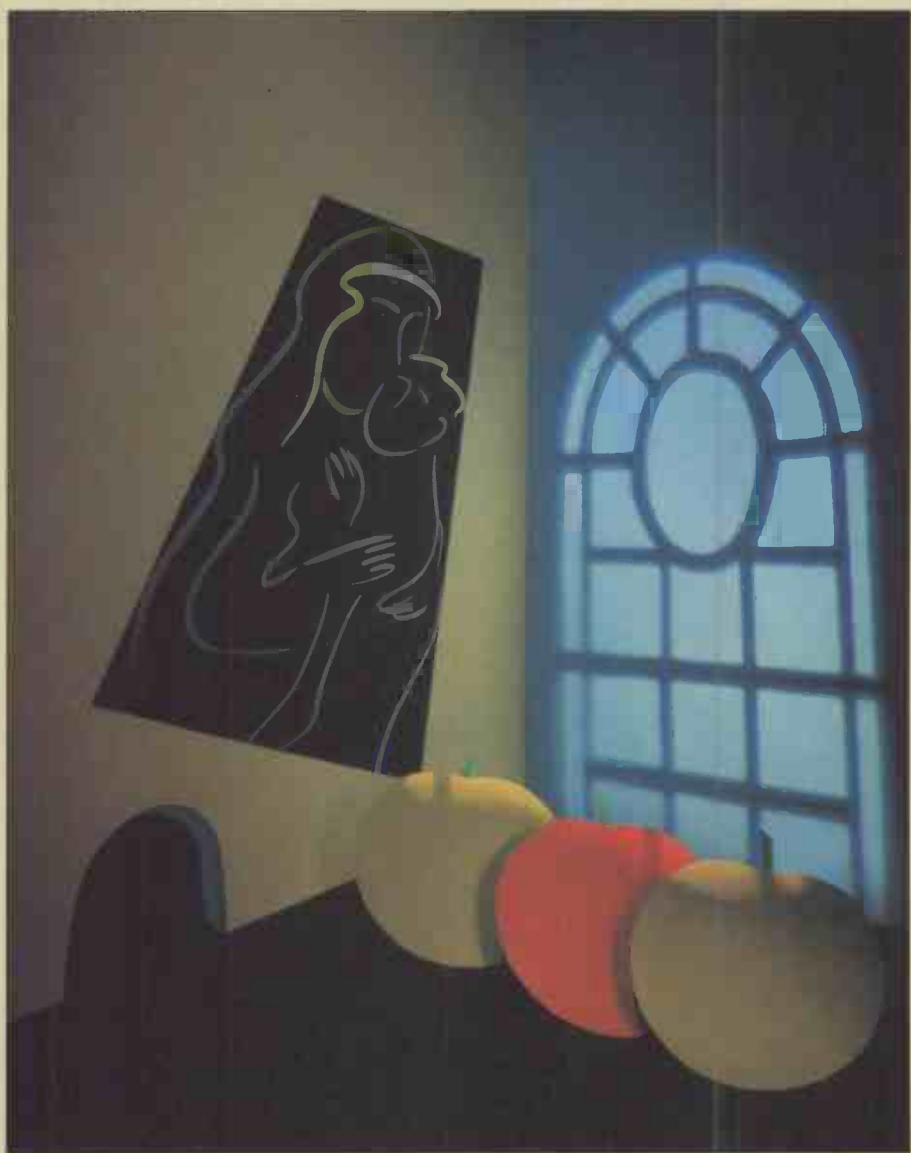
LASER SUCCESS

Perhaps Apple's biggest success has been its laser printer, introduced at the beginning of 1985. The Mac is a very competent machine when it comes to handling graphics. It is also easy to display text on the Mac's screen in different styles and sizes, making it ideal for all kinds of word processing. The Laserwriter was designed to complement the Mac in this role. It can print text and graphics at a resolution of 300 dots

to the inch, which is approaching typeset quality, and it comes with genuine typesetting founts such as Helvetica and Times Roman built-in.

The Mac/Laserwriter combination rescues Apple at a difficult time. Together the machines are capable of a great deal more than conventional word processing. Software like Aldus Page Maker lets you do a wide range of document-preparation work in-house, saving on typesetting bills and making new kinds of project viable. So successful has the Mac been in this role that it has virtually spawned a new industry: desk-top or personal publishing. The IBM world has still not caught up.

Apple is also well placed to take advantage of the interest in local area networks that is beginning to materialise. Every Mac ever sold has an Appletalk LAN interface already built into it. All it takes is a £50 connector to link it to other Macs. Admittedly the Appletalk network is not very fast, but it is cheap and genuinely easy to set up. If several users want to share a hard disc or laser printer, or send each other electronic mail, it is perfectly adequate. At the moment Appletalk can offer little in the way of true multi-user database or



accounting software, but Apple will shortly be launching a full file server for use on the network which will allow applications of this kind to be developed.

The Mac cannot match the IBM and its clones in the sheer volume of business software that is available but, arguably, it offers better quality in several application areas. It has what is probably the best spreadsheet on the market, Excel, and without doubt the best choice of desk-top publishing software. IBM is still probably ahead in databases, particularly the more powerful ones, and wins hands down when it comes to choice of accounting software. The Mac, on the other hand, has some packages aimed at people in the creative professions which are unmatched by anything in the IBM universe. Starting below we detail the key Mac software packages, while John Lewis looks at some new painting programs on page 109.

When it comes to ease of use, Mac software is stronger virtually across the board. Mac packages share many features in common. The Mac operating system is much more comprehensive than its IBM equivalent. It contains a larger number of routines for editing text and graphics, moving data between applications and handling the user interface generally. Unless there is some compelling reason for doing otherwise, most Mac software developers use these routines wherever possible rather than writing their

own code. As a result, most Mac programs work the same way from the user's point of view. Once you know one it is generally not difficult to learn another.

It is also generally much easier to copy data between different applications than it is in the IBM universe. Mac software developers generally follow the well-defined standards laid down by Apple for representing text and graphics. This makes many Mac application programs file-compatible with each other. In addition, the Mac's operating system provides the user with convenient tools like the clipboard and scrapbook for moving smaller chunks of text and graphics data between applications.

GRAPHICS FRONT END

Graphics is widely used in Mac programs. It is employed in the user interface, where different text styles for symbols and highlighting make the program easier to understand. You can also get a great deal of control over the appearance of program output. For example, it is quite normal with Mac programs to be given a choice of type-faces and sizes when printing things out on either the laser printer or the cheaper Apple Imagewriter impact matrix printer. As a result, many Mac packages are capable of producing presentation-quality work, and the distinction between presentation graphics and other software does not exist in the same way as in the IBM universe.

This graphical sophistication may seem surprising, given that the Mac is a monochrome machine while many IBM systems are equipped with colour displays. But the vitally important point is that the Mac's monochrome graphics are common to all Mac systems, giving software writers a common base of users to write for. IBM graphics, both monochrome and colour, are a mishmash of competing hardware and software approaches; if you take an IBM graphics program at random there is no guarantee that it will run your own IBM system.

The Mac's standardised, unified market, together with the inherent power of its 68000-based hardware, has attracted all the major personal-computer software houses to write for the Mac. Microsoft, the company behind the IBM PC's operating system, has been strongly committed to the Mac from the outset. It may now be taking as much as 40 percent of the market, with application packages in most of the major software categories. Lotus has Jazz, a major Symphony-like integrated product, while Ashton-Tate is about to launch its first Mac package. Borland has just produced Reflex for the Mac, a data-analysis package which Mike Lewis reviews on page 108 of this issue. It has also adapted Turbo Pascal for the Macintosh, and has said that it will be supporting the machine with a complete family of software.

MACINTOSH SOFTWARE

WORDS

Because the Mac has an excellent display most Mac word processors show on-screen a good representation of what you get when you print. As many word-processing functions are included in the large toolbox of routines built into the Mac operating system, most Mac programs have very good text-editing functions anyway. The specialist word-processing market has been dominated by Macwrite till recently. Originally Apple bundled it free with the machine, which tended to discourage the development of competing word processors.

MAC AUTHOR

Aimed mainly at academic and scientific report writers. Mac Author is good at handling footnotes and weird specialist character sets, and it has a compact and powerful way of dealing with global style changes. A very new package, its current main problems seem to be a lack of automatic footnoting and general slowness. Nonetheless a package with potential.

MACWRITE

Apple's own word processor which was bundled in with the Mac until very recently. Like Macpaint, a classic of its type and a much emulated and highly influential program. The main thing about it is that it is extremely easy to use. Macwrite is fine for general-purpose office and authoring use. With the ability to handle large

type sizes and multiple founts, and to incorporate pictures, it also functions as a good presentation graphics package for producing text charts. However, Macwrite does have some limitations, no mail-merge and an inability to handle wide documents being the most severe.

MICROSOFT WORD

Better than Macwrite for mail-merging and some other secretarial tasks, but otherwise it has little to recommend it to the general user. On the IBM PC Word is outstanding because few other IBM programs get anywhere near as close to realising the WYSIWYG ideal. The IBM Word also has more features for handling global changes of style. Microsoft is said to be working on a new version now that Macwrite has been unbundled.

DATABASES

It has taken some time for good database products to emerge for the Mac. The lack of choice was most severe at the heavyweight, multi-file end of the market, where databases are used to generate complete business applications geared to a particular user's needs. However, things have improved and there are several contenders now available. Ashton-Tate, king of the IBM world in this category, is also joining the fray.

For simpler record-handling or browsing packages, Mac users have been better served. One feature some of the products have over their IBM equivalents is the ability to hold pictorial data as well as numeric and text data on file. However, this does eat up the storage space so there is not much point in thinking about a use for this facility unless you have a hard disc or Bernoulli drive.

BUSINESS FILEVISION

Innovative Mac-inspired product. You can use it as a fairly straightforward record-keeping and browsing package or you can also draw pictures and attach data records to them. For example, you could attach stock levels to a drawing of a product and ordering information to the component parts; pointing at a part on the picture will then retrieve the relevant data. Pictures can be broken down into lower-level pictures, which can also have data records attached. The Filevision approach works particularly well with maps and plans — libraries of pre-drawn U.S. and U.K. maps are available.

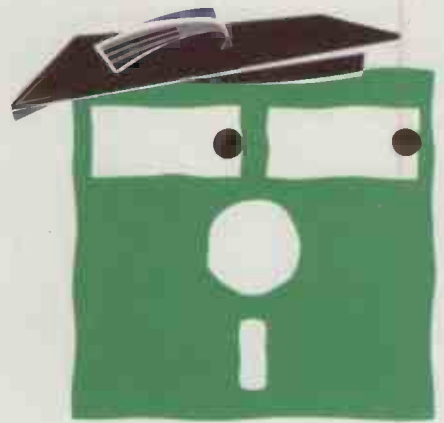
dBASE MAC

The Ashton-Tate heavyweight contender, soon to be released. Compared to the equivalent IBM product its distinctive features are a second, parallel Mac-style menu-driven interface alongside the command language, and the ability to keep graphic images in the database.

HELIX

Another capable heavyweight application generator, this time with a very distinctive Mac feel to it. You can program it to create a sort of jigsaw of pictorial images. Whether this really makes it easier to use is debatable, but it is

(continued on page 106)



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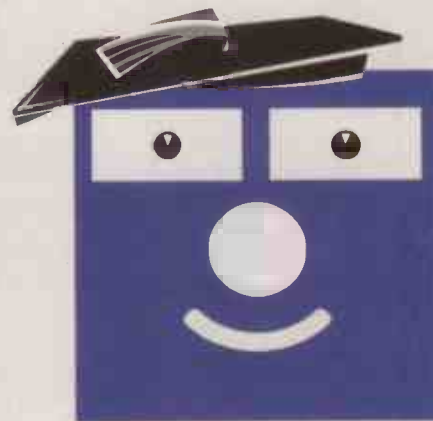
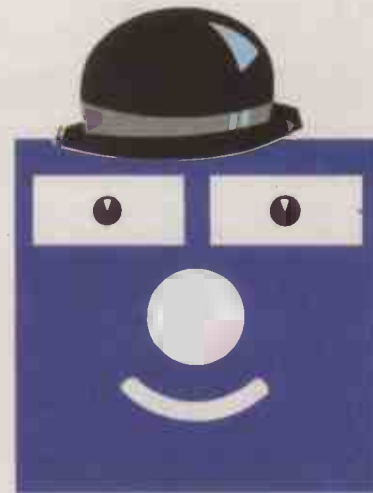
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Crystal. Makes better use of expertise than any other expert system builder.

mathematical functions. And uncertainty can be expressed either numerically or by using words such as 'maybe.'

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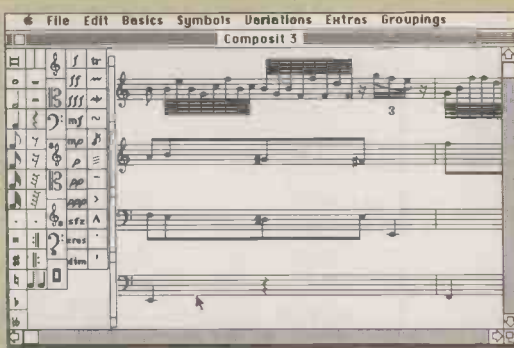
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Colormate: one of many Clip Art utilities.



Professional Composer produces multi-part scores.

such as Logo, Forth, APL, BCPL, Lisp, Prolog and Modula 2.

FREWARE

Free software, called freeware, is a thriving part of Mac culture, as is the related shareware where you only pay for a product if you like it. Clip art and desk accessories form a large part of what is on offer, although some substantial applications like the new paint program Macbillboard are also distributed this way. Communications programs, disc and programming utilities and fonts are also available.

Dealers and user groups can provide much of it for the price of a disc, but if it is shareware it's worth rewarding the authors of the good stuff to keep them producing more. The Mac User Group U.K. has a substantial library of freeware and shareware for members. Contact Mac User Group U.K., 55 Linkside Avenue, Oxford OX 8JE. Telephone: (0865) 58027.

VICOM

Excellent easy-to-use communications program, capable of handling both text and viewdata email and database services and of emulating popular terminals. Like many innovative programs it came out first on the Mac, transferring to the IBM PC only after a delay of a year or two.

WORK 'N' PRINT

Spools the printer so you can do something else while it prints.

ALL-IN-ONE

Because sharing data between applications is not as hard on the Mac as on the IBM PC, the all-in-one do-everything integrated package has not been as popular with software writers or users. The two products we mention stand out from the pack.

JAZZ

Troubled by bugs and too big for the original Mac hardware, Lotus's Jazz in cleaned-up release 1A may get a new lease of life on the more powerful Mac Plus. It certainly deserves to because it is a far more coherent and usable program than its IBM equivalent, Symphony. Has a better spreadsheet than Works.

WORKS

Microsoft's latest Mac offering, designed to destroy Lotus's foothold in the Mac user base. The word processor is better than the standard Macwrite, and the addition of a flexible and intuitive database make it unmatched as a writing tool. The spreadsheet is like Multiplan, with the addition of simple charting.

SWITCHER

The most important utility of them all — really a substantial operating-system enhancement put out by Apple itself. With Switcher you can have several packages going in memory at the same time. Switcher lets you jump instantly between them, and equally importantly, move data. For example, you could jump between word processor and spreadsheet, and move figures or a chart from the spreadsheet into your letter or report.

LANGUAGES

Unlike most IBM compatibles, which comes with Basic in the price, Apple does not bundle in a language with the Mac. But there is now plenty of choice available to anyone intent on programming the machine themselves. Mac languages include the standard workhorses such as Basic, Pascal, C and 68000 Assembler, the traditional such as Fortran and Cobol, and the more specialised or cultish

UTILITIES

Utilities are a thriving part of the Mac software scene. Users rapidly learn the basics of using the machine, but to do more obscure things inevitably involves turning to utility software.

One popular form that simpler utilities take on the Mac is the desk accessory, a category of pop-up program provided for by the operating system. Desk accessories can be invoked while you are in the middle of running some other application to, say, look up a phone number or check the time. The IBM PC has similar programs, the most famous being Sidekick. But on the IBM it is all a bit of a jungle; the pop-ups compete with each other for memory and incompatible ones can screw each other up, or in the worst case crash the system. Since desk accessories were designed into the Mac from the beginning this is much less likely to happen.

COLORMATE

Apple's Imagewriter II matrix printer can take a four-colour ribbon. Colormate lets you produce multi-coloured images from Macpaint files. Rival programs are Colorprint and Macpalette.

MACSERVE

For people with a hard disc and more than one Mac. It lets you share the disc between the Macs if you cable everything together with Appletalk. Easy to use but only offers partitioning of the disc rather than full file- and record-level locking, except with Omnifile which works exceptionally well with Macserve.

PC TO MAC AND BACK

Lets you move data between the Mac and an IBM PC. Consists of

software for both the Mac and the IBM, and a cable to link the machines physically; you can also go via a modem. Transferring text files is straightforward, but other software depends on program compatibility, with graphics providing the greatest problem. Data from Microsoft programs running on the two machines, such as Multimate and File, transfer well while Lotus 1-2-3 files will go into Jazz or Excel.

SIDEKICK

Although a runaway success on the IBM PC, the Mac version of Borland's best-known product has not done as well. The reason is that many of Sidekick's functions are available for the Mac as separate desk accessories and some of them as freeware.

PROFESSIONAL COMPOSER

The equivalent of a word processor for people who write music. Professional Composer lets you produce multi-part scores complete with slurs, ties, beams and other musical symbols. This task does demand some intelligence from the software and Professional Composer makes fairly good decisions where ambiguity is involved, although you can override it if you wish. A companion program is designed for live performance of music through Midi synthesisers, although Composer itself will output a version of the score through the Mac's speaker, or stereo socket. Music Works is a simpler rival.

STORYBOARDER

Hand-drawn storyboards are used for planning videos and other types of visual presentation. This package lets you do it on the Mac. You draw a set of key frames from the production, arrange them in sequence, and attach various notes and timing information to each frame. Storyboarder then lets you edit the frame images and notes and alter the sequence and timings.

VIDEOWORKS

Helps you make animated images which you can display on-screen or print out for frame-by-frame photographing. As well as drawing images with its own editor Videoworks lets you work on existing Macpaint files.

CREATIVE

The good graphics and fast processor make the Mac suitable for a lot more than routine data processing. It also looks a good deal more stylish than the IBM PC. In consequence, the Mac has attracted many users outside the traditional categories people are accustomed to think of as business, and software to support them is not lacking.

BORLAND TAKES THE PLUNGE

Borland International's Reflex for the Mac database may help to establish the Macintosh's popularity among business users. Mike Lewis tests out this powerful package.

The publication of Reflex for the Mac is something of a milestone in the development of the Macintosh as a machine for serious data crunching. This is not so much because of the product itself as the company behind it. Borland International has an enviable reputation for identifying genuine market needs and producing low-priced, imaginative software to satisfy them. Its first major commercial package for the Mac is bound to enhance the machine in the eyes of business users.

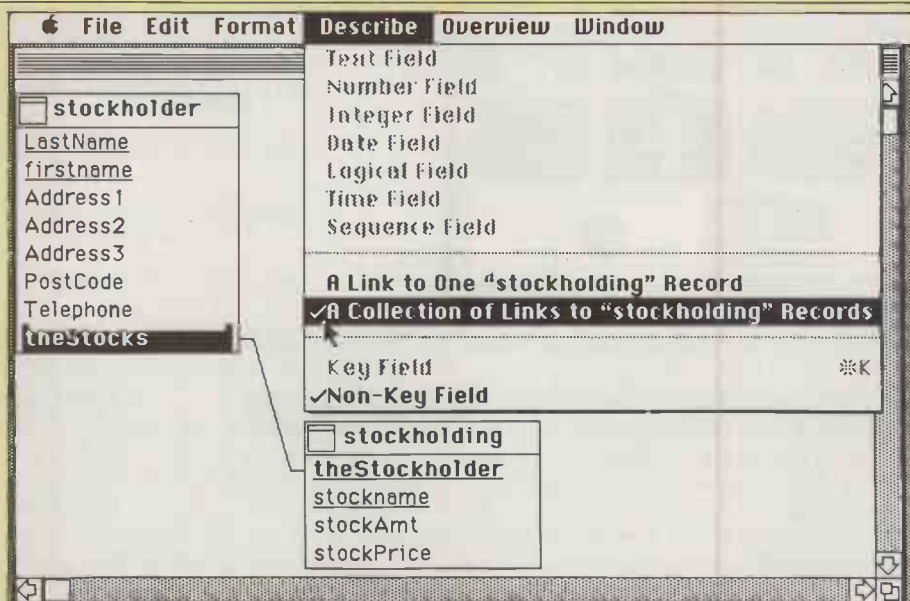
The product should not be confused with the similarly named package that Borland sells for the IBM PC. Both are databases with spreadsheet connections, but the similarity ends there. The Mac version does not have the dynamic graphing or the cross tabulations that make the IBM program so impressive. On the other hand, it does support true relational databases in a highly effective visual manner.

The database is at the heart of Reflex for the Mac. It uses the well-tried concept of data-entry forms to access and update the data. Designing a form is particularly easy, thanks to a Macdraw-like set of controls. You create rectangles for fields and drag them around a grid to make the desired layout. You can add free-format text in a variety of sizes and styles, and you can incorporate graphics into the form.

Although the database software provides plenty of ways of retrieving data, most of the useful work is done in the report module. At its simplest, a report is a straight tabulation of fields, with the option of imposing sorting and selection criteria. But by going into design mode you can juggle around with the columns and fields, and add text wherever needed. Again, a Macdraw approach is used.

You can attach formulae to any of the fields within a report, giving it many of the characteristics of a spreadsheet. The idea is that it is so quick to switch between design mode, where you can edit values and formulae, and display mode, where you see the results, that you can test assumptions and play What-If? with the same ease as with an ordinary spreadsheet.

In fact, Reflex goes several steps further by allowing you to combine data from many



Reflex is a true multi-file database. Here details on each stockholder are linked to a set of records in the stockholding file.

different sources. You could do this simply by having more than one database open while the report is being produced. But to exploit it to the full, it is best to use the relational properties of the package.

In essence, this is a way of linking two or more files by setting up common fields. The beauty of Reflex is the ease with which the links are established. You just display the relevant database structures on the screen, highlight the appropriate fields, then use the mouse to draw a line between them. From then on, altering one of the fields causes the other to be updated automatically.

This feature comes into its own when many files are linked. Links can be any combination of one-to-one, one-to-many or many-to-many. The linking lines can be made visible whenever the files are opened, so complex relationships become immediately obvious. You can use linked files to set up some reasonably sophisticated applications. Borland has included several examples with the package, including templates for client billing and share portfolio analysis.

DECEPTIVELY SIMPLE

Although Reflex for the Mac is a very powerful piece of software, Borland has succeeded in making it appear extremely simple. The manual is in Borland's usual paperback style, and is by no means heavy reading. Most users should have no difficulty in getting useful results from the package within a few hours of opening the box, even though considerably more effort might be needed to exploit it to the full.

At £99.95 Reflex for the Mac is excellent value. A 512K machine is required and a second disc drive is recommended. There is no copy protection. Most dealers should have the package in stock by the time you read this, but in case of difficulty contact Softsel, Syon Gate Way, Brentford, Middlesex TW8 9DD. Tel: 01-568 8866.

ON-SCREEN ART

John Lewis surveys the painting packages that have sprung up since Macpaint ceased to be bundled with the Mac.

When the Macintosh was launched it came bundled with the Macwrite word processor and a painting program called Macpaint. This was a wise move on Apple's part, as Macpaint was something quite new in the world of microcomputer software. It actually allowed you to draw on a computer screen in a way that was quite different to drawing on paper. The tools Macpaint provided – the pencil, the paintbrush, shapes, palettes and so on – made the whole process enticingly easy, and you could doodle away knowing that your mistakes could be erased without trace. It was easy to be convinced that you possessed hitherto hidden artistic talents. Doubtless many machines were sold as a result.

The launch of the Mac Plus early this year brought a change of policy from Apple. Software was no longer bundled with its machines; you had to buy the painting and word-processing packages separately. Here at last was the incentive third-party software producers had been waiting for. Anyone who could produce a package to match Macpaint would be in with a fighting chance; a package which improved on the original could have a large and lucrative market waiting for it.

A number of painting packages have now duly appeared, of which the most adventurous is probably Full Paint. It is published in America by Ann Arbor Softworks, and is available in the U.K. through McQueen Ltd, Elliott House, 8-10 Hillside

Mac
BILLBOARD™
 by Donald Brown

Only \$35

Sold under the MacHonor™ System
 See "About MacBillboard..."
 under the menu.

CE Software

CLICK MOUSE TO CONTINUE
 © 1984, 1985, 1986 CE Software

Billboard, a shareware program, can generate multi-sheet posters over 20 feet wide.

Crescent, Edinburgh EH7 5EA; telephone 031-558 3333. The price is £99, barely more than the £95 now being charged by Apple for Macpaint.

At first sight Full Paint looks very much like Macpaint, but as soon as you start to use Full Paint it becomes obvious that the program includes some very well thought-out improvements. For example, the scroll bars can be removed and the tool and pattern palettes can be moved around the screen so as not to obstruct the drawing. Up to four different drawing windows can be opened at one time, making the transfer of elements from one picture to another very simple.

Free rotation, skew, distort and perspective functions form part of Full Paint, whereas they had to be imported into Macpaint. Objects can be rotated in one-degree increments, for example, and can even be incorporated into text. Transparent painting is supported in text mode, which means that you can produce white text on, say, a black background without first having to put a box around it.

Full Paint provides a ruler similar to the one found in Macdraw on which you can select graduations in inches, centimetres, picas or points. The Mousespot option, available from the menu bar, lets you deter-

mine accurately how far your mouse has moved from the origin, along with the exact dimensions of the object you are drawing. This facility could come into its own when Full Paint is being used in conjunction with a desk-top publishing program. A further enhancement is Mouse Crawl, which provides very close control of the pointer for precise work.

Printer support is provided both for the Imagewriter and the Laserwriter. You can reduce or enlarge the image for printing; an image which is too big to fit on a single page is automatically printed out on two or more sheets. An additional program is supplied on disc which lets you output an enlarged image spread over 256 sheets to provide a poster over 13 feet wide by 10 feet high.

ENLARGED OUTPUT

Even bigger posters can be produced by a program called Billboard from CE Software. Like Full Paint it outwardly resembles Macpaint, and it is used in very much the same way. Unlike Macpaint it includes scroll bars, so you can move around the drawing more easily. Billboard's patterns are accessed via the menu bar, so there is no need for the palette that appears along the bottom of the Macpaint screen.

Billboard has no equivalent of Macpaint's

Fat Bits. Instead it provides three levels of zoom, with the bonus that the editing tools work at all levels. There is also a split-screen feature which displays a representation of your painting at normal size even while you are working on it at a more detailed level.

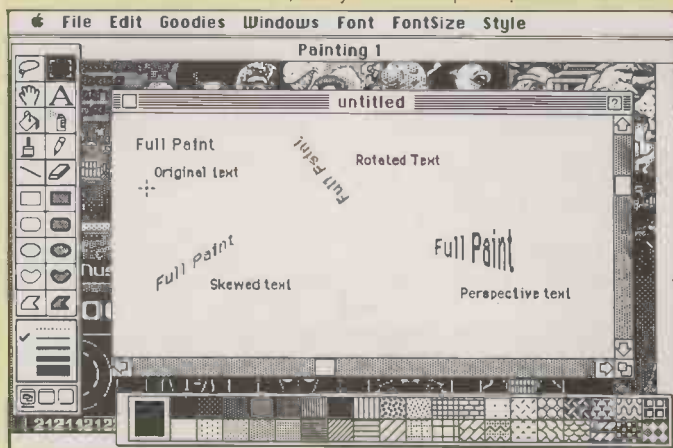
Billboard is distributed as shareware. The basic program is available free of charge for you to try out; if you want to continue to use it you are expected to pay a registration fee of \$35, in return for which you receive various enhancements. The program is available from the Macintosh User Group U.K., 55 Linkside Avenue, Oxford OX2 8JE; telephone (0865) 58027.

A brand-new package called Superpaint differs from the previous painting programs in that it combines bit-mapped painting with object-orientated drawing of the kind found in Macdraw. You can switch freely between the two modes, and together they form a really powerful combination.

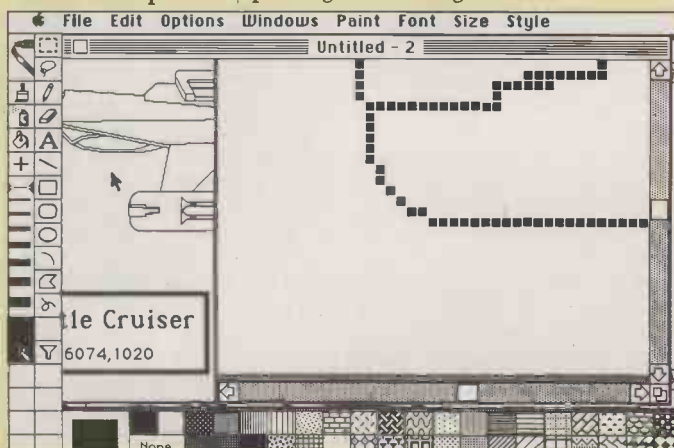
Superpaint allows you to have up to eight different drawings open at a time. Text handling is particularly good: a text box can be resized and reshaped, and the text itself then follows faithfully. On the early version we had to look at, the largest available type size was 72 point. One advantage of using object-orientated text is that it is output from a Laserwriter in one of the built-in fonts, which usually look a great deal better than bit-mapped text.

The scroll bars let you see all parts of the drawing, and most of the tools will cause the window to scroll when they reach the edge of the screen. Thus a whole drawing can be selected for subsequent pasting into another application. There are 39 patterns and 40 brush shapes, all of which can be customised if required. Patterns inside selected objects can be changed just by clicking on the object. There are three levels of magnification. In each the full image is shown in the left-hand quarter of the screen, with the magnified portion of your image occupying the remainder.

Superpaint is expected to be available from the end of October from Mac Serious Software, 17a Park Circus Place, Glasgow G3 6AH; telephone 041-332 5622. The retail price is £90. The authors say they are working on a version that supports colour printing on the Imagewriter II.



Using Full Paint you can superimpose text straight on to an image.



Superpaint combines bit-mapped and object orientated modes.

JACK'S MAC?

With the same Motorola 68000 processor, a graphics front end and as much or even more memory, Jack Tramiel's Atari ST micros look at first sight as though they ought to be beating the Macintosh on its own ground — especially as they can be bought at a fraction of the price, and with the possibility of a colour display as a bonus. But in fact they are finding favour with an entirely different sort of user, as **Steve Malone** explains.

It has been over two years since Jack Tramiel took over the ailing Atari Corporation from Warner Brothers, and just over a year since the launch of the ST range of machines. In that time the company has been turned around from one whose obituaries were already being written to a corporation whose future seems more assured than that of the majority of its rivals.

The ST was developed by Jay Miner, the designer of the original eight-bit Atari micros, in conjunction with Sam Tramiel at Tramiel Technology Incorporated. The first machines were demonstrated to the public in January 1985, and a few hundred STs reached the U.K. a couple of months later. These early machines were intended mainly for distribution to software developers, and the public did not get to see them until September that year.

First reactions to the ST were mixed. Atari's reputation — indeed that of Jack Tramiel — had been for selling mass-market games machines. The computer market at the time was swinging sharply away from

home micros and towards business-oriented machines; consequently few pundits took the ST seriously. But right from the word go Atari had taken the apparently bizarre step of including a DEC VT-51 emulator on board the 520ST. A number of establishments quickly realised that the Atari was a much cheaper option than the equivalent dedicated terminal, and began to buy it in large quantities.

But a successful machine is not built on mainframe and mini users in search of a bargain. The current model most likely to attract business users is the 1Mbyte 1040STF, perhaps with a colour monitor and a double-sided external floppy disc to add to the built-in drive. This setup costs £1,173. The same system with a monochrome monitor instead of colour comes in under the £1,000 mark.

The first applications to appear for the Atari ST machines as micros in their own right were simple conversions of programs which were already popular on other machines. Few programs took advantage of

the Gem interface or other special features of the ST which would persuade potential customers to buy that machine rather than any other. This is a particularly vital point, as it is only the availability of leading-edge software that has allowed the Macintosh to hold its own against the dominant IBM standard. More recently a number of packages have become available which do take advantage of the machine's power. The key programs are described in detail starting at the foot of this page.

This is not to say that the older type of software has not also had a place on the Atari. With the success of the Amstrad computers in mind, Atari placed great hopes on the release of a CP/M-80 emulator for its own machines earlier this year. But of the many packages available on the Amstrad 3in. disc format, only dBase II is available on Atari 3.5in. discs. Atari and its distributors say they are now working on this problem.

One program that is claimed to be having a big impact on business sales of the ST is

(continued on page 113)

ATARI SOFTWARE

VIP PROFESSIONAL

This package is claimed to be a fully functional Lotus 1-2-3 clone, the idea being that a user familiar with 1-2-3 on the IBM PC could use VIP Professional immediately. For small businesses unable to afford the IBM/1-2-3 combination, or people who require the Lotus setup along with the additional functionality provided by the ST, it is an attractive option.

Because of the increased speed of the ST, cursor movement around the screen and calculations generally are much nippier than on the IBM equivalent, though there do seem to be one or two problems with VIP Professional during operation. Occasionally, while keying through the menus and performing a disallowed command sequence, we found that the program simply locked us out of the system without displaying an error message. This can be frustrating to say the least if you have a large spreadsheet on-screen.

As a test of Lotus compatibility we decided not to use the VIP manuals but to follow a Lotus tutorial guide instead. All the commands mentioned in the Lotus

APPLICATIONS

After a slow start, quite a wide range of business applications programs are now available for the Atari ST series. In general they fall into two categories: programs adapted from other machines, which do not make use of the Atari's graphics-orientated interface; and software written specifically for the Atari or another 68000-based micro which does make use of the full Wimp front end. We looked at a small selection of programs typifying both kinds.

guide worked perfectly on VIP. This is just as well, as the first chapter of the VIP manual bears no relation to what you see on the screen. The manual says that on power-up you should see a full Gem interface instead of the familiar spreadsheet outline of 1-2-3 that actually appears. The publisher of VIP Professional is about to implement a Wimp front end to Professional and has written the manual accordingly. However, inexperienced users might find themselves totally confused, and could be forgiven for thinking they have been given the wrong program.

It is claimed that Professional can read and write to Lotus data discs, even though the ST uses 3.5in. discs rather than the 5.25in. IBM format. The rub is that in

order to plug a 5.25in. IBM drive into an Atari a certain amount of hard wiring is necessary. We do not know of any generally available 5.25in. drive for the ST, so this looks like a job for an electronics enthusiast rather than for ordinary business users.

VIP Professional is published by VIP Technology. The text-only version costs £169; supplied with a Gem front end it costs £199.

LASERBASE ST

Laserbase is adapted from a similar package running on the Apple Macintosh and so is able to take advantage of the Atari's Gem interface. The records and fields are created by adjusting boxes to the required size. Within the box, the program gives you the number of characters which

can be fitted within the field. While the record layout is being created, it is also possible to add headings, specify the fields as numeric or alphanumeric and set key numbers — all of which is done by clicking the boxes on the side of the screen. Password protection for the database can be implemented at read, write or read/write level.

Once the layout has been created, data can be added to the skeleton by use of the Laserbase input program. This allows for input and deletion of records and searches. The program is remarkably easy to use, although it lacks the kind of programming language and powerful facilities available under packages like dBase III. Many users will find it quite sufficient for their record management.

Laserbase ST is a fine example of what can be achieved using the ST's facilities. It is published by Laser Software International and costs £86.91.

TIMELINK

This package is intended to be an all-round appointments book, diary-planner and time-man-

(continued on page 112)

ATARI ST



Power Without The Price!

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 1/4 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).

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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
- 20Mbyte HARD DISK
- LOTUS 123™ CLONE
- dBASE III CLONE
- IBM COMPATIBILITY
- VT100 EMULATOR
- MICROSOFT WRITE
- 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, a 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 Intercomm 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.

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) MEGAROIDS - 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.

1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX
117 Orplington High Street, Orplington, Kent, BR6 0LG
Lion House (1st floor), 227 Tottenham Court Rd, London, W1
Selfridges (1st floor), Oxford Street, London, W1A 1AB

£699

PRICE MATCH PROMISE

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.

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- ★ HIGHLY COMPETITIVE PRICES
- ★ AFTER SALES SUPPORT SERVICE
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If you would like to be registered on our mailing list as an Atari computer owner, or as a person interested in buying an Atari machine, let us know. We will be pleased to keep you up to date with new Atari developments free of charge. So, return the coupon today and begin experiencing a specialist Atari service that is second to none.

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PLEASE SEND ME FREE LITERATURE ON THE NEW RANGE OF ATARI ST COMPUTERS

Mr/Mrs/Ms: _____ Initials: _____ Surname: _____

Address: _____

Postcode: _____

Do you already own a computer
If so, which one do you own? _____

(continued from page 110)

agement system. Equipped with a full Gem interface, it also allows you to perform calculator functions such as totalling expenses over a given period. As an added bonus Timelink contains a general-purpose address-book utility.

Softechnics claims that anyone familiar with Gem should be able to use Timelink without looking at the manual. On this basis we managed to examine the diary and add and delete entries, perform a text search for an entry, and find when our next free 30-minute period occurred on a particular day. This experience speaks well of the program's ease of use, though it is probably still preferable to read the manual and find out what a command is supposed to do rather than guess.

The aims of Timelink are strictly limited, but the program appears thorough and can be recommended to those whose needs do not stretch beyond an electronic version of Filofax. Timelink is published by Softechnics and costs £78.22.

EASY DRAW

This is a graphics package very similar in style to Macpaint. With a colour ST system you have a range of four colours.

The program allows you to set patterns, draw lines and write different sizes of text on-screen. Like Macpaint, Easy Draw has a clipboard function which allows figures and areas from one



diagram to be transferred to a temporary area, and later to another diagram. More directly it is possible to have two windows open and transfer the area straight across. Although Easy Draw has a zoom option, the kind of pixel-by-pixel construction available on Macpaint and Atari's own Neochrome is not supported. This restricts the package's ability to produce finely detailed work.

Easy Draw is published by Micrograph and costs £130.39.

BOS

The BOS software system is built around the British-designed BOS operating system. It is written in Micro Cobol and is designed to be a cut-down version of a mainframe-resident suite of business software.

Once installed, and with suitable drivers, the BOS operating system interposes itself between the applications programs and the computer's native operating system. The relative ease with

which the BOS software can be ported from one micro to another means that the customer does not have to standardise around a single machine. Instead, a business can install a wide range of micros in the office, all able to run the same applications. Applications written to run under the systems include word-processing, database and spreadsheet programs, and a recently introduced graphics package.

The mainframe origins of the BOS suite are plainly visible when the system is running. The system is menu-driven either via a list of choices displayed on-screen or via Escape characters on a command line.

This mainframe-style no-frills approach has both advantages and disadvantages. On the one hand, many businesses feel they can do without the bells and whistles that clutter up many modern applications; they are happy to go for a simple and reliable text-based data-input system. The more the programmer adds features like on-screen fonts and colours, the more machine-specific the program becomes, thus reducing the portability. The obverse of this is that you end up with a lowest common denominator which only supports those features implemented on all machines. On the ST, this means that the Wimp and graphics capabilities are unused. BOS Software Ltd is at 87/89 Saffron Hill, London EC1N 8QU. Telephone: 01-831 8811.

METACOMCO PACKAGES

Metacomco is a rare bird among U.K. software houses, having established a name for itself on both sides of the Atlantic as a provider of high-quality systems and development tools especially for the Motorola 68000 series. The products for the ST we looked at were the MCC Assembler and Lattice C compiler.

The first thing to be said about both of these products is that they are not small. The C compiler, for example, comes with a large number of library files packed so that they can be crammed on to two discs. Once they have been unpacked, the entire system comes to around a megabyte of code.

Both packages are comprehensive and highly professional programs containing most items that the ST programmer is likely to require, including editors, linkers and a library of subroutines. The complexity of the system meant that assembly or compilation was

PROGRAMMER'S TOOLS

In the early days of the ST a great deal was made of the number of programmer's development packs being sold. Though this kind of interest is not on its own enough to ensure the future of a new machine, it is undeniable that the wide range of utility packages and programming languages available on the ST series has been a big encouragement to would-be suppliers of third-party software. We looked at a selection of the utilities on offer.

a little on the slow side: it took several minutes to turn even the smallest program into executable code.

The two packages we looked at had a number of features in common, in particular the Menu + Gem front end to the system. As well as giving the programmer access to the various parts of the system, Metacomco has thoughtfully included a history of previously executed commands you can simply click to re-execute, rather than having to enter them again by hand.

Unfortunately the editors provided with the packages do not support Gem, and the cursor has

to be moved round either by using the arrow keys or via a number of Control characters. Compilation and editing support a full list of error messages, but the error recovery seems limited. MCC Assembler is priced at £49.95 and Lattice at £86.91.

DEVPAC ST

For the more modest assembly-language programmer, Hisoft has produced the Devpac Assembler/Debugger/Linker. It provides a powerful entry to 68000 assembly language and is far less forbidding than the Metacomco products, though it lacks many of Metacomco's bells

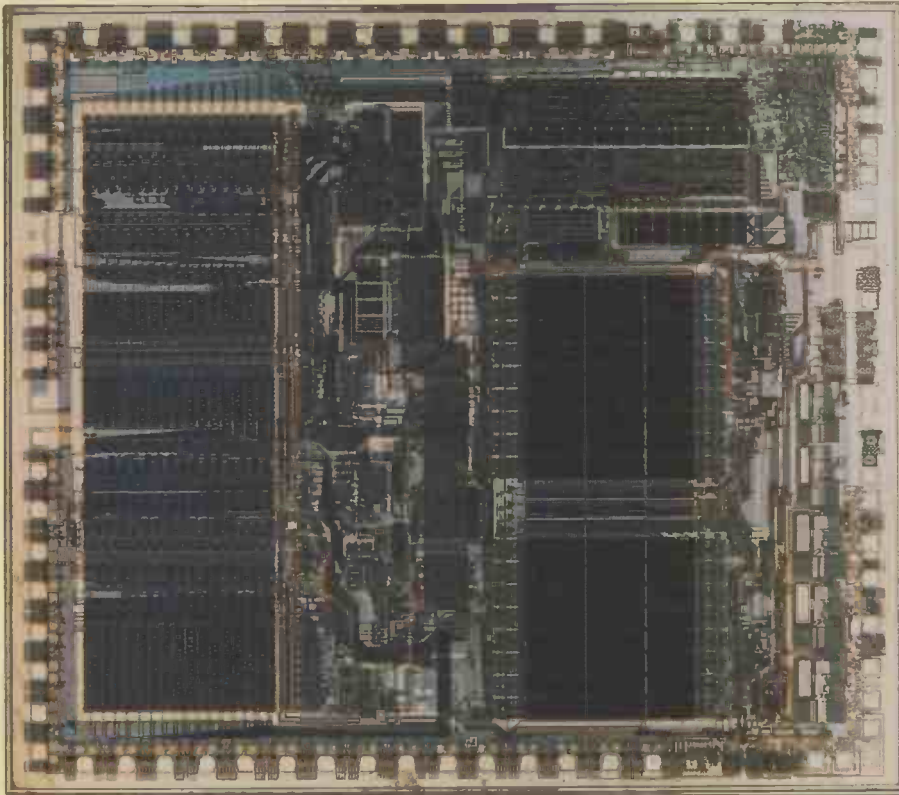
and whistles. All parts of the system make use of the Gem environment. It supports a number of useful functions, such as intelligent Copy, without fuss. It also provides you with a monitor.

Devpac ST is recommended for the beginner. It is published by Hisoft and costs £43.43.

K-RESOURCE

Although the other development tools mentioned here allow you to create your own programs for the ST series, they do not allow you to edit the Gem interface; K-Resource allows you to do just that.

The program allows you to create and design your own icons and windows. It is intended for use primarily with C compilers. There is a wide variety of options for use under K-Resource which enable you to decide exactly how a window and object will appear on the screen. Files and trees can be introduced and edited within the program. K-Resource is published by Kuma Computers and costs £34.74.



Motorola's 68000 chip. Atari is now working on a 68020-based Unix machine.

(continued from page 110)

VIP Professional. This fully functional Lotus 1-2-3 clone is sold at half the price of the original. Its distributor, Silica Distribution, says that it has actually sold a number of machines on the back of this piece of software.

Like other manufacturers, Atari is reticent about its plans for future products. One development that appears to be imminent is the release of a 1040ST machine with a block-image transfer or blitter chip built-in. This device can move areas of data around in memory — particularly video RAM — independently of the processor. Until now it has only been available on the Commodore Amiga, but Atari has made no secret of the fact that it has been working on a similar device for the ST.

BLITTER CHIP

The company initially indicated that the blitter chip would be available for all 1040 owners. More recently it has said that it has no plans to supply the blitter as an upgrade; rather its policy is to make new machines software compatible with existing STs. There may be difficulties in putting this policy into effect. The introduction of a blitter will alter the configuration of the machine's video memory, so software authors who ignored Atari's advice and addressed video memory directly rather than going through the BIOS may find their programs in trouble.

Another device promised from Atari is the IBM emulator box. This add-on appears to resemble the Mac Charlie box for the Macintosh. Inside is an 8088 chip, an IBM BIOS, 512K of RAM and a 5.25in. disc drive. It will allow all IBM software to run on the machine, relegating the ST hardware to

a mere front end. Atari is not willing to speculate about the final price of the ST Charlie — or whatever it will be called — although the last figure quoted was around £300.

Also promised for the near future is a 20Mbyte hard disc. The disc unit itself is now complete, and a number of models are already with U.K. software developers. Atari says it is only waiting to ramp up production before officially releasing the machine, which will be priced at about £750.

The final piece of hardware that Atari is willing to admit to is a computer based around the 32-bit 68020 chip, to be used mainly as a multi-user/multi-tasking machine running under Unix System V. Atari has already taken out a Unix licence from AT&T for what should be a full implementation of the operating system. The new computer is going to be fitted with 2Mbyte of memory, the minimum necessary for Unix System V. The 68020 can address a massive 4Gbyte, and Atari plans to fit each machine with a memory-management unit similar to that used on the IBM PC/AT, which will enable it to access virtual memory on disc. This setup could provide the kind of distributed processing only previously seen on mainframe computers.

ST SYSTEM PRICES

1040STF: 1Mbyte RAM, one built-in double-sided 3.5in. floppy disc with 720K formatted capacity, monochrome monitor, £779; with colour monitor, £999

520STF: 512K RAM, no disc drive, no monitor, £347

External disc drives: double-sided 3.5in. floppy, 720K formatted capacity, £174; single-sided, 360K formatted capacity, £130; 20Mbyte hard disc, £739

MAKING FRIENDS

Though it has yet to make an impression as a serious computer the Commodore Amiga has won itself a dedicated band of admirers. **Glyn Moody** assesses the future of this powerful and individualistic machine.

The saga of the Amiga has been an extraordinary one. Although the machine was announced 18 months back and first shown in this country well over a year ago, it has only been on sale for about six months. Commodore's continuing financial difficulties have tended to obscure the machine itself, and only now are we beginning to see the Amiga for what it is.

When the first reviews came out they mainly consisted of oohs and aahs, and there is no denying that there was much to admire. In addition to what looked like a colour version of the Macintosh interface there was multi-tasking. And above all, there were the graphics capabilities, largely thanks to some powerful custom chips dedicated to this function.

The big worry, then as now, was that the Amiga embodied a totally novel architecture using a minority chip, and had no existing software. Would software houses really be willing to convert from the tried and tested? In the April issue of *Practical Computing* we reported on the very first trickle of what was promised to be a flood of exciting software. Today it has grown to a rivulet, but there is still a long way to go.

Even with this limited perspective, some trends are apparent. It is clear that there will not be a huge range of word processors, spreadsheets and the like. After all, if you want those sort of functions you buy an IBM or compatible. If you want user-friendliness you might at a pinch buy a Macintosh, but there is no reason to buy an Amiga.

It is in the graphics and to a lesser extent the sound capabilities that the future of the machine lies. Two of the very first packages we looked at were drawing programs which allow you to manipulate colour images in a Mac-like way. One of them, *Deluxe Paint*, was particularly impressive and offered facilities previously found only on dedicated paint systems costing tens of thousands of pounds.

More recently a number of products have emerged which take the graphics even further. For example, there are several animation packages that allow you to build up smoothly changing sequences of text and images. Some also let you add synthesised sound as an accompaniment.

There are also true CAD programs designed for serious use by architects and

(continued on next page)



The Amiga's graphics make it ideal for animation.



Images as well as text can be stored in Superbase.

(continued from previous page)

engineering designers. Such packages on the Amiga have several advantages over standard CAD programs. For example, with the Amiga you can open several windows simultaneously, allowing details to be worked on while you retain a view of the whole.

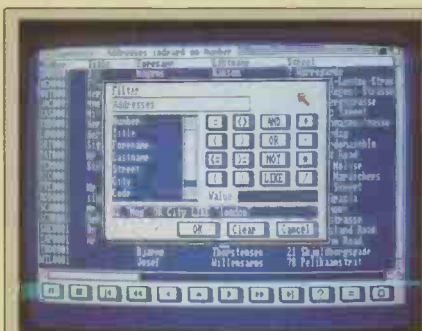
The graphics element is also creeping into conventional applications. For example, databases are being developed which allow you to store an image in one of the fields. They could well find favour in applications like buying and selling property: in addition to carrying text details of a house, the program could display pictures of exteriors and interiors. Security files with images as well as text are another possibility.

PERIPHERALS DEVELOPED

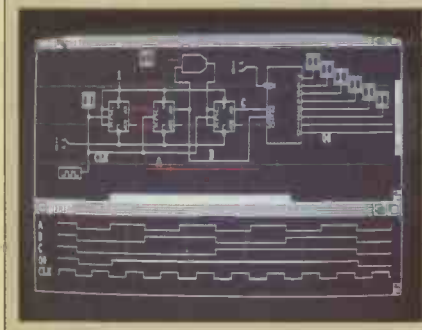
Hand in hand with this increased use of graphics has gone the development of various peripherals designed to get visual data in and out of the machine. At the recent PCW Show, Commodore was demonstrating its PAL genlock device. This allows computer images to be superimposed on and synchronised with video data drawn from an external source such as a video camera or recorder.

Digitisers are also starting to come through, allowing photographic images to be captured and then manipulated by software. Like the Macintosh, the Amiga is blessed with a recommended file format for the interchange of information between different manufacturers' programs. This will aid the development of such programs, and contrasts with the situation on the IBM PC where no such standard exists. Commodore has also announced a complete Amiga system combined with the Mitsubishi G-500 colour printer, which we looked at in our September issue, to provide high-quality dumps of full-colour images.

Another area where the Amiga's virtues have appealed to software developers is desk-top publishing. Although colour is not necessary in this sphere, the Amiga's excellent display lends itself to this kind of application.



Above: You set up command strings by pointing with the mouse.
Below: Simulating a circuit.



Aside from graphics-orientated applications the Amiga is well provided with languages. The company which designed the operating system and original Basic, Metacomco, has come out with Lisp and Pascal, with others to come. The number of programmer's tools available suggest that more software is on the way.

There are also some interesting developments on the hardware front. It seems likely that Commodore will shortly launch an upgrade to the Amiga which will offer a full 68020 processor as well as more RAM. Further enhancing the performance of the machine in this way will make it even more attractive for computationally intensive applications like graphics. You can already buy an expansion box for the Amiga which contains the 68020 and 512K of high-speed RAM. It costs £5,475 from Precision Software, which also sells the software illustrated on this page.

Beyond the 68020 lies the Inmos Transputer. Sophus has demonstrated an early prototype of an expansion box containing one or more of the Transputer superchips. At the moment they sit on cards held in the Sidecar add-on for the Amiga, along with a hard disc. The connection to the main processor follows a tortuous route via Sidecar's 8088 and the expansion bus. It is hoped eventually to link Transputers directly with the graphics chips in the Amiga. The developers believe this will result in enormous gains in performance — ideal for graphics applications, and for optical character recognition systems.

The Amiga has had a rocky ride so far. Some of the problems were self-inflicted: the operating system has gone through a number of incarnations, and generally Commodore seems unable to commit enough resources to the project to get things sorted out quickly and cleanly. Things have also been hampered by indecisiveness as regards the intended end market. In the U.S. the Amiga is looked on very much as a top-end games machine, though in this country its main thrust has been as an innovative business computer. This needs to be refined further, with emphasis on its potential as a solution in vertical markets.

INNOVATION NOT DEAD

The Amiga is never going to challenge the Macintosh on its own ground, let alone IBM. It is also likely to have difficulty doing much to the Atari ST series, which seems to be doing well in the lower end of the market. But it definitely has its place in the micro world, both as an illustration that innovation is not dead and as a warning of how innovation on its own is not enough. Superb graphics make the Amiga ideally suited for applications like animation displays and CAD, and its position in this sector will be strengthened by the appearance of various 68020 versions. Provided Commodore can keep going long enough to give the machine a chance then the Amiga should be around for a while yet. It may have a lot still to do, but it has certainly won a few friends along the way.

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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.

Please send your contributions to

Open File, Practical Computing, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

SPREADSHEET TEMPLATE

WORK SCHEDULER

S H Wells presents a Supercalc 2 template for scheduling the working hours of part-time staff.

MANY small businesses which deal with the general public find that their customers and their own staff are better served if they permit many of their employees to work part-time. This approach can also help the business because inevitably there will be some days when more staff are needed than on others. Equally, the employees themselves will have a preference for the days on which they wish to work and for the number of hours they want to work on their shifts.

Scheduling the staff each month would be easier if every month had the same number of days. Unfortunately, some months have, say, four Mondays and five Tuesdays, or some other combination that involves replanning each staff member's work schedule. It is in this area that a spreadsheet can help. The template called Staff, described here, happens to have been written on Supercalc 2, but there is nothing in it which could not be adapted to most spreadsheets.

The template also relies on the Sorcim program Dattim, which is provided with Supercalc 2. To use Staff you first load Dattim, specifying the first day of the month required. For example, if you wanted the schedule for November 1986, you would enter

11/01/96

then load Supercalc 2 followed by Staff.

Immediately after loading, the spreadsheet will work out that the first day of the month of November in the year 1986 is a Saturday. It will also decide that the 30th is the last day of the month, and that that day is a Sunday. It will not print anything for the 31st.

The program will then shuffle

FIGURE 1. MONTHLY PRINTOUT

October		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu
John	Th Fr Sa	8.00	8.00	8.00	8.00				8.00	8.00	8.00				
Mary	Th Fr Mo	8.00		8.00		8.00				8.00				8.00	
Fred	Th Fr Sa	8.00	8.00	8.00	8.00				8.00	8.00	8.00				
Tracey	Mo Tu We	6.00	6.00			6.00	6.00	6.00						6.00	6.00
Alison	Tu Fr Sa	6.00			6.00			6.00			6.00	6.00			6.00
Margaret	Th Fr Sa	4.00	4.00	4.00	4.00				4.00	4.00	4.00				
Anne	Su Tu We	4.00	4.00			4.00		4.00	4.00				4.00		4.00
Derek	We Th Su	4.00	4.00	4.00		4.00			4.00	4.00			4.00		
Gerry	We Th Su	4.00	4.00	4.00		4.00			4.00	4.00			4.00		
Barbara	Tu We Sa	4.00	4.00		4.00			4.00	4.00			4.00			4.00
Beverly	We Th Sa	4.00	4.00	4.00	4.00				4.00	4.00		4.00			
Total for day		26.00	32.00	34.00	34.00	12.00	14.00	20.00	26.00	32.00	34.00	34.00	12.00	14.00	20.00
Coverage		3.25	4.00	4.25	4.25	1.50	1.75	2.50	3.25	4.00	4.25	4.25	1.50	1.75	2.50
		15	16	17	18	19	20	21	22	23	24	25	26	27	28
		We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu
John			8.00	8.00	8.00					8.00	8.00	8.00			
Mary				8.00		8.00					8.00			8.00	
Fred			8.00	8.00	8.00					8.00	8.00	8.00			
Tracey		6.00					6.00	6.00	6.00					6.00	6.00
Alison				6.00	6.00			6.00			6.00	6.00			6.00
Margaret			4.00	4.00	4.00					4.00	4.00	4.00			
Anne		4.00				4.00		4.00	4.00				4.00		4.00
Derek		4.00	4.00			4.00			4.00	4.00			4.00		
Gerry		4.00	4.00			4.00			4.00	4.00			4.00		
Barbara		4.00			4.00			4.00	4.00			4.00			4.00
Beverly		4.00	4.00		4.00				4.00	4.00		4.00			
Total for day		26.00	32.00	34.00	34.00	12.00	14.00	20.00	26.00	32.00	34.00	34.00	12.00	14.00	20.00
Coverage		3.25	4.00	4.25	4.25	1.50	1.75	2.50	3.25	4.00	4.25	4.25	1.50	1.75	2.50
		29	30	31	Totals										
		We	Th	Fr											
John			8.00	8.00	112.00										
Mary				8.00	72.00										
Fred			8.00	8.00	112.00										
Tracey		6.00			78.00										
Alison				6.00	78.00										
Margaret			4.00	4.00	56.00										
Anne		4.00			52.00										
Derek		4.00	4.00		56.00										
Gerry		4.00	4.00		56.00										
Barbara		4.00			52.00										
Beverly		4.00	4.00		56.00										
Total for day		26.00	32.00	34.00											
Coverage		3.25	4.00	4.25											
Total for month		780.00													

each employee's shifts around so that they are shown to work on the days they want to work, and then calculates the coverage for each day. A printout for the month of October 1986 is shown in figure 1. The names of the employees can

be changed easily, as can the days and hours that they work.

The only preset parameters are as follows. There is currently space for up to 11 employees. Each employee can work for up to three days a week, but the hours they

want to work must be the same each day. Finally, the business is assumed to be open eight hours a day, seven days a week. Once the template has been entered, any of these parameters can be changed.

(continued on next page)

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The main objective of the program is to calculate the coverage each day for the business, but it also shows the total number of employee-hours worked each day and for the month. It also totals the number of hours that each employee will work in the month. It would be easy to add an hourly rate and the total to be paid to each employee. The spreadsheet is designed to print out at 17 characters per inch (cpi) and to fit on an A4 page. That is why it runs out to day 14, then prints day 15 to day 28 and fits day 29 to day 31 underneath.

All the columns are seven characters wide with the following exceptions: columns A and V are 10 characters wide and column I is eight characters wide. There are two user-defined formats. Format 1 allows for two decimal places, while format 2 assumes no decimal places.

Six blocks of the template are

FIGURE 2. TEMPLATE SKELETON

A	B	C	D	E	F
2: LOOKUP(J1, U1:U12)					1
3:					
4:					
5:					LOOKUP(K1, U13:U25)
6: ("John") ("Th") ("Fr") ("Sa")	8				IF(OR(F4=B6, F4=C6), E6, IF(F4=D6, E6, 0))

concerned with establishing the correct days of the week for the particular month to be scheduled. They are I1 to L1, U1 to X12, U13 to V26, F4 to S4, F24 to S24, and F44 to H44. The cells I1 to L1 are hidden.

All days are entered as textual values: thus Monday is entered as "Mo", not "Mo. This enables the sorting part of the program to work. For the convenience of the user, the names of the employees are entered the same way; so when they are changed in section A6 to A16 they will automatically be changed in the blocks A26 to A36 and A46 to A56. In other words, A6 is entered in cells A26 and A46, although the status line on the

screen will immediately show the name, not A6. The contents listing also shows the names, not the cell numbers.

Although the listing may appear a little daunting initially, much of the template is entered with the Replicate command. The best way to start is to enter the F column and then replicate across to the S column. The full listing is provided so that you can check any cell that you wish to.

The skeleton of the template is shown in figure 2. Cell A2 looks up the month specified by Datim and entered in cell J1, and translates it via block V1 to V12 to the name of the month. Cell F2 is always 1, referring to the first day

of the month. Cell F4 looks up the textual value of the day of the month via the block V13 to V25; in figure 1 this is "We". Cell F6 is the keystone cell. It says that if any of the days on which John works, B6, C6, D6, is the same as this day, F4, then print the hours which John works on his shift, E6. If none of them is the same, then print zero, which always prints blank.

Cell F6 is replicated across to S6 with everything exactly the same, except that F6 changes to the block G6 to S6. F7 is much the same, except that B6, C6, D6 and E6 become B7, C7, D7 and E7. So it is easy to replicate F6 from F7 down to F16, and G6 from G7 down to G16 and so on.

STAFF SPREADSHEET LISTING

A1 = "STAFF (Print A2:S60)	F1 = "Set DAT	I9 = IF(OR(I4=B9, I4=C9), E9, IF(I4=D9, E9, 0))
G1 = "TIM to	H1 = "1st.	J9 = IF(OR(J4=B9, J4=C9), E9, IF(J4=D9, E9, 0))
I1 H = TODAY	J1 H = MONTH(I1)	K9 = IF(OR(K4=B9, K4=C9), E9, IF(K4=D9, E9, 0))
K1 H = WDAY(I1)	L1 H = LOOKUP(J1, V1:V12)	L9 = IF(OR(L4=B9, L4=C9), E9, IF(L4=D9, E9, 0))
U1, V1, F2, U13 = 1	V1 = ("January")	M9 = IF(OR(M4=B9, M4=C9), E9, IF(M4=D9, E9, 0))
A2 = LOOKUP(J1, U1:U12)	G2 = 1+F2	N9 = IF(OR(N4=B9, N4=C9), E9, IF(N4=D9, E9, 0))
T2 = 1+H2	J2 = 1+I2	O9 = IF(OR(O4=B9, O4=C9), E9, IF(O4=D9, E9, 0))
L2 = 1+K2	M2 = 1+L2	P9 = IF(OR(P4=B9, P4=C9), E9, IF(P4=D9, E9, 0))
O2 = 1+M2	P2 = 1+O2	Q9 = IF(OR(Q4=B9, Q4=C9), E9, IF(Q4=D9, E9, 0))
R2 = 1+Q2	S2 = 1+R2	R9 = IF(OR(R4=B9, R4=C9), E9, IF(R4=D9, E9, 0))
V2 = ("February")	W2 = 1+W1	S9 = IF(OR(S4=B9, S4=C9), E9, IF(S4=D9, E9, 0))
U3 = 1+U2	V3 = ("March")	U9 = 1+U8
F4 = LOOKUP(K1, U13:U25)	G4 = LOOKUP((K1+1), U13:U25)	F10 = IF(OR(F4=B10, F4=C10), E10, IF(F4=D10, E10, 0))
H4 = LOOKUP((K1+2), U13:U25)	I4 = LOOKUP((K1+3), U13:U25)	G10 = IF(OR(G4=B10, G4=C10), E10, IF(G4=D10, E10, 0))
J4 = LOOKUP((K1+4), U13:U25)	K4 = LOOKUP((K1+5), U13:U25)	H10 = IF(OR(H4=B10, H4=C10), E10, IF(H4=D10, E10, 0))
L4 = LOOKUP((K1+6), U13:U25)	M4 = LOOKUP((K1+7), U13:U25)	I10 = IF(OR(I4=B10, I4=C10), E10, IF(I4=D10, E10, 0))
N4 = LOOKUP((K1+8), U13:U25)	O4 = LOOKUP((K1+9), U13:U25)	J10 = IF(OR(J4=B10, J4=C10), E10, IF(J4=D10, E10, 0))
P4 = LOOKUP((K1+10), U13:U25)	Q4 = LOOKUP((K1+11), U13:U25)	K10 = IF(OR(K4=B10, K4=C10), E10, IF(K4=D10, E10, 0))
R4 = LOOKUP((K1+12), U13:U25)	S4 = LOOKUP((K1+13), U13:U25)	L10 = IF(OR(L4=B10, L4=C10), E10, IF(L4=D10, E10, 0))
U4 = 1+U3	V4 = ("April")	M10 = IF(OR(M4=B10, M4=C10), E10, IF(M4=D10, E10, 0))
P6 = IF(OR(F4=B6, F4=C6), E6, IF(F4=D6, E6, 0))	U5 = 1+U4	N10 = IF(OR(N4=B10, N4=C10), E10, IF(N4=D10, E10, 0))
G6 = IF(OR(G4=B6, G4=C6), E6, IF(G4=D6, E6, 0))	V5 = ("May")	O10 = IF(OR(O4=B10, O4=C10), E10, IF(O4=D10, E10, 0))
H6 = IF(OR(H4=B6, H4=C6), E6, IF(H4=D6, E6, 0))	W6 = 1+W5	P10 = IF(OR(P4=B10, P4=C10), E10, IF(P4=D10, E10, 0))
I6 = IF(OR(I4=B6, I4=C6), E6, IF(I4=D6, E6, 0))	X6 = 1+X5	Q10 = IF(OR(Q4=B10, Q4=C10), E10, IF(Q4=D10, E10, 0))
J6 = IF(OR(J4=B6, J4=C6), E6, IF(J4=D6, E6, 0))	Y6 = 1+Y5	R10 = IF(OR(R4=B10, R4=C10), E10, IF(R4=D10, E10, 0))
K6 = IF(OR(K4=B6, K4=C6), E6, IF(K4=D6, E6, 0))	Z6 = 1+Z5	S10 = IF(OR(S4=B10, S4=C10), E10, IF(S4=D10, E10, 0))
L6 = IF(OR(L4=B6, L4=C6), E6, IF(L4=D6, E6, 0))	AA6 = 1+AA5	U10 = 1+U9
M6 = IF(OR(M4=B6, M4=C6), E6, IF(M4=D6, E6, 0))	AB6 = 1+AB5	F11 = IF(OR(F4=B11, F4=C11), E11, IF(F4=D11, E11, 0))
N6 = IF(OR(N4=B6, N4=C6), E6, IF(N4=D6, E6, 0))	AC6 = 1+AC5	G11 = IF(OR(G4=B11, G4=C11), E11, IF(G4=D11, E11, 0))
O6 = IF(OR(O4=B6, O4=C6), E6, IF(O4=D6, E6, 0))	AD6 = 1+AD5	H11 = IF(OR(H4=B11, H4=C11), E11, IF(H4=D11, E11, 0))
P6 = IF(OR(P4=B6, P4=C6), E6, IF(P4=D6, E6, 0))	AE6 = 1+AE5	I11 = IF(OR(I4=B11, I4=C11), E11, IF(I4=D11, E11, 0))
Q6 = IF(OR(Q4=B6, Q4=C6), E6, IF(Q4=D6, E6, 0))	AF6 = 1+AF5	J11 = IF(OR(J4=B11, J4=C11), E11, IF(J4=D11, E11, 0))
R6 = IF(OR(R4=B6, R4=C6), E6, IF(R4=D6, E6, 0))	AG6 = 1+AG5	K11 = IF(OR(K4=B11, K4=C11), E11, IF(K4=D11, E11, 0))
S6 = IF(OR(S4=B6, S4=C6), E6, IF(S4=D6, E6, 0))	AH6 = 1+AH5	L11 = IF(OR(L4=B11, L4=C11), E11, IF(L4=D11, E11, 0))
U6 = 1+U5	AI6 = 1+AI5	M11 = IF(OR(M4=B11, M4=C11), E11, IF(M4=D11, E11, 0))
F7 = IF(OR(F4=B7, F4=C7), E7, IF(F4=D7, E7, 0))	AV6 = 1+AV5	N11 = IF(OR(N4=B11, N4=C11), E11, IF(N4=D11, E11, 0))
G7 = IF(OR(G4=B7, G4=C7), E7, IF(G4=D7, E7, 0))	AW6 = 1+AW5	O11 = IF(OR(O4=B11, O4=C11), E11, IF(O4=D11, E11, 0))
I7 = IF(OR(I4=B7, I4=C7), E7, IF(I4=D7, E7, 0))	AX6 = 1+AX5	P11 = IF(OR(P4=B11, P4=C11), E11, IF(P4=D11, E11, 0))
K7 = IF(OR(K4=B7, K4=C7), E7, IF(K4=D7, E7, 0))	AY6 = 1+AY5	Q11 = IF(OR(Q4=B11, Q4=C11), E11, IF(Q4=D11, E11, 0))
M7 = IF(OR(M4=B7, M4=C7), E7, IF(M4=D7, E7, 0))	AZ6 = 1+AZ5	R11 = IF(OR(R4=B11, R4=C11), E11, IF(R4=D11, E11, 0))
O7 = IF(OR(O4=B7, O4=C7), E7, IF(O4=D7, E7, 0))	BA6 = 1+BA5	S11 = IF(OR(S4=B11, S4=C11), E11, IF(S4=D11, E11, 0))
P7 = IF(OR(P4=B7, P4=C7), E7, IF(P4=D7, E7, 0))	BB6 = 1+BB5	U11 = 1+U10
Q7 = IF(OR(Q4=B7, Q4=C7), E7, IF(Q4=D7, E7, 0))	BC6 = 1+BC5	F12 = IF(OR(F4=B12, F4=C12), E12, IF(F4=D12, E12, 0))
R7 = IF(OR(R4=B7, R4=C7), E7, IF(R4=D7, E7, 0))	BD6 = 1+BD5	G12 = IF(OR(G4=B12, G4=C12), E12, IF(G4=D12, E12, 0))
S7 = IF(OR(S4=B7, S4=C7), E7, IF(S4=D7, E7, 0))	BE6 = 1+BE5	H12 = IF(OR(H4=B12, H4=C12), E12, IF(H4=D12, E12, 0))
U7 = 1+U6	BF6 = 1+BF5	I12 = IF(OR(I4=B12, I4=C12), E12, IF(I4=D12, E12, 0))
F8 = IF(OR(F4=B8, F4=C8), E8, IF(F4=D8, E8, 0))	BG6 = 1+BG5	J12 = IF(OR(J4=B12, J4=C12), E12, IF(J4=D12, E12, 0))
G8 = IF(OR(G4=B8, G4=C8), E8, IF(G4=D8, E8, 0))	BH6 = 1+BH5	K12 = IF(OR(K4=B12, K4=C12), E12, IF(K4=D12, E12, 0))
H8 = IF(OR(H4=B8, H4=C8), E8, IF(H4=D8, E8, 0))	BI6 = 1+BI5	L12 = IF(OR(L4=B12, L4=C12), E12, IF(L4=D12, E12, 0))
I8 = IF(OR(I4=B8, I4=C8), E8, IF(I4=D8, E8, 0))	BJ6 = 1+BJ5	M12 = IF(OR(M4=B12, M4=C12), E12, IF(M4=D12, E12, 0))
J8 = IF(OR(J4=B8, J4=C8), E8, IF(J4=D8, E8, 0))	BK6 = 1+BK5	N12 = IF(OR(N4=B12, N4=C12), E12, IF(N4=D12, E12, 0))
K8 = IF(OR(K4=B8, K4=C8), E8, IF(K4=D8, E8, 0))	BL6 = 1+BL5	O12 = IF(OR(O4=B12, O4=C12), E12, IF(O4=D12, E12, 0))
L8 = IF(OR(L4=B8, L4=C8), E8, IF(L4=D8, E8, 0))	BM6 = 1+BM5	P12 = IF(OR(P4=B12, P4=C12), E12, IF(P4=D12, E12, 0))
M8 = IF(OR(M4=B8, M4=C8), E8, IF(M4=D8, E8, 0))	BN6 = 1+BN5	Q12 = IF(OR(Q4=B12, Q4=C12), E12, IF(Q4=D12, E12, 0))
N8 = IF(OR(N4=B8, N4=C8), E8, IF(N4=D8, E8, 0))	BO6 = 1+BO5	R12 = IF(OR(R4=B12, R4=C12), E12, IF(R4=D12, E12, 0))
O8 = IF(OR(O4=B8, O4=C8), E8, IF(O4=D8, E8, 0))	BP6 = 1+BP5	S12 = IF(OR(S4=B12, S4=C12), E12, IF(S4=D12, E12, 0))
P8 = IF(OR(P4=B8, P4=C8), E8, IF(P4=D8, E8, 0))	BQ6 = 1+BQ5	U12 = 1+U11
Q8 = IF(OR(Q4=B8, Q4=C8), E8, IF(Q4=D8, E8, 0))	BR6 = 1+BR5	F13 = IF(OR(F4=B13, F4=C13), E13, IF(F4=D13, E13, 0))
R8 = IF(OR(R4=B8, R4=C8), E8, IF(R4=D8, E8, 0))	BS6 = 1+BS5	G13 = IF(OR(G4=B13, G4=C13), E13, IF(G4=D13, E13, 0))
S8 = IF(OR(S4=B8, S4=C8), E8, IF(S4=D8, E8, 0))	BT6 = 1+BT5	H13 = IF(OR(H4=B13, H4=C13), E13, IF(H4=D13, E13, 0))
U8 = 1+U7	BU6 = 1+BU5	I13 = IF(OR(I4=B13, I4=C13), E13, IF(I4=D13, E13, 0))
F9 = IF(OR(F4=B9, F4=C9), E9, IF(F4=D9, E9, 0))	BV6 = 1+BV5	J13 = IF(OR(J4=B13, J4=C13), E13, IF(J4=D13, E13, 0))
G9 = IF(OR(G4=B9, G4=C9), E9, IF(G4=D9, E9, 0))	BW6 = 1+BW5	K13 = IF(OR(K4=B13, K4=C13), E13, IF(K4=D13, E13, 0))
H9 = IF(OR(H4=B9, H4=C9), E9, IF(H4=D9, E9, 0))	BX6 = 1+BX5	L13 = IF(OR(L4=B13, L4=C13), E13, IF(L4=D13, E13, 0))

. O P E N F I L E .

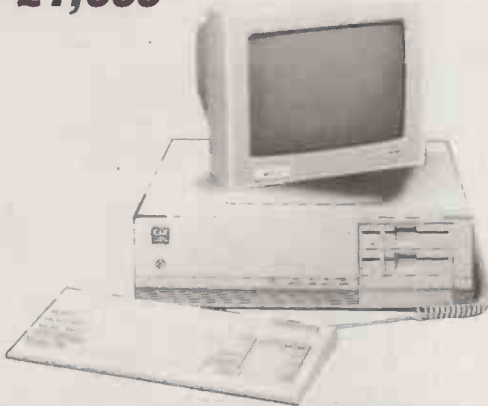
SPREADSHEET TEMPLATE

M13	= IF (OR (M4=B13, M4=C13), E13, IF (M4=D13, E13, 0))	P32	= P12	Q32	= Q12	R32	= R12
M13	= IF (OR (N4=B13, N4=C13), E13, IF (N4=D13, E13, 0))	S32	= S12	F33	= F13	G33	= G13
O13	= IF (OR (O4=B13, O4=C13), E13, IF (O4=D13, E13, 0))	H33	= H13	I33	= I13	J33	= J13
P13	= IF (OR (P4=B13, P4=C13), E13, IF (P4=D13, E13, 0))	K33	= K13	L33	= L13	M33	= M13
Q13	= IF (OR (Q4=B13, Q4=C13), E13, IF (Q4=D13, E13, 0))	N33	= N13	O33	= O13	P33	= P13
R13	= IF (OR (R4=B13, R4=C13), E13, IF (R4=D13, E13, 0))	Q33	= Q13	R33	= R13	S33	= S13
S13	= IF (OR (S4=B13, S4=C13), E13, IF (S4=D13, E13, 0))	F34	= F14	G34	= G14	H34	= H14
F14	= IF (OR (F4=B14, F4=C14), E14, IF (F4=D14, E14, 0))	I34	= I14	J34	= J14	K34	= K14
G14	= IF (OR (G4=B14, G4=C14), E14, IF (G4=D14, E14, 0))	L34	= L14	M34	= M14	N34	= N14
H14	= IF (OR (H4=B14, H4=C14), E14, IF (H4=D14, E14, 0))	O34	= O14	P34	= P14	Q34	= Q14
I14	= IF (OR (I4=B14, I4=C14), E14, IF (I4=D14, E14, 0))	R34	= R14	S34	= S14	F35	= F15
J14	= IF (OR (J4=B14, J4=C14), E14, IF (J4=D14, E14, 0))	G35	= G15	H35	= H15	I35	= I15
K14	= IF (OR (K4=B14, K4=C14), E14, IF (K4=D14, E14, 0))	J35	= J15	K35	= K15	L35	= L15
L14	= IF (OR (L4=B14, L4=C14), E14, IF (L4=D14, E14, 0))	M35	= M15	N35	= N15	O35	= O15
M14	= IF (OR (M4=B14, M4=C14), E14, IF (M4=D14, E14, 0))	P35	= P15	Q35	= Q15	R35	= R15
N14	= IF (OR (N4=B14, N4=C14), E14, IF (N4=D14, E14, 0))	S35	= S15	F36	= F16	G36	= G16
O14	= IF (OR (O4=B14, O4=C14), E14, IF (O4=D14, E14, 0))	H36	= H16	I36	= I16	J36	= J16
P14	= IF (OR (P4=B14, P4=C14), E14, IF (P4=D14, E14, 0))	K36	= K16	L36	= L16	M36	= M16
Q14	= IF (OR (Q4=B14, Q4=C14), E14, IF (Q4=D14, E14, 0))	N36	= N16	O36	= O16	P36	= P16
R14	= IF (OR (R4=B14, R4=C14), E14, IF (R4=D14, E14, 0))	Q36	= Q16	R36	= R16	S36	= S16
S14	= IF (OR (S4=B14, S4=C14), E14, IF (S4=D14, E14, 0))	A18, A38, A58 = " Total for day					
U14	= 1+U13 U15 = 1+U14 U16 = 1+U15 U17 = 1+U16	F38 1	= SUM (F26: F36)	G38 1	= SUM (G26: G36)		
F15	= IF (OR (F4=B15, F4=C15), E15, IF (F4=D15, E15, 0))	H38 1	= SUM (H26: H36)	I38 1	= SUM (I26: I36)		
G15	= IF (OR (G4=B15, G4=C15), E15, IF (G4=D15, E15, 0))	J38 1	= SUM (J26: J36)	K38 1	= SUM (K26: K36)		
H15	= IF (OR (H4=B15, H4=C15), E15, IF (H4=D15, E15, 0))	L38 1	= SUM (L26: L36)	M38 1	= SUM (M26: M36)		
I15	= IF (OR (I4=B15, I4=C15), E15, IF (I4=D15, E15, 0))	N38 1	= SUM (N26: N36)	O38 1	= SUM (O26: O36)		
J15	= IF (OR (J4=B15, J4=C15), E15, IF (J4=D15, E15, 0))	P38 1	= SUM (P26: P36)	Q38 1	= SUM (Q26: Q36)		
K15	= IF (OR (K4=B15, K4=C15), E15, IF (K4=D15, E15, 0))	R38 1	= SUM (R26: R36)	S38 1	= SUM (S26: S36)		
L15	= IF (OR (L4=B15, L4=C15), E15, IF (L4=D15, E15, 0))	A39	= " Coverage	F39	= F38/8		
M15	= IF (OR (M4=B15, M4=C15), E15, IF (M4=D15, E15, 0))	G39	= G38/8	H39	= H38/8	I39	= I38/8
N15	= IF (OR (N4=B15, N4=C15), E15, IF (N4=D15, E15, 0))	J39	= J38/8	K39	= K38/8	L39	= L38/8
O15	= IF (OR (O4=B15, O4=C15), E15, IF (O4=D15, E15, 0))	M39	= M38/8	N39	= N38/8	O39	= O38/8
P15	= IF (OR (P4=B15, P4=C15), E15, IF (P4=D15, E15, 0))	F39	= F38/8	Q39	= Q38/8	R39	= R38/8
Q15	= IF (OR (Q4=B15, Q4=C15), E15, IF (Q4=D15, E15, 0))	S39	= S38/8	F42 2	= IF (L1>28, 29, 0)		
R15	= IF (OR (R4=B15, R4=C15), E15, IF (R4=D15, E15, 0))	G42 2	= IF (L1>30, 30, 0)	H42 2	= IF (L1>30, 31, 0)	143 TR = "Totals	
S15	= IF (OR (S4=B15, S4=C15), E15, IF (S4=D15, E15, 0))	F44	= IF (L1>28, (LOOKUP ((K1+1), U13: U25)), 0)				
F16	= IF (OR (F4=B16, F4=C16), E16, IF (F4=D16, E16, 0))	G44	= IF (L1>30, (LOOKUP ((K1+1), U13: U25)), 0)				
G16	= IF (OR (G4=B16, G4=C16), E16, IF (G4=D16, E16, 0))	H44	= IF (L1>30, (LOOKUP ((K1+2), U13: U25)), 0)				
H16	= IF (OR (H4=B16, H4=C16), E16, IF (H4=D16, E16, 0))	F46 1	= IF (L1>28, F6, 0)	G46 1	= IF (L1>30, G6, 0)		
I16	= IF (OR (I4=B16, I4=C16), E16, IF (I4=D16, E16, 0))	H46 1	= IF (L1>30, H6, 0)				
J16	= IF (OR (J4=B16, J4=C16), E16, IF (J4=D16, E16, 0))	I46	= SUM (F6: S6)+SUM (F26: S26)+SUM (F46: H46)				
K16	= IF (OR (K4=B16, K4=C16), E16, IF (K4=D16, E16, 0))	F47 1	= IF (L1>28, F7, 0)				
L16	= IF (OR (L4=B16, L4=C16), E16, IF (L4=D16, E16, 0))	G47 1	= IF (L1>30, G7, 0)	H47 1	= IF (L1>30, H7, 0)		
M16	= IF (OR (M4=B16, M4=C16), E16, IF (M4=D16, E16, 0))	I47	= SUM (F7: S7)+SUM (F27: S27)+SUM (F47: H47)				
N16	= IF (OR (N4=B16, N4=C16), E16, IF (N4=D16, E16, 0))	F48 1	= IF (L1>28, F8, 0)				
O16	= IF (OR (O4=B16, O4=C16), E16, IF (O4=D16, E16, 0))	G48 1	= IF (L1>30, G8, 0)	H48 1	= IF (L1>30, H8, 0)		
P16	= IF (OR (P4=B16, P4=C16), E16, IF (P4=D16, E16, 0))	I48	= SUM (F8: S8)+SUM (F28: S28)+SUM (F48: H48)				
Q16	= IF (OR (Q4=B16, Q4=C16), E16, IF (Q4=D16, E16, 0))	F49 1	= IF (L1>28, F9, 0)				
R16	= IF (OR (R4=B16, R4=C16), E16, IF (R4=D16, E16, 0))	G49 1	= IF (L1>30, G9, 0)	H49 1	= IF (L1>30, H9, 0)		
S16	= IF (OR (S4=B16, S4=C16), E16, IF (S4=D16, E16, 0))	I49	= SUM (F9: S9)+SUM (F29: S29)+SUM (F49: H49)				
F18 1	= SUM (F6: F16)	G18 1	= SUM (G6: G16)	H18 1	= SUM (H6: H16)		
I18 1	= SUM (I6: I16)	J18 1	= SUM (J6: J16)	K18 1	= SUM (K6: K16)		
L18 1	= SUM (L6: L16)	M18 1	= SUM (M6: M16)	N18 1	= SUM (N6: N16)		
O18 1	= SUM (O6: O16)	P18 1	= SUM (P6: P16)	Q18 1	= SUM (Q6: Q16)		
R18 1	= SUM (R6: R16)	S18 1	= SUM (S6: S16)	U18 1	= 1+U17		
A19, J57, L57	= " Coverage	F19	= F18/8				
G19	= G18/8	H19	= H18/8	I19	= I18/8	J19	= J18/8
K19	= K18/8	L19	= L18/8	M19	= M18/8	N19	= N18/8
O19	= O18/8	P19	= P18/8	Q19	= Q18/8	R19	= R18/8
S19	= S18/8	U19	= 1+U18	U20	= 1+U19	U21	= 1+U20
F22	= 1+S2	G22	= 1+F22	H22	= 1+G22	I22	= 1+H22
J22	= 1+I22	K22	= 1+J22	L22	= 1+K22	M22	= 1+L22
N22	= 1+M22	O22	= 1+N22	P22	= 1+O22	Q22	= 1+P22
R22	= 1+Q22	S22	= 1+R22	U22	= 1+U21	U23	= 1+U22
F24	= LOOKUP (K1, U13: U25)						
G24	= LOOKUP ((K1+1), U13: U25)	H24	= LOOKUP ((K1+2), U13: U25)				
I24	= LOOKUP ((K1+3), U13: U25)	J24	= LOOKUP ((K1+4), U13: U25)				
K24	= LOOKUP ((K1+5), U13: U25)	L24	= LOOKUP ((K1+6), U13: U25)				
M24	= LOOKUP (K1, U13: U25)	N24	= LOOKUP ((K1+1), U13: U25)				
O24	= LOOKUP ((K1+2), U13: U25)	P24	= LOOKUP ((K1+3), U13: U25)				
Q24	= LOOKUP ((K1+4), U13: U25)	R24	= LOOKUP ((K1+5), U13: U25)				
S24	= LOOKUP ((K1+6), U13: U25)	U24	= 1+U23				
U25	= 1+U24	F26	= F6	G26	= G6		
H26	= H6	I26	= I6	J26	= J6		
K26	= K6	L26	= L6	M26	= M6		
N26	= N6	O26	= O6	P26	= P6		
Q26	= Q6	R26	= R6	S26	= S6		
U26	= 1+U25	F27	= F7	G27	= G7		
H27	= H7	I27	= I7	J27	= J7		
K27	= K7	L27	= L7	M27	= M7		
N27	= N7	O27	= O7	P27	= P7		
Q27	= Q7	R27	= R7	S27	= S7		
F28	= F8	G28	= G8	H28	= H8		
I28	= I8	J28	= J8	K28	= K8		
L28	= L8	M28	= M8	N28	= N8		
O28	= O8	P28	= P8	Q28	= Q8		
R28	= R8	S28	= S8	F29	= F9		
G29	= G9	H29	= H9	I29	= I9		
J29	= J9	K29	= K9	L29	= L9		
M29	= M9	N29	= N9	O29	= O9		
P29	= P9	Q29	= Q9	R29	= R9		
S29	= S9	F30	= F10	G30	= G10		
H30	= H10	I30	= I10	J30	= J10		
K30	= K10	L30	= L10	M30	= M10		
N30	= N10	O30	= O10	P30	= P10		
Q30	= Q10	R30	= R10	S30	= S10		
F31	= F11	G31	= G11	H31	= H11		
I31	= I11	J31	= J11	K31	= K11		
L31	= L11	M31	= M11	N31	= N11		
O31	= O11	P31	= P11	Q31	= Q11		
R31	= R11	S31	= S11	F32	= F12		
G32	= G12	H32	= H12	I32	= I12		
J32	= J12	K32	= K12	L32	= L12		
M32	= M12	N32	= N12	O32	= O12		
A6, A26, A46 = ("John") A7, A27, A47 = ("Mary") A8, A28, A48 = ("Fred")							
A9, A29, A49 = ("Tracey") A10, A30, A50 = ("Allison") A16, A36, A56 = ("Beverly")							
A11, A31, A51 = ("Margaret") A12, A32, A52 = ("Anne") A13, A33, A53 = ("Derek")							
A14, A34, A54 = ("Gerry") A15, A35, A55 = ("Barbara") B9, D7, V14, V21 = ("No")							
B10, B15, C9, C12, V15, V22 = ("Tu") B13, B14, B16, C15, D9, D12, V16, V23 = ("We")							
B12, D13, D14, V13, V20 = ("Su") B6, B7, B8, B11, C13, C14, C16, V17, V24 = ("Th")							
C6, C7, C8, C10, C11, V18, V25 = ("Fr") D6, D8, D10, D11, D15, D16, V19, V26 = ("Sa")							

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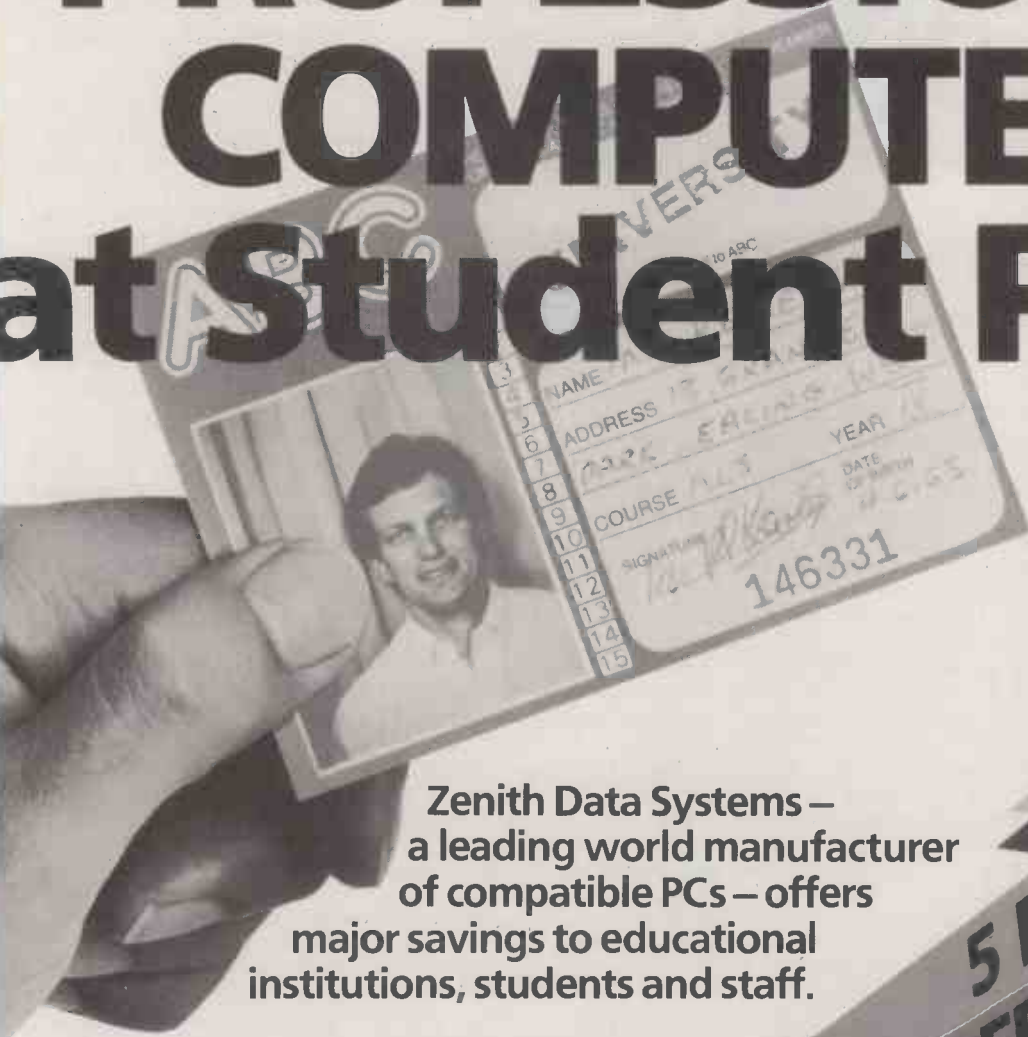
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TWO-WAY VARIANCE ANALYSIS

Owen Bishop and Daniel Bishop explain how the analysis of variance can yield valuable results even when an initial analysis is inconclusive.

LAST MONTH we described a statistical test known as the analysis of variance which was used to analyse the monthly sales of chocolate bars in a number of branches of a firm of newsagents. The analysis we described was a one-way analysis in that it considered the monthly sales to be replicates. In other words, it was assumed that the consecutive monthly sales of a given store differed from one another only in the way that sales typically fluctuate from month to month throughout the year.

The one-way analysis of variance was used to find out the causes contributing to the variance in the data. The total variance was divided into two parts. The first part is the variance due to differences in the sales performance of the individual stores; this could be called the inter-stores variance. The second part is the variance due to innumerable chance events and other unassignable causes that always creep into any set of data. These are the typical sales fluctuations already mentioned; in statistical jargon they are said to give rise to the residual variance.

REAL DIFFERENCE

The inter-store variance is four times greater than the residual variance; in other words the variance ratio is 4. Unfortunately the total amount of data available is insufficient to say whether with F equal to 4 the inter-store variance is big enough to warrant promoting some store managers and inviting others to apply for jobs elsewhere. The best that could be said is that the results indicate — with a probability of a little more than 20 percent of being wrong — that there is a real difference in performance between the three stores. It is not likely to be entirely due to typical fluctuations.

You might reach a more reliable conclusion after collecting and analysing more data, but there is still some more information to be wrung out of the existing figures. Table 1 shows not only the column or store averages calculated last month but also the row averages which show the monthly performance averaged over the three stores. The monthly averages differ among themselves almost as much as the store averages. Perhaps the stores are located in a seaside town, and the three months are July, August and September.

Whatever the reason, the monthly figures should not have been considered to be replicates. Obviously inter-monthly variance makes an important contribution to the total variance of the data. In the previous one-way analysis, which ignored monthly differences

as a contributing factor, inter-month variance was included in the residual variance. A two-way analysis separates the inter-month variance from the residual variance.

The program does this, with the results shown in table 2. The inter-store figures and the totals are the same as in the previous one-way analysis, but there is now an additional item in the table for inter-month differences. The figures for the residual variance are correspondingly reduced.

The effect of this two-way analysis is not only to estimate the effect of inter-month differences, if any, but to reduce the size of the residual variance. The estimate of the residual variance is now more precise, and there is a much smaller residual mean square to use when calculating the variance ratios. Consequently the values obtained for the variance ratio should be larger.

Taking the figures given in table 2 it is easy to calculate that the value of the variance ratio, F, for inter-store differences is now

$$22,157 \div 2,287$$

or 9.7. This is clearly much higher than the value of 4.0 which was obtained from the one-way analysis. Statistical tables show that if you then state that inter-shop effects really do exist, the chance of being wrong is less than five percent. The uncertainty has

thus been reduced from a little less than 20 percent to appreciably less than five percent.

The value of F for inter-store differences is

$$12,118 \div 2,287$$

or 5.3. This corresponds to a significance level of a little less than 20 percent.

All in all, the two-way analysis has shown that you can state with less than five percent chance of being wrong that the stores differ significantly in their performance. It also gives an indication that there is a factor at work which produces a monthly variation in the sales of chocolate bars.

This version of the analysis requires a data table of the three or more rows and three or more columns. The columns represent one set of different treatments or situations — the stores in this example. The rows represent the second factor, which is another set of different treatments or situations — in this example the different months.

MISSING VALUES

The program allows there to be one or two values missing from the table and calculates suitable entries in the table and calculates suitable entries in the table to replace them, with a loss of one degree of freedom for each missing value. This would hardly be acceptable in the example since the

data is so scanty to begin with. If there were more stores or more sales figures from each store the ability to calculate missing values makes it possible to carry out an analysis when one or two results are missing, perhaps from oversight or as a result of temporary closure of a store. 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. Load and run the program File name Anovar2. 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, as described in the May issue. The table is displayed with these statistics. You can use the cursor keys to examine the table if you wish. To carry out the analysis key T. The screen then displays the analysis as shown in table 2. It calculates F for differences between columns, and the probability associated with F. It also calculates F for differences between rows and its associated probability.

As explained in last month's article, the program cannot calculate probability when F is large or, as here, when there is only a small amount of data. In such instances you should refer to published tables of F. Key P to obtain a printout of the analysis, or R to rerun the program.

The statistics programs and tests covered in this series include histograms, scattergrams, essential statistics, chi-square test, runs test, variance ratio test, analysis of variance and binomial test. 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.

TABLE 1. SALES OF CHOCOLATE BARS

Month	Store 1	Store 2	Store 3	Store average
1	300	240	204	248
2	494	405	224	374
3	390	336	244	323
Monthly average	395	327	224	

TABLE 2. ANALYSIS OF VARIANCE

Source of variance	Sum of squares	Degrees of freedom	Mean squares
Stores	44315	2	22157
Months	24236	2	12118
Residual	9148	4	2287
Total	77700	8	

TWO-WAY VARIANCE ANALYSIS

```

10 REM- ANOVAR 2
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$32):MDF=0
120 MODE7:PROCcol:PRINT"ANOVAR 2"
130 PROCbtm:PROCcol:PRINT "Enter name
of file to be loaded":PROCalpha("(max 7
letters): ",7)
140 ON ERROR PROCferror:VDU31,15,0:PR
OCcls:GOTO 130
150 FILE$=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:CV=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$(NR-1)="ESDF"
:RL$(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:PROCcls
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-RS<RD THEN RD=NR-RS
460 CD=CC:IF NC-CS<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$="T" THEN 580
570 VDU7:GOTO 490
580 VDU30,31,0,2:PROCcls
590 FF=0:@%=&0102000A+(DF(1)*&100):PRI
NT""Source      SOS      D of F      M
n Sq"
600PRINT"Columns",FNform(SOSB-SOSD),FN
formd(NC-5),FNform((SOSB-SOSD)/(NC-5))
610 PRINT"Rows",FNform(SOSC-SOSD),FNfo
rmd(NR-5),FNform((SOSC-SOSD)/(NR-5))
620 PRINT"Residual",FNform(SOSA-SOSB-S
OSC+SOSD),FNformd((NR-5)*(NC-5)-MDF),FNf
orm((SOSA-SOSB-SOSC+SOSD)/((NR-5)*(NC-5)
-MDF))
630PRINT"TOTAL",FNform(SOSA-SOSD),FNfo
rmd((NC-4)*(NR-4)-MDF)
640 FP=(SOSB-SOSD)/(NC-5)/(SOSA-SOSB-S
OSC+SOSD)*((NR-5)*(NC-5)-MDF)
650 @%=&20109:PRINT "F for columns = "
;FP
660V1=NC-4:V2=(NC-4)*(NR-5)-MDF:IF (V1
<4 OR V2<4) OR FP>9 THEN 860
670 ON ERROR GOTO 850
680@%=&20306:P=FNf:ON ERROR OFF:IF P<0
THEN 860
690PRINT "Probability is ";P
700 FF=1
710FP=(SOSC-SOSD)/(NR-5)/(SOSA-SOSB-SO
SC+SOSD)*((NR-5)*(NC-5)-MDF)
720@%=&20109:PRINT "F for rows = ";FP
730IF (V1<4 OR V2<4) OR FP>9 THEN 860
740 ON ERROR GOTO 850
750@%=&20306:P=FNf:ON ERROR OFF:IF P<0
THEN 860
760PRINT "Probability is ";P
770 VDU 6,3
780@%=&90A:PROCbtm
790VDU6:WIDTH 0
800*FX21,0
810VDU30,31,39,22:K$=GET$
820 IF K$="R" THEN RUN
830 IF K$="P" THEN VDU2,21:GOTO 590
840 VDU7:GOTO800
850ON ERROR OFF
860PRINT"Probability not available"
870 IF FF=1 THEN 770 ELSE 700
880 DEF PROCmean
890 LOCAL J%,K%,C%,SUM,NT%
900 FOR J%=1 TO NC-4:C%=0:FOR K%=1 TO
NR-4:IF SC(J%,K%)<>1E-29 THEN C%=C%+1
910 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
920 NEXT:SV%(J%)=C%:NEXT
930 NT%=0:FOR J%=1 TO NC-4:NT%=NT%+NV%
(J%):NEXT
940 FOR J%=NC-3 TO NC:FOR K%=NR-3 TO N
R:SC(J%,K%)=1E-29:NEXT:NEXT
950SOSB=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%)
960 NEXT:SC(J%,NR-3)=SUM:SOSB=SOSB+SUM
*SUM/(NR-4):NEXT
970SOSC=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%)
980 NEXT:SC(NC-3,J%)=SUM:IF J%<NR-3 TH
EN SOSC=SOSC+SUM*SUM/(NC-4)
990 NEXT
1000FOR 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%)
1010 NEXT:SC(J%,NR-2)=SUM:NEXT
1020 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%)
1030 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

```

(continued on next page)

TWO-WAY VARIANCE ANALYSIS

(continued from previous page)

```

1040 SOSA=SUM
1050 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%))
1060 NEXT
1070 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%))
1080 NEXT
1090 SC(NC-2,NR-2)=SC(NC-2,NR-2)-(SC(NC
-3,NR-3)*SC(NC-3,NR-3)/NT%)
1100 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
1110 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
1120 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
1130 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
1140 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
1150 NEXT: SC(NC-2,NR-2)=SQR(SC(NC-2,NR-
2)/NT%)
1160 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
1170 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
1180 NEXT: SOSD=SC(NC-3,NR-3)*SC(NC-3,NR
-3)/NT%: SC(NC-3,NR-3)=SC(NC-3,NR-3)/NT%

1190 FOR J%=1 TO NR-4: IF SV%(J%)<>0 THE
N SC(NC,J%)=SC(NC-1,J%)/SQR(SV%(J%)) ELS
E SC(NC,J%)=1E-29
1200 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
1210 NEXT: SC(NC,NR)=SC(NC-1,NR-1)/SQR(N
T%)
1220 ENDPROC
1230 DEF FNF
1240 DF=.1: IFFP>5 THEN DF=INT(FP)*.04
1250 FOR J=0 TO 2: V(J)=1: NEXT
1260 FOR J=0 TO 4: F(J)=0: NEXT
1270 D=2/DF: VF=V1/2-1: FQ=INT((FP+.5*DF)/
DF)*2: VG=V1/2: VH=V2/2
1280 VV=V1+V2: VN=0
1290 PROCcalc
1300 VV=V1: VN=1
1310 PROCcalc
1320 VV=V2: VN=2
1330 PROCcalc
1340 AA=V(0)/V(1)/V(2)*V1^VG*V2^VH
1350 VI=VG-1: VJ=(V1+V2)/2
1360 FORJ=3 TO FQ+3
1370 JF=J/D-DF
1380 U(J,0)=JF^VI/(V2+V1*JF)^VJ
1390 NEXT
1400 FORK=1 TO 4
1410 FU=3-K
1420 FORJ=1 TO FQ+FU: U(J,K)=U(J+1,K-1)-U(J
,K-1): NEXT
1430 NEXT
1440 FORK=0 TO 4 STEP 2
1450 FORJ=3-K/2 TO FQ+1-K/2 STEP 2 : F(K)
=F(K)+U(J,K): NEXT
1460 NEXT
1470 A=DF*(F(0)+F(2)/6+F(4)/180)
1480 1-A*AA
1490 V2=V/2
1500 FORJ=1 TO V2-.5
1510 DEF PROCcalc
1520 IF VV/2=INT(VV/2) THEN 1590

```

```

1530 VV=VV/2
1540 FORJ=1 TO VV-.5
1550 V(VN)=V(VN)*(VV-J)
1560 NEXT
1570 V(VN)=V(VN)*1.77245
1580 GOTO 1630
1590 VV=VV/2-1
1600 FORJ=1 TO VV
1610 V(VN)=V(VN)*J
1620 NEXT
1630 ENDPROC
1640 DEF PROCmV
1650 IF FMV=2 THEN 1740
1660 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 1680
1670 GT=GT+SC(J,K)
1680 NEXT : NEXT
1690 TR=0: FORJ=1 TO NC-4: TR=TR+SC(J,MVR
): NEXT: TR=TR-1E-29
1700 TC=0: FOR K=1 TO NR-4: TC=TC+SC(MVC,
K): NEXT: TC=TC-1E-29
1710 SC(MVC,MVR)=(NR-4)*TR+(NC-4)*TC-G
T)/(NR-5)/(NC-5)
1720 MDF=1
1730 GOTO 1920
1740 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 1760
1750 GT=GT+SC(J,K)
1760 NEXT: NEXT
1770 SC(MV(1,1),MV(1,2))=GT/(NC-4)/(NR-4
)
1780 MV=1: REPEAT
1790 EGT=GT+SC(MV(MV,1),MV(MV,2))
1800 IF MV=0 THEN MV=1 ELSE MV=0
1810 TR=0: FORJ=1 TO NC-4: TR=TR+SC(J,MV(
MV,2)): NEXT: TR=TR-1E-29
1820 TC=0: FOR K=1 TO NR-4: TC=TC+SC(MV(M
V,1),K): NEXT: TR=TR-1E-29
1830 SC(MV(MV,1),MV(MV,2))=(NR-4)*TR+(
NC-4)*TC-EGT)/(NR-5)/(NC-5)
1840 P(MV)= SC(MV(MV,1),MV(MV,2))
1850 IF MV=0 THEN MV=1 ELSE MV=0
1860 F(MV)=SC(MV(MV,1),MV(MV,2)): SC(MV(M
V,1),MV(MV,2))=1E-29
1870 IF MV=0 THEN MV=1 ELSE MV=0
1880 UNTIL ABS(P(MV)-SC(MV(MV,1),MV(MV,
2)))<10^(DF(MV(MV,1))-1)
1890 IF MV=0 THEN MV=1 ELSE MV=0
1900 SC(MV(MV,1),MV(MV,2))=F(MV)
1910 MDF=2
1920 ENDPROC
1930 DEF FNform(A)
1940 LOCAL A$
1950 A$=STR$(A)
1960 IFRIGHT$(A$,1)=". " THEN A$=LEFT$(A$,L
EN(A$)-1)
1970 =RIGHT$(L$+A$,CW)
1980 DEF FNformd(A)
1990 LOCAL A$
2000 @%=&0102000A: A$=STR$(A): A$=LEFT$(A$
,LEN(A$)-1): @%=&0102000A+(DP(1)*&100)
2010 =STRING$(CW-LEN(A$)," ") +A$
2020 DEF PROCdata: LOCAL J,K: VDU23,1,0;0
;0;0: FOR J=5 TO 20: VDU31,HB-1,J-1: PROCc
11: NEXT
2030 FOR J=1+CS TO CD+CS: HH=HB-1+(J-CS-
1)*CW
2040 FOR K=1+RS TO RD+RS
2050 IF SC(J,K)=1E-29 THEN 2070 ELSE @%
=&0102000A+(DP(J)*&100): A$=STR$(SC(J,K))
: IF RIGHT$(A$,1)=". " THEN A$=LEFT$(A$,LEN
(A$)-1)
2060 VDU31,HH-1,3+K-RS: PRINT RIGHT$(L$+
A$,CW): @%=&90A
2070 NEXT: NEXT
2080 VDU23,1,1;0;0;0;

```

(continued on page 130)

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TWO-WAY VARIANCE ANALYSIS

(continued from page 128)

```

2090 ENDPROC
2100 DEF PROCcolumns:LOCAL J:VDU23,1,0;
0;0;0;VDU31,0,2:PROCC11:VDU31,0,3:PROCC
11
2110 VDU31,0,2:FOR J=1 TO CD
2120 VDU31,(HB-1+(J-1)*CW),2:PRINT;J+CS
;
2130 NEXT
2140 IF LC=0 THEN VDU23,1,1;0;0;0;:ENDP
ROC
2150 VDU31,0,3:FOR J=1 TO CD
2160 VDU31,(HB-1+(J-1)*CW),3:PRINTCL$(J
+CS);
2170 NEXT:VDU23,1,1;0;0;0;:ENDPROC
2180 DEF PROCrows:LOCAL K:VDU23,1,0;0;0;
;0;:FOR K=5 TO 20:VDU31,0,K-1:PROCC11:NE
XT
2190 FOR K=1 TO RD:VDU31,0,K+3:PRINT;K+
RS:NEXT
2200 IF LR=0 THEN VDU23,1,1;0;0;0;:ENDP
ROC
2210 FOR K=1 TO RD:VDU31,3,3+K:PRINT RL
$(K+RS)
2220 NEXT:VDU23,1,1;0;0;0;:ENDPROC
2230 DEF PROCalpha(Q$,Q1)
2240 *FX21,0
2250 PROCcol:PRINT Q$;:INPUT""QR$
2260 IF LEN(QR$)<=Q1 OR Q1=0 THEN ENDP
ROC
2270 PROCline:GOTO 2240
2280 DEF PROCline:VDU11:PROCC11:VDU7:EN
DPROC
2290 DEF PROCbtm:VDU31,0,20:PROCC1s:VDU
31,0,20:ENDPROC
2300 DEF PROCcol
2310 PRINT CHR#130;

```

```

2320 ENDPROC
2330 DEF PROCc1s
2340 LOCAL CRS%,V,H
2350 V=VPOS:H=POS
2360 CRS%=999-H-(40*V)
2370 VDU23,1,0;0;0;0;
2380 REPEAT:IF CRS%<255 THEN 2400
2390 CRS%=CRS%-255:PRINTSTRING$(255,CHR
$32);
2400 UNTIL CRS%<255
2410 PRINTSTRING$(CRS%,CHR$32);
2420 VDU31,H,V
2430 VDU23,1,1;0;0;0;
2440 ENDPROC
2450 DEF PROCc11
2460 LOCAL V,H
2470 V=VPOS:H=POS
2480 PRINT STRING$(40-H,CHR$32);
2490 VDU31,H,V
2500 ENDPROC
2510 DEF PROCferror
2520 ON ERROR OFF
2530 CLOSE#0
2540 VDU7
2550 IF ERR>44 OR ERR=6 THEN 2590
2560 CLS:VDU11:REPORT:PRINT " at line "
;ERL
2570 *FX4,0
2580 END
2590 PROCbtm:IF ERR=222 THEN PRINT"No s
uch file";:PROCcol ELSE VDU11:REPORT:PRO
Ccol
2600 PRINT" error. ":PROCcol:PRINT"Pres
SPACEBAR, when you are ready "
2610 *FX21,0
2620 REPEAT:A=GET:UNTIL A=32
2630 VDU11,11:PROCC1s
2640 ENDPROC

```



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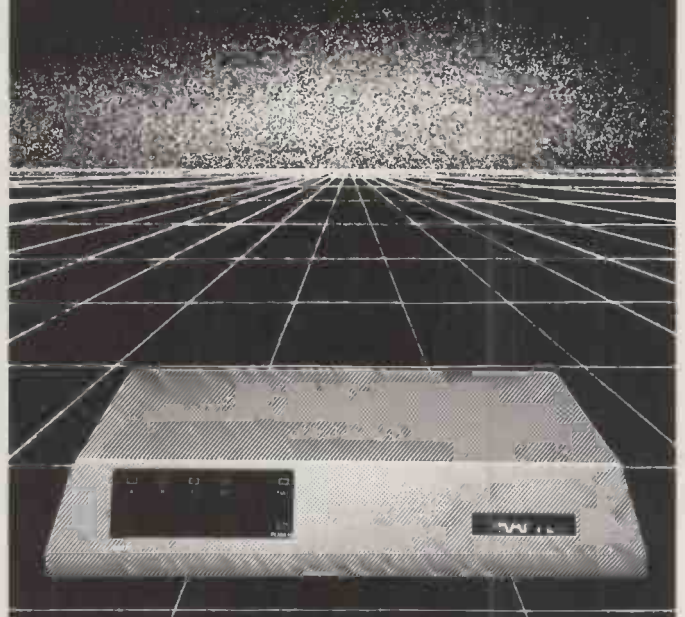
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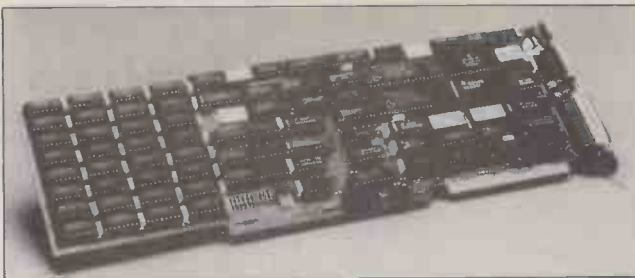
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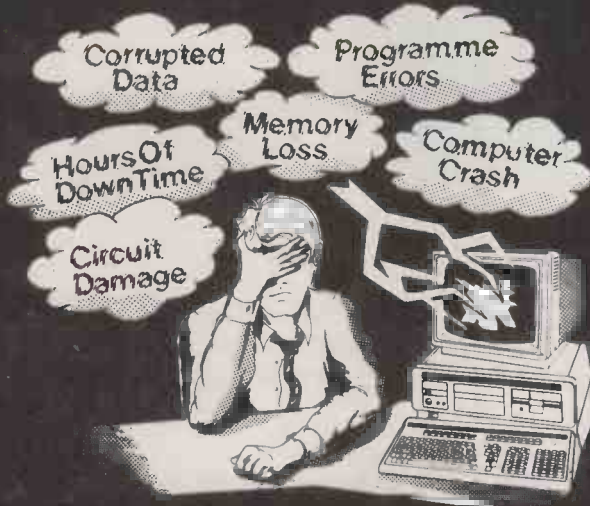
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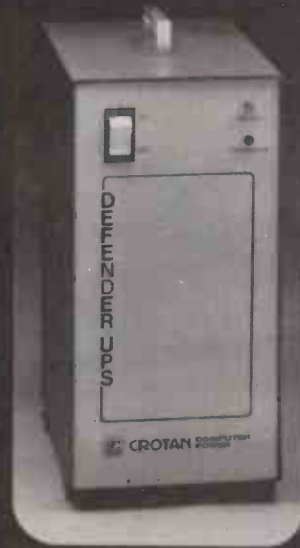
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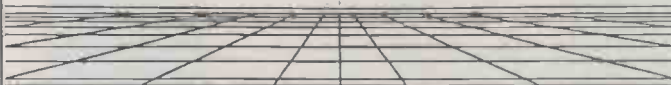
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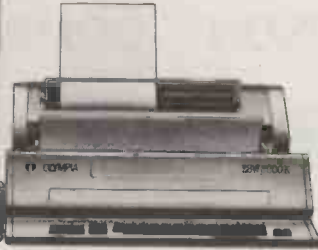
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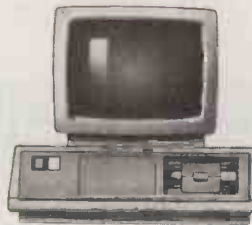
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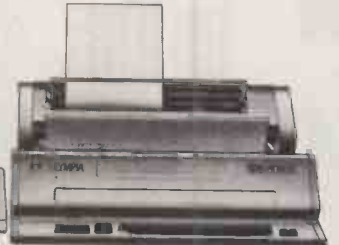
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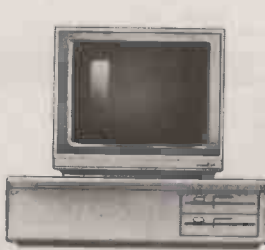


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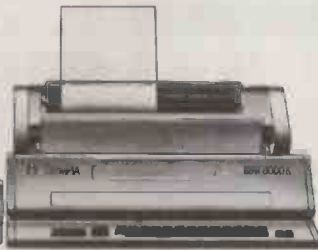


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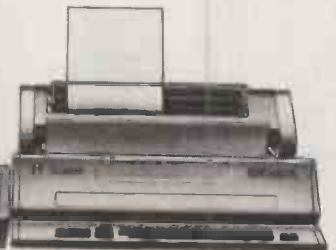
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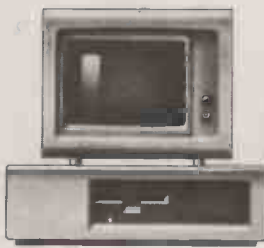
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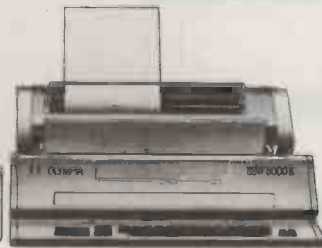
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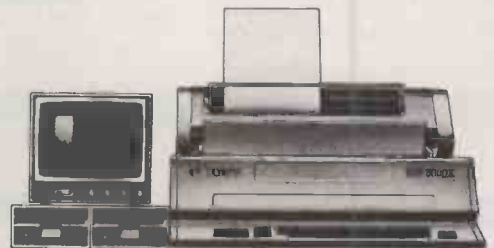
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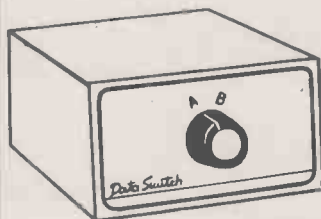
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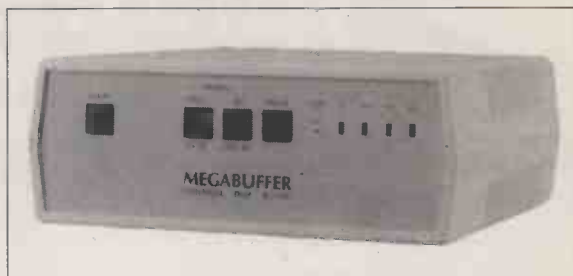
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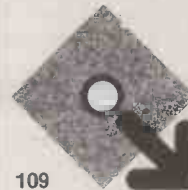
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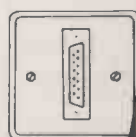
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